Cartridges for Long-Range Sniping Rifles

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Throughout the first half of the last century, the great majority of sniper rifles were more or less modified versions of the standard military rifles, chambered for the standard rifle/MG cartridge. The growth of self-loading rifles during and after World War 2 saw the sniper rifles departing from this tradition as the bolt-action type was generally retained for its greater accuracy. A further difference came when the standard rifles adopted lower-powered cartridges like the 5.56 mm NATO, much less suited to the business of long-range sniping. During the second half of the century, the military sniper rifle became a purpose-designed specialist instrument, capable of the highest practicable accuracy. This was usually complemented by precision-made ammunition, often loaded with heavier low-drag bullets, such as the US Army's 7.62 x 51 M118LR.

These developments have resulted in some superb equipment, but trends in accurate aimed fire can now be detected in two different directions: one is for the shorter ranges to be addressed by accurised self-loading guns providing faster repeat shots (Sharpshooter or Designated Marksman Rifles), the other is for guns firing more powerful cartridges being selected to increase the effective range. This article is concerned with the cartridges developed for meeting the second of these needs: long-range sniping.

To achieve a significantly longer range than the usual 7.62 x 51 requires at least a larger cartridge case to generate a much higher muzzle energy, and preferably a larger calibre as well; other things being equal, heavy large-calibre bullets retain their velocity better and are less affected by cross-winds. This was recognised by the first attempts to fire accurately at very long range which often used anti-tank rifles of 13-14.5 mm calibre. In fact, as early as the Great War the 13 mm Mauser M1918 anti-tank rifle was used in the counter-sniping role, although in this case the motivation was not so much to achieve long range as to punch through the armour plates being used to protect Allied snipers. The Korean War saw Soviet 14.5 mm PTRD rifles being used for long-range fire, as well as, on the US side, some experiments with .50 BMG guns. However, the guns were usually not that accurate and, even if they were, the standard production MG ammunition certainly wasn't.

A change came in the 1980s from two different sources in the USA. One was the adoption of long-range anti-materiel rifles in .50 BMG calibre, not primarily for sniping but for attacking vehicles and other inanimate objects, normally using standard API or (later) Multipurpose MG ammunition. The other was the establishment of the .50 Caliber Shooters Association, promoting the use of this calibre for long-range civilian shooting, which inspired much more accurate rifles and ammunition. In combination, these two developments led to the use of .50 BMG rifles for long-range sniping as well as anti-materiel use.

There is a problem, however: the .50 BMG rifles and their ammunition are necessarily very big and heavy, not ideal for the sniping role. Many believed that a smaller, but still powerful, calibre would do that job more efficiently. As a result, specialised long-range sniping rifles are now available in several competing calibres, with the widely-adopted .338 Lapua Magnum being the clear market leader, followed by the .300 Winchester Magnum. The ones described in this article are those offered in military-type sniper rifles; there is a host of "wildcats" (rounds made by individual experimenters) in addition. Furthermore, some anti-materiel rifles are also offered in the Russian heavy machine-gun calibres of 12.7 x 108 and 14.5 x 114, but these will not be considered here.

A high muzzle velocity is an advantage in long-range sniping, but that alone is not enough. As ranges extend, it is the ability of the bullet to retain its velocity which becomes increasingly important; bullets which slow down gradually are far more useful than those which rapidly shed velocity. To achieve this, the bullet needs a high ballistic coefficient (BC). This is achieved partly by using a bullet of exceptionally streamlined shape, and partly by making it heavy. It is worthwhile sacrificing some muzzle velocity in order to use a bullet with a higher BC.

The key yardstick for long-range sniper ammunition is the range at which the bullet drops below the speed of sound. This is important for two reasons. The first is because that provides a quick proxy for the trajectory and time of flight of the bullet; and the flatter the trajectory and the shorter the flight time, the greater the hit probability, other things being equal. The second is that dropping back through the transonic zone usually disturbs the flight of the bullet, adversely affecting accuracy, although this effect is minimised with the very low drag bullets developed for the more specialised calibres. To give an example, the 7.62 x 51 147 grain M80 standard NATO ball bullet is fired at a muzzle velocity 200 fps higher than the 175 grain M118LR, but drops to subsonic velocity at around 875 m compared with about 950 m for the heavier and initially slower bullet.

The table at the end of this article gives basic measurements and typical performances for the cartridges being discussed. Performance figures for the more specialist rounds should be taken as indicative as they will not have been measured to comparable standards. They will of course be affected by the barrel length selected and will be loaded with purpose-designed bullets (often machined from solid brass for greater precision) to whatever feasible performance level the customer wants. They may develop higher chamber pressures than would be acceptable for a standard MG round, pushing their performance up quite significantly.

.300 Winchester Magnum

This was first developed as a commercial hunting round in the early 1960s. Work on adapting this cartridge for the long-range sniping role was undertaken by the USN in the 1980s to meet a special operations requirement for a rifle which would extend the 800 m effective range of the 7.62 x 51 out to 1,200 m. The standard MK248 loadings use Sierra MatchKing bullets which retain minute-of-angle accuracy out to at least 1,000 m; the Mod 0 uses a 190 grain (12.3 g) bullet, the Mod 1 a 220 grain (14.25 g) version to increase the effective range to around 1,400 m. The .300WM has been in

US service for special purposes but was recently adopted by the US Army to replace the 7.62 x 51 in bolt-action sniper rifles, the existing M24 rifles being rebarrelled and redesignated M2010. The 7.62 x 51 remains in US Army sniper use in the M110 Semi-Auto Sniper System.

From left to right: 7.62x51 (for scale), .300 Winchester Magnum, .338 Norma Magnum, .338 Lapua Magnum, 9x85 MEN, 9.3x64 Russian, .375 CheyTac, .408 CheyTac (Extreme Performance loading), .416 Tyr (Extreme Performance loading), .416 Barrett, .460 Steyr, .50 BMG (Primetake loading). The last five rounds in this group are all loaded with machine-turned solid brass bullets by specialist companies.

.338 Norma Magnum

This was developed to enable the use of heavier bullets with longer noses than the standard .338 Lapua Magnum loadings without exceeding the overall length of that cartridge. The case is the same as the Lapua's but shortened by 5.5 mm. The neck is also slightly longer, which reportedly improves barrel life. Originally intended for civilian purposes, it was adopted for the General Dynamics Lightweight Medium Machine Gun to provide far more effective long-range fire with about the same gun weight as a 7.62 mm GPMG. Should this MG ever be adopted, it appears likely that sniper rifles would be developed to use this ammunition, which could be easily done by rebarrelling .338 LM rifles.

.338 Lapua Magnum

Originally developed in the mid 1980s by the Research Armament Company as a long-range sniper round to meet the same USN requirement as led to the use of the .300 Win Mag described above, this was subsequently adopted by Lapua and is now made for both military and civilian requirements. The normal maximum range is

regarded as 1,200 m but in ideal conditions it can reach out to 1,600 m, the distance at which the bullet becomes subsonic. Many feel that this is a very practical round for sniping since the rifles are not much bigger or heavier than the .30 cal weapons, and its use is accordingly spreading, to the extent that it is fast becoming the international standard long-range sniping round. The British Army adopted some Accuracy International rifles in this calibre some years ago, and has recently replaced most of its 7.62mm sniper rifles with more of the .338 guns.

9 x 85 MEN

An experimental German sniper cartridge, this was the end result of various tests for a 9 mm round which included some based on the .50 BMG. It was not adopted and the ballistic performance is not public, but it is included here out of interest. Rim diameter is .700 inches (17.7 mm).

9.3 x 64 Russian

This Russian military heavy sniper round is based on the century-old 9.3 x 64 Brenneke hunting round and was adopted to bridge the gap between the 7.62 x 54R SVD (Dragunov) and 12.7 x 108 anti-materiel rifles. It does not have such a high performance as the western equivalents but still offers significant benefits in range and hitting power over the 7.62mm. The round was available in the SVDK and various other rifles: the LOS-9, Saiga-9 and Tiger-9. The more modest performance should have resulted in good barrel heating and wear characteristics, indicating some potential for use in a machine gun. However, it seems that rifles in this calibre were never officially adopted.

.375 Cheyenne Tactical

This is simply the .408 CheyTac (see below) necked-down to the smaller calibre. Various special loadings and bullets have been developed, but Desert Tech offer a 352 grain (22.8 g) lathe-turned copper bullet fired at 3,080 fps (939 m/s), which remains supersonic out to around 2,000 m. In March 2017 it was announced that the Czech Ministry of Defence had ordered Desert Tech HTI rifles for special forces with barrels in both .50 BMG and .375 CT calibres: the first official use of this cartridge.

.408 Cheyenne Tactical

This round was developed by Cheyenne Tactical LLC and introduced in 2001 in conjunction with its own range of sniping rifles. The original basis for the cartridge was the old .505 Gibbs big-game hunting round, but it has been much modified as well as necked down. The standard 419 grain bullet remains supersonic and effective to 1,900-2,000m. A different loading, firing a lighter (305 grain) bullet at a velocity of 3,250-3,500 fps, has been developed to provide a flatter trajectory and shorter flight time out to 1,000m. The CheyTac rifle is reportedly in use with special forces in the USA, Poland, Turkey and Italy.

.416 Tyr

Like the .460 Steyr below, this was developed by Horst Grillmeyer for very long range precision shooting. Unusually, the case diameter appears to be unique (with the possible exception of the 9 x 85 MEN described above) so does not appear to be derived from any existing cartridge. No service use is known at present, and it appears that it has failed to achieve significant use.

.416 Barrett

This was developed by the famous maker of .50 cal rifles, reportedly in irritation at a Californian decision to ban .50 cal weapons. The basis of this round is the .50 BMG case, which is shortened and necked down. The performance is highly impressive, the standard bullet remaining supersonic to more than 2,250m. This bullet takes 2.5-2.6 seconds to reach 2,000 yards (1,830 m) compared with 3.0 seconds for the .408 CheyTac. No service use is known at present.

.460 Steyr

This round pre-dates the .416 Barrett, being developed in the early 2000s by the Austrian Horst Grillmeyer, but adopts the same principle of shortening and necking down the .50 BMG case, this time to .458 calibre. Little information about the performance of this round has so far emerged, but very specialised long-range bullets have been developed for it, so it is reasonable to assume a supersonic range in the region of 2,000-2,500 m. Ammunition is now available from AAA Arms & Ammo, loaded with 525 grain (34.0 g) bullets at 3,100 fps (945 m/s), giving a supersonic range of around 2,350-2,400 m. As with Barrett and their .416, Steyr Mannlicher can easily make weapons in this calibre by fitting new barrels to the .50 BMG rifles which they already offer. This also means, of course, that the guns are as big and heavy as .50 BMG rifles, so the customer will need to decide whether the ballistic advantages of these cartridges are sufficient to outweigh the loss of the wide range of ammunition types available in .50 calibre.

.50 Browning Machine Gun (BMG)

The history of this old warhorse is too well known to repeat here. Apart from its usual MG loadings, specially accurate bullets and loadings have been developed for use in rifles, for example the Sniper Elite listed in the table below and the ATK M1022 with its distinctive olive-green bullet. Most military sniper loadings are limited in their performance by being restricted to matching the trajectory of standard .50 MG rounds, which means that they only remain supersonic out to 1,500-1,600m. More specialised loadings reveal a lot more potential, for example the Hornady A-MAX 750 grain bullet remains supersonic out to 2,250-2,300m, despite having a muzzle velocity of only 2,700 fps. The Primetake solid brass bullet loading shown in the photo weighs 800 grains.

In conclusion, the long range sniper is spoiled for choice to a degree never seen before, and the drive to achieve the best possible performance and accuracy out to astonishing distances is pushing forward the boundaries of bullet design and ballistics.

cartridge	metric calibre	rim diameter (inches / mm)	bullet weight (grains / grams)	muzzle velocity (fps / mps)	muzzle energy (ft lbs / Joules)
7.62 x 51 M118LR	7.62 x 51	0.470 / 12.0	175 / 11.3	2,550 / 777	2,540 / 3,410
.300 Win Mag MK 248 Mod 0 (Mod 1)	7.62 x 66B	0.532 / 13.5	190 / 12.3 (220 / 14.25)	3,000 / 914 (2,850 / 870)	3,815 / 5,140 (4,000 / 5,390)
.338 Norma Mag	8.58 x 63.5	0.587 / 14.9	300 / 19.4	2,650 / 807	4,700 / 6,315
.338 Lapua Mag	8.58 x 71	0.587 / 14.9	250 / 16.2	3,000 / 914	5,020 / 6,765
9.3 x 64 Russian	9.3 x 64	0.500 / 12.6	270 / 17.5	2,500 / 760	3,765 / 5,055
.375 CheyTac	9.5 x 77	0.630 / 16.0	350 / 22.7	3,050 / 930	7,270 / 9,815
.408 CheyTac	10 x 77	0.630 / 16.0	419 / 27.2	2,900 / 885	7,860 / 10,630
.416 Tyr	10.6 x 80	0.700 / 17.7	410 / 26.6	2,820 / 860	7,280 / 9,835
.416 Barrett	10.6 x 83	0.800 / 20.3	400 / 25.9	3,250 / 990	9,430 / 12,690
.460 Steyr	11.6 x 90	0.800 / 20.3	600 / 38.9	3,000 / 914	12,050 / 16,250
.50 BMG	12.7 x 99	0.800 / 20.3	709 / 45.9	2,825 / 890	12,650 / 18,180
