


# 5.56×45mm NATO

5.56×45mm NATO			
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5.56×45mm NATO with measurement, left to right: bullet, empty case, complete round with bullet in casing			
Type	Rifle		
Place of origin	<span><span></span></span> United States		
Service history			
In service	Since 1963		
Used by	NATO		
Wars	Since Vietnam War		
Production history			
Designer	Remington Arms		
Specifications			
Parent case	.223 Remington		
Case type	Rimless, bottleneck		
Bullet diameter	5.70 mm (0.224 in)		
Neck diameter	6.43 mm (0.253 in)		
Shoulder diameter	9.00 mm (0.354 in)		
Base diameter	9.58 mm (0.377 in)		
Rim diameter	9.60 mm (0.378 in)		
Rim thickness	1.14 mm (0.045 in)		
Case length	44.70 mm (1.760 in)		
Overall length	57.40 mm (2.260 in)		
Case capacity	1.85 cm <sup>3</sup> (28.5 gr H <sub>2</sub> O)		
Rifling twist	178 mm or 229 mm (1 in 7 in or 9 in, originally 1 in 14 in)		
Primer type	Small rifle		
Maximum pressure	430.00 MPa (62,366 psi)		
Ballistic performance			
Bullet weight/type	Velocity	Energy	
4 g (62 gr) SS109 FMJBT	940 m/s (3,100 ft/s)	1,767 J (1,303 ft·lbf)	
4.1 g (63 gr) DM11 FMJBT	936 m/s (3,070 ft/s)	1,796 J (1,325 ft·lbf)	

4.1 g (63 gr) GP 90 FMJBT	905 m/s (2,970 ft/s)	1,679 J (1,238 ft·lbf)
Test barrel length: 508 mm (20.0 in) Source(s): NATO EPVAT testing, QuickLOAD, SAAMI, C.I.P. <sup>[1]</sup>		

The **5.56×45mm NATO** (official NATO nomenclature 5.56 NATO) is a rifle cartridge developed in the United States and originally chambered in the M16 rifle. Under STANAG 4172, it is a standard cartridge for NATO forces as well as many non-NATO countries.<sup>[2]</sup> It is derived from, but not identical to, the .223 Remington cartridge. If the bullet impacts at high enough velocity and yaws<sup>[3]</sup> in tissue, fragmentation creates a rapid transfer of energy which can result in dramatic wounding effects.<sup>[4][5][6]</sup>

History



The previous standard NATO rifle cartridge was the 7.62×51mm NATO, derived from the .308 Winchester rifle cartridge and designed to replace the .30-06 Springfield rifle cartridge in the U.S. military. At the time of selection, there had been criticism that the 7.62×51mm NATO was too powerful for light weight modern service rifles, causing excessive recoil, and that the weight of the ammunition did not allow for enough rate of fire in modern combat.<sup>[citation needed]</sup>

The British had extensive evidence with their own experiments into an intermediate cartridge since 1945 and were on the point of introducing a .280 inch (7 mm) cartridge when the selection of the 7.62×51mm NATO was made. The FN company had also been involved.<sup>[7]</sup> The concerns about recoil and effectiveness were effectively overruled by the US within NATO, and the other NATO nations accepted that standardization was more important at the time than selection of the ideal cartridge.<sup>[citation needed]</sup> However, whilst the 7.62×51mm NATO round became NATO standard the US was already engaged in research of their own, which ultimately led to the 5.56×45mm NATO cartridge.<sup>[citation needed]</sup>

During the late 1950s, ArmaLite and other U.S. firearm designers started their individual Small Caliber/High Velocity (SCHV) assault rifle experiments using the commercial .222 Remington cartridge. When it became clear that there was not enough powder capacity to meet U.S. Continental Army Command's (CONARC) velocity and penetration requirements, ArmaLite contacted Remington to create a similar cartridge with a longer case body and shorter neck. This became the .222 Remington Special. At the same time, Springfield Armory's Earle Harvey had Remington create an even longer cartridge case then known as the .224 Springfield. Springfield was forced to drop out of the CONARC competition, and thus the .224 Springfield was later released as a commercial sporting cartridge known as the .222 Remington Magnum. To prevent confusion with all of the competing .222 cartridge designations, the .222 Remington Special was renamed the .223 Remington. After playing with their own proprietary cartridge case design, the .224E1 Winchester, Winchester eventually standardized their case dimensions, but not overall loaded length, with the .222 Remington Special to create a cartridge known as the .224E2 Winchester.<sup>[8]</sup> With the U.S. military adoption of the ArmaLite M16 rifle in 1963, the .223 Remington was standardized as the 5.56×45mm NATO. As a commercial sporting cartridge the .223 Remington was only introduced in 1964.

In a series of mock-combat situations testing in the early 1960s with the M16, M14 and AK-47, the Army found that the M16's small size and light weight allowed it to be brought to bear much more quickly.<sup>[citation needed]</sup> Their final conclusion was that an 8-man team equipped with the M16 would have the same fire-power as a current 11-man team armed with the M14.<sup>[citation needed]</sup> U.S. troops were able to carry more than twice as much 5.56×45mm NATO ammunition as 7.62×51mm NATO for the same weight, which would allow them a better advantage against a typical

NVA unit armed with AK-47s.

Rifle	Cartridge	Cartridge weight	Weight of loaded magazine	Max. 10 kilogram ammo. load
M14	7.62×51mm	393 gr (25.4 g)	20 rd mag @ 0.68 kg	14 mags @ 9.52 kg for 280 rds
M16	5.56×45mm	183 gr (11.8 g)	20 rd mag @ 0.3 kg	33 mags @ 9.9 kg for 660 rds
AK-47	7.62×39mm	281 gr (18.2 g)	30 rd mag @ 0.92 kg*[9]	10 mags @ 9.2 kg for 300 rds

(\*AK-47 magazines are much heavier than M14 and M16 magazines)

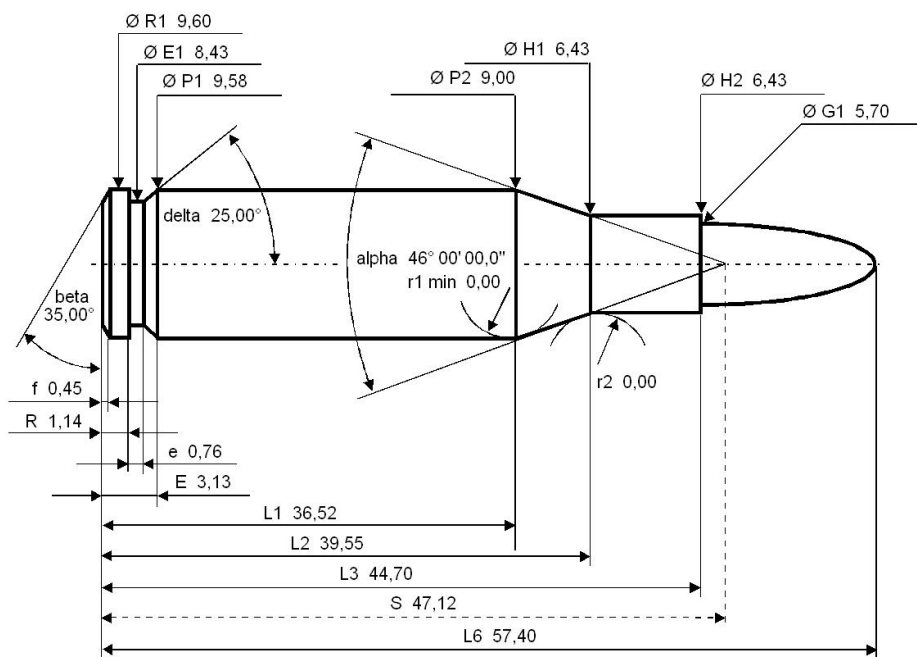
In 1977, NATO members signed an agreement to select a second, smaller caliber cartridge to replace the 7.62×51mm NATO cartridge.<sup>[10]</sup> Of the cartridges tendered, the 5.56×45mm NATO was successful, but not the 55 gr M193 round used by the U.S. at that time. The wounds produced by the M193 round were so devastating that many<sup>[11]</sup> consider it to be inhumane.<sup>[12][13]</sup> Instead, the Belgian 62 gr SS109 round was chosen for standardization. The SS109 used a heavier bullet with a steel core and had a lower muzzle velocity for better long-range performance, specifically to meet a requirement that the bullet be able to penetrate through one side of a steel helmet at 600 meters. This requirement made the SS109 (M855) round less capable of fragmentation than the M193 and was considered more humane.<sup>[14]</sup>



The 5.56×45mm NATO inspired an international tendency towards relatively small sized, light weight, high velocity military service cartridges that produce relatively low bolt thrust and free recoil impulse, favoring light weight arms design and automatic fire accuracy. Similar intermediate cartridges were developed and introduced by the Soviet Union in 1974 (5.45×39mm) and by the People's Republic of China in 1987 (5.8×42mm).<sup>[7][15]</sup>

## Cartridge dimensions

The 5.56×45mm NATO has 1.85 ml (28.5 grains H<sub>2</sub>O) cartridge case capacity.



**5.56×45mm NATO maximum NATO cartridge dimensions.** All sizes in millimeters (mm).<sup>[16][17]</sup>

Americans would define the shoulder angle at  $\alpha/2 = 23$  degrees. The common rifling twist rate for this cartridge is 178 mm (1 in 7 in) or 229 mm (1 in 9 in), 6 grooves,  $\emptyset$  lands = 5.56 mm,  $\emptyset$  grooves = 5.69 mm, land width = 1.88 mm and the primer type is small rifle.

According to the official NATO proofing guidelines the 5.56×45mm NATO case can handle up to 430 MPa (62,000 psi) piezo service pressure. In NATO regulated organizations every rifle cartridge combo has to be proofed at 125% of this maximum pressure to certify for service issue. This is equal to the C.I.P. maximum pressure guideline for the .223 Remington cartridge, that is the 5.56×45mm NATO parent cartridge.

## Performance

The 5.56×45mm NATO cartridge with the standard 62 gr. steel core bullets (NATO: SS109; U.S.: M855) will penetrate approximately 15 to 20 in (38 to 51 cm) into soft tissue in ideal circumstances. As with all spitzer shaped projectiles it is prone to yaw in soft tissue. However, at impact velocities above roughly 2,500 ft/s (760 m/s), it may yaw and then fragment at the cannelure (the crimping groove around the cylinder of the bullet).<sup>[18]</sup> These fragments can disperse through flesh and bone, inflicting additional internal injuries.<sup>[19]</sup>

Fragmentation, if or when it occurs, imparts much greater damage to human tissue than bullet dimensions and velocities would suggest. This fragmentation effect is highly dependent on velocity, and therefore barrel length: short-barreled carbines generate less muzzle velocity and therefore lose wounding effectiveness at much shorter ranges than longer-barreled rifles. Proponents of the hydrostatic shock theory contend that the rapid transfer of energy also results in wounding effects beyond the tissue directly crushed and torn by the bullet and fragments.<sup>[4][5]</sup> These remote wounding effects are known as hydrostatic shock.<sup>[6]</sup>

NATO Ball (U.S.: M855) can penetrate up to 3 mm (about  $\frac{1}{8}$  in) of steel at 600 meters.<sup>[20]</sup> According to Nammo, a Norwegian ammunition producer, the M995 can penetrate up to 12 mm (nearly  $\frac{1}{2}$  in) of RHA steel at 100 meters.<sup>[21]</sup>

The US Army's Ballistic Research Laboratory measured a ballistic coefficient (G7 BC) of 0.151 and form factor (G7 *i*) of 1.172 for the SS109/M855 ball projectile.<sup>[22]</sup>

## Criticism

There has been much criticism of the allegedly poor performance of the bullet on target, especially the first-shot kill rate when the muzzle velocity of the firearms used and the downrange bullet deceleration do not achieve the minimally required terminal velocity at the target to cause fragmentation.<sup>[23]</sup> This wounding problem has been cited in incidents beginning in the Vietnam War, first Gulf War, Somalia, and in the current conflicts in Iraq and Afghanistan. The change of the original 1 in 14 inch barrel twist rate of the AR15 to the 1 in 12 inch barrel twist rate in the M16 and XM16E1, resulted in greater long range accuracy and better bullet stability. However, it also resulted in making the bullet less likely to tumble on impact with soft tissue. Much of the spectacular wounding ability of the original AR15 in the Vietnam War, was on account of the 1 in 14 twist rate and the bullets tendency to tumble and fragment after impact. In recent lab testing of M855, it has been shown that the bullets do not fragment reliably or consistently from round-to-round, displaying widely variable performance. In several cases, yawing did not begin



until 7–10 in of penetration. This was with all rounds coming from the same manufacturer.<sup>[23]</sup> This lack of wounding capacity typically becomes an increasingly significant issue as range increases (e.g., ranges over 50 m when using an M4 or 200 m when using an M16) or when penetrating heavy clothing, but this problem is compounded in shorter-barreled weapons. The 14.5 inches (37 cm) barrel of the U.S. military's M4 carbine generates considerably less initial velocity than the longer 20" barrel found on the M16, and terminal performance can be a particular problem with the M4.

Combat operations the past few months have again highlighted terminal performance deficiencies with 5.56×45mm 62 gr. M855 FMJ. These problems have primarily been manifested as inadequate incapacitation of enemy forces despite them being hit multiple times by M855 bullets. These failures appear to be associated with the bullets exiting the body of the enemy soldier without yawing and fragmenting.

This failure to yaw and fragment can be caused by reduced impact velocities as when fired from short barrel weapons or when the range increases. It can also occur when the bullets pass through only minimal tissue, such as a limb or the torso of a thin, small statured individual, as the bullet may exit the body before it has a chance to yaw and fragment. In addition, bullets of the SS109/M855 type are manufactured by many countries in numerous production plants.

Although all SS109/M855 types must be 62 gr. FMJ bullets constructed with a steel penetrator in the nose, the composition, thickness, and relative weights of the jackets, penetrators, and cores are quite variable, as are the types and position of the cannelures. Because of the significant differences in construction between bullets within the SS109/M855 category, terminal performance is quite variable – with differences noted in yaw, fragmentation, and penetration depths. Luke Haag's papers in the AFTE Journal (33(1):11–28, Winter 2001) also describes this problem.

—<sup>[23]</sup>

Despite complaints that the 5.56 round lacks stopping power, others contend that animal studies of the wounding effects of the 5.56×45mm round versus the 7.62×39mm have found that the 5.56 mm round is more damaging, due to the post-impact behavior of the 5.56 mm projectile resulting in greater cavitation of soft tissues.<sup>[24]</sup> The US Army contended in 2003 that the lack of close range lethality of the 5.56×45mm was more a matter of perception than fact. With controlled pairs and good shot placement to the head and chest, the target was usually defeated without issue. The majority of failures were the result of hitting the target in non-vital areas such as extremities. However, a minority of failures occurred in spite of multiple hits to the chest.<sup>[25]</sup>

## Improvements

Recently, advances have been made in 5.56 mm ammunition. The US military has adopted for limited issue a 77-grain (5.0 g) "Match" bullet, type classified as the Mk 262. The heavy, lightly constructed bullet fragments more violently at short range and also has a longer fragmentation range.<sup>[26]</sup> Originally designed for use in the Mk 12 SPR, the ammunition has found favor with special forces<sup>[27]</sup> units who were seeking a more effective cartridge to fire from their M4A1 carbines. Commercially available loadings using these heavier (and longer) bullets can be prohibitively expensive and cost much more than military surplus ammunition. Additionally, these heavy-for-caliber loadings sacrifice even more penetrative ability than the M855 round (which has a steel penetrator tip). Performance of 5.56×45 mm military ammunition can generally be categorized as almost entirely dependent upon velocity in order to wound effectively. Heavy OTM bullets enhance soft tissue wounding ability at the expense of hard-target/barrier penetration.

For general issue, the U.S. military adopted the M855A1 round in 2010 to replace the M855. The primary reason was pressure to use non-lead bullets. The bullet is made of a copper alloy slug with a steel penetrator, reducing lead contamination to the environment. The M855A1 offers several improvements other than being lead-free. It is slightly more accurate, has better consistency of effect in regards to wounding ability and has an increased penetrating capability. The round can better penetrate steel, brick, concrete, and masonry walls, as well as body armor and sheet

metal. The propellant burns faster which decreases the muzzle flash, an important feature when fired from a short barreled M4 carbine. Though the M855A1 is more expensive to produce, its increased performance compensates. One possible danger is that it generates more pressure in the chamber when fired, slightly increasing the risk of catastrophic failure of the weapon, though this has yet to occur.<sup>[28]</sup> From fielding in June 2010 to September 2012, Alliant Techsystems has delivered over 350 million M855A1 Enhanced Performance Rounds.<sup>[29]</sup>

## Alternatives

If the 5.56mm bullet is moving too slowly to reliably fragment on impact, the wound size and potential to incapacitate a person is greatly reduced. There have been numerous attempts to create an intermediate cartridge that addresses the complaints of 5.56 NATO's lack of stopping power along with lack of controllability seen in rifles firing 7.62 NATO in full auto. Other cartridges focused on superior short-range performance by sacrificing long-distance performance due to relatively short engagement distances typically observed in modern warfare. As of late 2009, none of those cartridges gained any significant traction beyond special forces and sport shooting communities. Examples include, but are not limited to, the 6.8mm Remington SPC and 6.5mm Grendel.

## 5.56 mm NATO versus .223 Remington

The 5.56 mm NATO and .223 Remington cartridges and chamberings are similar but not identical.

### Brass

5.56 NATO and .223 commercial brass cases tend to have similar case capacity when measured, with variations chiefly due to brand, not 5.56 vs .223 designation. The result of this is that there is no such thing as "5.56 brass" or ".223 brass", the differences in the cartridges lie in pressure ratings and in chamber throat length, not in the shape or thickness of the brass.<sup>[30]</sup>

### Pressure

The NATO specification measures pressure differently, which can lead to higher allowable peak pressures. NATO EPVAT test barrels made for 5.56 mm NATO measure chamber pressure at the case mouth, as opposed to the location used by the United States civil standards organization SAAMI. The piezoelectric sensors or transducers NATO and SAAMI use to conduct the actual pressure measurements also differ. This difference in measurement method accounts for upwards of 20,000 psi (140 MPa) difference in pressure measurements. This means the NATO EPVAT maximum service pressure of 430 MPa (62,000 psi) for 5.56 mm NATO, is reduced by SAAMI to 55,000 psi (380 MPa) for .223 Remington.<sup>[31]</sup> In contrast to SAAMI, the other main civil standards organization C.I.P. defines the maximum service and proof test pressures of the .223 Remington cartridge equal to the 5.56 mm NATO.

### Chamber

The 5.56 mm NATO chambering, known as a NATO or mil-spec chamber, has a longer leade, which is the distance between the mouth of the cartridge and the point at which the rifling engages the bullet. The .223 Remington chambering, known as SAAMI chamber, is allowed to have a shorter leade, and is only required to be proof tested to the lower SAAMI chamber pressure. To address these issues, various proprietary chambers exist, such as the Wylde chamber (Rock River Arms)<sup>[32]</sup> or the ArmaLite chamber, which are designed to handle both 5.56×45mm NATO and .223 Remington equally well. The dimensions and leade of the .223 Remington minimum C.I.P. chamber also differ from the 5.56 mm NATO chamber specification.

Using commercial .223 Remington cartridges in a 5.56 mm NATO chambered rifle should work reliably, but until recently, it was believed this was less accurate than when fired from a .223 Remington chambered gun due to the



longer leade.<sup>[33]</sup> Although that may have been true in the early 1960s when the two rounds were developed, recent testing has shown that with today's ammunition, rifles chambered in 5.56mm can also fire .223 ammunition every bit as accurately as rifles chambered in .223 Remington, and the 5.56mm chamber has the additional advantage of being able to safely fire both calibers.<sup>[34]</sup> Using 5.56 mm NATO mil-spec cartridges (such as the M855) in a .223 Remington chambered rifle can lead to excessive wear and stress on the rifle and even be unsafe, and SAAMI recommends against the practice.<sup>[35][36]</sup> Some commercial rifles marked as ".223 Remington" are in fact suited for 5.56 mm NATO, such as many commercial AR-15 variants and the Ruger Mini-14 (marked ".223 cal"), but the manufacturer should always be consulted to verify that this is acceptable before attempting it, and signs of excessive pressure (such as flattening or gas staining of the primers) should be looked for in the initial testing with 5.56 mm NATO ammunition.<sup>[37]</sup>

It should also be noted that the upper receiver (to which the barrel with its chamber are attached) and the lower receiver are entirely separate parts in AR-15 style rifles. If the lower receiver has either .223 or 5.56 stamped on it, it does not guarantee the upper assembly is rated for the same caliber, because the upper and the lower receiver in the same rifle can, and frequently do, come from different manufacturers – particularly with rifles sold to civilians or second-hand rifles.

In more practical terms, as of 2010 most AR-15 parts suppliers engineer their complete upper assemblies (not to be confused with stripped uppers where the barrel is not included) to support both calibers in order to protect their customers from injuries and to protect their businesses from resultant litigation.

## Comparison of 5.56 mm NATO versus 7.62 mm NATO

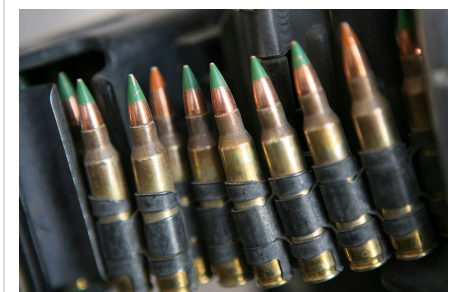


Comparison of 7.62mm NATO, 5.56mm NATO and 9mm Parabellum.

Cartridge	Model	Cartridge size	Cartridge weight	Bullet weight	Velocity	Energy
5.56mm NATO	M855 <sup>[38]</sup>	5.56×45mm	12.31 g (190 gr)	4.02 g (62 gr)	945.5 m/s (3,100 ft/s) <sup>[39]</sup>	1,797 J <sup>[40]</sup>
7.62mm NATO	M80 <sup>[41]</sup>	7.62×51mm	25.40 g (392 gr)	9.33 g (147 gr)	838.0 m/s (2,749 ft/s) <sup>[41]</sup>	3,275 J

## Military cartridge types

- **Cartridge, Ball, F1 (Australia):** 5.56×45mm FN SS109 equivalent produced by Australian Defence Industries(ADI), now Thales Australia.
- **Cartridge, Blank, F3 (Australia):** 5.56×45mm Blank cartridge produced by Australian Defence Industries(ADI), now Thales Australia.
- **Cartridge, Ball, SS109 (Belgium):** 5.56×45mm 61-grain [3.95 g]<sup>[42]</sup> Semi-Armor-Piercing cartridge w/. steel penetrator produced by Fabrique Nationale. It replaced the US M193 cartridge in 1979 as the NATO standard.<sup>[43]</sup>
- **Cartridge, Ball, C77 (Canada):** 5.56×45mm FN SS109 equivalent used in the C7, C8 and C9 type weapons. Made by General Dynamics Canada.
- **Cartridge, Blank, C79 (Canada):** 5.56×45mm blank cartridge used in the C7, C8 and C9 type weapons. Also made by General Dynamics Canada.
- **Cartridge, Ball, DM11 (Germany):** 5.56×45mm 4.1 g dual core ball cartridge w/steel core, produced by RUAG Ammotec. [green tip]
- **Cartridge, Tracer, DM21 (Germany):** 5.56×45mm tracer compliment to DM11, also produced by RUAG Ammotec. [orange tip]
- **Cartridge, Ball, L2A1 (United Kingdom):** 5.56×45mm M193 equivalent produced by Radway Green.<sup>[44]</sup>
- **Cartridge, Ball, L2A2 (United Kingdom):** 5.56×45mm FN SS109 equivalent produced by Radway Green.
- **Cartridge, Tracer, L1A1 (United Kingdom):** 5.56×45mm tracer compliment to L2A1, produced by Radway Green. [red tip]
- **Cartridge, Tracer, L1A2 (United Kingdom):** 5.56×45mm tracer compliment to L2A2, produced by Radway Green. [red tip]
- **Cartridge, Caliber 5.56 mm, Ball, M193 (United States):** 5.56×45mm 55-grain [3.56 g] ball cartridge.
- **Cartridge, Caliber 5.56 mm, Grenade, M195 (United States):** 5.56×45mm grenade launching blank.
- **Cartridge, Caliber 5.56 mm, Tracer, M196 (United States):** 5.56×45mm 54-grain [3.43 g] tracer cartridge. [red or orange tip].
- **Cartridge, Caliber 5.56 mm, Dummy, M199 (United States):** 5.56×45mm dummy cartridge, non firing, indented case.
- **Cartridge, Caliber 5.56 mm, Blank, M200 (United States):** 5.56×45mm violet-tipped blank cartridge.
- **Cartridge, Caliber 5.56 mm, Ball, M202 (United States):** 5.56×45mm 58-grain FN SSX822 cartridge.
- **Cartridge, Caliber 5.56 mm, Ball, XM287 (United States):** 5.56×45mm 68-grain ball cartridge produced by Industries Valcartier, Inc. An Improved version was also produced designated **XM779**.



M855 and M856 cartridges in an ammunition belt using M27 disintegrating links.



- **Cartridge, Caliber 5.56 mm, Tracer, XM288** (*United States*): 5.56×45mm 68-grain tracer cartridge produced by Industries Valcartier, Inc. An Improved version was also produced designated **XM780**.
  - **Cartridge, Caliber 5.56 mm, Grenade, M755** (*United States*): 5.56×45mm grenade launching blank specifically for the M234 launcher.
  - **Cartridge, Caliber 5.56 mm, Ball, XM777** (*United States*): 5.56×45mm ball cartridge.
  - **Cartridge, Caliber 5.56 mm, Tracer, XM778** (*United States*): 5.56×45mm tracer cartridge.
  - **Cartridge, Caliber 5.56 mm, Ball, M855** (*United States*): 5.56×45mm 62-grain FN SS109-equivalent ball cartridge with a steel penetrator tip over a lead core in a partial copper jacket. [green tip]
  - **Cartridge, Caliber 5.56 mm, Ball, M855 Lead Free** (*United States*): 62-grain bullet with a steel penetrator tip over a tungsten-composite core in a partial copper jacket.<sup>[45]</sup> Primarily used during training in countries with strict lead disposal laws. [green tip]
  - **Cartridge, Caliber 5.56 mm, Ball, M855A1** (*United States*): 62-grain bullet w/ a 19-grain steel penetrator tip over a copper alloy core.
  - **Cartridge, Caliber 5.56 mm, Tracer, M856** (*United States*): 5.56×45mm 64-grain FN L110 tracer cartridge. [orange tip]
  - **Cartridge, Caliber 5.56 mm, Tracer, M856A1** (*United States*): 5.56×45mm Lead Free Slug (LFS) Tracer with similar ballistic performance to the M855A1 and improved trace to range consistency. [orange tip]<sup>[46]</sup>
  - **Cartridge, Caliber 5.56 mm, Plastic, Practice, M862** (*United States*): *Short Range Training Ammo* (SRTA) has a smaller charge than standard ball, reducing its aimed range to 250 meters, and fires a plastic bullet. The M2 training bolt must be used in the M16 Rifle / M4 Carbine when using SRTA for the weapon to cycle properly due to its lower power. It is used during training on shooting ranges near built-up or populated areas. [Brass primer, Aluminum case and Blue plastic projectile].
  - **Cartridge, Caliber 5.56 mm, Armor Piercing, M995** (*United States*): 5.56×45mm 52-grain AP cartridge with a tungsten core. [black tip].
  - **Cartridge, Caliber 5.56 mm, Tracer, XM996** (*United States*): 5.56×45mm so-called "Dim Tracer" with reduced effect primarily for use with night vision devices. [red tip?]
  - **Cartridge, Caliber 5.56 mm, Special Ball, Long Range, Mk 262 Mod 0/1** (*United States*): 5.56×45mm 77-grain Open-Tipped Match/Hollow-Point Boat-Tail cartridge. Mod 0 features Sierra Matchking bullet, while Mod 1 features either Nosler or Sierra bullet.
  - **Cartridge, Caliber 5.56 mm, MK318 MOD 0 enhanced 5.56 mm ammunition** (*United States*): 5.56×45mm 62-grain Open-Tipped Match Boat-Tail cartridge.<sup>[47][48]</sup>
  - **Cartridge, 5.56 mm, Ball, MLU-26/P** (*United States*): Early USAF designation for 5.56×45mm ball cartridge produced by Remington.
  - **Cartridge, 5.56 x 45 mm, Ball, M1A3** (*South Africa*): 56-grain FMJ Ball round based on the M193 cartridge. It was used with the R4 assault rifle.
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## M855A1

In June 2010, the United States Army announced it began shipping its new 5.56 mm cartridge, the **M855A1 Enhanced Performance Round**, to active combat zones. During testing, the M855A1 performed better than current 7.62×51mm NATO ball ammunition against certain types of targets (particularly hardened steel), blurring the performance differences that previously separated the two cartridges. The US Army Picatinny Arsenal stated that the new M855A1 offers improved hard target capability, more consistent performance at all distances, enhanced dependability, improved accuracy, reduced muzzle flash, and higher velocity compared to the M855 round. Further, the Army stated the new M855A1 ammunition is tailored for use in M4 carbines, but should also give enhanced performance in M16 rifles and M249 light machine guns. The new 62-grain (4 g) projectile or bullet used in the M855A1 round has a copper core with a 19-grain (1.2 g) steel "stacked-cone" penetrating tip. The M855A1 cartridge is sometimes referred to as "green ammo" because it fires a lead free projectile.<sup>[49][50][51][52][53][54]</sup>



M855A1 Enhanced Performance Round and its environmentally friendly projectile.

The M855A1 was put on hold in August 2009 due to the experimental bismuth-tin alloy core exhibiting undependable ballistics at high temperatures. The US Army has since replaced the bismuth-tin alloy core with one of solid copper eliminating the heat issue. The United States Marine Corps purchased 1.8 million rounds in 2010, with plans to adopt the round to replace the interim MK318 SOST rounds used in Afghanistan when the M855A1 project was delayed.<sup>[55]</sup>

On a media day at Aberdeen Proving Ground on May 4, 2011, reports were given about the M855A1's performance in the field since it was issued 11 months earlier. One primary advantage given by the round is its consistent performance against soft targets. While the older M855 was yaw-dependant, which means its effectiveness depends on its yaw angle when it hits a target, the M855A1 delivers the same effectiveness in a soft target no matter its yaw angle.<sup>[56]</sup> The new SMP-842 propellant in the round burns quicker in the shorter M4 carbine barrel, ensuring less muzzle flash and greater muzzle velocity. The M855A1 was able to penetrate  $\frac{3}{8}$  inches (9.5 mm) of steel plate at 300 meters. The round even penetrated concrete masonry units, similar to cinder blocks, at 75 meters from an M16 and at 50 meters from an M4, which the M855 could not do at those ranges. Its accuracy is maintained and sometimes increased, as it was able to shoot a 2 inch group at 600 meters. February 2011 was the first time the M855A1 was used more than the M855, and approximately 30 million M855A1 rounds have been fielded from June 2010 to May 2011.<sup>[57]</sup>

The M855A1 was put to the test at the 2012 National Rifle Association's National High-Power Rifle Championship at Camp Perry, Ohio in August 2012. The shooter for the Army was Rob Harbison, a contractor supporting small caliber ammunition capability development at Fort Benning Georgia. This was a special event for the Project Manager for Maneuver Ammunition Systems and the Army's Maneuver Center of Excellence as it was an opportunity to showcase the capabilities of the Enhanced Performance Round. With an M16 loaded with M855A1 ammo, Harbison fired a perfect 200 points in the Coast Guard Trophy Match, which is 20 shots fired from the sitting position at 200 yards, finishing 17th out of 365 competitors. He also scored a perfect 100 on the final string of ten shots during the Air Force Cup Trophy Match, fired at 600 yards from the prone position, which is 10 shots in a row within the 12-inch, 10-point ring at 600 yards with combat ammunition. Harbison was happy with the performance of the EPR, with his scores showing that the Army's newest general purpose round is accurate enough to go toe-to-toe in the competition with the best ammo that can be bought or hand-loaded. Harbison even said, "I don't think I could have scored any higher if I was using match-grade competition ammunition."<sup>[58]</sup>

From fielding in June 2010 to September 2012, Alliant Techsystems has delivered over 350 million M855A1 Enhanced Performance Rounds.<sup>[29]</sup>

## Mk 262

The **Mk 262** is a match quality round manufactured by Black Hills Ammunition made originally for the Special Purpose Rifle (SPR). It uses a 77-grain (5.0 g) Sierra MatchKing bullet that is more effective at longer ranges than the standard issue M855 round.

Two versions of the round have been procured to date. Initial production runs, designated Mark 262 Mod 0, lacked a cannelure. Subsequent production, designated Mk 262 Mod 1, added a cannelure to the bullet for effective crimping.

According to US DoD sources, the Mk 262 round is capable of making kills at 700 meters. Ballistics tests found that the round caused "consistent initial yaw in soft tissue" at more than 300 meters. Apparently it is superior to the standard M855 round when fired from an M4 or M16 rifle. It evidently possesses superior stopping power, and can allow for engagements to be extended to up to 700 meters when fired from an 18 inch barrel. It appears that this round can drastically improve the performance of any AR15 platform weapon chambered to .223/5.56 mm. Superior accuracy, wounding capacity, stopping power and range power has made this the preferred round of many Special Forces operators, and highly desirable as a replacement for the older, Belgian-designed 5.56x45mm M855 NATO round.<sup>[59][60]</sup> Hard target penetration is slightly decreased.<sup>[61]</sup>

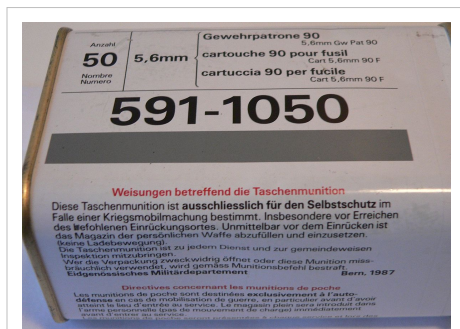
## 5.6mm Gw Pat 90

The **5.6mm Gw Pat 90** or **GP 90** (5.6 mm Rifle Cartridge 90), is the standard round used by the Swiss military in its rifle, the SIG SG 550. The cartridge is also known as the **Cart 5.6mm F** to the French and Italian speaking Swiss militiamen. The Swiss refer to the round as the 5.6 mm Gw Pat 90, although it is interchangeable with the 5.56x45mm NATO and .223 Remington round. The Gw Pat 90 is optimized for use in 5.56 mm (.223 in) caliber barrels with a 254 mm (1:10 in) twist rate.

The Gw Pat 90 was designed for the SIG SG 550 when it came into production in 1987, replacing the SIG SG 510. Previous experience of a change in standard rifle had proved that changing the distance of fire for the training ranges was more expensive than the design of a new ammunition; this prompted the design of a cartridge nominally capable at 300 meters. The cartridge was also designed to reduce pollution by controlling lead emissions.<sup>[62]</sup> The bullet was originally clad with a nickel alloy jacket, however, this was found to cause excessive barrel wear, so in 1998 the nickel jackets were replaced with tombac jackets. In addition, in 1999 a copper plug was added to the base of the bullet to address environmental concerns.<sup>[62]</sup>

The ammunition is currently (2009) produced by RUAG Ammotec, a subsidiary of the RUAG group.<sup>[63]</sup> The ammunition is manufactured in three variations: the standard FMJ round, the tracer round, and a blank round.

The FMJ cartridge has a Copper-Zinc alloy case and uses a double base propellant. The bullet is a 4.1 g (63 gr) tombac jacketed FMJ projectile with a G1 ballistic coefficient of 0.331 (ICAO) / 0.337 (Army Metro). The projectile contains approximately 95% Pb, 2% Sb, 3% Cu, and was designed for terminal ballistic instability. The required accuracy for Gw Pat 90 ammunition out of factory test barrels is 63 mm (0.72 MOA) for 10 rounds (100% radius measurement method) out to 300 m. The Gw Pat 90 cartridge dimensions are in accordance with the civilian C.I.P. standards for the .223 Remington C.I.P. chambering.<sup>[64]</sup>



Swiss Army 50-round Gw Pat 90 ammunition box.



Swiss Army Gw Pat 90 tracer rounds.

The Gw Pat 90 is used both in the Swiss military and in sport shooting. The very high level of individual training in the Swiss militia (every single soldier bearing a weapon has to shoot for qualification once a year; see Gun politics in Switzerland) and the overall use of the Gw Pat 90 by the many Swiss citizens who shoot in competitions and for amusement has resulted in significant input on its usage. Over 1 billion cartridges have been produced as of 2005.

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## External links

- Various photos of 5.56×45mm ammunition ([http://www.conjay.com/Ammunition for Armor Testing NATO 5.56mm x 45.htm](http://www.conjay.com/Ammunition%20for%20Armor%20Testing%20NATO%205.56mm%20x%2045.htm))
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