6.5x25 CBJ

CBJ Tech AB

Pistols and submachine guns are weapons with distinct benefits such as low weight, compact size and, in the case of submachine guns, high firepower. However, in modern combat these weapon systems, mainly based on the 9x19 Parabellum round, are proving less effective because of lack of penetration, limited effective range and poor wounding power.

Assault rifles are increasingly used for applications that used to be typical for submachine guns, like close quarter battle etc.

On the other hand, assault rifles too have important limitations. Firepower is reduced due to higher recoil and there are problems with overheating. They are heavy, and due to their length awkward to handle in vehicles and confined spaces. Attempts to make them more compact by shortening the barrel have resulted in significantly reduced wounding power, due to reduced muzzle velocity.

Realizing this, CBJ Tech has developed a cartridge system based on the new caliber 6.5x25 CBJ, which, after changing the barrel, can be used in most weapons chambered for the 9x19 Parabellum. The 6.5x25 CBJ, in combination with suitable weapons (like pistols and submachine guns), covers the full range of applications traditionally covered by everything from pistols up to and in most cases including assault rifles, and offers high firepower and superior penetration and wounding power at full combat ranges in any combat situation.

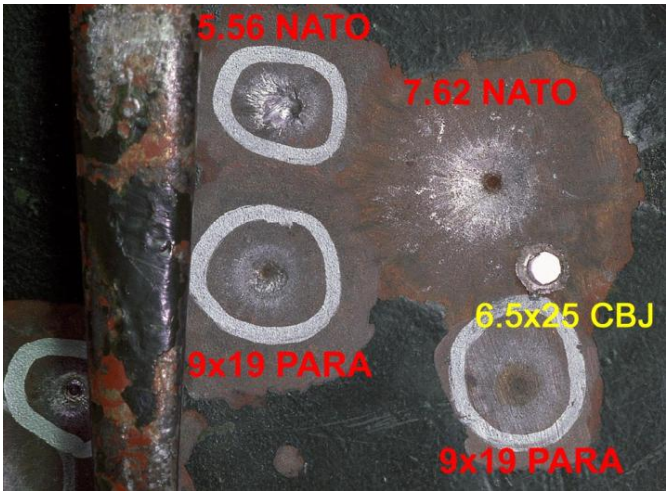
Weapon effectiveness

There are many factors that constitute weapon effectiveness, other than bullet performance in bare tissue even if this, of course, is critical. Weapon effectiveness can be defined as the ability of a soldier or policeman armed with a certain weapon system (weapon and cartridge) to defeat an enemy. This in turn is a function of how well the weapon system is adapted to the skills of the person using the weapon, the characteristics of the target and the combat environment. Focusing on the weapon system, this means there are three main aspects to consider, which are as follows in order of importance.

1. The ability to **hit** the target.
2. To have sufficient **penetration** to defeat barriers protecting the target and then penetrate deep enough in the target to reach vital structures to incapacitate reliably.
3. To have a high **energy transfer** to the target in order to increase the chance of rapid incapacitation.

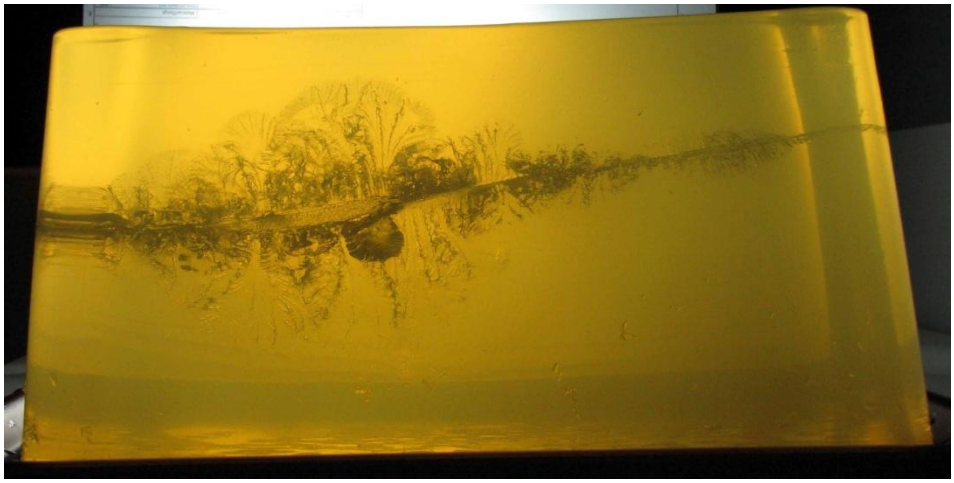
How the 6.5x25 CBJ solves it:

1. Hit probability is increased because of the low recoil generated, allowing rapid firing at high precision, and in the case of fully automatic weapons, the ability to fire accurate bursts. Also, at longer ranges and at moving targets the high velocity of the bullet with resulting flat trajectory and short time of flight to the target reduces the need of compensation, which greatly simplifies aiming.



2. The required penetration depends on the situation. For instance, the combat soldier generally needs more penetration than the average police officer. Within the 6.5x25 CBJ cartridge system, the entire spectrum of penetration is covered, from maximum penetration against tough targets to minimum penetration against unprotected targets in sensitive environments.

3. The different variants of the 6.5x25 CBJ have high energy and effective means to transfer it to soft tissue, resulting in a high wounding effect.



The 6.5x25 CBJ

6.5x25 CBJ Ball | 6.5x25 CBJ ST | 6.5x25 CBJ HET | 6.5x25 CBJ Subsonic AP

The 6.5x25 CBJ cartridge is of course primarily intended to be used in weapons designed and optimized for this caliber. However it is also designed to be used in 9x19 Parabellum weapons, converted by barrel change to the 6.5x25 CBJ. The cartridge generates the same level of impulse as the 9x19 Parabellum, which assures functioning of the weapons. The bolt face, groove and cartridge case up to the shoulder of the 6.5x25 CBJ are identical to the 9x19 Parabellum, as is the total length of the cartridge, 29.7mm.

This makes the transition to the new caliber easy. Another benefit is that existing stocks of 9x19 Parabellum ammunition can still be used for training instead of being scrapped.

There are many different potential users for the 6,5x25 CBJ, such as military, police, training units etc, with accordingly different demands. In order to be highly effective in all situations, the 6.5x25 CBJ has several cartridge alternatives, none of which contains any toxic material.

For training, there are cost effective alternatives. For combat, there are different cartridge alternatives depending on the situation and desired performance.

The development of the combat ammunition has followed a number of criteria, mainly;

- The bullet shall be effective within the entire desired combat range
- It must be able to penetrate any reasonable barrier typical for the application without breaking apart
- After penetrating such barriers it has to be able to penetrate at least 30cm of soft tissue to cause reliable incapacitation from any angle of impact
- After achieving the above, it shall have as high energy transfer to the target as possible

cartridge system

6.5x25 CBJ TRP 6.5x25 CBJ Frangible 6.5x25 CBJ Blank 6.5x25 CBJ Drill

To assure effectiveness, extensive testing has been conducted. To test performance and assess energy transfer in soft tissue, 10% ordnance gelatin shot at 4°C has been used and the permanent and temporary cavities studied. The wound channels have been visualized using the generally acknowledged Wound Profile Method by Fackler and Malinowski.

Barriers in front of the soft tissue simulant have included various body armors (notably the NATO CRISAT), car windshields, building materials, APC armor plate, military aircraft titanium and aluminum plates etc. Also, realistic composite tests have been made with scenarios such as uniformed protected soldier with web gear, protected soldier inside vehicle etc. The results confidently confirm that all development criteria are met.

To further assure effectiveness in real world combat, many side-by-side tests with the 6.5x25 CBJ and battle proven cartridges with known effects have been made, including 5.56x45 NATO, 7.62x51 NATO, various 9x19 cartridges, 7.62x39 and 5.45x39 shot from various weapons with different barrel lengths.

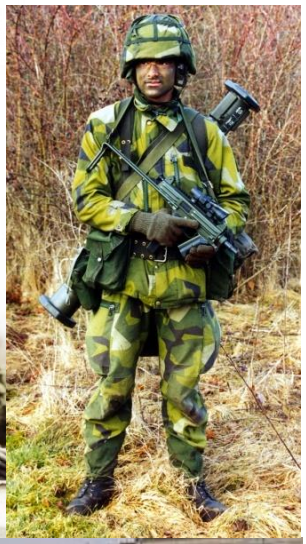
6.5x25 CBJ Ball

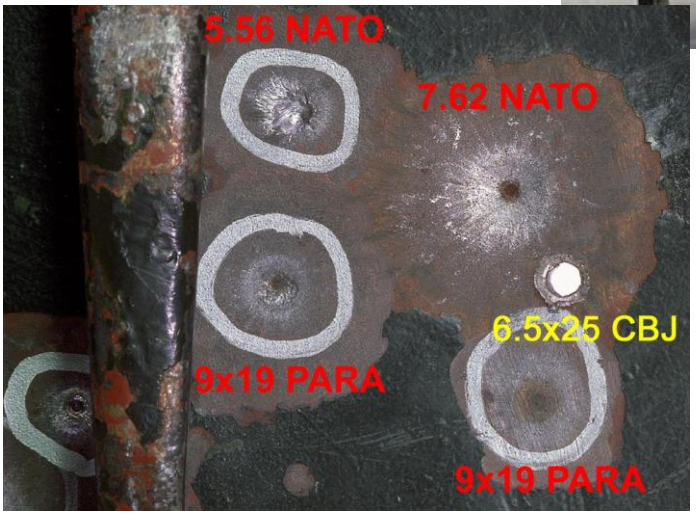
The 6.5x25 CBJ Ball is the standard cartridge with a tungsten projectile enclosed in a discarding plastic sabot.

Key benefits:

- High penetration
- High hit probability
- Long range
- High impact velocity at full ranges
- High wounding effect
- Low levels of barrel wear and corrosion

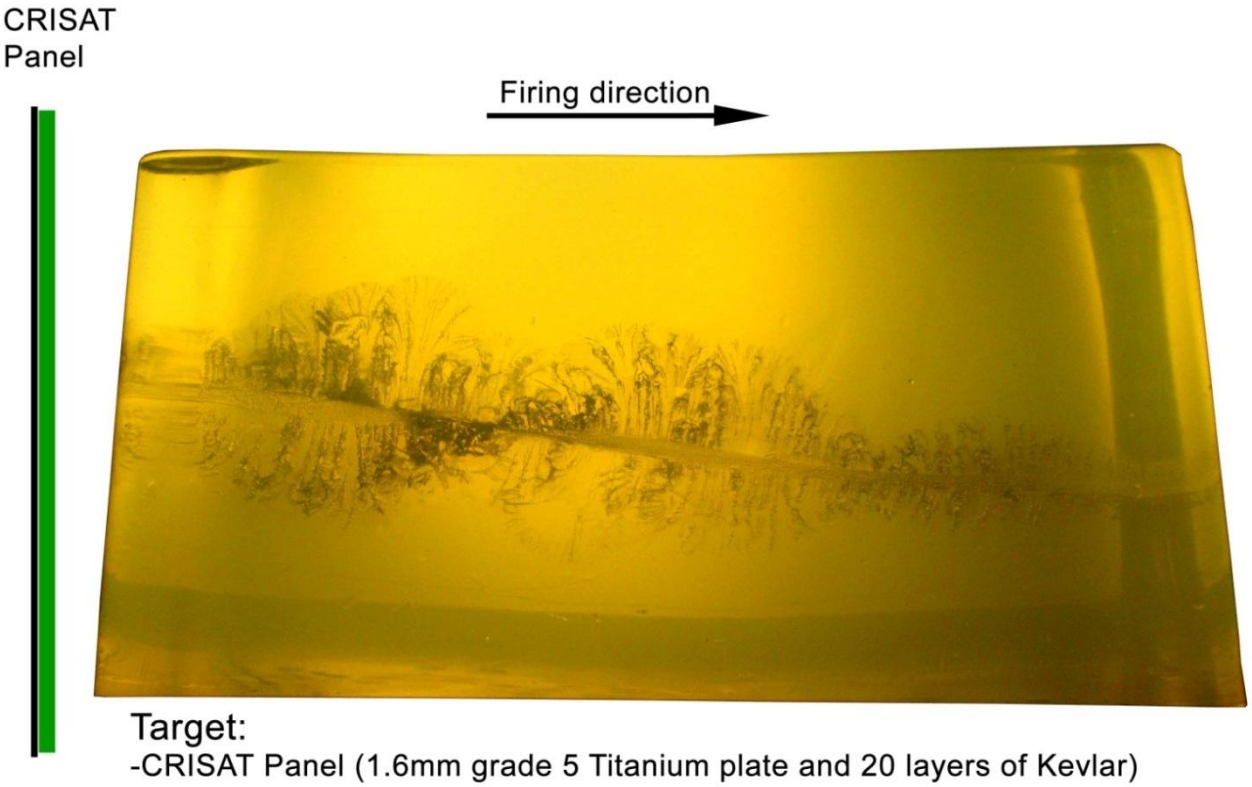
Typical application:
All-round military cartridge, used in varying combat environments where targets may appear at any range and with high levels of protection. Targets may include ground vehicles, helicopters and equipment. Situations often require high endurance for prolonged firing.





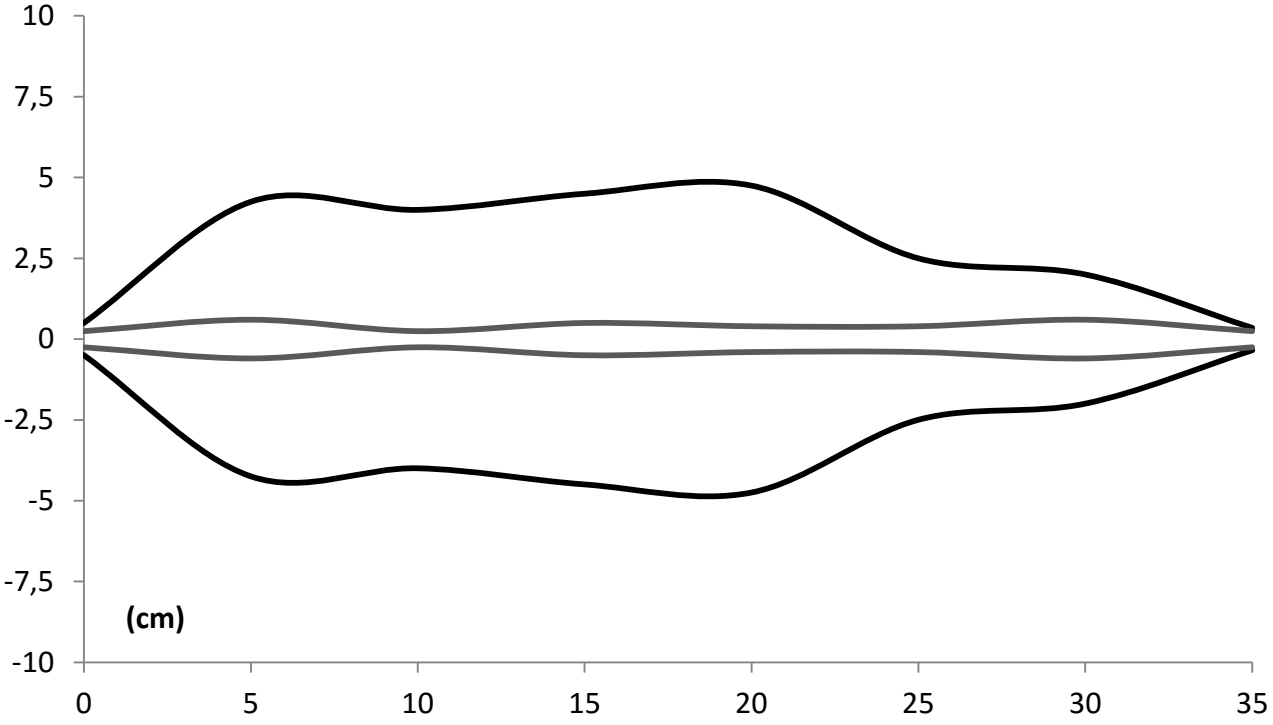
In a test of performance against hard targets, a hardened 7mm thick armor plate taken from a rear door of an MT-LB APC was fired at from a distance of 100 meters. The target was fully penetrated and the bullet retained considerable wounding potential, as was evident by a block of gelatin positioned behind the target. Standard military ball ammunition such as 5.56 NATO, 7.62 NATO and 9x19 Parabellum fail to penetrate this target at any distance.

Illustrated below is the effect in soft tissue simulant (ordnance gelatin) of the 6.5x25 CBJ Ball after penetration of the NATO CRISAT target, which is a simulated body armor consisting of a 1.6mm grade 5 titanium plate in front of 20 layers of Kevlar.



Target:
-CRISAT Panel (1.6mm grade 5 Titanium plate and 20 layers of Kevlar)
-Gelatin block (10% ordnance gelatin shot at +4ºC) with dimensions:
Length (Firing direction): 340mm, Height: 200mm, Width: 250mm
Vt (Impact velocity): 847m/s

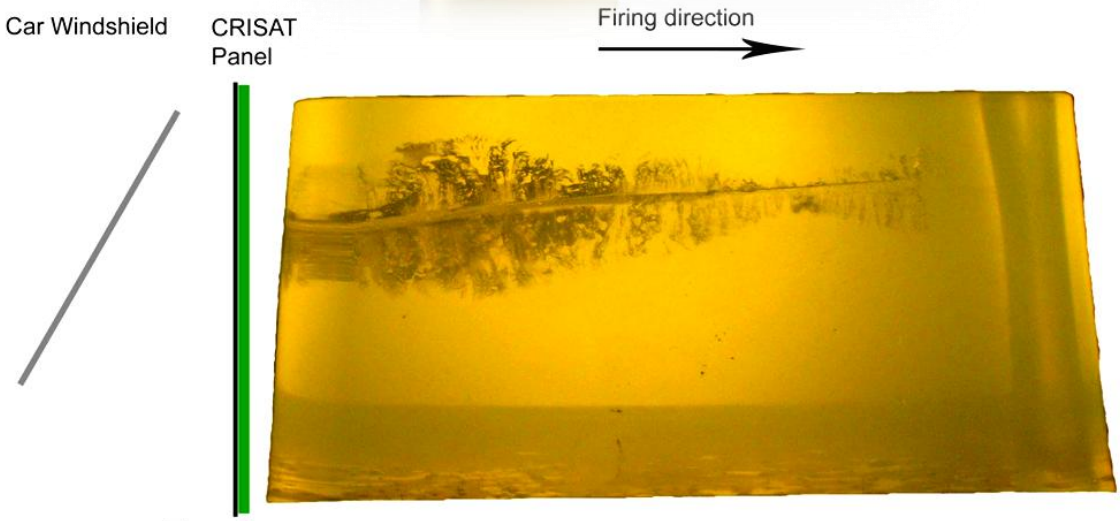
Below is the Wound Profile of the test, which visualizes the permanent and temporary cavities. The permanent cavity is outlined in the center, and is the remaining bullet hole. The outer cavity is the temporary tissue stretch from when the bullet passes the tissue simulant, and the plot is based on measurements taken of the radial cracks in the gelatin according to the aforementioned Wound Profile Method.



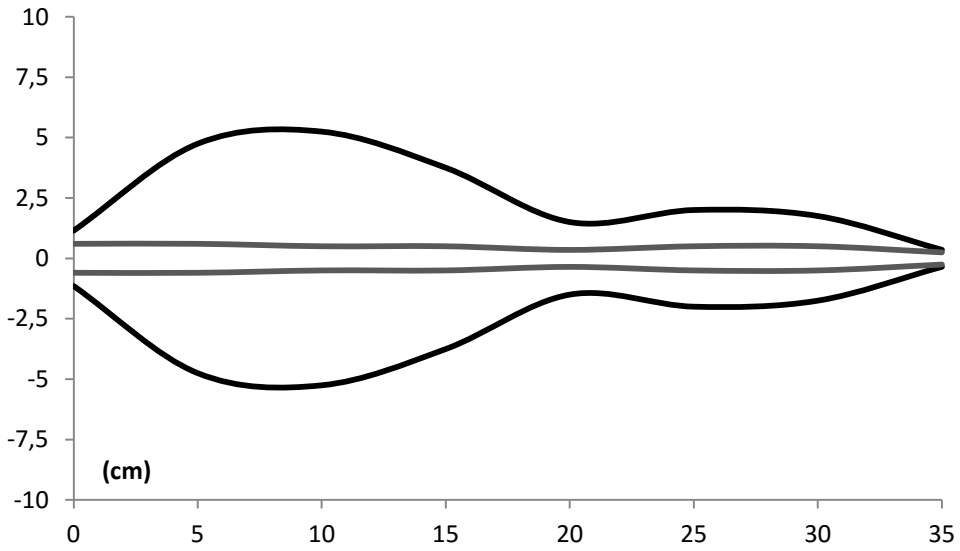
6.5x25 CBJ ST

The 6.5x25 CBJ ST is exactly the same as the Ball cartridge except that the projectile has a spoon tip, which is a spoon-shaped asymmetry in the tip of the bullet. It affects neither the outer ballistics nor the penetration capability. The spoon tip causes the bullet to tumble quicker than normal in soft targets in order to assure effectiveness in hits with very short wound tracks, for instance extremity hits.

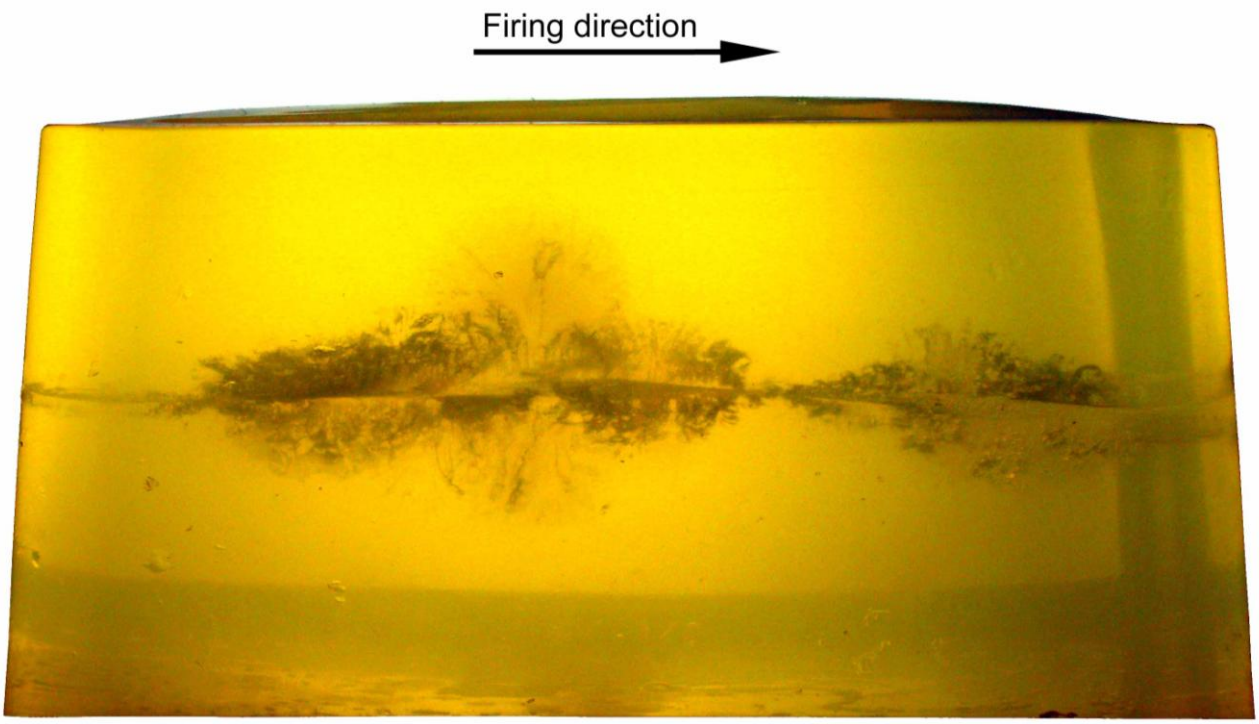
The 6.5x25 Ball and ST work reliable in less-than-ideal impact situations, for instance when the bullet has been caused to tumble before reaching the target. This would be the case when the target is behind barriers, thick foliage etc. Below are the test results of a composite test with the 6.5x25 CBJ ST where the scenario is that the target has body armor (NATO CRISAT) and sits in the front seat of a vehicle. The car windshield was placed 45cm in front of the CRISAT protection and gelatin block, and inclined 45° vertically and 15° to the left. Even though the windshield caused the bullet to tumble and impact the body armor sideways, the body armor and gelatin block (340mm) were fully penetrated with a substantial energy transfer to the tissue simulant.



Target:
-Car windshield, inclined 45º vertically and 15º to the left, offset 45cm from the gelatin block
-CRISAT Panel (1.6mm grade 5 Titanium plate and 20 layers of Kevlar)
-Gelatin block (10% ordnance gelatin shot at +4ºC) with dimensions:
Length (Firing direction): 340mm, Height: 200mm, Width: 250mm
Vt (Impact velocity): 844m/s

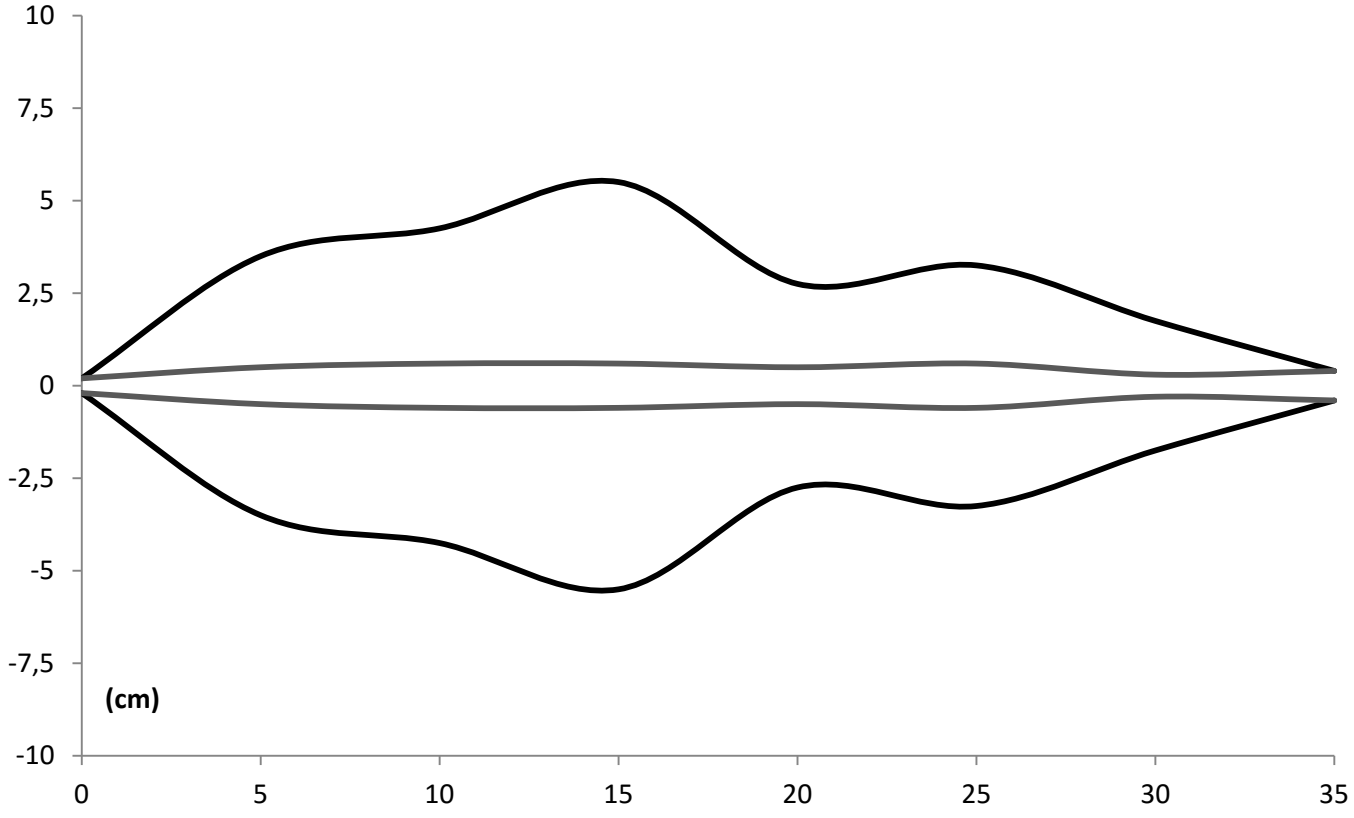


The test result of the 6.5x25 CBJ ST when fired at bare gelatin is shown below.



Target:
-Gelatin block (10% ordnance gelatin shot at +4ºC) with dimensions:
Length (Firing direction): 340mm, Height: 200mm, Width: 250mm
Vt (Impact velocity): 840m/s

The wound profile of this test is shown below.



6.5x25 CBJ HET

The 6.5x25 CBJ High Energy Transfer has a full caliber solid brass projectile with a hollow base.

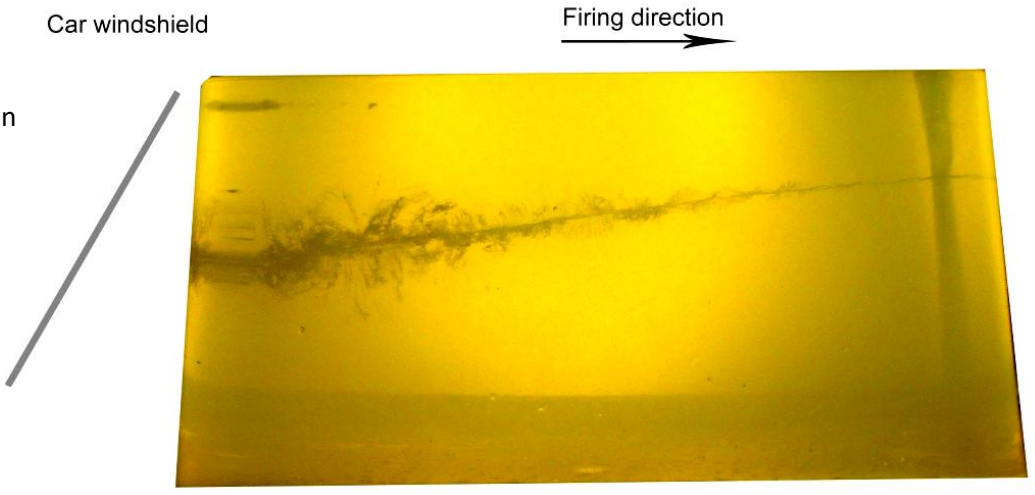
Key benefits:

- High wounding effect
- High hit probability
- Well balanced penetration
- Limited lethal range

Typical application:
All-round police bullet, used in urban environments with sensitive background. Targets are engaged at short range and have moderate levels of protection. Engagements often include vehicles.

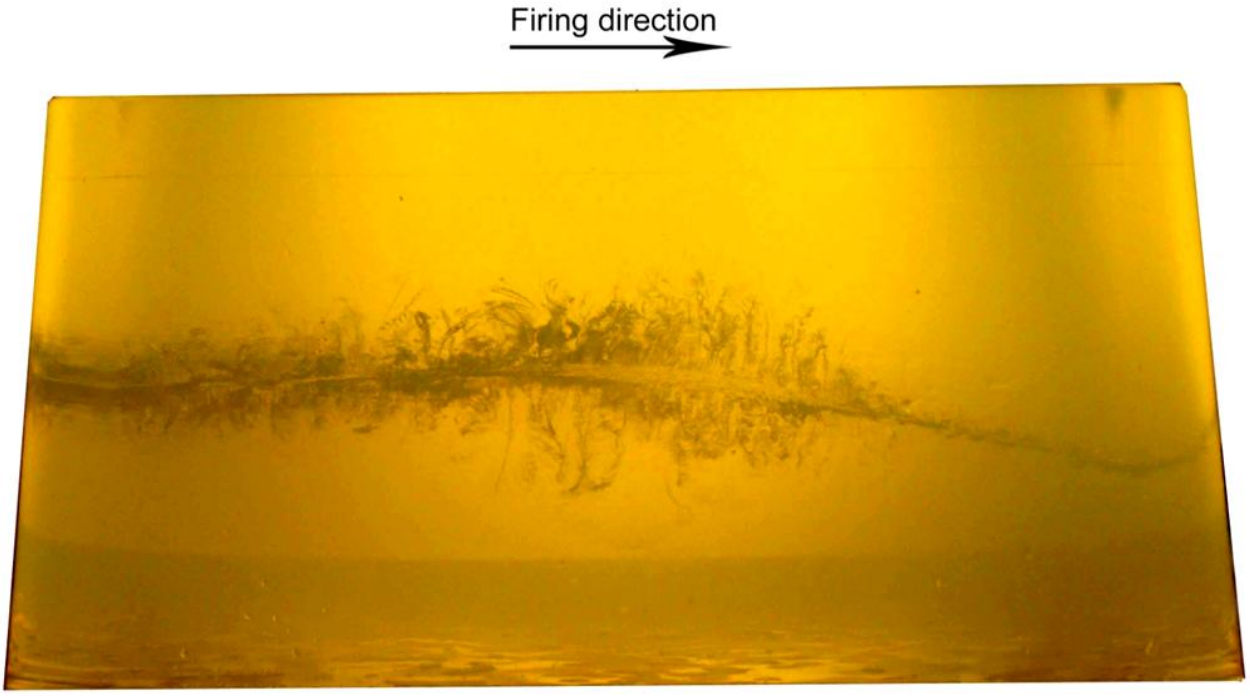
The penetration capacity of the 6.5x25 CBJ HET is carefully balanced so that common barriers are defeated and wounding effect is assured at short range, while performance is greatly reduced beyond this and at greater range.

A typical difficult situation in this application is a target inside a vehicle. Seen here are the test results of a simulation of such a situation. The windshield was penetrated as was the gelatin block behind (34cm). After this the bullet had negligible energy.



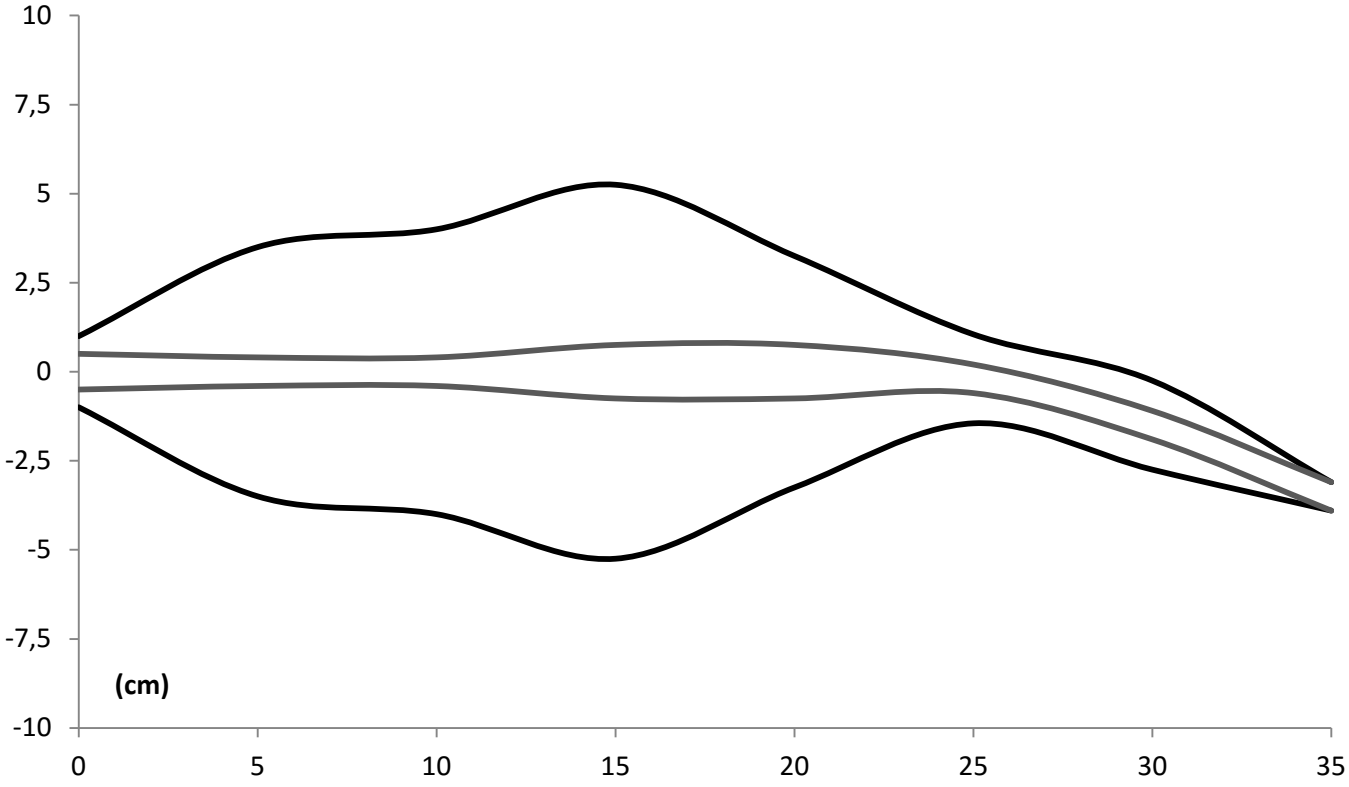
Target:
-Car windshield, inclined 45º vertically and 15º to the left, offset 45cm from the gelatin block
-Gelatin block (10% ordnance gelatin shot at +4ºC) with dimensions:
Length (Firing direction): 340mm, Height: 200mm, Width: 250mm
Vt (Impact velocity): 831m/s

Shown below is the effect of the 6.5x25 CBJ HET in bare gelatin.



Target:
-Gelatin block (10% ordnance gelatin shot at +4ºC) with dimensions:
Length (Firing direction): 340mm, Height: 200mm, Width: 250mm
Vt (Impact velocity): 824m/s

The wound profile of this test is shown below.



6.5x25 CBJ Subsonic AP

The 6.5x25 CBJ Subsonic AP fires a heavy, full caliber copper jacketed tungsten projectile at subsonic speed.

Key benefits:

- Subsonic
- Good penetration
- Low velocity loss down range

Typical application:
Sound suppressed operations by military special forces or police SWAT teams. Targets may appear at short to medium range and carry body armor.

The penetration capacity is less than that of the 6.5x25 CBJ Ball and ST, but sufficient to defeat most light body armors, notably the NATO CRISAT. The projectile is long and tumbles in the target which produces a substantial permanent cavity, thus creating a high wounding effect considering the low velocity of the bullet.

6.5x25 CBJ TRP

The 6.5x25 CBJ Training Reduced Penetration has a sabot containing a non-tungsten metal projectile.

Key benefits:

- High hit probability
- Long range
- Increased safety during training
- Reduced wear on training facilities
- Low levels of barrel wear and corrosion

Typical application :
Standard training round for full ranges.

The 6.5x25 CBJ TRP is the training cartridge for full combat ranges. It closely duplicates the outer ballistics of the Ball and ST cartridges, but lacks their penetration capacity and decreases its lethality at a higher rate at extended ranges.

6.5x25 CBJ Frangible

The 6.5x25 CBJ Frangible has a full caliber projectile made of a polymer with metal powder added to increase density. The bullet has very low penetration and completely disintegrates when hitting a hard object, causing no ricochets.

Key benefits:

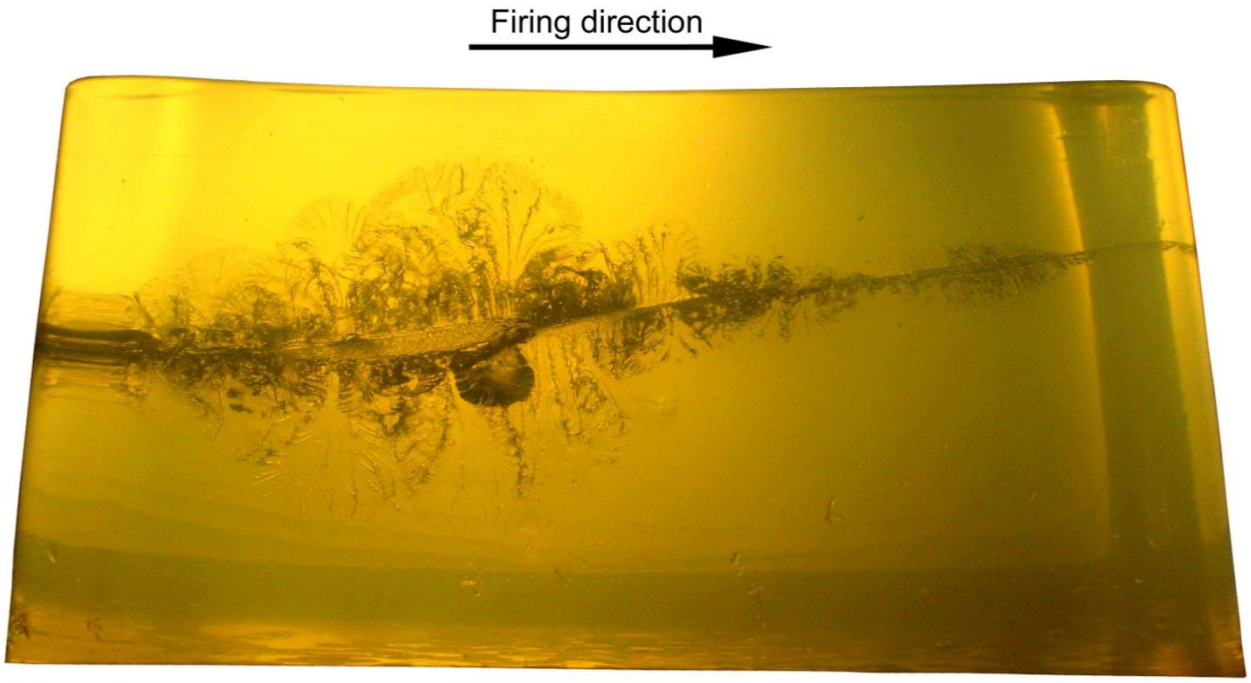
- Low cost
- High hit probability
- High wounding effect
- Limited lethal range
- Minimum penetration of hard objects
- Increased safety during training
- Low wear on training facilities
- Low levels of barrel wear and corrosion

Typical training application:
Short range (up to 100m) training round, used primarily in urban warfare training facilities.

Typical combat application:
Very sensitive environments, such as public areas, operations inside buildings with high risk of friendly fire and with presence of civilians etc. Targets appear at short range and without protection and in most cases there is a need for instant incapacitation of the target.

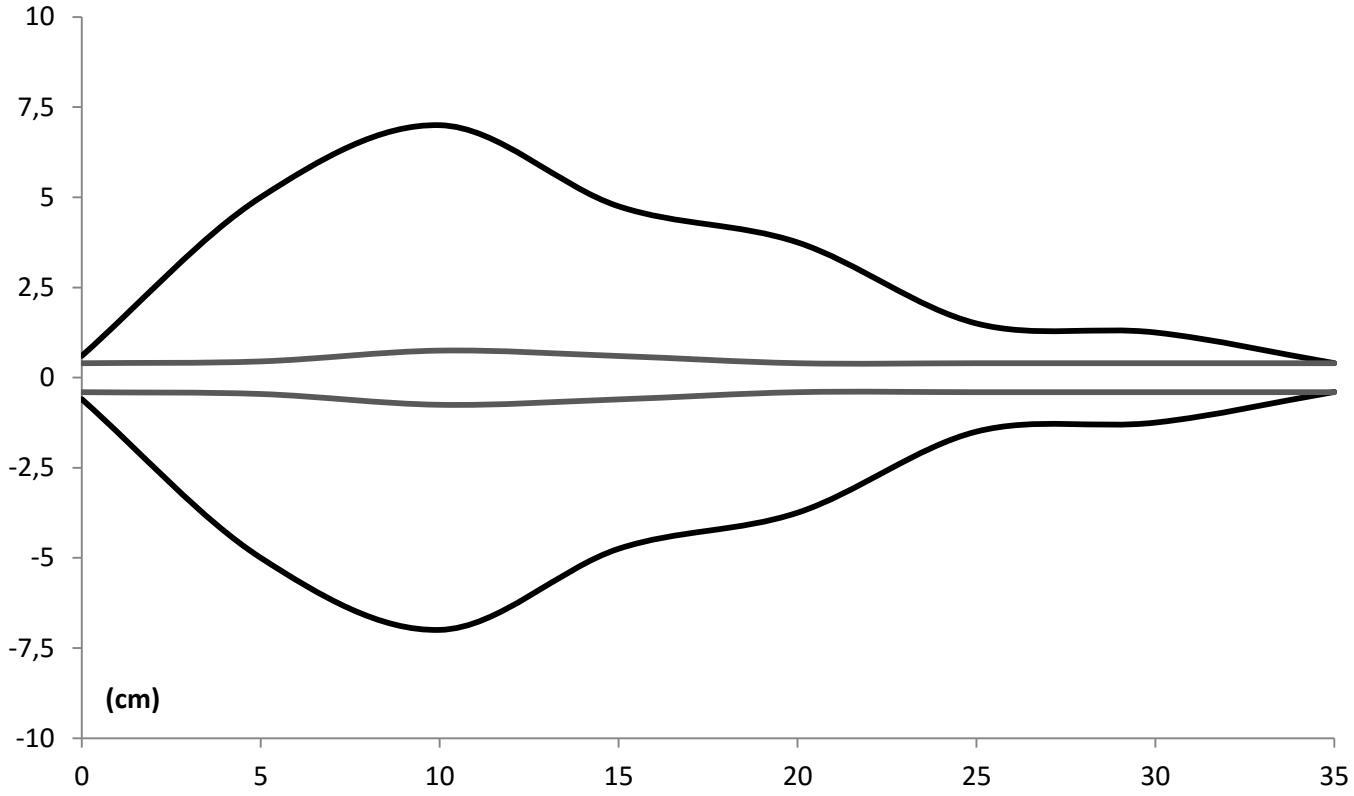
The 6.5x25 CBJ Frangible will disintegrate when striking hard objects, but will not fragment when passing clothes or soft tissue. This assures that the bullet will have sufficient penetration in soft tissue to be an effective combat cartridge against unprotected targets within combat ranges up to 50m.

Shown below is the effect of the 6.5x25 CBJ Frangible in bare gelatin.



Target:
-Gelatin block (10% ordnance gelatin shot at +4ºC) with dimensions:
Length (Firing direction): 340mm, Height: 200mm, Width: 250mm
Vt (Impact velocity): 904m/s

The wound profile of this test is shown below.



6.5x25 CBJ Blank

This is a conventional cartridge developed for training purposes, such as double sided exercises etc. A blank firing device needs to be attached in order to have a fully functioning cycling.

6.5x25 CBJ Drill

This cartridge is an inert dummy cartridge intended for training purposes such as loading and unloading drills, actions during stoppage etc.

Soldiers and policemen must be skilled marksmen who can effectively apply their shooting skills in combat. The proficiency attained depends on proper training and application of basic marksmanship fundamentals. More rounds spent on the firing range means more accurate and effective fire in combat. The low cost for training ammunition allows more extensive training.

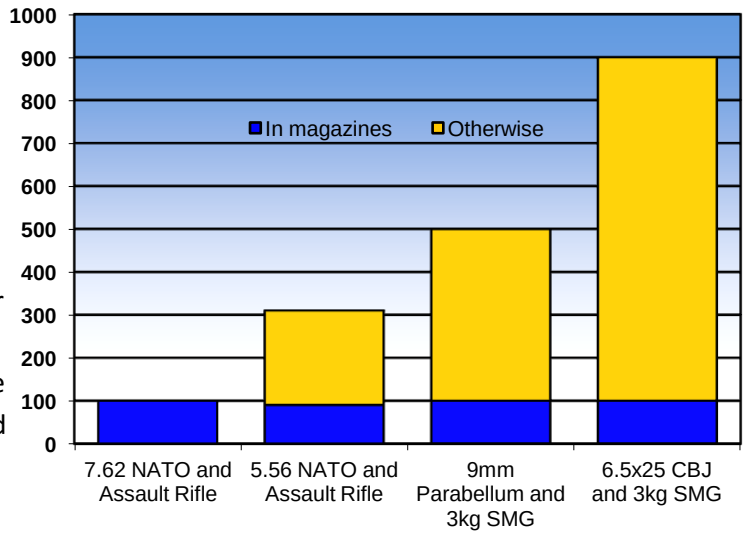
Many tactical benefits granted by the 6.5x25 CBJ stems from high firepower, which is the ability to deliver a high amount of projectiles in a short period of time onto the target.

This however requires that an ample supply of ammunition can be carried by the soldier without increasing weight or bulk.

In a pouch designed for 5.56 NATO magazines, twice as many magazines and rounds of the 6.5x25 CBJ or 9x19 Parabellum can be stored. The picture shows three 30 round 5.56 NATO magazines in one pouch, and six 30 round 6.5x25 CBJ magazines in the other identical pouch.

Regarding weight, not only the weight of the ammunition itself but also the weight of the weapon has to be considered. A typical 7.62 NATO assault rifle with 100 rounds in magazines weighs approximately 8.4kg. At the same weight a 5.56 NATO assault rifle allows for up to three times more ammunition to be carried.

A submachine gun weighing 3kg chambered for 9x19 Parabellum will allow even more rounds to be carried, owing to the lighter weight of the weapon. When the same weapon is chambered for the 6.5x25 CBJ the amount of ammunition that can be carried is three times that of a 5.56 NATO weapon system, or nine times that of a 7.62 NATO system.



Weapons that can use the 6.5x25 CBJ

Most weapons in 9x19 Parabellum can be rebarelled for the 6.5x25 CBJ cartridges. This includes pistols, PDW's, submachine guns and carbines, examples of which are shown below.

6.5x25 CBJ Technical Data

Cartridge name	6.5x25 CBJ Ball	6.5x25 CBJ ST	6.5x25 CBJ HET	6.5x25 CBJ Subsonic AP	6.5x25 CBJ TRP	6.5x25 CBJ Frangible
Case weight, g	4.5	4.5	4.5	4.5	4.5	4.5
Cartridge weight, g	7.5	7.5	7.5	12.5	6.4	7.5
Projectile length, mm	11.6	11.6	12.8	17.7	11.6	14.4
Projectile Ø, mm	4.0	4.0	6.5	6.5	4.0	6.5
Projectile weight, g	2.0	2.0	2.5	8	0.9	2.5

Below figures apply when shot from a 120mm pistol barrel / 150mm pistol barrel

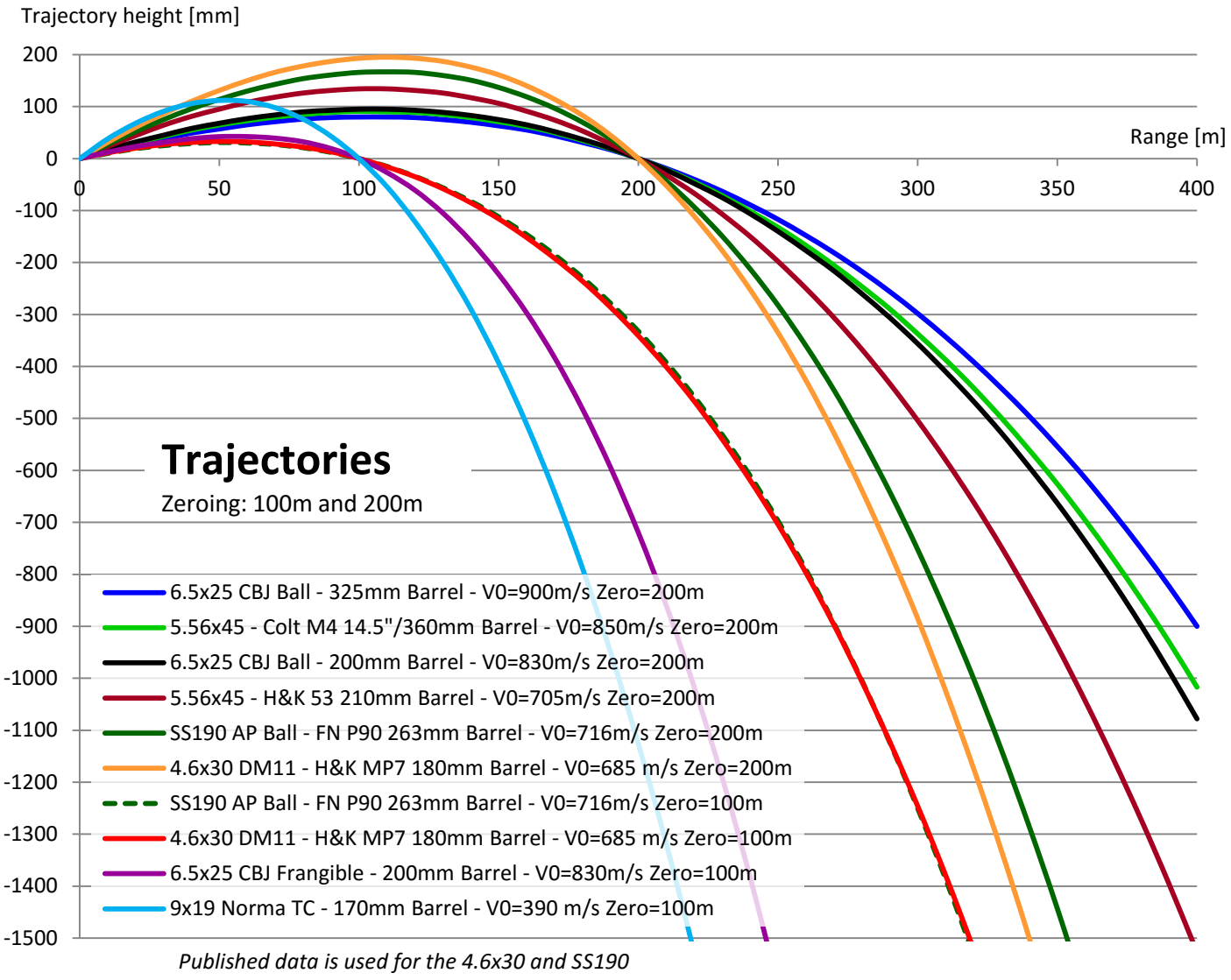
V_0, m/s	730 / 780	730 / 780	730 / 780	300 / 310	850 / 870	730 / 780
E_0, J	533 / 608	533 / 608	666 / 761	360 / 384	325 / 341	666 / 761

Below figures apply when shot from a 200mm submachine gun barrel

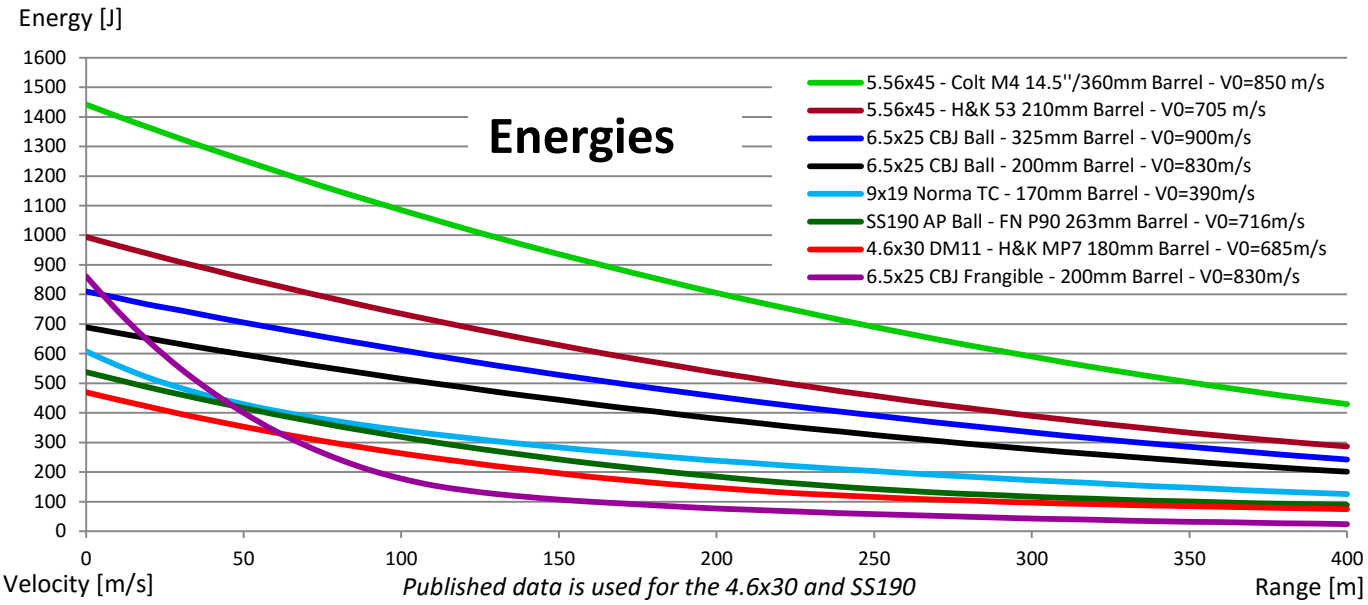
V_0, m/s	830	830	830	320	900	830
E_0, J	689	689	861	410	365	861

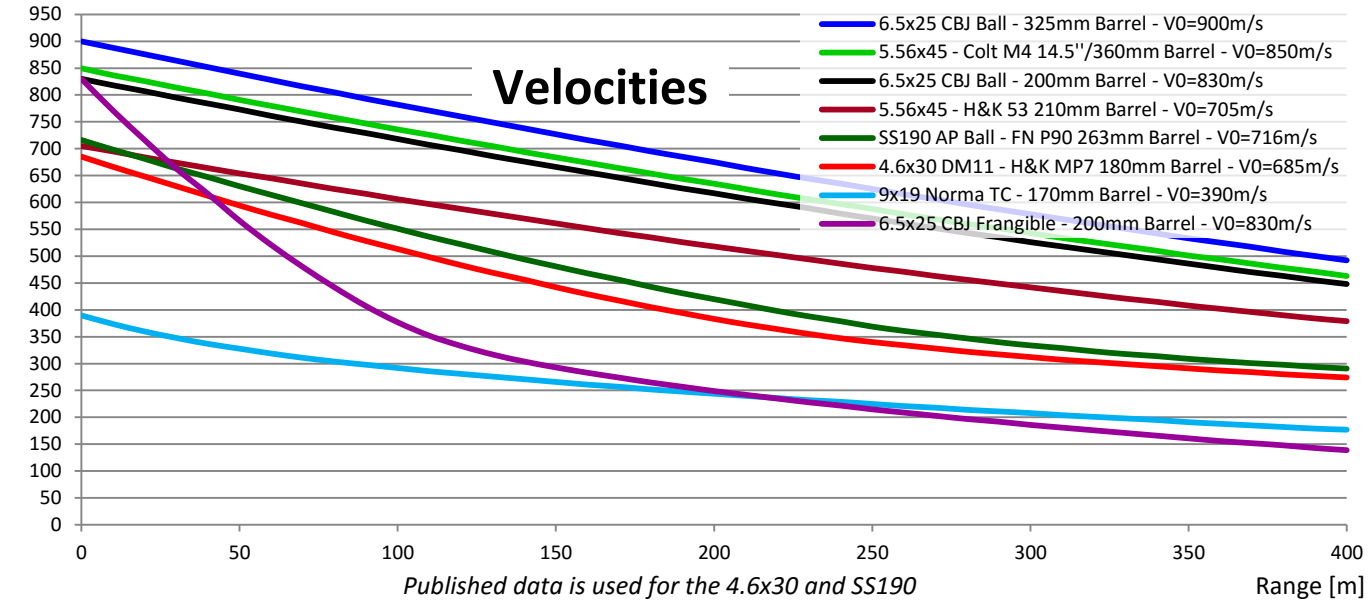
Below figures apply when shot from a 300mm carbine barrel

V_0, m/s	900	900	900	325	1050	900
E_0, J	810	810	1013	423	496	1013



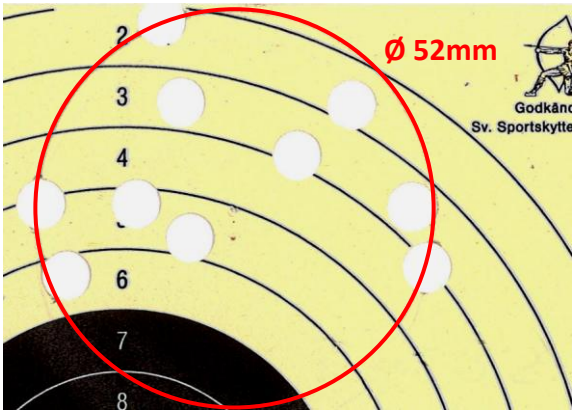
Published data is used for the 4.6x30 and SS190



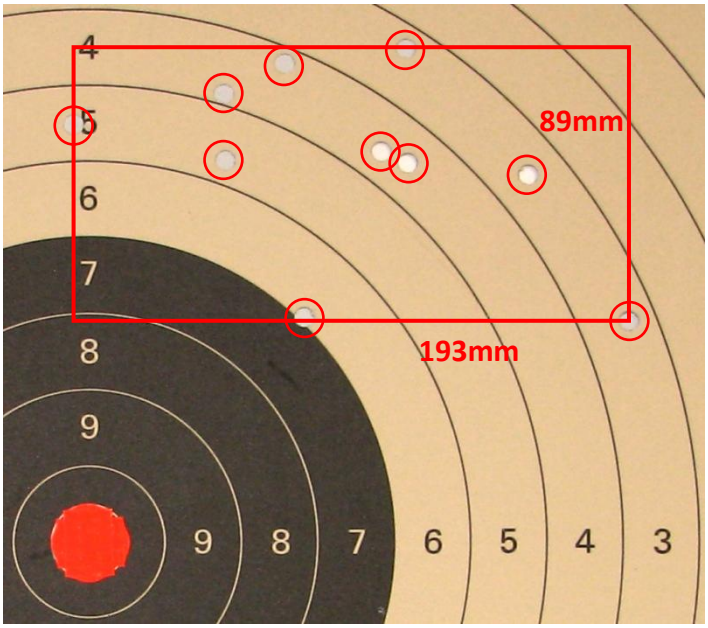


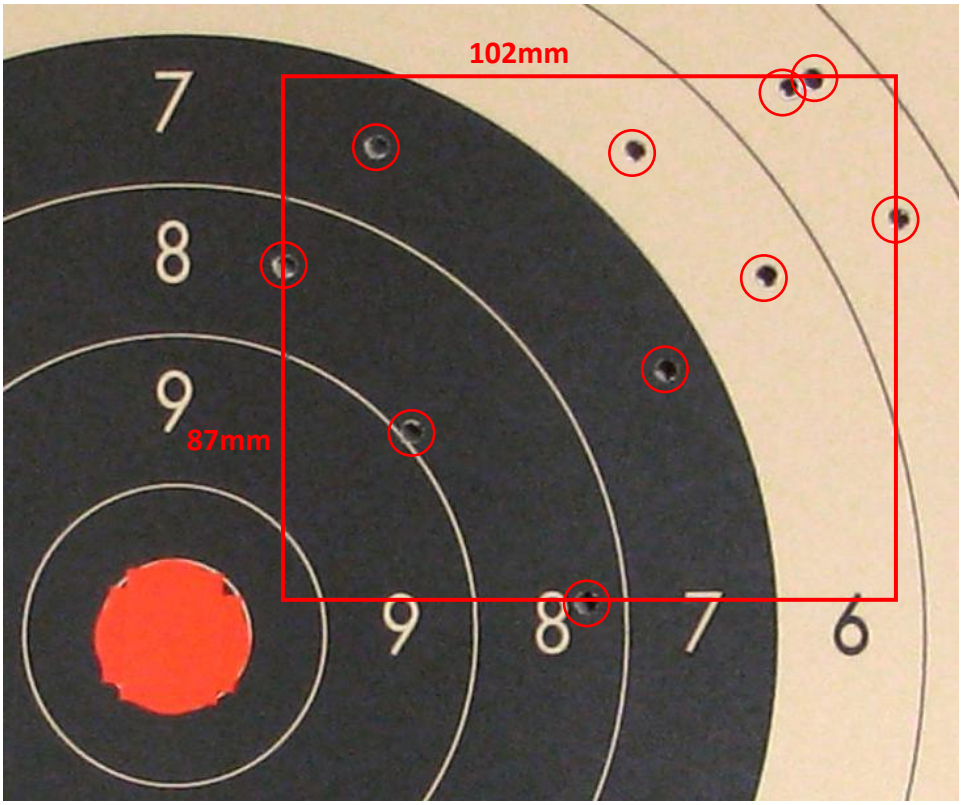
6.5x25 CBJ Accuracy

The image to the left shows a typical pattern with the 6.5x25 CBJ Frangible fired at 50m with an SMG. The pattern fits in a circle with a diameter of 52mm.

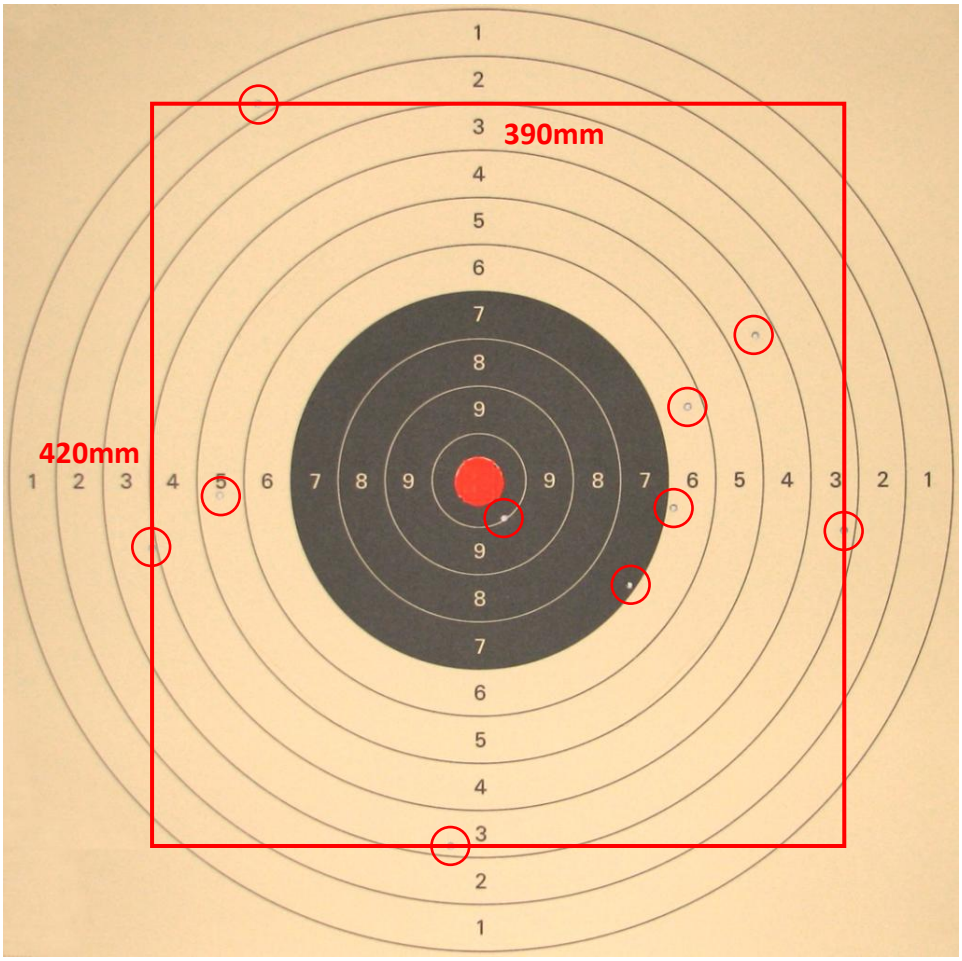


The image to the right shows a typical pattern with the 6.5x25 CBJ Frangible fired at 100m with an SMG under field conditions. The pattern width is 193mm and height is 89mm.





This is a typical 10 shot pattern with the 6.5x25 CBJ Ball fired at 100m under field conditions. The width of the pattern is 102mm and the height is 87mm.

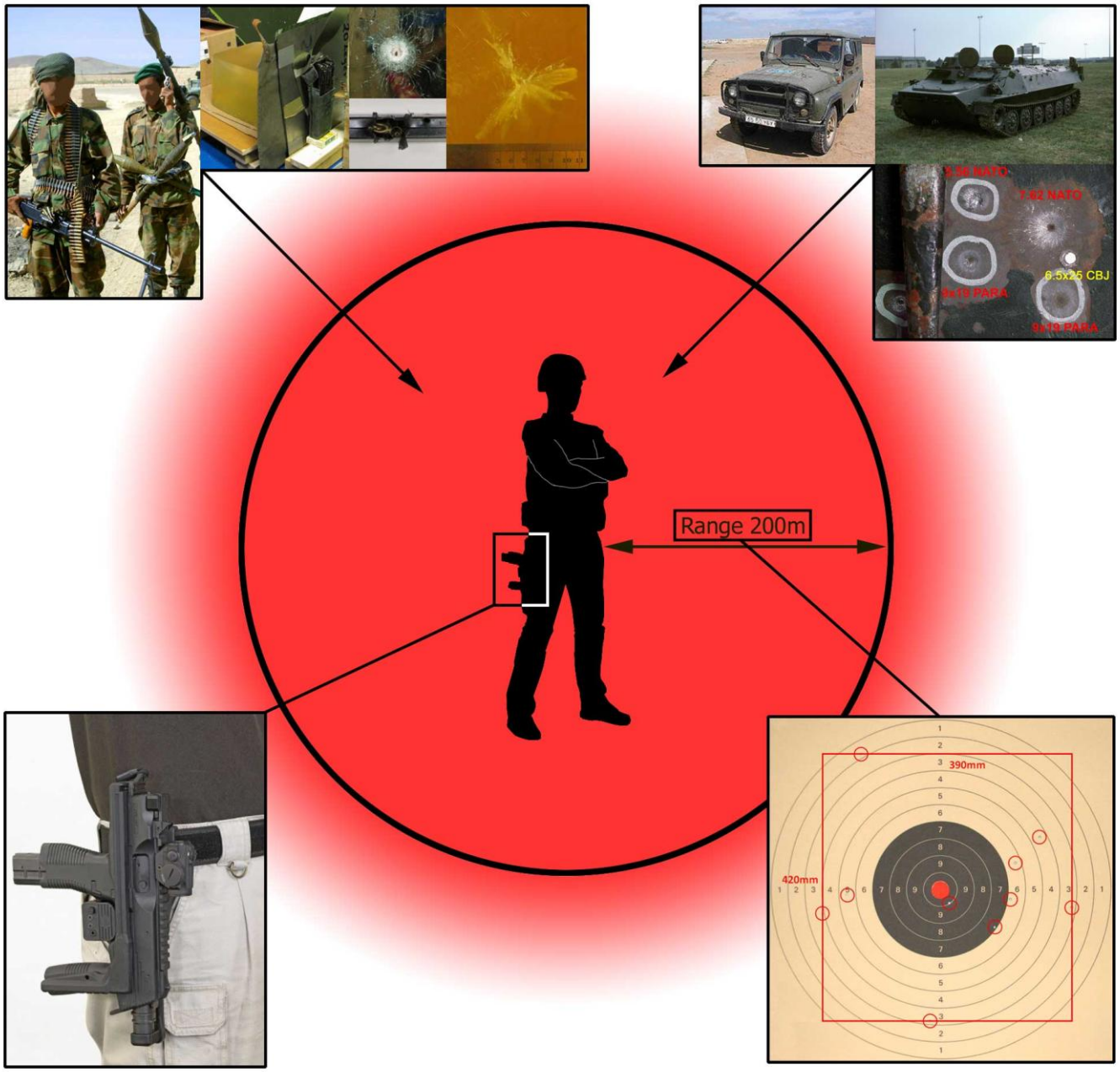


This is a typical 10 shot pattern with the 6.5x25 CBJ Ball fired at 300m under field conditions. The scoring area of the target is 500mm in diameter. The width of the pattern is 390mm and the height is 420mm.

Personal Combat Weapon

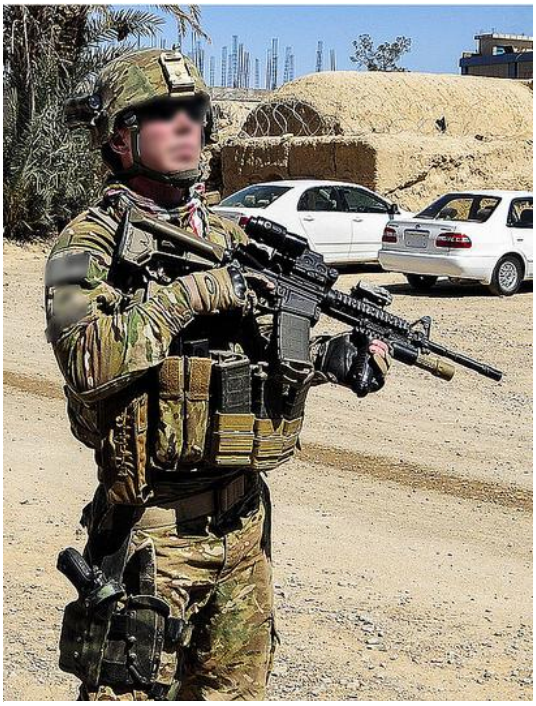
The term Personal Defense Weapon, or PDW, has been known for quite some time, and refers to small 1- or 2 handed weapons mainly used by military personnel which doesn't have combat with small arms as their primary task. This could be all kinds of support personnel like drivers or gun crews etc.

However, these small weapons with great firepower due to the 6.5x25 CBJ cartridge can now also be used in more offensive roles. A more suitable designation for these weapons is Personal Combat Weapon, or PCW.



A good example of a PCW is the BT MP9 chambered in 6.5x25 CBJ, as shown in the picture above. The weapon is small and light enough (1,5kg) to replace a pistol, and can be carried the same way (in a holster or sling or fitted to a combat vest.

With this weapon the soldier or police officer can engage all targets normally engaged with small arms up to at least 200m. Because of the armor piercing performance of the 6.5x25 CBJ Ball, also soft skinned- and light armored vehicles can be engaged with good result.



Today it is common that riflemen are armed with a semi short assault rifle (like an M4) in 5.56x45 Nato caliber as primary weapon, and a pistol in 9x19 Nato caliber as a backup weapon.

The assault rifle is normally used for all situations, from close quarter battle (CQB) in urban areas to long range engagements. In CQB situations, the weapon needs to be short and light and have a non magnifying optical sight in order to be fast on target. Fully automatic firing is needed at short range engagements in order to quickly incapacitate the target. This demands a weapon with low recoil. The weapon also needs to be able to fire large amounts of rounds during short periods of time, which means not overheat quickly, especially when fighting in urban areas.

On the other hand, at long range engagements, the weapon must be able to fire single shots with very high accuracy and deliver enough energy to the target to incapacitate with one or two hits. In this case, the incapacitation does not necessarily need to be instantaneous. An optical sight with magnification (normally around 4x) is needed.

The pistol is used when the assault rifle is unavailable, like when there is a malfunction, when the ammunition is depleted or when the weapon is out of reach. This means that the pistol is rarely used, and when so, it is usually for self defense rather than assault.

If the pistol is replaced by a PCW instead, it could be used for more scenarios than just self defense. It can be the primary weapon for all engagements up to at least 100m, with a capability to engage targets out to at least 200m. The ammunition is light and larger quantities can easily be carried.

This way the assault rifle does not have to be optimized for close combat in the same degree as before, and can instead be optimized for engaging targets at ranges from 100m to 800m, by using a larger caliber and a scope optimized for longer range. Less ammunition is needed for this weapon since the PCW is used for more tasks than only as a backup weapon.

The PCW can also be combined with other weapon systems like anti armor weapons or support weapons or entirely different equipment.

CBJ Tech AB

www.cbjtech.com