WESCO MAGAZINE
Excuse the pun !

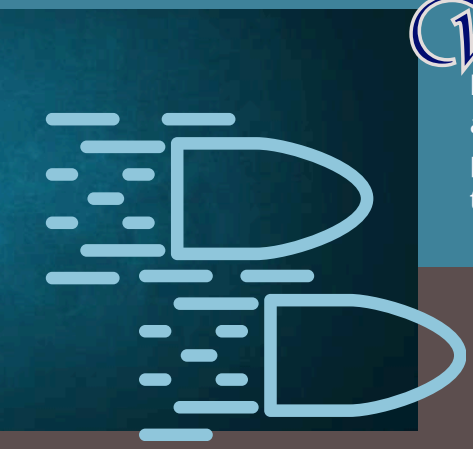
Decoding Impact:

"The Critical Role of TERMINAL BALLISTICS in Forensic Science"

Part Two

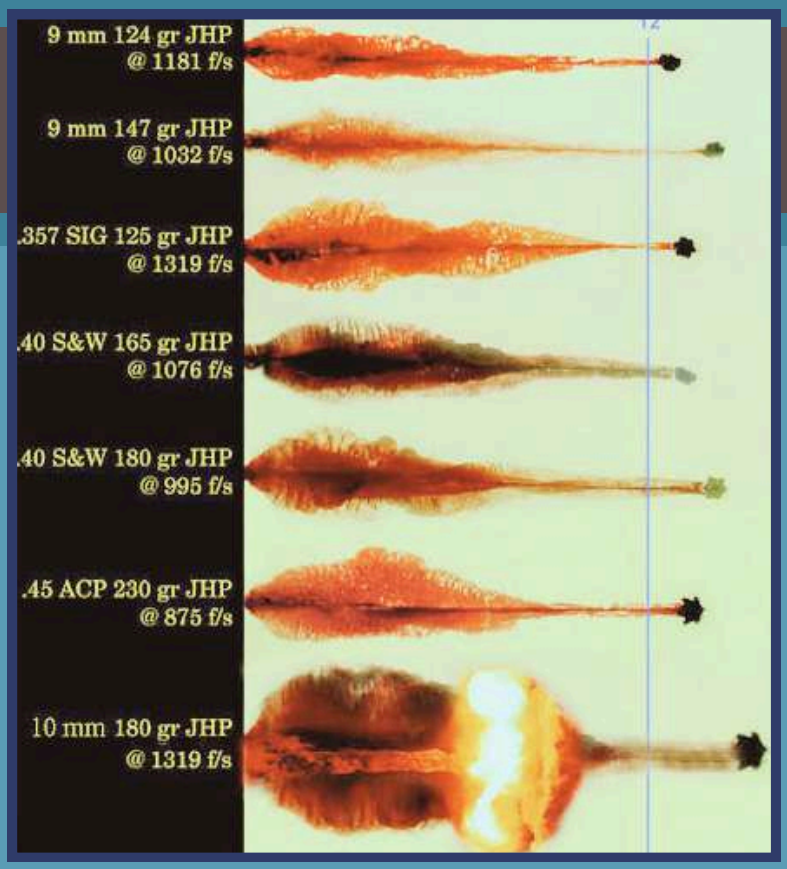
Controlled penetration

The final category of bullets is that intended to control penetration so as not to harm anything behind the target. Such bullets are used primarily for hunting and civilian antipersonnel use; they are not generally used by the military, since the use of expanding bullets in international conflicts is prohibited by the Hague Convention and because these bullets have less chance of penetrating modern body armour. These bullets are designed to increase their surface area on impact, thus creating greater drag and limiting the travel through the target. A desirable side effect is that the expanded bullet makes a larger hole, increasing tissue damage and speeding up incapacitation.



While a bullet that penetrates through-and-through tends to cause more profuse bleeding, allowing a game animal to be blood trailed more easily, in some applications, preventing exit from the rear of the target is more desirable. A perforating bullet can continue on (likely not coaxial to the original trajectory due to target deflection) and might cause unintended damage or injury.

In this graphic: Different projectiles and the damage they cause.



Flat point

One of the simpler ways to find consistent disruption from a bullet is forming a wide and flat tip. This increases the effective surface area, as rounded bullets can allow tissues to "flow" around the edges. Flat points also increase drag during flight to various extent, which along with the type of material and muzzle velocity, tends to affect the degree of expansion at impact.

Flat-point bullets, with especially pronounced fronts of up to 90% of the overall bullet diameter, are sometimes preferred for use against large or dangerous game animals. For such purposes, they are typically made of unusually hard alloys, and may be longer and heavier than normal for their caliber to decrease the chance of deflection, and even include exotic materials such as tungsten to increase their sectional density. These bullets are designed to penetrate with sufficient depth through muscle, bone, and vital areas while causing a wound channel ranging from bullet diameter to the size of a coin, significantly larger than the bullet, and are most likely to perform similarly at any angle and at various ranges. One of the hunting applications of the flat point bullet is large game such as bear hunting, in which case people may be carrying a sidearm such as a 44 Magnum, 10 mm, or a larger caliber that is not intensively reliant on expansion.

Light weight non-expanding projectiles pushed at a relatively high rate of speed are also utilized, generally for close ranged applications well inside 100 yards. The light for caliber bullets will transfer energy to a given medium more rapidly, yet with consistent penetration characteristics relative to their sectional density and a constant tapering effect as the bullet graduates to a stop. Such implementations may be conducive to mitigating fragmentation where weight retention is prioritized.

Other flat pointed bullets offer expansion ranging up into 1 to 3 times the original diameter of the bullet. Such ammunition is typically made from lead or with a supporting metal jacket design, which may contain pure lead, or a lead alloy which is strengthened in proportion to the expected range of velocities at impact. Particularly soft forms of lead may expand well at longer ranges, but must be kept at a velocity that is within reason for a close ranged shot. More resilient lead alloys which retain malleability will exhibit exceptional weight retention when pushed to a respective velocity and promptly striking hard surfaces at close range, but may have limited expansion characteristics at longer range. Ideally, the reduction in expansion will be proportionate to the reduction in energy over distance. Therefore, with equal or greater weight retention, the bullet proves to exhibit a higher sectional density necessary for sufficient penetration throughout its intended range.

In the real world, where people make some occasional mistakes in judgement, flat pointed bullets can have some forgiving advantages. Bullets fail in a variety of ways. While flat pointed bullets are not immune to deflection or severe fragmentation off hard surfaces, they do tend to be resistant, and any tendency to bleed off a small amount of speed only helps to mitigate misjudgements pertaining to metallurgy, particularly if the design coincides with additional weight. Secondly, when bullets fail to expand as expected, such as an impact on game 50 or 100 yards beyond what the ammunition is designed for, a bullet with a wide enough flat point (Meplat) will never "pencil through" with minimal disruption in the absence of tumbling. A properly proportioned flat pointed bullet can most assuredly leave a hole of sufficient diameter through the vital area, which is all that is necessary to end an animal's struggle with a difference of time appropriately measured in seconds from that of a higher velocity impact.

Expanding Bullets

More effective on lighter targets are the expanding bullets, the hollow-point bullet, and the soft-point bullet. These are designed to use the hydraulic pressure of muscle tissue to expand the bullet. The hollow point peels back into several connected pieces (sometimes referred to as petals due to their appearance) causing the bullet to create a larger area of permanent damage. The hollow point fills with body tissue and fluids on impact, then expands as the bullet continues to have matter pushed into it. This process is informally called mushrooming, as the ideal result is a shape that resembles a mushroom—a cylindrical base, topped with a wide surface where the tip of the bullet has peeled back to expose more area while traveling through a body.

For the purposes of aerodynamic efficiency, due to the hollow-point not creating drag, the tip of the hollow-point will often be tipped with a pointed polymer 'nose' which may also aid in expansion by functioning as a piston upon impact pushing the hollow point open. A copper-plated hollow-point loaded in a .44 Magnum, for example, with an original weight of 240 grains (15.55 g) and a diameter of 0.43 inch (11 mm) might mushroom on impact to form a rough circle with a diameter of 0.70 inches (18 mm) and a final weight of 239 grains (15.48 g). This is excellent performance; almost the entire weight is retained, and the frontal surface area increased by 63%. Penetration of the hollow-point would be less than half that of a similar nonexpanding bullet, and the resulting wound or permanent cavity would be much wider.

It might seem that if the whole purpose of a maximum disruption round is to expand to a larger diameter, it would make more sense to start out with the desired diameter rather than relying on the somewhat inconsistent results of expansion on impact. While there is merit to this (there is a strong following of the .45 ACP, as compared to the .40 S&W and 0.355 in diameter 9×19mm, for just this reason) there are also significant downsides. A larger-diameter bullet is going to have significantly more drag than a smaller-diameter bullet of the same mass, which means long-range performance will be significantly degraded. A larger diameter bullet also means more space is required to store the ammunition, which means either bulkier guns or smaller magazine capacities. The common trade-off when comparing .45 ACP, .40 S&W, and 9×19mm pistols is a 7- to 14-round capacity in the .45 ACP vs. a 10- to 16-round capacity in the .40 S&W vs. a 13- to 19-round capacity in the 9×19mm. Although several .45-caliber pistols are available with high-capacity magazines (Para Ordnance being one of the first in the late 1980s) many people find the wide grip required uncomfortable and difficult to use. Especially where the military requirement of a nonexpanding round is concerned, there is fierce debate over whether it is better to have fewer, larger bullets for enhanced terminal effects, or more, smaller bullets for an increased number of potential target hits.

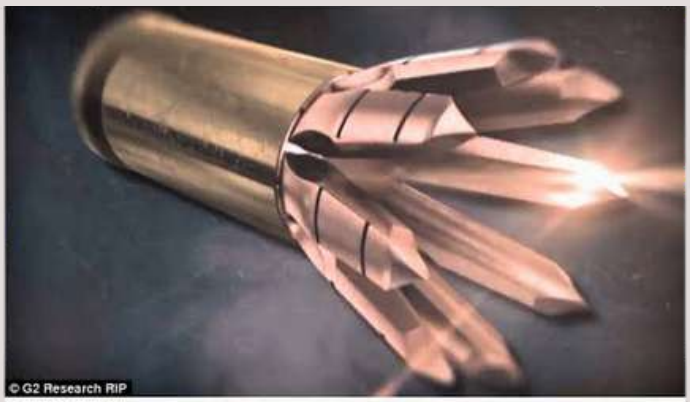
Fragmenting Bullets

Example photo of the over-penetration of a fragmenting projectile

This class of projectile is designed to break apart on impact whilst being of a construction more akin to that of an expanding bullet. Fragmenting bullets are usually constructed like the hollow-point projectiles described above, but with deeper and larger cavities. They may also have thinner copper jackets in order to reduce their overall integrity. These bullets are typically fired at high velocities to maximize their fragmentation upon impact.

In contrast to a hollow-point which attempts to stay in one large piece retaining as much weight as possible whilst presenting the most surface area to the target, a fragmenting bullet is intended to break up into many small pieces almost instantly.

This means that all the kinetic energy from the bullet is transferred to the target in a very short period of time. The most common application of this bullet is the shooting of vermin, such as prairie dogs. The effect of these bullets is quite dramatic, often resulting in the animal being blown apart upon impact. However, in larger games fragmenting ammunition provides inadequate penetration of vital organs to ensure a clean kill; instead, a "splash wound" may result. This also limits the practical use of these rounds to supersonic (rifle) rounds, which have a high enough kinetic energy to ensure a lethal hit. The two main advantages of this ammunition are that it is very humane, as a hit almost anywhere on most small vermin will ensure an instant kill, and that the relatively low mass bullet fragments pose a very low risk of ricochet or of penetrating unintended secondary targets. Fragmenting bullets should not be confused with frangible bullets.



Also used are bullets similar to hollow-point bullets or soft-point bullets whose cores and/or jackets are deliberately weakened to cause deformation or fragmentation upon impact. The Warsaw Pact 5.45×39mm M74 assault rifle round exemplifies a trend that is becoming common in the era of high velocity, small caliber military rounds. The 5.45×39mm uses a steel-jacketed bullet with a two-part core, the rear being lead and the front being steel with an air pocket foremost. Upon impact, the unsupported tip deforms, bending the bullet nose into a slight "L" shape. This causes the bullet to tumble in the tissue, thus increasing its effective frontal surface area by traveling sideways more often than not.

This does not violate the Hague Convention, as it specifically mentions bullets that expand or flatten in the body. The NATO SS109 also tends to bend at the steel/lead junction, but with its weaker jacket, it fragments into many dozens of pieces. NATO 7.62 mm balls manufactured by some countries, such as Germany and Sweden, are also known to fragment due to jacket construction.

To be Continued in the next edition of Wesco Magazine...

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the CEO and founder of Wesco Forensic Services, is a distinguished expert in the field of forensics, particularly known for his extensive knowledge of terminal ballistics. With a career dedicated to advancing forensic science, Wessie has played a pivotal role in understanding how projectiles behave upon impact, contributing significantly to crime scene investigations and the pursuit of justice. His innovative approaches and deep insights have established him as a leader in the industry. We extend our sincere thanks to Wessie for sharing his invaluable expertise and shedding light on this critical aspect of forensic science.

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