

# Triple-Shock™ X Bullet®



The all-copper **Triple-Shock™ X Bullets®** expand more quickly than conventional lead-core bullets, destroying vital organs and causing massive hydraulic shock. Aided by four, razor-edged cutting petals, they penetrate deeper through tissue and heavy bone. These bullets almost always exit the animal's far side, creating maximum internal damage and significant loss of blood. Rapid double-diameter expansion and extreme penetration make **TSX™** bullets the number-one choice for everything from whitetail deer to the largest game. Typically retaining 100 percent of their original weight, they're the most effective and dependable hunting bullets

- **Faster expansion than competing lead-core bullets offer**
- **Exceptional accuracy**
- **Lead-free, 100% copper construction**
- **Razor-sharp cutting edges**
- **Out-penetrates lead-core bullets**
- **Won't fragment or come apart**
- **Better weight retention than any lead-core bullet**
- **Available in factory ammunition**

you can buy. Multiple grooves in the bullet's shank relieve pressure and improve performance.

Accuracy is unsurpassed. Many shooters report groups half the size produced by other bullets. "Right now" expansion combined with deep-driving penetration make Barnes' TSX the deadliest hunting bullet available today.



**INTRODUCED  
IN 2008**

# Tipped TSX™

Like Barnes' Triple-Shock X Bullet, the **Tipped TSX** features a 100-percent copper body, with the addition of a streamlined polymer tip that boosts BC and prevents magazine walls from damaging the bullet's nose. Expands to create four tough, copper petals with razor-sharp cutting edges.

The tip and re-engineered nose cavity provide even faster expansion. Multiple rings cut into the shank reduce pressures, allowing higher safe velocities. The **Tipped TSX** delivers the same exceptional accuracy and "dead right there" performance the Triple-Shock bullet is famous for, but with improved long-range ballistics.

Rapid double-diameter expansion, full penetration and four razor-edged cutting petals create more internal damage than any competing bullet. The Barnes Tipped TSX means cleaner, quicker kills. Accept no imitations.



- 100% lead-free
- Grooved for lower pressures
- Higher ballistic coefficient
- Deadly accuracy
- 99-100% weight retention
- Available in factory ammunition

*Tipped TSX loading data was not available at the time this manual was printed. It can be found at [www.barnesbullets.com](http://www.barnesbullets.com), or by calling customer service: 1-800-574-9200.*

# Maximum Range X Bullet®



- Deadly long-range accuracy
- Rapid expansion at any range
- Flatter trajectory
- Greater retained energy at long range
- Exceptional penetration
- Full weight retention
- 100% Lead-free
- Won't fragment on impact or blow up on game

Barnes' most advanced hunting bullet, the **Maximum Range™ X Bullet™ (MRX™)** has a patented, tungsten-based Silvēx® core and streamlined Delrin tip. Featuring a high ballistic coefficient and exceptional accuracy, this bullet delivers premium long-range performance.

The dense Silvēx core moves the center of gravity rearward for optimum ballistic performance and maximum retained energy downrange. Produces controlled expansion at both short and long range. Typically retains 100 percent of its original weight. Delivers the deep-penetrating, bone-smashing power needed for raking shots at game.

Writers have called the MRX, *"the most technologically advanced hunting bullet ever created,"* and *"the ultimate multi-tasking do-anything big game rifle bullet."*

*Sold in 20-bullet packs*

*Available in factory ammunition*



# The XPB™ Pistol Bullet

**HUNTING** - Barnes' 100-percent copper **XPB Pistol Bullets** expand to more than double diameter, creating six razor-sharp petals that produce maximum shock and tissue damage. XPB bullets retain virtually all their original weight.

Ideal for hunting, XPB revolver bullets are deadly on deer, antelope and other thin-skinned game. Fired from .454 through .500 S&W Magnum handguns, they deliver the controlled expansion and deep penetration needed for the largest, toughest game.

## **MILITARY, LAW ENFORCEMENT AND**

**SELF-DEFENSE** - Barnes' XPB handgun bullets meet or exceed military requirements, and are equally suitable for law enforcement and self defense. Create maximum shock and trauma. XPB bullets deliver the 12 to 18 inches of penetration preferred for law enforcement and military applications. They easily penetrate standard barriers and windshield glass. Lead-free construction prevents contamination of indoor practice ranges and other enclosed environments.



- Proven X Bullet technology
- 100% Copper – no lead residue
- Out-penetrates jacketed lead core bullets
- Double-diameter expansion
- No fragmentation – remains intact
- Available in factory ammunition



*XPB bullets are available in .380 through .45 pistol calibers.*

# Barnes Expander MZ™



The muzzleloader version of the X Bullet is 100 percent copper with a large, hollow cavity for quick, sure expansion. They produce more consistent shot-to-shot velocities and better accuracy than competing bullets allow. This results in greater shooter confidence and more one-shot kills.

**Expander MZ** bullets deliver deadly performance at both high and low velocities. They expand to twice their original diameter, creating six razor-sharp copper petals that slice through game. These tough, deep-driving bullets typically retain 100 percent of their original weight.

- 100% Copper
- Exceptional accuracy
- Full weight retention
- Razor-sharp cutting edges
- Double-diameter expansion
- Deep penetration
- Effective at high and low velocities
- Recommended for in-line rifles

*Expander MZ bullets are available in 195-grain .45-caliber, 250- and 300-grain .50-caliber, and 275- and 325-grain .54-caliber sizes.*



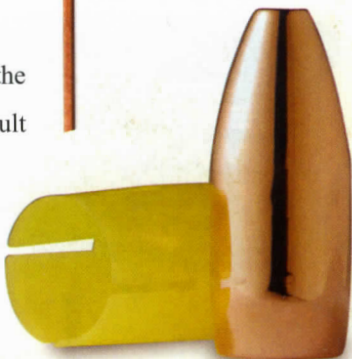
Barnes MZ Aligner Tools are recommended for faster loading and enhanced accuracy.

A separate Aligner Tool is required for each caliber and bullet nose configuration.

# Spit-Fire MZ™ and TMZ™

## SPIT-FIRE MZ

A semi-spitzer ogive and boattail base make the Barnes **Spit-Fire™ MZ** a great choice for difficult long shots. Deadly at high and low velocities. Six razor-sharp copper petals create massive shock and deep penetration. Retains virtually 100 percent of its original weight.



## SPIT-FIRE TMZ

The **Spit-Fire TMZ™** shares the same boattail design and 100-percent copper construction with the Spit-Fire MZ, but has a streamlined polymer tip for faster expansion. Higher ballistic coefficient means exceptional long-range performance. Remains intact at extreme velocities, yet expands at only 1050 fps. Redesigned sabot loads faster while retaining the tight gas seal that makes the MZ, Spit-Fire MZ and Spit-Fire TMZ the most accurate muzzleloader bullets on the market.



*Spit-Fire MZ bullets are available in .50 caliber, 245- and 285-grain weights.*

*Separate Aligner Tools required for MZ, Spit-Fire MZ and Spit-Fire TMZ bullets.*

- **100% Copper**
- **Exceptional accuracy**
- **Deadly at long range**
- **Double-diameter expansion**
- **Deep penetration**
- **Effective at high and low velocities**

**Plus TMZ features:**

- **New polymer tip**
- **Higher ballistic coefficient**

*Spit-Fire TMZ bullets are available in .50 caliber, 250- and 290-grain weights.*

# Varmint Grenade™



Based on a design Barnes developed for military applications,

the **Varmint Grenade** is a flat-

base, hollow-cavity bullet

with a copper-tin composite core.

Surrounded by a

substantial gilding-metal jacket, the highly frangible core greatly reduces the chance of ricochets. The bullet remains intact at ultra-high velocities, yet fragments explosively on impact with spectacular results. The lead-free bullet virtually vaporizes ground squirrels and prairie dogs, even at extended range.

This bullet produces instant fragmentation and dramatic one-shot kills. The Varmint Grenade expends its energy early, seldom exiting bobcat- and coyote-sized predators. Valuable pelts remain virtually undamaged.

- Sniper-like accuracy
- Dependable long-range kills
- Explosive performance
- Lead free
- Remains intact at extreme velocities
- Preserves valuable pelts

*Offered in 26-grain .204 caliber, 36- and 50-grain .223 caliber and 62-grain .243 caliber.*

*Also available in Black Hills factory loads.*

*For additional information, visit [www.barnesbullets.com](http://www.barnesbullets.com)*

**BARNES**  
**VARMINT GRENADE**



**THE ULTIMATE SMALL-CALIBER WEAPON**

# Multi-Purpose Green™

Barnes offers two all-new bullets featuring **Multi-Purpose Green (MPG™)**

technology developed for military and law enforcement applications.

“Green” is military shorthand for “lead-free”—often a requirement in military and LE practice environments.

MPG bullets feature a highly frangible, powdered-metal copper-tin core inside a guiding metal jacket. The open-tip bullets combine pinpoint accuracy with explosive fragmentation.

The 55-grain 5.56mm (.224) MPG bullet is designed for M4, HK416 and AR-15 type autoloaders and other firearms with rifling twist rates of 1:9" or faster. A 140-grain 7.62mm (.308) version is available for AR-10, SR-25, M40 (Remington 700) and M14 rifles with 1:12" or faster rifling twists.

These extremely accurate, Multi-Purpose bullets are ideal for shooting steel targets, competition, plinking, hunting and home defense.



*Panther DCM Rifle from  
DPMS Panther Arms*

- **Military technology**
- **Lead-free “Green” construction**
- **Highly frangible**
- **Sniper-like accuracy**

*Available in 100-round boxes of 5.56mm and 50-round boxes 7.62mm bullets.*

*Multi-Purpose Green loading data was not available at the time this manual was printed. It can be found at [www.barnesbullets.com](http://www.barnesbullets.com), or by calling customer service: 1-800-574-9200.*



# Barnes Banded Solids™



Barnes' **Banded Solids** can be depended on to stop dangerous game *right now!* Machined from homogenous copper/zinc alloy, these indestructible bullets won't disintegrate or deflect on heavy bone. An improved flat-nose design delivers sure, straight tracking through dense muscle and bone. These are the most dependable dangerous game solids you can buy.

Multiple bands, or rings, cut into the bullet's shank prevent excess pressure, eliminating concerns about damaging fine double-rifle barrels. The bullets are weight-matched with Triple-Shock X Bullets of the same caliber, allowing Banded Solids to be interchanged with expanding TSX bullets without altering the point of impact.

Banded Solid Spitzers are designed for target shooting. They also kill fur-bearing game cleanly with minimal damage to valuable pelts.

- Tough copper alloy
- Deep, dependable penetration
- Tracks straight
- Won't deflect on bone
- 100% weight retention
- No deformation

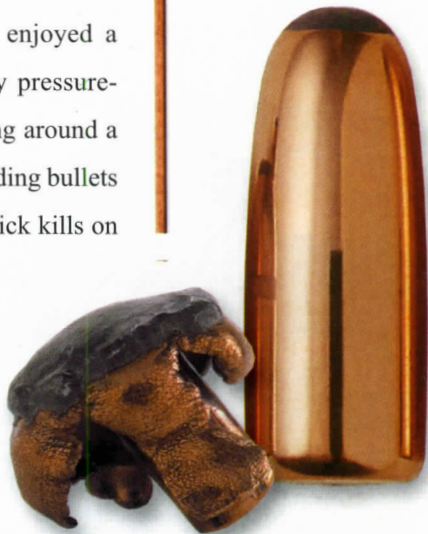


# Barnes Originals™

The very first custom bullets available to handloaders, Barnes Originals have enjoyed a loyal following since 1932. Made by pressure-forming a thick jacket of copper tubing around a pure lead core, these controlled-expanding bullets could be relied on to deliver clean, quick kills on even the toughest game

Proven through more than 75 years of effective service, these time-tested bullets are still offered for selected cartridges like the .348 Winchester, .38-55, .375 Winchester and .45-70.

Forerunners to the highly successful Triple-Shock, Tipped TSX and MRX bullets, Barnes Originals expand to more than twice their original diameter. Many big game hunters continue to rely on these time-proven bullets.



- Pure copper-tubing Exterior
- Pure lead core
- Controlled expansion
- Deep penetration
- Proven results

# *The Trouble With Long-Range Shooting*

*In the hunting world,  
it sounds better than it is.*

*By Craig Boddington*

Long-range shooting is one of the hottest trends among today's riflemen. In some ways this is really good because it has driven the manufacturers to create a bow wave of excellent new products. We have a whole bunch of fast new cartridges, so many that it's downright confusing, but they're all wonderful. Some of them, at least theoretically, offer more accuracy than the previous generation of belted magnums, and a few offer genuine increases in trajectory-flattening velocity.

We also have a lot of rifles that, right out of the box, offer significant improvements in accuracy. To me this is even better to play with than new cartridges. Hunting scopes and this new breed of "tactical scope" are more rugged than ever, plus—a big plus—they have genuinely repeatable adjustments and a variety of reticles to help judge range and allow a more precise hold at extended ranges.



This is all good, and the best part of it all is that it has given guys like me lots of things to write about. So we've written about long-range shooting, and many of you have done it. With or without the new equipment, you've honed your skills and increased your capabilities until you are genuinely dangerous at much farther ranges than you once thought possible. This is also good; riflery is about getting better, not standing still.



I do have a rub with this thirst to extend the range envelope, however, and that's when it is taken hunting. Don't get me wrong. There are circumstances where long shots are appropriate, and the very word "long" is very subjective. A great many hunters, perhaps the majority, have no business shooting at game much beyond 200 yards. There are others, a minority, who are perfectly competent out to

400 yards and beyond when the conditions are right. There are a very few who, on a calm day, in good light, with plenty of time to set up and think it through, can shoot considerably farther with confidence and reliability.

It is not my place to tell anyone how far he should or should not attempt to shoot at game, so I'm not going to put a figure on how far is too far. It depends a whole lot on the circumstances and the conditions at a given moment, as well as an individual's skill. I can say that, with all the new equipment, I occasionally hear people telling about shooting game at 700, 800 or even 1,000 yards. This is sort of like pornography: It's very difficult to define, but you know it when you see it. I can't precisely define a range limit; it varies with every person, and no two situations are alike. But I can say that I am totally opposed to shooting at game at the ranges mentioned above.

Note that I am not suggesting that shooting at such ranges is impractical. Long-range shooting is fun, and long-range competitive shooting is fascinating.

Thousand-yard shooters continue to raise the bar, now shooting groups that many of us would have trouble matching at 200 yards. And the stories are just now starting to trickle in about the shooting feats of some of our snipers in places like Afghanistan and Iraq. This is all great stuff, but to my mind it has nothing to do with hunting.

#### This Isn't Combat



The variables that make long-range shooting difficult are the same whether we're talking target shooting, hunting or tactical shooting (which I take to be a euphemism for police and military sniping or preparation for same). The list is long, but it includes knowledge of distance and knowledge of trajectory for the proper hold; adjusting the hold for wind; sheer accuracy, which includes

the inherent accuracy of the rifle and load, the shooter's skill and the degree of steadiness and stability that the current circumstances allow—and finally, pesky little things like shooting angle, light and temperature. Long-range target shooting is a wonderful sport and the best way in the world to learn about these variables. One of the lessons to be learned is what you *can* do and what you *cannot* do.

Tactical shooting for real is the ultimate test. I have never been to sniper school, but I have commanded Marine scout/snipers on numerous occasions. The training is wonderful but no less wonderful than the great shooting these folks have done. Snipers have played an important role in American military tactics since our Revolution, although it has only been in recent years that we have had formal schooling and an official "Military Occupational Specialty" (MOS) for the trade. Some have passed into legend: Timothy Murphy, whose felling of a British general during the battle of Saratoga may well have changed the course of the American Revolution; Alvin York, not a designated sniper but one helluva rifleman; Carlos Hathcock, Marine Distinguished Marksman, whose incredible exploits in Vietnam led to several books.

As riflemen, we admire their skill, but I consider it an exceptionally bad idea to try to replicate their feats in game country. Hunting is not combat. The stakes are immeasurably higher in the latter, at least to the shooter and his teammates, but the two situations couldn't be more different. As hunters, we have an obligation to take our game cleanly, efficiently and humanely. It is preferable to do this with one well-placed shot, but we all know sometimes this isn't possible, so we are prepared to follow up with additional shots until the game is brought to bag. This is not the preferred situation, but it's acceptable. What is not acceptable to any hunter worthy of the name is wounding and losing game.

In combat, the situation is much different. While the military sniper always seeks the best shot he can get, the real goal is almost always to take the target out of the fight. A nonfatal hit is perfectly acceptable under most conditions because most hits will take most men out of the fight, and near-misses will cause a lot of men to rethink their next move. Perhaps more important, in most armies a wounded soldier must be recovered and cared for, which expends resources, takes other enemy soldiers out of the fight and just may expose other targets during the recovery process.

Folks, this has nothing to do with hunting, where the only goal is to take your game cleanly so you can recover it. Let's review some of the challenges in long-range shooting as they apply to hunting situations.



### Distance And Trajectory

Thanks to the laser rangefinder—a truly wonderful tool—near-perfect knowledge of distance is now within everyone's grasp. Used correctly, the laser rangefinder does remove one of the critical variables in long-range shooting.

Of course, this is only half the battle. Once you know the range, you must also know where your bullet will hit at that range and adjust accordingly.

Do not think that this is just a matter of getting one of today's fastest and flattest-shooting magnums. Flatness of trajectory helps, but not as much as you might think. Thousand-yard competitive shooters generally sight their rifles inordinately high at short range to simplify holding on their known-distance targets. Hunters cannot do that. If you sight in more than three inches high at 100 yards, you must hold low at the midrange distances. This is very difficult to make yourself do, so misses at about 200



yards are almost a certainty. With a normal sight-in of perhaps three inches high at 100 yards, we have a lot of cartridges that will allow shooting without holdover to 400 yards and change. This is a very far poke and gives a great deal of flexibility, but push them much farther and it simply doesn't matter what you're shooting. You will have to adjust your hold, and in order to do this you must know your trajectory.

It isn't impossible, not at all. At the Battle of Adobe Walls, scout Billy Dixon is credited with knocking a Cheyenne off his horse at nearly a mile. In Cuba and the Philippines, American troops using trapdoor Springfields silenced Spanish and insurgent positions at 1,100 yards. Today most of our military sniping is done with match 7.62mm NATO ammo. Downrange ballistics aren't impressive, but these kids are deadly—and consistently deadly—at 1,000 yards and beyond.

So the issue isn't really trajectory at all but how well you know your trajectory. It can be learned, but ballistics charts won't tell you what you need to know. The only way to effectively shoot at distance is to actually shoot at distance—a lot—with the exact rifle and load you intend to use. Few of us actually shoot at 400, 500 and 600 yards—and if you don't, you have absolutely no business shooting at game at these distances.

This is because ballistics charts are only a guide. Your barrel may be faster or slower because of internal dimensions. It may be longer or shorter. The height of your scope above the bore may be different from the standard used on the charts, and this throws off everything. At medium ranges these differences may not be enough to matter, but at long range everything matters. These things can be learned, but it takes hundreds of hours and thousands of rounds at genuine distances.

Another supposed shortcut is the scopes that allow you to dial-in the range. Some are useless and some work very well, but none is so good that it provides a textbook solution without actually shooting at real ranges to verify each increment of adjustment. Personally, I have found very few "dial-in your range" scopes to have adjustments consistent and accurate enough to make this possible. Because of this, I much prefer to leave the adjustments alone and use reticles with additional stadia lines or aiming points such as mil-dot reticles. These work, but again, you must shoot them at actual ranges under ideal conditions, because the textbook solution is very unlikely to be a perfect match to your rifle and load.

## Wind

Once you get past knowledge of distance and trajectory—and with practice you can get past them—you must deal with wind. There is nothing simple about this. Even on a formal rifle range with range flags blowing, it's hard to figure. In the field it is almost impossible. There are great little wind gauges that will give you the wind speed and direction, but this only applies at the rifle. You also must judge the wind at the target and along the way between you and the target.

It's a simple thing to learn that a 10-mph crosswind will blow a .30 caliber 180-grain spitzer bullet with a muzzle velocity of 3,200 fps somewhere between 14 and 20 inches (depending on the exact bullet) off course at 500 yards. But what does a

10-mph wind feel like? And how do you tell if the wind is the same at the animal?

There are clues as to what the wind is doing downrange, like waving leaves and moving grass. With experience, a few really great riflemen—like Carlos Hathcock—develop an innate feel for it that is almost like a sixth sense. But there's no way to be sure. In sniping, given the vertical presentation of a human and the relatively narrow target, misreading the wind probably means a miss—or a perfectly acceptable wounding shot. In hunting, with the horizontal presentation of four-footed animals, misreading the wind is much more likely to mean a wounding shot. Sometimes, of course, it's calm. Sometimes there's a very mild breeze that seems consistent. If everything else is accounted for, then you can take the shot. But if there's much more than a puff of breeze, you probably need to get closer. And guess what?

The hunting country where long shooting is most likely—plains, mountains, tundra—is usually windy country.

### Accuracy And Stability

For serious long-range shooting there is no such thing as too much accuracy. The kind of group that we think of as perfectly adequate for hunting accuracy—say, 1 1/4 inches at 100 yards—is nowhere near good enough. With normal spread, that's more than six inches at 500 yards, which is still well within a deer's vital zone. Except very few rifles and riflemen can hold a group to that normal spread at extreme range.



Again, the only way to know how well you and your rifle can shoot at 500 yards is to actually shoot at 500 yards. Once in a great while you run into a rifle that groups better farther out than up close, but don't count on it. I figure the standards for a serious long-range rifle are about the same as for a serious varmint rifle. I want consistent groups of 1/2 inch or less at 100 yards, and I feel a whole lot better if I can break the quarter-inch barrier.

The good news is that both rifles and ammunition are considerably more accurate than ever before. This is at least partly because American riflemen have demanded better accuracy, and the manufacturers have responded. Barrels are better, and factory ammo is a whole lot better. Today it isn't unusual to get the kind of groups with factory ammo that were once the exclusive province of precision handloaders. So, while accuracy will always be somewhat mysterious and, in a given rifle with a given load, may prove elusive, you can get the raw accuracy you need.

The next question is whether you can apply that accuracy under field conditions. There are no shooting benches in hunting country, so the perfect conditions that produced your best groups no longer apply. Obviously, there are many ways to get steady, such as over a pack, with a bipod, even a good prone position. But however



you do it, getting steady is an absolute requirement for taking a long-range shot.

This means that even if everything else is right, sometimes you can and sometimes you can't take the shot. Things like vegetation and uneven ground may make it impossible to get into a steady, supported position. The bottom line is that, somehow, some way, you simply must get absolutely steady. If you can't, then there isn't a shot.

Again, it's the same story: A miss is the really good news. At very long range, the average shooter who hasn't spent a lot of time shooting at distance will probably miss. On the other hand,

the shooter who has done the homework—knows the distance, knows the trajectory, understands wind drift and has the accuracy required—will probably not miss by much. Which means a wounded animal.

### Angles And Things

Hopefully, we all understand what happens when shooting at uphill or downhill angles. The effect is the same. Gravity acts upon the bullet only on the horizontal distance, which, whether it's uphill or downhill, is a shorter distance between you and your target. This means your trajectory is stretched out. It doesn't mean that your bullet rises when shooting at steep angles, but since you are sighted-in above your line of sight at shorter ranges, this is the effect.

This is not something to lose sleep over at short to medium ranges. It takes a fairly steep angle and considerable distance before the effect is worth worrying about, but way out there you'd better worry about it.

Shooting at angles is a bit like doping the wind. Some detailed ballistics charts and computer programs will tell you what the effect is for a given load at a given angle and distance. You could print out this data and carry it with you, just like a wind-drift chart. But in the field, can you accurately measure the angle? Can you really tell the difference between a 25- and a 40-degree slope?

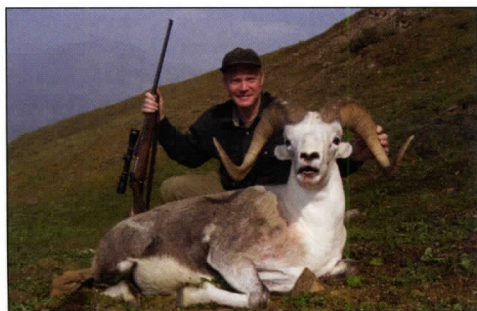


As I've often written, I do not actively pursue long-range shooting in the field. But I do practice for it and know how to do it. If conditions are right and there is no way to get closer, I will take a shot at, say, 500 yards and change. I have never



taken a shot at game at 600 yards or beyond and don't intend to.

At 500 yards and change, most of my shots have been successful—with two notable exceptions. Both times, once on a downhill shot and once on an uphill shot, I failed to read the angle correctly, didn't adjust for it properly and shot right over the top. The good news, of course, is that I missed cleanly both times.



It's important to remember that temperature affects velocity, and as altitude increases, retained velocities are higher because of reduced air friction. Any shift in velocity will impact your carefully memorized and annotated ballistics data. If you do all your hunting close to home, this isn't a big deal. But don't think you can work up your data at sea level in Florida

and use it in the Canadian Rockies. As with shooting angles, it takes both a lot of distance and a radical shift in outside temperature or altitude to make a difference, but we're not talking about normal shooting ranges here. Out at the quarter-mile mark and beyond, you need to know if you've lost or gained a couple hundred feet per second.

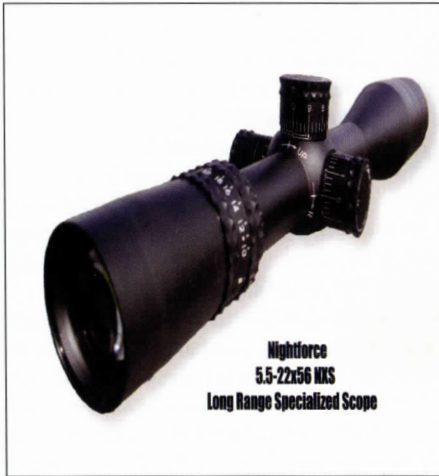
### Bullet Performance And Energy

This is one long-range variable that applies only to hunting. In target shooting, the criteria for long-range bullets are accuracy and aerodynamics; all the bullet has to do on arrival is punch a hole through paper. In combat you can argue endlessly about what might be best, but international treaties stipulate nonexpanding bullets. So match-grade spitzer boattail FMJs are almost universal.

This is not fine in hunting. Ideally, you want the same bullet performance at long range as you get at close range: enough penetration to reach the vitals coupled with enough expansion to create a large wound channel, disrupt vital organs and dispatch the animal quickly. This is not only a humane consideration. The faster the animal goes down, the quicker and easier it is to recover your game. No matter where the hit, the farther an animal is able to travel after receiving a bullet, the greater the chance of losing the animal.

Unfortunately, it is almost impossible to obtain the same expansion at long range that you can get routinely at close range. Velocity is always a key contributor to bullet performance. Way out there, your velocity has dropped off considerably, so bullet expansion will generally be less, and less





rapid. It also becomes more erratic. Most of the guys who shoot game at long range tend to use bullets that are both very accurate and generally quite frangible.

In my experience it doesn't much matter what you use. At extreme ranges, when velocity has dropped off dramatically, bullet performance is no longer consistent. I have seen even quick-expanding bullets act just like solids at longer ranges. Energy drops off right along with velocity, and as expansion is reduced, energy transfer is also diminished. What this means is that as range increases, shot placement

needs to be even more precise because you can no longer count on bullet expansion and energy transfer as hedges against poor shot placement.

Personally, I don't want anything to do with shooting at game at 600 yards, but when conditions are right, I have several friends who make this work on a routine basis. So my limits need not apply to you, but there are limits.

In terms of hunting ethics, our image as hunters and the future of our sport, the stakes are much higher in hunting than in the other venues. As range increases, a near miss is an increasingly likely result. And hunting is the one shooting venue where a near miss is absolutely unacceptable.

*Excerpted from "The Trouble With Long-Range Shooting," originally published in Petersen's Hunting magazine, with the kind permission of the editor and Craig Boddington.*

# Sighting-In For Effect

By Ron Spomer

Whacha doin'?" asked a familiar voice on the phone.

"Sighting-in a rifle."

"Oh, you're at the range?" Tom asked. "Kinda dark for that, ain't it?"

"Naw, I'm in the basement."

"You shoot in your basement! Isn't that kinda dangerous? Oh, wait a minute. You've got one of those boresighters, don't you?"

"Yeah, but I'm not using that yet."

"What? Then how can you be sighting-in?"

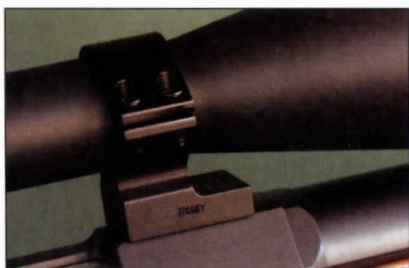
"I'm mounting the scope."

Few people stop to think that sighting-in starts there, but it does. If you don't mount the bases and rings properly, you'll never get a rifle to shoot to point-of-aim— but waste a lot of ammo trying. It happens every year, some poor guy banging round after round downrange, cussing and twirling his adjustment dials in confusion as shots scatter over a sheet of paper the size of some tents. I've seen people burn through 20 rounds, throw up their hands in frustration and go home, no closer to dropping bullets where aimed than when they started. That's a pity, especially when you can sight-in a scoped rifle with as few as two shots.

Yup, just two rounds.

Before we outline that nifty trick, let's return to scope mounting, the foundation for every shot thereafter.

If a base or ring is misaligned or loose, even slightly, the most accurate rifle may not group inside a monster truck tire. And you might not detect that loose screw no matter how you wriggle the scope. It'll lie hidden under the ring, and you'll be loath to remove said ring just to check it. So why not mount it correctly in the first place?

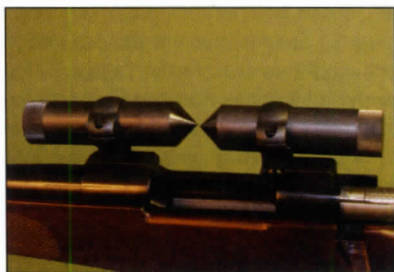


Proper scope mounting

begins with high quality bases and rings. They can be one or two-piece, steel, aluminum or titanium (if anyone even makes the latter.) The best are milled from bar stock rather than cast. Examples include, but are not limited to, Talley, Leupold, Burris and the top end Weavers. Bases integral with rings eliminate another connection point, another screw or two, and usually reduce weight slightly. Adjustable windage models, like the Leupold STD mounts, let you align the scope with the bore, minimizing the need for internal windage adjustments. This, in turn, reduces stresses on the erector tube and spring while allowing you to sight down the optical center of the lenses, always their sharpest.

Rings can be attached with a variety of screws, clamps, hooks or caps. Whichever you choose, clean them and all screws, plus the tapped holes in the receiver or barrel, of all oil. You'll add a tiny drop of Loctite to each during final mounting, but first mount everything loosely as a "dry run" to make sure it

all fits properly. Sometimes packages are mislabeled or the wrong part slips in. I've seen odd-sized bases, screws and rings. One scope box labeled 3-9X contained a 2-7X! Some scopes are too short to span base spacings, others lay with turrets or bells over the rings when positioned for proper eye relief. Check all this out before final mounting.



Once things look properly aligned, dismantle, keeping everything orderly, and remount the bases with a tiny drop of semi-permanent Loctite (not the formula that can't be broken free later) on each screw. Alternate screws as you gradually tighten. Next mount the lower rings, following manufacturer's instructions. For a more perfect fit that places no stress on your scope, use a tool such as the Wheeler Engineering Scope Alignment and Lapping Kit to turn dovetail rings into position, align them perfectly and polish them to remove rough spots for perfect grip. Position the scope carefully for proper eye relief with crosshairs level with the bore. Apply Loctite to the top ring screws and tighten alternately, taking care to not over tighten and crush the scope.

Bore sighting will get you near point-of-aim, but rarely right on. If you don't own a boresighter, mount your rifle in a cradle (two notches in the upper ends of a cardboard box will suffice,) remove the bolt, look down the bore and visually center within it a bull's-eye about 20 yards away. I find bright orange dots or the shiny end of a soda can easiest to see. Shift the rifle/box until the bull stays centered in the bore. Without moving the rifle, turn the scope reticles until the crosshair falls over the bull. It's boresighted.

### Ready to Fire

At the range you face a small dilemma. Sometimes boresighting is good enough to put you on paper at 100 yards, sometimes it's not. Do you risk a shot or start closer? I find it generally pays to take that first poke from about 25 yards where you're sure to hit paper. And here's where you sight-in with just two shots. After the first hole appears on the target, realign your rifle with the crosshair exactly where it was for your first shot (over the bull.) Lock it in this position and watch the reticle while turning the windage and elevation dials until the crosshair rests over that first bullet hole. Bingo. The reticle is now pointed exactly where the barrel is throwing its shots. You're essentially sighted-in for 25 yards (because the bullet crosses line-of-sight due to the upward angle of the barrel) and about 200 yards (where the bullet falls back through the line-of-sight.)



It may seem obvious to veteran shooters, but it's worth mentioning that bullets do not rise above the axis of the bore. The instant they exit, gravity begins pulling them down. To counteract this, barrels are canted slightly upward. The bullet is then thrown in an arc much like a baseball

from center-field to homeplate, increasing effective range.

Serious shooters shouldn't be satisfied with a 25-yard sight-in. Move back to 100 yards to perfect things. Naturally you're going to use a steady rest to remove all human error. Bean bags, tripods, bipods, perhaps some sort of cradle. This isn't a contest to see how well you shoot, but a series of mechanical adjustments to make your scope/rifle shoot where you want. From your rock-steady position, fire another shot at the bull's-eye. It will probably land higher or lower than your 50-yard shot, perhaps slightly to either side. It's tempting at this point to dial in correction. Big mistake. A single shot could have been a flier. Or you could have pulled it. It's better to take two more and average the group center, then make your corrections, noting whether your scope gives 1/2-, 1/4-, or 1/8-inch movements per click at 100 yards. Most are 1/4 click. In that case, you'll dial in 4-clicks left (as indicated on the dial) if you want your point-of-impact to move 1-inch left. Give it 8-clicks up if you want your hits to come up 2 inches and so on. Now take another shot. Did it move left 1 inch and up 2 inches? If not, don't panic and don't move those dials! Sometimes erector tubes (which hold the reticles) don't shift when you screw the dials, but do after recoil jars them. So shoot two more times for a much more accurate picture of where your point-of-aim shifted. If one shot is in the original group and the other two have moved where they were supposed to, the erector tube was probably stuck after your initial adjustment.

What if your second group moved only half the distance it was supposed to – or double? Either you miscounted clicks, misread the click adjustment rate or own a scope that isn't as accurate as its manufacturer claims. The latter happens almost as often as the former, but this isn't the end of the world. A scope that doesn't adjust exactly 1/4-click each time can still be a perfectly trustworthy, functioning hunting scope once it's sighted in. Just don't try cranking-in new range adjustments while afield and expect them to be accurate. Obviously, if you bought a scope expressly to dial-in long-range corrections, it had better be accurate. Return it if it isn't.

One other error that is sometimes made while sighting-in scopes baffles those engaged in making it. They dial corrections left and right and up and down and the bullets land nowhere close to where they should. The entire scope seems schizophrenic. Check to see if it's mounted "upside down." Hey, it happens. Someone (no finger pointing here) set the thing in its rings with the elevation turret turned to the left side of the rifle and the windage turret on top. So when you adjust the dial that indicates R for right, you really move the reticle up or down. When you turn the Up dial, you shift the reticle left or right. Yeah, pretty hard to correlate those moves. Some shooters intentionally mount scopes this way to better clear the ejection port, knowing that the windage and elevation dials are then reversed.

### Which Sight-In Distance is Best?

With a perfect scope and MOA or better rifle, it is indeed possible to sight-in with two shots as described above, but the safer way is to keep shooting three-shot groups until you're confident their centers are landing exactly where you want them at 100 yards. The question then is "should that impact point be 100 yards, 200, 250 or 300?" And the answer depends on the terrain and habitat in which you hunt. In open country where shots are often long (pronghorns, mule deer, sheep,) sighting dead-on at 100 yards with a flat-shooting centerfire wastes its trajectory advantage. It makes more sense to adjust reticles for a high hit at

100 yards so the bullet flies farther before falling under the target at long range. In heavy cover (woods hunting) where shots rarely stretch beyond 150 yards, it makes more sense to sight rifles dead-on at 100 or 125 yards. This reduces mid-range trajectory, keeping the bullet's path within 1.5 to 2 inches of line-of-sight (remember, the scope sits that high above the bore). This helps you shoot through small gaps in the cover. Let's investigate some sight-in options for different types of hunting.

### 100 Yards, Close Cover and Low Velocity

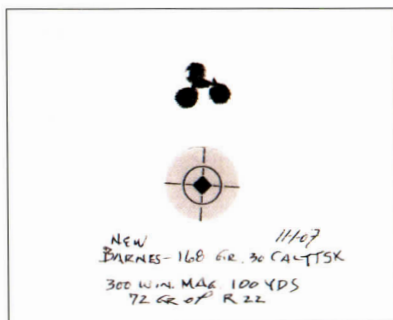
The 100-yard sight-in is ideal for close-range shooting as mentioned above and for low-velocity cartridges firing blunt, inefficient bullets with arcing trajectories, i.e. .30-30 Win., .45-70 Govt., .44 Magnum, muzzleloaders, etc. Scopes should be mounted as close to the bore as possible to keep sight-line and bore-line close. Tall, see-through

mounts and/or huge objective bells that put scopes more than 1.5-inches above the bore increase the chance you'll hit a low branch that appears well below the horizontal reticle in the scope. Don't fret about the occasional long-range shot. It rarely pops up in woods/brush hunting, and when it does, you can compensate by knowing your bullet's trajectory and holding accordingly. The 150-gr. Barnes TSX FN at 2,300 fps sighted for 100 yards barely rises above line-of-sight at 50 yards, drops 2.4 inches at 150 yards and 7 inches at 200 yards. After that it really starts to plummet, falling 15 inches by 250 yards. At that range you could hold just over the animal's back and drop the shot into its vitals, but that presumes you know the precise distance to the target, a tough call in heavy cover where 200 yards can look like 250 or 300. But really, how often to you see a clear avenue to 300 yards in woods?

If you're really serious about maximizing your woods rifle's potential, play around with 125-yard and 150-yard sightings. Depending on velocity and bullet Ballistic Coefficient (BC), you should be able to keep mid-range trajectory under 1.5 inches while raising the down-range flight path by several inches. Put in plenty of range time punching paper at numerous distances from 50 yards to 300 to gain a deep understanding of trajectory.

### 200 Yards, Mixed Terrain and Habitats

Most hunters who prowl a mix of habitats from Midwest hardwoods and grainfields to Western mountains and forests do well with a 200-yard sight-in. With average cartridges in the .243 Win. through .30-06 class (spitting .35 BC to .50 BC bullets 2,700 to 3,200 fps), a 200-yard zero will maximize mid-range trajectory at about 2 inches, and this will peak at about 110 yards. At 300 yards drop will be roughly 6 to 9 inches. This means you can hold dead-on a whitetail's chest and hit it without worrying about holdover or -under out to about 300 yards. The key is to never hold "off hair." If you're confident (or know) the distance is 300 yards, hold just under the backline. Otherwise, hold for vertical center.



Flatter-shooting magnums (Weatherby's, WSMs, Ultra Mags, and the traditional Winchester and Remington mags) will reduce mid-range trajectory perhaps an inch and fall just 3 to 5 inches at 300 yards. High BC bullets like the TSX line driven to maximum velocity in a given caliber also reduce mid-range trajectory.

### MPBR (Maximum Point-Blank Range)

This sighting "system" maximizes the range over which any rifle/cartridge/bullet will hit any target with a dead-center hold without worrying about range estimation or risking hold-over. You just aim for the middle and shoot. If you miss, the game was beyond your rifle's MPBR, and that could be well over 350 yards with the right cartridge and bullet.



MPBR works by setting sights so that the bullet's mid-range trajectory (the highest point of its arc) never exceeds the height of your target when you aim for its vertical center. The distance at which the bullet then falls below the bottom of the target is its Maximum Point Blank Range. For example, if you're hunting pronghorns with a chest-cavity vital zone measuring 10 inches top to bottom, adjust your scope so your bullet never rises more than 5 inches above your line-of-sight, corresponding to the top of that chest cavity. When the bullet falls to 5 inches below line-of-sight, it has reached its Maximum Point Blank Range. For moose this vital zone might be a generous 24 inches, giving you a mid-range trajectory of an incredible 12 inches! With a .30-06 launching a 150-gr. Barnes TSXBT at 2,950 fps, mid-range trajectory would be at 260 yards, zero would come at 424 yards and MPBR would fall at 499 yards!

Of course, few of us would want our rifles shooting a foot high at any distance, but 4 inches isn't unreasonable. The vital zone on the average whitetail's chest is at least 10 inches. A shot striking 4 inches above dead-center would land well within this zone. Sight the above 150-grain TSXBT for a maximum trajectory of 4 inches (which comes at 150 yards) and the zero range will be 275 yards, the MPBR 323 yards.

The faster the launch and the higher the bullet BC, the farther the MPBR. A .300 Remington Ultra Mag will spit that 150-grain TSX Bullet 3,350 fps for a MPBR of 383 yards. Zero in this case would be 326 yards and mid-range trajectory 200 yards. The beauty of controlled expansion bullets like the Triple Shocks and MRX—which penetrate so deeply and reliably—is that you can step down from traditional bullet weights, retain just as much penetration (if not more) and increase velocity, thus flattening trajectory and increasing MPBR even more.

The trick to shooting effectively with MPBR is resisting the urge to aim high. We tend to overestimate distance anyway, and doing so with a bullet that is already striking 4 inches high at mid-range risks shooting over. The cardinal rule with MPBR is to always hold for vertical center. I take it a step further and aim for the lower third when I'm confident the range is 200 yards or less. The MPBR system hinges on an accurate rifle and shooter. A rifle that scatters shots 2 inches above or below point-of-aim could put your bullet 6 inches high instead of 4. Add an inch or two for poor aim or jerking the shot and you end up shooting over

game. MPBR can also become problematic in steeply angled, long-range shooting situations when shots land higher than normal anyway. Do your homework and know your trajectory tables.

Of course, you can always opt for a smaller target diameter, say 6 inches instead of 8. This reduces MPBR, but minimized any tendency to shoot high. When targeting smaller game such as coyotes or woodchucks, target diameter might be 4 or 3 inches. Establishing MPBR is most easily done with a computer ballistic program, but always check real world performance with extensive target shooting at all distances. Your rifle/bullet combination might not shoot exactly as the computer model predicts.

#### Bullet Drop Compensating Reticles

If you opt for one of the many bullet drop compensating reticles on the market, you'll need to read and follow directions carefully and use a rangefinder – or be one heck of a talented guesser – to hit consistently at extended ranges. In the hands of experts, these scopes perform beautifully, but they aren't magic. The shooter still needs to practice and do his homework. In the heat of action, with that B&C buck about to walk into the trees, casual shooters may find multiple stadia wires, mathematical calculations and twisting dials more confusing than helpful. Apply yourself diligently.



#### Practice, Practice

Regardless which sight-in distance or system you choose, always back it up with extensive target shooting so you know, without a doubt, where your bullets land at all ranges. Don't be embarrassed to tape a trajectory chart to your butt stock. I don't mind being embarrassed when I get to wrap my tag 'round a thick antler beam.





# Choosing The Right Bullet

Hunters need bullets they can depend on. They need accurate bullets that hit hard . . . create massive hydraulic shock. . . penetrate tough muscle and heavy bone. They need bullets that kill quickly, dropping animals humanely in their tracks.

Barnes' premium bullets—the Triple-Shock™ X, Maximum-Range X and Tipped TSX™ bullets—do all this, and more. Here's the story behind the deadliest, most accurate hunting bullets you can buy.

While hunting brown bear in Alaska in 1985, Randy Brooks, co-owner (with his wife, Coni) of Barnes Bullets, first conceived the idea of an expanding, solid copper bullet with no lead core. Returning home, he began designing and testing the new bullet. A specially engineered nose cavity was developed that caused the revolutionary new bullet to expand on impact into four sharp, copper petals. Viewed from the front, the four copper petals formed an X-shaped silhouette, giving X Bullets® their name. The following year, Brooks used a 270-grain X Bullet from his .375 H&H Magnum rifle to shoot an Alaskan brown bear—the first game killed with an X Bullet. When the X Bullet was introduced in 1989, hunters quickly recognized its unique capabilities.

In 2003, the Triple-Shock X Bullet™ was announced. An improved version of the X Bullet, the Triple-Shock (TSX™) bullet features a series of rings, or grooves, cut into the shank of its all-copper body. Instead of increasing resistance as the bullet moves down the bore, surface copper flows forward or backward into these relief grooves, reducing pressure and virtually eliminating copper fouling. The result is faster velocities and the exceptional accuracy TSX bullets have become famous for.



With no lead core to deform or fragment, the TSX typically retains 100 percent of its original weight while expanding to twice its original diameter. This amazing bullet delivers unsurpassed penetration, even when heavy bones are struck. Because it expands instantly on impact, the TSX is deadly on whitetail deer. This extremely versatile bullet is also a favorite among African PHs, who rely on its unfailing dependability and exceptional penetration for both plains and dangerous game.

Made of 100 percent copper, the Triple-Shock X is the gold standard other hunting bullets are measured against.

Introduced in 2006, the Maximum Range X Bullet (MRX™) takes Triple Shock performance to an even higher level. The MRX bullet features a denser-than-lead Silvēx® core surrounded by a 100-percent copper body with relief rings cut into the shank. The heavy Silvēx core moves the bullet's center of gravity rearward for optimum ballistic performance and maximum penetration. Unlike competing soft

lead cores that fragment or squeeze out under pressure, the tough Silvēx core retains its shape on impact, maintaining bullet integrity. The Barnes MRX provides long-range performance no other bullet can match.



Its streamlined Delrin® tip gives this premium bullet a higher ballistic coefficient, allowing the MRX bullet to deliver flatter trajectory and greater retained energy at long range. Unlike some plastic-tipped bullets, the Delrin-tipped MRX won't fragment on impact or blow up on game. The MRX bullet provides controlled expansion at both short and long range. On impact, the nose of the bullet instantly peels back into four tough, razor-sharp copper petals that resist shearing off. The MRX bullet typically retains 100 percent of its original weight and delivers the deep-penetrating, bone-smashing power needed for raking shots at game.



Like the all-copper Triple-Shock X Bullets, the new Maximum-Range X Bullet contains no lead to contaminate venison. The MRX is the bullet to choose when you need to make difficult shots at extreme distances. It's a super-premium bullet that kills quickly and dependably at all hunting distances, including extended range. It delivers long-range energy and penetration lead-core bullets simply can't match. It works equally well when impacting close-range game at ultra-high velocities.

Introduced in 2007, the Tipped TSX (TTSX™) bullet features a polymer tip extending into a specially engineered nose cavity in the copper TSX body. The combination of tip and cavity initiates rapid expansion the instant the bullet strikes game. The streamlined tip increases the ballistic coefficient of both the MRX and TTSX bullets for superior long-range performance. This bullet expands reliably over a broad range of velocities.



When you must stop dangerous African big game in its tracks, Barnes Banded Solids™ deliver exceptional accuracy and deep, straight penetration. Multiple grooves cut into the shank relieve pressure as the bullet passes through the bore, eliminating concerns about high pressures in fine double rifles. The relief grooves also virtually eliminate fouling.

These machined, homogeneous copper/zinc-alloy bullets will not disintegrate or deflect when impacting heavy bone.

They resist deformation so well that some hunters have actually retrieved these bullets from game and reused them on later hunts.

Deep crimping grooves prevent bullet movement under the heaviest recoil, yet allow sure, smooth feeding in bolt-action rifles. Banded Solids are matched weight-for-weight with Triple-Shock X Bullets of the same caliber, allowing use of either solid or expanding bullets without changing point of impact.



At the other end of the size scale, Barnes Varmint Grenade™ bullets combine pinpoint accuracy with explosive fragmentation. They're ideal for shooting varmints ranging from bobcats and coyotes, to marmots and prairie dogs at extended distances. Created by exclusive technology Barnes developed for military applications, Varmint Grenade bullets feature a highly frangible, powdered-metal copper-tin core contained in a

guiding metal jacket. This hollowpoint bullet remains intact at ultra-high velocities, yet fragments instantly on contact, virtually vaporizing ground squirrels and prairie dogs. Its frangible, lead-free design positively prevents ricochets. Available in 26-grain .204-inch, 36- and 50-grain .224-inch, and 62-grain 6mm weights and calibers.

Developed for military applications, Barnes' MPG™ bullet is a multi-purpose projectile featuring a highly frangible, powdered-metal copper-tin core surrounded by a guiding metal jacket with an open tip. Unlike other frangible bullets lacking a protective jacket, MPG bullets remain intact under the rigors of handling, feeding and firing—eliminating the primary cause of jammed actions and plugged barrels when firing frangible ammunition in autoloading rifles.



In addition to sniping and other tactical duties, this flat-base, open-tip lead-free bullet can be used for hunting, shooting steel targets and long-range plinking. The MPG's frangible design greatly reduces the chance of ricochets. The Barnes MPG is offered in both .224-caliber 55-grain and .308-caliber 140-grain versions.

Designed for military sniping, hunting and extreme-range target competition, Barnes .50 BMG bullets are offered in both Solid and Borerider configurations. These highly streamlined 750- and 800-grain projectiles feature boattail bases and exceptionally high ballistic coefficients. Several world accuracy records have been set with these bullets.





Muzzleloading hunters have three Barnes Bullets to choose from. The Expander MZ™ is 100 percent copper and features a large, hollow cavity for quick, sure expansion. Barnes Expander MZ Muzzleloader bullets produce more consistent shot-to-shot velocities and better accuracy than competing bullets deliver.

They expand to twice their original diameter, creating six razor-sharp petals that slice deeply through game. The Expander MZ delivers deadly performance at both low and high velocities.

The Spit-Fire MZ™ features a streamlined semi-spitzer ogive and a boattail base, making it a great choice for difficult long-range shots at game. Penetrates deeply while retaining virtually 100 percent of its original weight.. This all-copper muzzleloading bullet is exceptionally accurate.



The Spit-Fire TMZ™ shares the same boattail design and all-copper construction as the Spit-Fire MZ, but features a polymer tip. The streamlined polymer tip gives this bullet a higher ballistic coefficient and initiates instant expansion when the bullet strikes game.



For best accuracy and performance, Barnes MZ Aligner™ Tools should be used for loading Expander MZ, Spit-Fire MZ and Spit-Fire TMZ bullets. These Aligner Tools are individually sized to fit each caliber and bullet nose configuration.



Barnes XPB™ pistol bullets are a great choice for law enforcement, hunting and self-defense. XPB .380 ACP, 9mm, .40 S&W, .45 Gap and .45 ACP bullets deliver top performance in auto pistol loads. These controlled-expanding bullets easily penetrate standard barriers and windshield glass. Lead-free construction prevents contamination of indoor practice ranges and other enclosed environments.

Constructed of 100 percent copper with no lead core to fragment or come apart, Barnes XPB hunting bullets are devastating on game. Deep penetration and double-diameter expansion insure clean, quick kills on everything from deer to Africa's largest game. Available in all handgun calibers, including .500 S&W.

Randy Brooks invented the all-copper X Bullet™ in 1986. Two decades later, Barnes Bullets offers a full range of lead-free rifle, handgun and muzzleloader bullets that handily outperform conventional jacketed lead bullets. After more than 20 years of experience designing, testing and perfecting copper bullets, Barnes now produces "Unloaded, Unfailing, Unbeatable®" bullets for game ranging from pachyderms to prairie dogs. No bullets work better, or deliver deadlier results.

# *Forget Foot Pounds*

## *How Bullets Kill*

*By Clair Rees and Tim Janzen*

Reg Collingwood kned his horse alongside mine, then reached over to tap my shoulder. "That's a nice bull," he quietly said, pointing into the rain.

Seconds later, I made out the black mass of a moose against the treeline. The animal was staring at us from 90 yards away.

I was hunting with the late Bob Brister, then shooting editor of *Field & Stream*. We were guided by the Collingwood brothers, of British Columbia's Skeena Flying Service. A day earlier, we'd followed a string of pack horses from Lake Kluyaz to a mountain spike camp 18 miles away.

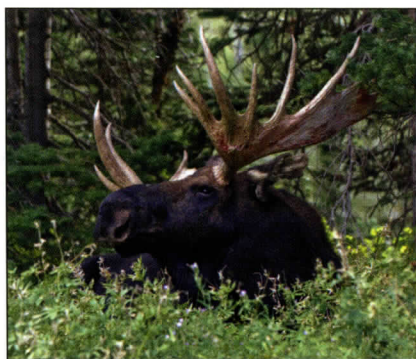
A coin toss that morning had given me first refusal of any game we spotted. I couldn't see the moose clearly through the driving rain, but Reg said, "he's a shooter!"

Hauling the .30-06 Sauer from its scabbard, I dismounted and stepped away from my horse. The rain partially obscured the target, and what should have been an easy offhand shot blew water from the bull's shoulder, six inches higher than where I'd tried to aim.

The bull flinched, but remained standing. Settling down, I fired the next two rounds in quick succession. Both 180-grain jacketed lead-core bullets struck just behind the animal's left shoulder, less than two inches apart.

This time the bull went down, disappearing in the tall brush. I hurriedly reloaded the Sauer's three-round magazine and worked the bolt. Knowing better than to approach from directly downhill, Reg and I circled wide to the left.

Moments later, the bull charged from the brush. Two of his wounds should have been fatal, but my first badly placed bullet had started his adrenaline pumping. He was less than 15 yards away when I put another bullet into his chest, quickly followed by another at point-blank range. That staggered him. I fired again, dropping the bull to his knees just six feet away.

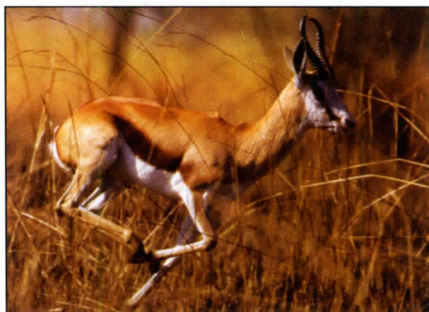


Snorted blood sprayed my jacket as the wounded bull lunged to its feet. I frantically threw a fresh cartridge into the ejection port and slammed home the bolt. Holding the rifle at arms length, I centered the muzzle between the animal's eyes and pulled the trigger.

I'd never considered moose dangerous game, but the enraged bull changed my opinion. Any six of my seven shots should have been fatal, but that first misplaced round supercharged the animal's nervous system. The close call had me shaking, as Brister rode up and, grinning, said, "I was about to head back to camp for more ammunition!"

That, and other experiences I've had in many years of hunting, underscores the four keys to killing an animal quickly and humanely. Here they are, in order of importance:

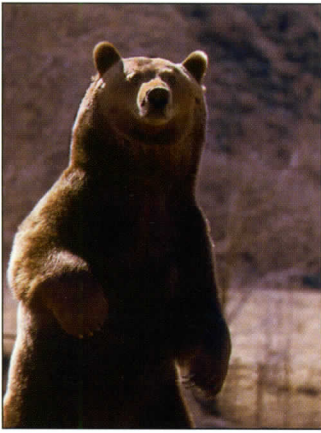
1. Shot placement. No matter how powerful your gun is, poorly placed shots are a disaster. An animal hit in the haunch or the left front foot will run off. Foot pounds can't compensate for bad marksmanship. Shooting an animal well also requires some basic knowledge of its anatomy—where you should aim to hit the heart, lungs, etc.



2. Bullet construction is next in importance. Three of the lead-core bullets I recovered from the moose had fragmented against bone, delivering poor penetration. A tougher bullet that held together and destroyed vital organs would have been a far better choice. Many bullets perform well under ideal circumstances, but don't deliver when things don't go as planned. Premium, properly constructed bullets won't shatter or deflect on striking heavy bone. They'll expand to double diameter, and pass lengthwise through an animal to create maximum destruction.

3. Animal physiology plays a huge part. Hit a moose in the wrong place, and he becomes practically bulletproof. This is doubly true for even more resilient species like Cape buffalo, grizzlies, polar bears and other large, truly dangerous game. Even deer and pronghorn can absorb follow-up shots, then travel surprising distances if the first round only wounds. Start an animal's adrenaline flowing, and you have a problem on your hands.

4. Energy transfer, while important, is probably not as important as you've thought it was. For years, hunters have used foot-pounds of energy as the best guide to killing power.



Possibly the best-known formula for calculating bullet deadliness is the “Knock Out Power” or “K.O. Factor” devised by John Taylor, a famous big-game hunter living in the last century. After a long career of slaying elephants, lions, Cape buffalo and other dangerous beasts, he rated killing power by multiplying the weight of the bullet (in grains) by its velocity (feet per second), then multiplying the result by bullet diameter (inches) and dividing the product by 7,000.

The resulting number (between 1 and 100) simply provides a basis for comparison. The Taylor K.O. Factor was devised at a time

**Bullet weight X Velocity X Bullet diameter ÷ 7,000 = K.O. Factor**

when nearly all hunting bullets were of basic jacketed lead-core design, so bullet construction wasn’t considered. Too, Taylor was primarily interested in stopping very large game, so the formula favors heavy, large-diameter bullets.

While the Taylor formula favors heavy, bigbore bullets moving at moderate velocities, it can’t predict the deadly effectiveness of a light, extremely tough, small-diameter bullet traveling at very high speed.

An extreme example is the 2500-pound American bison custom gunmaker James Ferguson shot with his .257 Hot Tamale—a 7mm STW cartridge necked down to .25 caliber. The cartridge launched a 100-grain Triple-Shock bullet at a muzzle velocity of 4,110 fps. Ferguson aimed for the point of the shoulder, and the tough, all-copper bullet completely penetrated both shoulders, dropping the bison on the spot. Bison are incredibly tough, hardy animals known for absorbing multiple heavy-caliber rounds and staying on their feet. Killing one instantly with a well-placed 100-grain .25-caliber projectile is an amazing tribute to bullet construction.



This same bullet and rifle has been used to kill a half-dozen bull elk—all with point-of- the-shoulder shots. All six animals were DRT—Texas speak for, “Dead Right There.”

Today, many rely on foot-pounds of energy as a guide to killing power. This energy can be calculated by using the following formula:

$$\text{Energy} = \frac{\text{Bullet Mass (grams)} \times \text{Velocity (fps)}^2}{450,400}$$

While it's valuable to know how many foot-pounds of energy a bullet packs, this isn't a reliable guide to fatal results. Consider this:

A 180-grain bullet from a .300 magnum traveling at 3200 fps develops approximately 4100 foot-pounds of energy.

When two 280-pound NFL linemen meet head-on at 15 miles per hour, they collide with roughly the same 4200 ft.-lbs. of energy

Do the players keel over and die? Or do they get up, shake it off and head for another huddle?

How about this example? When a pair of 280-pound rams battle, their horns crash together with 5,400 foot-pounds of energy. During mating season, they do this several times a day without suffering anything worse than an annoying headache. By themselves, foot-pounds of energy don't mean very much. How this energy affects game depends on exactly how and where it's applied.



It's only when you combine them with other, more important factors—shot placement, bullet construction, and animal physiology—that foot-pounds of energy mean very much.

### How Bullets Kill

When I discussed killing power with Randy Brooks, co-owner (with his wife Coni) of Barnes Bullets and inventor of the X, Triple-Shock X and Maximum-Range X Bullet, the first thing he said was, "Forget foot pounds."

As the above examples illustrate, bullet construction and placement—not foot-pounds of energy—are the most important factors in killing game.

"If you fire a target bullet and an expanding hunting bullet of the same weight and caliber at the same velocity," Randy said, "both will impact with the same foot-pounds of energy, but won't have the same effect on game."



“Most lead-core bullets stop after only partial penetration,” he added. “More solidly constructed bullets like Barnes’ all-copper Triple-Shocks typically pass completely through an animal to exit the other side. Tissue is destroyed the entire length of the wound channel, and substantial quantities of blood are lost when the bullet exits. Full penetration finishes the job more frangible bullets only begin.”

Partial penetration kills dependably only when broadside, behind-the-shoulder shots strike no major bones. Raking shots at fleeing game require a tough, quick-expanding bullet that remains intact while penetrating several feet of tissue and heavy bone.

As Randy points out, killing power isn’t measured in foot-pounds of energy. How quickly—or if—an animal dies is determined by several factors. They include, first, shot placement. Where your bullet goes is vitally important.



Next comes bullet performance. This is determined by how the bullet is designed and constructed, and how much tissue and vital organs it damages or destroys. “Ideally, you’ll use a bullet that expands quickly, then drives deeply through both tissue and bone,” he said. “Of course, I’m biased, but Barnes Triple-Shock, Tipped Triple-Shock and Maximum-Range X Bullets can be counted on for full penetration. They typically exit the animal’s far side, even when difficult front or rear shots are taken.”

Good bullets for heavy African game include the Barnes Banded Solid and the Trophy Bonded Sledgehammer. These bullets are designed for straight, deep penetration without deformation, even through heavy bone.

Never discount an animal’s toughness and tenacity of life. If a poorly placed first shot starts the adrenaline pumping, follow-up shots may have little immediate affect. Wounded deer and antelope can run amazing distances, while dangerous big game become far more dangerous if the first shot isn’t properly placed. While a good first shot kills quickly, a badly aimed round can mean real trouble—particularly when you shoot a big, bad-tempered beast with lethal hooves, tusks, teeth or claws.

While energy transfer is important, it ranks last on the list. All the foot-pounds in the world won’t do the job if they’re not accompanied by proper shot placement and effective bullet design.

*Excerpted from Rifle Magazine No.236.*

# Barrel Break In & Rifle Cleaning

It's a good idea to take a few hours to perform a proper barrel break-in process with new rifles. The barrel will be much easier to clean and it may hold accuracy longer between cleanings. The idea is to burnish away tooling marks and NOT to impregnate the steel with carbon initially. This process is one we've tried and have had success with.



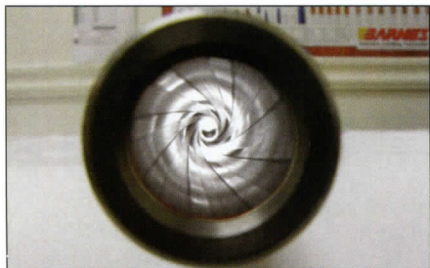
1. Fire one shot using a jacketed lead-core bullet (the jacket material is harder than the solid copper Triple-Shock X Bullet and will do a better job of burnishing the barrel during initial break in). Remove bolt and clean barrel thoroughly as detailed below. (Note: When cleaning a rifle, it's best to have the muzzle angled downward and always use a bore guide. This ensures solvents, crud, and grime won't drip/run through the action; gumming up the trigger and ruining the bedding. Also, one piece coated cleaning rods should be used.)

## Basic Cleaning Procedure, steps a-g

- a. Use the proper jag and a tight fitting patch or nylon brush wrapped with a patch soaked with CR-10 to remove the powder fouling. Use 2-4 patches and push each patch completely through the bore with one long stroke.
- b. Install the proper size bronze bristled cleaning brush. Soak the brush with CR-10 before brushing. Brush should be stroked through the bore 10-20 times (brush must be pushed completely through the bore prior to reversing direction). Add CR-10 to brush while it's at muzzle end of barrel half way through process. Once the process is complete, clean the bronze brush with a blast of crudbuster or something similar.



- c. Use proper size jag or nylon brush and Barnes CR-10 soaked patches until no discoloration is left on the patches. This step removes all copper fouling. The first two patches through the barrel after brushing should be pushed completely through the barrel in one long stroke. The remaining patches should be short stroked through the barrel a few inches at a time.
- d. Run one dry patch inside the chamber, remove and discard.



- e. Run two dry patches through the bore, remove and discard.
- f. Examine muzzle and throat area for any signs of copper fouling. If copper is still visible, repeat steps "b" through "e."
- g. Wipe any excess solvent from the muzzle and action area.

2. Lube the bolt lugs with grease (Traditions Firearms offers a white lithium based grease or Shooter's Choice offers a red grease called All-Weather High Tech Grease) and clean out the lug recesses. Also apply a small amount of grease to the bolt handle and cocking piece camming surfaces on the bolt.

Do this after each cleaning. There are great tool kits available from Sinclair and Midway for this purpose.



3. Repeat the cleaning process (Step 1, "a" through "g"), cleaning after each shot until 10 shots have been fired.
4. Shoot five sets of two-shot groups, cleaning after each pair of groups.
5. Shoot two five-shot groups, cleaning after each group.
6. Coat the bore with a light coating of oil (Shooter's Choice Rust Prevent works well) if gun is to be stored for some time.

Sinclair Action Cleaning Tool Kit (Item # ACT-2) includes a Lug Recess tool for cleaning of the locking lug area, Chamber Swab and Handle for cleaning and drying chamber and Multipurpose Brush for cleaning bolt face, etc. They have refill swabs available for the Lug Recess tool that can be ordered separately.

The importance of having a clean bore cannot be overemphasized. We shoot a lot of different rifles at Barnes, and probably four out of every five guns brought to us with "just cleaned bores" have a significant amount of copper fouling still in them. It is this fouling which will most affect the accuracy of the bullet. Some guns will shoot 100 shots and seemingly not be affected, while others will not shoot well after 20. Barnes TSX Bullets are made from pure copper, not a copper alloy like

other manufacturers' bullets. This pure copper is softer and therefore more sensitive to fouling.

Using a good copper remover, such as Barnes CR-10, one can remove the fouling quickly and safely. It has been our experience that the copper in our bullets will not foul any faster than a copper alloy IF THE BORE IS FREE FROM FOULING TO BEGIN WITH.

#### INSTRUCTIONS:

- \*Do not leave CR-10 in bore for more than 15 minutes at a time.
- \*If left for extended periods of time, CR-10 can be harmful to wood and special metal finishes. Wipe off immediately.
- \*CR-10 will discolor electroless nickel finishes.
- \*This product is intended for use on the inside of gun barrels only. Do not use for any other application!



#### Understanding Twist Rates

Twist rate is an important factor in optimizing accuracy. It's easy to determine the twist rate of your barrel. You'll need a cleaning rod equipped with a ball-bearing handle that allows the rod to rotate freely as it passes through the bore.

Fit a jag and a tight-fitting patch to the cleaning rod. Beginning at the breech, push the jag and patch almost completely through the bore. With a black marking pen, make a small mark at the very top of the rod exactly where it projects from the breech. Now slowly withdraw the cleaning rod, stopping when the mark you made is once again positioned at the top of the rod. Again use the pen to mark the top of the rod exactly where it projects from the receiver.

Now measure the distance between the two marks. If the distance is 10 inches, the rifling twist rate is 1:10 (one turn in 10 inches).

Note: The patch must be tight enough to make the rod turn at a consistent rate. The barrel must be long enough to allow a complete revolution of the cleaning rod (this won't work with short-barreled handguns).

While complicated formulas for determining proper twist rates are available, your best bet is to simply shoot groups into a target and see how the bullet performs. If groups are acceptably small—indicating good accuracy—and the bullet punches clean, round holes in the target, your barrel's twist rate is appropriate for the bullet you're shooting.

If accuracy isn't good and the holes in your target aren't perfectly round, the bullet may be tipping or "keyholing." When a bullet keyholes, it strikes the target at an angle. In extreme cases, bullets may tumble end-over-end and hit the paper sideways or even base-first. This makes good accuracy impossible

Can a twist rate be too fast?

Spinning a bullet faster than is necessary to achieve stability may cause accuracy to drop off, but at normal hunting ranges, it's not nearly the problem a too-slow twist rate is. If a bullet is unbalanced, spinning it faster than necessary simply magnifies the unbalanced condition, causing reduced accuracy. This is most prevalent in jacketed bullets with out-of-balance lead cores. It can also be a problem with poorly constructed varmint bullets. Very high revolution speeds can literally tear a weak varmint bullet apart in mid-air.

Let's look at some examples.

Say you're shooting a jacketed-lead 40-grain varmint bullet in your .220 Swift at a muzzle velocity of 4,200 feet-per-second (fps). You've found this to be an effective varmint bullet and you want to try it in your .223 Remington rifle.

You work up a load that produces 3,700 fps. You fire a five-shot group for accuracy and it measures 1/2 inch across, so you head to the nearest prairie dog town.

You notice something odd: While the combination produces deadly results, occasionally you see a puff of dust some 40 yards downrange. You miss the prairie dog completely. Your bullets are coming apart in mid-air.

You check the twist rate of both the .220 Swift and the .223 Remington barrels, and find the .220 Swift has the SAAMI-specified twist rate of 1:14, while the .223 Remington has a super-fast 1:7 twist.

Using the formula for calculating bullet rpm (velocity x 720, divided by twist), you find that the .220 Swift is spinning the bullet at 216,000 rpm. However, the same bullet from the slower .223 Remington is turning at 380,571 rpm! No wonder it's coming apart! This particular .223 Remington rifle was designed to shoot heavy 77- and 80-grain match bullets, hence the fast-twist barrel.

Twist rate is one key to obtaining small groups. If the rifling twist rate isn't right for the bullet you're shooting, accuracy may suffer.