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LONG-RANGE SHOOTING

- Proven Shooting Techniques
- Accurate Load Data
- Gear that Works



L.P. Brezny

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AMMUNITION

**The Gun Digest® Book of
LONG-RANGE
SHOOTING**



L.P. Brezny

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To

My wife Colleen

It takes special understanding to live life around a gun writer and outdoorsman.

Ross Metzger

My friend and teacher in a complicated subjects dealing with ballistics. He never failed to be there for help and assistance over these many years.

Jim Korzenowski

1943-2005

RIP

When I was about to give up the search for better ideas in ballistics my good friend pushed me on. Thanks, Jimmy.

The shooting sports industry

Without their continued support over these many years, little would have been gained by this writer.

My readers

The most important folks out there in the world of shooting. Without you, there would be no industry – or anything to write about!



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LONG-RANGE SHOOTING

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Chapter 1

An Overview of Long-Range Shooting

It was 1964 when the box arrived from the NRA DCM program. That was a program that allowed members of the NRA to buy up military surplus rifles for as little as a 10-dollar bill. My brand new, soaked-in-grease Springfield that had been manufactured in the Remington Arms plant in 1944 had arrived. The rifle was the Springfield 30-06/03 series two-groover. That meant it had been manufactured using a less costly and time-consuming two-groove rifling system that had been found to produce good accuracy, at least in terms of hunting the enemy during WWII. These Springfield's had been turned into effective sniper rifles for the task of reaching long-range pill box targets in the island wars of the Pacific, or taking on a German bell tower artillery spotter in a small French town on the other side of the world.



Stripping the military stock, turning back the bolt handle, and removing the iron sights was a start toward this rifle's life as a reworked centerfire long-range rifle. With the help of the Herter's company, a stock blank with enough wood to allow me to carve a wide, beaver-tail forend was purchased out of the original Waseka, Minnesota store's budget box. A pound of fiberglass bedding compound, sling studs, and a recoil pad finished off the deal.



Author and buddy glassing across a Minnesota swamp in the Spring of 1972 for crow targets. The rifle is an author-rebuilt military 30-06 Springfield. These were very common conversions after the war among hunters and shooters in general.



Author hunting northern California with a pre-1964 Winchester Model 70 in 30-06 Springfield. Photo taken in May of 1965.

Without really knowing it at the time, that heavyweight 30-06 shooter was my gateway introduction to the art of long-range shooting. After a month's work

at the basement workbench, I had the makings of a first-class heavy target rifle.

With an old steel-tube Weaver 10X fixed-power mounted with Weaver bases and rings, and a set of 30-06 dies for my Lyman turret press, I was moving toward the completion of my first long-range rifle. Add some Sierra 150-grain bullets that preceded the current MatchKings, military surplus 4350 powder at 61 grains in GI cases, and I was off to learn the fine art of sending bullets toward long-range crows, woodchucks, badgers and other critters in the random varmint department. My handloads produced a bullet drop at 300 yards of -6.8 inches, allowing me to keep “hair on target” well out to 350 yards when fox or other, larger critters were in the crosshairs. Even shots to 400 yards were quite often possible, because of the quality Sierra boattail bullets and a good weight balance between the 30-caliber rifle and its matched Springfield barrel. This home-built rifle held accuracy to minute of angle (MOA) at 100 yards. While this was not up to today’s standards regarding group size, it was a pretty good shooting stick for a budget-minded young guy who liked to hunt, but was still trying to get through the University of Minnesota, pay the bills, and start a teaching career down the line.

Today you will find that most modern rifles shoot to 250 yards or more with positive accuracy. That means the rifle will hold its bullet groups to at least one inch at 100 yards (MOA). Even the common deer rifle that is sold in the \$300 price range today will hold groups to the above-indicated range with ease. Better barrel steel, laser-guided cutting methods, and modern milling processes can turn out accurately milled actions well beyond anything known even as late as 10 years ago. The average rifle trigger today compared to the reworked trigger assemblies used when I started in the business are a far cry from those early two-stage, slack-filled firing pin let-off systems. Nothing about the modern centerfire rifle, be it a standard deer rifle or a long-range varmint/target rig, is even close to those rifles we started with way back in the 1950s and ‘60s. With the advanced design and manufacturing methods associated with modern rifles, one thing stands out very clear: for the most part, the shooter who wants to get into long-range rifles will not have to invest his life savings.

Specialized Rifles for Long-Range Work

Rifles for long-range shooting are different from those used by the “walking” varmint hunter, deer hunters covering rough mountain country, or stump-sitting Midwestern woodland whitetail shooters. The long-range rifle is generally a bit

heavier than its “pencil-pipe” (thin barreled) cousin, mounts a stock that won’t warp or twist with humidity or rough field use, carries a well designed and tuned trigger, and retains a bedding system for the action that makes use of milled aircraft aluminum or glass. The barrels of these rifles are “twist-tuned,” meaning the rate of rifling twist down the barrel every inch is matched to specific weight bullets, and the actions are tuned to some degree to hold the cartridge case in alignment with the rifle’s chamber. These are key points in gaining good accuracy from a rifle, and today even an over-the-counter rifle in the factory box can produce some outstanding accuracy not found in those early years of long-range rifle production.



Today’s out-of-the-box rifle will outshoot any of the custom rifles of yesteryear.



Author shooting coyotes with the new Remington Light Varmint (LV) in 223 Remington. Even this short-pipe, light rifle is quite capable of taking prairie dogs to over 500 yards with dead air and a good ranging system.

As an example of just what even a very standard out-of-the-box rifle can do when applied to even a lightweight cartridge, a hunt that made use of the newer 223 Remington LV comes to mind. This rifle, described by Remington as a Light Varmint (LV) rifle mounts a fluted stainless steel barrel, short stroke 700 pillar bedded action, a synthetic scaled-down varmint stock and is drilled for mounting a scope (no iron sight capability).

Hunting Colorado well west of Denver and the front range of the Rockies, I was paired up with a group of scope manufacturers and bullet makers while sitting hip deep in prairie dogs, or as I call them, “grass rat” targets. Using a heavy bench rest that was portable and a fully adjustable forend rest with sand bags, I set the light rifle up for shots across a wide valley. Rick Payne, a Pentax optics sales supervisor, was acting as my spotter and ranging systems helper. Rick was well versed in the business of taking long-range pokes at grass rats, and as such came back quickly with an exact range of 587 yards to my first target.

What I’m not about to tell you is that with the range recorded I simply adjusted my sights and plunked off the fur ball on the far ridge. No, this was an exercise in artillery school shooting, and as I shot several rounds Rick spotted my impact points and returned information as to my required sight adjustments as I walked in the bullets to the unsuspecting critter.

With the third round downrange – a Hornady V-Max 55-grain pill – the prairie dog rolled off the mound with a small cloud of dust following the bullet impact. I had adjusted my Pentax target scope to the second mildot, and pushed about a dog’s body away to the right of the animal. There was a slight cross wind of about five to seven miles per hour, and coupled with the high elevation and warm air, I knew that my little 223 Remington 55-grain load had more going for it up there than what would normally have been the case back at sea level. With the first kill and a confirmation by Rick, I simply moved to the right and promptly dusted off two back-to-back rats. These were not artillery school tries, but one-shot dead-on kills. In effect, the little lightweight, lower-tech “walking” rifle was taking on work designed for much heavier gun systems with much bigger cartridges. For the most part, the 223 Remington is designed for work to about 300 yards. However, in the hands of a shooter who knows the cartridge, or by way of a good second man spotter, this little varmint/military round can be pushed a whole lot in terms of extended range applications on small targets.

Specialized rifles paired with cartridges for long-range shooting are available

as both standard over-the-counter, factory-built guns or as customized offerings. Today you have a buyer's market out there if you want to get into a specialized long-range shooting rig. First of all in the factory-built department, Remington is just about king of the hill when it comes to factory-packaged long-range critter control rigs. In my case I shoot a pair of Model 700 Varmint Synthetic (VS) varmint rifles. The first is in 22-250 Remington, and the second is a 243 Winchester in the very same configuration. These rifles are exact copies with the exception of caliber to the current military M-24 sniper rifle. They use HS Precision varmint/target stocks that retain aluminum pillar bedding, have medium weight varmint barrels, and good, crisp, gunsmith-tuned 2-3/4 lb triggers. Both rifles retain Redfield bases and rings and mount Weaver and Simmons 4X16, and 4.5 X-14 tubes, with sniper mildot elevation and windage correction indicators. Accuracy with both rifles is sub-MOA at 100 yards, with good handloads punching one rough hole in the paper.



Rick Payne of Pentax Optics gets behind a Browning A-Bolt medium weight varmint rifle and Pentax varmint scope in 243 WSSM. Rick is shooting 600 yard dogs, and note the spotter directly behind him calling the shots against a far hillside.



Hunting partner Nick Sisley shooting the Ruger MK II heavy target rifle in the new .204 Ruger cartridge. This rifle in a factory-built offering is a deadly long-range delivery system.

Remington offers the Model 700 Sendero in the heavy 300 Winchester Magnum cartridge, which of late has become very popular with our military snipers doing long-range work in Afghanistan and Iraq. This rifle is also offered in 7mm Remington Magnum and 7mm Remington Ultra Magnum. Move off that mark a bit and the Remington Model 700 VSF (Varmint Synthetic Fluted) can be obtained in the 7.62 NATO (308 Winchester) cartridge. The rule here is: Want more range? More powder and more bullet weight, please.

Yet another offering are the Ruger MK II long-range target rifles. Here Ruger provides some well-made rifles that retain all the elements of a good long-range shooter, but at a price that is a real value for the dollar. Built with a very nice two-stage trigger that has a crisp let-off, this rifle also has a barrel that is stainless steel, hammer forged, and target crowned. Add the laminated wood stock to the game plan and you have an accurate shooting platform for sending long-range pills across fields of prairie dogs or incoming coyotes.

I entered the long-range club via the Varmint Hunter Association years ago by way of a Ruger MK II chambered in 25-06 Remington. Shooting a handloaded 87-grain Speer TNT, I dusted off a grass rat at 527 yards with the first shot downrange. Be advised the 25-06 Remington is a real favorite of mine, and there will be more coming on that hot long-range cartridge a bit later on. From the 22-250 Remington, the 220 Swift, the 25-06 Remington, through the

308 Winchester, this rifle can cover all the bases with the exception of the ultra long-range powerhouse offerings. However, if you want a solid 600-yard shooter or more, Ruger can get it done at an affordable price.

Another excellent rifle on my list, but by no means the last, is the Savage Arms Model 12 Varmint. Here again value for the dollar is right up front. Savage has designed accurate rifles that won't kill the budget. These rifles use the AccuTrigger, which can be adjusted from 1-1/2 lbs. to 3 lbs. in complete safety. The system uses a double release shoe that is failsafe in terms of an unintentional discharge.

Savage Model 12s in the 112 series will chamber the heavy long-range cartridges such as 25-06 Remington and 300 Winchester Magnum. Move to still other hard-hitting rounds and the Savage Model 12FVSS "long-range" rifle will chamber everything from 223 Remington in the medium-range category through the range-stretching 300 Winchester Short Magnum (WSM), with a pile of big heavy distance cartridges in between. Savage is known to build some of the most accurate and modestly priced rifles on the market today. I have suggested these rifles to many beginning varmint/long-range shooters with some very pleased shooters coming to the forefront.



Author shooting a Browning A-Bolt in 243 WSSM. The rifle and cartridge are both state of the art.



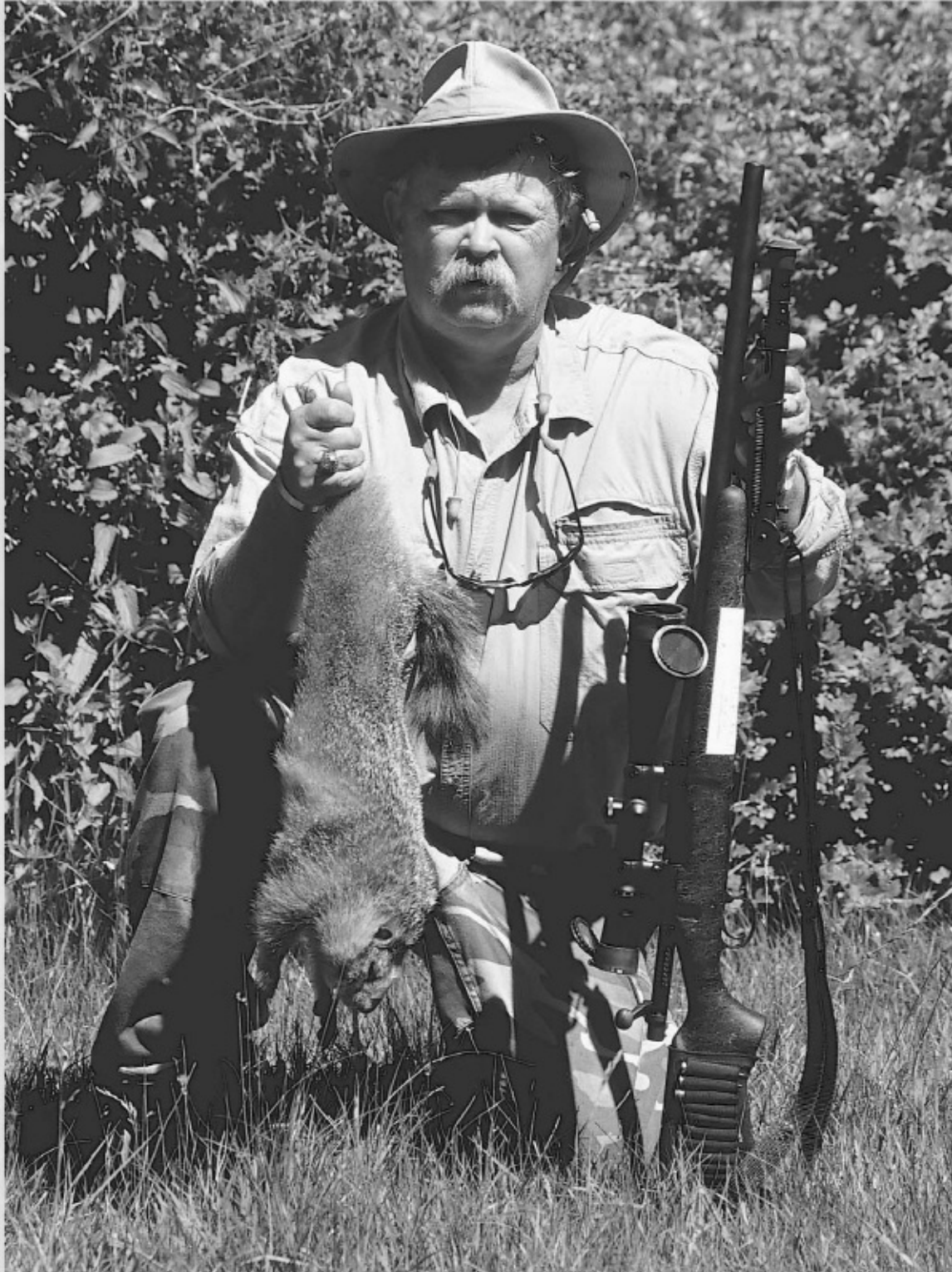
Author at the bench rest with his Remington Varmint rifle (VS) chambered in 22-250 Remington. This rifle is a closer match to the military M-24 sniper rifle in current use today.

While I could go on with brand names of affordable out-of-the-box rifles, the fact is that today it is a buyer's market out there and the competition for your business in the big rifle department seems to have no upper limit.

In the cartridge department, be advised that not all bullets or fuel cells are created equal. In fact, some cartridges are best left at the dealer's shelf, while others are great producers of solid downrange performance. Assuming you have acquired a rifle designed for long-range shooting, the next step is selecting a cartridge for that new shooting stick. Here there are some rules that need to be addressed. First off, looking at a list of possible cartridges like those listed in this sample reference listing, you will find massive differences in each. This includes recoil levels, price per round, basic working range applications, and, as is pointed out here, even specific rifle types.



Author's military/police Tikki/Beretta T-3 sniper rifle. This rifle, in 223 Remington or 308 Winchester, is a tack-driver and deadly long-range shooting system. It can be obtained from Beretta right out of the box.



Author with a rock chuck taken with his Remington VS in 22-250 Remington. Note the ranging card attached to the forend. These help a great deal when correcting holdover at long-ranges.



Author's coyote hunting partner Larry Symes, who is approaching a long-range killed coyote. Larry is shooting a custom. 22-250 Remington in a hand-built rifle based on a Remington Model 700 action.

You're not likely to find factory rifles chambered in some of the listed "exotics." Buying a 6mm x 284 over the counter, or the 7.82 Warbird unless it is a Lazzeroni custom, is doubtful. That is, unless you want to get into some additional custom built higher-end rifles, which will be covered here as well as a bit later on.

Rule number one is more power and powder are required for long-range shooting. That means the big cartridges – such as the 300 Winchester Magnum, or the 6mm x 284 that is of late so popular among long-range shooters – will push more bullet further with less drop at ultra long-range distances. Take the 300 Winchester Magnum, for example. This 338 Winchester-based cartridge uses a 30-caliber bullet and is without question the most popular super long-range 30 of all time. Army snipers like it, as do law enforcement units that are required to punch out tough targets. For the long-range sport shooter, the 300 Winchester Magnum is again king because it can send heavy very low drag (VLD) bullets to 1000 yards against warm targets, and still hit the vitals of what is being shot at.

Basic Suggested Cartridge Listing

.22-caliber cartridge

.22-250 Remington

.220 Swift

.223 WSSM

.22-06 (Wildcat)

6mm cartridge

.243 Winchester

6mm Rem

6mm x 284 (wildcat)

.243 WSSM

.25-caliber cartridge

.25-06

.25 WSSM

.25-284 (wildcat)

.257 Weatherby

.30-caliber cartridge

.30-06 Springfield

.308 Winchester (7.62 NATO)

.300 Winchester Magnum

.300 Weatherby

7.82mm (.308) Warbird by Lazzeroni

Rule number two, however, is don't overdo your ability or recoil stress tolerance level. Shoot too much rifle cartridge and you won't shoot well at all. The 300 Winchester Magnum, for example, may cause a sensitive shooter to develop a flinch quickly. Also of interest here is that big high-power long-range rifle shooting almost always requires a spotter at the shooter's side. Recoil levels are so high that the target becomes a blurred-out image upon cartridge ignition. That is, unless the target is so far away that the rifle and paired scope have time to settle down prior to the bullet's impact. Believe me, that won't happen very often, if ever.

What you need to do is select a maximum range distance that works best in terms of a cartridge choice and generated recoil levels, then go to work learning everything you can in terms of performance about that given cartridge. As long as I have been shooting long-range targets, I've tended to like cartridges like the 243 Winchester, 243 WSSM (Winchester Super Short Magnum), the never-to-be-discarded 25-06 Remington, the best of the wildcats to go commercial, and the workhorse 308 Winchester. Learn any of these cartridges well and you will do some serious damage to some very long-range targets. They will send bullets to long ranges and do so without the massive recoil that can cause fatigue. On the high-recoil and -energy end of things I do shoot the 7mm Remington Magnum in a Ruger Number One, or a 50 BMG upon occasion, but with far less frequency than other rifle/cartridge choices, the reason being obvious.



This is a full-custom, heavy varmint long-range rifle chambered in 6mm x 284 (wildcat). The rifle incorporates a Nesika Bay Precision action, a custom fluted barrel, and a Jewell trigger. With a Pentax varmint glass sight, this is a long-range shooter to be sure.

The final rule is stay within your means. That is, by moving to some exotic caliber in a full custom rifle, you're going to have to pay a good deal more per round sent downrange in every case. The big loads cost big bucks to keep a rifle in the game. You can shoot a whole lot more 243 WSSM rounds, or even 22-250

Remington, than you can 6mm x 284 or even a 300 Winchester Magnum for a given amount of money. If you want range and speed without much if any recoil, move to the new 223 WSSM, and you're in the 4000 foot-per-second club and shooting low-recoiling 55-grain pills to boot. I shoot this cartridge as a long-range round and it is not only effective, but I can see my hits as close as 300 yards downrange due to the lack of extreme recoil.



Barnes VLC varmint bullets. these pills are designed for long range by reducing drag against the bullet, and they expand quickly on warm targets. Selecting a bullet with care can make or break an accurate shooting long-range rifle.



You don't need to overkill regarding rifle caliber. This coyote killed by the author was taken at 300 yards by way of a Winchester Coyote heavy rifle chambered in 223 Remington.

Handloads Are Required

Except for shooting a factory 223 Remington, for which you can find ammo almost anyplace nowadays, most long-range cartridges are going to require you to handload if for no other reason than to be able to shoot more for less money. When you begin handloading, you plummet into an endless learning curve, or so it at least seems that way. Building your own loads will produce an understanding of basic ballistics as in bullet drop, velocity loss at different ranges, and what powders will produce the best loads in your individual rifle. Handloaders always have an edge in the field. I see this all the time while on commercial hunts or with friends, tromping across the prairie dog towns of western South Dakota.

While the new factory load offerings are indeed a far cry from what was available in my early days of rifle shooting, you can always tinker with a handload and pull a few hundredths of an inch off that group size, or save some hard earned money when shooting even with the factory loads. Just by having the spent brass to work with, you're saving, and you can surely shoot for half or one-third the price of using factory-rolled ammo when it comes to the bigger, more expensive cartridges.



Author's Viper 50 Caliber BMG. Moving too fast into this kind of artillery can cause a shooter to

develop a flinch. Work up to heavy rifles slowly.



Author's 7mm Remington Magnum at 50X glass. This is an ultra long-range rifle set up for dog shooting to 1000 yards if required.



The author prepares to send a 50 cal. bullet downrange.

When I buy a new rifle, I run a series of handloads through it after some break-in time. What I'm searching for is that special sweet spot in terms of powder charge, bullet weight, design, and in some cases even primer brand. When that hot accurate load is located, my new rifle will shave off one-quarter of an inch or more from its standard group size based on break-in rounds downrange. Remember, you can cut groups down to under one-half inch MOA at 100 yards by handloading. If your rifle sends a bullet to exactly one-half inch at 100 yards, that same group will be 1-1/2" at 300 yards, 2 inches at 400 yards and 2-1/2" at 500 yards. That's a miss on a fat prairie dog downrange even when not factoring in wind, temperature, altitude and about a dozen other elements that can make you miss the shot. The tighter the 100-yard-zero group, the better it will be way out at 500 or more yards.

The key here is not to go wild, but to settle on a few good tested and researched loads. With a press, scale, powder measure, and a set of dies, you're in business for the cost of only a few boxes of higher end ammo. (Load tables appear in Chapter 2.) I shop around for used dies that are in good shape, and at gun shows I often find rifle presses at bargain prices. How long will all that loading equipment last? My Redding powder measure has been kicking out powder charges for better than 47 years to date, and my RCBS "C" frame is not far behind.

From the days of the buffalo rifles in 45-70 Winchester (our first long-range tools) to the heyday of the 30-06 Springfield, one thing is for sure; rifle cartridges do fall by the side of the trail in favor of newer and better products. The case here can be made for the new WSSMs in 22, 6mm, and 25 calibers. Here we have very short, fat cases that hold massive amounts of powder and burn it all very efficiently. The velocities are high, actions lightweight and short, with accuracy outstanding in a well-seasoned bore that is taken care of. Add the new Winchester WSM series wide-bodied short cartridges in 270 WSM and 300 WSM, and with just this one ammunition manufacturer you can see some major changes developing well beyond the modern long-range rifle itself. Today the newer cartridges tend to burn powder more efficiently, reduce recoil levels even in lightweight rifles, and have been developing a good track record among big game and varmint hunters in the field.



Handloads can make the difference in a great long-range shooter or an average job. More shooting for less money is the rule and those loads can be very dependable.



From the 223 Remington to 25-06 Remington, the handload can stretch range – and a dollar as well.



Author handloads the 25-06 Rem. This is a go-to cartridge in western South Dakota. Handloading can make it a light-shooting dog gun, or a heavyweight mule deer killer as well.



A 218 Bee (right) and 50 BMG. The cartridge rules the long-range game.

Bullet designs are always being researched and improved upon. Loading the new WSSM in mass bullet types and charges for several major magazine articles in 2005, I found that VL (Low Drag), and VLD bullets did improve group size, and downrange drop figures. When VL-classified bullets are designed, they are manufactured to make maximum use of boattail bases, long smooth nose cones, and a good ballistic coefficient (BC).

BC is the factored number assigned to a bullet that will determine how efficient it will be as it runs downrange. The higher the BC, the better that bullet will perform downrange. There are problems with this system however in that at very low velocity that BC calculation dies a quick death. Also as the same bullet is fired in different rifles and cartridges at varied velocities that BC number will change. Add high altitude as in mountain hunting and again the BC numbers all

roll out differently. The best way to determine a bullet's performance profile in real time, of course, is to shoot it.

The long-range varmint and game rifles are indeed changing due for the most part to the cartridges being designed for them. With the new short cartridges, short actions are coming to the forefront every year making for a shorter and consequently less flexible action. With out a doubt less flexing action rails means better accuracy when it comes to bedded action systems in long-range rifle stocks.

Research Your Long-Range Rifle with Care

Let's call him Bill, because he would not want his real name stated here. Bill wanted to get into long-range varmint hunting and shoot with our gang, that to the man, shot the 22-250 Remington cartridge in a varied group of rifle brands, as well as several other cartridges and rifles in a few larger fuel cell systems. Bill was going to do this on his own without discussing his choices with the rest of our gang.

It was the spring of 1998 and I had just retired from teaching and was researching the building of a home in western South Dakota. Bill wanted to join our little group that was now heading west out of the Minneapolis Saint Paul area for a weekend of grass rat hunting near Rapid City, South Dakota. We had elected to start our expedition just across the Missouri river at Cheyenne River, a major Lakota reservation on the western side of the state.

Bill had brought along his new shooting iron and was obviously very excited to get it into the field. His choice had been the Sako Hunter in 17 Remington. While I have nothing but high regard for Sako rifles in any caliber, the selection of a pencil-pipe walking rifle would not have been mine. Shots on our pre-scouted dog towns almost always ran well out into the 400 yard range limit, and the little 17-caliber 25-grain bullet, as good as it was, just didn't carry the mail that far down range.

A quick look in almost any ballistic table will show that the 17 Remington starts off like a rocket heading for the moon at 4040 feet per second (fps), but at 200 yards it has degenerated to 2644-fps, and at 400 yards it is all the way down to 1606-fps. Compared to the 22-250 with a 22-caliber bullet in the 55-grain class the difference at 400 yards is a 235-fps spread, with the 55-grain being able to buck wind far better than the smaller 17-grain lightweight bullet.

Even though the exact 400 yard 17-inch drop is the same for both bullets, the energy that determines the bullet's ability to carry well in hot up or down draft, and cross winds is a slumping 143 ft./lbs. for the 17 Rem, and a stable 410 ft./lbs. for the 22-250. If you want to drop red fox on snow by way of a fur buyer's cartridge this bullet is fine, and the 17 Remington is the way to go every time. However, this was a trip shooting long-range prairie dogs, and the little 17 was going to be outclassed by the 22-250 – and a couple of heavy target 243 Winchesters and 25-06 Remington pill throwers as well. No, Mr. Bill was headed for some disappointing dog gunning ahead.

Bill also had not considered the amount of cleaning supplies and time involved in keeping the subcaliber up and shooting. The 17 needs a lot of cleaning rod time, as that super-small bore can get skunky fast when hot powder residue starts to build up. By the time we had covered the first morning of gunning, Bill understood that there could have been some far better choices in a long-range rifle, and at best his rifle was suited to medium range work more in line with the 223 Remington shooting 40-grain bullets.



The light .17 caliber is a great red fox round, but it dies a quick death at long-range, or in windy open country conditions.

While it is true that the 17 Remington is a great cartridge, long-range shooting for that cartridge and paired rifle is about 300 yards. What is long-range for one shooting system is only a starting base for another. Taking the time to research the effectiveness of any long-range rifle system is required. My 7mm Remington Magnum with a Sierra 100-grain Varminter hollowpoint bullet is just getting started at just about the point where the 17 Remington leaves off. Conversely, at the point where my 7mm Mag dies out, the 50 BMG is hauling along with a Mach II velocity pushing its 700-plus-grain projectile. On the next hunt that Bill elected to join, he had upgraded to a nice Savage 110 target/varmint rifle chambered in 22-250. What a difference a year makes!

Chapter 2

Getting Started

It was late winter up near the Black Hills of South Dakota, and I had been winding down my coyote-calling season by way of a few local hunts early each morning along the Boxelder Creek east of Rapid City. It was an exceptionally cold morning for late season hunting, and with a fresh four-inch snowfall on the ground I was able to make some accurate checks regarding coyote sign as I slowly drove the two-track trail that headed into some low buttes and rolling buffalo grass hills. Coyotes had been active the night before, as my headlight bounced off song dog tracks crossing my trail every several hundred yards or so.

Packed in my 4x4 was a new rifle that had been somewhat of an adventure bringing together. The caliber was 25, and the cartridge was my old favorite 25-06 Remington. Or, as it was known for many years around the time of WWII, the 25-06 in a wildcat configuration. Necked down from an '06 case, this wildcat was easy to make by just neck sizing a 30-06 case once through the 25-06 die. My set of 25-06 RCBS dies were flawless in their ability to keep all the correct dimensions in line each and every round. I had started my search with two previous rifles that I had intended to scavenge a barrel and action from and installed them in a new stock platform built by a local Rapid City company, Accurate Innovations Inc.

The rifle action that I had settled on had been taken from a new Remington Model 700 Classic. The factory rifle had a 24-inch barrel needed for the big-burn 25 caliber, and the trigger was darn good for a factory tuned product right out of the packing box. This rifle shot sub three-quarter MOA with a green barrel, and I figured by restocking the barreled action in the Accurate Innovations bamboo laminated stock with that previously discussed special bedding system, I could shave off at least a one quarter inch at 100 yards from those early test groups. My other two rifles had been benchrest tested, but as old-school rifles manufactured way back in the 1950s, neither of them could tighten 100-yard groups within 1-1/4" MOA. That's not cutting it for a longrange rifle out on the Dakota plains, so the Remington 700 was the logical choice, even though it cost a few more bucks.



A longrange coyote kill via author's 25-06. This South Dakota rifle by Accurate Innovations was designed for longrange work.

Reaching a cross track I turned east, now paralleling the path of the coyotes. I drove another two miles along that track and then came to a stop with my truck masked by a single large butte. This was crunch time, and with a camo white and black Cabela's coverall on, a set of shooting sticks, calls, and a camo face cover, I headed along the lower end of the butte. Now moving in the direction in which I thought I could set up to call and intercept my coyotes, I began a search for a good calling hide.

Rounding the base of the big hill, I caught sight of a male dog with his head down and his nose cutting a track in the fresh snow. I slowly dropped down and set my rifle across my shooting sticks. The forend of my rifle was not very wide, but rather in the style of its former Remington classic cut stock. With the bamboo being very dense and among the strongest wood known to man, the 7-lb. rifle with its 24-inch pipe was a bit muzzle heavy, but that is an advantage when resting on sticks.

About the time I got set for a shot at the big male, a second dog emerged straight out of the dry creek bed. This was a gyp (female coyote) and she was squatting now, about 100 to 125 yards closer than her partner. I turned the muzzle toward the female and with the cross hairs of my Cabela's Premium 6x20x40 set directly on her vitals for a clean side shot, I touched off the 87-grain handload in her direction. The gyp had been at about 325 yards downrange. I had

made a quick assessment of her ranged distance using a gap, or visual space distance ranging locating system, that is simple and quite effective to about 400 yards. What I had not done, however, was to allow for my bullet going high. I was shooting at a sharp angle downhill, and consequently the shot just skipped an inch or two over her back.

At the shot, the gyp hauled tail for a big flat and some heavy brush on the far side. The male was long gone by now, and but a recent memory to be sure. At the point both dogs dropped into the heavy brush about 1500 yards down range, I turned to my FoxPro caller and broadcasted a young dog in distress. “Waa, wa, wa”, droned the electric calling unit, and to my complete surprise the gyp came running around a butte that was a full 500 to 800 yards east of me, and then came to a stop at almost my exact elevation. Upon stopping, she turned and sat down looking straight at me. This was too much to expect of a willing target, but good luck for me.

Resetting my sticks and dropping a half breath, I set my crosshairs right between the old girl’s ears. I figured the shot to be 425 yards, again using my quick system of gap. The rifle felt like home, the scope was as clear as new ice, and now trigger control was what this was all about. When the trigger broke free the 25-06 snapped, but with the light 87-grain Sierra Varminter hollowpoint bullet, the low recoil level allowed me to watch the gyp get hit and roll like a bowling pin back on her rear end. She gave a couple of kicks with her legs straight in the air and then everything went dead still again on that cold snow-covered hillside. The male had been watching the whole event from above her, and if I had been able to get my muzzle elevated a second or two earlier, I believe he would have been walking wherever dead coyotes go for sure. This shooting rig was the latest in my quest for the ideal longrange rifle out in my state of South Dakota. The 25-06 has range, balance, accuracy, and energy as a “hair on” killer to 400 yards, with a real edge well out to 600 yards when required. As for that 1000-yard work? Well, that’s another story, and yet to come.



Author with his favorite custom-stocked rifle, and a good morning's work.



Big, open country demands longrange cartridges and rifles. Here the 25-06 has gone to work.

243 WSSM: The New Kid on the Block

It was a dusty section of Texas dirt road that first got my attention as to the performance possibilities of the new 243 WSSM offered by Winchester. Kevin Howard, a friend and associate on many outings, was sitting in the middle of this dirt trail and planted over a set of shooting sticks with a prototype 243 WSSM varmint rifle. In the distance was a feral hog that had covered an open flat as we had bailed out of the pickup for the shot, and now it was cresting the far side of a dry wash gulch.

As the hog, which appeared to be about 150 lbs., hit the rim of the dry gulch, Kevin touched off an 80-grain Ballistic Tip bullet. Almost at the shot, the bullet crossed better than 375 yards, then collided with the Texas wild pig, returning a clear, loud popping sound. At the moment of bullet contact, the big hog just rolled up end over end, and laid stone dead in plain sight even at that extended range. This was my introduction to the 243 WSSM, and at that time some four years ago well within its infancy as a long range commercial big game/varmint cartridge.

I was very impressed with both the shooting and the effect of the 243 WSSM bullet on a darn tough target. More than once I had witnessed Texas wild hogs hit and running off due to bullet contact by far lesser field gunning tools. However, in this case Winchester brought together what would turn out to be something like an advanced super 243 Winchester on steroids. At any given bullet weight the 243 WSSM outran the 243 Winchester by at least 100 fps and some odd change.

The very next morning I elected to scrap a 223 WSSM I had been issued on the test hunt and trade it for that 243 WSSM. I wanted very much to bring down something with this new 6mm longrange fast mover. On paper this cartridge drilled a 80-grain pill at 3350 fps, and when moving down to the flyweight 55-grain Ballistic Silvertip, the speed moved up to 4060 fps.

With its ultra-short action the 243 WSSM makes for a great walking varmint rifle. My test rifle was a forerunner to the Browning A-Bolt Hunter and Varmint Stalker that are now used for each of the new WSSM cartridges. The test rifle mounted the A-Bolt action design and a black synthetic stock. Except for the required reinstallation of the magazine follower on my prototype rifle every now and again as I got into the cycling of my last round, the new 243 WSSM rifle shot very well and was quite impressive during four days of field reviewing.



New space age, fast-moving cartridges are taking over today.



Kevin Howard with his longrange 243 WSSM Texas hog. The shapes of cartridges are changing in the longrange rifle game today. Mr. Howard made that very clear.

The preceding accounts of some hands-on work with new rifles illustrates that based on real-time events by real-world hunters in real-world hunting situations, even two rifles and cartridges that span better than 50 years apart were able to get the job done. Why? Because both cartridges and their paired rifles were well-designed shooting systems. Second, unlike our friend in Chapter One – shooting his 17 Remington at 400 yard dogs – a good deal of both planning and knowledge made the difference when turning on a good longrange shooting system. Selecting a longrange rifle is not just a crap shoot, but involves answering many questions that will clearly impact the outcome regarding your choices.

With the first series of handloads tested, I found that most were best suited for flexible adaptations against gunning work on coyotes, speed goats, or deer. As for the coyote targets specifically, again, the heavy bullets would best serve

varmint hunters on windy days, an old story among shooters of the older and well-established 243 Winchester. In terms of accuracy and performance, there were few if any surprises at the range. For the most part, the Browning light rifle was indeed quite accurate overall.

In terms of loads no. 11 through no. 15, here the horses were let out to run and in general velocity was moved up and bullet weights down. As manufactured with a 1:10 twist, the Browning A-Bolt tended to handle the complete range of bullet weights well.

It is obvious here that the Browning A-Bolt liked the 58-grain Hornady bullet a great deal. Accuracy was outstanding even when velocity was pushed a bit as in load no. 8. This is my handloader's choice in 243 WSSM.

Long Range Load Tables: 243 WSSM

Courtesy Ballistics Research & Development, Piedmont, SD

The following are a series of test loads in the Browning A-Bolt 243 WSSM

Load	Powder: wt./gr.	Bullet: wt/ gr.	OAL (")	MV (fps)	Pressure (psi)
1	Ramshot Hunter 44.3 gr.	Barnes 85 gr.	2253	3050	50000*
2	Varget 43.0 gr.	Barnes 72 gr.	2220	3600	63600
3	Varget 43.7 gr.	Speer 70 gr. TNT	2272	3655	63400
4**	Ramshot Hunter 42.0 gr.	Homady 100 gr. Interlock	2300	2850	N/A
	Ramshot Hunter 47.0 gr.	Homady 100 gr. Interlock	2300	3100	N/A
4A**	Ramshot Magnum 48.0 gr.	Homady 100 gr. Interlock	2300	2800	N/A
	Ramshot Magnum 52.0 gr. (compressed)	Homady 100 gr. Interlock	2300	3200	N/A
5	Hodgdon H 414 48 gr.	Homady V-Max 75 gr.	2318	3514	63000
6	Varget 36.6 gr.	Homady Interlock 100 gr.	2270	2981	62100
7	Varget 43.7 gr.	Homady V-Max 65 gr.	2298	3655	63400*
8	Varget 43.7 gr.	Homady V-Max 58 gr.	2301	4032	N/A
9	H414 49.0 gr.	Homady V-Max 58 gr.	2301	3704*	50200
10	H414 48.0 gr.	Barnes 72 gr. Varmintator	2205	3533	N/A
11	H414 52.0 gr.	Homady V-Max 58 gr.	2220	4004	60.800
12	H414 49.0 gr.	Nosler BT 70 gr.	2280	3795	58.900
13	H414 52.0 gr.	Sierra 55 gr. Blitzking	2220	4004	N/A
14	H414 52.0 gr.	Nosler 55 gr. Combined Tech	2220	4024	N/A
15	H4895 45.3 gr.	Nosler 55 gr., Combined Tech	2220	4102	63.100

* Where enough data exists to extrapolate.

** Western Powder experimental loads (in sets of two).

All primers : Federal GM 210 M Match Grade Cases all once fired and full length resized.

Group Results Listed By Above Load Number

Load	Bullet	3-Shot 100-Yd. Group (")	Game
1	Barnes X Bullet XBT 85 gr.	.48	Antelope/Deer
2	Barnes VLC 72 gr.	1.22	Antelope/Deer
3	Speer TNT 70 gr.	1.33	Coyote-Wind
4**	Hornady Interlock 100 gr.	.89	Antelope/Deer
4	Hornady Interlock 100 gr.	.79	Antelope/Deer
4-A	Hornady Interlock 100 gr.	1.55	Antelope/Deer
4-A	Hornady Interlock 100 gr.	1.02	Antelope/Deer
5	Hornady V-Max 75 gr.	.98	Coyote
6	Hornady Interlock 100 gr.	.78	Deer
7	Hornady V-Max 65 gr.	.89	Coyote/Dogs
8	Hornady V-Max 58 gr.	.48	Coyote/Dogs
9	Hornady V-Max 58 gr.	.97	Coyote/Dogs
10	Barnes 72 gr. Varmintator	1.00	Coyotes
11	Hornady V-Max 58 gr.	1.35	Coyote/Dogs
12	Nosler BT 70 gr.	.97	Coyote
13	Sierra 55 gr. Blitzking	2.87	N/A
14	Nosler 55 gr. Combined Tech	2.99	N/A
15	Nosler 55 gr. Combined Tech	3.22	N/A

**#4 Hornady Interlock 100 gr. special powder change testing. (Note group size change.)



Author zeroing the Browning A-Bolt in 243 WSSM. With a 55-grain bullet this rifle is deadly to 600 yards with good wind conditions behind the bullet.



Accuracy is everything in longrange shooting. You need all the edge you can get when bullets are pushing past 400 yards. Here the 243 Winchester, in the author's Remington VS Model 700, drilled 1/2 MOA groups to 100 yards.

Action Types: What is the Best System for You?

longrange rifle actions have evolved into everything from turn bolts, to falling blocks, hinged breech, and lately autoloaders as well. When turning to a longrange and accurate shooting system, which is the best way to go? First of all, keep in mind that unless you're an urban countersniper or military special ops unit sniper, you're not going to need fast multiple shots. In other words, speed kills, but not necessarily in your sport shooting back yard. Dropping hard-earned money on a tricked-out Springfield with a heavy barrel and accuracy kits installed, or a full blown German Heckler & Koch PSG-1 7.62 gas gun, is nice if you're making your living with that rifle, but not at all necessary if shooting prairie dogs or called coyotes.

Even the US Army and Marines have adapted some of the RAI Model 500 Long Range Rifles into single shots in 50 BMG. The big 50 can be loaded singly with most of its use centered around destructive structure shooting, or ultra-long range sniping. Lately, however, I must confess that the newer 50-caliber Barrett M82A1 autoloader has taken over with the heavy fighting in the Middle East. This is again a military option, however, and it's quite a stretch from the needs of an average hunter.

Bolt Action

My first choice in a longrange rifle action has to be the old turn-bolt rifle. This action is as simple as field dirt, and tough as a prizefighter. Turn-bolts require little maintenance, feed well even in extreme field conditions, and lock down a cartridge squarely in the chamber. Accuracy with this action is deadly when a tuned rifle has been put together by a competent gunsmith, or factory built with an eye toward quality.



Here the bolt action is king. Zero work in Texas prior to a coyote hunt. The rifle is a Savage Model 16 in 223 Remington. A good choice for covering shots under 400 yards when gunning Texas two-track trails.

Designed as a repeater using a box magazine, or as a loading plate single shot, these are deadly killing machines to be sure. Selection regarding brands and extra features goes on for almost ever when selecting the turn-bolt rifle. These rifles are priced from the low \$500s to thousands depending on brand and custom additions, making the turn-bolt king of the hill when it comes to the longrange hunting, varmint shooting, and paper-punching.

Hinged/Falling Block

The hinged falling block, or fixed-breechblock designs like those found in the famous Sharps buffalo rifle, have been carried down into the Ruger Number One and Browning low-wall varmint models, to name just a couple. Single shot rifles can be very accurate, easy to maintain, and very safe to use by beginning sport shooters.

If one of the actions seems to have any problems it is the Ruger single shot. I find bullets tending to climb in this rifle as the barrel warms up. Special barrel bed reworking of these Number One rifles can reduce this problem, but I have found it to plague me over the many years I have shot the Ruger single shot. As has been previously indicated, my 7mm Remington Magnum is none other than a Ruger one-shot breechloader. With a cold barrel, I have seldom, if ever, missed a mule deer or goat with the rifle, and today it is equipped with a massive 50x50 Tasco ultra-high magnification scope expressly set up for 600-yard-plus prairie dogs. There was a time when I shot the big rifle as a backup to east coast greenhorns hunting western states for deer. More than once the “Big Seven” dropped a wounded deer that was about to drop off into a deep draw toward a bottomless pit.

Autoloaders

Third are the gas guns that use spent barrel gasses to generate energy to activate the rifle’s bolt system. The gas-activated autoloader in its semi-auto mode can be an effective source of firepower. However, how much is enough, and is it worth giving up some possible dependability to gain more rounds down range in less time?

If you’re thinking that the newer autos can’t deliver the mail, please reconsider. Except for the fact that the autoloader, with few exceptions, doesn’t chamber very heavy cartridges, the new semi-autos are deadly tools. Let’s take a

detailed look at the Les Baer rifles as an example. I have selected this AR-type system because in my experience they are the cream of the crop in terms of dependability and accuracy. Of late I have been informed as to several other up-and-coming autoloading systems that make use of cartridges like the new 223 WSSM (Table A). However, at this time I have not fielded any of these newer variants in self-stuffing, gas-blowing action types.

Les Baer AR rifles are hand-built except for the stock and trigger, meaning every part is manufactured in-house and then hand-fitted to each custom rifle. My Custom Ultimate AR 223 or just “Super Varmint,” was shot from bag rests and in most cases didn’t miss a beat. At one point I sighted a ridge that against its gradual slope contained eleven nice, adult dogs, all arranged in a neat, staggered line. With my tech assistant from the Les Baer rifle company alongside, and passing me the first 30 round magazine of Winchester 55-grain “Silver Death” Ballistic Silver Tip bullets, I dropped the Leupold VX-III 4.5x14 mildot crosshairs on dog number one at a ranged 300 yards and then proceeded to clean out the rest of the dogs. The total number of targets hit from the now-warm barrel were nine, with a single miss recorded for the record. That missed dog was quickly followed up by way of a very fast second shot, while observing a sight picture that never faded away due to recoil. This gun system was gaining my attention, and I would never view the autoloader as a varmint hunting rig poorly again.



Thompson Contender in 22 Hornet owned by author is a classic example of a modern hinged-action rifle. These rifles are accurate and simple to maintain and shoot.



Author moving up on a dead coyote with an autoloader that has been built for accuracy and longrange work. Les Bae custom AR 15s can get the job done. These "gas guns" arc hand-made with all parts built in the USA.



The west is big country, and it's where the author ran much of what is being covered here through its field trials.

Shooting the Varmint AR was not about to turn me from my bolt guns, but I was gaining a real respect for just what these AR gun systems are capable of when machined into tight mechanical systems. I was informed that my individual rifle had been used on a series of hunts, and in fact had digested better than 1,300 rounds. Even so, my rifle had not lost a single bit of accuracy. When buying a Les Baer rifle, you can be assured that each rifle has been inspected by Les himself and personally benchrest tested. If the rifle won't shoot sub-MOA (under one inch at 100 yards), it goes back to the drawing board, and that again was clearly evident as the first day of dog hunting proceeded.

Stretching the AR's range to better than 400 yards did not present any problem, and in several cases I was able to push one-shot (first round) kills to almost 500 yards. We were shooting down on a gradual, short grass and deep green basin that contained almost black dogs that if larger could have been mistaken for rockchucks. At a range of 400 to 500 yards, these fur balls were not at all aware of us on that ridge, and during the better part of an hour we managed to dust off a series of very longrange kills. My partner, Dick Metcalf, noted

gunwriter out of Pasa Park, Illinois, who runs the high-grade rifle shooting center there, had elected to bolt on a special 10x50x50 scope that with its sun shade almost hung out over the muzzle of his AR. With the dead air, great target angle, and big dogs, the sub-MOA accuracy associated with these rifles was showing off in spades.

I'm sure you're now thinking, "Great, these autoloaders were getting the job done, but maintaining them in the hot dusty conditions of central Wyoming must have been a real pain, right?" The fact of the matter was that in terms of maintenance, each gun received a blast of Break Free lube at mid-day directly into the bolt assembly, and that was the end of any special care whatsoever. It reminded me of dumping full quart cans of motor oil over the receivers of 50-caliber machine guns during high stress firing tests. By day's end the rifles were taken down by separating the top ends from the lower, then a swab was run through the bore and the actions were wiped down.

Everyone knows full well that autos require a better maintenance schedule than do turn-bolts, but to be sure, this was not a major factor when shooting these rifles at prairie dogs and subsequently digesting massive amounts of ammunition. For the most, part each shooter was running through at least two cases of cartridges per day, and up to four cases at times. I can say for a fact that even my bolt guns get a detailed going-over at the end of a day's shooting involving the application of quality bore, and action products to remove copper fowling and grit. In the previous year I had hunted the same ranch with my own personal Remington Model 700 VS in 22-250, and I know for a fact that my rifle received no less attention than the AR 223 gas guns.



Les Baer AR 15 being used in the Big Horn mountains during a long range coyote hunt. (“Super Varmint”.)



Author zeroing the “Super Varmint” prior to taking it afield.



The gas rifle is soft on recoil, and easy to shoot from prone, or any basic position.

longrange Coyote Rifles

I would like to say up front that, in general, I don't call or shoot coyotes during the late spring, in that I shoot for fur and don't like the idea of gunning mom (the gyp) when she needs to be feeding the kids. On the other hand, we were working as field testers and writers, and getting a coyote into the sights would be a welcome addition to the overview of the Les Baer AR varmint rifle systems.

On the morning of the second day, Dick Metcalf and I hooked up with local guide and coyote hunter Troy Hartwick, the head guide at Spur Outfitters. Troy indicated that he had a section that he believed contained some song dogs, and we were welcome to get up very early to see what we could do about getting a bullet sent by way of the AR 223 at a called dog. I indicated to Troy that I had a new Burnham Brothers Compucaller II and was itching to use it. Troy had no problem with my giving the caller a try, and as a backup we both carried mouth calls that would be put to work in the event something went wrong with the electric calling system. This caller was brand new out of the gate, and I had no idea of what to expect from it in terms of its performance on Wyoming song dogs.

At first light the three of us were picking our way up a deep draw for several hundred yards, then climbed high against a large butte that was studded with sagebrush. Positioning the caller above and behind us at about 100 yards, I would work the system with a remote unit that would allow me to select any one of four different critter calls. With Dick spread to my right and covering a fence line ridge, I covered the left, which included a small creek bottom and an adjoining ridge line directly ahead. Our guide worked a pair of field glasses and scoped a distant line of ridges from a position almost over my back.

We started with a cottontail rabbit cry. Not much happened for the first ten minutes of the calling run.

Thinking the series was a bust as we could see at least a full mile in two directions, I switched to the baby jackrabbit. Now the caller changed pitch and cadence as the yelp of the hurt rabbit bounced off the rock ledges and valley floor. Within a moment's time a gyp came bouncing in from directly over my shoulder and almost down Dick's back. When she hit the call unit itself, she almost did a back flip, and looking like the coyote in the "Road Runner" cartoon, she now turned tail and quickly dropped over a rocky depression.

At the same time Troy was pointing ever so slowly at a running coyote that was silhouetted against a ridgeline about one half mile away. This dog was on

the run full-tilt, and I now adjusted my Sniper Styxs, fully expecting the coyote to come rolling in straight up from the creek bottom in a few minute's time. That was to be an event cut short, however, as a third coyote, a big male, appeared at a fence some 300 yards to the right of Dick, then decided to camp out right there, his eyes glued on the exact spot where the calling machine was located.



Author with gunned coyote via the longrange AR 223 Rem. When built with care and tight tolerances the AR 15, or M-16 can be a tack driver when called upon.



Berry's rifle being shot on the range. Full auto was even easy to control with the use of the suppressed quiet shooting gun system on the muzzle.

Metcalf simply readjusted his sticks, locked down the crosshairs, and touched off a shot sending the Winchester crosshairs, and touched off a shot sending BST 55-grain into the old gray coyote. At the shot, the coyote turned, and obviously hit, started for who knows where. Dick didn't have to even lift his head off the scope and proceeded to punch a second bullet straight through the critter's chest, ending that part of the event quickly. Again, the fast second shot ability of the AR rifle was clearly evident. Would the bolt gun have done the job? Most likely, but with large rock formations everywhere, that wounded 'yote could have just as easily put a big boulder between Dick's sight picture if given enough time to do so.

Not to tell war stories, but I remember a day when I was hunting south Texas with some Winchester reps and two friends, Kevin Howard of Howard Communications and Larry Symes, an Oklahoma coyote caller and guide. We had five or six dogs coming straight at us at a dead run after Larry turned loose a series of wounded critter mouth calls. I was point shooter on that setup and I can say for a fact that even though we did dust off three of the six dogs, I'm sure that all of them would have met their maker if ARs had been employed. Equipped with 30-round magazines, these rifles are beyond belief in terms of their

effective level of reliable firepower. However, you still need to ask the question of yourself: do you need all that bullet dispensing ability, or the price tag that goes with it?



Berry Dueck on staff with Surefire shooting a tricked up variant of the AR 15 Super Varmint. This is a military model of the Les Baer rifle, and like those in current use throughout the Middle East by special operations troops. (Full auto selector.)



Coyote and Ruger “ gas gun” in the new 2005 Ruger accuracy variant.

Other Variants on the Baer AR

Up to this point I have hovered around details regarding the Les Baer Custom Varmint AR 223 or “Super Varmint.” In truth, Les Baer offers a varied line of AR guns that include a very nice AR 223 M4 Flattop (civilian model), a “Super Match” custom in 223, and a “Action Model” AR 223 IPSC. Add the new “Thunder Ranch” variant in a police/military combat model and you have quite a range of AR-type gun systems.

Currently Les Baer also offers his ARs in the new 204 Ruger chambering in the “Super Varmint” and “Super Match” grade rifles. As I have observed and experienced in many hunts testing the new Ruger/Hornady bullet developments in small caliber ammunition (20 caliber), the AR rifle system is a natural for the advanced ultra-high velocity varmint cartridge design. Could it be the next M-16 military round? Some are saying that it would not be out of the question, but military ordnance is not really being covered here, so we will let that question sit on the back burner for the time being.

With all the parts of the rifle machined as a matched set, the Baer ARs are built on a custom ordered basis, and if you’re interested in owning one of these

gas gun masterpiece systems, it will take up to 16 weeks to bring all the elements of the hand-fitted, one-of-a kind-rifle together. Each upper and lower are hand-fitted after being totally manufactured in-house. I shot the police military variant in the M4 AR 223 while on the target range in Wyoming, supervised by Barry Dueck, the Director of the SureFire Suppressor Division, the folks who build the quiet-shooting suppressor cans for the Les Baer customs.

I feel I need to say something at this point about some of my past feelings about the use of autoloading firearms for varmint hunting. As a police officer of 23 years, I shot autos more times than I care to remember. In all cases these gun systems were designed and trained as mankillers, period, and that is how I came to understand them. We shot “Hot House” entry scenarios in training that included “spray and pray” techniques, or just dumped select fire rounds into J-100 FBI targets at close range all day long. Sniper units were, and still are, issued M24 style Remington Model 700s in 308 (7.62) and the fine shooting work was left to the turn-bolt crew. The bottom line was that AR-type firearms were relegated to the urban battlefield or against a standing army, and turn-bolts and single shot break open guns were the tools of the longrange shooters.

After the Wyoming AR event I changed my mind regarding the value of the autoloading rifle as a coyote caller’s gun system, or even a long range PD/coyote eliminating tool. Gun systems like the Les Baer are classed well within the upper limits of quality firearms, and in fact do produce the field results that match their quality and price tag. These systems are not cheap to be sure, and getting into an AR of this quality will run you the better part of \$3,000, and that figure is not in stone by any means. Recently I talked with a varmint hunter that sold off several older turn-bolts and went to the AR style rifle. He could not have been more pleased with that choice. Would I do that same thing? Not without hanging on to a number of quality bolt guns, to be sure. I guess I’m just not quite there yet.

Factory or Custom-Built Rifles?

With the use of laser-guided milling, advanced space age materials, and just the introduction of some solid engineering, the modern factory rifle is a real bargain. I have always stated that the rifles built by Savage, Browning, Ruger, Remington, CZ, and others today, are so far advanced over the custom rifles I shot years ago, that there is absolutely no valid comparison. Want an old school custom rifle? Buy a modern out-of-the-box factory-tuned shooting tool, and you’re still getting a whole lot of bang for the buck.



Author with a coyote taken via the new Ruger Min 14 that has been upgraded in 2005 for accuracy. Autos need to be accurate today, or they are out in the cold among center fire shootings.



This is a custom heavy long range rifle that commands a custom barrel, stock and action. You can bet that the trigger is first class and in general this is a gun system designed for ultra long range work 600 plus yards.

In reviewing the current battery of rifles that are to my way of thinking affordable, and outstanding examples of engineering, by sheer numbers there is no way that I can touch upon them all. The market today is just too vast. By taking into account the brands of rifles and their appointments I will address here, you can put together one of these suggested gun systems or another that retains some of my suggested options. If money is no object, I would suggest contacting the people at Rifles, Inc. This Texas rifle builder specializes in custom lightweight rifles. With rifles built to your own personal fit and requirements, this gun maker source is a good buy in the upper end custom department.

Again, in the custom built department, the rifles offered by HS Precision of Rapid City, South Dakota, are second to none. Being turn-bolt designs, these rifles are manufactured one at a time with all American labor and parts. That's big news nowadays. I have shot HS rifles extensively and each has exhibited nothing less than dead-on perfect results. Tack a Leupold varmint target scope to

a 308 or 22-250, and it's time to get tough on prairie dogs, or whatever crosses those sights. HS Precision builds rifles that will chamber any SAAMI standard cartridge. Thirty-caliber cartridges will all shoot sub-MOA, and larger cartridges are guaranteed to shoot at least 1 MOA at 100 yards. Each rifle is proof fired, and a physical target accompanies each new rifle.

Currently HS Precision builds their hand-made rifles for U.S. Government agencies, police departments, professional contractors working on foreign soil, and you, the long range shooting sportsmen. Shoot anything from a 223 Rem to the 300 Win Mag and HS can build a gun system for you.

In a custom rifle you're going to get precise manufacturing methods and always very good accuracy. If not, the rifle goes back. I was informed by Todd Boughton, Vice President of HS Precision, that there have been times when the customer had been taken right to the test tunnel after informing Tom that his rifle would not shoot groups. In every case to date the fault has been that of the guy behind the rifle. HS rifles and many other customs will outshoot most riflemen. Keep that in mind if your groups look a bit shabby with that new high-end shooting stick.

At a drop-in price, but still a high-end rifle, the Browning A-Bolt has been around for some time and is offered in several different weight and stock configurations. These rifles are available in the new Winchester 223, 243,0 and 25 caliber WSSM cartridges. I shot the A-Bolt in 223 WSSM during its early test trials with Browning/Winchester in Texas on 'yotes, and I will tell you that this cartridge in the A-Bolt or any good rifle is going to be a secret favorite of many as the 220 Swift was once upon a time. While I don't believe the A-Bolt is as fast an action as, say, the Kimber, the Remington Model 700, or the Winchester Model 70, it is a reliable turn-bolt system that has great fit, smooth function, and is well-detailed in terms of wood to steel fit.

Offered by Beretta, the Tikka from Finland is a deadly tool in its tactical, or varmint variation. I shoot this rifle in 223 Rem as a tactical design, but it is offered in the 308 Winchester as well. Believe me, this rifle is as close to custom as possible without ordering one out of a specialty shop. Priced at about \$1,200, the T-3 retains a special pillar bedded action (turn-bolt), heavy muzzle break on a short 22-inch heavy barrel, fully adjustable comb, detachable box magazine, and an outstanding trigger/barrel combination that will drive one-hole groups with good ammo to 100 yards. In 308/7.62 this is a solid 600-yard rifle.

If I let the cat out of the bag at all, it is merely to say that more often than not

I have recommended none other than a Savage 110 action with a synthetic target stock and medium heavy barrel chambered at least in 22-250 to first-time buyers of longrange rifles. In time, a move to the heavyweights in 30-caliber is advisable, but this requires a detailed learning curve. Don't just jump off the deep end yet.

The Magnificent 25-06

As I have indicated previously, handloading the 25-06 is an exercise in simplicity. That is, it is a dream cartridge to handload even though its lineage stems from that old wildcat idea in 1920. Just lube a 30-06 case and run it through a standard full-length 25-06 sizing die. For the time being the case will require no trimming, as the brass will not tend to flow greatly, and at least in the two different rifles I used over a year there was never even a slight level of case binding during chambering of a reloaded cartridge. Dies used for all my handloading were RCBS standard two-die sets, and much of my reformed brass was reworked 30-06 military gleaned during my old M1 Garand days on a Minnesota rifle range. The fact is simply that the 25-06 is just one of the best cartridges ever to load, or use in terms of taking on most north American game, and even a number of the African offerings. As a flexible varmint/game cartridge for long range shooting, you will have to go a very long way to outgun this long 25 caliber. Yes, you guessed it, I'm a real fan of this "widowmaker" of a cartridge.

223 WSSM Handload Performance

Note: 100-yard bench rest; Winchester M-70 with reworked 3-lb. trigger

Bullet	Powder wt/grains	MV (fps)	Group (") 3&5 shot	Note
Varmint				
Sierra Blitzking 55 gr.	Ramshot Hunter 45.3	3526	.345 ⁽³⁾	Good Accuracy Load
Coyote				
Sierra 60 gr. JHP Varminter	Ramshot Hunter 46.5	3629	.378 ⁽³⁾	Wind
Hornady 55 gr. V-Max	Ramshot hunter 46.7	3748	1.006 ⁽³⁾	
Prairie Dogs/General				
Sierra 55 gr. Blitzking	Hodgdon Varget 40.5	3836	1.036	
Hornady 55 gr. V-Max	Hodgdon Varget 40.5	3827	.199	
Winchester 55 gr. BST	Factory	3787	.339	
Sierra 55 gr. Blitzking	Ramshot Hunter 46.0	n/a	.242	Accuracy load
Hornady 55 gr. V-Max	Ramshot Hunter 46.0	n/a	.371 ⁽³⁾	Accuracy load
Deer				
Sierra spitzer 65 gr. BT	Ramshot Hunter 45.0	3475	1.03	
Speer 55 gr. Trophy	Ramshot Hunter 46.0	3500	1.050	
Bonded Bear Claw				
Hornady 60 gr. SP	Ramshot Hunter 46.0	3514	1.00	

Notes: *All groups five shots unless noted as (3)

Wind zero

Temp 77° F

Elevation 5400 ft.

Chronograph: Oehler Chronotech Model 33 (Two Screen System)

Groups measured center to center

Note: Reloading Tip

If you want to keep reloading to a very accurate and simple level, buy factory-loaded cartridges and save the fired brass for reloading. Now everything gets a full-notch simpler. With neck sizing only after firing, you can reload to benchrest accuracy levels and work at even an easier pace. As you work with the 25-06 the whole deal just gets better all the time.

[TABLE] 25-06 Varmint/Game Handloads

Courtesy Ballistics Research & Development, Piedmont, SD

Shooting at 6,500 feet above sea level.

Temp 55° F

Tailwind 5 mph

1

Type: Coyote Load

Bullet: Sierra 87-grain Varminter.

Powder/Charge: 47.2 grains of Reloder 15

Primer: Fed 210M Primer

Overall Length ("): 3.46

Muzzle Velocity (fps): 3,425

Case: Government 30-06 necked to 25-06

Benchrest Accuracy at 100 yds. ("): .882

2

Type: Windy Coyote Load

Bullet: Sierra 117 Grain Spitzer

Powder/Charge: 49.3 grains of Ramshot Hunter

Primer: Fed 210M Primer

Overall Length ("): 3.155

Muzzle Velocity (fps): 2,861

Case: Remington Factory 25-06

Benchrest Accuracy at 100 yds. ("): .994

Note: This load as loaded by Author harvested a large mule deer buck at 523 yards; gun used was a

T/C Encore.

3

Type: Prairie Dog/Coyote Load

Bullet: Hornady 75-grain V-Max

Powder/Charge: 56.5 grains of Ramshot Hunter

Primer: Fed 210M Primer

Overall Length (“): 3.160

Muzzle Velocity (fps): 3,537

Case: Government 30-06 necked to 25-06

Benchrest Accuracy at 100 yds. (“): 1.238

4

Type: longrange Coyote Load

(Federal Factory Load)

Bullet: 90-grain Sierra Varminter Hollowpoint

Powder/Charge: n/a

Primer: n/a

Muzzle Velocity (fps): 3,440

Case: Government 30-06 necked to 25-06

Benchrest Accuracy at 100 yds. (“): .894

5

Type: longrange/High Wind Coyote Load;

longrange Deer & Goats

Bullet: Barnes 90 grain XBT

Powder/Charge: 53.0 grains Ramshot Hunter

Primer: Fed 210M Primer

Overall Length (“): 3.180

Muzzle Velocity (fps): 3,216

Case: Government 30-06 necked to 25-06

Benchrest Accuracy at 100 yds. (“): 1.221

6

Type: Coyote, Prairie Dog Load

Bullet: Speer 87-grain Spitzer

Powder/Charge: 57.3 grains Reloader 19Primer:

Fed 210M Primer

Overall Length (“): 3.09

Muzzle Velocity (fps): 3,525

Case: Federal factory

Benchrest Accuracy at 100 yds. (“): .786

7

Type: longrange/Wind; Deer, Goats, Coyote Load

Bullet: Sierra 90-grain HPBT GameKing

Powder/Charge: 51.0 grains H414

Primer: Fed 210 M Primer

Overall Length (“): 3.100

Muzzle Velocity (fps): 3,315

Case: Federal factory

Benchrest Accuracy at 100 yds. (“): 1.033

8

Type: Coyote, Deer/Goats, longrange/High Winds

Bullet: Sierra 90-grain GameKing HPBT

Powder/Charge: 45.0 grains Varget

Primer: Fed 210M Primer

Overall Length (“): 3.100

Muzzle Velocity (fps): 3,312

Case: Federal factory

Benchrest Accuracy at 100 yds. (“): .944

9

Type: Big Game/Windy Conditions on
longrange Coyotes

Bullet: Nosler 100-grain Partition

Powder/Charge: 44.0 grains Varget

Primer: Fed 210M Primer

Overall Length ("): 3.200

Muzzle Velocity (fps): 3,125

Case: Government 30-06 necked to 25-06

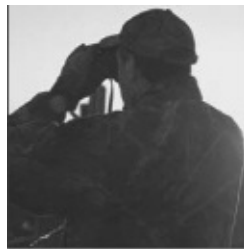
Benchrest Accuracy at 100 yds. ("): .995

Chapter 3

Selecting A Long-Range Cartridge And Developing Long-Range Eyes

Selecting a rifle cartridge for long range work is serious business. As we were able to see by way of our old friend Bill in Chapter One, if you make the wrong choice, the days in the field can get long. I have touched on some elements associated with cartridge choice already, but looking a bit deeper into the subject we encounter questions regarding just how your rifle is to be used and where.

Let's say you're living in a close-by urban environment; long-range shooting in this case may be under 400 yards almost all the time. Here, a cartridge such as the 223 Rem is a "get by" choice, with the 22-250 a better option. This round is laced with some added edge in downrange energy and velocity. When you take that western United States varmint hunting trip, the added energy velocity of the 22-250 Rem will come in handy for dog town shooting or incoming coyotes.



Next up are recoil levels. We have discussed flinch to some degree, but other results of excessive recoil are the loss of target (blackout), readjustment to the target after the shot, and recoil fatigue in the field when gunning multiple targets at long range. This borders on that age-old problem of too much rifle for the individual shooting it. It is just possible that by selecting the 308 Winchester, or even 30-06 Springfield over the massive 300 Win Mag, you will ultimately do a

better job with a bit less cartridge.



The rifle cartridge is the element that makes the system work. Poor ammo means poor ballistics and a missed target at long range.



Selecting the correct bullet can be the difference between game on the ground or a wounded animal. A shooter worth his salt never wants the latter to happen.

About two years ago I was hunting in Colorado with a group of prairie dog shooters when a fellow pulled up driving a large Chevy Suburban. This rig was

set up expressly for carrying everything the hunter needed to shoot long-range dog with his custom-built set of 6mm x 284s. This fellow had trays of handloaded rounds, tables of data for each rifle on preset mildot points that matched exact ranges beyond 400 yards, and a massive heavy swiveling bench rest, forend rest, and sand bags that locked everything in place rock-solid.

Chambering and firing those big 6mm x 284 rounds caused the ridge to shake as his muzzle brake spat out gas and fire with each shot sent across a wide draw. He had set his scope sights on a dog lodge that contained a single large prairie dog, and when it was ranged to 630 yards he was determined to put a bullet in the right place. Boom, boom, boom the shooting went on, and yet the rat just hung around the mound as dirt was sent flying high above the rodent's head. What had gone wrong here was that this dedicated shooter was shooting too much cartridge. It was obvious that he was becoming fatigued with each successive missed round, and the shaking blast of that big cartridge was starting to get to him. Over the course of a full two hours I never did see him hit that or any other dog on that far-off ridge. I'm quite confident that this dog shooter would have been far better off with less cartridge in this situation.

Factoring in the cost of a single round of ammo today is also a major part of the equation when selecting that chamber size. I hope that 6mm x 284 shooter was well-heeled, because the amount of brass that was hitting the ground had to add up to one pile of money.

Figuring the amount of powder a cartridge will eat up per shot, the price of bullets to top off the cartridge, and even the price of new or once-fired brass is imperative. This may seem like a small element at the sporting goods store when selecting your cartridge and paired rifle, but when you get all that rifle home, the fun is just beginning, as is the reloading bill.

Recently I helped a young fellow get a long-range rifle and by using some common sense the whole deal came out quite well. My friend had only one eye, and being forced to shoot left handed, he elected to take on the Thompson Encore chambered in .25-06 and a Leupold VXIII 4.5 x 14 glass. He figured the .25-06 recoil levels were manageable in the light Thompson Center rifle, and reloading it was, as I have already indicated, a complete breeze.

Western South Dakota is a place of long shots even if you're not necessarily searching for them. Goat, deer, elk, and varmints don't give you much in the way of close-up and personal during a hunt, so the young fellow, being a native of the area, understood the mentality of the western rifle hunter very clearly.

In the first season using his .25-06 creation, my buddy dusted off a nice mule deer at 385 yards, dropped several long coyotes at or near 400 yards, and shot some extra long-range prairie dogs to fill in the blanks. Average range with the light Encore in most cases was beyond 300 yards, and at times almost out to 500 on those grass rats. Was his long range choice a good one? Yes, and far better with much less cash outlay than the fellow with the big 6mm and a pile of recoil flinch to boot.



Matt Martinez, a fellow coyote hunter in Texas, decided to stay with a soft shooter, and here elects to work with a Savage 110 in 223 Remington. It gets the job done for Matt, and that's what counts in the end.

Ask yourself, what type of targets will you most likely be facing in the field? This can again have a major bearing on which cartridge you select. If you're hunting prairie dogs almost all the time and working with good weather, meaning low wind conditions in easy rolling country, staying with the light 223 caliber cartridges is a good idea. However, taking on mountain rock chucks, or marmot, big open country coyotes, or game animals at appropriate hunting

ranges (more on this subject a bit later), you may want to consider a bit more cartridge for the job. Here the 6mm, 25 caliber, or 30 caliber may fit your needs. Remember the rule: more powder and more bullet equals more distance downrange.

Selecting Long Range Bullets

Fur taker or pest controller, your choice in rifle bullets can make or break your field success. Assuming some of you will handload for your long-range rifle work and some of you will stand by factory rolled ammo, the question of cartridge is only the first step in the understanding of what it takes to reload a solid long-range round.

The bullet can be a major part, if not everything, in a long-running rifle load, and the following example is again a real-world event that illustrates exactly what I'm referring to.

Oklahoma in 1999 was a vast holding pen for thousands of coyotes. Pairing up with my partner in the business of 'yote hunting, Larry Symes, I had been given permission to call and clean out as many 'yotes as possible from a Texas/Oklahoma border ranch.



Often a long-range big game cartridge can double as a long-range varmint round. The Winchester 270 WSM Short Mag is a good example of that dual use.

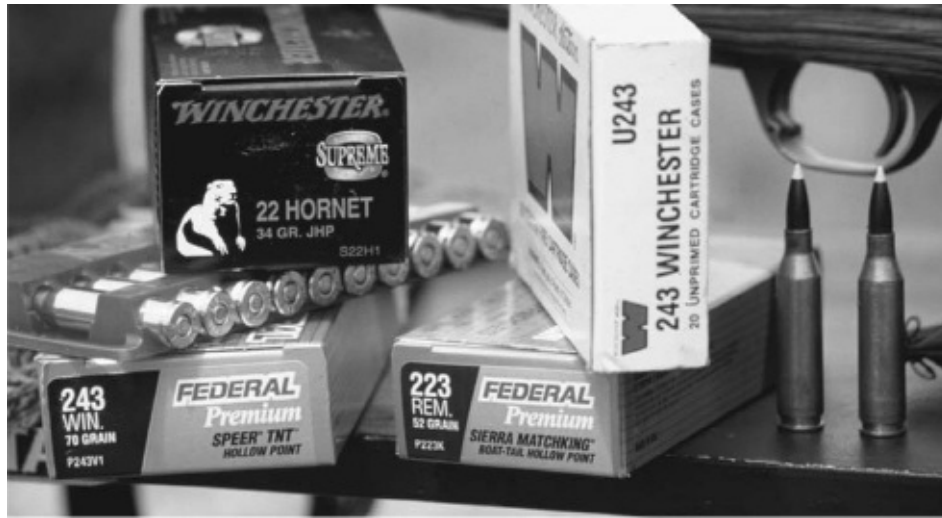


Bullet selection for big game and long-range shooting can be closely parallel. Using enough bullet for both tasks is critical when range is pushed beyond the normal limits.



handloading will enable the rifleman to select very specialized loads that often can't be found in the

sporting goods store.



Here is a mix of ammo that will all do a good job under the right conditions. Remember, the more bullet and more powder, the longer the extended range. Keep each cartridge working within its proper limits.

Larry is a horse dentist by trade, and a ‘yote hunter by hobby, or at least that’s the way he puts it. I know for a fact that Larry is one of the best ‘yote hunters in the country, but a bit too modest to say so, and now he had gone ahead and locked down about 5,000 acres for calling on this late winter hunt for song dogs. Amateurs don’t scout and lock up that many sections of Oklahoma ranch land if they are not dead serious about their craft. Larry was serious, and as a direct result of that acquisition of land, I was to learn a great deal about rifle bullets and the way they can behave against large varmint targets in the field.

In those days, hunting song dogs, or even red fox in Minnesota, would, over a long period of time, produce a lot of useful information as to the net effect of various rifle bullets that are built in varied designs. However, hunting Oklahoma means that you will get off as many shots in a single morning as you may experience over a full season in the land of ice and snow. No matter how you cut it, the big country style of ‘yote hunting over vast expanses of land that hold thousands of dogs will always produce a far better open-air classroom setting for the hunter. Read all the books you want, but hitting the draws and ridge lines with a call and rifle is the real world school of long-range rifle work.

Hunting that Texas border ranch, Larry and I hit upon a pack of calf-killing ‘yotes that seemed to be headed up by a very massive coy dog; what we call a

half-coyote and half-domestic dog. This makes for a real killer because the 'yote part of the critter is the real natural hunter, and the domestic dog in the animal knows man and how to work around him.

After hunting the better part of four hours, we were rounding a bend in the road as it fell away toward some bottomland and a small herd of cows with calves. All at once from the far side of the uphill end of the draw, we both spotted a pack of 'yotes headed up by the big gray, half-breed coy dog, now moving away fast at the sight of our pickup truck. Crossing the pastured bottom, we bailed out of the truck and headed at a dead run up a slope and into some heavy buck-brush cover. Larry motioned me to move to the right as he headed farther uphill into the thick, black, brush-ridden cover. I was not at all impressed by the fact that we were giving chase to a half 'yote and half dog that didn't give a rip if he tore into us full tilt. In as much as I didn't have enough of an opening to get off any kind of measured shot, I figured that given the chance I would have just about given up my soul to the devil at the time for a short-barreled scattergun loaded with buckshot.

Suddenly I became clearly aware of a growling and snarling 'yote heading directly at Larry. With my rifle at the shoulder position, I tried to search for any kind of opening so I could aid my friend. No sooner had the thought crossed my mind when Larry turned loose a round from his 22-250 Rem heavy varmint rifle. This action was followed by a large 'yote busting through brush and moving across my path. Now I searched for even a very small, but workable opening that would allow me to bust a cap on my 223 Remington. Spotting the coyote in a tight, but workable sighting gap, I touched off the small-caliber critter control system. At the shot, the big dog rolled up tight and came to a stop in a heap of fur with most of his chest cavity unglued.

Larry's bullet had found its mark, but in this case, he had been test-shooting a new bullet design that was far too light in construction for heavy varmints. As a direct result it had only produced a massive flesh wound dead center on the animal's chest. I on the other hand, had chambered a bullet that was lighter in weight, but was designed to hang together, then blow up after reaching the vitals of the big, raw-boned critter.

Varmint Bullets Aren't All Alike

As was previously noted, Larry's 22-250 bullet didn't do the job, whereas my much smaller 223 bullet with a different design, but by the same

manufacturer, did indeed drop the critter quickly and cleanly. Today different bullet designs are as common as houseflies, and seem to all work a bit differently depending on the size and density of the varmint being hunted. Bullets designed for ground squirrels or prairie dogs won't get the job done as well on heavy-boned 'yotes or animals of the same body type and size. Therefore, getting to the basics of what you need in varmint bullets is the direction I'm about to take this discussion.

Selecting bullets being handloaded, or factory-rolled fodder for your rifle, can be simple if you observe several simple rules. First of all, try to stay with lighter weight bullets for smaller cartridges in the varmint class loads. If you're shooting a 22 Hornet for example, it would be wise to consider ammunition from the reloading bench or store shelf that makes use of a 40-to 45-grain bullet. Heavier bullets will work, but due to the velocity limitations of the smaller cartridge, you should expect less effective expansion from the thicker-jacketed and heavier bullets.



Larry Symes shooting his custom 22-250. Larry takes a break after dusting this Oklahoma coyote. Larry found as I did, that even a coyote bullet can fail at times.

Turning to the 222, or 223 Remington, a move upward in cartridge energy and velocity has been attained, and the use of still heavier pills is again in order. Here, the 50-grain bullet is a popular choice because it is fast-moving in the smaller cartridge case, but still can produce clean and effective kills given the proper bullet design.

In the final group of 22-caliber varmint pills, we turn to the 22-250

Remington. Here the 55-grain bullet is king, because it can be pushed very fast from this larger-cased cartridge. Of course you can move up into the 220 Swift and retain the same bullet weight as the suggested bullet in the 22-250, but the Swift's muzzle velocities of 4000 fps will take their toll on a rifle's barrel over time. This is why the 22-250 Remington has outstripped the large Swift today as the cartridge of choice by most varmint hunters searching out that ultra-high velocity long-range rifle/cartridge combination.

When I mentioned bullet design a few lines back, what I meant was that today, more than at any time previously, we are seeing a greater move toward innovative ways of using space age materials in bullets so as to make them more effective projectiles. By streamlining bullet shapes, and using everything from polymer tipped pills, or special jacket expansion designs, varmint bullets can react like bombs on target impact, or they can push through, causing internal damage but little in the way of pelt loss. If you hunt for fur, you want a bullet that will penetrate deeply, then blow up and not leave an exit hole, one-hole pelts I call them, and that's the way the fur buyer likes it.



When bullets work, everything else works out just fine.



Here hunters are checking with a rancher prior to going afield. Getting information from the local folks can save time and allow the rifleman to set up in a productive area.

How do you know when you're buying the correct bullet? For the most part, the new poly-tipped or plastic point bullets are much alike, and will drive deep into a soft target and then explode. Small critters, as in prairie dogs, will just come apart, but fox and 'yotes will take the shock and remain intact if hit at ranges beyond, say, 100 yards. As any bullet reaches a target at a closer point, the energy is going to be compounded and more damage will result. Take Larry's bullet on that coy dog for example. If he had hit that critter at 150 through 250 yards and not the 50 yard point-blank shot he was offered, that bullet most likely would have penetrated deeply, and then come apart. Being of a light jacket design and a hollowpoint, it simply rolled over and flew to pieces on the surface or hide of the 'yote.

Are new bullets coming down the line for varmint hunting? According to my quick count, we now have 59 factory variations offered by the big four (Winchester, Remington, Federal, and Hornady as well as 118 bullets in the centerfire varmint rifle class for handloading. These home-rolling bullets are offered up by Hornady, Speer, Nosler, Sierra, and Winchester. Hornady alone offers 47 different bullet types that could be applied to varmint-class targets. However, as ballistic science moves along, you can never tell what is just around

the corner in new projectile development. The modern poly bullets offered by handloading component manufacturers as well as Winchester, Remington, Federal, and others, are among the state of the art in high-tech development. Currently, younger companies such as Environmetal Inc., the makers of Hevi-Shot waterfowl ammo (non-toxic), are designing bullets that make use of a pure dust tungsten core enveloped around the bullet's jacket. As I write these lines, I'm smack in the middle of writing press release material for these 224 70-grain pills, and I have just completed a major Texas hog hunt while testing the effectiveness of the new bullet concept. A bit later as we get into the super guns, as in the 50 BMG, you will see that bullet designs and types are just about infinite regarding design possibilities.

The thing to remember here is to pay attention as to just what your selected bullet is doing on contact with targets. If critters are running off after being hit, it is possible that your bullet is not getting the job done. With all the current choices in bullet designs today, there is no excuse for using the wrong bullet for the job at hand. The long range rifleman wants a clean-killing bullet, but good retained velocity, low drag by way of overall design, and accuracy, are all elements to be considered, too. A tall order here, but it's some of the stuff that makes "stretch shooting" a whole lot of fun and a challenge as well.

As a final topic regarding cartridges and bullets, the subject of availability is paramount. If you can't find components, you're in trouble from the start. Take on some out-of-sight wildcat round that you've got to feed with some hard-to-find brass, and a bullet of an odd size, and you're heading up the road of hard times, my friend. Keep in mind where you live, what is available locally to you, and even how much it will cost to ship in products from establishments that handle components for reloading rifle cartridges.

In terms of reloading equipment, keep in mind the amount of case sizing involved in a specific round, as it could be necessary to obtain custom-made dies, or sets of dies that work brass in stages versus a single run-through (as in the 243 Win sized from a 308 Win case, or the 25-06 Rem from the 30-06 Springfield case). As you will see in my discussion regarding shots beyond 400 yards a bit later on, you're not gaining a whole lot even with some overrated big boomers that require a special bank account to handload. If these rule ever fit anywhere, they fit here; "Keep it simple," and, "If it ain't broke don't fix it."



The V-Max bullet started a revolution in varmint and long-range bullet design. Good ballistics mean accurate hits at extended ranges.

Also of note here, the fact that when you move up in cartridge size, the rifle must be moved up in weight as well. If you think that is no big deal, try hauling a 14-pound cannon around a dog town on a hot South Dakota or Wyoming summer day. Even if you're willing to hump that gun over hill and dale, I will bet a day's pay that you're not going to shoot it very well at all.

Using Ballistics Programs Via the Internet

There are advanced tools the modern "new school" long-range rifleman can use today that we never had back in the old days. Those tools involve surfing the net in search of ballistic tables and general information that applies to your specific needs. Today, bullet and ammunition manufacturers have published vast amounts of information directly on the internet, and getting a handle on one bullet over another is a simple matter of logging on to Sierra's, Barnes's, or Hornady's website and start reading.

Published manufacturers' catalogs are also a big help, as are reloading manuals that cover a wide range of cartridge and bullet types. Information

contained in this book for the most part is author-generated over a 25-year period of real world downrange, and warm-target field testing. One major exception is information that will cover the military 50 BMG, or the new Barrett 416, the latter being so new that information is still quite limited. That stated, I often turn to the manuals and internet data when working through a new cartridge, or reworking an old standard cartridge for a story. It is just good sense to do so.

Selecting Optics

Optics to the long range rifleman are in essence his or her eyes in the field. Lacking good clear optics on the rifle or hanging around your neck, much can be lost out beyond a human being's normal vision. I knew of a hunter that just would not drop a dime on anything but a low grade scope, and even less in binoculars. Little did he know the number of targets he passed up simply because he could not see them. His rationale was simply that this was pure entertainment to him, and he didn't care to invest much, if any real money in the sport. Consequently, I never observed him take a shot much beyond 300 yards, never get excited at a slinking 'yote moving across the skyline at 500 yards with a chance of putting a bullet in his hide, or even observing a feeding mule deer or goat that required a careful stalk before attempting a longer-range shot. With his poor eyesight, this hunter, if anyone, should have been keenly interested in better optics. But, alas, that was not the case, and to my way of thinking his hunting always suffered because in effect he was hunting blind and shooting almost blind most of the time.

There is an old saying among big open country game and varmint hunters: if you have to cut back someplace regarding your equipment, put less in a fancy stock, embellished metal parts, and even a heavy expensive shooting caliber, and turn instead toward a good scope, and quality pair of binoculars.



Hunters zeroing glass sight prior to a hunt. The scope is the eye of the hunter when long-range shooting.

Prior to getting into choices in these tools of the long-range shooter, let me say that there are a couple of facts that I would like to share with you. First of all, in terms of many of the off-brand scopes sold today, be advised that many of them come off the same assembly line as an outsourced product, and simply get stamped or capped off with an individual brand that is different from another at the end of the line. Yes, that's correct, the same run of scopes, but with different names. Not to be found in that department, are the name brand American and German glass sights many of us have come to associate with high quality. If you buy Leupold, Weaver, Redfield, Nikon, Burris, Bushnell, Simmons, Millett, or Sightron, to name a few, you're in good hands all the way. Still higher on the scale, are those upper-end Zeiss and Swarovski/Kahles glass sighting and spotting systems that without question, are at the top of the food chain.

Shooting a Kahles 3 x 9 with sniper hash marks on my Beretta Tikka T-3 for a year totally spoiled me. If I were a one-rifle shooter and had to make a choice in optics, that or my current Leupold glass would be first choice. In terms of bang, or in this case value for the dollar, Weaver is the scope to buy all the time. Leupold is all-American and very well-made, and the company stands behind each and every glass tube sold. Bushnell may not be fancy, but I have run a

Bushnell Yardage Pro 400 almost forever, or at least from the very first run ever produced. I also have several of their 3 x 9 and straight 4x glass systems on hard-pounding Hastings Paradox slug gun barrels that have been rocked by 500-grain 12 gauge projectiles for many a year back to back. Not one of them has given up the fight.

For the most part, I have used just about all of them over the years, and when it comes to my own personal rifles most of them mount Leupold glass. I have a Leupold 3x9 Gold Ring and old Weaver mounts locked onto a Winchester Model 70 30-06 that was bought as a rifle scope package in 1964. The rifle has been hunted across Wyoming, South Dakota, Minnesota, and half the southwestern end of the country, and never has there been a need to reset the zero on the Leupold scope. That's performance way beyond any anticipated expectation of a glass sight system. Don't get me wrong, I'm not saying that you need to mortgage the house to get better optics for field use, but do try to move beyond the ultra low-end products that are just not going to get it done for you.



Weaver V16 and variants are a gold standard among long-range shooters. Large objective lens, reticle with mil dots, and high magnification are standard.



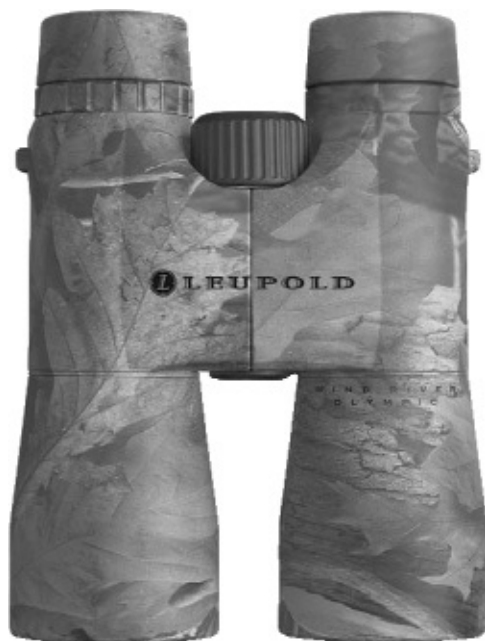
T-3 Tikka with a Kahles 3X9 with sniper hash marks is a nice rifle in the 223 Rem. Michael Nischalke, NRA editor, is doing the shooting.

One way to get an idea of how good a pair of binoculars is to look through them and run your eye toward the outer edge of the glass. If you start to see distortion or color change quickly after leaving the center of the eyepiece, stop right there. Those glasses won't cut it as you try and glass a whitetail on a pine-covered hillside, or a coyote sitting near a den hole at extended range.

As a second method of checking out a brand of glasses, or a scope for that matter, look into dark shadows under tree limbs on a sunny day. If you can't see into those shadows you may want to check out a different binocular system or scope sight. Good glass can, at times, get inside shadows or those spots where elk like to bed down, as well as those areas that mule deer tend to rest in during midday.



Here, spotting glass and scopes make the day on a long-range prairie dog town. Without quality optics, you're shooting blind.



Leupold 10x50 binoculars. In open country, you can't have too much quality in a glass system when it comes to locating long-range targets.



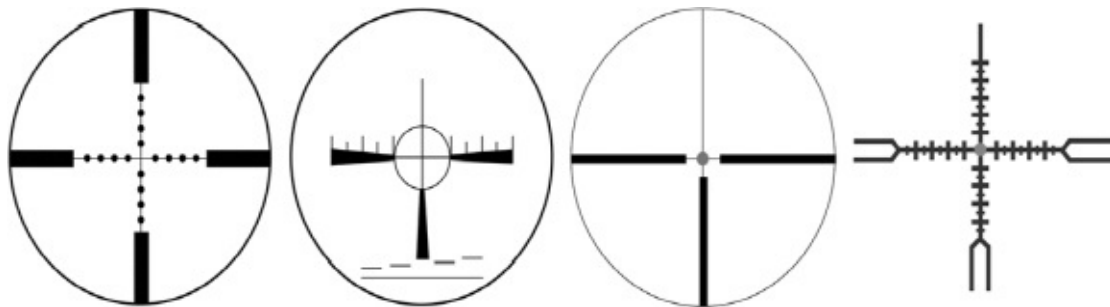
Turret arrangement on the BSA Sweet 17. Easy to read and use in the field.

If you're buying glass, don't just sight the scope or spotting system across a store. Step outside and get a real-world view of things. Often the natural light, or even low light in the late afternoon, will show a completely different side to a set of binoculars, spotting scope, or rifle scope sight.

One very important element to consider when buying a rifle scope is the reticle itself. What type of reticle are you going to go with on that dog or coyote shooter? Using Leupold as an example, as I use their equipment often, you can select from a very wide range of reticle types, but rest assured, what you want is a system that can aid you in fast field ranging estimation. At first, the reticle systems filled with dots and lines seem cluttered. However, because you will sometimes need information as to the exact distance of an animal so you can select the correct wind drift and holdover for the bullet, using a varmint hunter's reticle, or mil dot ranging system, is required here. Big open crosshair scope reticles are designed for running shots, or low light deer hunting, and won't help you a single bit when trying to figure the bullet drop and drift on that 550-yard mountain marmot.

The varmint, or mildot reticle is set to distance for common bullets for 200, 300, 400 yards, and more. These systems are also pre-set for wind deflections using a 10 mph wind as a baseline indicator. Line up the mildot or hash mark, set right or left for wind, and send the bullet downrange.

Scope systems are advancing at an unprecedented rate. Even with the advances in ranging equipment, and that will be covered a bit later on, we have rifle scopes coming into existence that carry their own ranging systems right along with quality, long range optics. Burris Optical is about to introduce a new ranging scope that is low-profile, lighter than previous models that didn't make the grade, and is field tough. The following is an updated press release regarding this new development in rifle optics. According to Burris, the system will be in hunters' hands starting in July of 2006.



These are four different reticles used in long-range scopes. The mildot illustrated will allow the shooter to raise the aiming point without adjusting turret knobs. Each system has its own advantages in the field.

NEW LASERSCOPE™

BURRIS COMPANY launches the LaserScope, a 4X-12X-42mm riflescope with an integrated 800-yard laser rangefinding system.

After over a decade of research, development, and testing, the LaserScope by Burris answers the challenges of delivering a laser rangefinding riflescope that will hold together under severe recoil, is affordable, and is of a size and weight that is workable for everyday field use. Not only does this unit produce extremely vivid, bright, and crystal clear optics and Burris rock solid severe recoil performance, but also eliminates the need for a handheld laser unit thereby dramatically decreasing the time to range a trophy and get a shot off. Naturally, Burris also installed the simple and proven Burris Ballistic Plex trajectory compensating reticle so that once you range the target, you can hold dead on and squeeze with confidence at any distance.

A single button to activate the laser is located about mid-section on the left side of the scope. In addition, Burris provides a remote activator that can be

strapped either to rifle's forearm or to the objective bell of the scope. The remote activator makes ranging while viewing through the scope more natural and steadier.

Burriss has also developed and protected the most optimal mounting system possible. The unique mount allows the lowest possible mounting of the LaserScope to the rifle. The LaserScope, by nature of its shape, positions the shooter's eye much higher than with a conventional riflescope. The Burriss mounting system allows the LaserScope to be mounted at its lowest possible mounting which compares to normal high rings on a conventional riflescope.

Real world pricing will be around \$999. Warranted forever.

Specifications:

Laser Scope Model 4-12-42

Laser Range* (yards reflective): 800

Laser Range* (yards deer): 550

Laser Accuracy: -plus/-1 yard

Batteries: 2 AAA

Battery Life: 1100 cycles

Operating Temperature: 14°F -122°F

Field of View (Low-High feet @ 100 yards): 25-9

Exit Pupil (mm): Low -High 10.5 -3.5

Click Value (Inch@100yards): .25

Max Adj. (Inch @ 100yards): 1 50

Weight with Mount & Battery: 26 oz

Optimum Eye Relief (Inches): 3 -3.5

Objective End Diameter (mm): 60

Clear Objective Diameter (mm): 42

Ocular End Diameter (mm): 39

Overall Length (Inches): 13

Mounting Rail Length (Inches): 5.7

*Environmental conditions may limit range



Laser range finding scopes, like the Burris Laser Scope, are the wave of the future in long-range shooting.



Shooting long-range requires a balanced rifle and scope system. Here the Remington Model 700 is matched to a Leupold varmint glass system for good long-range accuracy.

After reviewing the data material supplied by the manufacturer, it is clear that Burris is without question making strides to turn the whole design philosophy regarding long range rifle scopes on its ear. To be sure, we have not seen the end of this space age development yet.

Assuming you don't have the new Burris system and are working with other scopes that applied to longer range rifles, what are some of the other features you should be looking for in that glass sight system? First of all, pay attention to the turret system employed on your scope. Some shooters want exposed and high turret knobs. This allows quick changes in elevation or windage in the field. However, if you're of a mind to just hold to a locked-in range, say a 200-yard zero, and work with mildots or hash marks in the scope reticle, the use of these exposed adjustable turrets is not required. In some cases, these system tend to get moved off the correct zero by handling, but most shooters who use them have a pre-marked field ranging and shooting card that allows them to know right away if anything has changed on the turret itself.

On the subject of magnification, for the most part military long-range snipers tend to favor a scope that will not advance above 12X. That's because target mirage can cause the actual target to "jump," and in effect, not be where you think it is at long range when shooting in high heat. By working with a lower power glass, the mirage is lessened and the target stabilized.

Prairie dog shooters and long-range big game hunters often opt for high magnification systems because target identification is paramount. I will often move up on a large dog town that can cover a mile or more, and glass that town for active prairie dogs. Here, I will run up a varmint scope to 14X or 16X during scanning, or even drop the power to pick up a full field of view that covers a whole 400-yard ridge at say, 500 yards. For this kind of long-range work the high magnification glass gives me more flexibility, though less power, in the field.

In terms of what magnification is used the most, I play a little game with myself in which I find my target and pull back the magnification as the target comes into view. When I feel comfortable with my choice in magnification, I drop the trigger on my target. After the shot, I will look at my magnification selector ring. Many times if not always, it will be between 10X and 12X.

In spite of all the new, fun tools now available for riflemen, there are times when keeping it simple is the best way to take on the subject. My advice is not to be too quick on the trigger in terms of buying up all the tools and toys that are designed for finding range and hitting targets. For the most part, the best tool you own is in your own mind.



Author's wife, Colleen loads a Remington Mauser Model 799 mounting a Simmons 3.8 x12x44. The scope is a bit large for the small 223 Rem rifle, but it is easy to use in that she can shoot the rifle well. This is a simple but effective system that get the job done for her.

Chapter 4

Barrels, Triggers and Other Stuff

There are some things about a long-range rifle that you just can't live without. The question here is, what makes a good rifle shoot well? The answer takes some explaining. The following are some of these details that can make or break a good rifle.

When discussing the elements of a good shooting rifle, the first consideration to my way of thinking is the barrel. I know some will not agree with me on this, but here is my rationale. Barrels need to be accurate in terms of getting bullets downrange and on target each and every time. The action, trigger, or even bedding system – it is all for naught if that barrel won't shoot, regardless of what is behind it.



How do you know if you have a good barrel? The old fashioned way is to get out and shoot it from a good solid bench rest. Bench rest systems and even mechanical shooting rests will take away much of the human error that can make good barrels look bad.

There was a time when at least one if not more of the manufacturers started to get a bit lowball on barrels. It was noticed at once within the shooting world, and quickly things changed regarding that element in rifle manufacturing. You can't have a poor shooting barrel on any rifle and expect someone to use that system with any degree of success.



This ultra long-range varmint rifle has a custom barrel for one good reason. It shoots where you point it. That's always the bottom line regarding performance.



Author's hunting partner Dough Williamson shoots a Tikka T-3. These rifles from Finland mount some of the best factory barrels I have ever seen. One hole at 100 yards all day long.

The best barrels are often custom-manufactured pipes. I have been in the factory at HS Precision in Rapid City and watched a barrel being drilled and rifled from a piece of raw barrel steel. These barrels are handmade to each specific rifle and a good deal of attention is given to each step in the manufacturing of every barrel.

Barrel manufacturers like Douglas, E.R. Shaw Inc., Shilen, Pac-Nor, or Hart, to name a few, will always produce a barrel of extreme quality, and if it is not a

shooter, it will be covered to the last degree in terms of warranty. HS Precision, for example, states all its barrel will shoot sub-MOA at 100 yards or the rifle comes back. That's a very standard warranty today regarding quality pipes on long-range shooting equipment.

As an example of exactly what can be expected of a quality barrel, the following is the result of some benchrest shooting with a variety of ammunition with an HS Precision rifle. I selected this example because I have spent a significant amount of time behind this rifle and have learned it well as a long-range varmint rifle. While I'm not about to say that everything regarding these solid groups is the result of a good barrel on the rifle, I will say that lacking that quality pipe, none of these groups would be even remotely possible.



Fitting the pieces together at HS Precision during the manufacture of a complete varmint, sniper, or police rifle.

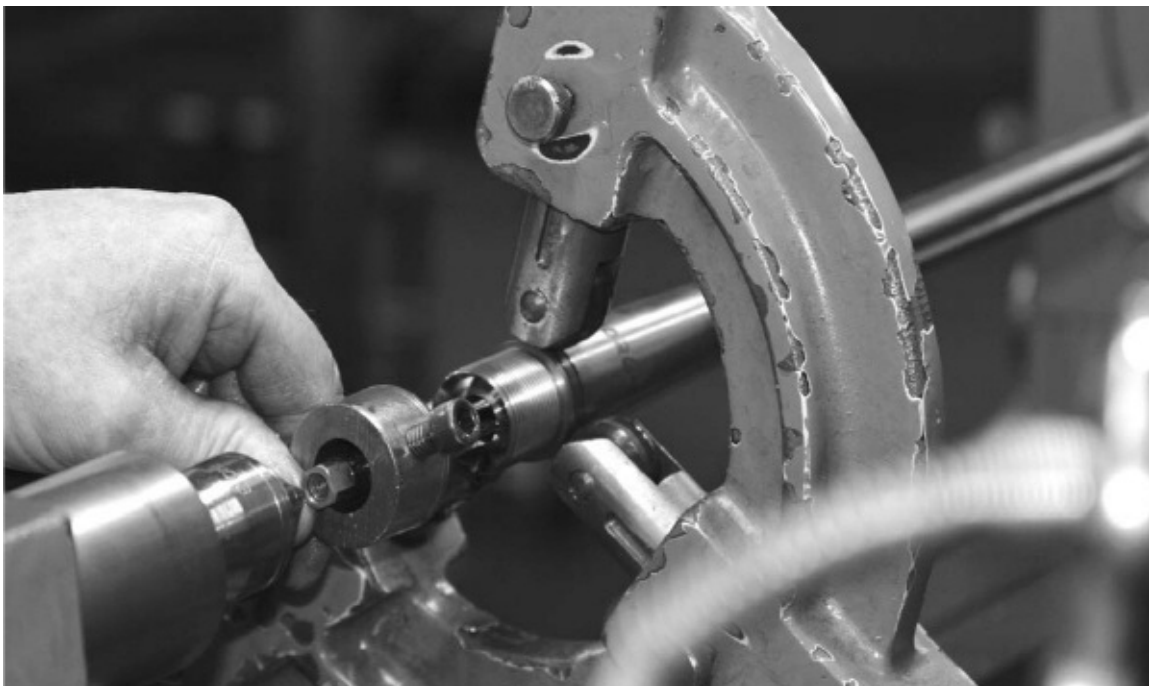
Tested: H-S Precision Bolt Action in 22-250 Remington

Factory Load/ Handload	Bullet/Load	Muzzle Velocity (fps)	Group (") (3-Shot@100 Yards)
Factory	Winchester 40-grain JHP	4000	.542
Factory	Winchester Super X 55-grain Pointed Soft Point	3680	.486
Factory	Winchester USA Brand 45-grain Jacketed HP	4000	.620
Handload	Sierra Blitz King 55-grain/38.0 gr Hunter*	3361	.470
Handload	Hornady V-MAX 55-grain/38.0 Hunter*	3327**	.381
Handload	Barnes VLC 50-grain/40.7 Hunter*	3546	.455
Factory	Federal Premium Nosler BT 55-grain	4150	.532
Factory	Federal Premium Sierra Game King BTHP 55-grain	3680	.388
Handload	Trophy Bonded Bear Claw 55-grain/39.5 Hunter*	3478	.444

*Ramshot Powders/Western Powders Inc.

**Chronographed

Moving to a factory-offered rifle with a very high grade barrel, lets take a look at the results I obtained by bench rest shooting a Kimber Pro-Varmint in the new 204 Ruger. This rifle has a 22-inch barrel and a custom Model 70 Winchester-style action. Accuracy is paramount with Kimber, and this is a rifle you can buy right off the dealer's gun rack. Many shooters tend to believe that a rifle like Kimber is about as close as you're going to ever get to a handmade custom rifle and still buy it from a local dealer off the shelf. I tend to agree with that thinking, but I must also include rifles that pop up here in the local area gun shops of western South Dakota, e.g., the Dakota Arms rifles, Cooper shooting systems, and Volquartsen rifles.



Barrel under construction at HS Precision in Rapid City, South Dakota. HS makes all their own barrels from scratch. That way they know they're going to shoot well.



HS rifle in the test tunnel for final group printing. Every rifle gets this treatment prior to leaving the factory.

Tested: Kimber Pro-Varmint in 204 Ruger

Factory Load/ Handload	Bullet/Load	Muzzle Velocity (fps)	Group (") (3-Shot@100 Yards)
Handload	Berger 35-gr. HP/Varget 29.0 gr.	3812	.375
Handload	Homady 40-gr. V-Max/Varget 28.0 gr	3647	.522
Handload	Homady 32-gr. V-Max/H335 28.3 gr.	4123	.392
Handload	Berger 35-gr. HP/H335 27.5 gr.	3915	.376
Handload	40-gr. V-Max/H335 26.8 gr.	3738	.446
Factory	Homady 32-gr. V-Max/Varget 27.0 gr	3557	.634
Handload	Sierra 32-gr. BlitzKing/H335 28.3 gr.	4044	.244
Factory	Homady 32-gr. V-Max	4225	.387
Factory	Homady 40-gr. V-Max	3900	.444

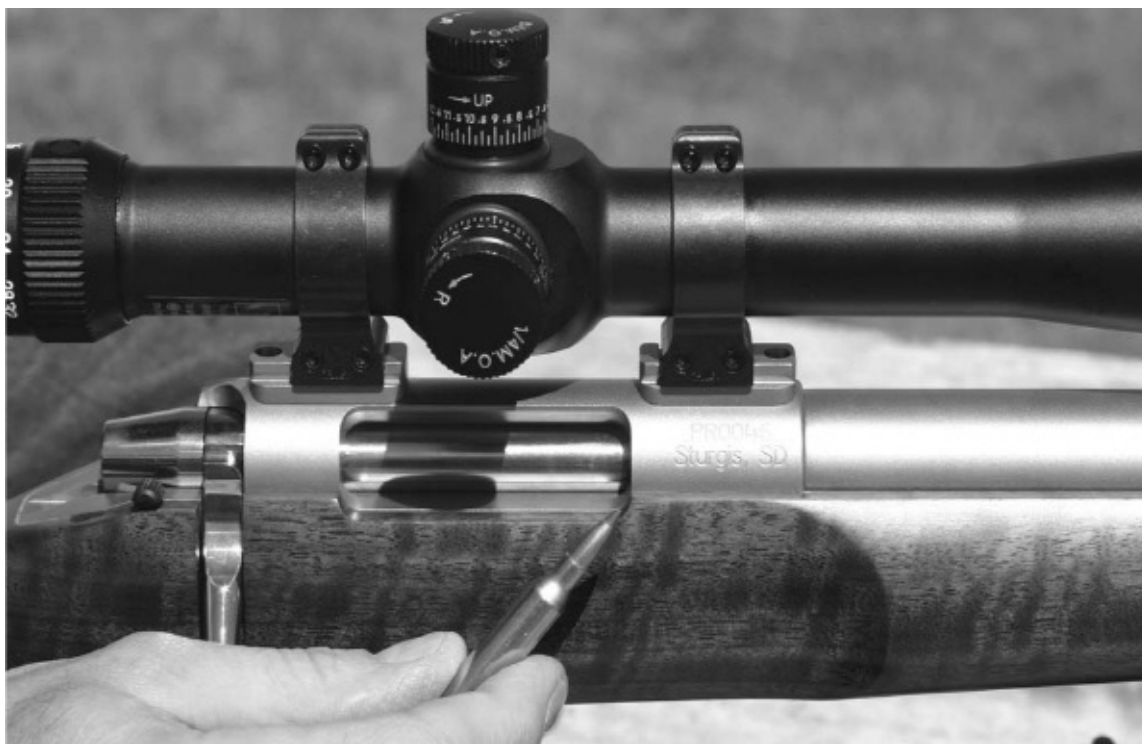
Triggers: The Second Component of Accuracy

Without a good trigger on your rifle, you're fighting all the problems of a

poor-shooting rifle, even when that rifle has a better than average barrel. I want to start by saying that I have shot so many rifles with bad triggers in my life that I can make almost any trigger workable just by “mapping” the thing as I work with it. Triggers are the link between the cartridge and the barrel and when sending the mail out of that pipe, the better the trigger, the better the accuracy.

For example, I shoot a little Remington Custom 40X 22 rimfire that with its short Hart barrel, and tuned 40X trigger will shoot one-hole groups on paper all day long at 25 yards and a rough hole at 50 yards. When I bought that rifle, it had been a project rifle at the Minnesota School of Gunsmithing. The young man who built it had done an outstanding job and even though the rifle is now almost as old as I am, I wouldn't think of parting with the little dead-on 22 LR rimfire shooter.

When I buy a fancy-grade rifle – which is not often given the kind of money a writer brings in – I try to get that rifle to my gunsmith for trigger work right away. Trigger work even on a factory trigger does not have to be expensive. My local gunsmith will dress up a trigger by taking the creep out of it, lightening the pull, and producing a nice even let-off for about \$30. That's a low price for accuracy gain each and every time I light the rifle up. I figure just by reworking a trigger I can pick up at least one-quarter inch MOA or better from that work. At a downrange target, that can add up to a miss or a hit on a speed goat, mule deer, or old song dog standing far off.



Feeding a 204 Ruger Dakota rifle during a test shoot on the range. Trigger, barrel and stock are first class all the way.



Shooting Dakota Rifles in a friendly competition at the Ramshot shoot in Miles City, Montana, in

2005.

In most cases, your custom rifle – if you're lucky enough to afford one – will already have a good trigger, and if not the manufacturer has goofed up someplace along the line, and that rifle needs to go straight back to wherever it came from. In the out-of-box department, triggers can vary, as some rifle manufacturers pay more attention to the company's legal department than to hunters' needs. We like to call these triggers "lawyer triggers" because it takes a tow truck and cable to touch them off, or so it would seem at times. Heavy triggers don't go off as easily, and that's the rationale behind a heavy 8-lb. pull on a factory rifle trigger. The bottom line: the whole mess is not as likely to end up in court as when someone shoots his or her foot off due to a light trigger pull on a factory rifle. When you buy that factory rifle with a rough or heavy trigger, see your qualified gunsmith for a trigger job.

Having a custom trigger installed in your over-the-counter rifle is still another option, but don't think these systems come cheap. A good trigger can cost hundreds, and it is one reason the custom rifle adds up so quickly in terms of the bottom line. Triggers such as Jewell, Jard Inc., or Timney are upper crust, but believe me those systems will be a delight to shoot and will cut inches in bullet group accuracy off your long-range targets.

Learn your trigger well. It makes a big difference in downrange results. When you get that new rifle home, be it a custom or factory-built gun, the first thing you need to do is to start learning that trigger. Every trigger has its own set of physical attributes, and the only way I know of to get the feel for that trigger is shoot the rifle, and shoot it a lot. A good trigger should not creep, but in a two-stage system, meaning a very short slack period followed by a solid feel, it should just drop away and release the firing pin. In a single-stage system, there should be very little movement prior to let off, and when that trigger breaks it is very crisp and almost a complete surprise to the shooter.

When you're on a target at, say, 450 yards and those crosshairs are all lined up, the last thing you want to happen is to have the crosshair slide to one side as you try and get that firing pin to break free and light off that cartridge because of a heavy, rough trigger. You want to control every element that deals with the shot, and when everything is all lined up and you're holding dead still while not breathing at all, crack that trigger and then hear as well as see success ahead of the muzzle.

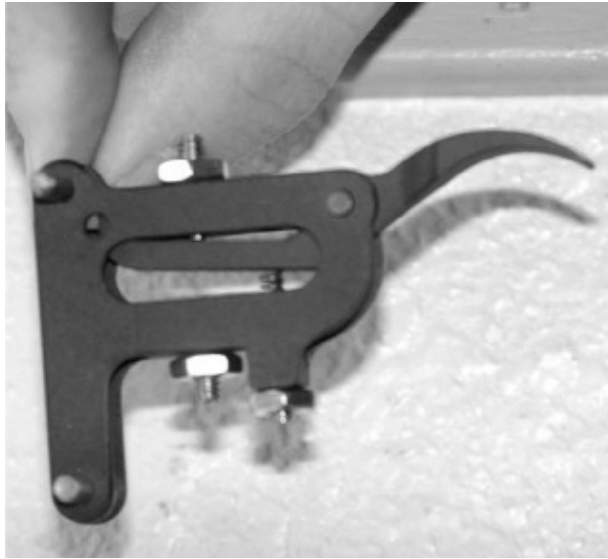


A good, light trigger pull is what you need for long-range work.



Author shooting prairie dogs with a Dakota 204 Ruger in Montana. Mounting a Swarovski 6x24x50 and a sniper reticle this is a can't-miss system clear out to 400 yards given a light cartridge.

Working with my 243 Winchester in a Remington VS heavy varmint rifle, my choice for longer-range dog shooting, I always feel in complete control when on a dog town and punching away at rats as far away as 600 yards. That's because I know my rifle like a good old book, and most of all I know that the trigger will break free at exactly the same place each and every time I send a round down range.



Trigger used on a HS Precision rifle. These are handmade in the USA. Triggers are a major part of an accurate rifle.



Savage Model 16 with an old school trigger. The new Savage Rifles use the Accu-Trigger, an outstanding out of the box system.

Factory Triggers: Good Bang for the Buck

I would be dead wrong if I didn't take into account the massive improvements in some factory triggers today. In one case, that improvement is related to a rifle that won't cost you an arm and leg to own.

Savage has developed their Accu-Trigger system that makes use of a inner trigger shoe that must first be engaged prior to the second trigger going into engagement. This is a safe and dependable system. I have tested this trigger on the Model 112 Heavy Varmint and also on my own personal Savage Model 16 223 Rem rifle. When I first took this system to the rifle range I was completely taken back by the ease at which I was able to pick up the use of this new trigger design. Accuracy is paramount in that you can adjust this system to any weight you like because that first stage trigger shoe always stays the same prior to engaging that second stage system. Half a pound is workable, and that means the final stage could just about be set off by a butterfly's wing.

With the advancement of the Savage trigger system, other manufacturers have started to clean up factory trigger as well. Remington used to have a heavy but workable trigger but has now moved to a new trigger on their outstanding

Model 700 actions. The triggers on Winchester's recent Model 70s, as of the spring of 2006, are a bit rough but very workable in terms of a nice let-off, a real aid toward accuracy even in lightweight rifles.

If you're not well-versed on set triggers, they work this way: when you are ready to shoot, you push the trigger forward, thereby setting the trigger from its normal drop weight of about three or four pounds to something less than a pound of let-off. Now, when you're ready to squeeze that trigger, simply a light brush across the shoe will dislodge the firing pin. In effect, trigger control has been minimized greatly by the set trigger.



Sako 75 Varmint in 308 Win. This Sako test engineer from Finland is running the new varmint rifle through its paces at Elk Mountain, Wyoming. It passed with flying colors, as the set trigger crunched groups to a dime size at 100 yards.



Author with a Black Hills coyote taken with a Browning A-Bolt Varmint. These Rifles have basic factory triggers and at times do need some slight tuning so as to get all you can from the rifle.

The Sako 75 is a lighter-weight varmint rifle with a set trigger, and it's also available as a bench-weight stainless steel laminated model. The set trigger is a new deal for Sako, and it took a great deal of time to get those legal eagles to go along with making that major change to their varmint rigs. Set triggers are great in the field, but they can be touchy and are definitely not for the beginning shooter, as that 9 oz. of pressure is just too light for starters.

In the event you change your mind and don't want to use the set trigger system, all that is required of the Sako 75 is a simple bolt lift or safety disengagement. Either way the trigger returns to its normal pre-set weight.

Field test shooting the Sako 75 in the Varmint Stainless Steel (SS) configuration proved enjoyable from the benchrest position. Chambering the 308 Winchester, the rifle was able to place bullets on dogs with ease well out to 450 yards. I'm sure much longer shots were possible, but 450 yards seemed to be the average long-range shots taken during our test hunt. We didn't get any paper time with these rifles, and as such didn't see any groups shot by the 308 Winchester or a few 223 Remington chambered rifles.

Judging by my test rifle's field performance you could just about place a bullet on a 250-yard dog exactly where you wanted it and achieve a solid and greatly extended 375-plus yards when those longer-range shots were possible. Set triggers are a solid addition to any accurate rifle, and the long-range system can benefit greatly from them. Looking into these systems is advisable if you're searching for the best. A set trigger is even standard on my 45-70 Sharps which goes back a ways to be sure. Buffalo hunters knew what was required of a good long-range rifle, and the set trigger was without question a part of that big-bore accuracy system.

Rifle Action Platforms: Making Accuracy Work

My first involvement with rifle actions and the stocks fitted to them occurred more than 45 years ago. At that time I was building up WWII surplus Springfields and Mausers for the local deer hunting population of north central Minnesota. Those 8mm German Mausers and 03-A3 Springfields allowed me to learn a great deal about just what bedding will or will not do for a rifle's accuracy.

In building up those bolt-action deer rifles I soon learned the extreme value of working up a good action bedding system. Lacking any sophisticated bedding back during those old-school gun-building days, you could be sure that most of those rifles would not be capable of holding anything close to a minute of angle at 100 yards.

By using a thick layer of fiberglass bedding material and driving the barreled action down into the wet surface, then allowing it to set until the material was hard and dry, I was able to achieve some of the results that are so common today as applied to many of the better rifles in commercial production. Often I guess more by luck than brains, I was able to get a Springfield 30-06 to drive 110-grain coyote bullets inside one-half MOA, even from in those old two-groove late-production military rifles. More than one song dog, fox, or crow met its maker to

the whack of the old '06, and in some cases those actions and stock systems were good enough to deserve beavertail forends, straight target stocks, and better grade glass sights during the 1960s and 70s. Seldom did I ever observe a rifle that shot well lacking a solid platform bedding beneath the action.



Hand work at Accurate Innovations is critical so as to meet every requirement of an accurate bedding and stock system.



Ben DeRuyter, owner and President of Accurate Innovations of Rapid City, South Dakota. Ben's machined aluminum bedding system is state-of-the-art and will pull in groups at least 50% of what you're now shooting. I shoot these bedding blocks exclusively on my custom-stocked rifles.

High Tech Bedding

I guess the first real class-act bedding system I owned came about through the Remington Varmint Synthetic 22-250 and 243 Winchester I have discussed previously. HS Precision stocks, wisely bought by Remington and others including CZ for their factory rifles, retained the pillar bedding system that will not allow the action to shift or change zero. Group sizes with both of these rifles have always been under one-half MOA at 100 yards and have never suffered a change in zero from year to year.

A good deal of attention has turned to synthetic stocks in rifles today, and for good reason: they are efficient and produce accurate rifles. Some hunters on the other hand are turning toward other innovative ideas as in different types of wood stocks employing full-length aluminum bedding systems. Enter Accurate Innovations of Rapid City, South Dakota. Headed up by young, free-thinking

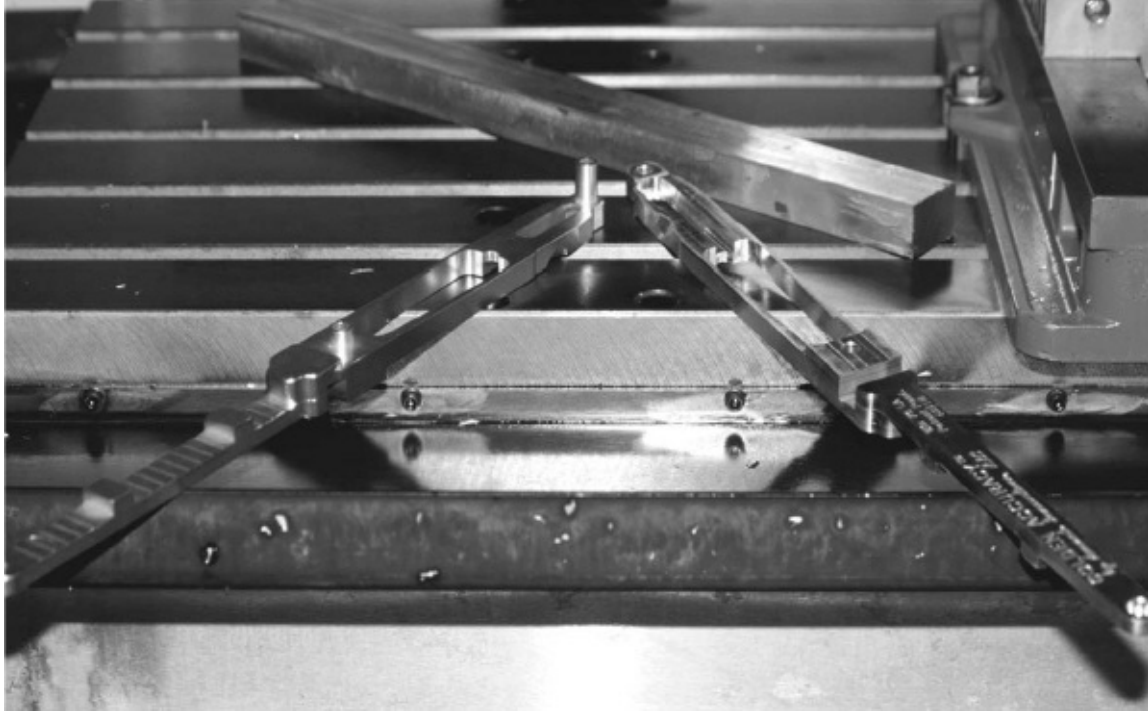
Ben DeRuyter, Accurate Innovations makes use of all types of wood. The kicker here, however, is that they install a full-length aluminum bedding platform in these stocks, thereby making them recoil proof and deadly accurate in terms of group shooting, zero retention, and refined long-range capabilities.

My first exposure to Accurate Innovations came when I was restocking my very accurate Remington action/Hart-barreled 40X. The stock was as old as I am and had developed some cracks in the forend section and had lost a piece of wood under the right side of the magazine well. Let's just say the rifle had been hunted hard often over a 40-year period and was showing her age.

Taking the sick rifle to Ben, I was informed that by leaving my old stock with Accurate Innovations they would be able to computer-pattern a milled aluminum bedding frame, and install it in a new walnut stock of the same dimensions as the stock that I was about to discard as just plain used up. The whole deal sounded good, and I gave the rifle to Ben so he could begin reconstructing the 40X 22 LR.



Author with his Remington VS in 243 Win. This rifle has a factory trigger that is outstanding right out of the box. Sub-1/2 MOA with good ammunition.



These are bedding blocks machined from solid aircraft grade aluminum bar stock. Note the blank bar at the top of the photo. That's where the Accurate Innovations system gets its start.



Ben sets up the fully automated milling systems when cutting a bedding platform for a given rifle stock.

Upon getting my finished rifle back, I set out on a hunt with the boys at Federal Cartridge, and as such ran some back-to-back shooting against the

current hot dogs in 17 Mach II and 17 HMR. My choice for the 40X was the CCI Stinger, a round that was known to have some problems in some rifles regarding accuracy. Well, that wasn't the case here as the Accurate innovations 40X just shot circles around some very high-grade equipment and paired ammo. At 165 yards in a stiff crosswind it held its own just fine against the field. I was impressed and very pleased with my choice in restocking to say the least.

In Chapter Two of this book I made reference to my 25-06 coyote rifle and described it as a deadly long-range shooting tool. At that time I also referred to the Accurate Innovations system also because like the 40X 22 LR, it is an outstanding platform for accuracy as applied to that custom-reworked Remington Model 700 long-range coyote rifle.

Why are these types of systems that use pillar bedding with aluminum inserts around the action lugs, or a full bridging system like those of Accurate Innovations, so effective? Because when the rifle fires, the barrel vibrates in a way or wave that we call harmonics, and the action itself along the length of its side rails will flex as though it were made of rubber. The flexing is very slight. in the tens of thousandths of an inch, but it is enough to change the bedding alignment of the action to the barrel, and the next shot will cause the barrel and action to vibrate differently. This difference in bedding alignment will change bullet impact from a good deal to a small amount. Any change is not good, however, in that consistency changes or, should I say, becomes nonexistent.

Any one of three basic systems of bedding a rifles action are good systems. I have my preferences, obviously, but that does not mean the others are bad. Glass as in fiberglass resins and hardener is a good system that, as I have already discussed, was used by this shooter for many a year prior to the development of the aluminum bedding methods. Why stay, or move to aluminum? Because I believe it is the best material in use today to house a barreled action when you want top-end accuracy. This bedding material can be laser-cut to the final millimeter in size and installed in a synthetic or wood stock. The wood being the warmer of the two, you have a system that drives out all variables in terms of final rifle accuracy. If the full-length bedding has any drawback it is that it will increase rifle weight slightly, but on the other hand when a mountain rifle like a Remington Model Seven gets a facelift with this bedding system its weight increase is not even noticed – but its newfound outstanding accuracy will be. I have found that these aluminum bedding systems will consistently pull in the group accuracy of a Remington 700 a full one-quarter inch almost all the time. Remington actions, with their round undersides, like the long and high contact

point system very much.

Remember this: your gun won't be exactly like your buddies' even when you're shooting the same rifle. Don't rely on a gunsmith or friend to zero your rifle. That's a mistake right from the start. You need to learn that rifle and every little trait you can discover about it. The gunsmith isn't the owner, so you need to take charge and become a real buddy to that shooting piece. Practice until everything becomes secondary. When it's time to send the mail downrange, often you're short on time in terms of a target hanging around, and you're going to be relying on memory training and not step by step motor skills. It is what you have learned that will get you through a shooting scenario.

That is how I trained cops on the street for years, and how I regard and view rifle training for hunters as well. What you know instinctively, you will do without having to think about it. Lacking that knowledge, you're frozen in time when the big deal goes down. Long-Range shooting will return many gifts that won't stop giving over a lifetime of open-range rifle shooting.

Chapter 5

Applied Physics And The Rule of 400

When we start to think of shooting long-range, and I mean really long-range, we are taking the extreme case and moving that bullet past 400 yards into a new world of unknowns. That is because at 400 yards, regardless of the rifle (except for the super guns in 50 caliber BMG, or possibly the new Barret 416 Supersonic), nearly all projectile velocity starts to die off very quickly and the drop factor really rears its ugly head.



If you have trouble believing this, just open any factory ammunition catalog and run down the list of rifle cartridges. Pick one. Now move to the far right and check out the remaining bullet velocity and drop as it passes the 400-yard mark. In some case the manufacture will not even list a load past 400 yards because it has dropped that far off the performance grid.



This hunter is shooting a 6mm x 284 on long-range coyotes. He owns that valley out to 600 yards or more, but he must know the rifle/bullet well to get that kind of performance from his gun system.

About the only way to fight off the negative effects of the “400-yard rule” is to move your zero or point of dead-on aim farther out from say 100 to 200 or even 300 yards. As you move that zero point you do gain in trajectory, or rainbow effect, in that the bullet tends to flatten out as opposed to a close-range dead-on zero. Remember, bullets start to drop the moment they leave the barrel. If you shoot a rifle bullet and at the same time drop the same bullet from a height that is exactly the same as the rifle’s chamber, when that dropped bullet reaches the ground your bullet, if shot from a level bore, will also hit the ground.

By example let us take a load directly from Federal’s 2006 catalog, in this case the outstanding 308 Win with a 168-gr. Sierra MatchKing hollowpoint boattail bullet. This bullet is designed for long range, and when I was in the police service and training, was sought after by members of our sniper units and other metro departments when tough long range tests, as in shooting across long distances and through glass windows, came along. Military snipers also favor this long-range bullet because of its basic grain weight, velocity retention, drop factors, and energy transfer to a warm target. It could also have something to do with the fact that the 308 is also a light machine gun round, but that’s another story.

Bullet Drop: 308 Winchester with 168-gr. Sierra MatchKing

(Federal Factory Load)

Make: Federal Premium 308 Winchester (7.62 NATO)

Bullet: 168-grain Sierra MatchKing Hollowpoint Boattail

Barrel: 30-inch Test Barrel

Range (Yds.)	Velocity (fps)	Wind Drift in Inches (10 mph Crosswind)	Mid-Range Trajectory (Inches)	
			100 Yd. Zero	200 Yd. Zero
0	2600	0	-	-
100	2410	0.7	Zero	-plus2.3
200	2230	3.2	-4.4	Zero
300	2060	7.6	-15.8	-9.3
400	1890	13.9	-	-25.9
500	1730	22.9	-	-52.1

Keep in mind that this is a preferred load among long-range shooters. Now, when we observe the massive drop beyond 400 yards, the concept of the rule of 400 stands out as clear as can be. When shooting at long range, don't assume that all that power and energy are going to stay with you all the way to the target. Past 400 yards it is impossible.

All right, you're saying, why not move up to the big guys in the alley? For that comparative test, let's take the 300 Win Mag as an example. Now we are shooting a very large fuel cell and a bullet similar to the one used in the 308 Win above. This is a very valid real-world comparison.

Bullet Drop: 300 Winchester with Nosler 168-gr. Solid Base Boattail (Federal Factory Load)

Make: Federal Premium 300 Winchester Magnum

Bullet: 165-grain Nosler Solid Base Boattail

Barrel: 30-inch Test Barrel

Range (Yds.)	Velocity (fps)	Wind Drift in Inches (10 mph Crosswind)	Mid-Range Trajectory (Inches)	
			100 Yd. Zero	200 Yd. Zero
0	3140	0	-	-
100	2910	0.6	Zero	-
200	2700	2.6	-2.6	Zero
300	2470	6.2	-10.0	-6.1
400	2250	11.3	-	-17.7
500	2120	18.6	-	-36.0

In this case, this pair of 30s in different cartridges and at much different velocities both end up looking darn weak at the 500 yard mark. Are adjustments for elevation and windage required for both here? You bet.

Can a guy or gal work with such ballistics? It can be done, and it is done all the time. The learning curve requires learning your rifle, and there is no better way to do that than to shoot at long range and shoot often. By way of example, my friends who were unit snipers on entry teams and special units shot every other week for at least a half day on the 200/300-yard range. Shooting cold barrels so as to keep groups very tight, these snipers trained for one-hole groups at 200 yards, duplicating the taking out of a very bad guy in a hostage situation with an eye hit or a hit just above the lip. However, when they pushed those Remington M-24 military sniper rifles much beyond 300 yards, things got dicy because the bullets started to have a mind of their own.

Can you improve on long-range ballistics at all? Yes, to my way of thinking; just review the ballistics associated with those lighter weight 25-calibers. Here again the new 25 WSSM, or my old tried and true 25-06, stand tall in that both will shave off drop at 500 yards and greatly improve bullet impact levels at 400 yards. Here are again the details.

Bullet Drop: 25-06 Remington 85-gr. Nosler Boattail Ballistic

Tip (Federal Factory Load)

Make: Federal Factory Load

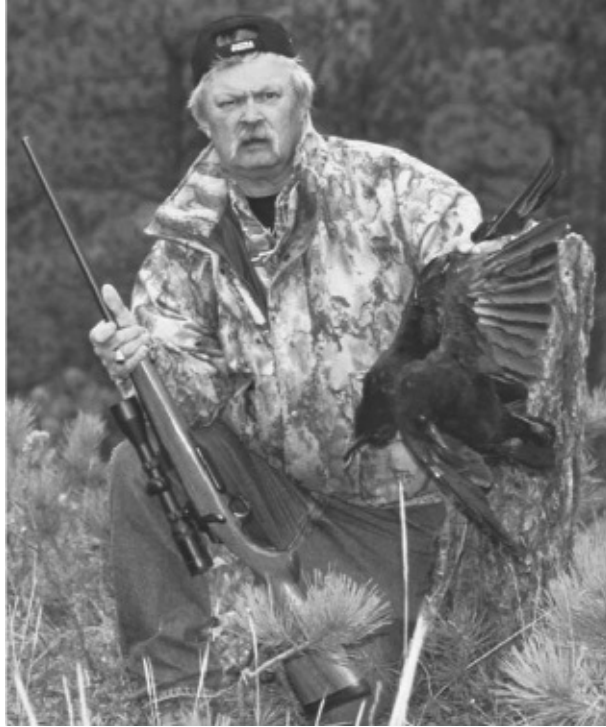
Bullet: 85-grain Nosler Boattail Ballistic Tip

Barrel: 30-inch Test Barrel

Range (Yds.)	Velocity (fps)	Wind Drift in Inches (10 mph Crosswind)	Mid-Range Trajectory (Inches)	
			100 Yd. Zero	200 Yd. Zero
0	3350	0	-	-
100	3230	0.7	Zero	-
200	2930	3.0	-1.8	Zero
300	2640	7.2	-7.8	-6.8
400	2380	13.3	-	-17.5
500	2130	22.0	-	-35.8



Author glassing a dog town in western South Dakota. Ranges here can get very long very fast. Moving through the 400-yard range is easy and the shooter needs to be very aware of all the conditions that can cause him or her to miss a shot.



Author with a 223 Ruger M-77 and a 300-yard crow. Keeping light rifle cartridge performance inside 400 yards will assure the hunter of good results.

Shooting a bullet that is 80 grains lighter than the 300 Win Mag, this load in 25-06 will not match the big magnum's energy. However, energy is not what we need here, but rather reduced or flat trajectory upon downrange impact. In effect, the 25-06 will do for the longer-range shooter to at least 500 yards what the much heavier magnums will do to the same range.

This is why when you get into the Western states, calibers as in the 25s and 270s are often popular among locals. Over time these hunters have learned the difference. Most of my coyote-hunting buddies on the wide-open buffalo grass prairie tend to shoot the 25-06 and for good reason.

Being a sniper or hunter, and over history both have been often the very same in the long run, the rifleman needs to master sight adjustments, mildot application, and just good old Kentucky windage. Much after 400 yards, as we have seen here, things start to fall apart quickly. I tend to believe that far too many super-long-range kills are made on word processors rather than in the real world of hunting. Luck can be a major factor as well here. Just the other day I was talking with my friend Scott Grange at Browning Arms about a coyote kill he had made at almost 500 yards downrange in the mountains. Like myself,

Scott would rather chase coyotes than hunt bull elk most of the time. When Scott finished his tale about his outstanding 25 WSSM kill, he smiled and stated “A lot of this stuff is luck, you know.”

Yes, luck is a part of the equation, but also a good deal of skill can be trained into the shooter to cut those odds quite a bit. Scotty, as I call him, is a deadly long-range shot to say the least. He shoots from the gut and not the text book. That’s the difference between guys who shoot long often and those who just visit a range every now and again that retains a 200-yard backstop.



South Dakota on the west side of the Missouri river. Range is a wide-open option when shooting this kind of country. The 400-yard rule is always in effect out here.



In tan and holding his black Remington 700 custom rifle is Greg Hendricks, mentioned elsewhere in this book. Greg, the 1000-yard competitive rifle shooter, is known to study a 600-yard shot with his basic 223 Rem for an hour prior to making it, often as a one-shot kill, when winds are down and shooting conditions are good. His partner here is Jerry Martin, shown shooting his Ruger MK II in 223 Rem. Often the team will spot long shots for each other.



Author with a South Dakota speed goat. This winter meat doe went down at almost 400 yards via a Winchester Model 70 chambered in 243 wSSM, and a handloaded Barnes 85-grain XLC bullet. Learning to shoot long-range can add up to real benefits during the big game hunting season.

Overview of Some Good Long Range Cartridges

Though we've already discussed a number of long-range cartridges, let's take a closer look at some of the best of them.

25-06 Remington

Once a dedicated wildcat cartridge, the 25-06 came about prior to WWII, and found its niche when surplus powders were turned loose to handloaders after the war. Being a necked down 30-06 case paired with a 25-caliber bullet this speedster can hold velocity, energy and flat trajectory well out to 400-plus yards. Nowadays factory cartridge brass is an easy find, as is necked-down (one step) 30-06 brass, and loads and bullets are almost limitless. My strong vote goes to this choice in a long-range rifle/cartridge system.

6mm x 284 (Wildcat)

The 6mm x 284 is a home-rolled cartridge based on the 284 Winchester. At this time it is the rage among many bench and varmint shooters. The short case makes for a short action throw, and that can mean accuracy with less action flex during firing. Ballistics obtained by the 6mm x 284 are about the same as those of the 6mm x '06 wildcat. The case is easily formed from 30-06 brass, and except for its need for a longer action, the 6mm x '06 returns about the same downrange results as the 6mm x 284. All rifles designed for the 6mm x 284 need to be hand-built as no off-the-shelf factory rifle is currently chambered for the cartridge. This can add up in both handloading expense as well as the basic cost of the rifle. a deadly variant cartridge and accurate your going to need deeper pockets to keep this varmint killer up and running afield.



Author zeroing his 243 WSSM prior to a hog hunt in Texas. This rifle/cartridge took several 400-plus yard hogs during this specific event. Bullet: a 64-grain factory Power Point.



Using light rifles and cartridges at closer range can be less aggravating when taking a day on a prairie dog town, or woodchuck patch.



Here a shooter and spotter are working a prairie dog town at long range. The spotter is required to get the shooter dialed in on target using the “walk in” method of getting a bullet into the kill zone.

7mm Remington Magnum

This is my choice as a prairie dog long-range rifle. I have added high magnification glass and have handloaded lightweight 110-grain bullets for use in my personal “big seven.” With a spotter required due to recoil, this rifle/cartridge will really deliver the mail, but handloading costs are high with the heavy case and high volume of powder. If I were starting from scratch I would select a different option, probably the 300 Win Mag.

270 Winchester

This is a very popular rifle in the western states and for good reason. Between the 30-06 crowd and these guys who shoot the 270 Win, the fight still rages on as to which is the better. Ballistics associated with the 270 Win are long-range all the way, and this cartridge doubles nicely as a heavy big game round as well.

30-06 Springfield

This cartridge, for you younger shooters, is the gold standard by which

everything else is judged here in the USA. The '06 was our military cartridge from WWI through the Korean War, and even on to special operations well beyond that “police action” many years ago. American snipers such as Carlos N. Hathcock (alias White Feather), a legend among Marine snipers, preferred it for ultra-long-range sniping in Vietnam, and both military and police snipers still use it to this day. I believe more wildcat cartridges have been designed off the 30-06 case than any other. If I'm wrong please show me, because I can't find any information to prove me wrong. In my mind the good and very old 30-06 is just about perfect.

308 Winchester (7.62 mm NATO)

Our current light machine gun cartridge and very popular among military and police snipers largely because it is military in origin, the 308 Win is a solid choice as a long-range cartridge. After owning several two Remington VS rifles chambered in 308, I can see why the military has based much of its sniper training on a variant of this rifle (the M-24) also chambered in 308. When any cartridge is or has been military issue, it is assured a very long life in the game of shooting. The 308 Winchester is no exception to this rule.



Even at a zero range of 100 yards the 50 BMG will still start to drop almost 3 inches at 223 yards. Nothing is safe from the laws of gravity.



In big country, range is always a problem and knowing the ballistics associated with your rifle and cartridge will aid you greatly in being able to hit those far-off targets.

300 Winchester Magnum

This is the gun that won South Dakota, or so some of the local cowboys say. The 300 Win Mag is king out here because it can drop elk and send bullets to 1000 yards accurately. If I didn't shoot the 25-06 around Piedmont, my home base in this western state, my choice would be the 300 Win Mag. This is a big-country cartridge and that's what is needed when you leave the protection of the 40-acre plots of the eastern states and move out onto many thousands of acres that don't even have a high blade of grass in the way of a bullet.

50 BMG (50 Browning Machine Gun)

This is the big kid on the block and it's reserved for heavyweight work. Period. With a bullet that can exceed 600 grains traveling at over Mach I after

1000 yards, the big 50 BMG has picked up quite a following among long-range shooters of late. While this is a cartridge not to be chosen by everyone for sure, it is an interesting round that will be given a large section of its own later in this book.

The 50 BMG is king of the hill, bar none. Anything larger would require wheels and would need to be towed into position. The current Viper 50 I'm shooting tips the scales at a light 24 lbs. That's unloaded weight, without a scope.

Chapter 6

Light Rifles & Cartridges: The Seeds of Long Range Shooting

The subjects in this chapter center around the use of rimfire and subcaliber centerfire cartridges, and the rifles that fire them. Never set aside the small-caliber rifle as less than important. Rimfire rifles have served hunters, ranchers, and farmers throughout the long history of firearms ownership in America. When wars break out, the selected snipers have often been farm kids and cowboys who were raised with 22 rimfires in their hands.

These cartridges can produce some outstanding results in the right shooter's hands. I have personally witnessed local South Dakota shooters do some amazing things with a single shot 22 rifle and a handful of cartridges. These reviews contained here are real-world examples of how subcaliber rifles and cartridges tend to get the job done. By reading these accounts you can greatly increase your general knowledge about exactly what to expect from different cartridges in the small-caliber class. It is not always best to turn to the most massive caliber you can find to send big bullets way downrange. At times, more can be learned about quality shooting methods from a simple 22 Long Rifle cartridge, and a \$75 rifle, or an easygoing light small-caliber centerfire cartridge field rig.





rimfire loads in both 17 Mach II, 17 HMR, and 22 LR can provide a great deal of hands-on training for the beginning long-range shooter. These are low in cost and effective to 200 yards when correctly used.



Author shooting the first Remington non-production 204 Ruger as a hand-built test model used during the early reviews of the new 204 Ruger ammunition in Wyoming. Everyone knew that this cartridge was going to be a big hit with varmint hunters.

204 Ruger: The New 20 Caliber for the 21st Century

Hornady designed and built it; Sturm-Ruger put the first rifle under it; and the 204 Ruger came to life as a new and very effective varmint cartridge for the 21st century.

I got my first look at the 204 Ruger while prairie dog hunting with Hornady in western Wyoming during 2004. The rifle was a worked-over Remington Model 700 ADL in a plastic stock that had been brought together just for the hunt by the Remington custom shop boys. Hornady was in effect still taking a look at field results regarding the 204 Ruger cartridge, in that very little information had as yet been released, and other than the Ruger M77 bolt-action rifles in Mark II designs, there was not much more to take afield and shoot when reviewing the new 20-caliber. It was clear at that time, however, that Remington and a few other rifle manufactures were serious about chambering the Ruger 204. This was a fast moving 4000-plus fps bullet that was being fired from an upgraded 222 Rem case measurements. When I previously shot the very first cartridges in 204 Ruger, they were so fresh off the production line that engineers were standing around picking up the spent brass as it hit the deck. These loads were so new that Hornady didn't have enough brass manufactured to meet the needs of research and development. I had found that the 204 Ruger was a very accurate cartridge from the start – enough so that it got my complete attention from that experience on the benchrest 220 meter range, at Pasa Park in Quincy, Illinois.

Several months after that first hunt, a package arrived on the local UPS truck. It was a long brown box that contained a brand new Remington Model 700 Light Varmint (LV) chambered in what else but the 204 Ruger. Here in South Dakota, a rifle is pure western culture and can sink or swim based on real-world performance. The Remington LV in the Model 700 bolt design in the 204 met my expectations right from the start. This was going to be a fun project held together with a great new cartridge and an equally well-designed rifle by Remington.



Author with a bobcat taken with a 40-grain 223 Rem round. Light bullets, if correctly used, can get the job done. (Rifle is a Savage Model 16 short action.)



Author's selection of bullets for the 204 Ruger during testing.

First up in terms of running the 204 Ruger on its LV configuration through its paces was to take a crack at some local prairie dogs near my home in western South Dakota, but before that there was additional work that needed to be done. With a run to the Lead, South Dakota, rifle range, some zeroing work was completed with both the 40-grain 204 bullet in a V-Max design and its little brother, the 32-grain V-Max bullet. Remington had sent their Premier AccuTip cartridges in both grain weights. The bullets were manufactured by Hornady for Remington and retained a gold tip versus the orange tip found on Hornady ammunition. Is there a difference in the remainder of the bullet when comparing the two brands? Not much, if any, as it is my understanding that all the 204 Ruger ammo, except for Federal and Winchester ammunition offerings, comes directly out of Hornady.

Mounting a Pentax Light Seeker 4x16 glass sight onto a set of Weaver bases and rings on the Remington LV produced a well-balanced rig. The rifle was easy to control on the bench and retained a workable trigger as well. After some initial zeroing I proceeded to shoot 100-yard groups that measured 1.044-inch for five shots, and .439-inch sub-MOA three-shot strings time after time. Shooting both the 32-grain and 40-grain pills produced a net zero loss of target view as in recoil blackout.

With the 40-grain pills wind drift is reduced greatly, and the ballistics are close to what is observed when shooting the 223 Rem and a 40-grain V-Max style spirepoint bullet. On one prairie dog hunt I pushed that first Remington 700 test rifle to almost 500 big yards with a Hornady 40-grain 204 Ruger bullet. The point here is that the 204 will do the work if the shooter behind the rifle can dope wind, read yards, and shoot straight.

Handloading the 204 Ruger and Living with the Super Fast 20-Caliber

With the 204 Ruger being such a young cartridge, we were forced to accept factory loads. With recent developments from several powder manufactures and bullet offerings from Berger Bullets, Sierra, and Hornady, we are starting to see the handload possibilities associated with this hot new varmint hunter's tool.

I, for one, like to work with printed, published handloading data whenever I can. For one thing, it takes an element of chance and deadly surprise out of the handloading equations. Secondly it is like load building with very solid ground work in place. While we can buy special computer programs to fill in the blanks

at times, nothing can compare to the pressure tested and chronographed results published by powder manufactures or bullet designers.

Therefore, it is with that thought that I will dive head long into some experimentation surrounding the 204 Ruger based handloads. However, I will stay with published data as much as possible. That data as used here will enable you to duplicate my handloads at will. With restrictions based solely on the availability of the various components that will go into the individual handloads, or how your rifle tends to take on the given load option, you should be able to duplicate and shoot much of what you read here.

Also of importance here is the fact that I also spent a considerable amount of time in the field with Hornady engineers shooting the Ruger M77 MKII in 204, and that custom Remington pre-market Model 700. Lastly, that first Pasa Park, Illinois, event that introduced the 204 Ruger allowed me to start my small, but valuable, cache of brass that has served as the starting point for the following handloads.



Author shooting Dakota Arms rifle in 204 Ruger during a Montana dog hunt. Even the upper end rifle makers were getting on board as the 204 Ruger gained a reputation for accuracy and effectiveness afield.

Make no mistake about it, the factory load offerings in 204 Ruger are good solid products. At the time of this writing, Winchester has just introduced the new 204 Ruger loading with a 34-grain jacketed hollowpoint bullet (JHP). This is now a completely new hollowpoint jacketed bullet design that will fill a new role in the 204 Ruger. Hornady is about to turn loose a 45-grain SP game bullet with a thicker jacket and softpoint lead tip as well. Add the Federal Cartridge 39-grain Sierra to this list of advancing factory loads, and you can quickly see that the 204 Ruger is not going anyplace within the shooting sports industry but up.

To my way of thinking it makes very little sense to build handloads that can't measure up to factory-rolled fodder. To date I have taken fall gobblers to 220 yards with the 32-grain Hornady V-Max bullet, shot the new Winchester loads with 100-yard three-shot groups inside .421 of an inch, and rolled up prairie dogs to ranges exceeding 500 yards with the 40-grain Hornady V-Max. With those previous events in mind, the requirement in handloading was to equal, or exceed, the factory load offerings, and do so under a tight budget if at all possible.



Remington LV in 204 Ruger and Hornady V-Max 204 factory loads. The 204 Ruger in this rifle is a nice carry option for varmint and medium long-range shooting.



Author benchrest shooting the savage Low profile Model 12 during accuracy testing.



Author's partner John Anderson with a slung Remington Light Varmint LV in 204 Ruger.

Rifles for the 204

I guess I got lucky as the new 204 Ruger was unfolding across the industry, in that in no time at all I was offered three class-act rifles chambered in the new cartridge. First off was the Savage Model 12 Low Profile weighing in at almost 11 -pounds The heavy varmint rifle by Savage, mounted Weaver bases and rings and a varmint-style Pentax Lightseeker 30, in a 6x24 magnification. Loaded, this rifle is a handful, and I selected it as the bench rifle for all of my handload testing. Keeping the rifle standardized gave every handloaded round the same level playing field when it came to shooting groups on paper. The second rifle in the battery was that previously discussed Remington LV, or Light Varmint. Now with a couple of new rifles now on board for the project I took on still a third rifle that came to me by way of a hunt with Browning. Scott Grange of Browning was good enough to ship out the Browning A-Bolt in a Stalker configuration and chambered, of course, in 204 Ruger. I had shot the A-Bolt in a Grade II Browning during the hunt with these folks previously, and after plastering sub one-half MOA groups to 100 yards with the new Winchester PSP 34-grain pills, I was sold on this addition to my test base. Mounting Burris rings and bases, with the addition of a Ramshot 6x16 varmint scope in the 30mm tube, the Browning A-Bolt was up and ready to tackle paper targets, or whatever came its way afield. As a final 204 Ruger rifle the Kimber 84-M in the Pro Varmint got the call. Here was a field rifle that would see a great deal of work, in that it shot as well as the heavy barreled Savage Model 12 right out of the box (sub one-half MOA), retained a very good loaded field carry weight of under six-pounds, and balanced between the hands for running or off-hand shots like a dream.

In terms of sights, the Kimber rifle mounted the Kimber “turn-in” bases and rings, then locked down a BSA 6x16 scope with an on-demand and rheostat-controlled lighted reticule. The BSA was not a high-dollar system, but it had dusted no less than a pair of 200-plus-yard long-range gobblers by way of that previously discussed 32-grain Hornady 204, and hit both right at the spine, leaving no meat damage whatsoever. I then proceeded to roll up prairie dogs near my home located in the Black Hills of South Dakota. These dogs were shot at 400-plus yards. With a very crisp 3-pound trigger that compared to the Savage Accutrigger, the Kimber made a good showing of itself.

Hodgdon Powder Gets The Call

In the search for load data covering the 204 Ruger I locked onto Chris

Hodgdon of the powder company by the same name, and in no time at all via my computer's e-mail, I was sitting on a stack of starter data that would serve to build my first 204 Ruger handloads.



Kimber M-84 in 204 Ruger.



The 204 Ruger in a Ruger MK II Heavy Target/Varmint being field tested in Wyoming. This cartridge and the rifle were run through many tests prior reaching the market. On prairie dogs it was pushed to 500 plus yards with success.

It would seem that Hodgdon had been doing their homework and was very much ready to deal out tested data so as to get handloads up and shooting in the new flat shooting fast-mover by Hornady and Ruger. By the way, anyone can access the Hodgdon loading data for the 204 Ruger. All you need do is bring up their website (www.hornady.com) and take a look.

Developed from the basic 222 Magnum case, this cartridge is a very user-friendly fuel cell in that it takes to handloading like a dream. The 204 Ruger brass case doesn't suffer from excessive brass flow during the first couple of reloading cycles, and it is simple to run through sizing and bullet seating dies, in this case the Hornady New Dimension two-die set.

Turning to Varget and H335 as propellants, I built the following series of handloads. What I was trying to achieve were loads that shot accurately, maintained good velocity, and didn't turn cases into misshapen metal stumps with blown-out primer pockets.

204 Ruger handloads

Courtesy Ballistics Research & Development, Piedmont, SD

Load	Bullet/Powder	OAL (")	MV (fps)	Pressure (psi)	Group (") @ 100 Yds.
1	Hornady V-Max 32 gr./Varget 27.0 gr.	2250	3557	38300	.535
2	Berger H.P. 35 gr./Varget 29.0 gr.	2254	3812	53100	.275
3	Hornady V-Max 40 gr./Varget 28.0 gr.	2.290	3647	55100	1.122
4	Berger H.P. 50 gr./Varget 26.0 gr.	2.300	3311	55200	.236
5	Hornady V-Max 32 gr./H335 28.3 gr.	2250	4123	54800	.299
6	Sierra Blitzking 32 gr./H335 28.3 gr.	2270	4044	N/A	255
7	Berger H.P. 35 gr./H335 27.5	2230	3915	56600	.398
8	V-Max 40 gr./H335 26.8 gr.	2250	3738	56700	1.133

The selected rifle for these handloading tables was the previously mentioned Savage Model 12 Low Profile. This heavy target model featured the Accu-Trigger system and that large 30mm varmint/target Lightseeker Pentax glass. Using the new Caldwell benchrest I adjusted as much forced creep out of the crosshair sight picture as possible, then tried to pull everything possible from the handloaded fodder to 100 yards on a warm, slightly breezy morning. Elevation at my range was over 5000 feet, giving me some added edge in terms of a lower bullet resistance and drag to heavy air.

Regardless of the wind, elevation or whatever, the Savage Model 12 shot the first batch of handloaded fodder beautifully. I simply could not have asked for more from both rifle and loads. Here right out of the gate I had good velocity, no pressure signs at all, and accuracy. That made a very happy handloader, and I believe it is because of a very well-designed varmint cartridge and rifle.

In the early accuracy load development, the Berger H.P. 50-grain bullet ahead of 26.0 grains of Varget was a clear winner. Why? This 50-grain pill requires a 1:8 twist to stabilize well, and the Savage Model 12 retains a 1:12 twist that is best suited to lighter bullets. Well, it would seem that shooting at 5000 feet above sea level, and at a room temperature of 70 degrees, with a uniformly fast load of 3311 fps, this bullet decided to run true all the way to the 100-yard target.

In truth, as you will see a bit later on, the 50-grain Berger is better suited to a fast-twist bore. When tested at a bit lower altitude with a different powder and less velocity (Load number 12) that bullet came in key-holing on its side at 100

yards. If you need to shoot the 50-grain Berger, shoot it fast at high temperature and well above sea level. If you don't have that combination of conditions, forget it.

In terms of turning up the heat, the number 6 load in a Sierra BlitzKing 32-grain, pushing along at 4044 fps and cutting 255-inch holes in the 100-yard target backer, was a clear winner. This is a prairie dog killer bar none, and I'm loading a pile for field work on the next dog hunt I take here in the rifleman's state of South Dakota. As it was to turn out later, I was going to see a whole lot more of the Sierra BlitzKing 32-grain bullets before this project was concluded.

Turning to Other Propellants

With Chris Hodgdon helping on his end at Hodgdon Powders I was soon presented with a list of IMR powders that had been found workable in the 204 Ruger. While I didn't have much IMR powder in my inventory, I did have a can of IMR 3031 at the loading bench, and that would serve as a starter load for the 204 Ruger.

Along with the IMR load I did retain an array of Accurate brand powders, and this would be an additional strong element in load design around the new 20 caliber fast-mover. My test loads would not exactly be book-published data, as Accurate propellants and others had not as yet been fitted around the 204 Ruger cartridge. However, my starting and high end loads would be "advised" loads by engineers at Accurate/Ramshot and Sierra bullets, and as such serve as a good base when working up loads with several different powders.

As part of that additional entry in 204 Ruger load offerings, I would select some varied recipes from data obtained from Sierra for their new BlitzKing 32-grain and 39-grain bullets in 204. Sierra had already shipped the previously loaded H335-pushed 32-grain BlitzKing pills that had produced some very positive results, but now the 32-grain and the recently-arrived 39-grain bullets would be driven by IMR 3031.

As an additional offering in this mix, the Ramshot X-Terminator and TAC propellants would also be tested. I had found the X-Terminator was a fine grained ball type propellant that retained a very smooth flow when loaded from my Redding measure, and also compressed well in this short-necked, small-diameter case. X-terminator powder would be a winner at the loading bench if it could produce good results downrange. The question here was if my phase two test results could stay with that first outstanding series of groups offered up

previously on that first eight-load round at the bench.

Round Two Testing

I stayed with the heavy Savage Model 12 as a primary test rifle. I figured that there was no need to fix anything that was not broken, and the Savage heavy varmint was without question a very good shooter off the bench. There would be more than enough time for the Remington LV, Kimber Pro-Varmint, and the Browning A-Bolt when additional paper and warm targets needed to meet the new kids on the ballistic block.

Even with an improved game plan I was sure that there would be some changes in performance as I pushed ahead with the 204 Ruger cartridge. As is almost always the case, when testing progresses facts are uncovered that will dictate the events to follow. By the end of the review some loads will withstand strict scrutiny, and others fall by the wayside. That fact alone saves time and effort, and therefore allows you to get into the field faster with an assortment of accurate handloads.



Author shooting factory 32-grain Hornady with a Kimber Pro-Varmint in Wyoming. This jack got unlucky and was caught by a 204 bullet.

Keeping Factory Fodder in the Loop

I think I should clarify at this time that in no way was I about to abandon the

204 Ruger factory load option. While I was indeed making an effort to introduce the 204 to the handloader, I realize that not every varmint hunter is a prairie dog shooter who wants to spend time on the reloading bench. For those shooters I will take care and blend the factory offerings right alongside the basic selection of home-rolled fodder. No one should be left out of the new world of the 204 Ruger, as this little fast-mover is just too much fun for that to happen.

204 Ruger Handloads

Courtesy Ballistics Research & Development, Piedmont, SD

Rifle: Savage Model 12, 24" barrel

Load	Bullet/Powder	OAL (")	MV (fps)	Pressure (psi)	Group (") @ 100 Yds.
9	Homady 32 gr. V-Max/IMR 30-31 25.0 gr.	2.240	3602	44.400	.884
10	Homady 32 gr. V-Max/IMR 30-31 26.1 gr.	2.240	3793	52.800	.805
11	Homady 40 gr. V-Max/IMR 30-31 25.6 gr.	2250	3694	56000	255*
12	Berger 50 gr./IMR 30-31 24 gr.	2.300	3284	55100	Key
13	Sierra Blitzking/32 gr. IMR 30-31 26.2 gr.	2250	3900	N/A	.275*
14	Sierra Blitzking 39 gr./IMR 30-31 25.3 gr.	2250	3600	N/A	.621
15	Sierra Blitzking 32 gr./X-Terminator 27.0 gr.	2250	4200	N/A	.276*
16	Homady V-Max 40 gr./X-Terminator 25.0 gr.	2250	3800	N/A	.450
17	Sierra Blitzking 32 gr./TAC 29.0 gr.	2250	4100-plus**	N/A	.496
18	Homady 32 gr. V-Max/TAC 29.0 gr.	2250	4100-plus**	N/A	.280*
19	Berger 30 gr./TAC 29.0 gr.	2250	4100-plus**	N/A	.780
20	Sierra Blitzking 32 gr./Accurate 2015 26.0 gr.	2.285	3696	N/A	.370*
21	Homady V-Max 32 gr./Accurate 2015 26.0 gr.	2.285	3684	N/A	.679
22	Berger 30 gr./Accurate 2015 26.0 gr.	2.239	3714	N/A	.346*
23	Homady V-Max 40 gr./Accurate 2015 25.5 gr.	2.285	3627	N/A	.772
24	Berger 35 gr./Accurate 2015 25.5 gr.	2.240	3686	N/A	.186*
25	Berger 30 gr./X-Terminator 25.0 gr.	2250	3748	N/A	.864
26	Berger 30 gr./X-Terminator 27.0 gr.	2250	3972	N/A	1.124
27	Berger 35 gr./W748 29.5 gr.	2.230	3875	55700	.279*
28	Berger 30 gr./W748 29.5 gr.	2229	3913	N/A	.313*
29	Homady V-Max 32 gr./W748 29.5 gr.	2.290	4094	N/A	.281*
30	Berger 50 gr./W748 29.5 gr.***	2.240	2978	N/A	.327
31	Berger 40 gr./X-Terminator 25.0 gr.	2250	3872	N/A	.311*

*Accuracy loads. Under group size .300"/100 yards

**Chronograph (Chronotech Model 33 Oehler) recorded to 4100 fps (maximum upper range)

***At 6000 feet above sea level

With the fourth trip to the range, a complete picture was starting to develop around the 204 Ruger, at least in terms of home-rolled fodder. In general the 30-through 34-grain bullets did the best in terms of tack driving accuracy in the 1:12 twist rate Savage heavy varmint rifle. Some of the groups were so good at 100 yards that I believe they would have won a benchrest competition hands down.

Thanks to Rick Jamison, a recent shooting editor at Shooting Times magazine, I was able to get a head start using W748, a powder that I retained a great deal of in my shop because it is accurate and easy to work with. Shooting the 32-grain V-Max bullet behind load #29, which was developed by Rick, will to be sure find itself being handloaded in quantity as I take on prairie dogs this coming spring.

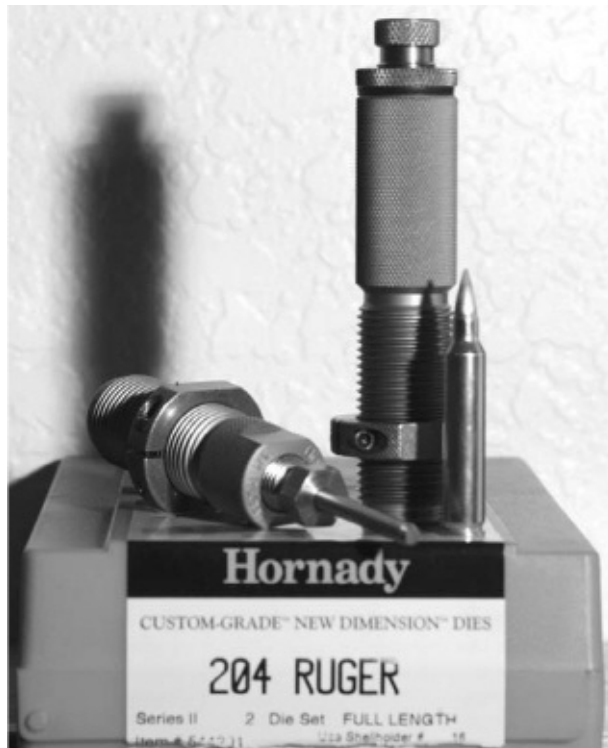
The 30-grain Berger was not always the top bullet in accuracy, but load #28 in W748 and load #19 pushed by TAC are also going to see summer work. I like this little fast-mover as it intrigues me a great deal. The 30-grain Berger bullets move off the muzzle fast and are reduced to dust against even very soft targets. I think a twist rate of about 1:14 would push this little blistering bullet to a better level of accuracy. On the other hand, in the Savage Model 12, darn few prairie dogs would ever get past its muzzle in one piece.

For the most part every powder tested turned loose at least one great accuracy load. I would have to say that the 204 Ruger is a natural in terms of producing good accuracy, when keeping in mind that a good rifle is also a major part of the equation. While almost all loads tended to group at the same general point of impact, there were some changes in horizontal line that dictate that close attention should be given to some paper zero checks prior to taking any 204 Ruger handload afield. This is not the good old 30-06 Springfield, or even the 223 Rem, that can be a group shooter's dream with varied bullet brands and weights.

Where I did not indicate chamber pressure on my data tables (N/A) it is because these loads were starter loads offered by powder manufactures or bullet builders. In short, no hard data exists for them as yet, but there was sufficient data to ensure that these loads were within safe chamber pressure limits. At no time did I experience any signs of excess pressure in these loads. This includes a stiff bolt lift, cratered primers, and erratic velocities.

In all cases I ran my Oehler Chronotech Model 33 right alongside published velocity data. With my screens set at 4 feet from the rifle's muzzle, my velocity recordings were always a bit lower than published data. However, as was

indicated with loads 17, 18, and 19 my equipment would not record the exact velocity of these handloads as they exceeded the limits of my old tried and true two screen system (above 4100 fps). Just how fast will the 204 Ruger push a bullet? That question is up for grabs. I didn't stress the system or take any chances with my loading methods. Forty-one hundred fps velocity is enough for this dog shooter. I think that these three loads were all moving well above 4200 fps That's just a guess, however, but that bullet got down range very, very quickly.



Hornady dies in 204 did much of the work when handloading test fodder for the new rifles.



A variety of powders were used when building new loads on the handloading bench for the 204 Ruger. This cartridge is flexible, although it has only been around a few years.



Author rolling home from a jack hunt. The 204 Ruger was used on many jackrabbit forays with great sue

Reviewing Factory Options

As I have previously indicated, I have shot all the current factory packages in 204 Ruger ammunition. With the Remington offerings in both 32-and 40-grain V-Max bullets (and, yes, these are Hornady V-Max designed bullets with the Remington AccuTip label attached to them) I succeeded in dusting turkey, prairie dogs, badgers, and coyote. I have learned through those gunned critters that the “V” bullets are top-end performers in the field.

Turning to Hornady V-Max bullets in the factory loaded wrapper, again the 32-and 40-grain pills acted like the Remington fodder as I pushed these fast movers against the same above indicated types of warm targets. Winchester’s new 34-grain JHP loads have added an additional new twist to the factory options in 204 Ruger.

204 Ruger Factory Load Accuracy

Test Results (100 Yards)

Courtesy Ballistics Research & Development, Piedmont, SD

Rifle	Load	Group size (")
Remington LV	Remington 32-gr. V	.493
Remington LV	Remington 40-gr. V	.689
Kimber PV	Remington 40-gr. V	.398
Kimber PV	Hornady 32-gr. V-Max	.523
Kimber PV	Hornady 40-gr. V-Max	.399
Kimber PV	Winchester 34-gr. JHP	.421
A-Bolt Browning	Winchester 34-gr. JHP	.414
A-Bolt Browning	Hornady 32-gr. V-Max 100	.388
Savage Model 12	Remington 32-gr. V	.338
Savage Model 12	Winchester 34-gr. JHP	.441
Savage Model 12	Hornady 40-gr. V-Max	.389

During the testing of the 204 Ruger bullets, static shooting against sections of butchered whitetail deer and shot jack rabbits were used to gain visual information on the amount of damage bullets of different weights would inflict on small to large targets. What was found during that phase of testing was that the 204 Ruger, loaded with everything from 30-grain Berger bullets to 40-grain

V-Max or JHP Berger pills, can be effective on even large coyotes if some attention is paid to target range.

For example, the 204 20-caliber 30-and 32-grain bullets in V-Max or JHP designs all produced good wound channels to 150 yards when deer rib sections or heavier neck areas were used for penetration test shooting. I set up sections of rib cage slabs at 100 to 150 yards in a simulation of what a coyote could encounter in terms of bullet energy and wound channel damage. If even a 30-grain super-lightweight bullet in 20-caliber hit bone, there was substantial tissue damage inasmuch as the velocity of this bullet at 100 yards (3500 fps) is still very high, and quite devastating.

Notice that I have given no attention here to ultra long-range shooting with light bullets, as I don't believe the 204 Ruger is an ultra long-range rifle cartridge in the first place. Keep coyote shots to under 300 yards, and better yet inside 200 yards and you're home free with this sub-sized centerfire varmint tool.

Shooting coyotes with the 204 Ruger will require a shift to the 40-grain bullets in the Berger or Hornady V-Max design, or the new Hornady 45-grain SP designed to hold together on larger animals, if shots are taken to extended range limits. Obviously the Berger pills are handloaded only, unless some cartridge manufacturer can strike a deal with that innovative bullet builder.

To date the coyotes I have gunned with the 204 Ruger have returned good examples of measured bullet behavior. When shot in the 40-grain and most likely the new 45-grain Hornady this coming season, coyotes will fall over in their tracks. Exit wounds have been nonexistent so far during test shooting, but be advised that being a lightweight 20-caliber pill, the 204 will shed velocity quickly beyond 300 yards. This is why pushing range beyond the indicated range above will result only in less than effective bullet performance.



John Anderson with an author-called Wyoming coyote taken at 70 yards with the 204 Ruger. keep range short for the best results on large critters.

Turkey Shoot!

I have hunted the open South Dakota prairie for turkey with the 204 Ruger on a number of occasions. On one hunt, when reaching a bottom land area that I had gained permission to hunt, I spotted a large group of birds well out on a very wide-open flat made up of late fall cut alfalfa. The field was table flat and didn't have a stick to hide behind for better than 500 yards.

Belly crawling for over 100 yards, I reached a fence line that retained some light thin grass that I could use as some kind of cover, but even so the shot on any one of six big adult gobblers was still a solid 400-plus yards. I had loaded a Kimber Pro-Varmint with three rounds of handloaded Berger 30-grain bullets, figuring that I would get a rifle shot someplace inside 200 yards. Wrong! Now I

faced a real challenge, and to be truthful I didn't have much faith in the ultralight bullet or small-bore caliber at such long range.

Now the crosshairs of my scope stood dead center on a big gobbler in full strut, but at that range I lifted those intersecting hairs to the big bird's back, allowing the second sniper elevation hash marks to fill-in the middle of the bird. This gave the 30-grain pill about a foot of drop, but I still had scope sight contact with the bird's body.

At the shot I could hear the bullet slap something. I had hit that gobbler someplace about midway up its side. The bird jumped out of my scope almost straight up, but then came down, and while using a wing to balance itself started to walk toward some rough heavy cover. Working the bolt, I sent a fresh round into the chamber and locked the glass sight on my now departing, but wounded, target. Crack wop! As with the first round, an audible echo across the field confirmed a second bullet strike. However, now my target was pushed into the high grass and out of sight.

Reloading my rifle I set my sight on a second gobbler at least the size of the first. I had a prairie unit double tag and I was about to fill both with the fast moving 30-grain Berger H.P. bullet in the 204 Ruger. At the shot, being again better than 400 yards, the gobbler went stiff in the tail, then just dropped to his chest, never making it to the light brush at the field's edge. After checking wound channels in my terminated toms I found that the light 20-caliber, 30-grain bullet had just enough energy to get the job done. Bullet failure was evident, and I'm pleased to learn that Hornady is going to bring out the above mentioned 45-grain SP, a stiff new softnose game bullet. This should add to the bullet options 20-caliber shooters will have down the road.



Author and partner Ron Spomer, noted outdoor writer, with prairie-gunned gobblers taken over a two-day period. The author's birds were harvested with a Kimber Pro-Varmint in 204 Ruger. Ron shot his birds with a scattergun.



Author glassing an open flat for turkeys. Often several hours can be used up in a spot and stalk method by way of a rifle application. Here the 204 Ruger has become an author favorite.

204 Ruger Benchrest Target Results at 100 Yards

Group: Three shots

Rifle: Ruger M77 M II in 204 Ruger

Bullet: Hornady 32-grain V-Max

Target: 4" Caldwell Insta-View

Group #	Group (Inches)
1	.897
2	1.182
3	.587
4	.279
5	.927 (very hot barrel)

The following groups were shot after a round of 220-meter steel targets.

- 1 1.257
- 2 1.649
- 3 1.526

Small Calibers with Big Hearts: 17 Mach II and 22 Long Rifle

This section of the book deals with the 22 rimfire and the 17 Mach II cartridge and centers on some testing regarding solid measured ballistic data as well as practical field performance. I guess I first met up with the new 17 Mach II in the field during a hunt with the folks at Kimber Industries a few years ago. At that time the new cartridge was just coming out, and except for a new Kimber turn-bolt chambered in the hot 17 Mach II rimfire, there were few rifles around for testing at the time. I had shot the new cartridge on an almost prototype shoot at Pasa Park, Illinois, and at the time the choices were a Thompson Encore carbine chambered in the new cartridge, as well as several T/C handgun configurations. At that shoot we were only able to take a crack at some steel targets inside 25 yards, and attempt punching out paper targets to a range of 50 yards.



Kimber Pro varmint in 204 Ruger and a South dakota gobbler's fan. At times rifles are the only game going when hunting this wide open spaced birds. the 204 Ruger is a natural even at long range.



Volquartsen Custom semi-auto in 17 Mach II.

Now with a modest amount of ammunition, and a field full of prairie dogs in central Kansas on a previous Kimber hunt, I got the opportunity to turn loose the Kimber rimfire rifle (pre-Pro-Varmint.) I also took afield a prototype of the Kimber Model 1911 17 Mach II autoloading pistol on some unsuspecting prairie dogs. What I quickly learned on that hunt was that the 5"-barreled handgun could not produce the full velocity of a cartridge with a slower-burning powder, and it took the full length Kimber rifle barrel (21") to realize the full velocity potential of the 17 Mach II.

When I returned from that hunt courtesy of Dwight Van Brunt, VP of Marketing at Kimber, one of the Kimber Pro-Varmint rimfires in 17 Mach II followed me to South Dakota. This was my home range, and living in the Black Hills I was right in the very middle of rifle country, and a varmint hunter's paradise to boot.

The first thing I did with the 17 Mach II in the Kimber turn-bolt Pro Varmint was to turn it loose on some early fall dogs close to home. What I found was that prairie dogs were not recoverable much of the time as the sub-sized bullet just didn't retain enough kinetic energy to put them down before they could roll into the den hole. Or so it seemed at the time.

Taking a Close Look at the. 17 Mach II

With some physical evidence generated in the field, it was time to take a look at ballistic data regarding the 17 Mach II. Information from CCI, the company that brought this cartridge together, indicated that the 17 Mach II started off the line at 2010 fps. At 50 yards the energy generated by the 17-grain pill is at 117 ft./-pounds, with a terminal velocity of 1759 fps. Moving to 100 yards, the energy is 89 ft./-pounds, with a terminal velocity of 1535 fps.

Running my chronograph equipment (the Oehler Chronotech Model 33 and two screen spaced units), the 17 registered a muzzle velocity of 2050 fps from a 21" Thompson Center Encore carbine. According to SHOT data Systems of New Brighton, Minnesota, the Mach II's 100-yard terminal velocity fell to 1491 fps, with an energy of 84 ft./-pounds While this is a small technical detail, some folks want the exact information I came up with. However, any prairie rat that took a hit would never know the difference.



Kimber Pro-Varmint chambered in 17 Mach II. One-hole accuracy to 75 yards when the wind is not blowing.



Author with the 17 Mach II, a small cartridge with a lot of velocity and accuracy built in.

As to where the 17 Mach II compared to 22 LR cartridges, that became the crux of my research as I sorted out fact from fiction regarding this subcaliber, fast-moving rimfire. For starters I elected to chamber two cartridges in my Remington 40X custom stocked Accurate Innovations 22 LR. This Rifle had a Hart 21-inch medium weight barrel, the Accurate Innovations pillar bedded aircraft aluminum stock, and a Redfield 3x9 glass sight.

Accuracy was sub one-half MOA at 100 yards in good shooting conditions, and I was able to shoot sub MOA in Kansas during midday and in an in-your-face, hot 20 mph wind. This was done during a review of an assortment of rimfire rounds. In effect, the 40X Remington with Federal's new 40-grain 22 LR new prototype "Autoloader" ammo stayed with the Kimber 17 Mach II on all accuracy counts when tested. In fact the 40-grain 22 LR out shot the 17 Mach II during those building midday winds.

Knowing the restocked Remington 40X was clearly capable of hanging with the Kimber Pro-Varmint during hands-on, back-to-back testing, I proceeded to set up a ballistic gelatin test using the new Perma Gel gelatin medium. This test was shot at 60 yards because that is where the 17 Mach II starts to lose critters as they crawl off down their den holes. Inside this range I was able to recover some

prairie dogs for bullet damage reviews, but after 60 yards I had real trouble recovering anything hit by the ultra-fast, 17-grain poly tip bullet.

Mounting a 10-pound block of ordinance gelatin 60 yards downrange, I proceeded to shoot Mach II bullets into the medium. My resulting measurements and observations indicated that the poly tip 17-grain bullet dropped its plastic nose section almost at once, or within a one-inch penetration depth of the gelatin material. After starting to mushroom, the bullet penetrated the gel to a depth of 10 inches. Weight retention was good, but the energy channel that was indicated by a white clouding of the bullet's path was quite thin. This thin line indicated very little energy transfer as the bullet passed through the clear, yellowish, tissue-like gelatin material.



Remington 40X and test loads used against Perma Gel blocks during the author's review of various rimfire cartridges.

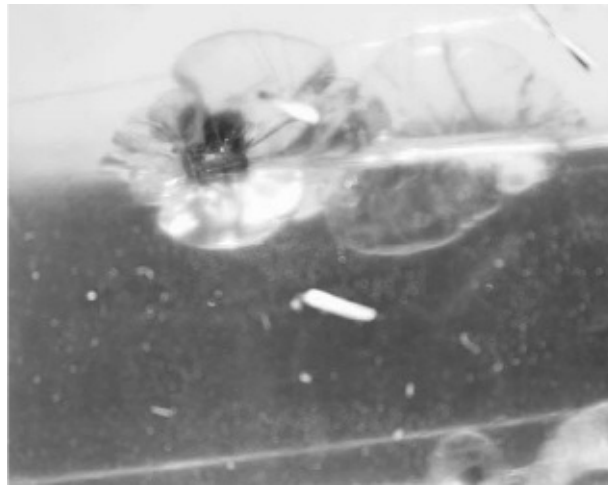


Author at his home test range in the Black Hills shooting both the 17 MACH II and 22 LR during Perma Gel block testing.

In terms of an “energy dump” or the greatest amount of bulge in the ballistic material, that dump occurred at 1-1/4 inches, or just after the nose came unglued from the bullet itself. Most of the bullet’s energy had dissipated at 3-3/8 inches. What clear ballistic gelatin can show the hunter is exactly what that bullet is doing, much like watching it on film.

Turning to the 40X and a CCI Stinger, the second test was shot back-to-back against the 17 Mach II. The Stinger was the very case selected by CCI when the Mach II was developed, as it is longer than the standard 22 LR case. I felt this

comparison was of interest. Currently the Stinger is the fastest LR in use today, and as such it is a solid comparative match to the 17 Mach II.



The Stinger ran a long way into the gel block during penetration test. This is a top-performing 22 LR.

At a bullet weight of 32 grains and a muzzle velocity of 1643 fps, the Stinger may be a bit slower than the 17 Mach II, but the added grain weight of its bullet can mean a great deal in terms of performance. At 50 yards the Stinger is pounding targets at a terminal velocity of 1352 fps and generating 130 ft./-pounds of killing energy. That outguns the Mach II by 13 ft./-pounds of energy, even though the Mach II is hitting the target over 400 fps faster. While the Mach II shoots flat to 100 yards, both cartridges will place their bullets on fur to that range and not require any holdover.

If I seem to favor the Stinger here it is because that's the way the bullet was performing out of the test gun barrel against the Perma Gel material. I also had shot hundreds of CCI Stingers for years as a Minnesota deep-woods squirrel hunter. Those big fox squirrels and grays took a whole lot of shooting to bring them out of tall oaks at times. The Stinger was a dead-sure meat-to-pot tool, and I developed a good deal of respect for the round during the mid-1970s. To be sure, tree squirrels are a far tougher target than those prairie dogs could ever be.

On the ballistic gelatin testing, the Stinger turned up very positive results. Again at 60 yards as shot against the 17 Mach II, the Stinger penetrated 13-3/4 inches into the ballistic gel block. At 1-3/4 inches deep, the hard hitting killer bullet dumped off energy, creating a well defined blister in the gelatin. Again at 6-1/2 inches into the block there was a second energy dump, creating another noticeable blister in the media. After that the bullet pushed gelatin aside, causing

a milky trail to its final deep resting place. My conclusion was that the CCI Stinger developed more observed disruption of the gelatin, and penetrated the 10-pound block deeper than the Mach II 17-grain round.

Additional testing with the Winchester 40-grain HP Power Point 22 LR indicated that this bullet, which retains a great track record against prairie dogs and gophers to about 75 yards, pushed into the gelatin block 1-1/2 inches and then blistered a good energy dump. After that first energy burst a second energy dump was produced 4-1/2 inches into the block, followed by a series of disk-shaped energy blasts coming off the now-mushroomed bullet. This 40-grain Winchester stopped at 14-1/2 inches into the block, becoming the deepest-penetrating projectile of all the types tested.

Because the information regarding bullet ballistic gelatin performance was so unique, and could make such a major difference regarding the positive or negative reaction to the new 17 Mach II by hunters, I re-enacted the same test a second time at my gun club range in Lead, South Dakota. However, now I added several additional LR rounds and bullet designs to the test series, and also included the new Eley Mach II 17 and the 17 Aquila 20-grain FMJ cartridge.

Test II Results

With gelatin blocks placed at again 60 yards downrange, I returned to my 40X Remington/Accurate Innovations test rifle and proceeded to first shoot the CCI Quik-Shok 32-grain separator round. Quik-Shok is not totally a CCI product, as I have been shooting the original Quik-Shok-designed ammunition even in 12-bore 300-grain deer slugs for some years. What CCI has done is given the Quik-Shok bullet design new life, and for darn good reason in that this is a very deadly varmint pill as applied to the 22 Long Rifle chambering.

Leaving the rifle barrel at 1640 fps, or the same velocity as the CCI Stinger, the bullet will separate into three equal sections upon impact. Sure enough, when the Quik-Shok bullet hits the gelatin block it developed an instant energy dump (blister of shock), followed by the anticipated separation of the bullet's three sections. These small but effective sections traveled into the gelatin 5-3/4 inches, sending damage to a much wider area than what is encountered by bullets that retain a mushroom shape and travel along a single wound channel path.



Perma Gel in a clear block illustrates the energy dump discussed in the review of bullet performance. Note the first damage to the block followed by the second change in gelatin texture.

After logging in my penetration data I reloaded the 40X with a second run of Stinger ammunition. This time my results were about the same regarding penetration, but my wound channel looked a bit different in that I was using a second generation Perma Gel ballistic gelatin that contained no water.

The Stingers ran 10-1/2 inches into the medium and produced a perfectly proportioned mushroom-shaped bullet when it came to a stop. The energy dump previously created in the first test was now reduced to a deep milky line through the gelatin for the first five inches, followed by a lower or less aggressive line during the final run through the gelatin block. My conclusion was the new, or second generation, gelatin was proving more resistant to bullet penetration than the earlier yellow colored blocks had been.

Now up for review was CCI Velocitor. This cartridge is designed around a Speer Gold Dot H.P. bullet that weighs 40 grains. It will deliver 30% more energy on target than many other bullets, according to CCI's ads.

When shot into the gelatin block this cartridge produced deep penetration to 10-1/2 inches with a great mushroom quality and total weight retention. "Game bullet" was my first thought, see as this pill could hold together and get deep penetration on larger varmints as in raccoon, skunks, and porcupine or close-

range rockchucks. At a muzzle velocity of 1435 fps and a retained velocity of 1249 fps at 50 yards, this is the fastest 40-grain 22 LR being loaded today.

The Background Involved in Reaching My Conclusion

Before proceeding to my last, but not least effective, field tool – raw ballistics – I feel it should be clearly stated that much of my data on bullet behavior has been the result of some 10 or more years of testing subcalibers in the field. Among many states and specific varmint hunts, events like the famous industry Winchester hunt in Nevada that consumed 38,000 rounds of 22-250, 22 Hornet, and 22 LR Winchester PP Rimfire against prairie dogs and ground squirrels in three days time set in stone the ability of the 22 Long rifle to “get it done.”

The following is a short set of tables that will give you some idea of how effective the rimfire can be at an appropriate range. While the accuracy and combined velocity data was author generated on a local range, the base drop tables for the rimfires were generated by SHOTdata Systems of New Brighton, MN.



Even the light 22-Hornet in this Browning single shot can return very good data regarding bullet performance.

CCI 17 Mach II, 17 Grain V-Max

Rifle: Remington/Accurate Innovations 40X

Conditions: 30 mph wind

Range	Velocity (fps)	Energy (Ft.-pounds)	Accuracy (Inches) (3-Shot Group)
0 yds	2050	159	N/A
25 yds	1897	139	1.7
50 yds	1753	116	.362
75 yds	1610	99	.439
100 yds	1491	84	.994*
125 yds	1376	71	N/A

*Wind conditions on open ground contributed to accuracy loss. Accuracy regarding the 40X is within 1/2 MOA at 100 yards at a controlled indoor

range.

Comparative 17 Mach II/22 LR High Performance Types

CCI 17 Mach II 17-gr. V-Max

Muzzle: 2010	Velocity (fps)	Energy (ft./-pounds)
50 yards:	1759	117
100 yards:	1535	89

CCI Stinger 32-gr. H.P.

Muzzle: 1640	Velocity (fps)	Energy (ft./-pounds)
50 yards:	1352	130
100 yards:	1124	90

Quik-Shok 32-Gr. Separator
(Same data as CCI Stinger) Velocitor 40-Gr.

Muzzle: 1435	Velocity (fps)	Energy (ft./-pounds)
50 yards:	1249	139
100 yards:	1112	110

Rimfire Ballistics Comparisons: Muzzle Velocity

Range (Yds.)	Velocity (fps)	Point of Impact Above Zero
25	1897	-plus0.2
50	1753	-plus1.4
75	1618	-plus1.8
100	1491	-plus1.4
125	1376	0.0
150	1273	-2.5

* Chronographed by author.

** This is the old 22 Winchester rimfire as chambered in the Model 1890 pump rifle. It can be fired in Rifles chambered for the 22 rimfire magnum (22 WMR).

Bullet Drop: 17 Mach II

NOTE: 125-Yard Zero

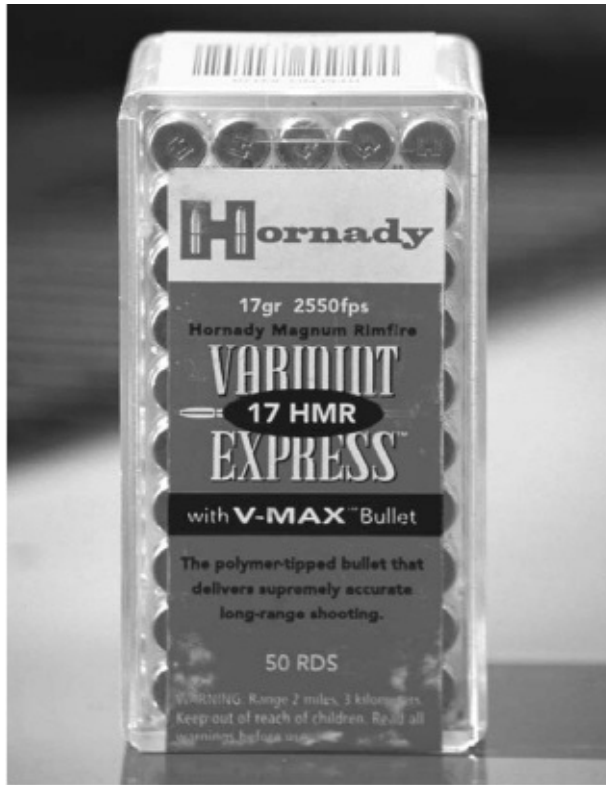
Range	Velocity	Point of Impact
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(Yds.)	(fps)	Above Zero
25	1897	-plus0.2
50	1753	-plus1.4
75	1618	-plus1.8
100	1491	-plus1.4
125	1376	0.0
150	1273	-2.5

New Fuel for the 17 HMR

With a 20-grain hollowpoint jacketed bullet, CCI and Hornady have upgraded the 17 HMR from purely a light varmint cartridge to an effective midrange game bullet.

Late in the summer of 2003 I was introduced to the 17 HMR with the Hornady 17-grain V-Max bullet as loaded by both CCI and Hornady at that time. For some time thereafter I shot varmints from western South Dakota to Wyoming with the 17-grain pill in Thompson Encore carbines, and a few Kimber Classics that were all but prototype rifles. While everything from prairie dogs to jackrabbits did indeed fall to the crisp shooting little 17 caliber round, if the range was pushed much beyond 150 yards both wind velocity and energy falloff started to play tricks on the bullet, and the round's effectiveness became somewhat questionable.



HMR by Hornady. Now new grain weights add to its effectiveness to 225 yards even in light wind.



Author shooting a Ruger M-77 in 17 HMR during early testing of the new cartridge. This is a great low-cost, shorter-range varmint cartridge – and a great training tool for longer-range rimfire work in the field.

In the summer of 2004, I accepted an invitation from Hornady to participate in an event that would showcase the new 204 Ruger and 22 Mach II, and the subject of the effectiveness of the 17 HMR surfaced during a discussion with Hornady engineers. I was soon introduced by the big red "H" to the totally new Hornady 20-grain XTP bullet as loaded in the 17 HMR cartridge. Inasmuch as I was returning to South Dakota from the Hornady hunt only to re-board an aircraft and head for Colorado to hunt with Pentax a week later, I elected to shoot my Ruger M-77 in 17 HMR as the ammo was lightweight to carry and Hornady Bullets was anxious to have the new 20-grain pills put into some varmint targets, the larger the better for test purposes. Mounting a Pentax Pioneer 3x9x40 on the Ruger turn-bolt, I packed a brick of 17-grain V-Max and a single box of the brand new 20-grain XTP cartridges. That is just how new these heavier pills were then: just one box was available. In Colorado, the prairie dog population was nothing less than fantastic. Every place I glassed, dogs were popping up, and in some cases they were super-large in size compared to what we would consider normal in the prairie dog populations back home in South Dakota. At times I was looking at dogs that resembled something close to woodchucks or rockchucks.

Setting up with several rifles, which included ultra long-range tools such as the 243 WSSM Winchester super rifle and a 223 Remington Light Varmint (LV) for medium range work, I set myself to the task of getting some targets dusted off with my Ruger M-77 and the new 17 HMR 20-grain pill. When I cooked off everything inside the light 17 caliber's range limits of about 175 -200 yards, the larger rifles would act as clean up tools. Now the small 17-caliber HMR would return good dog shooting, save me money in the use of less expensive ammo for some of my hunt, and be a whole lot easier on the old body when compared to the pounding dished out by the bigger 243 WSSM.



BSA Sweet 17 with auto elevation adjustments specifically for the 17 HMR.

What I did find was that the 17 HMR with both the light 17-grain bullets and the new Hornady HP jacketed 20-grain pills tended to push over prairie dogs with ease to ranges as great as the 200-yard mark. Without any wind, and that's a major point here, I was able to dope the bullets with great accuracy to ranges within the 200-yard envelope. Also because of the extended range limits I tended to stay with the little rifle much longer than what I would have thought at the onset of the hunt.

This new cartridge had become so popular of late that the folks at BSA America introduced a "Sweet 17" scope sighting system designed with graduations up and down, as applied to the exact drop associated with the 17-grain bullet and the 17 HMR cartridge. If you want to move up to, say, 250 yards from a 100-yard zero, just turn the elevation turret to the 250-yard marked point after zeroing, and that bullet is automatically adjusted for that specific shot.



Author hunting jacks in Harding County, South Dakota, with the 17 HMR and its new 20-grain pills.

Hard Heavy Targets

During that western Colorado hunt I dusted off some dogs that were massive in size but didn't even start to compare to the South Dakota West River jackrabbits found throughout Harding County. During my year-end muzzleloader deer hunt, I routinely kept my Ruger turn-bolt 17 HMR with a magazine in the rifle at the ready as I moved around the Routier/Goehring ranch near the Wyoming state line. I would often hunt down varmint critters as a method of keeping them in check on the wide expanses of that cattle/hunting camp operation, thereby developing good solid information as to new bullet effects and general field ballistics as well.

Early in January of 2005, at the tail end of the muzzleloader season, we had hit some very warm weather that had melted off all the snow cover on the high plains. That weather change left Mr. Jack Rabbit all white and easy to spot as he sat near his den hole on a warm sunny morning. Food for 17s was my thought, and in between tracking small groups of mule deer for winter meat I succeeded

in sending the new, heavier 20-grain 17-caliber bullets into 11 jacks.

Shooting the big rabbits that ranged in weight from seven to 10 pounds, I found that even when the range was stretched to 100 yards the hot little rimfire round tipped them right over. If they had anything left in them, they would have made the den hole, but rest assured that never happened. Jacks under 50 yards had the hollowpoint bullets go straight through them, but at longer range they soaked up the pills and didn't exhibit any exit wounds. It seemed to me that this little cartridge is indeed a specialized jackrabbit killer, and to you cowboys who spend time during the long western South Dakota winter harvesting these critters, take note. The hides are in great shape for resale.

Again, I think that based on what I was seeing in terms of stopping power, the 17 HMR would be a good choice on called fox under 75 yards. Anything larger, as in coyote, would be iffy. I'm sorry, but this is still a small rimfire cartridge, so staying within its effective limits is advisable.



The 20-grain 17 HMR is a little powerhouse to more than 200 yards.

With two good bullets now being offered for the 17 HMR, and ammunition production coming into line with current demands, the 17 HMR is a strong contender against even the 22 WMR, the king of the midrange rimfire hill for a very long time. Except for bucking strong winds, this lightweight fast-mover can get the job done on small to medium size varmints with ease. The 20-grain JHP is a slower-expanding bullet that is best used against larger varmints, while the V-Max bullets – loaded by the folks at CCI's Lewiston, Idaho, main plant – are bombs against prairie dogs, ground squirrels, and other critters of that size.

During my testing field work with the 17 HMR I have found that on the wide-open prairie, the cartridge produced very little sound whatsoever compared to most centerfire rifle cartridges. Just a dull pop that was quickly soaked up by the rolling prairie is all that came to my ears. When I did have doubles on jacks my second target was disturbed very little by the report given off by the little rimfire. Rest assured that this cartridge coupled with my Ruger turn bolt will be in the pickup truck cab during many a day in the field.

17 HMR Accuracy at 100 Yards

Rifle: Ruger M-77 Light Sporter

CCI 17 HMR 20-gr. JHP Gamepoint

Five-shot group at benchrest (in inches): 0.634*

Three-shot group bench rest (in inches): 0.601*

Hornady 17 HMR 17-gr. V-Max

Five-shot group at benchrest (in inches): 1.004

Three-shot group at benchrest (in inches): 0.450*

* Sub-MOA performance

Sako Quad: The Four-Barreled Rimfire

Unless you have been living under a rock, you're quite aware of the fact that we now have a series of four separate rimfire cartridges for general plinking and game/varmint control. With the development of the new 17 HMR and 17 Mach II we are facing four very different chamberings if you throw in the 22 WMR and 22 Long Rifle. In my loading room I have enough rimfire rifles to cover all the bases when testing the new loads and cartridges that keep coming at me. However, Sako has engineered the "Quad" rifle system that makes use of a single receiver and stock, then mounts any one of four separate barrels, letting you change the rimfire cartridge you're intending to take afield.



Sako Quad. The four barreled rimfife rifle.



The Ruger M-77 and 20-grain 17 HMR is a tough combination to beat.



Bret Olin, an engineer at CCI, shooting prairie dogs via the new Sako Quad. At last, one rifle for all the new rimfires.

The Sako Quad is a sport utility rifle in that it is lightweight, features thinner, pencil-pipe barrels, and has a very high-end receiver group, much the same as those found on other Sako-designed rifles. In other words, right from the get-go the Quad is a class-act piece of engineering. With a black polymer stock designed by the Italian firm Giugiaro, this rifle comes up with a high degree of balance and pointability. Fast is the word here, this being a walking varmint rig set up for most types of close-range rimfire field work. However, the Sako is accurate all the way, and even lacking time on my hunt to set down at a bench while testing this little rifle I realized during several days of prairie dog shooting that this rimfire shoots tight groups regardless of the cartridge being employed.

While running some rimfire tests with Bret Olin, a ballistics engineer and rimfire inventor at ATK, we walked through dog towns selecting targets with both a 17 Mach II Quad barrel and a paired barrel in 22 WMR. I had been doing some extensive research on the new 17 Mach II because it was beginning to get a bad rap by some hunters in terms of downrange retained energy on warm targets.

When a shooter wants to change out a Quad barrel all that is required is the use of a special key wrench that must be inserted and then turned five times. This key fits into a hole in the forend of the rifle, and after turning the lock screw out the barrel, you simply pull the barrel straight out of the receiver. No threads or splines are used except for a flat milled section at the base of the barrel where you would normally find the barrel ring located on a high-powered rifle.

So as to keep everything neat and easy to understand, each barrel is color-coded. The 22 LR is ringed with a green band, while the 22 WMR barrel has yellow, the 17 HMR has red, and the 17 Mach II has a bright blue band. With the special magazines (a short one for the 22 LR and 17 Mach II and a longer one for the 17 HMR and 22 WMR) you can't make a mistake. When a 22 LR barrel is installed, the receiver won't accept the longer magazine of the other two longer cartridges. While working with this new rifle we found that a barrel could be changed out in about 20 seconds, perhaps a bit more time at first as we did have to follow the directions. Accuracy according to Sako is within MOA at 100 yards even with the removable barrels. Again this was according to Sako, as we did not get any time on paper targets with the new rimfires. The Quad rifles we used in the field were pre-zeroed. That is one element of the test hunt I would have liked to change. Each shooter tends to retain his or her own exact trigger control, resulting in a different impact point. At one point while shooting at a called coyote with the Tikka T-3 Tactical (my personal centerfire of choice on this hunt), I found that my rifle shot a full four inches to the right of dead center at 100 yards. My called 275-yard 'yote had gotten lucky, and I'm sure he was pleased with the fact that I had not zeroed my own rifle, as he then trotted away after my missed shot, blending away into some high sagebrush.



Burriss has built a scope for the Sako Quad that can be quickly adjusted to zero all four barrels when changed out. Appropriately named the “Quad” 3x9, this system is well-matched to the rifle.

In terms of scope sights, Beretta and Sako have teamed up with the folks at Burriss. Burriss has designed a “Quad” 3x9 scope that retains special turret rings that allow the hunter to set the exact zero for each of the four barrels. This eliminates the need for separate scopes or re-zeroing as each barrel is installed. In the field, Bret Olin and I, found that we were having problems with the zero systems as applied to making quick barrel changes, and turned instead to the old method of adjusting our zero for each barrel we used in the field.

For the most part the exact zero regarding horizontal hold was the same regardless of the cartridge being employed, but elevation was a major consideration and did require massive adjustment. It was interesting to see just how much flatter shooting the 17s are as compared to the 22s when shots are kept inside 100 yards. Beyond that stated range, all of the rimfires tend to show some faults as dog guns.

Quad rifles retain outstanding metal finish and fit, with actions tight right out of the box. Triggers are fully adjustable from 2 to 4 pounds, and P04, being the new action designation for this rifle, is without question Sako all the way. As the old saying goes, “the name says it all.”

Sako’s specs are as follows. The Sako Quad Synthetic weighs five rounds regardless of cartridge, and mounts a 22-inch barrel, with an OAL of 40-inches.

In terms of weight, without scope the rifle comes in at five pounds, 12 ounces. Retail cost as a complete combination rifle (four barrels) is currently \$1739, and according to Sako they can't meet current demand for the rifle at this time. If you choose to select a single barrel and add others later, the complete one cartridge-one barrel rifle is \$948.

We have reviewed the smaller rimfire and centerfire cartridges and a few pair rifles to some degree here, never indicating that these choices should be applied to long range shooting. Everyone needs to start someplace, and often that place is with less rifle and cartridge. The old saying that less is more tends to hold up in this case. Don't pass on small calibers or rimfire loads, because these are great learning tools for all shooters in the long run. Shoot a box of rimfire and as you move out in range you will see the bullet act differently on those close-range shots. That is basically an indicator of how a bullet from a high-power centerfire will act at long range, but on a much reduced scale.

Chapter 7

A Rest is Best: Cross Wind or Dead Air Shooting

long-range shooting is not pulling up and taking a long-range shot. Seldom, if ever are you going to hit much that way, so this game requires systems that take the shake out of your sight picture. I was once instructed by an old time hunter in Minnesota that if I had to take an offhand shot to keep rotating the sight in a tight circle, and as the crosshair hits the bottom of the circle, touch off the shot. That works for shots inside, say, 100 yards when using iron sights or low-power glass, but when we stretch the bullet a bit, things start to go a bit crazy in terms of keeping bullets where you want them way downrange.

About the easiest way to steady a rifle is to use locally found objects or landscape items. Tree trunks, windfalls, rocks, or even mounds of earth can act as rests to stabilize your rifle for the shot. I once shot a mule deer buck way down below me at 400 yards on a snow-covered flat in the Big Horn Mountains using the root of a juniper bush and my cowboy hat. The hat rested over the root, and the rifle's forend creased the hat, which developed quite a solid rest, while I shot over the rim of the deep draw from the prone position.



When I fired my pre-1964 Winchester Model 70 in 30-06 the muzzle flash turned my Leupold 3x9 Gold Ring blood red for a second after the shot. When everything had settled down the deer was just standing there, and as I jacked a second round into the chamber it just fell over stone dead in my sights. The

measured range turned out to be 424 yards. When shooting a great cartridge but a very light pencil-pipe mountain-weight rifle, I regard a shot like that as one for my personal ranging data notebook.



Ross Metzger of SHOTdata Systems of New Brighton, Minnesota, with his own personally designed field shooting benches. Lightweight and low-cost, this is a dog gunner's winner.



This dog shooter is using a commercial benchrest in the field. You need to have road access to get this system up and shooting.

I have used everything from a corn harvester cab, as I spotted called coyotes across some set-aside ground that was weed-choked, to an old hay rake on a field edge when selecting a good rest for a shot. These are things you don't have to haul into the field but are just there for the general use of the riflemen. The

lesson here is never to pass up the obvious when searching out a good natural or man made shooting rest.

Light Weight Rests

Located on the driver's side and in the bed of my pickup truck is always a set of standard commercial shooting sticks. The shooting stick system is the tool that saves the day almost every time. Today, like every day, I walk vast ridge lines out on the prairie or cut across canyons or draws always with those sticks in one hand or hanging from my belt in a folding model design. The basic shooting stick is as simple as field dirt. Many hunters with a flare for style make up their own sticks, using very detailed measurements to fit their own body type.

Many shooting sticks are simply based on a heavy shaft fiberglass arrow. Even the field points are used on the bottom ends, with a rubber cap and attachment on the rest end so as to keep the forend of the rifle cradled and unmarred. For quick shooting work out of the pickup truck, I use a fixed set of sticks that don't fold. However, when in deep back country I will elect to take along a set of folding sticks, as they are easy to pack and come to life in seconds when needed.



This coyote hunter is working from commercial shooting sticks. These are low cost, effective and used by most song dog hunters today.



Dog hunters using Harris bipod rests in the prone position while shooting prairie dogs at long range.

While some hunters tend to like even a single pole that also acts as a walking stick, I shy away from these when long-range shots are a possibility. The single pole is just not rock-solid enough to my way of thinking when targets can be well beyond 300 yards.

One of the best ways to use sticks is to position yourself against a tree or even a fence post so that you're making a triangle shape that distributes your body mass over an even area. If nothing is available, another thing you can try is just pushing your right leg back a bit and building a wide base against the positioned shooting sticks. Anything you can do to reduce movement is well advised here. Remember, a slight twitch at the muzzle translates to many feet off target at 300-500 yards.

A second system that is always carried on the rifle are steel or plastic bipods. There are a number of manufacturers offering these systems. Some builders of custom rifles such as the 50 BMG Viper or the current military autoloading 50-caliber by Barrett, actually design the bipod into the gun itself. Harris, being a very well known manufacturer of bipods and currently the top choice on about eleven of my rifles, offers a prone position model, a medium height system, and a triple extension set of tall sticks. These are mounted to the forend of the rifle directly on the sling stud, so no drilling is necessary. These bipods also use a quick-release system for fast on and off situations.

When shooting my Tikka T-3 Tactical, a dedicated sniper rifle, I alternate

between my standard one-piece shooting sticks (Sniper Styx) or the Harris. Why would I want two systems? Because each is set at a slightly different height. This past year while hunting coyote I gunned a field-sniffing song dog at 375 yards using the Harris system because my Sniper Styx were a bit too tall for a comfortable shooting position. I was sitting along a fence, almost in a hole, and the Harris steel sticks were the clear ticket. If I'm not using the Harris bipod system it just folds against the rifles barrel and is completely out of the way.



Author's friend and retired police sniper Vern Rose makes use of a block of wood and a sand bag as a rest. Vern was trained to use anything at hand when on location in a sniper "green light" mode.

Bags

Shooting from bags is commonplace for nearly all prone shooting in the field, as is using auto windows, hoods, and pickup end gates when rolling through varmint or other long-range rifle country. Even an ATV can become a quick rest with the use of a bag rest to finish off the setup.

I think it is safe to say that the shooting bag, be it a commercial type or homemade, is about as simple as it gets for a rest system. I use the Bulls Bag as a window rest in my truck cab, as my state will allow hunters to shoot from a vehicle if the target is a varmint. Heavy shooting rest bags positioned over the end gate, or from the prone position, include the Caldwell bag by Battenfield and those made by Dog-Gone-Good. I have even used bags in combination with

benchrest quality forend rest systems that are fully adjustable for elevation and windage. Adding the soft bag keeps any element of creep out of the equation when I'm checking a rifle for group accuracy after handloading a new load.

In the field I will fill my shooting bags with corn meal or oats to reduce weight. Sand is a final option and is always reserved for bags used at the rifle range on a benchrest table. Weight is always a consideration in the field for me, and a lightweight corn meal-filled small forend bag in my daypack is workable, versus carrying around seven pounds of sand all day long. If you're setting up even a light benchrest system on a dog town for the day, the use of a shooting bag can help reduce many accuracy problems associated with possibly using a less effective rest system.

Shooting Tables

Assigned to the heavy rifle rest department are shooting tables that in effect are designed to be used in the field when offloaded from a truck bed. Sometimes these tables are left on the truck, and the shooter just sits atop the truck bed at the table and fires away. These systems are great if you're on a dog town or have access to shooting areas with a motor vehicle. They are not workable if you're off road and using an area that is limited to foot traffic only.



Author's wife Colleen sets up with a Case Gard shooting table and Caldwell bag rest during a prairie

dog shoot.



Author zeroing a Model 70 223 WSSM with shooting bags on a bench. This is a simple and accurate method to use when benchrest shooting.



Case Gard table and adjustable benchrest shooting station. This system is accurate when zeroing a rifle, but not the best in the field.

About the grandest system I ever was a part of was during a hunt with Beretta near Elk Mountain, Wyoming. We were hunting prairie dogs and coyotes. It was during the dog hunting part of this event that we were all piled into a large road service cross-country bus. This outfit carried 25 people with ease, retained a full kitchen and lounge, and on the underside of the rig were packed two large shooting tables, bags, and benchrest shooting systems.

Reaching the area that was to be hunted, which was close to a main road for obvious reasons, the rig was unloaded and the generators were started for the air conditioning systems. Then those big shooting tables that held three shooters at a time were set up in the shade of the big bus. It was a crazy deal, but there were dog targets and we were in total comfort.

The new Steady Rest System by Caldwell was employed as was the Case Gard MTM system built by MTM Molded Products Company. Because so many shooters now set up, a small rig or a large outfit near shooting areas, the new unit rest systems, as I call them, are becoming very popular. The Case Gard MTM system I'm currently using on a Case Gard shooting table allows full adjustments for elevation, windage and rifle attitude. These systems are almost always one-piece units made of lightweight material, but when set up, they offer enough strength to keep a rifle rock solid, and do aid in gaining accurate groups. Working from a shooting table, just about anything is possible in terms of using all different types of rest systems. My Case Gard shooting table is made of ultra lightweight aluminum and heavy plastic and retains a total carry weight of six pounds. No, that's not an error, this is a super lightweight system that is still rock solid. As a seat for that light table I have turned to Beretta and their pack frame seat that is a backpack and a seat all in one. I carry water, ammo, and a GPS in this bag along with a snake kit, handgun, and extra ammo for that field tool as well. Set the table up, drop the pack, swing the seat open, and I'm in business at less than nine pounds of carry weight.

Shooting tables come in many different forms. Some are just big, heavy bench-type tables while others are fancy pivoting systems that allow the shooter to rotate 360 degrees without leaving his rifle sights. It is like using a B-17 ball turret on the ground, or in the truck bed, so to speak. It seem as though every time I turn around someone is building a newer and more advanced shooting table. Most of them that I have used are great, but again you need to get them to the shooting location, and that's something to keep in mind. Another older unit I have down on my range at home, and is also taken afield from time to time, is a Shooters Ridge product that is a nice solid steel shooting table and combo seat.

None of my tables cost me an arm and a leg, but I get the job done using them as I test several hundred loads each year for both shotgun and high-power rifle.

A final word of caution here is in order. Some systems out there are so massively over-designed that you're no longer the shooter at all. I reviewed a system about a year ago that was so full of bells and whistles that all I had to do was reach over and touch off the trigger to make the shot. When working with a rest you need to ask yourself this question: am I trying to aid my natural abilities in becoming a better shot, or am I trying to turn my shooting into a non-human mechanical event? We need to ask another question of ourselves as well. Did we make the shot, or did the equipment cause it to happen?

Cross Wind Shooting: Only When You Must

Now that we have the rifle tied down by way of some type of rest, the next major element facing long-range shooters is wind. Wind is the killer of many a good long-range shot, but it can be dealt with if approached in a logical and straightforward manner. Here I will turn to the lessons learned in the World Wars and to our current Middle Eastern military units employed as trained snipers. These guys have to make the shot or get killed themselves. Don't think for a minute that all of their shooting is on a dead-calm morning, because nothing could be further from the truth. Snipers learned quickly how to dope the wind, and it is not done using fancy wind measurement equipment but some old-fashioned horse sense.



Shooting in wind requires some knowledge about a bullet's reaction to a crossing wind. Lacking that

information, you will miss every time.



Shooter Tom Hansen and his spotter Kevin Janish of South Dakota are shooting with a strong 20 mph crosswind. This is over the limit, but by pulling in the range the 223 Rem can still stay in the game at least until lunch.

Learning the wind is the easy part. If the wind is less than three mph you most likely won't feel it at all. However, if three mph or over you will feel it on your face, and smoke will drift slowly away. When the wind speed is above five mph, smoke or dust will drift faster and be more apparent to the viewer. At 5 mph to 8 mph the leaves on trees start to go into motion. When the wind builds to 12 mph the tops of small trees will be moving, and when the wind velocity hits 15 mph large trees will start to sway. I'm sure our snipers in Iraq need to use some other indicators when judging wind on a sand-covered treeless surface, but judge they do, because that is a major part of the riflemen's field craft skills.

Even if you have measured or determined wind speed at the point you're shooting from, everything could have changed several hundred yards downrange. Wind tends to switch, thermals cause updrafts or downdrafts, and at times the winds simply goes dead. Now you need to "read" sign using your spotting scope, field glasses, or even riflescope. Observe the grass near a target. If there is water nearby, check the direction of wave action and size of waves.

Small ripples moving right to left will indicate a soft wind of under seven mph, but waves that roll off themselves will mean 12 mph or more. In South Dakota we have numerous stock tanks that are filled with water. These small pond areas always have coyotes, jacks, prairie dogs, or game critters such as pronghorn hanging around them. I always watch the water when I hunt over these magnet locations for varmints or game. It is one small example of working with exactly what you have to work with. (A news flash here: not many trees on the prairies of western South Dakota.)



The author's Remington Model 700 25-06 in a Custom Innovations bamboo stock will fight wind far better than light 224-caliber bullets and cartridges.

Another rule to follow is that by working with more cartridge and more bullet weight, you're fighting off the effects of wind on a bullet. I want to make it very clear that in no way will you ever find a bullet and cartridge that are not affected by the wind at all. That's just not going to happen, but bigger and better can mean less drift-off targets. On prairie dogs I like to work with a bit more rifle than some because it keeps me in the game longer as the day's heat builds and those natural windmills in the atmosphere start up. A dead calm morning can end up building to a raging 25 mph wind by high noon on the open prairie. Shooting say a 75-grain 6mm (243) will cut a lot of drift off a bullet versus

shooting a 55-grain 223-caliber rifle. (Note and study the long-range rifle ballistic tables covered elsewhere in this book.)

For example, the powerful 300 Win Mag, shooting its time-honored 168-grain boattail bullet, will drift off target a full 10.7 inches at 400 yards with just a 10 mph wind across the bullet's path. Drop the bullet weight to 130 grains, as in the Sierra HPBT in 7mm Rem Mag, and again the 400-yard drift for that bullet in the big seven is 12.2 inches. At 2322 fps in the 7mm Mag versus 2372 in the .30-caliber 300 Win Mag, the 7mm bullet's lighter weight, with almost the same velocity at 400 yards as the .30-caliber, is more affected by wind. In this business even very small differences mean a whole lot. Good riflemen don't assume anything when setting up for the shot.

When hunting an area, read the wind and try to use it to your advantage. If shooting across wind, try and maneuver around so that wind is at your back. You can eliminate the wind as a problem if it is a tailwind. Almost the same goes for headwinds, but I have shot gusty headwinds that I believe caused my bullet to drop more than normal.

Shooting a deep draw away from wind can be a way to spend a windy day on a dog town or marmot' rock ledges. I hunted just this way in Idaho several years ago shooting 22-250 Browning low wall rifles and Winchester/Nosler BST ammo. The 55-grain pills just didn't have it along the ridgeline as the winds blew off those high tops. Deep in a large rock canyon, however, we had it made, and the light rifles with those light, fast bullets did a fine job well out to 450 yards or more.

If you can pick your shooting times, always try to shoot early in the morning and late in the day. Both times tend to develop less wind, and at times you can even enjoy some dead-calm field shooting conditions. I have shot my very best long-range targets at dawn on a summer morning with dead still air. I use a match, and when that burning carbon from the match head goes straight up, it's time for long-range shooting. I had a buddy years ago who shot a custom-built 223 Remington on prairie dogs. He shot many a morning off sticks and killed 600-yard dogs with that setup. He knew his rifle, and he also knew that the 224-caliber 55-grain pill could not fight off much wind downrange, but his system worked because he had taken the time to learn his rifle and his craft well. Just how good was Greg Hendricks? Taking his M1 National Match Garand to a NRA Nationals competition, Greg, using his wife as a spotter, shot the M1 Garand 1000-yard open sight competition against all comers, including military

snipers, and won his event. As a side note here, the 7 mm Remington Magnum in the Ruger No.1 that I shoot today for long-range work was one of Greg's rifles. He had bought them as a matching pair. He believed in the "big seven" as a long-poke killer, as do I.



The author prepares to go to work on a distant dog town shooting off a "Caldwell" bag rest.

Other Elements That Cause Accuracy Problems; Bullet Drop

Bullets hitting high when shooting uphill or downhill are also a problem to deal with. When you're in mountain country, fighting winds is one thing, but you also need to compensate for up or down angles as well. How high? According to the Vihtavuori First Edition Reloading Manual, with an elevation angle of -plus30 degrees the increase in bullet path/height will be $0.134 \times d$ ("d" being the symbol for bullet drop). When that angle is increased to -plus40 degrees, the bullet drop will increase to $0.234 \times d$. While this may not seem like much, I have missed at long range because of this effect.

Other elements can come into play as well. The Magnus effect, being the amount of resistance on one side of the bullet or the other as it rotates through the air, can cause it to move right or left. The Poisson effect, being the bed of air

under a bullet in flight, can change as the bullet loses velocity, causing that bullet to move off its trajectory. However, to take all this in as you drop a couple of pounds off the trigger at the shot is just too much to handle. You're better off learning solid field craft skills and practice shooting at long range as much as possible.



John Anderson of VAM Publications uses a tree limb for a rest.

Chapter 8

Ranging For Accuracy

When you shoot at long-range targets, you need to know how far away that target is. With bullets dropping like rocks much beyond 400 yards, you will need to learn the correct holdover, sight adjustments, or the use of sniper mildots and the like. This is the most important element of long-range shooting, because lacking this knowledge you're just another artillery piece out there sending flak at the target.



Ranging systems are more than just a single approach to the problem. When I was a young shooter I started by using telephone poles along roadways as a guide to show me the gap that existed between 100 yard points. I used that system for so long that after a time the gap method of ranging became quite natural. until years later while training with several police It was not until years later while training with several police snipers that I observed the very same system come into play as these police marksmen jumped toward a long-range target at 100 yard guessed increments.



When you only get one shot, you want to know how far the target is from the muzzle of your rifle.

Learning to gap shoot by ranging distance to a target is not only a good method when determining a target's approximate range, but being self-generated it won't cost you a dime. First of all, learn where 100 yards is in terms of a very close-ranging guess. Use those phone poles, football field markers, or anything that comes along that illustrates this range limit. After getting a solid handle as to what 100 yards looks like, go into the field and start establishing that range on natural markers: odd trees in the open, rock clusters at a distance, or even clumps of grass on open country. A fence line can be of help here, as can irrigation pivots. Know the distance between two points and you're starting to come together in terms of gap-ranging targets.

In the military the gap system is also used when training snipers, even though it can be labeled differently at times. For the military sniper it is the one shot that counts. However, when that shot is a bull elk that counts at 7x7, and you have that single second to make a long-range shot to get the job done, you need to call on your learned shooting skills.

I believe that accurate gap shooting can be accomplished with practice to about 400 yards with solid accuracy. After that the human brain data bank starts to run a bit thin. After measuring that first 100 yards in your mind, jump ahead to 200 yards using a second group of markers. Now stop at that point and actually measure off the distance or pace it off. This will give you a clear

indicator as well of your distance estimation ability.



Spotting a target is only half the battle. Getting a clean hit on the animal is the other half of the event.



Learning to “gap” shoot will allow you to get on a target faster in the field. This long-range ram is not going to stand around all day waiting for you to find its range, set your scope and take the shot.



Using telephone poles is a good way to judge 100 yard distances. When hunting from a high line or

roadway this system works well.

If there is one area that gives everyone trouble when trying to estimate range, it is shooting in mountains or areas that have deep draws and are covered by different-shaped hills and ridges. This can make the shooter a bit crazy, and I have played a game with friends where as several of us will take a crack at guessing the distance to an object, then ranging it with good equipment, discovering just how much we were all off target.

Rangefinders are nice tools to use here because they take the guesswork out of the process. “If I have a rangefinder, why bother with the gap system?” you’re now saying. Believe me when I tell you that having both systems has saved the day for me more often than I can count. Batteries die, systems freeze up, and gadgets get stuffed in the wrong pocket in the pack sack just when you need them the most. That gap system is never any farther away than your mind and eye. A nice ranging setup when you learn to use it.



Range finders come in all sizes and types today. From left, the old Tasco 600, one of the very new Leupold compacts, and an old set of Bushnell Yardage Pro 400s.

After 400 Yards

Stretch that range limit beyond 300 or 400 yards, however, and trouble starts

to raise its ugly head. We are human, and as such, limited in some of the things we can or cannot do. Gaining exact range, or even an approximate range at very long distances, can be a real problem, and now the use of a range system to aid the shooter is a good idea.

Way back in the early days of ranging equipment I bought the simple and effective Bushnell Yardage Pro 400. This rangefinder makes use of a monocular eye piece but opens out to a binocular design mounting a pair of lenses at the exit side of the unit. Along with that Bushnell unit, a Tasco "Lasersite" ranging unit of a single primary lens design, but equally as large as the Yardage Pro, showed up for evaluation from the manufacturer. The Tasco was designed with an added range limit, bringing its capability to 600 yards. Right from the start the distance game was starting, and it has not ended even to this day some 15 years later. These tools were very new and all the rage to be sure. Now all the guesswork was melting away when it came to knowing the exact range of a target, at least out to 400 yards with the systems I had in hand. Right off I turned to my old system of gap ranging once again, but now I had a second option and that was to gap range with the optical rangefinder first. Yes, that's correct. I would first gain a recorded range, say 300 yards, using the optical system. After marking that range by using a downrange object such as a tree or rock I jumped that gap in distance by a factor of one to 600 yards. While not dead-on accurate when gaining ranging distances, it was effective in getting me close to a working range in terms of the rifle and cartridge I was fielding on a given day.

Taped to the underside of my rifle's forend is a drop table for the given bullet I'm using in that rifle. By making a quick check of that table on the small card, I can compute the bullet drop based on my estimated range to the target. After taking into account the amount of bullet drop associated with the range my target is at, the next step is to compensate for that amount of drop by elevating my sight using the vertical adjustment knobs on my scope sight or the invaluable sniper mildots located in a nice neat line on the vertical cross hair. Most often I do opt for the mildot as it is quick and I don't lose zero in the event I'm required to take a second quick shot at a closer range. Remember, this is hunting, and anything can happen when it comes to setting up on coyotes or game animals. On more than one occasion I can remember taking the long shot on a song dog well out to 500 or 600 yards, only to have a close-range canine hunting partner of his jump up at 200 yards right into my scope. Say what you want about my system, but I don't like to mess with my zero range any more than I have to. It's old school, but it works well for me.



The compact Leupold rangefinder is easy to pack and quick to get into service. Out past 400 yards, you're going to need some extra help finding range.



Here dog hunters are checking for bullet impact and also getting the range to targets. Using glass systems is very much a part of modern long-range rifle work when there is time to set up these advanced tools of the trade.



Author's wife Colleen ranging targets in the South Dakota Badlands. Hunters and shooters like Colleen started off with these advanced systems. Some of us were very much more old school in terms of judging range.

Long-Yardage Ranging

In some cases long-range shooters work from static positions, meaning situations in which they don't intend to move much. If they do move at all will, they'll set up elaborate ranging systems such as military artillery-range equipment, or very advanced compact commercial units. These shooters are in a separate class of long-range riflemen in which the art is to get that bullet as far away as possible and be successful in hitting a target.

Now the use of the basic gap system, or even a shorter range system, is out of the question. The name of this new game is technology, basic math, and the deep pockets needed for some very high-priced gear. Currently there are systems that can integrate with the rifle scope that will allow on the spot adjustments for 1000-plus-yard targets simply by dialing them in, setting the elevation adjustment for drop compensation, and then touching off the round downrange.

The Burris ranging scope discussed in Chapter 3 is an excellent example as to how far technology has come. Here we have a scope system that retains its own ranging system to 800 yards and allows the shooter to dial in a target without any additional support equipment whatsoever.

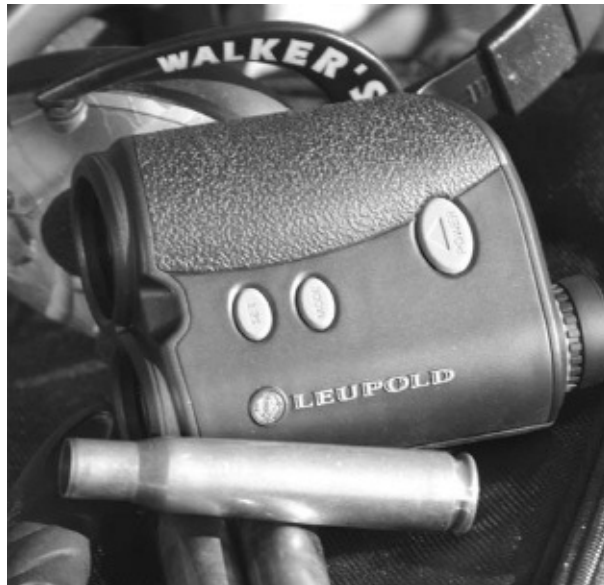
On the basic and practical side of things, using a general purpose range finder can meet almost all your needs in the field. Believe me when I tell you that you can get by with a lot less in equipment if you build confidence in yourself behind that rifle. I hunted most of my adult life without any of the tools of today's long-range riflemen. I did have my grandpa Jake Domning as a boy, who by the fact that he had been an old salt on a US Navy battlewagon during the Spanish American War, knew something about hitting stuff way off in the distance. He started me out with a Model 94 Winchester .25-35 with iron sights, an extra-long magazine, and some darn good advice. "Aim small, shoot small," he used to say.

Current Rangefinders

You can spend just about any amount you like for a rangefinder nowadays. However, try to keep in mind exactly how you're going to be using that system, because bang for the buck is always a good idea even in ranging glass.

In the upper range of equipment, but still not off the charts in price, is Leupold. American-made, dependable, and accurate in the field just about says it all about Leupold. I use a lot of Leupold product because they tend to get the job

done without the problems we often encounter when hunting. The compact RX III digital range finder by Leupold is a class-act system, but it retains added elements that you may or may not want. Remember, the primary purpose of a rangefinder is to find out how far away something is. You don't always need to know where to hold for bullet compensation, but the RX III will do that for you nevertheless. Or you might not have access to a varied number of reticle types. The RX III will allow you to change the reticle so as to allow you to "bracket" an animal inside a square, thereby giving you some idea as to where to hold over. I still find that I basically bring my system up, read the range, and go back to my glass sight and mildots for any required elevation. Leupold currently offers no fewer than seven different systems, and some, such as the Wind River RX, are priced closer to \$250.



Range finders make up only one part of the long range equation.



The Swarovski range finder on the bench is the smallest thing there. However, this very advanced system will range to 1500 yard with outstanding accuracy.

One rangefinder that was used for a great deal of this book in terms of evaluating new guns and loads was the Swarovski LG ranging system. This unit is very small, being about the size of a pair of opera glasses, and ranges to 1500 yards and at times beyond. I found that the Swarovski system is quick to lock onto very long-range targets, requiring only a small subject like a rock, tree, or brush to produce a bounce-back laser reading. This system is not a budget item, however, but it is very dependable and it will take all the guesswork out of establishing a target's range.

Bushnell, another company that is well-known in this business, offers another complete line of ranging equipment. Here you can get into a quest Binocular range finder for under \$450 or stay with a basic ranging system such as their Scout or Trophy units. These systems can push recorded ranges out to 999 yards, but be advised that seldom will you need to estimate that kind of distances. On the average you can get into a Bushnell system that will be quite workable for under \$150.

Simmons Optics offers their laser rangefinders such as the Yardage Master 800 or 1000 for well under \$225, and to be sure with today's technology these systems will get the job done. Even Nikon currently lists eight different systems in 2006, and in terms of price they sell from as much as \$450 to as little as \$199.

In terms of pricing I'm staying as close to my information source as possible, but don't hold any company to an exact figure. Instead, use this information as a general guide in selecting ranging equipment.

Again in the ultra-grade department, Leica sells the rangefinder binocular Geovid BRF for up to \$2,500. This system is designed as a highgrade optics system for spotting as well as a solid long-range measurement unit. I have used the system when hunting rockchucks in Idaho when I couldn't make out a thing with cheap binoculars. The chucks were exactly the color of the rock and when sitting still they were lost to the grainy formations above. Geovid picked them out and also returned exact ranges well out to 800 and 1000 yards. In the 15x36 magnification range it's priced at around \$1,950. In my opinion these are professional systems designed for guides hosting high-end clients who are mountain hunting sheep or other trophy-class game, or military snipers requiring far more exact measurements to the target. In general, you need to think it through before spending that kind of money on a ranging system.

Leica offers compact range finders that run about \$500 and are very lightweight, small and accurate as can be. Again, I have hauled these units around and found them to be a great field tool. Optics are so good in this small compact system that it will double as a spotting system when ranges are not overly great.

The final high-end system in this bank of ranging equipment is built by Swarovski. Here we have the 8x30 laser-guided rangefinder priced at about \$900. Accurate to 1500 yards according to the manufacturer, you can be sure it retains good optics and will hold up in the field. Again, this is a professional system designed for commercial work, or the hunter who has everything.



Leica rangefinder in conjunction with a spotting scope is being used here in the field. Multiple optics are often required when gaining exact and accurate information regarding range or hits on targets.



Here a staff member of Leica is shooting a heavy long-range rifle while reviewing Leica equipment in

the field. Practical field application is very much required when testing products that will be used by the public down the road.

Insofar as a good deal of this basic information came from Cabela's after a walk through their Mitchell, South Dakota store, be advised that Cabela's also sells a complete line of hunter-grade ranging systems. Cabela's systems run from \$250 to \$800.

In the area of specialized computer bullet compensation ranging systems, Barrett, the builder of tactical weapons systems, has just introduced the BORS, which stands for Barrett Optical Ranging System. This unique ranging unit is installed in the top turret of better-grade long-range sniper scopes, and in effect becomes a ballistic computer for the shooter. Range the target and dial in the information directly to a computer in the turret. As of this writing, the BORS calculates only bullet drop. Advanced calculations such as wind drift and running shot lead, that problem are under development. With the basic computer corrections dialed in and the crosshair directly on the target regardless of the range, it will make for a one-shot event.

BORS will allow 100 different bullets and velocities to be dialed into different ballistic charts within the system. Advanced systems under development will hold up to 2,000 calculations, making this system the most flexible of mechanical ranging systems. If there is any question here about ranging units, it is probably "Are we becoming dependent on mechanical devices, versus a learned physical response to a ranging problem?" In other words, is it equipment or practiced skills that make a good long-range shooter? It is easy to fall back on the toys and then forget what granddad taught us way back when.

One exception to this whole discussion is the military or police sniper. The army sniper or Marine scout sniper needs all the tools he can get in his hands. If this system saves snipers and the lives of our boots on the ground, there is no discussion necessary. Police snipers, whom I've played some part in training, have their 223 Remington or .308 Winchester loads dialed to about a 200-yard dead-on zero. These shooters will hold over slightly in some situations, but urban cops waiting for the "green light" in most cases are assigned to shorter-range targets. However, if a new sighting aid helps these shooters, fine. A life saved is worth the cost of the systems and the training involved.

Why are some units so expensive and others far less so? Rangefinders, without getting technical here, use components that border on gemstones,

computers. and advanced laser directing systems. The rangefinder unit sends out a signal through a liquid crystal at times, and when that signal is bounced off an object at, say, 400 yards it is returned to the source and a computer takes over. That computer reads back the range in a digital mode to the shooter. Now, with all that stuff taking place and the level of quality involved in those components, you can see that the more complex the parts, the higher the cost. This is not always true, however, so buyer beware. There was a flap for a time about a name-brand ranging system that was using substandard parts and living off its name. Today, however, that is a rare case, because there are so many units on the market and the general quality in even the lower priced systems is very good. Also, competition is a major factor here and if your system is a poor performer you're out of the game quickly.



Author hunting speed goats. The rangefinder is standard equipment on such a hunt.

Using a Rangefinder

Hunting the rolling hills along the Missouri river in early spring can make for some outstanding prairie dog shooting. However, these dogs get shot at a whole lot by hunters coming across from Minnesota, Wisconsin, and even Nebraska. Range can be a problem, and on the trip illustrated here that was the situation in spades. Dogs were everywhere, but according to the rancher getting close was all but impossible. One shot rolling down a valley puts heads within 400 yards down for the remainder of the morning.

Time for some drastic action. First of all our group of three shooters checked out the wind and moved toward the dog town while keeping the morning breeze, what there was of it, directly to our backs. That meant as the winds built up during the mid morning, largely due to the increased heat of the day, we would have the advantage of using the wind to push bullets, versus having them drift off course as the result of a crossing wind.

Reaching a high ridge we could see about 3/4 mile out into a long rolling valley. At the far end of the valley were a stand of cottonwoods and a small pond. Here we could see movement in all directions. Grass rats by the dozens were out and feeding. I guess “feeding” is what you call destroying a rancher’s grazing land.

At once we moved off down the valley, keeping a sizable hill between ourselves and those pothole rats. On reaching the crest of that hill, we got low and set up our rifles, shooting mats, and bipods. Pulling out a Leica Geovid from my pack, I ranged the dogs at just over 500 yards. Some were well out to 600 plus, but we figured we would start on the first line of targets and “walk” bullets back into the crowd if they didn’t head down the holes after our first series of rounds were sent downrange.

I was shooting a Ruger M-77 MK II in 243 Winchester, while my partners were shooting a Kimber Pro-Varmint 22-250, and a second 243 Winchester in a home-built custom Mauser 98. My mildot Redfield reticle had a series of dots at the six o’clock position, and positioning them above my target at about 18 degrees and ranged to 525 yards, I set the mil-dot directly below the crosshair’s center right on a fat dog. I had zeroed my rifle for a 200-yard impact dead-on, with the 243 Winchester developing about a 13-inch drop with a level shot, since this was a downhill shot, the first mil-dot looked to be just about correct. The crosshair stood over the dog’s chest at 14X magnification.



Big open mountain country requires better ranging equipment. Even 1000 yards is a small pebble on the trail when it comes to hunting in large rocks. (Photo by Colleen Brezny)



Texas hog in the evening. Bullet testing required that each target be ranged exactly so as to gain accurate information about the net effect of the new projectile.

At the shot, dust boiled up just at the base of the prairie dog's lodge. I was

shooting about four inches low, and as I chambered a fresh round of handloaded 55-grain Nosler Ballistic Tip dog food, I pushed the same mildot right above the dog's head. As the trigger broke the sear and the rifle snapped, there was a slight delay and then the dog came unglued in a cloud of dust and red mist. I had found the range, and the rest of my story was keeping the barrel cool, so as to not allow bullets to climb, and maintain a clear sight picture as I proceeded to eat up rats with many successive shots.

When I gained the range via the Leica range finder and correct holdover, my partners were quick to adapt to the situation. As a group we pounded that prairie puppy town at long range for the better part of an hour before moving on.

Inasmuch as the rifle and scope setup were new to me on that hunt, I took along a small notebook and made a quick citation to the fact that the rifle shot to the indicated impact point based on the rounds being used. It is a good idea to match your field information to both rifle and cartridge, then apply it to your ranging equipment. The more information you have about your rifle and paired equipment in the field, the easier it will be to set up the next time.

When Ranging Equipment Won't Work

Admittedly there is some correlation between the price of a unit and its dependability, but in some cases many units will not respond to a ranging situation because of terrain problems. The ranging systems requires something to bounce a signal against and return it to the unit. When the ground is quite flat and you're at the same elevation as the surrounding terrain, many times the unit will not respond because it cannot acquire a solid object to use when bouncing a signal back to the system. Even super-high-grade systems can run into this problem, so I have found that even when I'm holding a unit that is very high priced there are times when I still need to "gap jump" the range to the actual target.

Always try and locate a solid object when you're ranging flat country. Even if the object is not exactly where you're ranging, if it is close it will give you a starting point when determining the exact range of the target subject. Remember about working with what you have, and that means bringing your own skills and brain/eye coordination together. At times this is all you will have to go on in the field. Ranging equipment is just that, and anything man-made can and will fail at times.



Author with a large Texas boar shot during the Environmental, Inc. “Dead Coyote” bullet test in Texas. In this case not long-range, but accurate to the inch nevertheless.



The responsible hunter will work on attaining good field skills while at the same time making use of advanced equipment. Here the author's wife Colleen works with her eyes, ears, and a good Winchester rifle in 30-06. That's a good start.

About the time I was writing this book, I hunted Texas with the folks at Environmental Inc. The Hevi-Shot manufacturer was developing a new varmint bullet in .224 caliber, and this pill needed testing at both longer and shorter range limits. As some readers will clearly understand, Texas is not a user-friendly environment. The terrain is rough and full of heavy brush, open cuts, and more brush. Targets come into view quickly and often for a very short period of time. In other words, it offers very little if any time to range the target.

We had a couple of days to get bullets on pigs as they were the primary target with secondary possibilities going to coyotes and badger. We would locate activity, move in by vehicle, and then on foot try to get into position for a shot. Usually that shot would be at a moving and quickly departing target. Ranging was next to impossible except by using a very lightweight and small unit like the Leupold RX II, which could hang at the ready from the rifle's sling or belt loop. With the RX II, I was able to pick up readings prior to the shot on several

occasions. What all this boils down to is that the biggest and heaviest is not always the best system to work with. Keeping size down and utility up can mean more work for the rangefinder in the field under some conditions. Try to determine where and how your ranging system will be used. It can save you disappointment and even expense in the long run.

Ranging Game at long Distances

What I'm about to say at this point in the ranging story will not fly well with some, but it needs to be addressed. I have a problem with big game hunters over-extending range in order to bag a trophy deer, elk or whatever. I do believe there are limits in place here and the sport hunter needs to curb his or her range limits so as not to wound game in the process. While 600-, 800-, and 1000-yard shots are very spectacular I believe they need to be reserved for varmint critters or paper targets. Long-Range shots on game are very workable, but long-range in this case should not exceed the dead-on killing limit of the cartridge and the shooter. In other words, give the animal you're hunting a break by working toward a clean, humane kill. At 400 to 1000 yards you know as well as I do that anything can happen to that bullet in route to the target, and in this case the game animal will pay the price of a less than well-thought-out move on the hunter's part. The knowledgeable long-range hunter will retain an edge when that trophy elk or mule deer stands up at 300 yards. He can now make a one-shot hit the very first time around. After shooting well at these kinds of ranges, the 300-yard shot looks almost point blank.

Some time ago I watched a television program in which hunters were shooting elk across one mountain to another. That my friends, is no longer hunting, but an exercise in the use of advanced ranging equipment, rifles, and big cartridges. At best, it is simply shooting, and little more. Be responsible when using these new and very effective tools. As we move into the 21st century we are seeing new developments all the time in both guns and loads for long-range work. Word has it that some folks are in the process of building an ultra-long-range sniper rifle off a Russian anti-tank gun system that will drive a bullet of about 37mm to a target in the next county. There is also word that a 40mm sniper rifle is under development by still another group of experimenters. Therefore, never say never, and always remember that nothing, regardless of its size or design, takes the place of woodsmanship, shooting skill, and basic know-how by the hunter in the field.

Chapter 9

Big Rifles and Long Shots

Getting a large caliber or belted magnum big game rifle into some long-range varmint work requires some special handling. When the heavyweight rifles start to cook, some fun and interesting results surface, being it prairie dog hunting, whistle pig shoots, or canine control forays.

My 7mm Remington Magnum lay in mothballs for several seasons due in part to the fact that I just didn't have anything east of the Mississippi to shoot the big rifle at. When I lived in Minnesota, I decided to bring out the 7mm, and I put it to work when I hit South Dakota permanently. This long-range shooter consisted of a standard Ruger No.1 with a trigger that was next to none in tack-driving quality, and a lightweight barrel that if kept cool, it would group one moa clusters all day long. Up to this time I had not sent anything but Hornady 150-grain SP pills as home-rolled fodder off my reloading bench at mule deer around Ten Sleep, Wyoming, but insofar as the rifle had accounted for a good share of well-placed bullets at 300 through 400 yards on those central Wyoming mule deer, I didn't think twice about mounting some different glass on the big rifle and developing a fast, flat-shooting load to take west on my annual spring migration toward some South Dakota dog towns.





Remington 7mm Mag/Ruger No.1. Scope, Tasco Custom Shop 50X. This is an author-setup long-range rifle system.



More powder, more bullet makes for long-range performance. Here the 7mm Rem Mag, right, is towering over the 223 Rem. Both are great cartridges, but built for different purposes.



7mm Rem Mag in the loading gate of the Ruger single shot rifle.

To be quite frank about the whole subject, I was getting a bit bored with sitting down and busting several hundred caps on already dead dogs. It seemed that missing them was just not a part of the gunning equation with top of the line 22-250 Remington, and 243 Winchester centerfire gunning systems built on Remington Model 700 Varmint and sub-moa Heavy Target frames. No, what I wanted to do was push my limits with the heavy-caliber rifle at some exceedingly longer range critters. Why the 7mm Remington Magnum? Because it was there, and I didn't have to develop a payment plan via my local bank to come up with an alternative long-range rifle/cartridge system.

While I'm sure the 7mm STW, 300 Win Mag, 300 Weatherby Magnum or even the new Winchester 300 WSM would push bullets quite effectively based on data provided by various powder manufacturers, the 7mm Remington Magnum drove a heavyweight bullet fast enough to fight off western open-country winds without leaving me watery-eyed as soon as I dropped three pounds on its tuned trigger. As a side note, this cartridge is also chambered in a number of military sniper weapons of the day and offered right alongside the .300 Win Mag in some rifles for those professional long-range shooters considering a change in caliber.

Glass Sight Selection

When selecting a scope sight for my long-range system I turned to a Tasco I had on hand that was designed for ultra long-range work. The scope was the Tasco Custom Shop 10x50, which makes use of the large parallax adjustment wheel that is calibrated from 10 through 400 yards, then off to infinity. With its double sunshade and massive 50mm bell, the scope length reached to within

seven inches of the rifle's muzzle. With its 1/4-moa windage and elevation adjustments, the scope could be pre-set for any zero range and then moved up or down to meet bullet trajectory requirements. In my experience with field scopes, this glass sighting system was by far the best I owned in terms of getting a quality sight picture on a very distant target.

Bullets for the Long-Range 7mm Remington

In my search for a bullet for the big rifle, my partner Ross Metzger of SHOTdata Systems in New Brighton, Minnesota, came to my aid. Ross brought up his self-designed ballistics program regarding a varied number of bullet designs and weights, then settled on one bullet that seemed to meet my needs. This 7mm pill was a Speer 110-grain bullet, a .284-caliber hollowpoint TNT that retained the best ballistics coefficient when it came down to pushing air across some long-range field situations. While a lighter bullet such as the TNT 100-grain pill could have reduced recoil a bit, the fact remained that this 110-grain configuration just met my requirements in terms of a very long-haul dog bullet and in effect gave me the most performance for my grains of burning powder. For those of you that need to know the fine details, the Speer 110-grain TNT retains a ballistic coefficient of 0.3380.



One of the author's complete long-range packages in 7mm Rem Mag.



My partner Ross Metzger shooting the 7mm Mag in the Ruger No.1.

Cases for the handloaded varmint cartridge were available from supplies gathered up at local gun shops and also a few gun shows as well. The brass was well sorted and all of it retained clean primer pockets with no sign of stress such as stretched necks and other related problems.

In terms of powder I elected to turn to Hodgdon's Varget as my first choice because I had been shooting large quantities of the newer propellant for some time and had found it to produce very uniform ballistics regarding burn rate in both low and high temperatures. In effect the loads could return good results on 'yotes in the Dakotas during December or prairie dogs in the heat of July if necessary. As a new addition to my fire-making tools I turned to the powder offerings by Ramshot, who indicated that I would be more than pleased with the results of their blends of Big Boy Powder. As listed in their loading manual, a

Sierra 130-grain HPBT called for 78.50 grains of Big Boy behind it. This rocket fuel package is set off by a Winchester Magnum Large Rifle primer for a muzzle velocity of 3270 fps. I figured to cut to the 110-grain Speer TNT and if the burn was able to hold up with the lighter-weight bullet, I should pick up a couple of hundred feet in velocity while still holding chamber pressures at acceptable limits.

Varget powder, according to the Hodgdon manual, called for a 54-grain starter charge to drive the 110-grain pill at 3174 fps. Chamber pressure stood at a book-listed 44.600 CUP, making this a gentle giant in terms of shooting off the benchrest. As it was to turn out, the bench work involving the Varget loads was flawless, and getting the big scope and belted magnum dog loads zeroed-in was a walk in the park, at least to the 200-yard marker on my local gun club rifle range. Now I only needed to increase the Varget powder charges to a full-house 58.5-grain dose to watch the velocity peak at 3356 fps and the chamber pressure top out at 50.300 CUP. Along with the first generation Ramshot Big Boy handloads, the second trip to the range would again be an educational experience.

Even though the Ruger No.1 tended to “walk up” a bit as that pipe got warm, I stayed with a low volume of rounds and thereby maintained some control of the “walking” effect regarding my group shooting even at 100 yards.

Shooting the final offering in the 110-grain Speer TNT loads at the previously indicated 3356 fps, I was able to obtain workable groups that were well within my required limits of sub-moa performance. I did get an occasional flyer off my group, but I attributed that to the heavy rifle’s recoil and muzzle blast, when shot in a half-enclosed bench rest house. When you have been sending rounds downrange via the 22-250, 243, and even the 25-06 for months on end, this belted 7mm Magnum cannon can be a bit much to get used to.



Mountain country hunting requires ultra long-range rifles at times. Here the 7mm Rem Mag fit the task at hand well.

Field Time and the Big Gun

I liked the ballistics of the 110-grain Speer bullets in the “big seven,” and when I got the gun into the field again, the choice in bullet and load quickly aided me in getting on target with pinpoint accuracy. Recoil was not overly massive, and having a spotter at my side giving me a clear picture as to my bullet’s impact at long range was easy. The big 110-grain bullets came into dog lodges with enough energy to blow the tops off them, and if I didn’t hit the dog outright I sure did bury it on the spot with a spray of earth.

With the big 50X Tasco mounted on the Ruger No.1, I owned the field. When shooting, I turned down my magnification to about 14X, but afterward I moved up the scope’s power to a full 50X as I checked over my handiwork on the dog lodges. Soon shooting fatigue began to set in. There’s a difference between shooting the 22-250 Rem or 223 Rem and the big guns. The big blast will start to get to you if you’re gunning high-volume dog targets. Taking frequent breaks is a good way to approach the use of the heavy calibers for long-range shooting.

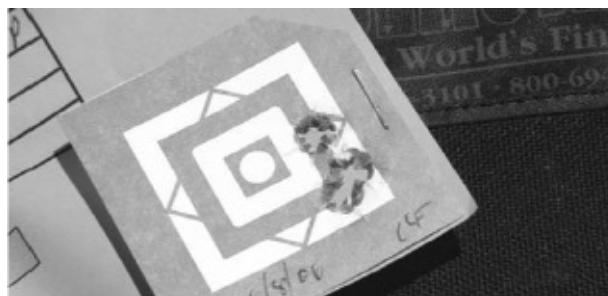
With the vast numbers of heavy rifles and cartridges in use today I’m not

about to say the 7mm Remington Magnum is the best or the only way to go. For the most part, choosing the straightforward 308 Winchester will get anything done you're likely to come across in the field, and to be sure it has built quite a reputation in the military as a long-range sniper's tool and on the target range as a 1000-yard winner.

Out here in my part of the country, the western South Dakota crowd tends to look at the 308 Winchester as a medium to light rifle system, the same way eastern shooters view the 223 Remington on those 100-and 200-yard urban rifle ranges. I'm being general here, as I have found after leaving the land east of the Mississippi a long time ago that the farther west you travel, the bigger the rifles and the longer the range. I guess that's just natural given the fact that we have a lot of space and darn few people to get in the way.



Badlands can eat up bullets at ultra-long-range. Here the 308 finds a home among the author's working long-range rifles.



308 Win factory target that came with the rifle. Note the .5-moa group right out of the box.

The 308 Winchester: A Solid Compromise

While the 308 is regarded as a light rifle by my local buddies out here in the west, the fact is that this is one heck of a good long-range cartridge. The 308 Win is also matched up to a pile of great shooting rifles as well, being born as a benchrest cartridge well before being picked up by the military on a world wide basis. In the test rifle camp, Savage Arms stepped forward when they got word about this book and consigned to me the new HS Precision-stocked Model 10 LE, or police sniper rifle in 308 Winchester. The Model 10 is all guts and go, with few fancy added toys. It's bedded in an aluminum pillar bedding system designed by HS Precision, and retains the now famous Accu-Trigger, among the best of the best factory configurations when coaxing accuracy out of a given rifle. Using a bridging rail mount for a Weaver-type ring, the Picatinny military style rail is well-made and as solid as a rock. With this class-act setup I locked the standard Weaver Grand Slam rings onto a new Leupold VXL 4.5-14x50 with the Boone & Crockett reticle. This Leupold glass was on what seemed to be at the time a match made in gun heaven in the Savage Model 10 tactical rifle. I say "at the time," because, as you will soon see, what you're observing in a given situation is not always what is really taking place at all.

In most cases I am not a fan of "black rifles," but I have to say that of late the military sniper variants have stepped up and made themselves known as extremely accurate, and sporting rifles are seemingly taking notes on the tactical rifle types. In fact, the Savage Model 10 LE is just such a rifle in that I'm sure some of its design traits will rub off on other rifle models in time.

The Savage came with a pre-shot 100-yard target which indicated that the rifle shot from the bench at .5 inches. That's the first three rounds out of her pipe, my friends, so after breaking in the green bore I fully expected to see a one-hole shooter at 100 yards down the line. Because I was not set up to handload the 308 Winchester at the time, I turned to Remington and their 165-grain Sierra MatchKing during my first encounter with grass rats in Wyoming. During the zeroing of the new rifle and paired Leupold glass, I discovered a rifle that could just about lay each shot over the other at 100 yards in dead still air. This was a dream rifle to shoot in that its balance was dead-center perfect, its recoil was easy on the old hide just with a gentle roll before settling down – and its buttstock fit my shoulder like it was custom-fitted.

Stocked with a sharp drop at the pistol grip, the rifle falls into line for use with a large ring scope. Add the Accu-Trigger System, which is a Savage exclusive, and the 3-lb. fully adjustable trigger is as smooth as wet ice. If you don't mind a news flash here, you guys that are searching for a very accurate

rifle in a 30-caliber could do well to consider this member of the Savage high power line.



Detail photo of Savage Model 10/scope.



Author behind the Savage Model 10 308 Win at the Hutton ranch. This is an accurate and very effective shooting system developed by Savage Arms. You can live with the price tag as well.

Pushing the Envelope in Wyoming

Wyoming in the spring of 2006 was prime ground for letting out the horses on the Savage Model 10 LE in 308 Win. Shooting on Ken Hutton's ranch near Hulett, Wyoming, I had all the ground I could cover in a three-day, two-state shoot, and as there were shallow rolling hills near the primary dog towns, I could stretch the range of the 308 Savage sniper rifle as far as I wanted to.

Starting on a large town of Ken's, I locked the new Savage LE down on a set of Caldwell bag rests on a Case Gard bench table, and then pointed the whole

deal down at a long 1/2 mile dog town that was backed by a creek bed's steep bank at 1400 yards distance. This was the first time out for the Savage, and I had only shot zeroing rounds through it prior to this event.

With the winds building at a stiff blow out of the northeast, I found that I had now been confronted by the fact that I would be restricted to shots straight downwind.

Any change in shooting angle of as little as five or six degrees to either side would tend to result in a real dogfight by the bullet against that gusting and steady high wind. At this point anything less in bullet weight and caliber and I would have been all done before I had gotten started, at least in terms of getting bullets downrange to any extended distances.



Remington 308 Win ammo at the ready during field shooting. Remington uses the outstanding Sierra MatchKing 168-gr. JHPBT in this load configuration.



Author zeroing the 308 Win at Hutton's ranch. Working with a portable target standard is an easy way to check regarding proper sight alignment when covering many miles of rough road during hunts.

With Ken acting as my spotter, I ranged a standing dog at 287 yards through the outstanding Swarovski LG Class 1 rangefinder. I was going to warm up on the close targets at almost three football fields distance.

Now with the cross hairs of the Leupold VX-L planted dead center on the dog, I touched off a Remington 168-grain Sierra BTHP Matchking packaged round that sent the dog someplace other than the top of the mound. After several more midrange 300-plus-yard shots in that area of the dog town I was ready to push bullets still farther downrange. Again, with the wind following, all shots were taken straight away. Anything other than that in terms of angle shots was a waste of ammo.

Now Ken was glassing the town with my Cabela's 1x42s, and within a minute or two he had a dog locked in, but this guy was pushing 597 yards, or almost the end of the first major section of this town. With this wind I was not at all sure about the shot, as even a slight push near the muzzle to 100 yards would

keep that bullet moving off course all the way out to 500 yards. If I had not driven so far and covered so many miles of muddy, rutted offroad trails to get into this town I think I would have packed the day up right there. I needed data, and I could see that it was going to be an alley fight all the way in terms of gathering much if any good information on longer range 308 Win work.

Pushing my body into the rifle I raised to my first set of hash marks on to the Boone & Crockett reticle and touched off a round. Ken indicated that I was shooting low and somewhat left. That left turn was wind for sure, I thought, and even though I was about plumb straight on to the target, I was shooting downhill and over rolling knobs that could develop wind drafting and consequent trajectory changes downrange. This was not at all easy, and even the heavy 30-caliber was having a bad day against the stiff breeze.

With Ken having to get back to hay baling and running a working ranch, I was going to be left alone to try and pull off some workable shots that would return positive or negative information about the Savage LE in 308 Win. After Ken pulled out for the home place I checked out an old broken-down structure that ranged 1,190 yards. One wall of the old building was still standing, and I judged it to be about eight feet high, or much like the old lean-to structures found throughout the west even today. Please understand that this was a safe shot, as I was the only living human for miles on this vast empty prairie. The building was not at all complete as a structure, and my subsequent safety walk through, clearly indicated that fact. Pushing my hash marks well beyond the centerline of the scope, and now holding about mid way into the heavy duplex triple crosshair, I judged the sight elevation to be about five yards high. This rifle was zeroed to 200 yards, and I had not touched the elevation turret at all.

With a pair of Walker's GameEars in place, and turned on high volume, I was going to search for the thud of the bullet against the single standing wall of wood siding on the old building. At the shot the GameEar tracked the bullet for almost three seconds, but no sound except for more wind blowing was returned. With a push of the sights up another yard to what appeared to be about six feet in elevation I touched off round number two. This time after the running sound of the bullet covering the 1100-plus yards, I caught the sound of a solid slap against a hard object. Driving back toward the structure I did indeed locate a bullet hole about one third of the way up the side of the worn log wall. I had hit my target, and the shot served me well when understanding how a military sniper can dial into a target like that at ultra long-range, and then keep some bad guys at bay with their heads down while a fire or assault team gets into position. Beyond that

little element of that exercise there was no practical value in what I had just done with the 308 Win, and a ultra long-range poke out onto the Wyoming prairie didn't prove very much.

After the structure shooting event I pulled back my horns and ranged several dogs at 540 yards. I had a slight angle on them of about 11 degrees, and now I was holding over for the wind about three feet to the right, but using my second hash mark dead on in terms of adjusting for elevation. I didn't connect at the first shot, or anything even close, but I did "walk" the bullets into the kill zone, and thereby took out two of three dogs even in the stiff wind. However, that stated I was now down almost a full twenty-round box of cartridges by the time I had concluded that 500-plus-yard event.

Harding County, South Dakota

After a fine dinner of shepherd's pie put up by my host Ken Hutton at H-Crown Outfitters, and a good night's sleep in the bunkhouse, I headed out early the next morning for Harding County, South Dakota, and my old friend Randy Routier's guide operation near the town of Buffalo. Randy had indicated that it was completely safe to push bullets out over a section of badlands that was on the ranch, and for targets I would have all the mud buttes I could shoot at, including every color and size of rock imaginable. Again, like the old standing wall on Ken's place, this was a safe zone in terms of shooting the mud buttes or individual rocks at long-range. The whole of Harding County does not have the population of most small towns, and to see another individual in a single day is very unusual when afield.

Upon reaching the ranch I did encounter a lady named Ronnie Shinabarger. Ronnie was Randy's fulltime assistant, as my friend needs some extra help, being confined to a wheelchair at all times. As it was a lazy Sunday morning and Randy had decided to join me and load up in his special van with ramps and backup gear, Ronnie was doing the driving and was joining us for the shooting event. When we reached the mud buttes and Ronnie spotted my shooting equipment, she got on her cell phone and promptly called in her husband Warren. Warren, like so many of our local folks, was an avid coyote and big game hunter, and guns were a big part of his day-to-day world. What this did now was give me three spotters with the husband and wife team being on field glasses and Randy covering the broad expanded landscape with his naked eyes, which were far better than most.



Harding County Badlands. A great place to send bullets from big Rifles a very long way downrange.

At first, as I had done in Wyoming, I elected to first take a few shots at targets ranging from 350 yards to just under 400 yards. Using the first hash mark at 400 and allowing for bullet climb, as we were shooting into a very deep canyon on a 10 -degree drop in elevation, I found that it was not much trouble keeping bullets on mud-coated rock overhangs and outcroppings that stood against large several hundred-foot-tall buttes.

After a bit of shooting, and using Ronnie as my spotter, I soon discovered that she was an iron-eyed individual, in that she just didn't flinch at all with the bark of the .308. She in effect had turned into the fire control person for the day as she picked out targets and I ranged them, recorded them and then shot them. Now some good long-range shooting information on the 308 Win was starting to come together.

Pushing the 308 Win to 677 yards (ranged) I proceeded to pull up two full hash marks and halfway into the lower heavy line under the duplex point in the reticle. Like the previous shooting, I didn't want to move the elevation turret off its 200-yard pre-set zero. After cracking rock at that range I turned the rifle over to Warren, who with my advice on exact hold proceeded to crack the same big rock dead-center with his first round downrange. We had the 308 Win dialed in, and as we switched positions spotting and shooting, it became very clear that once that scope is dialed to a target the rest is simply breathing, hold, and trigger work.



My guide and friend Randy Routier spotting shots with his buddy during the long-range tests on the Harding County Badlands.



Author shooting the Savage Model 10 LE at long-range targets over the expansive Badlands of northwestern South Dakota. This was a great “safe zone” to use when sending bullets well out beyond normal range limits.

Like the 25-06, 300 Win Mag, 7mm Mag and others, this rifle in 308 Win is a great crossover piece of equipment. One day it's used on long-range dogs, and the next, speed goats on open prairie grass. If I had my way this same rifle in the Model 10 LE would be chambered in 223 Rem and 22-250 Rem, as well as 223 WSSM. I think Savage would sell a pile of them in short order. The Model 10 rifle may be cop-shop sniper material, but it is all balance and accuracy, which is always required of a good varmint/target rifle.

One major element that surfaced from the work that was done with the 308 Win was my choice in glass sights. While I could have mounted several other scopes on the Savage sniper rifle, I had elected to use the Leupold VX-L 4.5-14x50mm. But the problem here is that this and scopes like it are set up as big game sighting systems and not ultra long-range ones. This scope, as outstanding as it was, and I mean that to the bone, didn't retain enough hash marks, mildots or whatever to get the job done. long-range glass is just that, “long-range,” and it requires several elements to become a first-class distance rig.

First of all, it needs to have that above-mentioned reticle system installed.

All of the elevation and windage needs to be usable right to the bottom of the scope. Secondly, external 1/8-moa elevation knobs need to be employed so that extended and quick adjustments can be made for elevation. Third, the best system of all for this work is a beveled scope base that retains adjustments, like the military-style Leatherwood M-1200 Tactical. Leatherwood uses a system that zeros each range graduation to 1200 meters when high-BC 308 Win or 50 BMG rounds are used for ultra long-range sniper or target work. This is a no-math 6x24x50 scope set up very much like the Sweet 17 ranging scope systems reviewed in Chapter 3, but on a much larger scale.

When I was testing the new VX-L Leupold glass on the Savage Model 10 LE I did give “in scope gap” ranging a try, based on the distance between the hash marks on the Leupold glass. In the evenings close to my camp, large mule deer, and I mean record-book animals that were massive velvet 5x5s, started to move toward the tops and out of the canyon. I was “gapping” the animals in the hash marks on the Leupold glass and found that with the Boon & Crockett reticle set at 16X, a large buck mule deer at 400 yards fits the spacing from the crosshair center to the top of the first hash mark. In other words, here is a ranging system you can use through the scope when hunting big game. I hunt that area where I was camped for winter meat each year, but if you’re in search of a book deer this whole area is the best-kept secret going. Western South Dakota is trophy country bar none.

With some time behind the Leupold glass, it was time to move into a second option in scopes, and this time the folks at Swarovski got the call. Swarovski had been good enough to send out a PVI 2 6-24-50 L that featured a set of four hash marks and a low light reticle system as well. Still not a dedicated ultra long-range unit of glass, but a change from the previous effective, but hunter’s model, Leupold scope.

With the change in glass I had to go straight back to the Savage rifle’s Weaver rail because the new glass had a large 30mm tube. So Weaver standard highbase rings the got the call. As the rifle was now finally set up with the Swarovski glass, I started to make plans to get this second sighting system up and on some long-range prairie dogs.

After a quick 25-yard basic point-blank zero on my home test range, I sparked up the Tundra 4x4 and headed for Greg Iversen’s ranch where I had previously tested several rifles and loads for this book. Greg was out cutting the last of his early summer hay crop, so I was given the run of the place in terms of

his well-populated dog towns.



Author glassing targets during the Badlands shoot.

Now with the new sights, the Swarovski rangefinder and my field glasses, it didn't take long to lock onto a fat dog that ranged 347 yards, and almost at a right angle to a building prairie breeze. With the rifle zeroed two inches high at 200 yards I figured the 168-grain Sierra in the Remington fodder would drop almost directly onto my 11-inch-tall or so gray rat. Setting up for the shot with a bag rest and shooting table, I set the crosshairs on the critter's head, pulled to the left side of the body for wind drift, and touched off the round. With the buck of the rifle and the subsequent settling of the scope, the dog was just gone. I had been shooting the 308 Win in the Savage tack driver enough of late that I had developed a system by which I didn't strangle the rifle at all, but let it lie loose in my arms with only two fingers closed around the folded bipod rests at the forend. This in effect gave me just enough force on the rifle to allow it to roll back and settle again by the time the bullet got to the target. I was seeing my hits even though I was shooting a heavy-caliber rifle with a heavy weight bullet. As I have indicated previously in this book, the larger calibers can fight wind off well, and the 308 Win is a classic example of a rifle cartridge that will keep the dog shooter in the game much longer than many of the sub-caliber cartridges

that can't hold up against the wind.

Firing several more rounds at dogs at or just inside the ranged 347-yard targets, I pulled out the stops and ranged a 456-yard critter that was hanging out near a whole group of young pups. Now pulling up to the first hash mark on the Swarovski glass at 12X, and a good sight push into the wind, the bullet cut a bit right off the dog, but bullet jacket and rock fragments were dispatched into its hide resulting in a wounded prairie dog that was not going to live long. I sent round two into the dog lodge and took most of the right side off of it, thereby sending that rock-slapped dog cartwheeling end over end. I had been fighting the wind all the way to the target, and I'm here to tell you that no 223 Rem or even 22-250 would have been able to get the job done under those field conditions. The Savage Model 10 in 308 Win was winning my admiration to be sure. I realize that these shots taken at prairie dogs were not world-shaking in terms of extreme range, but when shot under 18 to 20 mph winds these may as well have been 600 -700 yard shots in still morning air.

Day two at Greg's ranch was a bit different, in that I was now joined by my two partners Tom Hansen and Larry Crawford. The morning air was clean, calm, and the dogs were out in force. I had been visited by the UPS truck a few days earlier and I now had two more load options to take into the field. Federal Cartridge had sent out their match grade Sierra 168-grain MatchKing loads and also some American Eagle 150-grain JHP rounds for bombardment exercises.

In terms of a third option in 308 Win ammunition brands, the folks at Wolf Ammunition had shipped a plastic pack of 150-grain JHP 308 "Gold" that was loaded by Wolf in eastern Europe. I always check the manufacturer of Wolf ammo because everything from waterfowl and upland loads in shotshells to 223 Rem "blam blam" fodder will come from manufacturing operations across the globe. That stated, however, Wolf ammo tends to shoot well in everything I have tried it in to date. Now we would see how the new production, old eastern-bloc ammo would perform in the all-American Savage police sniper rifle.

Setting up my portable bench rest with an eye toward the same end of the dog town I had been shooting on that first day out with the Savage 308, I locked down my bag rest, and then chambered a round of Federal American Eagle of the 150-grain jacketed boat tail variety. For a JHP round that is at the bargain end of the retail ammo price range, this Federal fodder shot very well right out of the gate. Settling down on a warmup 255-yard dog I turned it over with a quick slap of the 30-caliber bullet. In general I don't shoot much jacketed ammo in the

field, but in this case I was sure of a very long-range backstop of 1500-plus yards, and I had miles of open space between me and any living thing.



Some of the loads used during the long-range shooting of the Savage Model 10 LE in 308 Win.

With the barrel warmed up I searched out a standing dog at 333 yards and with my crosshairs set just atop its head, I touched off the round, thereby taking its feet out from under it. Wop! In a cloud of dust that lifted about fifteen yards in the air, the dog was just rolled up into a fur ball, and no longer was part of the equation.

Shooting 18 more rounds of Federal JHP, and finding my mark with 15 of them but with all shots inside 300 yards, I soon found that I had run out of targets. The air was dead still, temperature about 78 degrees Fahrenheit, and the conditions were letter-perfect for shooting ultra-long-range. Ranging a single fence post that stood about four feet tall, my range finder returned a 657-yard figure. I had my zero set at 200 yards, but my range card attached to my rifle was calibrated to 600 yards. At 53 inches of hold over, the 168-grain Sierra MatchKing bullet would drop dead center on a 600-yard target, so I simply adjusted my sights using the scope's hash marks to a total raised elevation of 62 inches, figuring that would put the bullet about dead center on the pole. As to

seeing if I hit the thing, that was easy as the ground was bone dry and prairie dogs had eliminated any amount of grass, making the area around the post a powder-dry surface that would clearly show a bullet impact. Secondly I was using my previously successful GameEar system, and with it I would hear the bullet smack the post if I did indeed hit it.

Setting up and raising my elevation to 62 inches, I touched off the shot and waited for dust or a smack to reveal the bullet's impact downrange. What returned was a loud smack, followed by dust rising almost straight up off the post. Again the 308 Win was showing off its stuff as a very effective long-range shooting system, and there was little wonder why snipers tend to gravitate to this choice in cartridges.

With the 308 Win making use of great BC bullets, and lacking the stiff recoil found in larger cartridges, it is my opinion that this is an outstanding choice for sending bullets well out beyond the ranges we associate with the 224 class of long-range cartridges. While I'm not about to get rid of my 243 Win, or what we could call a 6mmx308, or my old wildcat 25-06 Rem any time soon, the 308 Win is gaining a strong position as a working choice in my personal long-range arsenal.

50 BMG: Really Big Guns

The supergun or 50 BMG is a throw back to WWI. Yes, that's correct, when the Germans developed the first antitank rifles to be used against British tanks during that "Great War," the John Browning modified the German 55-caliber round into the world-famous 50-caliber Browning Machine Gun, or 50 BMG, cartridge.

This massive cartridge has the same baseline dimensions as the good old 30-06 Springfield, with one obvious exception: it is much larger in proportion. With the 30-06 being the jack of all trades in the days of the 50's development, it was quite natural to take a look at designing the 50 caliber BMG around the same basic case dimensions as the 30-06. The design must have been a darn good one because we still use the big 50 BMG in the US Army's heavy machine guns today. Little from that first gun has changed with the exception of mounting it on much newer vehicle designs, and as of the Korean War this big 50 has found a new application as a single-shot sniper's tool. By the time Vietnam rolled around, the big 50 was a serious threat to the enemy as our sniper gunners dusted them in the open at 1000 yards or better. Information I have been afforded has

indicated that this gun has cleaned out the bad guys in Afghanistan to distances as great as 2,200 yards. Oneshot stops without question, and a real morale breaker as well among the enemy.



The 308 Win is a good choice when pushing bullets to long-ranges.

Today with the exception of the state of California, which bans its use, the big 50 has built a real following as an ultra-long-range target rifle and critter control tool. Nothing except for an antiaircraft gun could match or beat its muzzle velocity, projectile-sending ability, or sheer power. No, the “Ma Deuce” as it has been called is the ultimate long-range rifle. Since federal law prohibits cartridges with a bullet diameter larger than .500”, the 50 BMG is as big as we’re ever likely to get.

The Blue Grass Viper I shoot takes up the entire bed of my Toyota Tundra when I go afield with her. She has a name “Ms ATAT,” and just getting her into action on a prairie dog town takes a good deal of effort. This is not a run-of-the-mill normal target rifle by any means. Any larger and it would be classed as towed artillery. (Be advised that as of this writing, no criminal element or terrorist has used the 50 BMG in the commission of a crime on US soil.)

I first got my hands on the big. 50 BMG during a writer event at Pasa Park,

Illinois, some years ago. We were testing a new 30-caliber Hornady bullet with ordinance gelatin on an 800-yard range, and by chance I arrived at that venue just about the time the folks at Midway, the big shooting supply company, were unveiling a McMillan turn bolt, box-magazine 50-caliber at the benchrest. Well, it didn't take much coaxing for me to climb behind that big rifle and chamber a round of 650-grain ammo. As everyone cleared the area and then doublechecked their ear protection I touched off a shot at a 600-yard block of ordinance gelatin. At 12x12 inches this was almost too easy as the block jumped up and then back with the impact of the big bullet striking it close to dead center.

At the shot, some extra rounds on the bench were blown over my shoulder and the white paint on the roof overhead was now flaking off and drifting down like a small snowstorm. I guess you could say that I was more than a bit impressed with this very big and effective unit of firepower. In the past I had shot everything from an English 4-bore commercial market hunter's duck gun to the solid and hammering 416 Remington Magnum. As well as those heavy guns previously mentioned, I had produced a good deal of work with the many 10-gauge heavyweights over the years. At times those big 3-1/2" and special 4" shotshells were capable of delivering as much if not more punishing recoil than the 50 BMG. I have to say that the 50 BMG is a bit overrated in terms of recoil. I'm not saying that the big gun is to be taken lightly at all. This cannon will deliver some massive energy, but it is tolerable and, after a bit of time behind the rifle, reasonably easy to accept.



The big 50 in this case the McMillan turn bolt tends to draw a crowd on any range.



McMillan 50 BMG at the bench rest during long-range shooting at Pasa Park, Illinois.

Shooting the 50 BMG is without question a whole lot of fun. That is to say when you start to shoot one, you want to shoot more. This gun is so massive and far above anything else in my inventory that it just commands all of my attention.

I can give you some tips in the event you decide to try the big 50 BMG. First of all when you scope the rifle, allow yourself at least a three-inch clearance between your eye and the rear of the scope. Recoil can be enough to bounce this tube off your skull, and keeping a safe distance is mandatory.

At first, shoot from a solid benchrest. Shooting prone is useful and quite workable, but getting used to the muzzle blast and recoil is better done in the sitting position. Your upper body can flex with the shot and allow you to build confidence shooting the monster rifle. When I first shot the 50 BMG there were exactly three takers on the range. That was out of about fifty individuals hanging around the big gun. I think you're getting my point here.

Zeroing a 50 BMG is an art form all by itself. When I scoped the Blue Grass Viper I'm currently shooting, I elected to mount a Ramshot VARTAC 4x14 varmint/tactical tube that featured completely open turret adjustments and parallax dial in controls. At first I simply removed the bolt and boresighted the scope using the big 1/2" bore and crosshair alignment against a pre-established

25-yard mark on a pine tree near my house. This system is very accurate with small bore rifles, but I must admit I knew that I was only going to get somewhat close as the big hole in the barrel left a good deal of slop from side to side as I directed it at that white spot on that tree.

After getting a basic bore sighting, I took the rifle to a prairie range east of Rapid City, South Dakota. This range was on the Buffalo Gap National Grasslands, and if a bullet did get away it could travel for miles and not hit anything but mud, snakes, or a very unlucky coyote. Using a bench rest that some nice folks had built years ago at the range, I set up a portable Champion target standard that held a 3x3 piece of cardboard and a zero-in target. This was mounted a full 50 yards downrange. If I was going to miss the center bull at several dollars a shot, I wanted to at least find the hole on the paper.



VarTec scope mounted to Viper 50 via the Weaver rings and rail system. This system held tight in the heavy recoiling rifle during a full month of extensive shooting.



Author checks zero target via the Viper 50 BMG during the mounting of the VarTac scope.

Using a set of Caldwell shooting bags while keeping the bipods folded under the barrel, I proceeded to load the big Viper single shot, drop off the safety that goes on automatically as you close the bolt, and then pushed the buttstock into my shoulder. At the shot, which was muffled by my Walkers Game Ear shooting muffs, the earth came unglued behind the target about 25 yards, but in a nice tight direct line with the target backer. I knew I was at least close, and sure enough even with my naked eye I could see the big 1/2" hole a bit left and high on the paper.

Turning the adjustment knobs on the VARTAC scope, I proceeded to do a whole lot of spinning as the graduations on this glass tube were 1/8" versus the 1/4" found on many scopes today. After turning the turret knobs for what seemed like forever I set up for a second shot, but this time pulled away the bags, dropped the bipods, and only using one small sack under the buttstock so as to adjust for elevation. Recoil of this light 50 was manageable. In the event that first round had been a piledriver I wanted to have the gun set solidly on the bench so as maintain control.

Shooting with the pods down, that second round felt good as the rifle rocked back, but not into my face as one would expect. At the target I still needed a second adjustment to the right and a few clicks down to hit my correct ultra close-range zero point. I wanted the bullets to hit 1-3/4" high at 50 yards. Now with that second turning of the windage and elevation knobs the third shot went

straight home and I had a baseline zero which would now allow me to move the target out to the 200-yard backer.



Author's wife Colleen spotting in the Badlands via tracking the rounds downrange sent by the Viper 50 BMG.



Author behind the Viper 50 BMG in the Badlands of South Dakota.

At 200 yards I moved up my magnification to 10X and promptly dropped a well-centered but 3” low hit on the bull. It would seem that according to my ballistics tables, an additional elevation correction for a 200-yard zero was required. Anyone who thinks that the big 50 BMG won’t drop downrange is living in a dream world. This massive 650-grain bullet drops like a rock, but it can fight wind and maintain momentum very well, making it one of the best possible 2000-yard shooting systems in use today.

With the rifle zeroed it was time for my wife Colleen, a very capable spotter, and I to head for the miles of badlands in western South Dakota. This was stretch day for the 50 BMG, and as such I would use it to shoot everything from long-range mud buttes to some paper targets out on the empty and vast wastelands toward the Missouri river country. Even though the area was full of prairie rats, the government in their infinite wisdom had seen fit to close all shooting down in this area. That federal move is something I will never understand to be sure.

Dog shooting would have to wait until I could get out to a local ranch.

As I set up the Viper on a Case Gard bench and buttstock bag rest, Colleen stood back with a pair of 10x42 Cabela's Euro binoculars and locked onto a slim bum butte that stood about fifteen feet high in a flat wash that was back dropped by a sharp ledge that would catch a bullet in the event I sent one over the top of the mud hill. It must be understood that the 50 BMG has a 7000-yard effective range in terms of inflicting damage. At no time is this big gun taken lightly in terms of safety, and each shot downrange is planned with care at all times.

At the shot at a predetermined spot on the butte, Colleen jumped straight up and didn't see a thing through those glasses. I on the other hand did see the dust trail drift off the butte as the scope settled back. Now I glassed the surface of the mud pile, searching for the bullet impact point on the ranged 438-yard target.

Dead center, and exactly where I was aiming was a three-inch hole in the center of the butte's face. Now with an aiming point established, round two was also sent into the butte, but this time the hole only got larger. With an accurate zero in place my next step was to get the 50 Viper out and on some warm targets on a rancher friend's back 40.

Heading for Greg Iversen's ranch, where a section needed the local rat population thinned out, I met several local friends the following Saturday morning. The days was warm and clear, but even early in the morning the winds had already started to build, giving us a stiff crosswind from right to left. Larry Crawford had arrived early and had gotten off some close-range shots with his neat little .218 Bee in a hand-built Martini-action single-shot rifle. Even though long-range shooting is a challenge, getting a tigh-shooting little centerfire rifle on target can be a real blast as well, and it was obvious that Larry had been having a good start to his day on the dog patch. At 250 yards the little 218 Bee was doing its long-range work. If you don't think so, give the small fry in rifles a try sometime.

My two other partners Tom Hansen and his buddy Kevin Janish had pulled up near the big dog town, and Tom was unloading his small portable bench that allowed him to "walk" the towns quickly. Larry and I on the other hand were using bench tables and rest systems in a more static mode. My bench was a very lightweight Case-Gard table with aluminum legs and and an injection molded plastic top that ran about five pounds total weight. This bench was lightweight but very solid, and had a large enough surface area to easily hold the 50 BMG Viper.



Tom Hansen doing the shooting and Kevin spotting the shots downrange. Shooting as a team can be a big help when pushing bullets to their limits.

In terms of starting my morning, the big 50 was going to be pushed back a bit inasmuch as I had work to do on an upcoming story that dealt with a new Remington Arms Mauser rifle, the new Model 799. The rifle was built under contract for Remington in Serbia, and it was a scaled-down turn-bolt Mauser in 223 Rem that by all measure was a neat looking little rifle. I needed to shoot and clean the rifle several times with some Wolf (Russian-manufactured FMJ steel case 223 ammo, and a few rounds of Winchester 45-grain JHP.

With a Simmons 3.8x12x44 locked down with Warne bases and rings on the receiver, this rifle shot like a dream in terms of its accuracy. However, the wind was still building and as such the light 223 Rem was going to be shut down soon with the constant 25-mph breeze cutting across the dog town at a right angle to our position.

By the time the switch grass had been blown flat to the ground and dust devils were starting to swirl overhead, I figured it was about time to pack up the light rifle and go for the heavyweight during the final few minutes of the morning's shoot. I had ordered 100 rounds of Talon American new production ball ammo for the 50 BMG through Cabela's, but it was on back order, and so I was down to only a handful of rounds.

Setting the big 50 up on my bench I located a dog using my Leupold system

at a ranged 397 yards. Not a massively long shot, but the 223 Rem and that 25-mph wind were not about to get it done. The big 50 on the other hand could fight that wind well.

With a standing upright large dog in my VARTAC scope sight, and the crosshair center set on eight clicks up with an advanced zero of 300 yards, the 50 BMG cracked. I allowed about a three-dog width along the dog's left side for a windage adjustment of about 5 degrees in angle, and at that sighting the bullet destroyed the top of the dog lodge, and the grass rat just disappeared.

At the shot I had company, as the guys had not seen me haul the big gun out of the bed of my truck. Tom indicated that he could feel the drafting concussion of the muzzle brake out to the 130 yards that he and his spotter were set up at.

I offered the guys a shot with the Blue Grass Viper and both Larry and Tom took me up on the chance to get behind the massive 50 caliber gun. In both cases, after taking a crack at long-range dogs, the men indicated that the gun was pleasantly gentle to shoot, and softer in recoil than some of their own big-game rifles. The brake system actually deflected the energy around and away from the shooter. Anyone standing behind and to the side got caught up in the muzzle blast, however, as had my wife Colleen on the day I was having her spot shots for me in the Badlands.



Larry Crawford shooting the small but effective 218 Bee in a high wall custom rifle of his own design. long-range can at times mean shooting less than the big guns downrange.



Larry Crawford making a major switch to the Viper 50 Caliber rifle. As Larry stated. “This is no 218 Bee for sure.”

The Blue Grass Viper weighs 24 pounds less the varmint scope and loaded round, which itself weighs 1/4 lb. The big rifle has a long Weaver/Picatinney rail that will allow a scope to be positioned over a very long receiver distance. I used standard Weaver rings on my system, and to date the old Weavers have held their ground well. In all honesty I don't believe the 50 Viper generates any more recoil than my Remington 870 12 gauge with a 21" slug barrel on the benchrest. In fact, it could well be less after you get used to the shock of the heavy gun's report.

With an overall length of 57 inches and a 32" barrel, less the muzzle brake that resembles the one on an antitank gun, the Viper is a handful to move around. When the big gun is locked down for a round or two sent downrange, it is a nice gun to shoot. I should add that the folks at Blue Grass Armory were one of the only 50 BMG companies to stay on task and get a gun to me for this book. In other words, these folks were willing to hang their product right out for all to see, and take the chance that all would go well in terms of the big gun holding up to a long series of field events. Many thanks to the folks at Blue Grass, as they have contributed greatly to the overall development of this book.

At a second location (covered in the “where to go” section in Chapter 13) I headed again for Hulett, Wyoming, and H-Crown Outfitters for additional gun time behind the Viper 50 BMG. H-Crown has space, and as such a safe

environment for big guns like the 50. Here I shot several old well-known dog towns , but due to poor wind and general weather conditions I didn't get the data I was searching for. What I wanted to do was push the range to a new limit that would bring the big 650-grain bullets out to nearly a 1000-yard range. There are problems with this type of shooting, however, in that you always need spotters due to the big 50's recoil and target blackout. I was starting to see targets with bullet impact beyond 400 yards at times, but it was not consistent, and with ammo costing \$2.75 to \$5.00 a pop, I wanted data on as many rounds downrange as possible.

Ken helped to some degree, but except for the fact that he got behind the big gun for a few shots we didn't accomplish much in the way of hard information downrange. I cracked a dog at 392 yards, or at least it was not there any longer after I shot. Also by pushing the 50 BMG's range to 578 yards, a maximum range for the day, I at least added one longer-range warm target to the list. Wet ground limited impact observations, and that meant a hold was put on the high dollar ammo for the time being.

Like the previous work I did with the 308 Win, a day later I was back to Harding County and Randy's place once again. Now the big 50 was in place for long-range targets out over those badlands buttes, and Randy was along, as was his driver, now acting as my iron-eyed spotter once again.

Target selected, agreed on, and ranged via the Swarovski LG, the 50 BMG was set to work once again. Using the first mildot on a 538-yard round gray rock that was about halfway up the side of a butte, the 50 cal just smoked the ledge and the rock was gone. In its place was a gaping hole about the size of a coyote's body. Pushing to a ranged 731 yards and targeting a red oval rock that stood midway up a shallow gray slide wall, my next shot went about 36" low. With the shot called by my spotter and confirmed by Randy, I corrected the gap with some additional holdover and sent another round downrange. Wham! The 50 thundered, and the rock now stood out with its whole center missing. Range confirmed a second time for the book at 730 yards. It was hard to get an exact fix when the targeting aid in the range finder is larger than the rock being viewed.



Author with the Viper 50 BMG and Savage Model 10 LE 308 Win. Both are considered military active sniper/long-range rifles.



Ken Hutton glassing for a target as he gets behind the 50 BMG.



long-range dogs require rifles that can send bullets fast and flat a very long way down range. Advanced ballistics is the key to gaining good results on long-range targets.

Now with a second dead rock gunned at 768 yards, and a green bush cut off

its base at 677 yards, the final shot pushed the 50 cal to 819 yards and a third rock died. We had fun with this last shot, as I could see the dark hole in the rock's center, but Randy insisted in fun that it had been there previously. He indicated that a shot with a 50 needed to be at least 1000 yards, but try as we did for the super long shot, we just could not get dirt to fly, or rocks to die at that range. I on the other hand drove off that bluff very satisfied that I had hit things farther than I had at any other time in my history as a rifleman and gunwriter.

Like other work I had done with larger caliber rifles, about a week after the Harding County shoot, I took up the big 50 cal again on a very windy morning near the Black Hills of South Dakota. This time I was using prairie dog targets as my primary objectives. The weather was cool, but a warm front was rolling in from the Big Horn Mountains, and as such, winds were driving hard across the open prairie.

Shooting at ranged 425-yard dogs, the big 50 BMG kicked up dust so high I thought I was shooting a French 75mm on wheels instead of the great American 50-caliber machine gun round. While I didn't shoot all that well in the gale-force winds, I did drop a few 650-grain pills on enough rats to convince me that the 50 cal is a wind fighting machine next to none. While the bullets drop like rocks even inside 500 yards, these big chunks of copper and lead don't drift far off course at all. In effect, I owned the field well out to 500 yards, but at the price of ammo and with those high winds I did tend to pull in my horns just a bit.

In terms of target hit identification, I had been shooting the big gun enough over the past month that, like the .308 Winchester previously reviewed, I was starting to see my impact dust storms boil up in the sights at ranges beyond 400 yards. That was just enough time for the bullet to get downrange and the rifle to settle down and return a nice clean impact picture to my eye.

Basic Ballistics: The Big Guns

With the greatly appreciated help of specialized ballistics experts like Ross Metzger of SHOTdata Systems of New Brighton, Minnesota, and Tom Burczynski, the top gun at Experimental Research of Montour Falls, New York, I have been able to develop some ballistic tables as a part of this review. Included here are tables that deal with the heavyweight bullets in both 416 Barrett and 50 BMG. These tables will allow the reader to understand the performance of the big bullets downrange, and also allow the shooter to print out a workable drop table quick reference card in the event these cartridges are taken

afield.

What we do see with the 50 BMG right off is that it is not a cure-all for getting on long-range targets. Drop factors involved with this massive round are still major elements to be considered when shooting at long-range. Even a slight change in bullet design, ballistic coefficient will produce major changes in retained velocity and drop figures out at the business end of the big rounds.

For example when taking a quick look at the table listing the 50 BMG and a 647-grain bullet with a BC calculated at 0.6700, and using a drag function of G1, we see the following performance profile develop. Using a short version to save space, and because you can review the full table listing in depth on your own, we can see that at the muzzle this round is producing 2910 fps. At a reasonable zero of 300 yards, considering what this cartridge is capable of downrange, we have a velocity of 2568 fps. A good deal of loss, but the faster a bullet is moving, the greater its velocity loss over a given range. Less speed, less loss. That's the end of that story.



Barnes's bullets are known for keeping full weight retention.

At 400 yards the velocity of this pill has been reduced to 2375 fps. Now it is just coasting along, but good old gravity is taking hold and pulling at the bullet. The drop figure stands at -9.7 inches, or enough to miss a prairie rat cleanly, lacking any holdover. At 500 yards things are really going to pieces in that the velocity is falling off to 2251 fps and the drop is getting to be a real problem at -25.6 inches. (Remember Chapter 5 and the Rule of 400.) Even this massive round can't outrun physics and now the bottom is falling out of its velocity.

Even so we can mildot-compensate for a 25-inch drop, so what's the big deal? Fine, but now at 600 yards this machined steel football has dropped a full 48.4 inches and its velocity has fallen off to 2131 fps. Push the range out to 1000 yards, the much-written-about maximum practical range of the 50 BMG, and we have an astounding 226-inch drop and a velocity of 1688 fps. Speed is good, energy is still sufficient to knock out a vehicle, but that drop means a pile of

calculations when getting a hit on the bad guy in the mountains of Afghanistan, or taking out a rock chuck in the Big Horn Mountains of Wyoming.

With a change in BC to a figure of .5010 and a muzzle velocity of 2846 fps, the 600-yard drop for this bullet is now 57.4 inches with a terminal velocity of 1849 fps, and at 1000 yards the stubbier bullet is now falling -288.4 inches with a velocity of 1341 fps. That's a drop at 1000 yards of 62 inches and some small change. Not that either is looking really good on paper, but that second bullet is falling farther than the height of a man when compared to the first example.

What we can now see is that BC is a definite element to be considered when checking out bullets in even these very specialized long-range guns and loads. Barrett Firearms and Ronnie Barrett, the man behind the gun if you will, has unveiled the new Barrett 416 which I have introduced else where in this book. Here however we will run this new hot cartridge through the computer programs and see what rolls out the other end. Again, you have a complete profile included in this chapter based on Mr. Metzger's SHOTdata calculations.

When this data was being generated Mr. Metzger had a problem with the advanced, and just about perfect, BC associated with the new Barrett 416. At a figure of .934 it was hard for an old trigger-yanking ballistics guy to buy into that number. As he stated in e-mail after e-mail, "L.P., are you sure about that BC with the new Barrett .416 bullet?" Time and time again I reassured my good friend that indeed that was the information I had been presented with, and that he should move forward with this information and see what developed in terms of some workable downrange drop tables.

First of all, shooting the 416 Barrett with a bit of a more common BC of 0.546 indicates that this cartridge with a muzzle velocity of 3250 fps and a 300-yard zero will drop its bullet -8.1 inches at 400 yards and retain a velocity of 2718 fps. That's a nice shooter for a medium long-range shot. After all, folks, let's get real here: 400 yards, or four football fields is not any kind of chip shot to be sure.

At 500 yards this bullet has dropped 21.5 inches and is moving at 2396 fps. Still a hot round by any standard. Now push the range up to 600 yards, which even the big-time military gunners feel is "long-range" shooting, and you have a drop of 40.9 inches and a terminal velocity of 2243 fps. The rest of that story you can review for yourself in the accompanying tables.

Now, let us take a crack at the new Barrett 416 with a hot BC of 0.943. With a muzzle velocity of 3250 fps and a 300-yard velocity of 2934 fps, this fast-

mover comes into a 400-yard target at 2833 fps and has only dropped 7.1 inches. That's not the big news however because at 500 yards the drop is still only 18.5 inches, and at 600 yards 34.5 inches with a velocity of 2639 fps, or the speed of a 180-grain .30-06 at the starting gate.

Moving out to 1000 yards, the 416 Barrett is steaming along at 2275 fps with a total drop of 152.5 inches. That's 75 inches less than the first 50 BMG we calculated at the onset of this discussion. If this is all correct, and I'm only the messenger here as I have not shot the .416 as yet, this is the go-to gun system for taking out soft targets in a military setting. This super round is also one heck of a long-range woodchuck shooter in Pennsylvania or marmot killer in the Rocky Mountains. If this new 416 Barrett shakes out cleanly without problems in a wider range of actions, you're going to see a lot more of this big fast-mover in the future.

Making Another long-range Run: The 50 BMG/308 Winchester

Indian country, being the Cheyenne River Sioux lands in South Dakota, has always been a real home base for me when pushing bullets a very long way off. This time I would be hunting a local ranch with my old friend John Anderson once again. John, as editor of Varmint Hunter Magazine, had a pile of rifles and scopes to run through testing for the magazine, and I needed to run both the 50 BMG and the 308 Win. With about 70 rounds of 50 BMG remaining in my ammo can, I wanted to try for a 1000-yard kill with the big 50, and I was going to give the task my level best. As for the 308 Win, the folks at Black Hills Ammunition had stepped up and offered two loads for some long-range shooting, the first being the military sniper variant in again the Sierra 168-grain MatchKing, and the second a 150-grain Hornady A Frame bullet.

The week we had decided to head for Eagle Butte and the reservation lands, it was very hot. Temperatures were hovering around 110 degrees Fahrenheit, and the prairie winds were not at all friendly by late morning on any given day. Forting up in Faith, South Dakota, at the local motel, John and I we were about 50 miles out in terms of getting to our dog towns, but in this part of the country that's not much more than a ride around the block.

The day started at 5:00 a.m., and after an hour's drive we found ourselves amidst dogs that had in effect denuded the land of all vegetation. Brown earth and dead foliage was everywhere, and the main town stretched for about 700

yards in three directions, with a stock tank to our backs.

John was shooting his 223 Ackley Improved, while I elected to turn loose the Black Hills Match Ammo in the 308 Win. While John was forced to shoot into the headwind so as to keep bullets on target, I was taking on a gusting 8-15 mph breeze at a right angle with the 168-grain 308 bullets. This was a great matchup of the light 223 Ackley Improved rifle versus the heavy weight 30-caliber in a windbucking contest.

At first I got the range via my ranging equipment and proceeded to pound a 285-yard dog with the first shot that cut across the now-building wind. I had my shooting eye right off and now I proceeded to move the bullets out along a butte wall that allowed me to push those target-grade pills from 335 to 386 yards. Shooting a single box of 20 rounds I connected on 13 dogs at the indicated range and clearly was exceeding John's effective range by a full one-third in the hot, dry prairie wind.

In terms of getting the big 50 BMG out and on targets, that element of the shooting event was not going to happen at all. I was not at all interested in using up the big cartridges on 300-yard dogs, and since the extreme range limit of the targets was around 550 yards, repeating my exercise that had taken place in Harding County just didn't compute at the time.

With the exception of John turning loose a round downrange against the hillside, and my taking a couple of warmup shots on 300 yard pups, the big 50 was retired back into the bed of the truck for the time being. By the time we had cleaned up on a few more medium-range prairie dogs with our lighter rifles, the temperature had already climbed to an astounding 119 degrees in the truck cab, and it was time to pull the pin and head for a cool motel room and lunch.

What was clearly proven on that hot, windy morning was that heavy rifles can add yards to long-range shooting even when fighting off poor field conditions. When entering the game of long-range shooting there will always need to be some consideration given to the big guns. These are the real workhorses in the game of hitting a target far off.

Basic Ballistics: 50 BMG

Ballistics have been streamlined by author

Ballistics have been streamlined by author for ease of use.

Load: M33 Ball, .50 Cal., 647 Grs. at 2910 feet per second (military-spec

load)

Elevation Angle: 0 degrees

Ballistic Coefficient: 0.67

Wind Direction: 0.0 o'clock

Wind Velocity: 0.0 Miles per hour

Altitude: 0 Feet with a Standard Atmospheric Model.

Temperature: 59° F

Range (Yards)	Velocity (Ft/Sec)	Energy (Ft/Lbs)	Momentum (Lb-Sec)	Drop (Inches)
0	2910.0	12163.5	8.36	0
50	2839.5	11580.9	8.16	-0.52
100	2770.1	11021.7	7.96	-2.12
150	2701.7	10484.8	7.76	-4.85
200	2634.5	9969.2	7.57	-8.77
250	2568.2	9474.1	7.38	-13.95
300	2503.0	8998.7	7.19	-20.44
350	2438.5	8541.5	7.01	-28.32
400	2375.1	8102.7	6.82	-37.66
450	2312.6	7681.9	6.64	-48.54
500	2251.0	7278.2	6.47	-61.04
550	2190.3	6891.0	6.29	-75.26
600	2130.5	6520.0	6.12	-91.29
650	2071.7	6164.8	5.95	-109.24
700	2013.8	5825.2	5.79	-129.21
750	1956.9	5500.6	5.62	-151.32
800	1901.0	5190.9	5.46	-175.71
850	1846.1	4895.5	5.30	-202.5
900	1792.3	4614.4	5.15	-231.84
950	1739.7	4347.3	5.00	-263.88
1000	1688.2	4093.9	4.85	-298.8

Overview of Selected 50-Caliber Bullets

Barnes LRS Borerider

Weight: 750 gr. BC: 1.070

Barnes LRS Borerider

Weight: 800 gr. BC: 1.095

Note: A “solid” or monolithic bullet.

Barnes LRS Standard Throat

Weight: 750 gr. BC: 1.070

Note: A “solid” or monolithic bullet.

Barnes LRS Standard Tangent

Weight: 750 gr. BC: 0.766

Note: A “solid” or monolithic bullet.

Barnes X-Bullet

Weight: 600 gr. BC: Not available

Note: A “solid” or monolithic bullet.

AAA-Ammo “Harlow”

Weight: 705 gr. BC: Not available

Note: A “solid” or monolithic bullet. AAA Ammo bullets are neatly turned with a very fine finish.

Lost River Ballistic Technologies J40

Weight: 773 gr. BC: 1.06

Note: A “solid” or monolithic bullet. The J40 is also a turned bullet. The surface is a bit rougher than the Harlow, but consistent.

US M2 50 BMG BALLISTICS (1000-Yard Zero)

The following is the data for the standard U.S. M2 .50 BMG ammo. This is not the ammo to use if you’re expecting any degree of good accuracy, but it will do just fine against hard targets out past a mile (1600 meters).

Specifications: U.S. M2 .50 BMG, 709 gr., FMJ BT at 2850 fps

Yards	Bullet Drop (Inches)
100	-plus28.2
200	-plus51.9

300	-plus70.5
400	-plus83.6
500	-plus92.9
600	-plus89.3
700	-plus81.4
800	-plus65.0
900	-plus18.2
1000	Zero
1100	-49.8
1200	-112
1300	-191
1400	-288
1500	-404

US M2 50 BMG BALLISTICS:

Wind Drift in Inches with 10 MPH Crosswind

Range	Drift
100	0.5
200	1.9
300	4.2
400	7.5
500	12
600	18
700	25
800	33
900	43
1000	56
1100	69
1200	84
1300	101
1400	121
1500	143



Author indicating the large hole made in a mud butte at several hundred yards via the Viper 50 BMG. The 650-grain bullet will do a job on almost anything it hits.

SHOTdata Calculated Ballistics: 50 BMG

PROJECTILE I.D.: 50 Cal. BMG

STANDARD ATMOSPHERE: 59° F.; 29.53" MERCURY @ SEA LEVEL

SIGHT OVER BORE, (INCHES): 2

HIT ABOVE 0: 0.0

BULLET-GR.: 647.0 SPEER FMJ

DRAG FUNCTION: G1

STD. B.C. = 0.701

ZERO RANGE: 300

CROSSWIND (MPH): 10

RANGE (YARDS)	BULLET RISE	DEFL. (IN)	VEL (FPS)	TIME (FPS)	ENERGY (FT-LBS)	DROP (IN)
0	-2.0	0.0	2846	0.0000	11639.4	0.0
50	1.3	0.1	2780	0.0533	11102.1	-0.5
100	3.5	0.4	2714	0.1079	10585.3	-2.2
150	4.6	1.0	2650	0.1639	10068.1	-5.1
200	4.4	1.8	2586	0.2212	9609.8	-9.1
250	2.9	2.9	2523	0.2799	9149.5	-14.5
300	0.0	4.2	2461	0.3401	8706.7	-21.3
350	-4.3	5.8	2401	0.4018	8280.9	-29.5
400	-10.1	7.6	2340	0.4651	7871.4	-39.2
450	-17.5	9.8	2281	0.5300	7477.8	-50.5
500	-26.6	12.2	2223	0.5966	7099.5	-63.4
550	-37.4	15.0	2165	0.6650	6736.3	-78.1
600	-50.1	18.1	2108	0.7352	6387.6	-94.7
650	-64.7	21.5	2052	0.8073	6053.3	-113.2
700	-81.4	25.3	1997	0.8814	5733.1	-133.9
750	-100.3	29.4	1943	0.9576	5426.6	-156.7
800	-121.5	33.9	1890	1.0358	5133.6	-181.8
850	-145.1	38.8	1838	1.1163	4853.7	-209.4
900	-171.3	44.1	1787	1.1991	4586.8	-239.6
950	-200.2	49.8	1736	1.2843	4332.7	-272.5
1000	-232.0	55.9	1687	1.3719	4091.0	-308.4

PROJECTILE I.D.: 50 Cal. BMG

STANDARD ATMOSPHERE: 59° F.; 29.53" MERCURY @ SEA LEVEL

SIGHT OVER BORE, (INCHES): 2

HIT ABOVE 0: 0.0

BULLET-GR.: 647

DRAG FUNCTION: G1

STD. B.C. = 0.6700

ZERO RANGE: 300

CROSSWIND (MPH): 10

RANGE (YARDS)	BULLET RISE	DEFL. (IN)	VEL (FPS)	TIME (FPS)	ENERGY (FT-LBS)	DROP (IN)
0	-2.0	0.0	2910	0.0000	12168.8	0.0
50	1.2	0.1	2839	0.0522	11586.0	-0.5
100	3.4	0.5	2770	0.1057	11026.5	-2.1
150	4.4	1.0	2702	0.1605	10489.7	-4.9
200	4.2	1.9	2634	0.2167	9973.4	-8.8
250	2.8	2.9	2568	0.2744	9477.9	-13.9
300	0.0	4.3	2503	0.3336	9002.0	-20.4
350	-4.1	5.9	2439	0.3943	8545.0	-28.3
400	-9.7	7.8	2375	0.4566	8106.3	-37.7

SHOTdata Calculated Ballistics: 50 BMG (continued)						
RANGE (YARDS)	BULLET RISE	DEFL. (IN)	VEL (FPS)	TIME (FPS)	ENERGY (FT-LBS)	DROP (IN)
450	-16.9	10.0	2313	0.5206	7685.3	-48.5
500	-25.6	12.5	2251	0.5864	7281.5	-61.1
550	-36.1	15.3	2190	0.6539	6894.2	-75.3
600	-48.4	18.4	2131	0.7233	6523.1	-91.3
650	-62.6	21.9	2072	0.7947	6167.8	-109.3
700	-78.9	25.8	2014	0.8682	5828.0	-129.3
750	-97.2	30.0	1957	0.9437	5503.4	-151.5
800	-117.9	34.6	1901	1.0215	5193.5	-175.9
850	-140.9	39.7	1846	1.1016	4898.2	-202.8
900	-166.5	45.1	1792	1.1841	4617.1	-232.3
950	-194.8	51.0	1740	1.2690	4349.9	-264.5
1000	-226.0	57.3	1688	1.3565	4096.4	-299.7

PROJECTILE I.D.: 50 Cal. BMG

STANDARD ATMOSPHERE: 59° F.; 29.53" MERCURY @ SEA LEVEL

SIGHT OVER BORE, (INCHES): 2

HIT ABOVE 0: 0.0

BULLET-GR.: 647

DRAG FUNCTION: G1

STD. B.C. = 0.5010

ZERO RANGE: 300

CROSSWIND (MPH): 10

RANGE (YARDS)	BULLET RISE	DEFL. (IN)	VEL (FPS)	TIME (FPS)	ENERGY (FT-LBS)	DROP (IN)
0	-2.0	0.0	2846	0.0000	11639.4	0.0
50	1.5	0.2	2753	0.0536	10893.4	-0.5
100	3.8	0.6	2662	0.1090	10187.0	-2.2
150	4.9	1.4	2574	0.1663	9517.4	-5.2
200	4.7	2.6	2486	0.2256	8883.2	-9.4
250	3.1	4.1	2401	0.2870	8282.5	-15.0
300	-0.0	6.0	2317	0.3506	7713.9	-22.2
350	-4.7	8.4	2235	0.4165	7176.0	-31.0
400	-11.2	11.1	2154	0.4849	6667.5	-41.5
450	-19.6	14.3	2075	0.5558	6187.6	-53.9
500	-29.9	18.0	1998	0.6295	5735.5	-68.3
550	-42.5	22.2	1922	0.7061	5310.2	-84.9
600	-57.4	27.0	1849	0.7856	4911.1	-103.9
650	-74.8	32.2	1777	0.8684	4537.5	-125.4
700	-95.0	38.1	1707	0.9545	4188.6	-149.8
750	-118.2	44.6	1640	1.0442	3864.0	-177.2
800	-144.6	51.8	1575	1.1375	3563.0	-207.9
850	-174.5	59.6	1512	1.2348	3285.1	-242.3
900	-208.2	68.2	1452	1.3360	3029.5	-280.6
950	-246.1	77.5	1395	1.4415	2795.8	-323.1
1000	-288.4	87.5	1341	1.5512	2583.4	-370.4

SHOTdata Calculated Ballistics: 416 Barrett

PROJECTILE I.D.: 416 Barrett

STANDARD ATMOSPHERE: 59° F.; 29.53" MERCURY @ SEA LEVEL

SIGHT OVER BORE, (INCHES): 2

HIT ABOVE 0: 0.0

BULLET-GR.: 400

DRAG FUNCTION: G1

STD. B.C. = 0.5460

ZERO RANGE: 300

CROSSWIND (MPH): 10

RANGE (YARDS)	BULLET RISE	DEFL. (IN)	VEL (FPS)	TIME (FPS)	ENERGY (FT-LBS)	DROP (IN)
0	-2.0	0.0	3250	.0000	9383.9	0.0
50	0.7	0.1	3157	0.0468	8851.8	-0.4
100	2.5	0.5	3065	0.0951	8346.3	-1.7
150	3.4	1.1	2976	0.1447	7865.8	-3.9
200	3.3	2.0	2888	0.1959	7409.0	-7.1
250	2.2	3.1	2802	0.2486	6974.5	-11.4
300	-0.0	4.6	2718	0.3030	6561.2	-16.7
350	-3.4	6.3	2635	0.3591	6167.9	-23.2
400	-8.1	8.4	2554	0.4169	5793.6	-31.0
450	-14.1	10.8	2474	0.4766	5437.4	-40.1
500	-21.5	13.5	2396	0.5382	5098.5	-50.7
550	-30.4	16.6	2319	0.6018	4776.3	-62.7
600	-40.9	20.0	2243	0.6676	4470.1	-76.4
650	-53.2	23.9	2169	0.7356	4179.3	-91.8
700	-67.3	28.1	2096	0.8060	3903.4	-109.1
750	-83.4	32.8	2025	0.8788	3642.1	-128.4
800	-101.6	38.0	1955	0.9542	3394.9	-149.8
850	-122.1	43.6	1886	1.0323	3161.5	-173.6
900	-145.0	49.7	1820	1.1133	2941.5	-199.8
950	-170.6	56.4	1754	1.1972	2734.7	-228.8
1000	-199.0	63.6	1691	1.2843	2540.6	-260.6

PROJECTILE I.D.: 416 Barrett

STANDARD ATMOSPHERE: 59° F.; 29.53" MERCURY @ SEA LEVEL

SIGHT OVER BORE, (INCHES): 2

HIT ABOVE 0: 0.0

BULLET-GR.: 647

DRAG FUNCTION: G1

STD. B.C. = 0.9430

ZERO RANGE: 300

CROSSWIND (MPH): 10

RANGE (YARDS)	BULLET RISE	DEFL. (IN)	VEL (FPS)	TIME (FPS)	ENERGY (FT-LBS)	DROP (IN)
0	-2.0	0.0	3250	0.0000	9383.9	0.0
50	0.6	0.1	3196	0.0465	9072.5	-0.4
100	2.3	0.3	3142	0.0939	8770.2	-1.7
150	3.1	0.6	3089	0.1420	8476.7	-3.8
200	3.0	1.1	3037	0.1910	8191.8	-6.9
250	2.0	1.8	2985	0.2408	7915.1	-10.9
300	0.0	2.6	2934	0.2915	7646.4	-15.9
350	-3.0	3.5	2883	0.3431	7385.4	-21.8
400	-7.1	4.6	2833	0.3956	7131.9	-28.9
450	-12.2	5.9	2784	0.4490	6885.6	-37.0
500	-18.5	7.4	2735	0.5034	6646.3	-46.2

SHOTdata Calculated Ballistics: 416 Barrett (continued)						
RANGE (YARDS)	BULLET RISE	DEFL. (IN)	VEL (FPS)	TIME (FPS)	ENERGY (FT-LBS)	DROP (IN)
550	-25.9	9.0	2687	0.5587	6413.8	-56.6
600	-34.5	10.8	2639	0.6150	6187.9	-68.2
650	-44.4	12.7	2592	0.6724	5968.4	-81.1
700	-55.5	14.9	2545	0.7308	5755.0	-95.2
750	-68.0	17.2	2499	0.7903	5547.7	-110.7
800	-81.9	19.8	2453	0.8508	5346.4	-127.6
850	-97.3	22.5	2408	0.9126	5150.7	-145.9
900	-114.1	25.5	2363	0.9754	4960.7	-165.7
950	-132.5	28.6	2319	1.0395	4776.1	-187.1
1000	-152.5	32.0	2275	1.1049	4596.9	-210.1

Trajectory for Hornady .510 dia. (50 cal) 750 gr. A-Max at 2950 Feet per Second

Elevation Angle: 0 degrees

Ballistic Coefficient: 1.05

Velocity Boundaries (Feet per Second): 2120

Wind Direction: 0.0 o'clock

Wind Velocity of: 0.0 Miles per hour

Wind Components (Miles per Hour): DownRange: 0.0

Cross Range: 0.0 Vertical: 0.0

Altitude: 0 Feet with a Standard Atmospheric Model

Temperature: 59° F

Range (Yards)	Velocity (Ft/Sec)	Drop (inches)
0	2950	-1.5
50	2904	-0.5
100	2859	-2.04
150	2814	-4.64
200	2770	-8.33
250	2726	-13.15
300	2683	-19.15
350	2640	-26.35
400	2598	-34.79
450	2556	-44.53
500	2514.6	-55.59
550	2473	-68.02
600	2432	-81.88
650	2391	-97.21
700	2351	-114.05
750	2311	-132.47
800	2272	-152.51
850	2233	-174.23
900	2194	-197.7
950	2163	-222.97
1000	2118	-250.1
1050	2081	-279.18

Trajectory for Custom .51 M33 Ball, 50 Cal. 647 Grs. at 2910 Feet per Second

Elevation Angle: 0 degrees

Ballistic Coefficient: 0.67

Velocity Boundaries (Feet per Second): 2120

Wind Direction: 0.0 o'clock

Wind Velocity of: 0.0 Miles per hour

Wind Components (Miles per Hour): DownRange: 0.0

Cross Range: 0.0 Vertical: 0.0

Altitude: 0 Feet with a Standard Atmospheric Model

Temperature: 59° F

Range (Yards)	Velocity (Ft/Sec)	Drop (Inches)
0	2910	-1.5
50	2839	-0.52
100	2770	-2.12
150	2701	-4.85
200	2634	-8.77
250	2568	-13.95
300	2503	-20.44
350	2438	-28.32
400	2375	-37.66
450	2312	-48.54
500	2251	-61.04
550	2190	-75.26
600	2130	-91.29
650	2071	-109.24
700	2013	-129.21
750	1956	-151.32
800	1901	-175.71
850	1846	-202.5
900	1792	-231.84
950	1739	-263.88
1000	1688	-298.8

Chapter 10

Practice Makes Perfect

Regardless of how much equipment you own – ranging units, benchrest tables, spotting scopes, and high grade sights and rifles – your shooting accuracy won't be much unless you take the time to practice. For the most part you can leave about half the stuff some guys pack into a hunt back at camp if you have mastered the art of understanding your rifle in terms of accuracy and range limits. This comes about when you put in time on the trigger. Nothing can replace good old hard work and in shooting, that rule doubles in spades.



I'm not saying that good equipment won't help. We all know that accurate barrels, triggers that are smooth, and good optics can make a good shooter far better. Lacking basic training, however, none of the above will help a bit. Where then do you start when getting trained as a long-range rifle shot? First off, find a place where you can send bullets safely and at reasonable distances. A quality rifle club is one place to begin, but try to locate an outfit that retains at least a 400-yard range, if not more. I belong to a rifle club at Lead, South Dakota, that has only a 300-yard range, but it is good enough to zero and practice trigger control as I break in a new rifle. When the times comes to let out the horses, so to speak, I can head for the wide-open lands of the western plains, and I realize that in that area of this shooting business I'm very lucky indeed. In general, if you're going to shoot the heavy rifles such as the 50 BMG, 416 Barrett, 338 Lapua Magnum, or even the 300 Win Mag you want a 600-to 1000-yard range. These heavy horsepower cannons, and I have not named them all by far, need

room to burn. At one point I belonged to a rifle club in the Twin City metro area of Minnesota that actually retained full-blown computerized targets at ultra long-ranges (800 to 1000 yards). This system was outstanding in that all you needed to do was check the target illustrated on the overhead screen as you shot, and your impact points were recorded in electronic ink.



This gang of dog shooters has about everything you could ask for in long-range equipment and gear. Yet lacking good marksmanship skills, it is all worthless equipment in the field.



By stepping down in cartridge size you can at times gain in performance skills when practice shooting. This Ruger M-77 rimfire is a good example.

On a different range that was also set up for 1000-yard shooting, you needed

to drive down and set targets when shooting alone. With a buddy helping out, the two-way radios were put to good use as the 1000-yard target backers were built along a well-fortified deep trench, with mechanical target pullers for competitive match shooting. Even by shooting on these pre-set paper punching ranges, you soon learned the drop characteristics of your cartridge and rifle.

Some of the very best training I ever undertook was done during my early years as a long-range shooter. Back in the late 1950s the land was far more open even in the Midwestern states, and farmers welcomed the varmint hunter when it came time to clean out unwanted trash birds or rodents. I would wander miles of open meadows in search of targets using a day pack as a rest and shooting one of my home-built 30-06 target rifles. A bit later in the game, the new-old wildcat, the commercial 22-250 Remington, in a very nice long-barreled Model 700 BDL got the call more often than not. That Remington was the first commercial varmint rifle I ever owned, and as most of us have said at one point or another, I wish I had never sold it to this day.

By stepping down in cartridge size you can get by with less shooting distance, and the 223 Rem or even the 22-250 Rem are in a class that can be worked through at 500 yards without sacrificing good training habits. For the most part if you can hit at 400 to 500 yards you're in the game at 1000 yards after the bullet drop and wind drift have been doped out.

Trigger control is the key here as even a minor twitch or tug on the trigger can pull a long-range bullet off target by several yards. When shooting at even 100 yards you need to hold groups inside MOA. That's inside an inch measurement at the indicated range. Anything more and groups will open fast when your pushing bullets past 400 or more yards.

I even favor shooting a good target grade 22 long rifle for basic trigger control training. Here you can shoot close-range at 100 yards or less, and the cost of a day's training is a walk in the park.



Author at the benchrest getting some time on paper targets. You can't shoot enough.

Basic Elements that Develop a Good Long-Range Shooter

It's called rhythm. Rhythm is a pattern of self-control that sets in among prairie dog and gopher shooters who are locked into a specific range and are repeating shots at targets that are very close to the same range and being gunned under the same shot-to-shot field conditions. Some shooters refer to this type of condition as instinctive shooting, and they may well be correct. Different semantics, but the same general idea.

When this rhythm sets in I have observed shooters getting dialed in on, say, 300-yard dogs and almost never miss a shot. However, at some point a close-range dog sticks its head up and that shooter can miss three or four shots in a row. What has happened is that the brain has as yet not redialed the different shooting conditions, and the shooter is playing the shooting game with old tapes, versus locking into the new set of conditions.

When setting up for a shot, try and stay tuned to what is going on around you and the requirements associated with that individual shot. To dial in your shots is good when that system is working, but keep in mind as the situation changes, so will your requirements in terms of point of aim, wind drift allowance, and overall drop (hold under, on, or over the target).

Temperature must be considered when shooting at long-range. When the air

is warm it is lighter and a bullet tends to fly farther and flatter. As the air cools the bullet meets stiffer resistance because this air mass is very much like a fluid that the bullet is passing through. Cold air in the dead of winter can also affect the burn rate of your cartridge. At 75 degrees Fahrenheit, a bullet may well hit a velocity of 3500 fps, but at 10-degrees below zero that same load may lose as much as 100 fps. Both the air's density and the slower burn rate have caused a major change in the load's performance curve.



This is a 1-MOA group, and it's what you should be training for when shooting paper targets. Anything less and long-range shooting won't pay off for you as you extend that distance to the target.

The hard part to all this information is keeping it up front as you aim at your long-range target. Because that deer, goat or coyote is 400 or 500 yards away, these elements will often times come into play. What the rifleman needs to do is work at varied levels of these conditions enough so that the shot in the dead of winter, or the heat of midsummer, the shot become second nature. A fifth element if you will. I was reading someplace a while back where a young sniper was starting his training and had hauled into the field all the bells and whistles he could pack in his backpack. Upon linking up with his instructor he was

unburdened by most of the stuff as the instructor removed everything from his pack save for ammo, water, a few energy bars, and his field glasses. The student's reaction to all this was complete bewilderment, but the instructor simply stated that none of that junk was necessary.



Rhythm is how a rifleman can dial in on targets close to the same range. Here crows feeding on a rotting cow at the end of the field are dialed in by the author.

That statement by the shooting instructor about sums the whole thing up in a tight bundle. Oh, yes, the neat ranging equipment is nice and very useful at times. Wind indicators and tables are a big help when you have time to figure the angle and shot on a slide rule system, and the ballistic computer is a great tool as you take time to punch in the data. For the most part, however, the real world will not give you that kind of time and luxury in the field. Again, going back to the basics and learning to shoot from your gut is a cardinal rule of long-range shooting. Yes, the paper-shooting match shooter can take all the time he needs to dope the competitive shooting course, and the benchrest shooter can check wind flags and gadgets all day long prior to pounding out a three-leaf clover group at 200-400 yards, but you're different. You shoot in the field where things move, critters don't follow rules, and gaining that deadly shooter's inside straight from the gut makes all the difference in the world.

Every solid long-range shot I have ever made was done from the gut so to speak. The deer was there, the range was quickly computed in my head, and the shot was taken, win, lose or draw. In many cases thankfully the game was not a draw or loss, but a win.



Cool air determines how our bullet will perform. Practice in cold winter air is required in order to gain an understanding of what that bullet is going to do downrange.



Fox hunters know their bullets well in terms of performance when the temperature starts to fall.



Author with Federal during bullet test hunting. In this case the deer is no cull whitetail, but a fine trophy class animal.

Deer Culling at Long-Range

Several times over the years I have been asked to help work through new guns and loads on special culling hunts on whitetail deer. To cull deer is to lean out the herd a bit by taking out the poor genetic bucks that are specifically listed on detailed kill directives by the game keepers, and also reduce the general doe population where very high grade trophy whitetails are being cultivated.

For the most part I have never had much interest in this work with the exception of the fact that I do get to learn about bullet behavior and rifle and optic accuracy, and I get time over the rifle for some long-range work. Not a bad deal at all, seeing as how it produces to enough venison to feed an entire local town. (All deer are processed and given to food shelves.)

Even with great ranging equipment and fine optics in the tower blinds that are set up like fire watch ranger stations, shooting can still be difficult. Deer expose themselves on the big glades and wooded openings morning and evening. Many times this seemingly easy shooting still involves making that snap decision by bringing everything together without the use of those aforementioned specialized tools of the trade.

Several years ago while testing a new bullet for Federal Cartridge on a shooting preserve down south, I culled whitetail using regulated cue cards distributed by the ballistics engineers running the bullet tests. In effect we had to drop the animal at a very exact range, and the bullet had to strike the animal at a specified angle of entry. These tests were necessary so as to bring out a humane bullet versus a game-wounding one. The problem here, however, was time on target, and I found myself going back to the basics of gut level shooting more often than not as deer entered my kill zone at a workable range.



Author was allowed to take one trophy class whitetail on a deer cull hunt. Even cull hunters get lucky every now and again. However with every shot fired downrange, something is always learned when your paying attention.



Author culling doe for deer management programs. This allows a good deal of real world time to learn about bullet behavior, and also become a better shooter in the process.

Often we read about systems that shooters use to get an accurate sight picture on a target. All of this information is of value in one way or another, but for the most part I have found that breathing and physical form are among the most important of all when it comes to getting a hit at a long-range target. The cull hunt illustrated above was easy in terms of the first several elements of proper shooting. We had a high tower benchrest setup, and all that was required was to know the rifle and cartridge, control breathing and trigger, then make the connection between animal and bullet.

Now change to a swamp in north central Minnesota with a 15 mph wind and blowing snow and nothing but a half-frozen deadfall to get locked down against as that deer moves into view. That's trouble, and I have not found any industry types offering a cull hunt under those conditions. As a long-time resident of the

Gopher State I did indeed kill a pile of whitetail under just those kinds of field conditions. I learned to work with what I had at hand, and in most cases it was not much. Taking a 300-yard poke at a running whitetail from the high top of a jack pine and making a one-shot killing hit is supremely satisfying. Believe me, it was time to high five the day, when those kinds of successful events happen.

Learn to Use a Data Record Book

One simple way to get better at what you're doing with a rifle is to record all your shots for a long period of time. When I got well into prairie dog shooting at long-range I started to keep a note book that contained information on each and every shot I took. Range, wind, temperature, rifle and bullet were all considered primary subjects in this small shirt-pocket data book.

After recording hundreds of kills over about eight years I found that on average most "long shots" are not that long at all, but taken at ranges at or under 250 yards. Well, seeing as how 250 yards is the length of two and a half football fields, and as a dog shooter you're shooting at a target measuring about 2-1/2 inches at the heart, that's still not bad shooting no matter how you cut it. In most cases 400 yards – almost one-quarter mile – isn't even considered long-range by some riflemen, who will scoff at the notion anyone would consider that long-range shooting. Yet in my log book there were references to some shots each day at 400-plus yards, but far less than what we often see in bold print off a word processor. Are folks lying about the ranges they shoot things at? No, I don't think so, but I do believe that more of them should use a rangefinder a bit more often.

Determining range is one of the major problems the long-range shooter confronts. That data book will bring into light exactly what is taking place in the field. When you're back at the motel and cleaning your rifle it can be a good time to review what you set to print, and in some cases new and interesting information will surface right off those pages.

Along with that little field book, take the time to shoot a single benchrest group with your rifle at the start of your primary shooting season. This group can be added to the book as a record of how the barrel on that rifle is holding up. I learned this little trick from Greg Hendricks, the 1000-yard competitive shooter mentioned elsewhere in the book. Greg shot that group with his dog rifle each and every spring prior to leaving for west central South Dakota and his annual prairie rat killing spree. If the group started to open at all, he knew it was time to

start thinking about a replacement.

You need to understand that in those days, in early 1993, as you were shooting one rancher's field, another rancher would stop and ask you to "please" hunt his ranch next, due to a massive infestation of grass rats everywhere you looked. Yes, those were the good old days. It also didn't take long to fill a data book either. Sitting atop a high ridge overlooking a mile or more of dog lodges, a good rifleman owned the valley. Often as many as two or three hundred dogs would be gunned from a single position prior before fresh targets were needed.



Here my partner Ross Metzger of SHOTdata Systems makes a quick check of his zero during a prairie dog hunt as applied to his Savage heavy target 22-250 Rem.

Sample Pages In A Data Book

Location: Ted Knife ranch Cheyenne River, SD. (Spring 1998)

Load: 60 gr. Sierra 6mm MV -3400 fps/Remington Model 700 VS/

Glass: Redfield

Range #1: 238 yds

Wind: 15-18 "Full"

(Laser ranged.)

(In shooter's face)

Range #2: 247 yds

Wind: 20 mph

(Note: Partner shooting 223 Rem took five rounds to make 207-yard kill in 15 degree crossing wind.)

Range #3: 188 yds

Wind: Gusting above 20 mph.

(Range reduced due to high winds.)

Range #4: 333 yds

Range #5: 227 yds

Wind: Dropping

Range #6: 251 yds

Range #7: 244 yds

(Wounded & required a second shot)

Range #8: 356 yds

Wind: Down

(Best for the day.)

Range #9: 298 yds

Wind: No wind

Range #10: 291 yds

Wind: No wind/70-grain Hornady SX

Shoot summary: (For a full morning shoot.)

6mm total rounds fired: 121

Kills: 42

Range: 291 -350 yds (avg. range 197.5 yds.)

Wind: High; 15 to 25 mph gusting.

Kill Ratio: 34.7%

My data range book retains hundreds of pages of kill data concerning long-range shooting. At times the range is not massive. Be advised that most dog shooting is at, or under, 300 yards. This information in my range book is accurate and realistic to be sure. What that first page illustrates is that the wind was playing games with us that morning, and by shooting the 6mm versus the 224, I was at least getting shots downrange and on some targets. The long-range hits were especially gratifying, as this is not easy work with a 20-mph breeze blowing in your face.

Roaming

As was previously mentioned, the act of roaming with a rifle in prairie country or mountains can be a great training method as it supplies hands-on, learned knowledge that deals with long-range shooting. Here the textbook is out the door, and the real world in real time takes over. Come over a ridge and a fat rockchuck gives you the eye from atop a rock ledge some 500 yards downrange.

It's now time to bring the quick action responses together and get sights on the warm target. A quick check of the wind at the muzzle says it is right to left at about eight miles per hour. However, through the scope the brush on the rock ledge is moving the other way at about five miles per hour. Cancel out the wind, and dope the shot for center of mass with a yard's holdover using the first hash mark at 6 o'clock position on your scoped .308 Win. Now lock down your body over those bipods, and then drop three pounds on the trigger. It's as easy as that – but if you missed, take careful notes and learn from the circumstances at the time of the shot.



Author with a coyote taken while roaming open country on foot and calling every 1/4 mile or so.

A day of roaming in the mountains may result in several real-time long-range training shots. Just covering prairie grass can bring the rifleman up against a prairie dog town, badger den, or coyote haunt. Using a day pack, ground cloth and a set of bipods I have walked countless miles of Wyoming and South Dakota searching out targets of opportunity.



You're never too young to start learning and practicing. This little cowboy will grow up to be a long-range shooter.

Even rolling across the open country in a pickup truck by way of a little-used two-track trail can yield some great shooting as you can cover far more area than a man on foot over the course of the hunting day. Every shot downrange is a real world classroom lesson, and the more shooting you get, the better you're going to get at this extended range rifleman's game.

Chapter 11

Basic Ballistics for long-range Shooters

In this chapter we are going to see where the bullet meets the target, or as is often stated, where the rubber meets the road. Ballistics is the stuff long-range shooting is made of, and by way of some exacting ballistic tables generated by SHOTdata Systems of New Brighton, Minnesota, and my own real-time test shooting for velocity over chronograph recording screens, we will see exactly what different bullets do at varied range limits. While it is a very common practice to shoot chronograph tests while searching for muzzle velocities, in this case we will shoot bullets across photo screens at ranges clear out to 400 yards. This information is, to my knowledge, exclusive to this book and has not been attempted and published by any other researcher, hunter, or target shooter to date.





Author shooting at long-range. Knowing the bullet's ballistic profile is important.

Setting Up the Shot for Downrange Chronographing

Gaining detailed downrange chronograph information as to exact bullet velocity even at 100 yards can be a bit tricky, but now add on 300 more yards to the event and problems are also compounded by a factor of four. First of all, the chronograph recording system in this case, an Oehler Chronotech Model 33, used photo screens in double sets, and they need to be armored. In the event a bullet strikes low instead of going over the top of the photo screens, it must be stopped or it will destroy the photocells straightaway.

With a screen width of only four inches, the bullet has a very narrow running line to cross so as to enable the computer system to record the bullet speed. At first the bullet needs to pass screen number one, which sets off a timer in the computer system that by design is in a wood box buried in the ground behind the armored screen. After the bullet has passed the first photo screen, it trips a second photo screen exactly four feet away from the first. Now the computer returns a digital record of the exact bullet velocity. When the screens were set up at 200 yards, that is the reading you got back, and when that range was increased to 400 yards again you now had a real-time, real-world measurement as to the

exact bullet velocity.

Why not move the screens all the way to 500 yards? Because as the Rule of 400 says, after 400 yards bullets start to drop into targets versus flying over them on a flatter trajectory. When I tried to determine a 500-yard figure, I got caught by a bullet that crossed the first screen successfully, but dropped straight into the second screen, missing the armor plate completely. Thanks to Dr. Oehler of Oehler Research in Texas, he was good enough to replace that damaged screen as support for my project. It would seem that more bullets hitting 500-yard and farther targets come in high versus flying in a straighter flatter line to the target. As I have previously stated, long-range work with a rifle is more like artillery shooting than straight-on rifle work.

Rifles used for this work need to be accurate enough to drive that bullet inside that four-inch window at 400 yards. That means the rifle has to shoot sub 1-MOA, or under 1 inch at 100 yards, or bullets would be all over the place even if the shooter was right on the mark every time. When the system is set up, a background target is placed directly behind the last screen unit so the shooter has an aiming point to work with. Hit inside the black of the aiming point bullseye and you have sent that bullet across both screens for record.



Top view of a Chronotech Model 33 sky screen photo cell that measured the velocity of the bullet downrange. This very fragile system needs to be protected by heavy armor at all times.



Author's chronograph unit and rail as used downrange for detailed bullet measurements.



Savage Model 10 LE police sniper rifle is used for downrange work because it is accurate and gets bullets over those very small photo cell windows.



Bullet design such as these Federal Fusion 25-06 loads will differ from other brands and designs. Downrange chronographing can clear up those differences in real time.

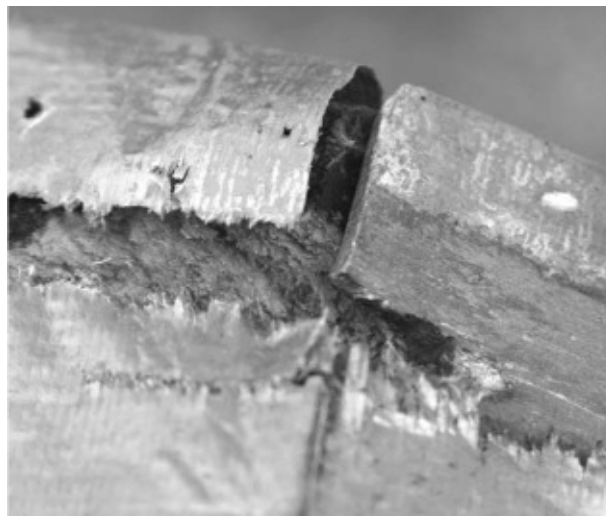
As to the location of this test, I had the help of my good friend Jim Korzenowski, who just happened to own a small farm in northern Minnesota with a good house and enough open land to set up the 300-yard downrange program. As for the 400-yard work, a local farmer got interested in my project and allowed me to set up all my equipment for a full week at a time on a vacated and cut pasture that was table-flat, had a good two-track road that ran the length of the field, and sat right between two large wooded sections that kept the wind to a minimum. The project, in terms of actual shooting, took the better part of a full summer to complete.

Have ever wondered how close the manufacturers' ballistics are to the real world velocity of a bullet at a given range? Downrange chronographing can answer this question. Have you ever thought about the difference between a boattail bullet design versus a flat-base bullet in terms of retained velocity? Again downrange measurements, not computer data, can return real world

answers to that question as well. Downranging is difficult and very time-consuming, but the information it returns is unique and for the most part well away from the text book answers.

Back in the late 1980s, I was chronographing shotshell loads as at that time, we had started to move toward the development of non-toxic waterfowl shot ammunition. In terms of shotshell downrange velocity measurements, I had devised a system for measuring shot in flight that had not been done before. In fact, it was considered impossible to measure pellets that were flying in a shot cloud. After getting my ballistic programs rolling in the shotshell department, and accomplishing the so-called impossible, I turned to rifles and the same method of finding information about bullets in flight. As a long-range shooter and varmint hunter I wanted the straight dope, and not the computer's idea so to speak; in effect, computers don't hunt, and I do.

One of the very first things I found out was that I needed to have the muzzle of my rifle lined up exactly in a straight line with my chronograph screens. Any deviation in this arrangement meant that a bullet might cross the first screen but miss the second as it was coming in at even a very slight angle. In effect, I had to make frequent checks of my rail that held my photo screens with a spotting scope and even allow for crosswinds that at times could blow a bullet completely off both recording screens. It was little wonder why others had not given this system a try, as it was full of pitfalls to be sure.



Even heavy steel plate can become damaged. Here the armor has been cut by a bullet, in this case a fast-moving 25-06 round.

With heavy railroad tie plates as secondary armor and set at 30-degree angles to my screens, and a primary one-quarter inch steel plate attached to the screen mount itself, I had in effect a well-designed and foolproof system in the event a fast-moving centerfire bullet came in contact with the downrange units. That did indeed happen every now and again, as I could hear the metallic slap of the bullet as it bounced off the heavy iron plate. I figured at any range I needed to keep my shots inside 4-inch square down range, or I would gain no information off the screens.

With my test field secured, and a system ready to be taken downrange, the next step was to select rifles for the task ahead. At the time I favored the 25-06 Remington (and still do), in this case chambered in a Ruger M77 MK II mounting Redfield varmint glass, and a Remington Varmint Synthetic rifle (VS) chambered in a 22-250 Remington. As I have previously indicated, this rifle is a close match to the Military M-24 sniper rifle, and a deadly accurate tool to be sure.

For starters, however, I elected to turn to a much lighter rifle in the 223 Remington. Here I had also selected a Ruger MK II in its heavy target configuration. This rifle had been in production for only a few months at the time, but I was receiving information that it was indeed a shooter. The better accuracy I could get from a rifle, the fewer problems I would be confronted with downrange. At least that's how I saw the situation, and that indeed seemed to hold true. Fewer shots fired meant less time over targets, and to be sure there would be copious amounts of time used up anyway, even if everything went like clockwork.

Bullet selections for the 200-yard shooting were the Speer 224 TNT at 50 grains, Berger custom 55-grain 224 pills, Nosler Ballistic Tip 55-grain bullets, and Federal factory-rolled 40-grain ammo. The Federal bullet was their top of the line at the time, and with its hollowpoint and flat base it would indeed be interesting to see how it performed even at a close zero range of 200 yards.



The author started with shotshells when developing downrange chronograph methods. Rifles came second on the list on those days.

My thinking was that at 200 yards, I could get accustomed to my equipment and methods of rifle and cartridge chronographing downrange. As the Speer TNT had a somewhat different shape from that found on the other 224 bullets due in part to its extended ogive (or bullet nose section) and heel roll at its base, would I see some difference in performance at the target?

Berger's custom 224 had a flat base as well, but again a different ogive shape from that of the Speer bullet. It goes almost without saying, but the Nosler Ballistic Tip was at the top of the food chain in terms of sleek bullet design. Bullets are like jet fighters, or racecars, in that any small change in shape can and will affect their performance downrange. At times this is related to retained velocity, but in other circumstances it directly relates to accuracy as well.

A word here regarding BC or ballistic coefficient before we move on. Measurement of a bullet's BC performance dates back to pre-WWI and G-1 tables that came out of Germany. When those detailed programs were compiled, the bullets of the day were more round-nosed than when what we use for long-range work today. The ogive was more blunt and didn't foil air like modern projectiles. Therefore, established data covering BC is often not in line with the current bullets of today.

What we do have when using BC, or the basic number dealing with

downrange performance of a bullet, is a general indicator of how well that bullet will perform. Actual downrange chronograph work, however, differs from the G-1 system in that you're going to see real-time events taking place that are also real-time measured.

When the 200-yard testing was completed on the Speer 224-caliber 50-grain bullet, the end result for four recorded downrange hits was as follows.

Speer 224 50-Grain Downrange Testing

Muzzle Vel Recorded	200 yards Downrange Recorded
3174 fps	2263 fps
3179 fps	2248 fps
3259 fps	2232 fps
3229 fps	2212 fps

We see that even as close as 200 yards, which is a zeroing-in range for the 223 Remington, the bullet in the fourth test sample that started off at 3229 fps is crossing the 200-yard photo screen at 2212 fps. That's 51 fps slower than the bullet in the first sample test, which started off 55 fps slower out of the muzzle (3174 fps, falling off to 2263 fps).

Can't happen, you're saying? Well, tell that to the chronograph unit, which incidentally was cross checked every 10 rounds. In fact it isn't rocket science to see that the bullets' velocity is jumping around all over the place in terms of the recordings. What causes all this variation to take place? A good deal more, I believe, than we currently understand about bullet behavior. When that sniper in the movie sits and hand-polishes the slight nick in his bullet's nose before going on a mission, there just could be a whole lot to that small and seemingly insignificant action. Any surface deviation in a bullet from one to another, or velocity change, bullet exit attitude, or change in BC downrange can and will change the terminal velocity. Checking weight on each and every bullet used in competition is a good idea, as is doing so before reloading long-range ammo for to the hunt.



Full view of screen armor plate used to protect the photo cell system.



Front view of Oehler Model 33 Chronotech. This unit measured the exact velocity of a bullet at the muzzle, or at 400 yards downrange.

In terms of long-range cartridges I was going to handload for both the 25-06 Remington and the 22-250 Remington. For starters, the 22-250 got the call in terms of a variety of bullets. Calhoon Bullets in the 51.3-grain weight was set atop a Winchester once-fired case, started up by a Winchester Large Rifle

primer, and burned with 36.5 grains of Varget powder. This bullet was a real beauty and almost too nice to shoot. With its silver colored jacket topped off with a Nosler-style extended plastic point, the double hollow-based bullet had “Killer” written all over it. However, how would it fly downrange? As to that, again it would get its day afield like many others in this ballistic testing project.

In regard to Nosler products, the 22-250 would get a fair share of both 50- and 40-grain bullets sent down its barrel. Hornady followed with the 55-grain SXPS, and a second Hornady in the FMJBT (full metal jacket boattail) bullet. This race would be between a real flat-based bullet design and a boattail design from the same manufacturer. I was going to watch this test shot closely. Additional 22-250 Rem boattail bullets included were Federal’s 55-grain Premium that used the Sierra boattail, followed by Winchester’s CXP-1 52 grain hollowpoint boattail.

With the 22-250 Rem now handloaded and ready for testing, my attention turned to the 25-06 Remington. This was the big push in my testing, and I was counting on a flat trajectory to get bullets over screens well out to 400 yards. Here I would use only four different loads to gain my required information. Three flat-based bullets – a Sierra Spitzer 87-grain, Speer’s 87-grain TNT and the Berger 87-grain varmint bullet – followed by a Speer 100-grain boattail hollowpoint made up my list of 25s.



Downrange through the sights lie many of the answers to questions regarding bullet behavior.

Pushing Bullets and Air Over Photo Screens

The bulk of the 223 testing previously discussed took place at 200 yards. Now I will move ahead directly to the 22-250 and some longer-range recordings. The 300-yard mark was my entry into the land of the complete unknown. I had covered the bases by way of discussion with engineers regarding some military tank gun tests over the big Oehler Research screen units at several thousand yards, but I didn't have any hard data as to how well this extended range event would go in term of gaining ballistic performance information and keeping my equipment in one piece at the same time.

Mounting the 22-250 Remington VS on my benchrest, I reset my armored screens at the 300-yard mark. Rechecking my alignment to the muzzle and first screen, I chambered a handloaded Berger 55-grain bullet loaded to a muzzle velocity of 3527 fps. Four rounds later the muzzle average for the handload stood at 3511 fps, and the downrange 300-yard average was recorded at 2401 fps. This gave the Berger 55-grain pill a 31.6% velocity loss of 1110 fps. Aside from gaining my recorded hits right in a row with any missed shots, or armor strikes, little was known at this point except for the fact that the Berger bullet will lose the previously indicated velocity at 300 yards downrange.

Calhoon 51.3-grain double hollowpoints in 224 caliber were up next, and the Remington Model 700 VS pushed these bullets out of the muzzle at 3464 fps. At 300 yards the bullet crossed the recording screens, moving at 2325 fps. Calhoon's bullet had returned a net loss of 34% over the 300-yard run. This result tended to fit the profile in that when bullet weight was reduced even a small degree, the results downrange became obvious in energy/velocity loss.



Author shooting Perma Gel blocks down downrange velocity testing. At times a double test of penetration and velocity can be set up.



Accuracy is only one component in understanding what a bullet does downrange at the target.



The author's Remington Classic in 25-06 is a good example of an outfit that is easy to shoot on downrange targets. Flat shooting is a big help in this case.

As the Calhoon bullet was designed a good deal like the Nosler Ballistic Tip, I matched the Nosler 55-grain against it in the next run at the recording screens. The Nosler crossed the muzzle screen at 3489 fps, and clipped the 300-yard downrange window at 2481 fps. The loss rate in velocity for the Nosler was 28%, giving this bullet the least amount of "hang time" among all those bullets tested. (I have come to call the running time of any bullet "hang time," and when shooting long-range and you're a half mile or so alongside a buddy who is shooting ultra-long targets you can actually time the bullet in flight and get a working feel or understanding as to the amount of "hang time" and subsequent distance that rifleman is shooting at.) I guess that knack for hearing the rush of air and estimating the bullet's "hang time" came about during the 50,000 shots or so with high-velocity centerfire rounds.

What I also noticed during this testing was that as the velocity/energy of the fired bullet increased, for the most part because of the increase in cartridge energy, it got much easier to hit my 4-inch-square target window. This fact stayed unchanged even when the target moved out to 400 yards. Less wind drift and less drop with a shorter "hang time" meant better ballistics and more hits versus bouncing bullets off armor or missing the whole screen altogether.

With a very solid comfort level built around the 22-250 Remington and 300-yard work, it was time to move to the 25-caliber bullets in the 25-06 Remington. Now a Ruger M-77 MK II Target/Varmint rifle was pressed to work on the range. Loads in this test consisted of the 87-grain Berger, the 87-grain Sierra flat-base bullet, the 87-grain Speer TNT hollowpoint, and the 100-grain Speer boattail. Shooting the Speer TNT and Berger custom 87-grain pills produced an even load-to-load 25% velocity drop at 300 yards. The Speer hit the screens with 2431 fps retained velocity downrange, while the Berger came in at 2503 fps. Berger's 87-grain had been pushed a bit faster with a muzzle velocity of 3349 fps average, giving it a 97 fps head start over the Speer bullet.

Moving to the Speer 100-grain bullets, on the other hand, clearly indicated an increase in terminal velocity loss. Now the heavy varmint bullet was coming into the downrange screens at a 23% velocity loss figure. In terms of hitting that 4x4 window, it was easy as this bullet was able to fight off crosswind and didn't indicate much drop at all over the course of that distance. Just seeing this event take place at the chronograph screens told me that the 100-grain Speer BT was

up for some serious work on dog towns a bit later in the year. As it turned out, this bullet in the 25-06 Remington and Ruger M-77 MK II did record a 618-yard measured kill on a prairie dog that early fall in north central South Dakota.

As a final element to the ballistics test, I moved to the 400-yard range. At first it was not even my idea to push bullets that far downrange and try to measure velocities, but my farmer friend who watched this test taking place from day to day suggested that I push the screens to the very end of his field. Thinking about the proposal, I was clearly aware that all had gone well up to that point in time, so why not?

After resetting all the equipment on a bright Monday morning with a clear sky and dead air I loaded the 25-06 with a fresh handloaded round with an 87-grain Berger bullet. At a muzzle velocity of 3360 fps, this pill pushed over the 400-yard screen at 2289 fps for 68% in retained velocity. Again as in the 300-yard work, I found the heavier bullets easier to manage in terms of drift and drop, and I would gain data faster even to this extreme range versus shooting 224 lightweights at 300 yards.

Shooting a second run with the Sierra FB 87-grain produced a muzzle velocity of 3416 fps, and a target velocity of 2135 fps, Velocity retention with this bullet was 63%, indicating that a bullet in 25 caliber at this grain weight will hold a bit over 50% of its velocity within that 400-yard range limit. In other words, when shooting this combination in a 25-caliber rifle, you're about half done at 400 yards in terms of bullet speed.

Shooting the 100-grain Speer BT at 400 yards indicated that this bullet came over the screens at 3320 fps and retained a full 77% of its downrange speed. That says you're gaining in less drift with the big bullets, and most likely more able to fight off updrafts, cross winds and the like.

By reviewing the tables I have included here, notice the shots that were measured downrange using all of the above bullets and rifles and you can see how bullets are not dead-sure events in terms of the actual performance that take place when they reach the target.



Hunting wide-open country requires a knowledge of what bullets are doing when stretched on long-range targets.

Velocity Retention Test Results

Cartridge	Bullet	MV (fps)	Target Vel (fps)	Target Range (Yds.)	% Vel. Retained At Target
22-250 Rem	40-gr. Fed.	3894	2070	300	53%
223 Rem	40-gr. Fed	3676	2212	200	60%
22-250 Rem	40-gr. Nosler	3667	2162	300	59%
22-250 Rem	50-gr. Nosler	3700	2471	300	67%
223 Rem	50-gr. Speer	3171	2199	200	69%
223 Rem	50-gr. Speer	3251	2258	200	69%
22-250 Rem	51.3-gr. Calhoon	3671	2241	300	61%
22-250 Rem	51.3-gr. Calhoon	3582	2325	300	65%
22-250	Rem 52-gr. Win EXP	3652	2276	300	62%
223 Rem	55-gr. Berger	3139	2241	200	71%
22-250 Rem	55-gr. Berger	3527	2401	300	68%
22-250 Rem	55-gr. Fed BT	3611	2374	300	66%
22-250 Rem	55-gr. Hornady FM	3286	2284	300	70%
22-250 Rem	55-gr. Hornady SX	3353	2150	300	64%
22-250 Rem	55-gr. Nosler	3503	2481	300	71%
223 Rem	55-gr. Nosler	3170	2311	200	73%
22-250 Rem	55-gr. Win SP	3365	2162	300	64%
25-06 Rem	87-gr. Berger	3360	2289	400	68%
25-06 Rem	87-gr. Berger FB	3361	2503	300	74%
25-06 Rem	87-gr. Sierra FB	3416	2135	400	63%
25-06 Rem	87-gr. Sierra FB	3415	2437	300	71%
25-06 Rem	87-gr. Speer TNT	3263	2431	300	75%
25-06 Rem	100-gr. Speer BT	3330	2550	300	77%
25-06 Rem	100-gr. Speer BT	3320	2364	400	71%

Test Conditions: Temperature 70-78° F; elevation 1,230 feet above sea level; muzzle chronograph readings taken nine feet from the muzzle.

The second part of this ballistic profile deals with raw drop tables including 30 mph lead and 10 mph wind drift data. Using tables like the following you don't necessarily need the expensive ballistic computers so common among professional shooters and military police snipers nowadays. If this book were dealing solely with sniper tactics yes, the advancement of more sophisticated equipment would be in order. However, try and remember that for the most part, hunters and even many target shooters are not going to require massively advanced ranging equipment in the field. Again, you're better off learning your own instincts than depending on manmade tools of the trade.

Using the following tables for the 300 Win Mag you can, for example, gain a solid idea of where that bullet will strike at, say, 600 yards. At zero range, meaning where that bullet will strike dead-on using your sights, the 600-yard bullet will fall a full 53.2 inches. That's roughly a yard and one half of falling bullet, and now those sniper mildots or hash marks on the new Leupold VX-L 4.5-14X50mm with the Varmint Hunter's Reticle, for example, become solid gold to the long-range shooter. Lift your scope sight to the correct mark for drop compensation, and touch off the round.

You will note in many of the photos included here that ranging cards are attached to rifles. These are simply drop tables that are matched to the individual rounds being used. Make a quick glancing reference to these cards and your hold over is established within seconds. In most cases that's about all the time you have to get everything into motion when the old song dog shows up to the call, or the mule deer crests the ridgeline for his last look back at you.

While I have not indicated every cartridge used in this business in these tables, I have included enough of them to give you a working idea of what different bullets will do at varied ranges. When adding other ballistic tables to your file, or searching out that special cartridge, using the Internet is one way to find data quickly and easily. Make a quick check of Sierra, Hornady, or any of the major ammunition manufacturers and you're very likely to find what you're searching for.

300 Winchester Magnum Shot Drop

DRAG FUNCTION: G1

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

STANDARD BALLISTIC COEFFICIENT: 0.4470

SIGHT OVER BORE (INCHES): 1.5

ZERO RANGE (YARDS): 250

CROSSWIND (MPH): 10

BULLET-GR.: Sierra 168.0 HPBT

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
0	-1.5	0.0	3200	0.0000	3820.9	0.0
50	0.8	0.1	3087	0.0477	3556.8	-0.4
100	2.1	0.6	2978	0.0972	3308.6	-1.8
150	2.5	1.4	2871	0.1485	3075.2	-4.1
200	1.8	2.5	2766	0.2017	2855.7	-7.5
250	-0.0	4.0	2665	0.2570	2649.1	-12.0
300	-3.0	5.8	2565	0.3144	2454.7	-17.7
350	-7.4	8.1	2467	0.3740	2271.7	-24.8
400	-13.2	10.7	2372	0.4360	2099.5	-33.3
450	-20.5	13.8	2279	0.5005	1937.7	-43.4
500	-29.5	17.4	2188	0.5677	1785.6	-55.1
550	-40.4	21.5	2098	0.6377	1643.0	-68.6
600	-53.2	26.1	2011	0.7107	1509.5	-84.2
650	-68.1	31.2	1926	0.7869	1384.8	-101.9
700	-85.4	37.0	1844	0.8665	1268.7	-122.0
750	-105.2	43.4	1764	0.9497	1160.9	-144.8
800	-127.9	50.5	1686	1.0367	1061.1	-170.4
850	-153.6	58.2	1612	1.1277	969.2	-199.2
900	-182.6	66.7	1540	1.2229	884.8	-231.5
950	-215.3	76.0	1471	1.3226	807.9	-267.6
1000	-252.1	86.1	1407	1.4269	738.2	-307.9

308 Winchester Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 0.4470

ZERO RANGE (YARDS): 250

BULLET-GR.: Sierra 168.0 HPBT

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

SIGHT OVER BORE (INCHES): 1.5

CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
0	-1.5	0.0	2712	0.0000	2744.4	0.0
50	1.6	0.2	2611	0.0564	2544.4	-0.6
100	3.4	0.8	2513	0.1149	2356.1	-2.5
150	3.8	1.7	2416	0.1758	2178.9	-5.7
200	2.7	3.1	2322	0.2391	2012.3	-10.5
250	0.0	5.0	2230	0.3050	1855.7	-16.8
300	-4.4	7.4	2140	0.3737	1708.7	-25.0
350	-10.8	10.2	2052	0.4453	1570.9	-35.0
400	-19.2	13.6	1966	0.5200	1442.2	-47.0
450	-29.8	17.6	1882	0.5979	1322.1	-61.4
500	-42.9	22.2	1801	0.6794	1210.4	-78.2
550	-58.7	27.5	1722	0.7646	1106.9	-97.7
600	-77.4	33.4	1646	0.8537	1011.3	-120.2
650	-99.3	40.1	1573	0.9469	923.5	-146.0
700	-124.8	47.5	1503	1.0445	843.1	-175.4
750	-154.1	55.8	1437	1.1466	770.0	-208.7
800	-187.6	64.8	1374	1.2534	704.1	-246.4
850	-225.7	74.8	1315	1.3651	644.9	-288.9
900	-268.8	85.5	1260	1.4817	592.5	-336.7
950	-317.4	97.2	1210	1.6032	546.4	-390.2
1000	-372.0	109.7	1165	1.7296	506.5	-449.9

30-06 Springfield Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 0.3970

ZERO RANGE (YARDS): 250

BULLET-GR.: 150-gr. FMJBT

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

SIGHT OVER BORE (INCHES): 1.5

CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
0	-1.5	0.0	3048	0.0000	3095.1	0.0
50	1.0	0.2	2926	0.0502	2852.0	-0.5
100	2.5	0.7	2807	0.1026	2625.0	-2.0
150	2.9	1.7	2691	0.1571	2413.2	-4.6
200	2.1	3.0	2579	0.2141	2215.3	-8.4
250	0.0	4.8	2469	0.2735	2030.5	-13.5
300	-3.5	7.1	2362	0.3357	1857.9	-20.0
350	-8.6	9.9	2257	0.4006	1697.0	-28.1
400	-15.4	13.2	2155	0.4687	1547.0	-37.9
450	-24.1	17.1	2055	0.5399	1407.6	-49.6
500	-34.8	21.6	1959	0.6147	1278.3	-63.4
550	-47.8	26.7	1865	0.6932	1158.8	-79.5
600	-63.3	32.6	1774	0.7756	1048.8	-98.1
650	-81.6	39.2	1687	0.8624	947.9	-119.5
700	-102.9	46.6	1603	0.9536	856.0	-144.1
750	-127.6	54.8	1523	1.0496	772.6	-172.2

30-06 Springfield Shot Drop

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
800	-156.1	63.9	1447	1.1507	697.5	-204.2
850	-188.7	74.0	1376	1.2571	630.5	-240.6
900	-225.9	85.0	1309	1.3689	571.2	-281.8
950	-268.2	97.0	1249	1.4862	519.5	-328.4
1000	-316.0	110.0	1194	1.6092	475.0	-381.0

7mm Remington Magnum Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 0.3910

ZERO RANGE (YARDS): 250

BULLET-GR.: Sierra 130.0 HPBT

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

SIGHT OVER BORE (INCHES): 1.5

CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
0	-1.5	0.0	3270	0.0000	3087.4	0.0
50	0.7	0.2	3139	0.0468	2845.7	-0.4
100	2.1	0.7	3013	0.0956	2620.7	-1.7
150	2.4	1.6	2890	0.1464	2411.1	-4.0
200	1.8	2.8	2770	0.1994	2215.6	-7.3
250	-0.0	4.5	2654	0.2548	2033.3	-11.7
300	-3.0	6.6	2540	0.3126	1863.1	-17.4
350	-7.4	9.1	2430	0.3729	1704.4	-24.4
400	-13.2	12.2	2322	0.4361	1556.4	-32.9
450	-20.7	15.7	2216	0.5022	1418.5	-43.0
500	-29.9	19.9	2114	0.5715	1290.3	-54.9
550	-41.1	24.6	2014	0.6442	1171.4	-68.8
600	-54.4	29.9	1917	0.7205	1061.4	-84.8
650	-70.1	36.0	1823	0.8008	960.0	-103.3
700	-88.4	42.8	1733	0.8852	866.9	-124.4
750	-109.6	50.3	1646	0.9740	781.9	-148.6
800	-134.0	58.7	1562	1.0676	704.7	-176.1
850	-162.0	68.0	1483	1.1662	635.1	-207.3
900	-193.9	78.2	1408	1.2700	572.8	-242.7
950	-230.2	89.4	1339	1.3793	517.5	-282.8
1000	-271.4	101.5	1275	1.4941	469.1	-328.1



Federal engineers study the effects of bullets on ordnance gelatin at several hundred yards. Add the velocity of the bullet in real time and you have the whole story in hand.

7mm Remington Magnum Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 0.3910

ZERO RANGE (YARDS): 250

BULLET-GR.: Sierra 130.0 HPBT

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level
SIGHT OVER BORE (INCHES): 1.5
CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
0	-1.5	0.0	3270	0.0000	3087.4	0.0
50	0.7	0.2	3139	0.0468	2845.7	-0.4
100	2.1	0.7	3013	0.0956	2620.7	-1.7
150	2.4	1.6	2890	0.1464	2411.1	-4.0
200	1.8	2.8	2770	0.1994	2215.6	-7.3
250	-0.0	4.5	2654	0.2548	2033.3	-11.7
300	-3.0	6.6	2540	0.3126	1863.1	-17.4
350	-7.4	9.1	2430	0.3729	1704.4	-24.4
400	-13.2	12.2	2322	0.4361	1556.4	-32.9
450	-20.7	15.7	2216	0.5022	1418.5	-43.0
500	-29.9	19.9	2114	0.5715	1290.3	-54.9
550	-41.1	24.6	2014	0.6442	1171.4	-68.8
600	-54.4	29.9	1917	0.7205	1061.4	-84.8
650	-70.1	36.0	1823	0.8008	960.0	-103.3
700	-88.4	42.8	1733	0.8852	866.9	-124.4
750	-109.6	50.3	1646	0.9740	781.9	-148.6
800	-134.0	58.7	1562	1.0676	704.7	-176.1
850	-162.0	68.0	1483	1.1662	635.1	-207.3
900	-193.9	78.2	1408	1.2700	572.8	-242.7
950	-230.2	89.4	1339	1.3793	517.5	-282.8
1000	-271.4	101.5	1275	1.4941	469.1	-328.1

7mm Remington Magnum Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 0.3380

ZERO RANGE (YARDS): 250

BULLET-GR.: Sierra 110

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

SIGHT OVER BORE (INCHES): 1.5

CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
0	-1.5	0.0	3356	0.0000	2751.6	0.0
50	0.7	0.2	3202	0.0458	2505.2	-0.4
100	2.0	0.8	3054	0.0937	2278.5	-1.6
150	2.4	1.8	2911	0.1440	2069.6	-3.8
200	1.8	3.2	2772	0.1969	1877.0	-7.0
250	0.0	5.1	2637	0.2523	1699.3	-11.4
300	-3.0	7.5	2507	0.3107	1535.3	-17.0
350	-7.4	10.4	2380	0.3721	1383.9	-23.9
400	-13.3	13.9	2257	0.4368	1244.4	-32.4
450	-21.0	18.1	2137	0.5051	1116.1	-42.7
500	-30.5	22.9	2021	0.5773	996.3	-54.9
550	-42.2	28.5	1909	0.6536	890.7	-69.2
600	-56.3	34.9	1801	0.7345	792.8	-86.0
650	-73.0	42.1	1698	0.8203	704.2	-105.5
700	-92.8	50.3	1599	0.9114	624.7	-128.2
750	-115.9	59.4	1506	1.0081	553.8	-154.5

7mm Remington Magnum Shot Drop

7mm Remington Magnum Shot Drop <i>(continued)</i>						
RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
800	-142.9	69.6	1418	1.1108	491.3	-184.8
850	-174.2	80.9	1337	1.2197	436.8	-219.7
900	-210.4	93.4	1264	1.3352	390.1	-259.9
950	-252.1	107.0	1198	1.4572	350.7	-305.9
1000	-299.8	121.7	1141	1.5856	318.3	-358.4

6mm x 284 Wildcat Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 0.1980

ZERO RANGE (YARDS): 250

BULLET-GR.: Sierra 60.0 HP

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

SIGHT OVER BORE (INCHES): 1.5

CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)	30MPH-LEAD (FEET)
0	-1.5	0.0	3526	0.0000	1656.8	0.0	0.0
50	0.8	0.3	3256	0.0443	1413.0	-0.4	1.9
100	2.2	1.3	3003	0.0923	1201.7	-1.6	4.1
150	2.7	2.9	2764	0.1443	1018.0	-3.7	6.4
200	2.0	5.4	2537	0.2010	857.8	-7.0	8.8
250	0.0	8.8	2321	0.2628	718.1	-11.7	11.6
300	-3.6	13.2	2116	0.3305	596.8	-18.0	14.5
350	-9.2	18.8	1922	0.4048	492.2	-26.2	17.8
400	-17.2	25.8	1739	0.4869	403.1	-36.9	21.4
450	-28.0	34.3	1570	0.5777	328.6	-50.6	25.4
500	-42.3	44.5	1417	0.6783	267.7	-68.1	29.8
550	-61.0	56.6	1284	0.7896	219.6	-90.2	34.7
600	-85.0	70.7	1173	0.9120	183.4	-118.0	40.1
650	-115.3	86.6	1087	1.0451	157.6	-152.6	46.0
700	-153.0	104.2	1023	1.1875	139.4	-194.7	52.3
750	-198.9	123.2	972	1.3382	125.8	-244.8	58.9
800	-254.0	143.5	929	1.4962	115.1	-303.6	65.8
850	-319.3	165.1	892	1.6611	106.1	-371.6	73.1
900	-395.4	187.8	859	1.8326	98.4	-449.3	80.6
950	-483.4	211.6	829	2.0106	91.6	-537.6	88.5
1000	-584.0	236.6	801	2.1951	85.5	-637.2	96.6



Mike Capps of Howard Communications checks out a block of ordnance gelatin after a test shot.

25 x 284 Wildcat Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 0.2830

ZERO RANGE (YARDS): 250

BULLET-GR.: Sierra 87.0 SPT

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

SIGHT OVER BORE (INCHES): 1.5

CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
0	-1.5	0.0	3347	0.0000	2164.6	0.0
50	0.8	0.2	3164	0.0461	1934.8	-0.4
100	2.2	0.9	2989	0.0949	1726.7	-1.7
150	2.6	2.1	2821	0.1465	1537.9	-3.9
200	1.9	3.9	2659	0.2013	1366.5	-7.3
250	-0.0	6.2	2503	0.2594	1210.6	-11.8
300	-3.3	9.2	2352	0.3213	1069.1	-17.8
350	-8.2	12.9	2206	0.3871	940.8	-25.3
400	-14.8	17.4	2066	0.4574	824.7	-34.7
450	-23.5	22.7	1931	0.5325	720.3	-46.1
500	-34.5	29.0	1801	0.6129	626.9	-59.9
550	-48.2	36.3	1678	0.6992	544.1	-76.5
600	-65.0	44.7	1562	0.7919	471.4	-96.3
650	-85.4	54.4	1454	0.8915	408.3	-119.8
700	-109.9	65.3	1354	0.9984	354.5	-147.8
750	-139.1	77.6	1265	1.1130	309.5	-180.8
800	-173.8	91.2	1188	1.2355	272.7	-219.6
850	-214.6	106.2	1123	1.3655	243.7	-265.1
900	-262.3	122.5	1070	1.5025	221.1	-317.7
950	-317.6	139.8	1026	1.6459	203.3	-378.0
1000	-381.2	158.2	989	1.7950	188.9	-446.4

220 Swift Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 0.2350

ZERO RANGE (YARDS): 250

BULLET-GR.: Sierra 55.0 HP

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

SIGHT OVER BORE (INCHES): 1.5

CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)	30-MPH-LEAD (FEET)
0	-1.5	0.0	3580	0.0000	1565.6	0.0	0.0
50	0.2	0.3	3349	0.0433	1369.8	-0.4	1.9
100	1.0	1.0	3130	0.0897	1196.4	-1.5	3.9
150	1.0	2.4	2921	0.1393	1042.5	-3.5	6.1
200	0.0	4.4	2723	0.1925	905.5	-6.5	8.5
250	-2.2	7.1	2533	0.2496	783.5	-10.8	11.0
300	-5.8	10.5	2350	0.3111	674.8	-16.3	13.7
350	-10.9	14.8	2176	0.3774	578.2	-23.5	16.6
400	-17.9	20.1	2008	0.4492	492.7	-32.5	19.8
450	-27.0	26.4	1849	0.5270	417.6	-43.8	23.2
500	-38.7	33.9	1699	0.6117	352.4	-57.7	26.9
550	-53.4	42.8	1558	0.7039	296.6	-74.8	31.0
600	-71.7	53.1	1429	0.8045	249.5	-95.6	35.4

22-250 Remington Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 0.2470

ZERO RANGE (YARDS): 250

BULLET-GR.: Hornady 52.0 A-Max

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

SIGHT OVER BORE (INCHES): 1.5

CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
0	-1.5	0.0	3630	0.0000	1521.9	0.0
50	0.1	0.2	3407	0.0427	1340.6	-0.3
100	1.0	1.0	3195	0.0881	1179.2	-1.4
150	1.0	2.2	2994	0.1366	1035.3	-3.4
200	-0.0	4.1	2802	0.1884	906.5	-6.3
250	-2.1	6.5	2617	0.2438	791.2	-10.3
300	-5.4	9.7	2441	0.3032	687.9	-15.6
350	-10.2	13.7	2271	0.3669	595.4	-22.4
400	-16.7	18.5	2107	0.4355	512.9	-30.9
450	-25.2	24.2	1951	0.5094	439.6	-41.4
500	-35.9	31.0	1802	0.5895	375.1	-54.2
550	-49.4	39.0	1661	0.6762	318.8	-69.9
600	-65.9	48.3	1530	0.7703	270.5	-88.8

223 Remington Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 02230

ZERO RANGE (YARDS): 250

BULLET-GR.: Speer 50.0 TNT-HP

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

SIGHT OVER BORE (INCHES): 1.5

CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
0	-1.5	0.0	3242	0.0000	1167.2	0.0
50	0.5	0.3	3017	0.0480	1010.9	-0.4
100	1.5	1.2	2803	0.0995	872.8	-1.8
150	1.4	2.9	2600	0.1551	750.6	-4.3
200	-0.0	5.3	2405	0.2151	642.3	-8.1
250	-2.9	8.6	2219	0.2800	546.7	-13.4
300	-7.5	12.8	2041	0.3505	462.4	-20.5
350	-14.3	18.2	1871	0.4273	388.9	-29.7
400	-23.5	24.8	1712	0.5111	325.3	-41.4
450	-35.8	32.8	1563	0.6029	271.3	-56.3
500	-51.5	42.4	1427	0.7034	226.1	-74.8
550	-71.6	53.6	1306	0.8133	189.4	-98.0
600	-96.8	66.5	1203	0.9331	160.6	-126.5

223 WSSM Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 02550

ZERO RANGE (YARDS): 250

BULLET-GR.: Sierra 55.0 BlitzKing

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

SIGHT OVER BORE (INCHES): 1.5

CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
0	-1.5	0.0	3703	0.0000	1675.0	0.0
50	0.0	0.2	3483	0.0418	1481.9	-0.3
100	0.9	0.9	3274	0.0862	1309.5	-1.4
150	0.9	2.1	3075	0.1335	1155.3	-3.2

Table continued on page 161



Red fox taken with a 22-250 Remington at 375 yards. Knowing where the bullet is going and what it will do when it gets there is a big advantage to a long-range rifleman.

223 WSSM Shot Drop

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
200	-0.0	3.8	2885	0.1838	1017.0	-6.0
250	-1.9	6.2	2703	0.2375	892.8	-9.8
300	-5.1	9.1	2529	0.2949	781.2	-14.9
350	-9.6	12.8	2361	0.3563	680.8	-21.2
400	-15.6	17.3	2199	0.4221	590.7	-29.2
450	-23.5	22.6	2044	0.4929	510.1	-39.0
500	-33.4	28.9	1895	0.5691	438.6	-51.0
550	-45.8	36.2	1753	0.6514	375.6	-65.4
600	-61.0	44.8	1620	0.7405	320.6	-82.8

243 WSSM Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 0.3300

ZERO RANGE (YARDS): 250

BULLET-GR.: Hornady 75.0 V-Max

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

SIGHT OVER BORE (INCHES): 1.5

CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
0	-1.5	0.0	3550	0.0000	2099.3	0.0
50	0.5	0.2	3385	0.0433	1908.8	-0.4
100	1.7	0.7	3227	0.0887	1734.2	-1.5
150	2.1	1.7	3074	0.1363	1573.9	-3.4
200	1.6	3.0	2926	0.1863	1426.5	-6.3
250	-0.0	4.9	2784	0.2389	1290.9	-10.2
300	-2.7	7.1	2646	0.2941	1166.1	-15.2
350	-6.6	10.0	2512	0.3523	1051.1	-21.4
400	-11.9	13.3	2382	0.4136	945.1	-29.1
450	-18.7	17.3	2256	0.4784	847.7	-38.3
500	-27.2	21.9	2133	0.5467	758.2	-49.2
550	-37.7	27.2	2015	0.6191	676.3	-62.0
600	-50.3	33.2	1900	0.6957	601.6	-77.1
650	-65.3	40.1	1790	0.7771	533.8	-94.6
700	-83.0	47.9	1685	0.8635	472.7	-115.0
750	-103.8	56.6	1584	0.9553	418.1	-138.5
800	-128.0	66.3	1489	1.0530	369.6	-165.8



Author's Tikka T-3 Sniper rifle in 223 Remington. Gel block is Perma Gel used for testing in this book.

300 WSM Remington Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 0.4470

ZERO RANGE (YARDS): 250

BULLET-GR.: Sierra 168.0 HPBT

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

SIGHT OVER BORE (INCHES): 1.5

CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
0	-1.5	0.0	2991	0.0000	3338.1	0.0
50	1.1	0.2	2884	0.0511	3103.0	-0.5
100	2.6	0.7	2779	0.1041	2881.8	-2.0
150	3.0	1.5	2677	0.1591	2673.7	-4.7
200	2.1	2.7	2577	0.2162	2477.8	-8.6
250	0.0	4.4	2479	0.2755	2293.5	-13.8
300	-3.5	6.4	2384	0.3372	2120.0	-20.4
350	-8.6	8.9	2290	0.4014	1956.9	-28.5
400	-15.4	11.8	2199	0.4683	1803.7	-38.3
450	-23.9	15.2	2109	0.5379	1659.9	-49.9
500	-34.4	19.2	2022	0.6106	1525.3	-63.5
550	-47.0	23.7	1937	0.6864	1399.6	-79.2
600	-61.9	28.8	1854	0.7655	1282.5	-97.3
650	-79.4	34.6	1774	0.8483	1173.6	-117.9
700	-99.6	41.0	1696	0.9348	1072.9	-141.4
750	-122.9	48.1	1621	1.0253	980.0	-167.9
800	-149.4	55.9	1549	1.1200	894.8	-197.9
850	-179.6	64.5	1480	1.2191	817.0	-231.7
900	-213.8	73.9	1414	1.3228	746.4	-269.6
950	-252.3	84.2	1353	1.4313	682.8	-312.1
1000	-295.5	95.3	1295	1.5447	626.0	-359.6

204 Ruger Shot Drop

DRAG FUNCTION: G1

STANDARD BALLISTIC COEFFICIENT: 0.2750

ZERO RANGE (YARDS): 250

BULLET-GR.: Hornady 40.0 V-Max

STANDARD ATMOSPHERE: 59° F.; 29.53 Inches of Mercury at Sea Level

SIGHT OVER BORE (INCHES): 1.5

CROSSWIND (MPH): 10

RANGE (YARDS)	IMPACT (LOS-IN)	DEFL. (IN)	VEL (FPS)	TIME (SEC)	ENERGY (FT-LBS)	DROP (IN)
0	-1.5	0.0	3601	0.0000	1152.0	0.0
50	0.1	0.2	3401	0.0429	1027.9	-0.3
100	0.9	0.9	3211	0.0883	916.1	-1.4
150	0.9	2.0	3029	0.1364	815.2	-3.4
200	0.0	3.7	2855	0.1874	724.0	-6.3
250	-2.0	5.9	2687	0.2415	641.4	-10.2
300	-5.2	8.7	2525	0.2991	566.5	-15.4
350	-9.8	12.1	2369	0.3604	498.7	-22.0
400	-15.9	16.3	2219	0.4259	437.4	-30.1
450	-23.8	21.3	2074	0.4958	382.1	-39.9
500	-33.8	27.1	1934	0.5707	332.4	-51.9

223 WSSM 55-Grain Hornady V-Max Condensed Drop Table

Range (Yds.)	Velocity (fps)	Energy (ft./lbs.)	Impact inches (250-Yd. Zero)
0	3600	1583	-1.5
50	3412	1422	0.5
100	3232	1276	1.7
150	3060	1143	2.1
200	2894	1023	1.6
250	2735	913	0.0
300	2581	813	-2.7
350	2432	722	-6.5
400	2288	639	-12.3

204 Ruger Hornady 45-Grain (Introduced 2006) Shot Drop

Range	Bullet Impact At 200 Yards
100 yds	+1.0
200 yds	0.0
300 yds	-6.5
400 yds	-16.9
500 yds	-36.3

rimfires

rimfire ballistics illustrated here are not meant to be regarded as a basis for long-range shooting. If new to the long-range shooting sports, the shooters need to have a starting point. For youths and first-time shooters of any age, the rimfire is a start toward range extension. Included here are the bulk of current rimfire cartridges being used for paper targets and both varmints and game shooting. The data included here will vary a bit depending on the source used. In general, everything here will aid the shooter in understanding more about how a given bullet is affected downrange in term of its basic accuracy.

22 Long Rifle Standard Velocity, 40-Gr. Bullet, 50-Yard Zero

Drop: 75 yds -2.4"; 100 yds -7.2"

Velocity: MV 1070 fps; 50 yds 996 fps; 100 yds 936 fps

22 Long Rifle “ Stinger,” 32-Gr. Bullet, 75-Yard Zero

Drop: 100 yds -2.1”

Velocity: MV 1640 fps; 50 yds 1277 fps; 100 yds 1132 fps

22 WMR (Magnum), CCI Maxi-Mag 17-Gr. JHP, 100-Yard Zero

Drop: 50 yds +0.9”; 75 yds 1.0”

Velocity: MV 1875 fps; 50 yds 1607 fps; 100 yds 1375 fps

17 HMR CCI TNT JHP, 100-Yard Zero

Drop: 50 yds +0.2”; 75 yds 0.3”

Velocity: MV 2550 fps; 50 yds 2199 fps; 100 yds 1892 fps

17 Mach 2 CCI 17-Gr. bullet TNT JHP, 100-Yard Zero

Drop: 50 yds +0.7”; 75 yds. 0.9”

Velocity: MV 2010 fps



Remington Model 700 LV rifle in 204 Ruger.

CCI Rimfire Accuracy Testing

My testing also included “Perma Gel” ordnance gelatin bullet tests for bullet performance and wound channel information.

The following six loads are a review of CCI 22 LR loads tested in my Accurate Innovations 40X Remington, T/C Contender 14-inch handgun, and a tack-driving T/C G2 rifle. In effect, the CCI line of rimfire cartridges is at home in just about any and all chambers. (One exception is some foreign rimfire chambers shooting the CCI Stinger.) Because the Stinger is in effect longer than a standard LR, some foreign manufactured chambers will come up a bit short.

1

Test gun: Remington 40X/Accurate Innovations custom

Load: CCI 22 LR Stinger, 32-gr. HP

MV: 1640 fps

Five-shot Group @ 50 yds: .648”

Medium: Perma Gel

Penetration: 14”

Comments: Bullet energy dump within the first four inches, than a second energy blister at nine inch penetration depth. Good bullet separation at 11-inch point, with energy damage evident fully to the 17-inch mark.** (Good fast expanding bullet for light varmints.)

2

Test gun: T/C G2 rifle

Load: CCI 22 LR Quik-Shok, 32-grain SHP

Load: CCI 22 LR Quik-Shok, 32-grain SHP

MV: 1640 fps

Five-shot Group @ 50 yds: .616”

Medium: Perma Gel

Penetration: 8”

Comments: Eight-inch penetration/separation into three distinct equal sections. Bullet sections traveled an additional eight inch route through Perma Gel ballistic medium. Energy blister at three inch penetration point with heavy “ smoke” trail following each separated bullet section until stopped.

3

Test gun: T/C G2

Load: CCI 22 LR Velocitor 40-grain GLHP

MV: 1435 fps

Five-shot Group @ 50 yds: .582"

Medium: Perma Gel

Penetration: 11.5"

Comments: 11.5-inch penetration as bullet held together, offering a small mushroom expansion. Energy channel was limited to an area close to the bullet. No blister effect as with exploding bullet designs. This is a deep penetrator that almost completely penetrated the gel test block.

4

Test gun: T/C G2

Load: CCI 22 LR SubSonic 40-grain HP

MV: 1050 fps

Velocity at 50 Yards: 901 fps

**Five-shot Group @
50 yds:** .592"

Medium: Perma Gel

Comments: 13-inches total penetration to within half-inch from the end of gel block. Almost nothing has gone this far including the new 160-grain soft point 30-cal Hornady 30-30, fired at point blank range. Massive and deep penetration. Big and slow is the rule here; the British with very massive slow game bullets have been right all along.

5

Test gun: T / C 14" Contender

Load: CCI 22 Short 29-grain HP

MV: 1080 fps

Five-shot Group @ 30 yds: .844"

Medium: Perma Gel

Penetration: 14"

Comments: An 11-inch penetration channel starting with a small blister energy dump, followed by a marginal smoke gray energy line to the bullet. Mushroom evident at location of resting bullet. Good game penetration/bullet behavior qualities.



rimfire cartridges up for testing. Pictured is the author's Remington/Accurate Innovations 40X 22 LR.

6

Test gun: T/C 14" Contender

Load: CCI 22 LR Small Game Bullet (SGB),

40-grain solid flat
nose lead

MV: 1235 fps

**Five-shot Group @
30 yds:** .794"

Medium: Perma Gel

Comments: Bullet penetration completely through block, exiting into hard wood backer. This bullet out penetrated the CCI SubSonic 40-grain. Bullet design as in the flat-nose solid lead was the reason for the penetration. Little if any expansion noted upon examination of energy smoke channel. (A very fine narrow bullet track line across the gel block.)

17 Mach 2/17 HMR/22 WMR

A second group of CCI rimfire offerings – the 17 Mach 2, the 17 HMR, and 22 WMR – is addressed below. Again, measured group performance as well as penetration measurements were recorded. Rifles used during this test included the Thompson T/C G2 in 17 Mach 2, the Ruger M-77 in 17 HMR, and a second

M-77 rifle chambered in 22 WMR.

7

Test gun: Thompson T/C G2

Load: CCI 17 Mach
2 17-grain **MV:** 2010 fps

Five-shot Group @
50 yds: .208" **Medium:** Perma Gel

Comments: A total of 7-1/2 inches of penetration with massive energy dump blistering a large round bubble at about two inch mark in gelatin. A second energy dump causing a second significant blister at the four-inch mark, with the bullet jacket and core coming apart completely at 7-1/2 inches. Outstanding performance.

8

Test gun: Ruger M-77

Load: CCI 17 HMR
17-grain V-MAX **MV:** 2550 fps
Poly-tip

Five-shot Group @
50 yds: .616" **Medium:** Perma Gel

Comments: 1-1/2-inch penetration: Explosive bullet reaction at about two inch mark. Bullet separation 30 degree angles eight to 10 sections. Bullet core continued another four-inch with smoke channel developing a fine print line exiting block. I assume the bullet core / base and base section of jacket had continued through the block. Total penetration through 17-inch gel block.

9

Test gun: Ruger M-77

Load: CCI 17 HMR
20-grain GamePoint **MV:** 2375 fps

Five-shot Group @
100 yds: .774" **Medium:** Perma Gel

Comments: 14-inches of penetration with gradual expansion. Some slight loss of jacket with first four inch channel. Bullet retained weight until it

totally penetrated gel block. Only one of several to do so.

10

Test gun: Ruger M-77

Load: CCI 17 HMR 17-grain TNT JHP

MV: 2550 fps **Five-shot Group @ 100 yds:** .6665"

Medium: Perma Gel

Comments: 1-1/2-inches of penetration with total bullet upset. Violent explosion and bullet splinters going in all direction within the gel block. Total penetration under five inches with most being bullet fragments versus any whole core material. (Outstanding varmint pill for prairie dogs etc.)

11

Test gun: Ruger M-77

Load: CCI 22 WMR 30-grain Speer TNT JHP

MV: 2200 fps **Five-shot Group @ 100 yds:** 1.016"

Medium: Perma Gel

Comments: Three-inches of penetration, exploded almost on impact. A 30 degree angle of bullet fragments in all direction. Good solid-bullet slap as a varmint bullet.. A very high performance bullet.

12

Test gun: Ruger M-77

Load: CCI 22 WMR 40-grain MAXI-Mag CCI

MV: 1875 fps **Five-shot Group @ 100 yds:** 1.321"

Medium: Perma Gel

Comments: Penetration two inches prior to expansion start. Secondary penetration 10-1/2-inches of bullet core material. Additional shock wave with liner line smoke signature pushing ahead of the bullet another four inches.

13

Test gun: Ruger M-77 Light Sporter

Load: CCI 17 HMR 20-gr. JHP Gamepoint

Five shot group bench rest: 0.634”

Three shot group bench rest: 0.601”

14

Test gun: Ruger M-77 Light Sporter

Load: Hornady 17 HMR 17-gr. V-Max

Five shot group bench rest: 0.634”

Three shot group bench rest: 0.450” (sub-MOA)

Five shot group bench rest: 1.004”

NOTE: All data provided by Ballistics Research & Development of Piedmont, South Dakota, L.P.Brezny, and SHOTdata Systems of New Brighton, MN, Ross Metzger, Engineer.

Chapter 12

handloads

Handloading can be regarded as the lifeblood of the long-range riflemen. I don't know any long-range shooters who don't load their own. Handloading is considered a baseline activity among almost all long-range shooters. With the exception of a police or military sniper who will get all his training and field ammunition from a commercial source, the handload is not a commercial source, the handload is not only an economical way to shoot long-range, but many times a more effective round than that bought over the counter in a factory wrapper.



It has often been stated that a good handload can outgun any factory load offering. Today I'm not all that sure this is a true statement. Modern factory loads have become very good products, and as such there are times when it is very tough to shoot a tighter group than what that factory rolled cartridge can produce.

The primary problem with shooting strictly factory ammo is in the area of cost, and there is always that question of group accuracy downrange. The price of factory fodder is high, and that element is not going away any time soon. I'm not saying that handloading components are not a costly item, but dollar for dollar you can shoot about double the rounds by loading your own, versus shooting the factory package in most long-range cartridges.



handloading press and cartridge

Getting involved in handloading for your rifle is not at all difficult, but it will require you to do some reading on the subject and buy the proper equipment. Because it may seem complicated at first, you may think you have made a mistake getting into this element of shooting sports. Believe me when I tell you that by loading your own ammunition you will, by that fact alone, become a better shooter. You will invest yourself in the development of your craft, and like most of us, take great pride in hitting a target at 600 or more yards with our own handloaded ammunition.

I started to handload all my rifle ammunition about 55 years ago in the late 1950s. In those days we didn't have a whole lot in the way of bullets and powders, but we still had enough component elements to build an accurate round of ammunition, and do so at a price that was affordable. Buying up bulk 4895, 4350, and 3031 powder, we would head for our local supplier with coffee cans to be filled at bulk pricing from large kegs when it came time to buy cartridge fuel for 30-caliber and other WWII military surplus rifles and long-range cartridges.

The big rounds of the day for me were the 300 H&H Magnum owned and lent to me at times by a friend. As a second option, cutting back bullet weight in the 30-06 Springfield increased its ability to shoot a flat trajectory. Some work was done with the British 303 Enfield rifles and loads, but the '06 always

seemed to win out in the end. I write here from a hands-on approach even though there were many other options open to the riflemen of the day. The bottom line was that as a young shooter and a student well into the mid-1960s, I could not afford much more in the way of range-stretching tools of the trade.

Early on I latched onto an RCBS Jr. press and a lightweight Lyman Tru-Line JR turret press for several short case cartridges. The 6.5x55 Swedish Mausers were everywhere and darn cheap at that. Drop a 49-grain charge of 4831 behind a 120-grain Speer bullet in the Swedish case and you had an accurate load pushing 2773-fps out of a Mauser mountain rifle.



Barnes 224 bullets and 223 WSSM being handloaded for deer applications.



RCBS handloading dies and equipment.



Author with a badger killed with the Savage Model 10 LE 308 sniper rifle, and 168-gram Sierra MatchKmg bullets handloaded for review by the author.

It wasn't that we didn't have hot high-velocity guns and cartridges back then because none would dispute the effectiveness of the 250/3000 Savage with its 60-grain pills punching out the barrel at 3522 fps behind a charge of H380. At the same time we also had the 257 Weatherby Magnum, and the 257 Roberts that sent a bullet of 60 grains in weight out of the tube at 3754 fps. This bullet was pushed behind H380, and 4320 to name a couple of fueling products of the day.

Shooting 4350 in the Weatherby rifle, you could up your velocity to a very hot 4229 fps and still shoot a 60-grain coyote killer for long-range work. If these sound like speeds in use today you're quite correct. The circle gets larger, but change is a slow-developing commodity in the new load business. The date of my old Speer reloading manual covering these types of loads was 1959.

What we do see today that was not present in years gone by are vast numbers of new cartridges that make the world of long-range rifle shooting very appealing indeed. Even the development of the previously covered WSSM and WSM lines of Winchester cartridges allows more velocity to be generated from tighter case packages and shorter-action rifles. Several years into these super-short cartridges, we are still seeing a slow move forward in the area of overcoming and replacing the 300 Win Mag, or even the old standard 30-06 Springfield. Rest assured these new fuel cells will have their day, and it is not very far off. Bench rest shooters and reloaders have known for years that a fat, short cartridge with the proper shoulder angle can develop a very efficient burn rate for a given powder charge. More speed and accuracy with less powder is a new rule in the business of creating new and effective handloads.



Wildcat round built off the .240 Weatherby Magnum case.

While this book is not a handloading manual, it has scattered across its pages a number of loads I have found workable, and at times outstanding as applied to real-world field situations. Aside from those loads I have decided to share several others that are in the “pet” load category in that these case and bullet packages have tended to bring home the fall meat, dust off prairie rats in good numbers, or drive tight groups on paper targets for a very long period of time.

Wildcats

long-range handloaders will often opt to shoot a wildcat round, that is to say a cartridge that has been redesigned from a current or old factory cartridge, but now uses a different-caliber bullet and has enjoyed even some changes in the cartridge case itself. When we think of long-range shooting, we think of wildcats as fuel cells that drive heavier bullets very fast over a much longer area of downrange space. Also, wildcats have always been selected from cases that were initially factory loads covering heavy game applications due to the size of the case and its capacity to hold high volumes of powder.

As an example, the 257 Ackley Improved uses a parent case taken from the

257 Roberts. These wildcat cartridges are always blown out a bit for added powder space, and at times the case shoulders are altered to develop a different burn or utilization of the powder during its burn time in the chamber. The end result is almost always an increase in performance, downrange velocity retention, or accuracy.

While 257 Roberts cases can be a pain to find in bulk, simple wildcats are developed from easy-access cartridges like the 30-06, 243 Win, or 223 Remington. Here a 30-06 can be necked down to 6mm x 06 and now shoot a bullet with a different BC, diameter, and grain weight. Often the bullet is pushed faster and will perform better at long-range, or so that's the general idea. The 223 Rem in a wildcat Ackley Improved is nothing more than a standard factory cartridge fire-formed with the first round shot from the Ackley Improved chamber, thereby opening the case up a bit at the shoulder to accept more powder when handloaded and shot the second time around. Simple, you say? Yep, and for good reason in this case. While some wildcat cartridges need to go through many levels of reforming a factory case, the Ackley innovations in wildcats made use of what was already in hand, and therefore those loads often use a much more simplified brass reforming system. Just fire old brass in the new Ackley chamber and you'll have a new wildcat case.

Currently, wildcat load development has become so big that designers of cartridges in the wildcat realm will copyright their wildcat loads in the event someone wants to turn them into factory offerings. Even the commercial arms industry tends to favor design ideas taken from wildcats. The development of the 25-06 Remington reviewed throughout this book is a classic example of Remington taking this outstanding 25-caliber, necked-down 30-06 and making it a Remington factory offering. When this takes place, rifle manufacturers will often start to build rifles to fit the new cartridges and then another rifle cartridge that can be bought over the counter is born.

The complete line of Winchester short magnums, for example, has in turn led to the development of the 223 WSSM, 243 WSSM, and 25 WSSM. This WSSM (Winchester Super Short Magnums) case in all three calibers is based on the Winchester 300 WSM (Short Magnum.) In effect, Winchester got itself into the fringes of the wildcat business during cartridge development. Taking the 300 WSM case and cutting it back has resulted in the super short fat WSSM, which is in a class all by itself. In the following load reviews, I will cover some of my load development regarding this new innovation in super short long-range cartridges.



Combined Technology 243 Win rounds being loaded for review on coyotes.

Author-Generated Handload Examples

223 Remington

I believe one of the very best cartridges is the 223 Remington. It's a do-it-all cartridge that is the number one round in terms of popularity among riflemen today.

Case: Any clean and preferably once-fired brass case

Primer: Rem Bench Rest Primer SM

Powder: 26.0-grains H 335

Bullet: 55-grain Hornady V-Max

Bullet Seating: Just off lands (short jump) Check all brass for clean primer pocket, correct neck length, full length realized.

MV: Approximately 3210 fps, 24" barrel.

Note: I have observed this round take out prairie rats to 600 yards in dead morning air and warm weather. One shot kills, not an artillery exercise. Group size at 100 yards inside .336", or one rough hole.

30-06 Springfield

Case: Government or commercial brass.

Primer: CCI LR

Powder: 61-grains 4350. Note: Build to this max load. Reduce by 10% for starting load and watch chamber pressure signs in brass and primer. In case of tight extraction or heavy bolt lift, reduce load at once.

Bullet: 150-grain Hornady SP

Bullet Seating: Just off lands (Short jump)

MV: Approx. 3065 fps (22" Winchester Model 70 Featherweight)

Notes: Kills big game to 425 yards (ranged).

22-250 Remington

Case: Factory

Primer: Win LR

Powder: 39.0-grains Win 760

Bullet: 55-grain Nosler BT

Bullet Seating: Just off lands (short jump)

MV: 3675 (calculated)

Notes: Very accurate and great long-range dog load.

243 Winchester

Case: Winchester factory

Primer: Win LR

Powder: 43 grains 760 Ball

Bullet: 55-grain Nosler BT

MV: 3131 fps 24" barrel (Remington Model 700 VS)

Notes: Lower velocity but deadly accurate to 100 yards. One-hole groups. With other powders this cartridge and bullet can be moved up to 4000 fps

25-06 Remington

Case: Necked down 30-06government brass

Primer: CCI LR

Powder: 47 grains 30-31

Bullet: 87-grain Speer SP

MV: Approx.3400 fps

Bullet Seating: Just off lands (short jump)

Notes: Accurate! Group inside 1" at 200 yards.

NOTE: Reduce all loads by 10% as starting charges. Remember, handloading is a detailed process and neither the author nor Krause Publishing is responsible for accident or injury as a result of loading your own ammunition. Reasonable care was exercised in the development of these handloads. However, as powder lots change in burn rates from time to time, and other components may be substituted in place of those listed, the handloader (you) assume all risk.

Barnes Blue Bullet Testing

The following field event is an example of how handloads come into play as

a normal part of everyday long-range varmint shooting. The handload is critical if you have not figured that out for yourself in the preceding pages, and without loading your own, there would be very little real-time work done with rifles in the field. Factory ammunition is just too expensive for the shooter who wants to get out often and get the job done.

Wyoming in July can be brutal in terms of heat. Being just a stone's throw across the border from my home state of South Dakota, the shade-less open spaces of eastern Wyoming didn't offer up much hope for any kind of cooling down. Over the several days that I had cut out to bullet test 22-250 varmint pills in my Remington Model 700 VS predator killer, I would have to face the heat, dust, and the super-dry conditions of summer dog-gunning in the far west.

My partner, John Anderson, editor of Varmint Hunter Magazine, had packed along a pair of Remington-based custom varmint control systems in 223 Ackley Improved and 22-250 Ackley that mounted Shilen or Pac-Nor number three contour pipes, and custom built McMillan stocks.

John's rifles had well-tricked-out Remington-base 700 actions, but in my case the "Black Devil," so named for its total lack of any color other than black, was a factory stocked Model 700 Varmint Synthetic. This rifle would be used to send the mail over a full two-week period that would start in Wyoming, then cover western South Dakota, thereby making for work in two different states before seeing the loading shop and a complete take-down cleaning.

On the first leg of our hunt we would fort up west of the Snowy mountain range, which would bring us out on the slopes of the Rockies. This was rolling country dotted with creek bottoms and rocky ledges that often contained rockchucks and an unlimited supply of prairie dogs. Hunting out of a base camp I often used, the Spur Ranch and Guide Company, I was assured of a massive number of dogs to work on during my "warm target" testing. This hunt would center on 22-250 Remington cartridges handloaded with Barnes VLC 22-caliber 50-grain pills. The cases, Remington once-fired factory containers, used Federal match primers, 38 grains of Ramshot X-Terminator, and 50-grain VLC "Blue Bullets." Barnes had indicated that the VLC bullet is cheap in that it sells at a fair low-end price and shoots well. As to that claim, the medium-heavy Remington varmint rifle would to be sure separate fact from fiction.

When shooting got underway my partner stayed with his Model 700 Remington 223 Ackley Improved a good deal of the time while using several different bullets. This gave me a solid opportunity to make some comparisons

between John's varied types of handloaded bullets against the performance of the Barnes VLC bullets as they splashed against prairie dogs on dirt mounds and rock ledges well out beyond 300 or more yards.

Working from a sitting-type ground bench rest and solid bag rests, the cross hairs and one-quarter MOA dot froze dead still as our Model 700s pushed bullet after bullet over the endless dog towns. About the first thing I observed was that my Remington VS shot the Barnes VLC bullets very well, and the bullets could in fact be placed at will on any part of a dog's anatomy. If I wanted to lift my target, a low body shot turned the trick with ease at ranges exceeding 250 yards. The Remington Varmint Synthetic retained enough weight with my Caldwell bipods hanging on the forend, as well as the 6x16 Weaver varmint glass, to allow me to see my hits against the recoil of the 3800-fps exiting bullets.



John Anderson shooting a Kimber Pro Varmint in 22-250 during the review of varied handloads in the field.



Barnes Blue Bullets being handloaded in 22-250 Rem by author.

John's application of almost all plastic tip technology produced the red mist associated with the space-age bullet design, but on the other hand the simple hollowpoint and thin jacket of the Barnes VLC bullet did a solid job on the prairie rats, and even when he was dug into the dirt on a low shot, upset enough real estate to throw Mr. Dog off his legs and send him flying end over end much of the time. Anytime you're sending any one of the many currently designed varmint bullets at 3800 fps to 4000 fps you can bet that something horrendous is going to take place when that bullet reaches its primary target, or for that matter anyplace close to it.

Moving North

By the second week of dog hunting we had dropped our gear at the Tipperary Lodge motel in Buffalo, South Dakota, which sits almost in both Montana and North Dakota at the northwestern tip of the state. A short drive to Randy Routier's guide operation, which caters to everything from prairie dog hunters to later season winter bobcat killers to big game hunters, had set us up for several additional days of gun and load testing. Now John hauled out a tricked-up Thompson/Center Contender in 17 HMR and a generous supply of Remington 17-grain 17-cal cartridges. We now were going to plant bullets on dogs to observe some real-world ballistic effects. As we now had a new and different

type of shooting than had been experienced in Wyoming with the 22-250, I again took time to turn loose both the Barnes “Blue Bullet” test fodder, and also a comparative Remington 22-250 factory load using the Hornady 50-grain V-Max bullet in the Remington package. In effect, John’s 17 Hornady bullets in Remington boxes used V-Max technology, which also allowed some comparison in terminal damage effects by both the smaller 17 and the much longer range 22-250 Remington.



Author with Dakota coyotes taken with the 224-caliber 223 Rem. In this case , a Combined Technology Ballistic Tip 40-grainer got the call.

When shooting started on the first town Randy Routier turned us loose on, the outcome was clearly predictable. Being at a lower altitude, both the 17 HMR and 22-250 didn’t push range quite as far as was experienced when gunning dogs at 9000 feet above sea level in Wyoming. Now we were set up on benches, being quite static as the towns were small and required some degree of stealth and sometimes long waiting periods between shots. Even so, we hit often and at

long-range, giving back good data on the V-Max and Barnes bullet designs. For the most part when shooting almost any modern bullet that is designed with a thin jacket and hollowpoint or soft nose like the Barnes bullets, the reaction is going to be a bullet that tends to hold together a bit better than the plastic tip bullets like the Hornady V-Max and others.

The 17 HMR requires a story of its own. The data was extensive, so I will conclude this segment by saying that in my Remington VS Model 700 22-250 the Barnes technology 50-grain “Blue Bullets” produced great field results, and indicated no negative effects in terms of accuracy. Accuracy in this case was engaging targets to a Leica LAF 1200 SCAN-ranged yardage exceeding 400 yards at times. The Leica system is among the most accurate taken afield by long-range riflemen today, and the SCAN system is state of the art in terms of this technology.

While Barnes is not saying that the blue-coated varmint bullets are benchrest quality I can say that the Remington Model 700 VS took a real liking to them and shot them well on both paper and afield. I can assure you with the high heat of a midsummer dog hunt I would not have wasted my time shooting anything that didn't get the job done. Prairie dog hunting at this time of year can almost border on actual work. However, it beats a desk job any day of the week regardless of the weather conditions.



Dead Coyote developed by Environmetal Inc. in bulk pack to the left of powder can. All the Dead Coyote test fodder was handloaded by the author.

New “Green” Bullets for Handloading

Dead Coyote 224 70-Grain HP

At a bullet weight of 70 grains, the Environmetal Inc. Hevi-Shot Company has launched a new 223-caliber varmint bullet. Designed to be used on medium-size targets, recent field tests have indicated that this new 224 bullet is a solid performer.

Dead Coyote is a “green” bullet. That is to say that this is a completely environmentally friendly bullet that is made from non-toxic safe materials. Based on a copper jacketed hollowpoint design, the Dead Coyote makes use of a soft tungsten core that won't overexpand and in effect is a solid hide-saver design when hunters want to sell those coyotes, badger, or fox pelts.

Tested on coyotes, Texas hogs, and other assorted varmints the new bullet tends to retain great accuracy, good penetrating ability, and positive controlled wound channel expansion.

Easy to handload by way of many current handloading manuals using data that deals with the 68-, 69-, and 70-grain 224 bullets, the Dead Coyote is at home in the case of the 222, 223, 22-250, 223 WSSM, or any other high velocity 224-caliber cartridge. This bullet is best suited to rifle twists of 1:7 to 1:10. Its practical velocity range is 3060 fps to 3560 fps. I tested it at 2830 fps in my 223 Remington with outstanding results.

With a flat-base bullet design and measuring .888 inch, which makes it a very long 224 projectile, this bullet develops great expansion and retained energy, but won't bust up your animal in the process of getting the job done.

Data

Handload: 70-grain Dead Coyote Bullet.

Rifle: 223 Remington Ruger Mini 14, 1:9 twist rate

Brass: Black Hills

Primer: Federal 109 SR

Powder: Tac (Ramshot), 24.2 gr

OAL: 2.213”

MV: 2,800 fps



Dead Coyote 223 Rem handload being tested against dye-filled Perm Gel ballistic gelatin.

Authors Handloads for New Cartridges

25 WSSM Handloads

Inasmuch as the 25 WSSM is new to shooters over the past three years, it is still in the blueprint stage regarding handloads. However, that stated, we have a number of good loads worked up for the new kid on the block and to date the results when shot on everything from coyotes to deer have been very positive. While there are some hunters and even writers who don't like the WSSM family of cartridges, I believe it is because those shooters don't understand them. These cartridges even when handloaded to the letter will require you to take care of the bore. Lacking proper care these WSSM hotshots will foul and shoot poorly. Keep the bore clean and it will stay mean.

Bullet	Powder/Gr.	MV (fps)	Pressure (psi)	OAL (")	Group 100 Yds. (")
Speer T.N.T 87-gr.	H414/48	3342	58200	2300	1.514*
Speer T.N.T. 87-gr.	IMR4895/43.9	3452	61700	2300	1.586*
Hornady V-MAX 75-gr.	IMR4895/46.3	3703	62100	2.350	.975*
Speer T.N.T. 87-gr.	IMR7828/49.4	3250	N/A	2.233	1.199**
Barnes X-Bullet 115-gr.	IMR7828/47.0	2910	N/A	2.319	1.321**
Hornady V-MAX 75-gr.	Varget/46.5	3677	62200	2.366	1.124*
Hornady V-MAX 75-gr.	H414/48.0	3431	N/A	2.350	1.423**

* Three shot-groups

25 WSSM: A Comparative Test With the 25-06

Just by chance during my writing of this book I came across an old friend, Mr. Dean Joachim out of Forest Lake, Minnesota, who owned an “old school” 1955 custom Flaig’s-built 98 Mauser chambered in 25-06 Remington. Writers and some hunters have compared the-25-06 to the 25 WSSM on more than one occasion, and now I had the obvious opportunity to field both rifles back to back and see what would roll out the other end of the experiment. My newfound test rifle was made up of a completely rebuilt German military 98 action during the period when the 25-06 was a true wildcat cartridge. The rifle retained a custom “flag” safety and single-stage trigger of about four-pounds. let-off. The barrel was a Flaig’s “ACE” 24-inch pipe, and the stock was an old and well-made Bishop piece of grade AA American walnut. Glass-bedded with a free-floated pipe, and scoped by way of a Simmons 6x18 X40 varmint, the rifle came ready to shoot and was basically well zeroed.

Prior to obtaining the 25-06 98 Mauser I had not given any thought to running this old wildcat alongside the 25 WSSM, but events at the time were pushing me to do so in that even some of my friends were saying that the 25 WSSM could not in any way stand up to the 25-06 Remington.

In terms of comparative ballistics, even from the first rounds in my series of seven handloads, I observed that the short, fat 25 was indeed a match for the 25-06. As an example, my test handload number three came in at 3703 fps, and pushing a 75-grain Hornady V-MAX varmint bullet, the 25 WSSM was right in line with the 25-06 straight out of the starting gate. Shooting this 75-grain V-MAX bullet in the 25 WSSM handload, I obtained group accuracy consisting of three rounds of .975-inch. Right off I felt that I now had a reasonably close working match to a factory 25-06 Winchester 85-grain BST. The Winchester 85-grain retained a muzzle velocity of 3470 fps for the 24-inch barrel, and a group that measured .905” from the old school Flaig’s turn-bolt rifle.



Author with a Black Hills buck taken during the evaluation of the 25 WSSM.

Actually the 85-grain BST bullet is loaded for both the 25 WSSM and 25-06. In terms of 25 WSSM measured velocity with the 85-grain BST pill, my Oehler Chronotech Model 33 returned a 22" barrel velocity of 3481 fps. What all this information comes down to is that load for load, and cartridge for cartridge, both cartridges are about the same with the 85-grain BST bullet. I'm also willing to bet that when handloaded, each cartridge is a dead-on match to any 25-caliber bullet and the results will be so close no deer, antelope, coyote, or hunter would ever know the difference.

What I did find, however, when cleaning these rifles was that the 25 WSSM was fouled to a much greater degree than the 25-06. Using Ramshot's new Montana X-treme aggressive copper fouling cleaner, 50 BMG, I stuck a well-

saturated cotton patch in the 25 WSSM's bore about midway down with the first pass. The patch started easily and then just came to a hard dragging stop. With some effort the cold black and blue colored patch emerged from the muzzle, showing signs of even darker blue streaks. Those blue streaks indicated not only heavy carbon fouling but deep copper buildup as well.



25-06 and 25 WSSM. A matched pair when tested in the field.

In comparison, the 25-06 received the same cleaning method and the use of Montana X-Treme 50 BMG, which allowed the patch to slide like quicksilver down the pipe. My conclusion at this early juncture is that the 25 WSSM with its super-short case tends to do a real job in terms of creating a massively intense burn. That big slug of powder driven down that small hole at the case neck starts some real fires in the bore. As a direct result of all that burning powder and gases, high levels of carbon buildup are an end product.



Coyote taken at long-range with 25-06 Rem in a custom Accurate Innovations platform.



old-school 25-06 built back when the rifle cartridge was a true wildcat round.



50 BMG was required to cut through carbon buildup with the super short magnum cartridges. Keeping the bore clean is mandatory in terms of gaining good accuracy.

Aside from the bore cleaning problems, the greater concern here was the fact that I had not produced the kind of tight groups overall that I had been searching for. With the 25 WSSM being the last super-short development out of the Winchester labs, it is understandable that varied load data was a bit on the light side. It should be stated, however, prior to moving ahead here that if it had not been for Hodgdon Powders and Chris Hodgdon personally, this project would have gone into the tank very early on. With some degree of luck and good timing Hodgdon Powders has moved forward and developed upward of 154 loads that I have been able to pull off the net. Add to the fact that each of these loads has a starting or basic suggested charge, as well as a maximum charge, and you have an untold number of options staring at you.

When working from the middle of the Hodgdon load selection list, there are hundreds of load variations available as powder charges are adjusted by one-tenth grain increments. As other bullet brands are applied to the various Hodgdon published loads, the selection only grows longer. The fact is that Hodgdon currently owns the handloading farm when it comes to the 25 WSSM.

Based on these possible load offerings, it is obvious that I have only touched lightly on the surface of the subject regarding the handloading of the 25 WSSM using Hodgdon propellants.

As a side note it is also of interest to learn that Hodgdon under the original management was the powder manufacturer that moved the old 25-06 wildcat off dead center with the introduction of Hodgdon powders that brought up velocity even with heavy bullets. I guess Hodgdon has been in the business of dealing out design modifications to the 25s for a very long period of time, as the 25-06 got its start in the 1920s.

25 WSSM handloads

Bullet	Powder/Gr.	MV (fps)	Pressure	OAL (")	100-Yd. Group (")
Sierra Varminter 75-grain	Varget/46.5 gr	*3677	62,200	2.350	1.0
Sierra Varminter 75-grain	IMR4895/46.3 gr	*3703	62,100	2.350	.884
Sierra Varminter 75-grain	H414/48.0 gr	*3264	N/A	2.350	1.031
Sierra Varminter 87-grain	H414/48.0 gr	*3355	58,200	2300	.749
Sierra Varminter 75-grain	IMR4320/47.4 gr	3671	62,000	2.350	.987
Sierra Varminter 75-grain	H4895/45.2 gr	3708 fps	61000	2.350	1.542
Hornady V-MAX 75-grain	H414/48.0 gr	*3316 fps	N/A	2.350	.795

* Chronographed with Oehler Chronotech Model 33

223 WSSM

This 224-caliber cartridge is about to push the 220 Swift on its side. This 4000-fps fast-mover with a 55-grain 22 bullet is able to dole out long-range accuracy. The cartridge will do this with a short-throw bolt, and a tight, efficient case that burns powder well. This new case also gives the shooter more velocity for less powder.

223 WSSM Data

Primer: Federal 210 LR

Case: Winchester Factory

Bullet	Powder/Gr.	MV (fps)	100-Yd. Group (")
Speer Trophy Bonded Bear Claw 55-gr	Ramshot Big Game/43.2 gr	3,682 fps	2.142
Barnes Triple-Shock X 53-gr	Ramshot Big Game/43.2 gr	3,593	2.156
Noeler Partition 60-gr	Ramshot Hunter/38.2 gr	3,313	2.175

223 WSSM handload Performance: 100 Yards Benchrest

Rifle: Winchester M-70 Featherweight with reworked 3-lb. trigger

Chronograph: Oehler Chronotech Model 33 (Two Screen System)

Wind: Zero

Temperature: 77° F

Elevation: 5400 ft.

Bullet	Powder/Gr.	MV (fps)	100-Yd. Group (")	Notes:
Sierra Blitzking 55-gr	Ramshot Hunter/45.3	3526	.045 (3)	Notes: Good coyote/accuracy load
Sierra JHP Varminter 60-gr	Ramshot Hunter/46.5	3629	.078 (3)	Notes: Good windy condition/coyote load
Hornady V-Max 55-gr	Ramshot Hunter/46.7	3748	1.006 (3)	Notes: Prairie dogs, general shooting
Sierra Blitzking 55-gr	Hodgdon Varget/40.5	3836	1.036	Note: Prairie dogs, general shooting
Hornady V-Max 55-gr	Hodgdon Varget/40.5	3827	.099	Notes: Prairie dogs, general shooting
Sierra Spitzer BT 65-gr	Ramshot Hunter/45.0	3475	1.03	Notes: Good deer load
Winchester BST Factory 55-gr	N/A	3787	.039	Note: General varmint load
Speer Trophy Bond. Bear Claw 55-gr	Ramshot Hunter/46.0	3500	1.050	Notes: Good deer load
Hornady SP 60-gr	Ramshot Hunter/46.0	3514	1.00	Notes: Good deer load
Sierra BlitzKing 55-gr	Ramshot Hunter/46.0	N/A	.042	Notes: General varmints/accuracy load
Hornady V-Max 55-gr	Ramshot Hunter/46.0	n/ a	.071 (3)	Notes: General varmint/accuracy load

* All groups five shots unless noted as (3)

Group Test 223 Bullets (Handloaded and Factory)

Courtesy Ballistics Research & Development

Bullet	Powder/Gr.	MV (fps)	100-Yd. Group (")
Barnes 50-grain VLC	X-Term/26.0	3333	0.998
Barnes 50-grain XLC FB	X-Term/25.5	3297	1.011
Barnes 40-grain VLC	X-Term/30	3833 fps	1.030
Federal 52-grain BT HP Sierra Matchking (Fact.)	N/A	N/A	1.051
55-grain Sierra Blitzking	Win 748/26	3150	1.044 *
50-grain Speer TNT	Varget/27.5	N/A	0.632
55-gr SP Remington (Fact.)	N/A	3240 fps	1.023
55-gr V-Max (Moly Coat)	Win 748/26.3 Gr	N/A	1.023
62-gr Remington Match (Fact.)	N/A	3025	0.673
55-gr Win SP	4320/27	3134	1.072
50-gr Barnes Varmintator	X-Term/24.8	3239	1.062
50-gr Winchester Supreme BT (Fact.)	N/A	3240	.297
55-gr Sierra Blitzking (reshoot)	Win 748/27.5	N/A	0.516 *
Federal 52-gr Sierra Matchking BT HP (Fact.) (reshoot)	N/A	N/A	0.914 *

* Three-shot group

While I have not gone through every element associated with handloading, I think you can see that the handload has a very definite place in the long-range rifleman's game plan. Without a handloading bench, you're coming up way short

of what is required of a dedicated long-range shooter. From developing wildcats to using very high-grade custom bullets in factory cases, the handloader can do it all when it comes to a custom load and improved accuracy.

Chapter 13

Where To Shoot Long Range?

There is no question about the fact that the western states are king when it comes to space and unlimited range when stretching for distance with that long-range rifle. Most Western states are great starting points in terms of getting that long-range rifle on targets. These states retain vast areas of federal land that is open to hunting, and also many of them have great public land access programs as well.



Growing up in Minnesota, I had to search out areas for long-range work with a rifle, and getting creative was a major part of my game plan. In the winter months, hunting the large expanses of the northern lakes region offered miles of open and frozen space, but the problem there was that the land was snowed in for about half the year, the varmint or game targets were infrequent over my rifle sights. It was a long haul by vehicle from home to those northernmost hunting grounds.

In the early 1960s I relocated for a time to Southern California and found the mountains along the coast and to the north of LA. That provided a new challenge in terms of both varmint and deer hunting. This was some very big, open country to a flatland Minnesota boy to be sure. I did learn to shoot at longer ranges in that mountain country, however, and after leaving that state some time later I found my way back to Minnesota and again started working through my long-range options as applied to a state that was half water and half deep and dense woods.



Cheyenne River Sioux reservation lands along the Missouri river in western South Dakota. Here the west opens up and Indian lands can offer good long-range shooting opportunities.



Big open country is home to the long-range rifleman.

After a time I learned that high-power-line cuts can make for great long range static shooting locations, as can fire breaks and two-track jeep trails. As these openings stretched along elder swamps and pine ridges I would sit and call

or even just stop and stalk them for critters that ranged from deer or brush wolf in the fall, to crows or woodchucks in the spring and early summer. I followed that game plan over many years right up until leaving Minnesota upon retiring from teaching school and the police department.

It is again the West that can provide the best conditions for the riflemen who wants to push range limits to the maximum. American Indian reservations are always productive. Each reservation has its own rules for non Indian hunters, but by taking the time to contact them you can find that a very positive western shooting vacation can be had. As an example, even living in South Dakota and having a few local ranchers who allow me to hunt coyote and prairie dogs, I still buy a Cheyenne River Sioux Reservation tag each year. This Lakota Indian Reservation just off the Missouri river about mid-state is a prairie dog and coyote hotbed. The Indian Reservation headquarters and town of Eagle Butte have everything you need including good motels and places to eat. This base area is dead center in the middle of easy access to dog-shooting lands that stretch to all four points of your GPS unit.

Clubs and various groups that specialize in varmint and long-range hunting can be of a major help when locating a place to shoot your rifles. For example, The Varmint Hunter Organization located in Pierre, South Dakota, publishes quarterly reviews that cover massive amounts of information in terms of where to shoot. This organization also holds competitive long-range shooting events on the club's range, and advertising in their quarterly magazine is by businesses that cater to shooters.

I have been told that hunting western states is a real mess, because you can't find a ranch owner with the ranches being so large. That's quite true, but there is a way around all that and it is called a government land map, or a state wildlife production, a school land, or a walk-in area map. Believe me, by just reading a simple map you would be amazed at what is available to hunters. Often posted signs have been removed from areas, but section lines and roads don't change, and many areas are wide-open to rifle hunters in the west. Wyoming for example is about two thirds Federal land, but you need a good map to find the right locations to shoot that bullet-stretching rifle.



Finding a place to shoot long-range targets can be a problem in some parts of the country.



Author calling across a wooded ridge in the Black Hills of South Dakota.

South Dakota has miles of Buffalo Gap grasslands to hunt, but again you need to know where you can gain access to that type of land. During the writing of this book I was shooting some very long range rounds with a 50 BMG on Federal land, and within an hour's time drew a crowd of cowboy-occupied pickup trucks at the government line gate. Yes, ranchers are always concerned

about what is going on near home, as you would be as well, but in this case I was as clean and legal as a New York attorney. I did find out a bit later that the rancher was grazing about 300 head of beef cattle several miles to the west of where I was shooting the big 50-caliber. He had leased the grazing rights to the Federal land, but in this case he had no control over the hunting or shooting rights as long as I didn't shoot near those cattle.

Don't overlook the eastern side of the Mississippi because smart hunters and shooters can and do find that there are ways to get a lot of distance out of that rifle, even when you're surrounded by timber and rolling hills. Over the years in the outdoor writing business I developed a much broader view of long-range shooting. With years of experience in rifles, 1000-yard ranges, and hunting in states such as West Virginia (without question, a woodchuck honey hole), my many years afield have been an education. The East has shooting, and a lot of it, but you need to get out and work from a basic plan if you want to keep viable, target-rich real estate under your feet.

Regardless of where you're shooting, and this goes double for long-range rifle work, you need to know what's over the ridge and where your bullets are going to end up. "Safety first" never rang so loud as it does on this subject. With rifles like the 50 BMG or 416 Barrett that can send bullets 7000 yards in some cases and still develop deadly wound channels or damage structures at those kind of ranges, you need to stay on your toes at all times.



Clubs with 800-to 1000-yard ranges can offer a lot to the long-range shooter.

Rent A Hunt?

I call some of the operations in the shooting and hunting business today “rent a hunts” because everything from the time you hit the front gate to the hour you leave has a price tag on it. On the other hand all the scouting, lodging, and meals can be arranged for you in advance. For the shooter who is tight on time these hunts are very efficient, and in most cases the results are positive. That is, if the guide operation, or dude ranch operation, wants to stay in business very long. Hunting with the long-range rifle can best be accomplished using pay-by-the-day operations in western states. In general, you’re going to get into more wide-open country where that super smokepole of yours can see some real work.

As an example of a working guide operation, take a look at Ken Hutton’s H Crown Outfitters at Hulett, Wyoming. That’s near the famous Devil’s Tower, in Wyoming, and where I let out the horses on the big 50 BMG and 308 Win. As a second operation of the type to be considered by the pay-as-you-go hunter is my rifleman’s proving grounds in Harding County, South Dakota and the Goehring-Routier Ranch near the town of Buffalo.



John Anderson shooting, and Randy Routier giving direction on his Harding County, South Dakota operation during the review of some new guns and loads. Randy spends many hours and days tracking game with long-range glass and keeping his hunters on targets.



Author with a guide during a Texas cat hunt. Guides can be a major help when getting bullets on targets.



The American west is the best game in town for long-range shooters to operate in.

In terms of Ken Hutton's outfit, he hunts about everything on his operation including all Wyoming big game found in the area, and he will accommodate hunters who want to take a crack at long-range prairie dogs and other assorted varmint-class critters. Inasmuch as Wyoming will not charge you for a varmint killing license, which is very different from most states now days, that is one part of the bill you can leave off the final ticket. outfits like Hutton's are often a good deal for hunters who want to take on some of the hunt themselves with a bit of guiding thrown into the mix. Ken will set up his hunters either way, and due to that kind of flexibility he is easy to work with afield.

As continued UPS drops of new commercial gear to be setup and tested

arrived, I found my way to Ken's H-Crown many times for hunting and shooting. This Wyoming operation has space to burn, in that miles of open rolling sage brush is just what the long-range shooter ordered when it's time to run rifle and bullet tests. The Routier spread can line you up with accommodations in town, camping, or on site, and Randy has a very large operation that sprawls out along the South Dakota/Wyoming boarder. Again I use this kind of setup in that it offers an easygoing approach to hunting, and these straight-up and honest folks will get dog hunters on rats, turkey hunters on gobblers, or deer and goat hunters on trophy animals.



Never pass up the chance to talk with a rancher. This little discussion netted our group four full days of great coyote calling in Oklahoma.

In some cases shooters are not at all interested in shooting varmints or game at all. Now the full service rifle club comes into play. I could not come close to counting the hours I have spent shooting on one of several clubs I have belonged to over the years. When I lived in Minnesota I was very fortunate to have belonged to a very large rifle club that supported a massive and advanced range operation to 1000 yards that has been covered elsewhere. A short time ago and during the writing of this material, I was called by an old friend who had moved

to the Southwestern United States. One thing he was delighted about was the fact that near his new home was a 1000-yard rifle range that he could use any time he wanted. While the big 1000-yard ranges are not common, they are around, but some searching is required to get attached to one of their benchrest setups.

In terms of gaining additional learned skills in long-range shooting, there are outfits that offer training programs that allow you to stay on site and work through special hands-on classes that teach long-range shooting skills. These programs can be accessed through major shooting publications, gun shops, and other shooting related venues.

The point here is that in today's age you seem to need to be on the search all the time for new areas to hunt or just target shoot. Joining that rifle club is the best idea yet, and after that, plan with care how you will spend your valuable time afield. Stay away from hunting states that are landlocked by private outfits, and states that don't retain much if any public or federal land. You will find a high price tag in these areas when it comes to varmint or big game hunting access.

Chapter 14

Bullet Performance: The Business End of Long-Range Shooting

It is a given that massive bullets made of pure brass and hand-turned for precision, like those used in the 416 Barrett and 50 BMG, will crash through just about anything. One element that the field long range shooter needs to keep in mind is how a selected bullet will perform when it is running out of speed downrange on that antelope, and when it hits its target early in the run at closer range. Remember, long-range shooting is relative here, and not every shot is going to be a stretch for your rifle and cartridge.



I have been lucky enough to have been involved in a number of culling hunts for whitetail deer and hogs over the years and have a solid handle on the subject of bullet failure. This is hunting with major ammunition manufactures in camps where harvested upward of 50 deer in two or three days has not been uncommon. Because of that experience, and the added value of shooting truck loads of big game on the American great plains of South Dakota's western edge, that I have witnessed a large number of bullets take down, and not take down, different game animals.



Getting a block of Perma Gel into position for a live fire test.



Left, 243 Win and 243 WSSM. Both are 6mms and both are good long-range cartridges.

Harding County, South Dakota, a place I write and talk of often in this book, is about at the end of the known world. It is the most northwestern section of land in my state and is composed of rolling grasslands, buttes, and an occasional washed-out gulch. Here it was, the opening day for antelope, and I was shooting my 243 Win in a tight little Remington Model Seven topped with a Weaver varmint scope that ranged from six to 16 power magnification.

As for ammunition on this soon-to-be-eventful morning, one of the major ammo manufactures had entrusted me with several boxes of a prototype load that made use of a new design in 100-grain 6mm bullets. When I say prototype, I mean that the loads didn't exist anyplace but from the loading bench in the companies' research and development lab to my rifle's chamber.

At my side, and on the field glasses, was John Anderson, the editor of Varmint Hunter Magazine, and my field guide, Mrs. Laurie Routier. We were hunting the Routier ranch, which had been groomed for commercial big-game hunting over a number of years and boasted some of the very best deer and antelope hunting in South Dakota. This was a doe hunt for winter meat and having two tags, I was searching for a dry doe running alone, or at least without a tagalong kid.

Laurie had elected to set us up on an old abandoned homestead that retained some standing walls that were remnants of an old barn and feed shed. On two sides of this partial enclosure were almost dry water holes that would bring in antelope, as this was another of several very drought ridden years in western South Dakota.

Within an hour's time a herd of about fifteen goats came into view along a wide prairie bowl-shaped section, and worked toward the broken-down corral fence that I had set up against for both camouflage cover and a steady rifle rest in the event I had to take a standing shot. John was indicating by way of his field glasses that a large doe was well ahead of the herd and I should try and keep track of her in the event she blended back into the other animals. Laurie on the other hand sat tight, knowing that all that remained in terms of filling a tag was to get a 6mm bullet on a critter, and the rest of the story would take care of itself.

As the old story goes, however, it is never safe to assume anything, and I believe that goes double when you're hunting big game. As the large doe grazed up the shallow ridge to within an exact rangefinder distance of 187 yards, she turned slightly away, which meant I would soon see an increase in range if I didn't take the shot I had. With the scope's crosshairs set dead center on her chest and John saying "It's a sure 243 kill shot," I dropped four pounds on the trigger.



Laurie Routier checks a harvested speed goat out with author during South Dakota hunt.

At the shot, the sound of a bullet striking tissue and bone resonated across the prairie. However, the doe didn't even change her direction, or for that matter show any sign of being hit. My jaw dropped to my shirt collar as I jacked a second round into the chamber.

Again crack whop! Now a second bullet crashed into the front quarter of the prairie goat, but the critter never twitched, but remained on a steady course back toward the bottoms. I will freely admit that my third shot went low as I now was flustered and darn confused. These bullets had been chronographed at almost 3000 fps, and with the 100-grain bullet weight should have knocked that doe clean off her feet right from the get-go.

Now I was in the process of quickly reloading the Model Seven, and as I jammed rounds into the magazine the doe just fell forward in an almost gentle roll and made no further attempt at regaining her footing. She had soaked up two bullets in the vitals and still covered a strong 75 yards at a slow walk before playing out for good. I had been lucky in that if that antelope had turned up her engine room rpm's, I would have probably chased her all the way to Wyoming.

During field dressing it was discovered that neither of the bullets had entered the animal's vitals. Lungs, heart and liver were completely intact. The bullets had in effect come apart almost on the surface of the antelope's hide. What had

killed the animal was the cutting of a major artery in the neck by small pieces of bullet, which resulted in the slow, steady bleed-out. Even though this bullet looked good on the drawing board, it didn't retain enough stiffness along the jacket body to hold the lead core together on impact. Here a bullet designed to take on high velocity with a totally enclosed base came unglued to the point that its small sections of projectile didn't retain enough energy to penetrate the animal's surface mass.

How often will you find this problem with the bullets you buy for deer hunting over the counter? Almost never, if you stay with the major brands with names like Sierra, Speer Trophy Bonded Bear Claw, Ballistic Tip by Nosler Bullets, and Barnes XLC big game bullets, to name only a few. Today the American hunter has choices in very good bullets that will boggle the mind. Remington's Swift A-Frame and Federal's Trophy Bonded big game bullets are fail proof, as are the trade name "Fail Safe" bullets by Winchester. Aftermarket-manufactured bullets now loaded by the major ammunition companies are so good that these companies use them rather than try and reinvent and manufacture the same or like bullets all over again.

During a several year period I hunted a number of states testing new bullets for the industry on whitetail, which gave me a good deal of insight as to just how diligent the industry is regarding the quality and performance they put into a new bullet before it reaches the American hunter. Even a basic Winchester 150-grain Super X Power Point (PP) bullet for the old 30-30 Winchester contains more engineering than super big game bullets did 20 years ago. Controlled expansion is the key, and with deer-or elksized game you want the expansion fast, but not too fast, and a bullet core that can hold together carrying its energy clear through the target vitals.

What you don't want to do is buy and use any bullet that does not have a track record behind it until that bullet is well-tested on targets other than a once-in-a-lifetime trophy whitetail. Today some strange ammunition is coming into the USA, due largely to the new open international market. In this case buyer beware!



Author making notes of bullet performance during goat hunt in Harding County, South Dakota.



A 243 WSSM bullet recovered from a speed goat (antelope) harvested at 225 yards. Note the outstanding ability of the bullet to stay together. This is a simple Winchester Power Point design. Nothing fancy, but it works.

While the bullet I was shooting during that antelope hunt was a true prototype and will never be found on the market as a big game harvesting tool,

the same type of failure can and will take place if the wrong bullet is applied to big game applications. Today there is a whole lot of hype around the idea of small, fast bullets getting the job done on large game animals. That is a bad idea because in all cases some very exact bullet placement is required, and if your aim is off even a few inches, the end result is a wounded and lost game animal. During a southern states ammunition test hunt some years ago, I observed a number of hunters shooting 220 Swift cartridges with lightweight bullets. While these professionals did indeed drop even trophy deer cleanly, every bullet was placed exactly where it needed to be put. Change the situation and add some rough weather, an over-excited hunter that has just crested a high ridge and now has a high heart rate working in his engine room, and you have the makings for a poorly-placed bullet on the deer that jumps ahead of our hunter.

On the other side of the fence, using a large rifle even to the size of a 338 Winchester Magnum presents no lead pipe guarantee that you're going to make a one-shot stop. Very large cartridges with big heavy bullets need body mass to open them up, and at times these big missiles just plow straight through smaller animals like deer, leaving a slug-like hole and an up and running target. With some manufacturers, the easy way is to select ammunition is to pay attention to the picture on the box of cartridges. Deer loads will show a deer, and an elk load will show an elk. That is about as simple as it gets. Oh yes, many manufactures are using the picture book code to assure the hunter of getting the correct cartridge and bullet.

Several years ago I interviewed a local South Dakota cowboy after he dropped a six by six elk in its tracks. The handloaded bullet was a Hornady 165-grainer launched at just under 3000 fps from his 300 Win Mag. This 900-lb. giant (field-dressed) took no more then ten steps after being hit. What that says is that this hunter knew his gun and load without question. On the second day of my goat hunt, I turned to my trusted pre-1964 Winchester Model 70 in 30-06 Springfield. Shooting a Remington Core-Lokt PSP I dropped a second animal with one shot like a lawn dart. The range was 200 yards, and I'm sure that critter never knew what hit it.



Antelope harvested for winter meat and bullet testing.



The Winchester 300 Short Mag (WSM) is an outstanding example of a great long range game or even

varmint bullet. These cartridges have a great track record among long range shooters.



There is no guarantee that even a large-caliber round will bring down a big game animal cleanly. Bullet construction counts for a whole lot in this business.

Even good bullets can let you down at times, and that is because nothing is totally free of problems under the right conditions. Hunting with a local South Dakota elk hunter this past fall, I was witness to his 300 Win Mag failing by way of a 165-grain bullet from a major ammunition manufacturer that almost cost him a fine four by four bull. In this case the range was not in excess of 200 yards, the sighting conditions were flat-out easy as the hunter was positioned over shooting sticks, and his target was standing broadside on a stock tank dike. About the only way it could get easier would be to paint a red target on the elk's vitals.

At the first shot, the elk dropped like a rock but then regained its footing and started to walk off. Well, an elk's walk is a whitetail's run and now this hunter had a moving wall of hide to shoot at. The second round hit within an inch of the first, but the bull never wavered from his course, requiring the hunter to send round three into the vitals. This bullet hit within three inches of the previous two and did drop the elk to end the ordeal. The first two rounds had been a bit high on the body but not high enough to take out the central nervous system. With vitals still pumping fuel to the critter's body, and the spine sending signals to the

muscles, it was a case that required the elimination of the bull elk's carburetor pressure. Round three did just that by hitting the heart and therefore ending the hunt.



Only the real thing can return the most information regarding bullet performance.



Hogs hunted during the field evaluation of Dead Coyote bullets in Texas.

Dead Coyote 224 “Duster”

With a call from the folks at Environmental Inc. this past spring I found myself packing for a hunting trip to Texas with company president Ralph Nauman and their head marketing man, Ron Petty. We were going to take on coyotes and feral hogs with rifles chambering their new Dead Coyote 224 70-grain bullets. Ron had set up a hunt at the Stasney’s Cook Ranch near Albany, Texas. The ranch holds hundreds of hogs for hunting and was a great spot for calling coyotes or hunting deer and turkey. In this case hogs would be the number one target as we were going to push the new 70-grain 224 bullets to their limit if at all possible. Boar hogs in the weight range of 75 to 125 pounds were a clear choice in this department.



TAC powder and Dead Coyote bullet in the handload ready format. TAC provided a solid 223 Rem test load when evaluating the new bullets.

Environmetal Inc., the company that developed Hevi-Shot shotshell ammunition for waterfowl and of late coyote loads with a buckshot pellet, does not call their new 224 caliber bullet a “Duster.” However, after field testing this very unique and effective 22-caliber projectile in handloaded 223 Rem loads, that nickname has stuck in my mind.



Ron Petty of Environmetal and rancher Johnnie Hudman with a hog kill during the review of Dead Coyote bullets in Texas.



Ralph Nauman, president of Environmetal, checks out damage inflicted on Perma Gel block by a Dead Coyote test bullet.

Testing the New “Green” Varmint Bullet

Because bullets are constantly under development as new materials become available to ammunition makers, it is only fitting to take a look at one of the most current designs in bullets today. This development centers on the “green bullet,” an environmentally friendly pill that won’t make critters or humans sick if it lies around the planet for the next several hundred years.

The development of the new bullet centers on the use of a copper hollowpoint jacket that is flat based and filled with a powdered tungsten dust developed expressly for the new bullet by Mr. Darrel Amick, Ph.D. of Environmetal. As Dr. Amick explains it, this material has been engineered to act like a self-bonding agent or inner locking media. Think of a piece of cotton that you try to pull apart in two halves. You can’t do it, but start small and you can break down the whole ball quite simply.

The new powdered tungsten dust, hence the nickname “duster,” is not bonded by heat, glue, fusion, or any other outside source. It is simply poured into

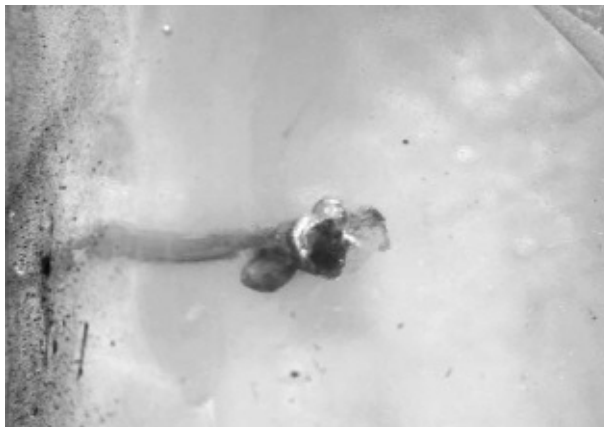
the jacket and then plugged with a tin cap so it won't run out the end of the hollowpoint bullet's tip. What, no "A" frame belt or core bonding here? No, none at all, and that makes this bullet one of the strangest inventions in projectile design I have ever worked with.

Designed as a midrange target/varmint bullet, however, it is showing some interesting reactions to larger targets. The Dead Coyote is best suited to rifles that have a fast twist. According to ballistics expert Tom Burczynski, the guy that developed many of the law enforcement loads Federal Cartridge sells today and the CCI Quik Shok 22 LR bullets, the 70-grain pointed flat-based pill will shoot best in a 1:7 through 1:10 twist rate. This is a heavy 224 bullet, and as such requires a fast turn to get it stabilized for flight. Shoot this bullet in a 1:12 or 1:14 twist and it will roll over and keyhole badly.

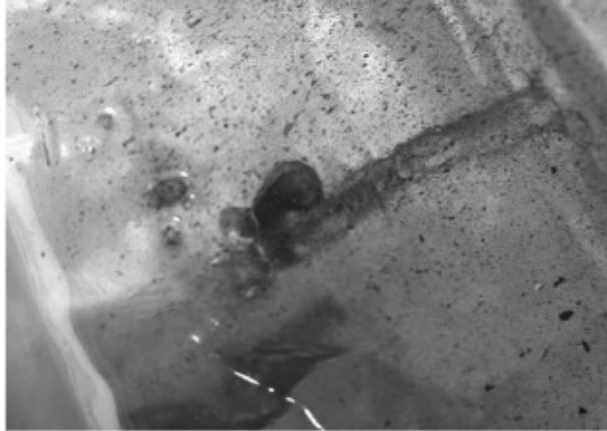
For my testing I used the new 2006 Ruger Mini 14 with a 1:9 twist, and that rifle stabilized the bullet nicely. Accuracy was MOA at 100 yards, but I did note that I had to adjust my sights a full 16 clicks down from the zero I was using up on my 4200 foot mountain in South Dakota's Black Hills. At home and after the Texas hunt I turned to my T-3 Tikka sniper rifle that uses a 1:8 twist. At that configuration, at 4000 feet the T-3 produced .336-inch groups at 100 yards with the new Dead Coyote bullets. Tom Burczynski found, as I had, that accuracy with a very good target grade rifle was outstanding. In his case the 40X Remington was producing one rough hole at 100 yards off a benchrest. I had shot my .336-inch group off the end gate of my pickup truck. I figure the T-3 was still capable of better accuracy than I was sending downrange.



Author with a hog recovered after dark during the Texas hog hunt. These hogs dropped like lawn darts when hit by the new “Duster” Dead Coyote bullets.



Bullet retained in Perma Gel block. Note the black trail behind the bullet. This is the tungsten dust trailing out of the bullet jacket as it comes apart.



Bullet dust trail into gel block. Note dark line behind bullet jacket.



Here Casey, a guide and cowboy at the ranch, is processing a hog for its meat after checking out bullet impact results. Nothing is left to rot when testing for performance.

As a handload for this test bullet that was used both on paper and in Texas, I had turned to a 24.2-grain charge of Ramshot TAC. This load produced a muzzle velocity of 2800 fps with an OAL of 2.213-inches. With the bullet length of .888-inch this cartridge is a formidable-looking 223 round. I figured it was not

worth the trouble searching out any other load for the time being with the accuracy and high velocity that were generated by the handload.

Anyone wanting to build handloads with varied powders need only to turn to book data centering around the 68-to 75-grain 224 bullets offered up by several component companies. In this case Ramshot offers a variation in loads that meet my needs at this time. Also of interest are loads published by Alliant Powder for Reloader 15. This powder by Alliant can take on heavy 223 bullets in the military type and return good velocities as well (2956 fps and up). In terms of primers used for my handloads, I stayed with Federal GM205M. They produced great accuracy and good velocity, so my thought was that if it ain't broke, don't fix it. Cases were a mix of once-fired Black Hills and Remington factory brass.

Warm Targets

On the first afternoon in Texas we spent time on the range getting several shotguns zeroed for the upcoming turkey season, and also running some Perma Gel testing of the Ruger Mini 14 and 223 Rem 70-grain handloads. Perma Gel is a product side-marketed by Dr. Amick, so it fit right into the overall review undertaken at the Cook ranch.

Dr. Amick had pre-cast several blocks of gelatin, and in one block he had imbedded a balloon filled with red dye. The idea was that upon bullet impact, a photo could be taken that illustrated the positive effect of the energy transfer into the dye and surrounding gelatin material. After setting up the shot using my Cannon digital and a telephoto lens, the shot was made by Ron Petty from the bench rest. At impact the gelatin block rolled up and back with a small stream of red dye emerging out the front of the block, but within a second stopping as fast as it had started.

Ordinance gelatin can tell us a good deal about a bullet's reaction to tissue, and in this case we were seeing a very controlled energy transfer that was not at all violent as in some fast-expanding varmint bullets. This bullet penetrated the full length of a 18-inch block and exited its spent and rolled-over jacket material. You could see a clear energy channel left behind that was colored a dark gray as the powdered tungsten separated off the jacket as it collapsed and turned through the gelatin block.



Ralph and Johnnie check over a fresh Dead Coyote-harvested hog.

Unlike conventional bullets the Dead Coyote didn't develop an energy blister at the point of gelatin contact or deeper into the material. The wound channel stayed narrow, indicating that the energy drop from the passing bullet was very even and uniform during its penetration. In truth I was a bit puzzled by the reaction of the bullet, and when it failed to bust up that balloon full of red dye I had my doubt as to what kind of effect it would produce on warm tissue.

On the evening of that first afternoon I was to get an answer that left me not sleeping well that night at all. Hunting with our group of Environmental staff and our guide Johnnie Hudman, the ranch's onsite wildlife manager, a large boar hog was spotted about 175 yards downrange. Johnnie gave the green light to take the shot, and I proceeded to punch a hole in the hog, which resulted in dust lifting off its back and the critter running headlong for some heavy brush. The hog had its head tilted well up on its shoulders as it ran, indicating a possible neck hit. But the animal didn't go down, and after an extensive search nothing in terms of

hair, blood, or other material was to be found. That hog had been hit hard and just ran off. We figured that the animal had taken a hit just behind the shoulder and a bit high under the spine. There is a small area at that point that contains nothing but soft tissue.

When the bullet finds no vital elements it generally means no kill, at least right off. However, we didn't know for sure exactly what had taken place, so lacking a second target before dark it was a wait-and-see deal until a sight picture could be painted on a second hog with the Leupold 6X glass.

Early in the morning, well before breakfast, Johnnie Hudman and I took off in his pickup in search of a good boar. We had not gone far from the ranch house when a large, spotted 110-lb. black boar appeared on my side of the truck. Stepping out I set the crosshairs directly on the shoulder of the hog and touched off a Dead Coyote 70-grain pill. At the shot, the hog, which was at about 75 yards, dropped straight down, never taking a single step forward. The bullet had entered just under the spine, and even though it didn't seem to disrupt that area of the critter's anatomy the central nervous system failed at once. Reaching the animal I dispatched it with a round to the skull from my AMT Hardballer 1911 45 ACP. It was a quick and clean demise to be sure.

When we returned to the ranch house, the pig was skinned at once and processed for its meat products. These are by no means junk hogs, and the eating, judging by the meal put together by the staff later in the week, was nothing less than outstanding. When the hams were cut away and back straps removed I got a chance to make a close check of the wound channel. The spine had not been touched at least in terms of bone or tissue. However the linear energy force driven by that 70-grain tungsten bullet had shut down the animal's nervous system completely. Around the wound there was little if any radial shock or blood shock damage. This was a very different reaction from what you see with bonded lead core or plastic tip varmint bullets.

That evening again we headed for hog country, and this time Ron Petty was in the shotgun seat and carrying my Mini 14 Ruger. When a small group of hogs was spotted, Ron turned loose the mini-gun, sending a 70-grain pill into the head of a large hog that was running straight away at about 80 yards. The critter went down hard. Reaching the animal we could see at once that Ron had put the bullet straight through the hog's brain. What was interesting was that the bullet had held together across the heavy thick boned skull. It would seem that Dead Coyote takes on resistance as needed. When the bullet meets bone it gets tough,

and when in tissue it calms right down and simply drives a clean hole.

At one point prior to this test hunt, information had come to Environmental indicating that these bullets don't penetrate targets completely. Several coyote hunters had indicated that all their bullets had been trapped in the animal's body. No exit hole whatsoever. Taking Ron's hog we strung it up and at 100 measured yards, we proceeded to shoot two rounds straight across the 100-lb. critter's body. The bullets went straight into the heart/lung area and in both cases exited cleanly out the opposite side. Also the exit wounds were only the size of a dime and didn't cut up the hog's hide at all. About the only thing we could figure from the coyote hunter's reports was that those 'yotes of theirs had been shot at long range and most likely head on. Not being on location it is a hard judgment to make.

Being we had just re-shot a dead hog and we still had some low light to get on target, we loaded up and headed out in search of another 100-lb. boar. Coming around a turn in the two-track road, we spotted nine pigs with a big black devil amidst the group. Johnnie indicated that I was clear for the shot if I could string the bullet between the lady pigs and not wound any other critters in the process. At that point the black hog walked ahead of the others and gave me a clear sight picture at about 75 yards. At the shot, which I planted with purpose straight into the lungs, the hog took off running, but piled up after covering about 23 yards. This guy was as dead as a doornail within seconds, and the bullet had indeed developed complete penetration, leaving a blood trail a blind dog with no nose could follow.



Dead Coyote bullet cutdown. Note the dust core at the center of the jacket.



Ron and Johnnie check a harvested hog where found in the brush during the bullet testing of the Dead Coyote 70-grain 224 pills.



Hunter checks out bullet damage on a big male coyote in Texas.



Author with a nice Texas coyote. Good loads produce good results.

After reviewing the processed hogs back at the ranch I was convinced that Dead Coyote is for the most part a very unique bullet, won't cut up your hides that are heading to market or the wall, and has a place in my 223 Rem quiver of options when I go afield in search of medium-to larger-size critters.

At this point in time Dead Coyote 223 is only offered in the 70-grain bullet, but I'm strongly suggesting to Environmental Inc. that they design a 55-grainer for the 1:12 through 1:14 twist rate 22-calibers and also take a very hard look at a 45-grain HP tungsten pill in 204 Ruger.

Considering that most rounds fired in the 223 or other 22-caliber rifles have slower twist barrels, and the new 204 Ruger is nothing but outstanding as a varmint critter control 20-caliber, the Dead Coyote would occupy a nice niche in that group of hunting bullets.

Coyote Cartridges: The Best Medicine for Long-Range Song Dogs

It was just about first light when the young yellow gray coyote showed up

along the water hole I had been sending the bleating calls of a dying rabbit across with my small plastic mouth call. I was hunting Texas, and as such, had been concentrating my calling around areas containing water. This was arid land, and where there was water there was life. Life meant food for predators, and as coyotes like fresh rabbit, I figured I had hit the hotspot, at least in terms of this west Texas area.

The coyote moved up at a trot, then at about 75 yards pulled up abruptly. Now sitting down, the song dog drilled all his radar-like energy and attention directly at me. I know the dog didn't see me, or he would have made a quick turn and been long gone. As he was upwind of my scent, that would not be a problem either. So, I took my time, dropped my crosshairs on his chest dead center, then pushed three pounds off my rifle's trigger. At the shot, the small fast-moving 50-grain Hornady V-Max 223-caliber bullet covered the distance to my target before I had time to blink. Whop! Came the sound of a varmint bullet reaching into a body cavity, then in an instant exploding in more pieces than a guy could count greeted my ears. My coyote pulled up tight, then went stiff-legged, rolling over once. He never moved a muscle after that, and I am sure he didn't know what hit him right from the get-go.

What had just taken place had not been an accident. Both cartridge selection and bullet design were wellthought-out prior to going afield. Coyotes are tough critters, and as such won't go down easily if the wrong bullet or even cartridge is put against them in the field. Cartridges like the 22 Magnum, 22 Hornet, or even the new Hornady 17-caliber rimfire are not coyote rounds. While they will kill a coyote or even much larger targets with proper bullet placement, in general they are crippling choices and best left at home when it comes time to call heavy varmints like coyotes, big cats, or other well-put together animals with muscle and body mass.

Bullet Problems?

If you don't believe in bullet problems and even wrong choices in cartridges, you have not hunted coyotes very often or in many places with varied groups of hunters. As a professional I have had the opportunity to hunt these critters from near Alaska's borders to the North and Mexico to the South, and in every case the animal is the same. That is, a tough, fast-moving and often a very hard-to-bring-down target.

As an example of a bullet problem resulting in a lost coyote, I can remember

shooting a manufacturer's test bullet that was so new it didn't have a labeled name and was being handloaded by the manufacturer into fresh brass cases. Getting an old gyp (female coyote) into range, my partner at the time, Larry Symes out of Oklahoma, pulled the trigger of his custom built Remington Model 700 varmint rifle only to see the new fast-moving bullet blow up on the critter's shoulder. If it had not been for a good tracking dog, the 'yote would have been lost without providing an understanding of the poor performance of the new bullet design.

Unlike some very light-jacketed bullets, a coyote bullet needs to hang together until it reaches the core of the critter's body. At that point a good bullet will come unglued, sending jacket and bullet core in all directions, which in effect will cause massive hemorrhage and general damage to the animal's vitals. If it sounds a bit rough in terms of a pure physical fact, be advised that good bullets kill cleanly and bad designs wound critters, which is to my way of thinking not in the best interest of the hunter or prey.

In terms of real bad bullet design, don't ever take on 'yotes with full jacket or target bullets. These pills won't open at all and will drill a small 22-caliber or 6mm caliber through the body, which will result in a slow, lingering death for the animal. What is often appealing about these bullets is they are cheap, available by the millions on the open market, and don't come with any directions as to their proper use.



A ballistic technician at Federal Cartridge testing loads to maintain quality control over the ammunition the hunter takes afield.



243 WSSM Ballistic Tip bullets are among the best when bring down varmint critters at long range.

Off-brand bullets will at times sell at very low prices, which makes the buyer

think they are getting a real deal. What they are getting is a very bad deal in that these bullets will cause runners and lost varmints more often than not. As a bullet expands in the intended target, it produces hydrostatic energy or shock. This energy acts like a compression system that allows energy to do the work of stopping the animal. Lacking expansion, the bullet simply drives through the animal like a pin or solid dart.

Best Bullets

If I had to pick a single bullet design for coyotes, it would be the poly-tip design found in Winchester's BST, Hornady's V-Max, Sierra's BlitzKing, and Nosler's Ballistic Tip – and any other bullets that also use the tough plastic nose section, which acts like a plunger ramming into and through the soft bullet core and expanding jacket material. Only a few months prior to writing this review, I was hunting Texas with the new Winchester 223 WSSM, which makes use of a totally new 55-grain BST plastic tip bullet. This bullet, driven at almost 4000 fps from a Browning A-Bolt varmint rifle, shot amazingly flat to 300 yards with 1-1/2-inches of rise at a dead-on zero of 100 yards.

On coyotes, the end product was beyond imagination. I took a crossing adult male at 110 yards and hit him low in the body almost behind the gut. The dog dropped like greased lightning, tried to regain its footing, then died seconds later. You could here the whop sound of the bullet contact above a 17-mph wind blowing through the trees around me. I was impressed then and even more so as other examples of dead coyotes came into camp during the new cartridge and bullet test hunt. Here Winchester had wisely decided that this fast-mover needed more bullet weight. The 40-and 50-grain BST has been around in 223 Rem and 22-250 Rem for some time. If you have enough push behind a bullet weighing a bit more, the net effect is sending more energy into a target at a much longer range. As the 223 WSSM is such a cartridge, the change in bullet design was much warranted. I expect even heavier bullets to come along for the fat little hotdog varmint round.

Opening up bullet design a bit, the list of great potentially good projectiles includes Barnes VLC and XLC 40-and 45-grain pills. Barnes and companies like them are working through new technology all the time as they work with surface treatments to reduce bore friction and air drag after the bullet has exited the rifle barrel. New cartridges like the previously illustrated Winchester WSSM as loaded with Barnes X Bullets are bound to strike a hot spot with varmint critter

control hunters. Currently, while living in a wide-open western state, I am working through a whole list of varmint pills for ‘yotes. It is my hope that a positive result will take place as I search for answers for the very best bullet cartridge combinations a hunter can select from while canvassing the store shelf.

Select a bullet regardless of brand that is designed for varmint hunting and medium-tough bodies like coyotes and you won’t be running a blood trail very far after the shot. Stay with a cartridge that is hot enough to move a good bullet flat to at least 250 yards and then opens up after the hit to get the job done. These requirements would include the 223 Rem, 22-250 Rem, 220 Swift, and the 223 WSSM. In 6mm the 243 Winchester and new 243 WSSM will drill deadly holes in things, but because the larger 6mm is just that, it will leave little hide remaining intact for the taxidermist or tanning bench.



Ground hogs taken in Wyoming by author, right, and John Anderson. These were big yellow hogs and we left some for seed on that river bottom.

Ground Hogs: The Big Game of the long-range Prairie Dog Hunter

I guess the year was around 1964, and I had just purchased an NRA

government-issued DCM 30-caliber M1 carbine for the grand total of \$25. Along with the surplus military carbine was a case of dirt-cheap 30 M1 ball ammo that had now set me up for a summer of low-budget varmint busting. I was a very young, almost broke college kid, and that NRA gift through the outstanding civilian marksmanship program allowed me to make it through the educational system and still hunt a bit along the way.

With a zeroed-in iron sight carbine I was king of the woods on the small farm my in-laws owned near Deer River, Minnesota. On that riverfront duck camp were countless whistle pigs, or as some call them, ground hogs, rockchucks, woodchucks, and who knows what else. The critters were large in size, running a solid seven-pounds plus, and could undermine a barn foundation in a summer, causing the place to tilt if not stopped by trap, poison, or in this case a good surplus 30 carbine in the hands of a young and eager critter getter just learning the craft.

That first groundhog stands out like my first deer in some ways, and the whole event went something like this. It was early in the morning with a wet, steaming, fresh-cut hayfield laid out before me. I was forted up in a small shed with my trusty M1 set into a V-block rest and everything at the ready for a shot. I had been watching my target for better than a week and began to realize that this critter was only going to give me a possible shot very early in the morning if at all. Ground hogs are very shy and always alert to possible danger from the ground level or above. When confronted by danger they often give out a whistle much like a beaver slapping its tail on the water. This is a signal that something is not right and for all the other hogs to take cover or at least raise their level of alert.

My target hog didn't do the whistle trick, or possibly I never gave him the chance. When the big brown critter came waddling out from under his brush pile I set the receiver sight on his chest, then dropped a few pounds off the M-1's trigger. I was hooked, and by the next summer I was building one of those first-rate heavy varmint rifles of the time out of a surplus military Springfield action that was procured again through the DCM, and handloading some lightweight 30-caliber bullets in the government chambered 30-06.

Times Have Not Changed

Shooting groundhogs 40 years ago was not much different from what varmint hunters encounter today when taking on these super-sized prairie dog-

like critters. Hogs are tough and require more firepower than is often applied to ground squirrel or medium-sized prairie dog targets. This is not the place for the tried and true 22 Hornet, 22 WMR rimfire, or even the new 17 HMR super-velocity rimfire varmint cartridge of current rage. Groundhogs require fast 224 , 6mm, and even 25-caliber bullets backed with big cases that hold a lot of powder for ultra-high velocity. Why all the horsepower, you ask? Because in most cases the ground hog, or in my end of South Dakota the rock chuck, is a long-range target that requires a whole lot of rifle to get the bullet down at the business end of the target.

What has changed today from those bygone years is the development of “rail guns,” rifles that are very heavy and run out ultra-high velocity bullets to ranges as great as 1000 yards. Several years ago while hunting turkeys in West Virginia, I encountered an old timer in a wheelchair that set up his bolt-action rail gun chambered in 25-06 on a special bench rest overlooking a rolling series of clover laced hills. This hunter would lock down his long-range rifle and shoot groundhogs to ranges as great as 800 yards, with an occasional shot well beyond that indicated range.



Here the heavy rail gun is used for rats and hog afield. These “exotic” rifles shoot big loads really fast and really far.

For those who don't want to tie up all their funds in a 20-pound rail rifle, the modern varmint rifle in a carry model, or even medium-weight barrel target-stocked system, can produce great results on hogs. This past summer I hunted Wyoming west of the Snowy Mountain Range at Encampment, Wyoming, off the Spur Outfitters ranch, with its riverbottom grasslands that were teaming with rock chucks. These western hogs were hanging out near very massive brush piles that were overgrown with vines, giving them ample cover as they ventured out in search of lush river's-edge vegetation. Hunting with John Anderson and Bob Zara of Battenfeld Technologies, our little team was trying out new varmint bullets as well as field equipment designed by the above company.

As I have previously stated, a good cartridge paired with a very workable bullet is required against groundhogs, and in Wyoming we were shooting Winchester Combined Technologies Ballistics Silvertips, comparable to Sierra BlitzKing and Barnes VLC Blue Bullets. These pills ranged in grain weight from 40 through 55 grains, and were being launched with Remington Model 700 VS 22-250s in the hands of Bob and me, with John turning loose his custom built Remington Model 700 action with a tricked up 223 Remington improved barrel. In other words, a fast wildcat 223 Rem pushing a 50-grain bullet. Any time you're shooting bullets near 4000 fps, you have a hog killer for sure, and this is what we entered the river flats with on a very warm sunny Wyoming afternoon.

It didn't take long to strike pay dirt as the four by-four rounded the first bend in the road, only to be confronted with three hogs standing straight up at about 225 yards. From a heavy steel rotating benchrest in the truck bed (completely legal in Wyoming) I locked on to the far right hog. I chambered a Barnes 50-gr. VLC. John, on the other hand, now down and on his shooting sticks, prepared to loft one of his wildcat 223 handloads with a 55-grain Winchester BST bullet. Bob, the third gun, was stretched over the hood of the big Ford using a bag rest designed by his company and had himself chambered a 50-grain Sierra Blitzking bullet in his 700 VS turn-bolt hog killer.



Author shooting a XP100 in 22 Hornet on rock chucks in Idaho. Even handguns can be applied to long range work.

In seconds the air was filled with the sharp crack of varmint rifles, and in less time than it takes to say dead hog, all three critters were sent to those clover fields in the sky. John's hog weighed in at a solid nine pounds, with those of Bob and me not far behind. These guys were a light yellow in color, and I have noticed while hunting them across the country a change in color and even size from the eastern variety of brown groundhog, to the rock chucks and mountain marmot of the far west, which run a light red to yellow.

With a full run down the several miles of river bottom, we managed to dust off a total of eight hogs. This was more than adequate for our purposes, and it was also part of a self-imposed limit of sorts. These are very interesting critters, and I for one would not want to see them completely eliminated from a given area.

Finding groundhogs is time-consuming because they don't just stand out like so many stumps in a swamp. Any place that is laced with clover, their favorite food, you can find hogs. Woodlands are also a solid bet for woodchucks, but here the hogs are hard to see with the fast-growing early spring ground cover so

common in the midwestern states. One element that is an advantage to the riflemen is that when taking some high ground for general observations, the large size of the groundhog will allow you to spot them even in some higher grass. Use a good pair of field glasses or spotting scope, and if possible even a ranging system. My Leica LRF 1200 scan will range to 1000 yards with ease. Ranging systems need to be good enough to cover at least 400 yards accurately. If you get a report of a hog sighting, chances are good that others are around. Talking to farmers can be a major help and they are often accommodating in terms of having you set up to take them out. You're doing the farmer a favor to be sure.



Mike Jordan of Winchester was often in the field during the review of guns and loads for this company. He watched where every critter was shot and what the end result of that bullet was in terms of damage.



Author and partner Kevin Howard with Texas hogs taken at over 400 yards with 223 WSSM and 243 WSSM cartridges in Winchester and Browning Rifles.

Proper Bullet Placement – It’s Everything

Over the past several years I have been hunting some guided outfitter hunts that have produced large numbers of harvested deer by various gun and load combinations. I have observed everything from the 375 H&H Magnum to small 6mm/243 caliber rifles work on whitetail afield. Along with these commercial ammunition and gun test experiences, which is in part what many of them have been, I have hunted hard on wildlife management lands and small local farms owned by friends. What I have observed is that far too many hunters today have lost touch with the basics of good marksmanship and are depending on a “spray and pray” style of shooting skills to get the job done. Well, my friends, it’s just not working, at least based on what I hear and see when taking up a stand on federal government or state land.

First off let’s get one thing straight: I’m not putting myself up as some know-it-all, do-it-right type that believes it’s my way or the highway. What I’m saying is that I do believe that as a general rule the American hunter is losing touch with

good marksmanship skills and that is in part because of the fact that we don't have the openings in gun clubs we once had around the country. The rifle club I had belonged to in Minnesota, for example, had a waiting list of over 300 individuals. Also the loss of the once very effective expanded DCM programs through the NRA has made its presence felt in many quarters today. Those systems that produced good civilian shots have faded from view and except for hunter safety programs, the young shooters in the major urban areas get precious little else in terms of training or introductions to varied aspects of the shooting sports. To my way of thinking, all change is not for the better, and this is a clear-cut case in point.

However, based on the chance to develop some stone hard tests using many different rifles, I would like to share with you the results of shooting when very close attention was paid to exactly where the bullet used was placed, and the general reaction of the target to that bullet.

In other countries when a hunter applies for a permit to hunt, that hunter must complete a detailed course and exhibit through some hands-on testing an ability to use a rifle against big game. While that system would not be very popular in the USA it does serve to illustrate that when game is rationed out in small countries that allow hunting, the net effect of a bad hit means a lost animal, and that just can't be tolerated. We should not tolerate that situation either.

If you don't get anything else out of this book I hope you see clearly that to just send bullets in the general direction of a deer at close or long range and hoping for a lucky hit will not work and only results in the wounding of the animal. First learn to shoot straight, then develop an understanding as to how a bullet works when selecting those loads for field use.

Assuming the hunter has learned how to hit with his or her selected firearm, bullet designs are next in line for review. I want to start with a young hunter by the name of Jon. Jon was on a hunt with me in Alabama for whitetail. He was under-aged and would be using equipment that was totally foreign to him. Jon had decided that he wanted to shoot a 270 Winchester. The rifles used were being writer-reviewed for Sako/Tikka, and each hunter was allowed to select his own ammunition.

Jon had selected the Winchester CXP 2 Super X 130-grain game cartridge for his 270 Winchester. The choice was good in that he had taken his first deer in Wisconsin only weeks before using the 270, and based on what he had observed the cartridge had produced a one-shot stop and a cleanly harvested whitetail.

On the evening prior to the hunt, I worked with Jon getting his rifle zeroed tightly to the 100 yard mark, so as to give him some extended range, or room to push bullets to 225 yards in the event he needed that bit of added effective range. With a half hour on the range Jon was placing some good groups at the 100-yard sight in target, and he walked away feeling that if he did his part the rifle and cartridge would do its job.

The next morning, fielding the 270 Tikka, a new and very nice turn bolt-rifle by the folks at Sako, Jon headed into his guide-selected stand. At Pa-Ko Plantation the deer hunting was an all natural affair, meaning fair chase with no high fence at all. Massive acreage and quality deer management methods, not fences, made this a very workable place to get a young hunter onto a good whitetail deer. After getting into his stand and spending about an hour searching for any sign of a deer, Jon observed a deer that was the size requirements of the hunting camp, so he laid his crosshairs just behind the shoulder as the text book says, then touched off that 130-gr. Winchester CXP bullet.

At the shot the deer turned and headed away into some heavy cover along the field edge. Jon held up for about a half-hour, then proceeded to follow a clean blood trail, locating his deer within 25 yards of the trail's edge. His bullet had hit a bit far back but in direct contact with the animal's vitals. As the bullet construction was designed for "light skinned" animals such as whitetail, it had expanded as it caught enough lung, thereby causing hemorrhage and the subsequent demise of the animal.

While that all sounds just like textbook talk that is exactly what is required when the task of harvesting a deer sized animal is being attempted. Anything other than the preceding scenario will result in less than favorable results. During the past several years both at Pa-Ko Plantation, and other ranches and farms, in each case where a clean kill has been produced, the bullet was planted directly and properly into the vitals of the animal. Also in each case the bullet design was a perfect ballistic match for the job.



Tom Leoni s moves a nice buck off the field. Not all culled deer were doe or poor bucks.



Tom Leoni of Beretta/Tikka just after harvesting a nice buck whitetail.



Author checking a culled doe during a bullet review hunt.

As a second example, I was testing the new Federal cartridge Premium Sierra Game King 165-grain bullet, again in a Tikka turn-bolt rifle. Sitting high in my firebreak shooting house blind, about 20 minutes into my second day afield I observed a good doe walk out at 276 laser ranged yards. She turned broadside then looked directly up the fire lane in my direction. Bringing my crosshairs to rest directly on her right shoulder, I touched off the 165-grain bullet, which spun the deer around and caused it to run low and slow into a heavy swamp. As Jon had done, I waited out the animal for a time, then proceeded to walk down its blood trail, which was clearly obvious all the way to the deer. The heavy bullet had done its job well. In my opinion the animal was a “dead deer running”; she just didn’t know it at the time.

On day three a buck came into my sight picture at 195 yards, and with the Tikka 30-06 and, again, a 165-grain Sierra Federal Cartridge load, it took a hit like Jon’s .270 kill, being a bit far back on the shoulder. However, the superior design of the Game King bullet bled out the deer in less than 30 yards.

As other harvested deer came into the camp at Pa-Ko and the hunters relayed their stories of the shots to me, it became evident that even when very heavy

calibers are used, there is no substitute for accuracy on the part of the hunter. In one case the deer was actually filmed on video so I could observe the whole scenario after the fact. This deer had been hit with the new 7mm STW Remington round. The fast-moving 140-grain bullet dropped a nice 10-point buck, but this animal did require another round from the STW, which gave it the combined energy equivalent of a .600 Nitro Express.

On still another occasion, the 7mm STW hit a large doe about 250 yards out and again required no less than two additional shots prior to closing the story on that deer. In my opinion the SWT was using a bullet with too much jacket for whitetail and not gaining proper expansion. If you don't believe that scenario, then just grab onto this piece of data: another hunter shooting a 375 H&H magnum loaded with a 300 Nosler FailSafe needed two shots to bring down an average whitetail buck of 150 pounds. What happened there? Placement and bullet expansion were the culprits, and I will stick to that theory forever.

On still another hunt the shooter was using the 220 Swift 55-gr. Trophy Bond Bear Claw as loaded by Federal Cartridge. The Bear Claw ultra high velocity pill cut into a 220-pound buck's chest cavity and dropped it like a rock at 50 yards. Here accuracy and bullet energy and expansion did the job, not sheer weight and mass. No, I'm not saying that we should all go out and buy light rifles, but the illustration clearly shows that it's usually where you put the bullet, not what that pill is designed like, that counts. Again, we are back to accurate shooting once again as much as a good working bullet and load.

On the other side of the ballistic and accuracy question, I'm going to take you quickly through an experience I observed while hunting some State Game & Fish lands this past fall for whitetail. After getting into my stand along a large swamp that showed some promise as a whitetail magnet, I was jolted to my senses by a string of shots, which resembled the tap of the old AK-47. In effect the rifle was most likely the Chinese SKS in 7.62x39 caliber, and the deer hunter was pushing rounds through what had to be an illegal 10-round magazine as fast as he could depress the trigger. As he cleared the first magazine I was seriously considering a dive for the forest floor and a small depression just in sight.

Now the second magazine hit the receiver because a new and more frantic string of shots cracked through the air in what seemed like four-round bursts. All totaled, I counted 31 rounds from that little military rifle, and when talking with several hunters near my vehicle later in the morning, I was informed that the whole mess had only resulted in a hit and subsequently lost doe.

There is a saying among old deer hunters. Hear one clean shot and it most likely means that someone has just put down a deer. Hear many rounds and just the opposite has taken place. I believe that education can be the answer to more quality deer hunting. My young friend Jon had completed his firearms training, and an instructor had done a good job with him. Sadly, some of us have not received that training and could benefit from it to be sure. By taking the time to learn what your rifle will do afield, and then taking additional time to become proficient in the use of that game harvesting tool, you can come up a real winner when you find yourself dragging that whitetail deer out of the woods.

Static Bullet Testing

There are times when the rifleman has not got the luxury of hunting a game animal in terms of reviewing a new bullet or load combination. Knowing what that given round will do downrange is then left to the other tools of the static ballistics measurement trade. I have used some of these tools as in advanced chronograph equipment, but a simple tool that can produce some good results for shooters is a newer form of ordnance gelatin that is easy to work with and transport and is totally reusable. Elsewhere in the book you will run across this new ordnance gel medium in use during testing because I have found it to be some of the best material and easiest to work with to date.

As far back as 1970 I was wondering what rifle bullets did in flight, how they reacted as they hit an object, and why some bullets were just so much better than others. Actually those questions were just the short form regarding this subject as my inquisitive nature continued to move past the obvious rifle cartridge performance, and much deeper into the what-if and how-does-that work line of thinking.

Over the years I guess I tried just about everything in working with some observable results as bullets hit objects. I used dead meat slabs, clay blocks, soap blocks, water filled jugs, and even the old ordnance ballistic gelatin. In those days ballistic gelatin was very hard to process and expensive, and it gave the shooter only a single shot or two before the gel block has to be discarded. Even some more up-to-date products are only a one-shot shooting test medium, and that takes a great deal of time and effort when trying to reset downrange for a series of test shots.



Author shooting into a gel block for bullet testing.

After a meeting at the 2005 SHOT Show this past year with Darryl D. Amick, Ph.D., and a subsequent phone call from this brilliant metallurgist who in fact was the developer of Hevi-Shot, the 21st century wonder nontoxic product, I was off on a totally new yellow brick road in ballistics. Dr. Amick had just come up with a completely new ballistic gelatin (Perma Gel) that was easy to produce, could be reused by the shooter, and could be stored for long periods of time without any refrigeration.

Currently manufactured by Dr. Amick, Perma Gel will be sold in pre-manufactured blocks. My sample blocks were 6x6x14 inches in size and weighed about 10 pounds each. The color of the gel block is a very light yellow, but Dr. Amick has indicated that the final or at least an option in this product will be a completely clear block for photo recording purposes. Even in the

yellow variant I could still obtain reasonably clear photos and without any problem observe the terminal or on target results of my test loads.

Test Shooting Perma Gel

As a test shoot for the new gelatin material I elected to take on a product that had been presented to me by my friend and associate Jay Menefee. the top gun at Polywad Inc. Polywad designs new loads, manufactures specialty ammunition, and takes care of the needs of major manufacturers when special requirements are needed, as in hand-built reference or test ammunition. A lot of what you shoot today has come through Polywad's development program, but these guys don't have their name on those shooting products.



Bullet, left, recovered from gel block and unfired, right. We can see by the use of Perma Gel what the bullet will do when it hits soft tissue.



Author setting up a Perma Gel test shoot on his home range in the Black Hills of South Dakota.

Jay had been working on a current industry-classified project, a new bullet design, which required some study in terms of terminal ballistics. In effect, what was the new projectile doing on live tissue, namely game bird targets downrange? While I had been working with the product in terms of dusting varmints, I didn't have a whole lot of data in terms of just how this new projectile was reacting as it passed through warm targets. I know it killed cleanly and quickly, but why? It was quite different from the usual bullets found in ammunition today.

For most ballistic testing, the product needed to answer my questions was almost always ballistic gelatin, which is hard to produce, has a retail cost that is off the wall, and after use tends to rot and stink. With the good doctor's Perma Gel development, I had an easy-to-use gelatin product that I could set up at my leisure, that would capture bullets in real-time on a tissue-related product that meets FBI live tissue test standards, and then photograph and record penetration and damage data as it occurred.



204 Ruger bullet trapped in a Perma Gel block.



The 204 Ruger is a potent little round when it comes to long range varmint work.

Because Polywad had sent not just one batch of ammo but also three different batches, with each being a small degree different from the other, this was a readymade setup to test Perma Gel against. If this product was any good at all, it would clearly show through the ice-clear 10-lb. blocks exactly what each projectile was doing after making target contact. In effect, we had a stop-action event taking place that could be photographed and measured.

It should be pointed out that Perma Gel not only falls well within FBI

standards, but also current military standards of performance as well. Two other agencies, as well as myself, are currently testing the Perma Gel ballistic gelatin product across the country. The product retains the required 2.9-inches of penetration with a steel BB at 52 through 75° F, and falls to within accepted standards using a 600 fps pellet/projectile penetration impact baseline requirement. In other words, this material meets or exceeds all standards previously used and categorized by the government for testing shot and bullets for a workable wound channel or inflicted damage against warm targets.

In terms of reuse, the product can be reused after as many as 10 rounds have been shot into it. Then the whole block can be simply put in an electric roaster (outside the house) and melted down to a pure liquid material, strained for bullet fragments, and then recast into a brand new usable block of ballistic gel. Now the gelatin material is ready to go for a second time around. To date the inventor has melted a single block as many as five times with no ill effect. When or where it goes bad is anyone's guess at this time.

On my home range in South Dakota I set up a slab of the Perma Gel, then also installed a set of armored photo cell sky screens that would send velocity information downrange back to my Oehler Model 33 chronograph unit. I wanted real-time target contact velocities in feet per second and bullet damage/penetration all caught as a unit from shot to shot. There was no place here for in the can computer data, as no computer had been programmed to take on the new "X" projectile with its very different ballistic coefficient, shape, size, and individual weight. Even the reaction on gelatin was so different that only real-time measurements by an objective chronograph would be acceptable.

As you can see I have given this projectile from Polywad Inc. the name "X," because it has no name on record as yet, at least according to its inventor. The "X" projectile is not at all round, but does take on the shape of a small caliber bullet with its base and core cut away. A strange looking projectile, but one that had some very interesting results on that block of gelatin. By way of my hands-on testing, I have to say Perma Gel is the new game in town as it is clean, safe, affordable, and reusable.

Perma Gel will show not only wound channel information but also clear measured penetration data, which can separate the less effective loads from the real workhorse game takers of the future. I know that with my SHOTdata computer ballistic programs in place, my use of chronograph equipment downrange at game harvesting distances, and my dead animal testing, Perma Gel

is a new addition to research and ballistics test tools.

Perma Gel, as it is washed out (melted and strained) and cast again, can be shaped into smaller shapes that are closer to the actual body size of game animals. As for using Perma Gel with all high velocity rifle bullets, have at it. I have tested 223 Remington, 22-250 Remington, 25-06 Remington, and the new Winchester 243 and 25 WSSM's in the new gel product. It stops varmint and deer bullets within inches of its surface at 100 -200 yards. Currently you can find Perma Gel sold through all Cabela's outlets across the country.

Other Materials Used In Testing

There are a number of other mediums that can be used to test bullets including wet paper, water-filled bags, sand, and even snow. About 10 years ago I was running some tests on different styles of 12-gauge rifled shotgun slugs, and over the course of my research I had decided to check out the old story that slugs are strictly a short-range deer hunter's tool. As it was late December in Minnesota, we had a good snow base on the ground, and by way of a friend's airfield that gave me better than 1000 yards downrange I proceeded to set up my benchrest early one morning at one end of the field. With me on that morning was my old friend Feather, an aging golden retriever that had a habit of locating spent wads after I ran test shots downrange. She got into this habit many years earlier when, knowing that I had just fired a gun, she had decided that something worth retrieving had to be down at that target someplace.

With a fresh powder the night before of about four inches, the airfield was pure white, and without a single mark of any kind. Setting a Remington 870 in a benchrest mount, I raised the barrel to about 30 degrees and fired a 1-oz. Foster rifled slug downrange. I had expected to see the slug turn up snow within a few hundred yards of my position, but instead I didn't see anything. It was as if I had not shot a projectile at all over that pure white field of fresh snow.

After shooting several more rounds, I was sure I would see something and I took a walk downrange. Well, we walked and walked without seeing anything as in a hole in the snow, or even a skid mark of a bouncing projectile. Reaching the end of the field at over 800 yards, and far too close to a hangar that held a twin engine Piper, Feather got my attention as she located a small hole in the snow. Ahead of the hole was a skid mark and sure enough Feather nosed into the soft powder and came up with about 500 grains of lead slug. It had hit warm, as some snow had melted on the sides of the slug and turned to ice.

I figured by some phone poles along the side of the airfield, and some standing paced steps as well, that the slug had traveled about 830 yards downrange. Finding that slug, Feather and I quickly came upon two others, and all total we gleaned off five slugs from the test. Each was on the surface, or just under it, as the snow had stopped them quickly without damaging them in any way.

Two things had been learned during that event, with the first being just how far a slug will actually travel, and the second what a pristine condition those projectile are in after leaving a smoothbore shotgun barrel. Since that event I have learned through reading ballistic information that a rifled slug's flight can be measured to better than 1400 yards with the proper elevation and conditions. As my test was in cold weather, there would have been some reduction in range due to air density and the fact that the ammunition was also cold, giving it a slower burn and therefore a lower muzzle and terminal velocity.



My partner, Ross Metzger of SHOTdata with a fat grass rat. Even these critters can return some good information when it comes to learning about bullets.

Wet paper is also a great medium to use and one way to work with this product is to take an old five-gallon pail, stand newsprint on end until you can't slip another sheet into the pail, then fill the whole thing with water. Allow the water to settle into the paper overnight and you're now dealing with a soaked and very dense medium that will take on everything up to 50 cal BMG bullets. I tested bullets for police work for many years using this wet paper method. I could add fabric to contaminate a bullet to see how it reduced expansion upon impact, or add bone sections to the mix and study how game bullets reacted to this stiff resisting material as it passed into the wet paper.

In terms of almost warm targets, I have used road kills including deer to run penetration and wound channel tests. Bullets, as has been previously illustrated, all react differently depending on their construction and the range at which they are to be used. Take a bullet that has a light jacket and send it at a close range target and chances are it will fail. Use that same bullet at, say, 200 yards and it could well hold together, if it retains enough velocity to utilize its grain weight, or basic mass against a warm target. There is only one way to know, however, and that is test the daylights out of it on both media-based materials and the real thing.



This old coyote is a long shot and the backstop is safe. That is not always the case, however.

Starting in 1977 and right up to the writing of this book, I logged in a total of 2241 events that involved testing loads, guns, or related products. Later on in that time, I got involved with the shooting sports industry and to date have

completed 94 test hunts that were all strictly for gathering data on new gun and load combinations. The industry events often required travel to foreign countries.

Also were included there were some massive big game culling hunts, some of which have been covered in this book. The bottom line is that I have been a party to hundreds of warm target test hunts as bullets were being evaluated for use by the general shooting public. There rule here is simple and direct. You need to shoot a lot of critters when evaluating a new bullet. Ballistics engineers like to use a figure of 100 as a baseline for measurement. That's a bit steep when it comes to shooting game, but some big game hunts that I have taken part in have totaled up as many as 50 animals. When numbers like those start to come together, the information gleaned from the raw data is without question valuable and far better than any paper punching, or chronograph information that could be generated on a test range.

How Far?

As has been alluded to in another area of this book, safety is always paramount when it comes to handling and shooting firearms. In effect, NEVER shoot at or above the horizon. Prairie dogs like to sit right at the horizon's edge, but that's asking for big trouble in the event you skip a bullet over the top and out to who knows where.

We know already that we have been talking about 1000-yard and longer kills with some gun systems. However, there is a usable range limit, and there's the actual range limit that is far from practical but will still result in damage and injury if persons or material are contacted by the bullet. By example, and this is by way of military compiled data, the following information will answer your questions as to how far a bullet will travel.

Based on the 7.62 NATO round, (308 Winchester), an M-80 Ball of 172 grains will travel 2-1/2 miles downrange. An effective range of 1500 yards can be drawn from this data, but as you can see the actual flight of the bullet is far greater. I would assess this by seeing a target in a scope sight as "direct fire" versus indirect fire as applied to artillery rounds sent aloft. To get that extreme distance of 2-1/2 miles, the rifle would have to be elevated much like a cannon or howitzer firing indirectly at a target out of sight.

If you think the small stuff such as the 22 Long Rifle can slip under the radar, think again. The 22 LR at 40 grains, leaving the muzzle at 1145 fps – and that's a standard velocity round and not a super fast one – will travel almost a

full mile downrange, or 1500 yards.

Move to the 223 Remington and that downrange figure moves up to 3867 yards, or almost 2-1/4 miles. The point here is simple. Always know where you're shooting and where your bullets are going to end up.

Several years ago I was hunting central South Dakota near the Missouri river and as a rule of thumb glassed the far ridges well before sending my first round downrange. I was shooting at a low draw to the far side, and as such, my prairie rat targets were being presented at about 400 yards on average. On the left side of the draw the land sloped away slightly, allowing a bullet to slide across the shallow part of the draw quite easily.

As I glassed beyond my specific shooting backstop I became aware of a full-scale cattle drive emerging from a draw about three miles beyond. In effect, my spent bullets would have landed within a half-mile of those cowboys and cattle even before I would have gotten started. Given a few more minutes and any skipping or ricochet rounds could have been dropping into the herd. Remember once again that the long-range rifleman is shooting equipment designed to send bullets very far away. Know the area you're shooting, and remember to pay attention to what you're doing at all times. Follow those rules and you can safely stay out of trouble.

Chapter 15

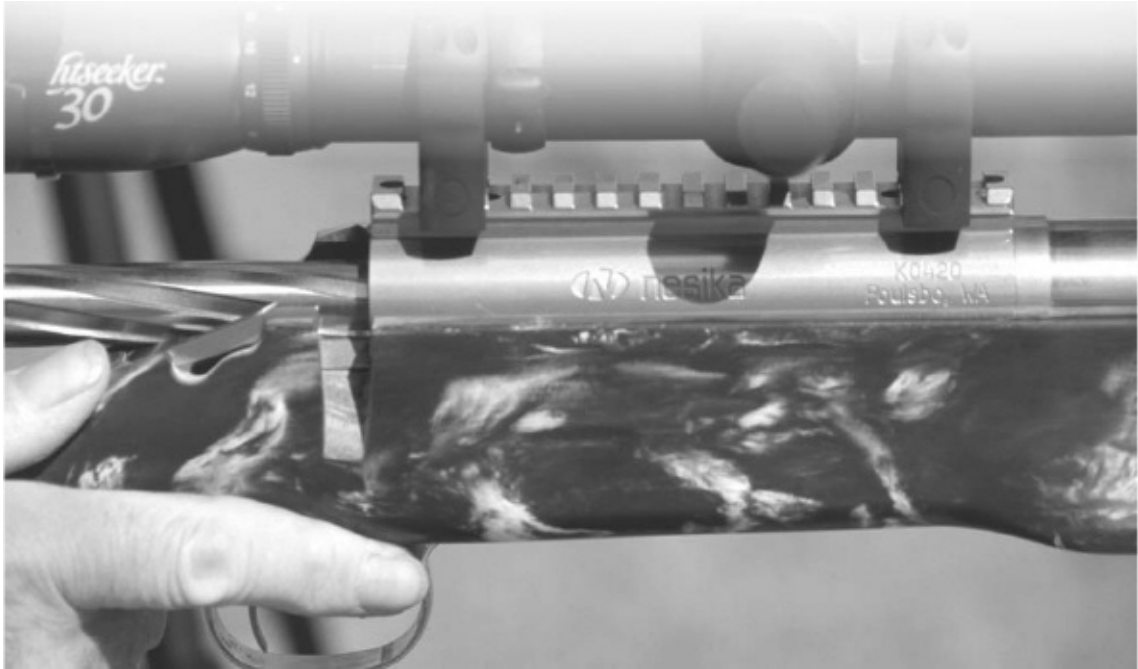
Exotic Long-Range Shooting Systems

Where do these exotic long-range rifles come from, anyway? To the rifle, all of them are built one rifle at a time are offered by custom shops across the United States, and the world in some cases. Names like Volquartsen Custom, Precision Arms, SG&Y Precision Rifles or Ed Brown rifles, to name just a few, rule the roost in this area of long range rifle development. Here the Shilen barrels, Jewell triggers, Accurate Innovations aluminum-bedded wood or McMillan GP fiberglass stocks can surface as component options by the time your rifle hits the shooting bench.

I like to call them “exotics” in that they don’t conform to the standard over-the counter rifle, always retain many if not all custom-built features, tend to shoot well all the time, and make use of the specialized cartridges developed for hard hitting long range work.



Often built in chambers from the 308 Win to the 338 Lapua, these one-of-a-kind, hand-built rifles are even starting to come into the long-range picture chambered in 300 WSM or the 6.5 WSM wildcat. As new cartridges are introduced to the shooting sports industry, wildcat reloaders and custom gunsmiths take up the challenge and often start designing new and exotic wildcat cartridges to match the advanced developments in rifles. In terms of just how effective these designs are among shooters, be advised that a pile of great-shooting cartridges have come directly from the wildcat cartridge developer’s bench. For example my favorite, the great 25-06, started as a true wildcat.



A Weaver rail is installed on this hand-built custom 6.5 x 284.



Lex Webernich, of Rifle Inc. of Pleasanton, Texas, built these high grade “Exotic” custom Rifles. Everything about these shooting tools is handmade and custom designed.

Bench rest shooters have contributed greatly to the advanced development of exotic long-range rifles as well. Here the benchrest rifle, which is almost always a custom built consortium of handmade parts so as to gain one hole groups downrange, has often morphed into the long range rifle. Don't think for a moment that when NBRSA-sanctioned 1000-yard benchrest matches or IBS 600-yard matches are held, every shooter's eye is not glued to the shooting systems that are being used. In terms of that final winning rifle and rifleman, more than one shooter will go away from the event with some new ideas as to

how to build that next super-accurate long-range rifle to be sure.

When the Vietnam war started, our snipers had little in the way of specialized rifles, and at the time an almost over-the counter Winchester Model 70 sporting rifle, usually chambered in 30-06 Springfield was as close as you could get to a tack driving long-range rifle. Today, just take a quick look at military variants in long range sniper rifles and you will see the ghosts of benchrest rifle designs all over the battlefield. Pillar bedding, reinforced glass stocks, Weaver/Picatinny rails, special beveled blocks and rings for scope sights start to make up the advanced, and in many cases benchrest-designed. tools of the long range rifleman's trade. Such as:

The SIG-Sauer SSG2000 chambered in 7.62 NATO (308 Win), 300 Weatherby Magnum, or Swiss 7.5x51mm, makes use of a McMillan adjustable thumbhole buttstock and forend, fully-adjustable bipod, advanced target trigger, and a hammer-forged muzzlebrake barrel that can be changed out in the field within minutes.

The German Mauser 86SR, which is chambered in 308 Win or 300 Win Mag, has a fully-adjustable thumbhole and ventilated stock with a muzzlebrake so as to aid in dissipating heat when successive shots are sent downrange. These designs are not all new but a throwback to benchrest design without question.



For 2007 Ruger has developed the standard Mini 14 into an exotic tack-driver in 223 Rem, complete with muzzlebrake.

The FN 30-11 in 308 Win that is in effect right in the back yard of Browning Arms here in the USA. Using a Mauser turn bolt design, the rifle has a sighting system designed to be workable to a full 656 yards.

The L96A1 -Accuracy International PM with a maximum effective range of 1000 yards is chambered for the 338 Laupa or the somewhat reduced-range 300 Win Mag or 7mm Rem Mag. This rifle is the current UK sniper rifle of choice. This very advanced turn-bolt retains all the bells and whistles we associate with advanced stocks, sighting aids, barrels and muzzlebrakes. In British shoot offs for the best sniper rifle, this shoulder cannon won out over a number of very high quality long-range gun systems.

There is absolutely no doubt that we are in the middle of a period of very advanced sniper and general long range shooting systems. Even the handmade Blue Grass Armory Viper 50 BMG featured in these pages is a custom rifle to the last coat of bluing. With every part built in house by hand, the Blue Grass rifle is an American success story all the way.

When I thought about doing a chapter dealing with exotic long-range rifles, I didn't realize that almost at my back door Ben DeRuyter, president of Accurate Innovations, was sitting on some of the first examples of this type of gunning system. Accurate Innovations not only builds rifle stocks with their own aluminum bedding system installed, but these folks also are continually developing accurate custom rifles that make use of their bedding product. With a call from Ben on another subject, I soon found myself at the Rapid City factory, and checking out three very nice turn bolt rifles that definitely were classified as exotic customs. One of these rifles had been chambered in an interesting wildcat long-range cartridge.

Accurate Innovation had just finished a nice 223 built on a Model 70 Winchester action, with a Bison octagon barrel in stainless steel and using a fast 1:9 twist for heavy 69-through 77-grain 224 bullets. Ben wanted to push this 223 Rem a bit more on our South Dakota windy days afield, and as such, using a heavier bullet would add some extra zip to a wind bucking 22-caliber rifle. With a factory tuned trigger, matted and trued action, this was a tight group-shooter to 100 yards, and a good dog rifle well out to 300+ yards when required. In terms of the stock itself, it was clearly a cut well above anything close to average. As with all of Ben's rifles, it featured real wood and the fully bridged aluminum bedding system, which made this a free-floating tack driver all the way.

The second rifle was again an Accurate Innovations creation all the way in that it had a Model 70-tuned action and reworked trigger, as well as an ABS carbon fiber barrel chambered in 338-06 Ackley Improved. This shooter was a thumbhole special, with wood to die for. Bedded with the Accurate Innovations'

special aluminum block system, the wood would never be subjected to the pounding given off by the 338 wildcat round.



This ABS-barreled Model 70 chambered in 338-06 uses a custom barrel to aid in accuracy and the ability of the barrel to fight off heat.

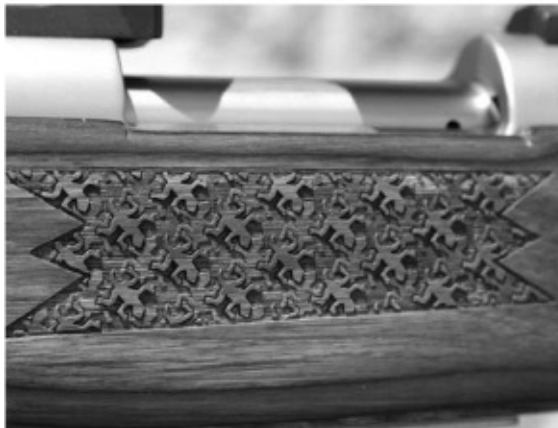


This Winchester Model 70 action is tied to a Bison octagon barrel and chambered in a fast-twist 223 Rem. Accurate Innovations wanted to build a South Dakota 223 Rem that could shoot heavy bullets accurately and still fight off high winds.

As a final offering in the exotic department, Ben offered up one of his employee's rifles that had just been completed in-house. This was a Howa action in their 1500 series, chambered in 22-250 Remington. This rifle had an Accurate Innovations custom stock that was laminated and dusted with blue strips, and a very unusual checkering pattern that resembled a modern computer video game character. The whole stainless steel setup was nothing less than impressive to say the least.

I guess nothing put a reflective light on the question regarding exotic rifles

for long-range work more than the 600-yard shoot during the 2006 Varmint Hunter Magazine Jamboree this past summer. In the open class, in which any centerfire design that the shooter believes can win is allowed, I observed a line of 26 rifles that didn't chamber a single round of straight factory-designed ammunition. Wildcat is an understatement in this class of long-range rifle shooting, and here the true "exotic" rifle stood tall.



Howa 22-250 Accurate Innovations custom varmint rifle. Exotic all the way. From the bedding system to the stock design.

The first pair of shooters I interviewed regarding their rifles in the open match indicated the following. Charlie Bland of Bethany, Illinois, was shooting a

custom-built 300 Win Mag, but in this case very different from a factory-chambered rifle. Charlie's Win Mag had a chamber tolerance that was much tighter than any standard factory 300 Win Mag round, and as such each cartridge handloaded for the rifle had to be run through a matching set of loading dies that reduced the factory case to the tighter dimensions required by this custom rifle.

Charlie's partner was Dave Boyar out of Sullivan, Illinois, and he had put together a custom open-class 308 Baer wildcat. This rifle utilized a Krieger barrel, Nesika Bay action, Sheehan Tracker stock, and Jewell trigger. The special Leupold scope was boosted to a 20x50, and the barrel retained a custom Vias muzzle break. Just making the special brass from the parent cartridge (the 340 Weatherby Magnum) requires three distinct stages in brass forming. After all that, a 220-grain Sierra bullet is stacked onto a 77.5-grain charge of Reloader Number-22 and the whole thing runs downrange as a tack-driving, wind-bucking, target-scoring winner. Both Dave and Charlie were winners in the 2005 open class competition using these very same rifles.

Moving down the line I met Dan Brooks of Tucson, Arizona, who was setting up his custom Nesika action 6.5 DB. This wildcat was Dan's own design, designated as such by the "DB" on the cartridge name. He had paired this personal wildcat to a heavy-barreled bench rifle that featured a black walnut stock of his own design as well. Often these exotic rifle shooters will put a great deal of their own personality into the rifles they shoot, and anyone who thinks the development of the wildcat is a dying art needs to get out of the house and to a match event more often.

After running the Jamboree's shooting line and getting a real eyeful of tack driving rifle art, I ended up at Todd Bettin's custom rifle booth. Todd uses any barrel a guy wants in terms of a full-custom bench rifle, but he likes to specialize in the advanced carbon-wrapped barrels built by Mike Degerness of ABS rifle barrels. Todd has indicated that these large-diameter barrels that are based on a standard taper cut rifled tube will just not heat up, as the heat is pulled off the barrel so quickly from the carbon fiber wrap treatment. Using Accurate Innovations bedding systems and some very high quality wood and fiberglass stocks, these rifles when tied together around a Viper or Nesika action become very handsome custom long-range tools.



Just a “green machine” sitting on a bench at the VHA 600-yard bench rest matches in Pierre, South Dakota.



Exotic benchrest rifle shooters Charlie Bland and Dave Boyer, both members of the Varmint Hunters Association.

In this category I have only touched on the very tip of a major series of

options open to the shooter. While a full custom can easily run between \$3000 to \$6000, there are a pile of long range accuracy shooters who want to head this direction in advanced rifles, avoiding the off-the-shelf standard factory cartridge offerings.



This full custom rifle, built on a new Viper action from the same folks who built my 50 BMG Viper, is being zeroed for the long-range events at VHA.

Long Range Goes Auto

In the exotics I have seldom preferred the autoloading type of rifle because in most cases these are built on AR-15, M-16, or M1 Garand style receivers, and I don't often shoot these types of rifles. Sure, there are exceptions, and those have been touched upon in other areas of this book. However, when the subject turns to the long range 7.62 NATO (308 Win) and the long-standing FAL rifle, this action type gets the nod by some custom rifle builders.

If you're talking about the guns offered by DSA Inc., a company that brings together the platform of the FAL and adds target grade barrels, rails for add-on equipment, special fully adjustable stocks, reworked accuracy enhanced actions, you're talking exotic all the way. Built in Barrington, Illinois, these rifles are sniper-grade autos that will shoot sub-MOA at 100 yards, and keep bullets in the kill ring well out to 500 and 600 yards with ease.

If there is a difference in these rifles as compared to the standard military FAL rifle aside from accuracy, it is in the area of retained weight. These are not lightweights at all and best adapted to static position support shooting, or in the case of the hunter a fixed position on a calling stand or overlooking a wide draw or valley. Visiting with Terry Wieland, noted writer for Primedia, I was informed that by serving in the Canadian Army, Terry had one pile of experience shooting

the FAL rifle. However, the issue version of the rifle is ultra light compared to this autoloading tack-driver. While we tend to think of the M-16 or the AK-47 as the rifle of choice on the world market, in actual fact, the FAL rifle in 7.62 NATO is carried by about 70% of the NATO forces across the globe today.



Curt Monnig, a military division manager at Trijicon Optics, behind the DSA 7.62 FAL custom tack-driver.

At Pasa Park, Illinois, during the summer of 2006 I got behind one of these examples of long-range tack driving accuracy and proceeded to pound consistent hits against 12-inch steel plates at 500 yards. The rifle I test-fired was equipped with the Trijicon ACOG optics (military) that are designed with a reticle that when zeroed at 100 yards will produce a sight picture returning the computed and exact bullet drop all the way out to 1000 yards. The sight had simple and clear hash marks that represented the ballistics of a 172-grain 30-caliber bullet with a 2700 fps muzzle velocity at 100 through 1000 yards. Put the 500-yard hash mark on the target at a ranged 500 yards, and crack whop!, that was all there was to it.

It should be noted that a good deal of Trijicon sight technology was

developed around modern combat methods being currently adopted in the Middle East by our forces. There is no doubt that these sights aid greatly the ability of riflemen to take out targets cleanly and accurately using a FAL 7.62 NATO enhanced weapon. I would have to say that based on what I'm now seeing in advanced rifle development and paired sight systems, the modern long-range military or police sniper has never had it so good. Easy to train would be my guess, given the degree of simple point-and-shoot sights and ballistic effectiveness at work here that can be associated with the current US military calibers in use today. Using these specialized types of sights, competition matches with even sub-calibers such as the 223 Rem have been known to deliver the mail dead-on target well out to 800 yards and in some cases even the 1000-yard mark by way of heavy bullets and fast barrel twists.

However, these are exceptions to the general rule, and for my money staying with the big 30-caliber rounds or larger is the best way to go down town in the long range business. The primary element to consider here is that what is military advanced development in the long run seems to fall into the sport shooting market at some point in time. Based on that hand-me-down concept we have not seen anything yet in terms of better sights and rifles for long-range shooting.

During the Pasa Park shoot I observed shooter after shooter get the hang of DSA's 7.62 NATO-chambered FAL autoloading rifles. In no time at all these shooters were zeroed on 300-and in some cases 400-yard steel targets, with a few even moving well out to the 500-yard line. These are very effective systems, and I'm very glad to know it is our side that is shooting them in real-world hot combat situations.

This has been a short overview of the auto as an effective long range shooting system. There are many others out there including the big 50-caliber in a semiauto version. In general terms the turn-bolts own this market, but special rifles in the autoloading mode are always present when the shot needs to cover targets a very long way off.

Latest Innovations

Because this book took a good deal of time and effort in terms of tracking the guns, loads, and sight systems required by a long range shooter, there were some innovative developments that just came up quickly along the way. We live in an age of ultra-fast communication and design development made possible by

modern computer generated information. As such, new things hit us head on even while we are in the middle of reporting on the best and most current subjects. The following are new commercial products for long-range rifle shooting. Many have come about only within a matter of a few short months or even weeks of this writing.



Downrange the new DSA/FAL was accurate to 500 meters. First-shot “hit-ability” was very high.



Knight rifle’s “Long Range Hunter” breaks all the rules in extended-range muzzleloading. This is accurate right out to 200 yards and can be pushed to 300 to 400 yards when required. I shot 200 yard steel plates with ease the very first time around.



Author with the new FAL from the folks at DSA.



This Savage tactical-stocked rifle is chambered in 22-250. It would be nice to see this development move into the varmint rifle field. The law enforcement stocks on these rifles are outstanding in the field.

When we think of muzzleloading, we don't associate these rifles with long range shooting to any major degree. That is because the charcoal burners have always been regarded as short-range tools. Well that's old news as of right now, because the folks at Knight Rifles have decided to introduce brand-new 50-and 52-caliber rifles dubbed Long Range Hunters. These turn-bolts' double locking lug system is built on a laminated beavertail target stock suitable for benchrest work, and has a medium heavy 27-inch, free-floated barrel. I shot the rifle on a 200-yard steel target, which resulted in clean hits each and every round. The rifle I test-fired had a Night Force sniper grade mildot scope sight, and for the first time I clearly observed that this was not just a gimmick in terms of glass sights, but a very workable addition to the muzzleloader. The staff at Knight Rifles, who know the gun well, were pushing over steel plates with the scope's mil-dot system to 400 yards, shooting the 50-caliber model. This level of accuracy was produced with a brand-new 290-grain Barnes boattail bullet. The new PBTs in 250 and 290 grains are poly tipped, adding a whole new dimension to sending muzzleloaded pills way downrange.

I guess Savage arms was reading my mind when I suggested that the Model 10 LE that I was shooting in 308 Win should be chambered in a pure varmint cartridge because at the same time I was reviewing the Knight muzzleloaders, Savage set a Model 10 Law Enforcement rifle on the bench, and it was chambered in 22-250 Rem. This rifle is the very same system that I'm currently

shooting, and I'm here to say that if that rifle had been dropped out of the sky in 1968, shooters would have been sure that it had come from aliens. This is not an exotic as such, but it has many of those refined accuracy features. With any luck it's about to hit the market soon, and a whole lot of dog hunters are going to be very pleased with it.

Also on the table at the same time was the Savage Model 12 Long Range Varminter. This short-action single shot has an ambidextrous ejection system, making it easy to load when you're down on the sights. Chambered in 204 Ruger, 223 Rem and 22-250 Rem, this stainless steel synthetic stock, long-range rifle is a tack-driver to be sure.

More Ranging Scopes

Bushnell Yardage Pro (not yet on market)

Chapter Three dealt with scope sights, and to some degree the new Burris ranging scope system. However, that scope has yet to be seen in hand for testing. Well, as I have stated previously, time moves fast in this business, and things change quickly, because knocking at the door are the folks at Bushnell Optics, as well as the Nikon people with their entrees to the ranging scope sight market. It would seem that the basic ranging design used by all three manufactures is not exclusive, but each company adds its own individual options to the basic technology involved in the development of the ranging scope system.

Only two days after I was promised a prototype Bushnell ranging scope to be reviewed in this book, the UPS truck dropped one off at my door. Jordan Vermillion, the product manager at Bushnell, had kept his word. This is the system that is so new that none had been issued anyplace as of July 30, 2006. The ranging scope Bushnell sent me was the first model in a basic 4x12x42 glass and was being adapted to both varmint and big game hunting rifles. This scope did not have any data sheet with it, but one can assume it is close in specifications of the Burris scope reviewed elsewhere in this book. However, be advised that at this time this information is pure speculation on my part.



Bushnell Yardage Pro ranging scope. Note forend control wireless system used to activate the scope's ranging unit.

The new Bushnell scope measured 13 inches with a semi-flat upper section. The ranging system designed into it is lightweight and lacks excess bulk. While early models of ranging scopes designed by the military were at times as heavy as an assault rifle, this is not the case with the Bushnell system. The weight of this scope is no more than any normal varmint or target style glass with a large objective lens.

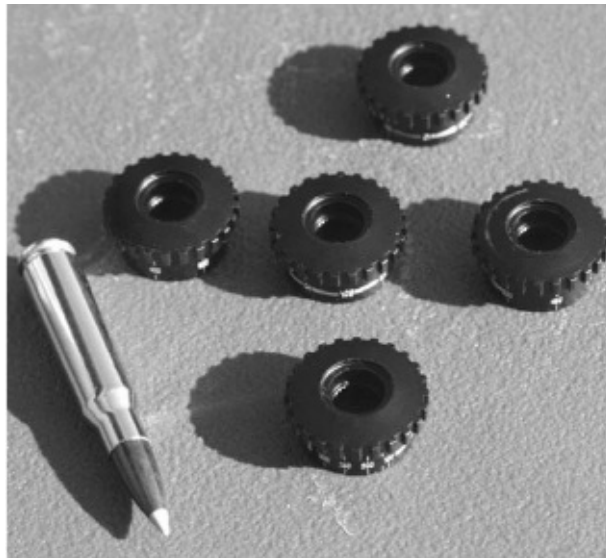
Built using a Weaver base system, it is easy to drop onto a receiver. In this case I mounted the scope to my Savage Model 10 LE with the solid one-piece Picatinney/ Weaver-style rail. On one side of the base is the clamp to the gun rail, while the top has a second semi-Weaver clamp that slides along the base of the scope on a second rail. Simple as field dirt, but as strong as a piece of solid steel when screwed down and in place.

The system uses a battery power system powered by a camera battery that mounts directly into the upper body of the scope. On the left side is the power switch that goes out in about 30 seconds when not in use. However, Bushnell has seen fit to install a wireless remote switch that can be quick mounted through a tie-buckle arrangement against the forend. Just tap the button on the forend control and the scope picks up that signal. You now get instant range displayed by a red digital figure in the top center of the scope tube.

Field testing this system on a local South Dakota dog town, I was able to gain a maximum range by image reflection of 828 yards on an earthen stock tank and direct readings on the much smaller dogs to 458 yards. All ranging equipment will range differently depending on the type of material it is being ranged against and also the degree of flat ground the system is asked to cover. This system is above average in this department when compared to a number of other systems in use today.

I cross-checked the ranging element on the scope alongside the Bushnell hand-held Model 1500 rangefinder and found the recorded ranges to be accurate. Different ranging by way of hay stacks in the distance recorded a maximum range of 889 yards. I was able to range prairie dogs as well using larger objects that were within a close proximity to my grass-eating targets. Getting the Yardage Pro rifle scope on ranged targets over flat ground was not always easy, but in effect this is a problem with many of the higher grade systems in use today. These laser-ranging units require a target to bounce back a signal to the unit when recording the exact range to the target.

The scope has sniper mildot arrangements on the crosshairs, and it was simple to adjust the mildots by knowing the drop figures of my 30-caliber 168-grain Sierra boattail bullets. An additional ranging system built into the Bushnell scope is a set of eight turret caps that are calibrated for different cartridges and grain weight bullets. Just select the turret that meets your rifle's needs and with a 100-yard zero you're able to turn up your elevation settings to allow you to drop a bullet directly onto a target up to 500 yards downrange. In other words, range the target, turn the compensating turret adjustment, and drop a few pounds on the trigger. It's similar to the BSA Sweet 17 previously covered, but with a fully complete built-in ranging system as well. This Bushnell is a nice idea that actually works.



Eight ranging turrets will be included with the commercial Bushnell Yardage Pro when it hits the store shelf. Just use the turret that meets your load and you're good to 500 yards.



Mounted on a Savage Model 10 LE, this new range finding scope is not bulky.

The early prototype unit sent to me did not have the caps calibrated correctly for the elevation adjustments, so I bypassed that test in terms of recording exact bullet compensating figures. Keeping in mind that this prototype system was released to me for review, and I was very pleased just to get the very new glass sight into the fields at all on such short notice.

In terms of optic quality this is a bright, clear scope that fights mirage and open prairie heat distortion well. The crosshairs are about standard with a downsized mil dot arrangement. I was able to keep a dog in my sights (12X) and still see both side of the critter well out to 500+ yards. Bushnell states that this scope is only the first of several to be introduced by the company. Other variations will be coming out, and in terms of price (which is currently about \$800 each) there will be some reductions as those raw production numbers build. Do we hear the word “military” down the road? I think that’s a safe bet for sure.

When introduced to writers at the Pasa Park shooting center this past summer (2006) there were questions whether the scope will be offered in a wind drift compensating model. For now that’s a bit far out on the drawing board, and just getting the ranging package into an almost standard size scope tube is a great feat in itself. The scope I was issued for test used a red or blaze orange digital display. This system was hard to see in very bright light and I would think the digital figures will be changed at some point to a black color. In terms of a final field model, the bases that are stated by the manufacture to be a bit elevated on the prototype model will be a bit lower on the final factory offering. By the time you read this information the 4x12x42 Bushnell Yardage Pro will be in sporting goods stores everywhere.

I used the Yardage Pro on my 308 Win-chambered Savage, with no ill effects whatsoever. The rifle got dumped over into rocks on one occasion and hauled around back roads in my pickup truck for days on end. The scope never lost zero and remained functional right up until I returned the test unit to Bushnell.

Over the course of testing I mounted the Bushnell Yardage Pro on both my Savage M-10 308 Win and my Tikka T-3 sniper rifle in 223. The 223 was a complete joy to shoot using the ranging system, as the 223 Rem is right at home inside 500 yards. This scope was able to direct range prairie dogs, or at least the raised lodge, much of the time well out to 450 yards plus. Locate a target via my field glasses, range the dog over the crosshairs and mildot arrangement, then whop! That was all there was to getting the shot off and job done. To my way of thinking we have not seen anything even close to the end of development regarding this innovative sight system to be sure. Needless to say but I'm totally impressed with this latest development in sighting systems.



With a day pack rifle and ranging scope, the hunter can move light and fast over big country when hunting deer, goats, or varmints. Now one system in the field can do it all.



Author shooting prairie dogs with the Tikka T-3 mounting the new Bushnell Yardage Pro ranging scope system. This scope worked effortlessly in the field.



Right, Hornady's first 30-30 Lever Revolution cartridge, and, left, the second generation with a better ballistic coefficient and more range.

Lever Guns Go long-range

I was about to think I had gone crazy when I hauled my Model 94 Winchester saddle ring short-barreled Trapper out onto a water hole last fall, and within an hour dusted off a nice speed goat with the new 160-grain SST LeverEvolution round designed and marketed by Hornady. Nothing about the shot was special except for the fact that it was taken at 197 yards with the ultra-short-range saddle rifle.

Hornady has addressed the lever action rifle with several new cartridges that make use of the V-Max style bullet tip, but in a soft material that will compress in the magazine and not cause the primer detonation known to be a problem in tube-fed rifles. Because the standard 30-30 has a blunt nosed bullet, it retains a low ballistic coefficient. As such, the bullet flies slow and stays that way to the normal 100-yard effective range most hunters use the cartridge at. I'm not saying that the good old 30-30 is at all bad, but you have to admit that it is a bit short on the distance end of the rifleman's game plan.

I have indicated that the new Hornady LeverEvolution, even in its first configuration, is very different, and in my 30-30 the new fodder greatly upgrades this cartridge to about triple its effective range, with an increase in knockdown power as well. Now the advanced second generation 30-30 bullet is an effective 200 through 300 yard tool, and again at Pasa Park, Illinois, I observed the cartridge even slap some 12-inch steel plates at better than 300 meters downrange. The rifle was a Marlin 30-30 lever gun (Model 336XLR) and the scope was a full-size Bushnell 3x9x40mm big game tube.

According to the ballistic guys at Hornady, the second new and improved 30-30 round for 2006, which has a shorter neck and longer bullet but will still chamber safely in any 30-30 rifle, has about the same terminal velocity at 200 yards as the old 300 Savage. In my mind, that's something in this day and age.

The ballistic coefficient of the first bullet designed by Hornady in 30-30 Win was .330, while the new second-generation bullet is a .400 configuration, and flies flatter yet than the first projectile did. These LeverEvolution cartridges are also offered in 45-70 and 450 Marlin. However, it is the smaller 30-caliber 30-30 that fits the bill in pushing for more extended range applications. I guess with all the 30-30's sitting around in pickup trucks and saddle scabbards, the new Hornady round makes a whole lot of horse sense. For the most part the good old 30-30 is now as effective as a varmint getter when using glass sights to a strong

250 yards and 300 yards in the hands of a guy who knows the rifle well.

Chapter 16

Conclusion

The subject of long range shooting is a complicated one to be sure. I have tried to cover it in terms that apply to many levels of the shooting sports, versus narrowing the subject down for a chosen few who shoot long range targets for a living, or shoot competitively.

As I travel to different range operations or page through shooting publications that keep track of both competitive shooting scores and ultra-long range kills on warm targets, I see a continuous advancement of names on the lists of successful 500-, 600-, 1000-and even 2000-yard shooters. I believe this is because today's long-range shooting equipment is very good and shooters use that equipment with skill and are take their craft seriously.

Shooting at long range is an art, and as you have seen in the preceding pages the approaches and tools of the trade are almost infinite. A workable approach for one shooter may not even be considered by another but that is just fine. For the most part the greatest element the shooter has on his or her side when taking up long range shooting with a high-power rifle is his-or herself. Never sell yourself short, because in almost all cases each individual has the inner tools to do the job, but those tools need to be awakened and set into motion.

From the rimfire rifle shooter who is stretching shots to 100 yards, to the professional heavy-caliber military sniper, pushing for 1000-yard hits on material or other military related targets, the game is the same. Get the most out of the gun you're shooting and learn it well in terms of your ability to send bullets down range accurately.



If you're just getting started, you don't need all the equipment made in order to judge range, and dope a bullet's flight to the target. Start simple and learn well as a solid baseline rule. Stick with that game plan and you're going to become a good long range shot.

Keep in mind that a rifle that is accurate is far better than a rifle that is great looking but won't group bullets. Ammunition that is made with care and a knowledgeable understanding will always perform better for the long range rifleman than bargain-basement loads that you found on some unknown clearance table.

When you have tested yourself at a given range and are doing well, push a bit and try for that next level of range extension on long-distance targets. Always try to do better at your craft, and above all, play the game with integrity. Don't push bullets to wild ranges on game animals, and always be sure of where those long-range bullets are going with a known and safe backstop. Follow these simple rules, and the rest of this story will take care of itself in term of your success.



Appendix I

Maintaining For Accuracy

Maintaining a rifle in terms of bore care, action cleaning, and lubrication can mean the difference between a smooth, efficient rifle and a clunker that fails you or at least produces less than effective results in the field. The following are some events that illustrate how taking care of that rifle can make the difference between a missed target or a solid 400-yard hit. As to what you do with this information, that's your department, but the information contained in the following events is meant to be a working guide for you, the shooter.



I entered the story a week later while hunting Colorado and gaining the use of the same rifles that had been used on the Encampment hunt. What we found were rifles in both the 243 and 22 calibers that would not shoot a group the size of an eight-inch circle at 100 yards. Were these rifles shot out? No, they were so packed with carbon to the point they were shooting like a smoothbore as the end product. In effect bullets were “sliding” prior to getting some grip on rifling a bit farther down the bore.

The New Super Short Magnums

With only a few years behind the fast, new “fat” cartridges, a number of elements have surfaced that do indeed require some attention and make them great examples in terms of proper field maintenance. As good as the new Winchester 223 and 243 WSSM are in terms of sending bullets very flat and fast

at prairie dogs, there are a number of important considerations that come into play when taking them afield. What works for these cartridges also works for all of the fast-moving cartridges we have talked about and makes for good discussion.

Slow Fire Or No Fire At All

Because the 223, in any of its varied loads, sends bullets at or very close to 4000 fps, this 22-caliber hot rod can get cooking quickly in terms of barrel temperature. During a very early dog hunt using a Winchester Featherweight Model 70 chambered in 223 WSSM, I found out just how hot. With a light wind and the action open to an empty barrel, this gun system was only able to produce a round downrange once every eight minutes, and when the sun got high that fired round count was cut down to under a round every 13 minutes.

Now understand that this rifle is constructed with a very thin, pencil-pipe 22-inch barrel. The fact that it got hot was quite understandable, but even with a heavy barrel things don't improve very much at all. A case and point would be a prairie dog hunt at Encampment, Wyoming, a year ago. On this hunt writers were shooting countless rounds of the 243 WSSM and 223 WSSM by way case lots of Winchester BST bullets at ground squirrels and prairie dogs. Encampment is overrun with rats, and after five years of hunting this area I have not observed any reduction in their populations.

Not only were the rifles not shooting well, but bolt lift was a major problem and at times it required two shooters to open a rifle's action. A major problem? Yep, you can take that to the bank, and now Winchester knows that the WSSMs require special maintenance compared to other cartridges.

Taking Care of the WSSMs and Other Fast-Movers

Of late a number of "stories" have been floating around that indicate that WSSM-chambered rifles are being shot out in a few hundred rounds or less. To set this modern myth straight, and get to the heart of the issue, these rifles are not shot out at all but crud-filled to the point that they quit shooting, period. These are high-tech WSSM cartridges calling for high-tech care as well. If you're not prepared to make the needed commitment, buy a 30-30 Winchester and be done with it.

I have been shooting my personal Winchester Model 70 Featherweight 223

WSSM for two years to date. I have shot it at prairie dogs, coyotes, and other assorted critters including ultra-long range gobblers in northwestern South Dakota . By staying with the indicated cleaning regiment my rifle has not failed to drill good groups for a light rifle if not some outstanding paper punching at times (sub-MOA at 100 yards).

Here is the system I use to keep fast-moving caliber rifles up and shooting straight. First off, I always clean every 20 rounds being in the field on dogs or back at camp. My system for in the field is as follows. Using Wipe-Out Accelerator, I run a wet patch through my rifle's bore, allow it to sit a few minutes, then pass a dry patch through the bore. That patch is always a black mess. I repeat this operation until I get a clean or at least a gray patch. This takes about four patches to gain the desired patch color.

After shooting up to 60 rounds I again wet a patch with Accelerator, but now I run a brush through the pipe for several strokes, followed by dry-patching the bore again. This takes care of field care on a dog town or at the range, but when I return to camp or home I turn to Wipe-Out Brushless Bore Cleaners, a foaming aerosol injected into the bore and allowed to stand overnight. When I pass a dry patch through the bore the next day, it comes out bright blue, indicating copper fouling and more. When this blue color is present, a second application of Wipe-Out is applied and repeated until I get a clean white patch through the barrel. Wipe-Out can be obtained at local outlets or through Sharp Shoot R, Paul Company Inc., Box 171, Paola, KS 66071.

I have used Blue Wonder bore gel-paste with good results as an application process ahead of bore brushing, and also Barnes CR-10, or J-B compound from Brownells. Blue Wonder can be located through www.BlueWonder.us, J-B at 800-741-0015, and Barnes CR-10 through Barnes Bullets, P.O. Box 215, American Fork, Utah 84003, 800-574-9200.

When turning to basic lubrication of the bolt slides and recoil lugs, both being critical areas for maintenance, I have found that Miltec-1, a synthetic military machine gun oil, is outstanding. Just a very small amount will impregnate the steel and stay with the metal from then on. Of late I have been working with a new product much like Militech-1 called Hercolube 202CR. Again this is a deep penetrating lubricant that won't run off in hot weather or get stiff in the cold temperatures. Hercolube can be found through Joe Bruch at 573-754-6211, ext. 324 or email jbruch@herc.com.

Products I would stay away from for the upkeep of the WSSMs and other

ultrahigh-velocity cartridges are any cleaner lubrications that are one-step, do-it-all systems. While those may work well on your scatter gun, handgun, or lower-velocity rifle, I would question their overall effect in these WSSM fast movers or other large-capacity ultrahigh-velocity cartridges. I did observe a shooter spend almost an hour brushing general cleaner into a barrel on a 243 WSSM that had gone south, only to find that after that conventional brushing and swabbing the rifle shot straight and grouped tight for about 10 rounds, then went to pieces and sent eight-inch groups into a 100-yard target all over again.

Currently compounds like Wipe-Out are under test by both independent writers and industry folks alike. This product seems to be getting the job done for the time being. I can say for a fact that my rifle is still shooting straight, but again I don't beat the daylights out of it either.

I do know for a fact that I can take any high velocity rifle, be it a 22-250 Rem, 243 Win or a 223 Improved, and burn that rifle up in less time than it takes to spend a half day out on the prairie. Just keep it hot and shooting, and give it no rest, and you are asking for trouble down the pike. As the old army saying goes "take care of your rifle and it will take care of you." That about goes double in terms of shooting and living with the new WSSM line of ultrahigh-velocity Winchester cartridges.

Onsite Field Care For Barrels

So often after a day's shooting I see hunters just pack up a rifle and head for the barn, not to uncase that shooter for days while all that crud cooks off in the rifle's bore. A simple step you can take right from the start is to carry a range kit with you, or in some cases a full-blown range box that is in effect a full-service cleaning station. I use the Tipton Range Box that holds everything I need including breakdown cleaning rods on ball bearing swivels and enough patches, brushes and cleaners to last a month of straight cleaning time. Also in my kit is a nice solid bench yoke attachment that holds my rifle solidly as I work in it from my pickup truck's end gate.

When I'm shooting on a prairie dog town and sending large numbers of 22- or 243-caliber bullets downrange in a short period of time, I will take time out every 40 or 50 rounds to run a wet patch through the rifle. Here I use general purpose products like Hoppe's solvent, or Outers one-step bore cleaner, because I'm not trying to produce a finished and stored clean barrel but get a head start

on a large cleaning job down the line.

Whereas some shooters have complained about moly coated bullets in the past, I have had good luck with them with 25-06, 220 Swift, 22-250 Rem, and 243 pills and other fast-movers that get hot quickly. The reason these bullets have served me well I believe is because of my onsite bore maintenance methods. Allow anything to build in a rifle bore and you're asking for trouble, or at least a tough job at the cleaning bench later in the day.

New Bores: Special Care

It goes almost without saying that any new barrel demands some special attention in terms of very frequent cleaning during that "green bore" break-in period. There are about a hundred different systems in use that have been written about covering this subject. What I will say is that regardless of which cleaning pattern you are using, stay with it like a religion for the first fifty rounds downrange. I do not believe the system employed is as important as staying with a system in the first place. If you clean the first five rounds and every five rounds after that for a 25-round total, stay with that program. If you push that total between cleanings up to 10 rounds, that's your choice, but stay with that game plan and don't let your shooting start to run wild. New barrels need a break-in period, and I have owned, tested and shot many rifles that got tighter groups as that barrel was seasoned by successive shots.

In general, I shoot about three to five rounds between the first three cleanings, and then move up to seven to ten rounds between runs of the cleaning rod going down the bore. I will do this for about 50 rounds, or as I start to see my bore polish off atop the lands. You can also feel the difference in the bore's condition just by passing a cleaning rod and patch through it. If that patch hangs up and is not slick to the movement, chances are you have fouling or a rough spot in that pipe. I shot a Remington Light Varmint in 223 Rem several years ago that required upwards of 300 rounds before a slight rough spot was burnished out of the bore. That rifle shoots inside three quarter MOA now, but at first it had a rough time staying inside 1-1/2 inches at 100 yards.

Just received and discussed in Chapter 9 is the new Savage Model 10 LE police sniper rifle. Chambered in 308 Winchester, this rifle comes directly out of the box shooting one-half inch groups at 100 yards. Targets supplied with the rifle by Savage indicated this to be a fact indeed. Even with this track record right off the line, this rifle has already been moved into the green bore break-in

process I use on new rifles. Will the Model 10 shoot better later on in its life? I tend to think that is exactly the case, and I'm betting that this rifle will become one of those one-hole 100-yard shooters we see every now and again.

Author's Postscript: The last group shot with the Savage Model 10 was .310-inch. Yes, taking care of that bore has resulted in a one-hole shooter.

Another major element in maintenance is keeping the action screws tight, as well as checking scope base and ring screws on a regular basis. Last winter while shooting a new rifle I was plagued with problems in accuracy, only to find out that the rifle's scope rings would just not hold tight. These rings would loosen even during a ride to the range in a smooth-riding pickup truck. I have to say that I wasted too much ammunition trying to figure out what was going wrong with the gun and glass system. Now I check more often, and carry some screw locking compound material with me at all times.

In the final analysis, any mechanical equipment that is well-maintained will always return a better performance track record. Taking the time to lubricate and clean your rifles will always pay off in terms of accuracy, dependable function, and gaining additional field life from that firearm.

Appendix II

Resources

Spur Outfitters

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Scott Black, Guide

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Nosler Bullets
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Bend, OR 97709

Buckhorn Gun Works

Custom & Complete Gun Building

Bill Dixon
605-787-6472

Winchester Ammunition
Winchester/Olin Corp
East Alton, IL 62024
www.winchester.com

Redding Reloading Equipment

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Cortland, NY 13045
www.redding-reloading.com

Sierra Bullets

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Sedalia, MO 65301
www.sierrabullets.com

Hornady Bullets

P.O.Box 1848

Grand Island, NE 68802
www.hornady.com

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900 Ehlen Drive
Anoka, MN 55303

Browning Rifles

One Browning Place

Morgan, Utah 84050
801-876-2711

The Rock BR

Battenfield Tech Inc.

5885 W. Van Horn Tavern Rd
Columbia, MO 65203
www.caldwellshooting.com

Nosler Bullets

Bend, Oregon.

1-800-285-3701

Kahles Scopes

2 Slater Road

Cranston, RI 02920
www.kahlesoptik.com

Pentax Scopes/Binoculars

Pentax USA Inc.

600 12th Street, Suite 300

Golden, CO 80401

www.pentaxusa.com

Goehring-Routier Ranch

HC66,Box 112

Buffalo, SD 57720

Contact: Randy Routier

Berger Bullets

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Fullerton, CA 92835-1045

www.nergerbullets.com

Kimber Rifles

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Yonkers, NY 10705

www.kimberamerica.com

BSA Imports/Scopes

3911 SW 47th Ave.

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Ft. Lauderdale ,FL. 33314

Savage Arms

100 Springfield Road

Westfield, Mass 01085

Tikka Rifles

Beretta U.S.A.

17601 Beretta Drive

Accokeek, ND 20607

Sturm Ruger & Company, Inc.

200 Ruger Road

Prescott, AZ 86301-6181

Remington Arms Co., Inc.

870 Remington Drive

P.O.Box 700

Madison, NC 27025-0700

Cabela's, Inc.

One Cabela Drive

Sidney, NE 69160

Thompson/Center

400 North Main St.

Rochester, NH 03867

603-332-2333

Gary Roberson, Guide

915-396-4572

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Menard, TX 76859

Larry Symes, Guide
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Eufaula, OK 74432
918-452-3034

Dead Coyote
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www.hevishot.com
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(experimental research)
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Hydra -Shok, Starfire,
Quick-Shok, EFMJ

Sharp Shoot R
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Box 171
Paola, KS 66071
785-883-4444.

getsales@paulcousa.com.

Blue Wonder

J-B at 800-741-0015

www.BlueWonder.us,.

CR-10

c/o Barnes Bullets

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American Fork, Utah 84003

800-574-9200

Black Hills Ammunition

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605-348-5150

Leupold & Stevens Inc.

14400 NW Greenbrier Parkway

Beaverton, OR 97006

503-646-9171

Hunter Specialties

6000 Huntington Court Northeast

Cedar Rapids IA 52402

319-395-0321

Wolf Performance Ammunition

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Anaheim CA 92806
888 757-WOLF

Olympic Optical

Safety Shooting Glasses

P.O.Box 752377
Memphis, TN 38075
www.olympicoptical.com

Battenfeld Technologies Inc.

5885 West Van Horn Tavern Road

Columbia, NO 65203
877-509-9160

Ed Brown Rifles

P.O.Box 492

Perry MO 63462
573-565-326!

Accurate Innovations

Rifle Stocks

P.O.Box 1007,
Rapid City, SD 57709
605-341-0601

Howard Communications, Inc.

289 Hwy CC
Elsberry, MO 63343
573-898-3422

Swarovski Optic North American Limited

2 Slater Road
Cranston, RI 02920

Blue Grass Armory

Viper 50 BMG

P.O.Box 1293
Richmond, KY 40476
859-625-0874
www.bluegrassarmory.com

Perma Gel, Inc.

3227 NW Countryman Circle
Albany, OR 97321

Environmetal Inc.

P.O.Box 834

1307 Clark Mill Road
Sweet Home, OR 97386
541-367-3522

Knight Rifles

P.O.Box 130

21852 Hwy .J46
Centerville, IA 52544

DSA Inc.

P.O.Box 370

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www.dsarms.com

Bushnell Outdoor Optics

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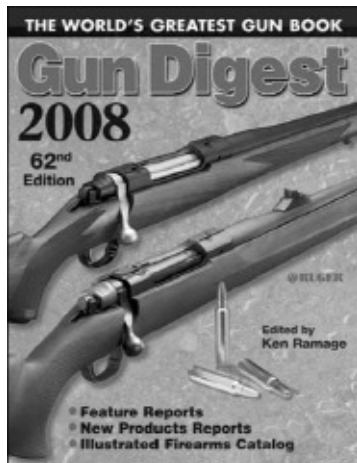
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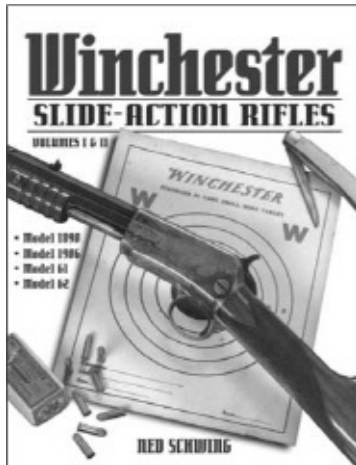
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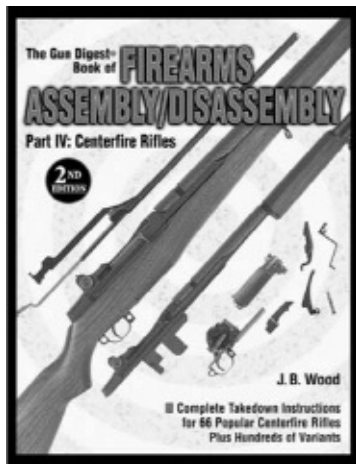
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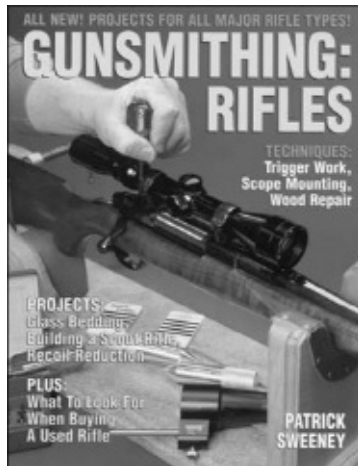
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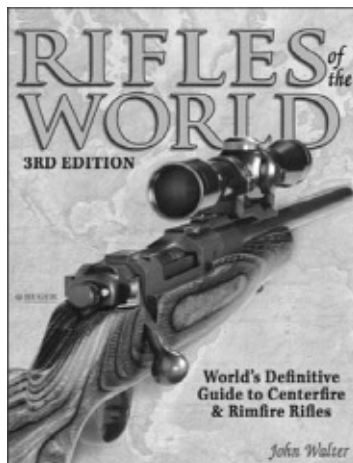
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