

# The State of Slugs

## A HIGH-TECH SLUGFEST

No longer a poor substitute for a rifle bullet, the sabot slugs of today deliver accuracy and terminal performance born of solid engineering, and they are on the forefront edge of ballistic technology.

By BRYCE M. TOWSLEY, Field Editor



**E**veryone has biases. I am not afraid to admit mine. Take shotguns, for example. I used to believe that they were designed to shoot at little things that scurry and fly. To me, the idea of hunting big game with a scattergun was just crazy talk. I have friends who live in areas where they are forced to endure this terrible injustice, and I always pitied them as I smugly shot my deer with a rifle.

But, all that changed a few years ago when a revolution swept through shotgun slug design. The new technology changed my thinking, enlightened me and made me a true believer in shotgun slugs. Slugs have been transformed from crude bludgeons in a smoothbore delivery system to highly refined ammunition using high-tech projectiles.

That evolution continues today, and the state of shotgun slug development is impressive. They remain a short-range hunting tool, but that was always the idea. The reason for the shotgun-only laws is based in safety. But today's slugs are engineering marvels that can hold their own in the company of any hunting bullet.

Mirroring the lead of developments in high-performance rifle bullets, new-generation shotgun slugs have polymer tips for higher ballistic coefficients, which allow them to slip through the air with less drag than the slugs of yesteryear. The result is reduced velocity loss, which means a flatter trajectory and more retained energy down-range. The polymer tips also contribute to better expansion at longer ranges, so they enhance terminal performance as well.

I recently spent some time shooting a variety of the most popular 12-ga., 2 $\frac{3}{4}$ " polymer-tipped shotgun slugs on the market. I tested them in two different shotguns. The first was a Remington Model 870 pump-action with a rifled barrel. This might well be the most popular shotgun for hunting deer on the market, making it the logical choice. I added a Nikon 2.5-10X Monarch scope on a cantilever mount. The second gun was a Harrington & Richardson Ultra Slug Hunter, a single-shot, break-action with a thumbhole stock. I selected this gun because it is built with a 10-ga. barrel contour in a 12-ga. bore. This "bull-barrel" slug gun has a reputation for outstanding accuracy. It was scoped with a Nikon 3-9X Slughunter with the company's BDC reticle, an optic designed specifically for slug guns. I thought that these guns and optics represented a good sampling of what most slug hunters are using in the deer woods.

## REMINGTON PREMIER ACCUTIP BONDED SABOT SLUG

The first slug we'll examine is actually the latest to hit the market. Early this year, Remington introduced its new Premier AccuTip Bonded Sabot Slug. The AccuTip is without a doubt the wildest-looking slug on the market.

Unlike the smaller-diameter polymer tips of the other slugs, the Remington has a hard plastic cap called the "Power Port Tip" that covers most of the face of the projectile like a hat. This tip also has a wide stem that fits into a large-diameter, hollow-point cavity in the slug. In fact, the hollow-point occupies nearly the entire area inside the jacket.

The tip has a series of holes in the ogive, hence, the name, "Power Port." While theories abound on the Internet and in gun shops about why they are there—one guy told me it whistled so the deer would hear it and freeze, making them easier to hit—the truth is the purpose of the holes is to add drag. At least that is what Greg Dennison—the Remington engineer who designed the slug—told me.

By adding the holes, Dennison was able to manipulate the drag forces on the slug. That's important because of something called "center of pressure." Center of pressure is the point of convergence of all the forces acting on the bullet in flight, including the drag forces, spin forces, lift forces, gravity and some others. Dennison told me that the relationship between the center of gravity in a bullet and the center of pressure of a bullet in flight is very important to accuracy.

The center of gravity is to the rear on this slug by design and is fixed in the position desired. So, to change the relationship between the two would require changing the center of pressure. Of the forces that comprise the center of pressure it is easiest to manipulate the drag forces.

By adding the ports in the tip they changed the way the air flows over the bullet and changed the drag forces. That in turn changed the location of the center



of pressure. Dennison tried several designs before finding the configuration that gave him the best accuracy. The added drag reduces the ballistic coefficient, but the theory is that a slightly flatter-shooting slug is of no use if the accuracy is not there.

The body of the Remington Premier AccuTip is different than other slugs in that it is pretty much cylindrical, with almost the entire ogive created by the plastic tip. Borrowing from technology developed for the Remington Golden Saber handgun ammunition, the jacket is made from cartridge brass.

Also carried over from the Golden Saber are the cuts in the front of the jacket. One side is folded in to form a spiral. This does two things: First, it holds the tip in place and; second, it provides a location for the jacket to rupture when initiating expansion. The base of the slug is rounded in a sort of quasi-boattail, but that is simply a result of the manufacturing process and serves no ballistic function.

The core of the AccuTip slug is pure lead. The jacket and the core are bonded, which prevents separation during expansion and penetration. This slug expands greatly when it hits something.

The expanded diameter of five of the .58-cal., 385-gr. slugs recovered from ballistic gelatin averaged 0.97". The average retained weight is 370.5 grs. Considering the tips weighed 8.8 grs., that's close enough to 100 percent weight retention to convince me that bonding works.

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*The Remington AccuTip Bonded Sabot Slug (top, and l.) is the newest of the class—and the most unusual. Its huge polymer tip has a series of holes in its ogive that change the drag forces on the slug. Remington engineers did this to change the center of pressure on the slug. The jacket is made from cartridge brass—like Golden Saber pistol bullets—while the core is of soft lead. In the author's tests, the 12-ga., 385-gr. projectile expanded to 0.97" and had a retained weight of 370.5 grs.*

# SLUG GUN RANGE RESULTS

The group averages are with five, five-shot groups at 100 yds., fired from a Caldwell Lead Sled. This testing protocol might be the curse of the shotgun slug, as groups often exhibited three—and sometimes four—shots tightly together and then a flyer or two. Much of this is due to the very thin walls of a rifled shotgun barrel. They heat up very quickly, and that can degrade accuracy. Also, the shallow rifling in a shotgun barrel can clog with plastic fouling from the sabots rather quickly and ruin accuracy. Testing protocol was to fire two, five-shot groups and then cool and clean the barrel. Fire a fouling shot, and then 10 more shots.

Another factor in accuracy is that all the ammunition tested was 2¾" shotshells, fired in a 3" chamber. While it's hard to find a hunting gun without a 3" chamber, this is not the best situation for accuracy. The jump to the rifling is too long. Still, the 2¾" slug loads outsell the 3" by a wide margin.

In my experience, sabot slugs are plagued with flyers. An engineer I talked with agreed. Any bullet that uses a sabot is subject to some influence from the sabot release, and that can cause a flyer—but shotguns are particularly susceptible. In fact, any time you fire a slug you are relying on a series of small miracles. The chambers, throats and bores in slug guns are usually much less precise than with a rifle. Often the barrel is not solidly attached to the action and can float around. Usually the bolt does not lock solidly into the barrel as with a rifle. Shotshells are made of plastic rather than metal, which is less precise. There is a crimp that must unroll as the slug and sabot exit, and any variation in that can affect accuracy.

According to Winchester's Steve Mayer, the crimp should guide the slug and sabot as it unfolds, keeping them centered and aligned with the bore. The chamber must also be large enough to allow the unrolled crimp room enough to let the sabot and slug pass. That means the chamber diameter has to be large enough for the plastic shotshell walls as well as the sabot and bullet. If the end of the hull doesn't reach all the way to the end of the chamber, there is a section that the sabot and slug must pass through that is much larger diameter than the sabot. This, of course, offers no support to the sabot and can allow it to tilt. All this adds an element of variability that can allow the sabot to enter the rifling slightly off kilter.

When you think about it, it's a miracle that shotgun slugs work as well as they do. At this point in time, it is my opinion that shotgun slugs have become so good that the limiting factor right now is the firearms. There are of course exceptions (the H&R, for example), but most hunting shotguns are simply bird-gun designs with a rifled barrel installed. On the other hand, some big-name gun companies have tried to sell high-end slug guns, but the public did not respond.

This new generation of slugs is shooting groups at 100 yds. that would have been tough to find at 25 yds. forty-something years ago. The slugs of today are at least as accurate as a lot of the deer rifles from my grandfather's generation. In the end, for the ranges that a slug gun is designed to be used to shoot at deer, everything works, as is proven by tons and tons of venison in freezers all over the country.

—BRYCE M. TOWSLEY

## SHOOTING RESULTS (100 YDS.)

12-GA., 2¾" SABOT SLUG SHELL	VEL. @ 10' (F.P.S.)	ENERGY (FT.-LBS.)	FIVE-SHOT GROUP SIZE IN INCHES			THREE-SHOT GROUP AVERAGE*
			SMALLEST	LARGEST	AVERAGE	
<b>HARRINGTON &amp; RICHARDSON MODEL 980 SINGLE-SHOT, 24" BARREL, 1:35" TWIST RATE</b>						
FEDERAL BARNES 328-GR. EXPANDER TIPPED SABOT SLUG	1677 Avg. 52 SD	2,049	3.0	4.8	3.7	1.7
HORNADY SUPER SHOCK TIPPED 300-GR. SABOT SLUG	1832 Avg. 68 SD	2,236	2.3	7.3	15.0	1.6
REMINGTON PREMIER ACCUTIP 385-GR. SABOT SLUG	1690 Avg. 25 SD	2,442	3.1	6.7	4.4	1.9
WINCHESTER XP <sup>3</sup> 300-GR. SABOT SLUG	1921 Avg. 20 SD	2,365	2.5	8.6	6.4	3.5
<b>AVERAGE EXTREME SPREAD</b>					4.87	2.17
<b>REMINGTON MODEL 870, PUMP-ACTION, 23" BARREL, 1:35" TWIST RATE</b>						
FEDERAL BARNES 328-GR. EXPANDER TIPPED SABOT SLUG	1635 Avg. 52 SD	1,947	2.2	5.3	3.3	2.1
HORNADY SUPER SHOCK TIPPED 300-GR. SABOT SLUG	1771 Avg. 63 SD	2,090	4.7	16.2	10.9	5.4
REMINGTON PREMIER ACCUTIP 385-GR. SABOT SLUG	1620 Avg. 45 SD	2,420	3.2	7.8	5.0	2.3
WINCHESTER XP <sup>3</sup> 300-GR. SABOT SLUG	1821 Avg. 30 SD	2,210	4.5	8.3	6.2	2.7
<b>AVERAGE EXTREME SPREAD</b>					6.35	2.12
VELOCITY WAS MEASURED WITH AN OEHLER MODEL 35P CHRONOGRAPH WITH THE FIRST SCREEN 10 FT. FROM THE MUZZLE. ACCURACY FOR FIVE, CONSECUTIVE, FIVE-SHOT GROUPS AT 100 YDS. FROM A CALDWELL LEAD SLED. ABBREVIATIONS: SD (STANDARD DEVIATION). *SEE TEXT.						

## WINCHESTER SUPREME ELITE XP<sup>3</sup>

Winchester's highly successful XP<sup>3</sup> rifle bullets have a big brother, the XP<sup>3</sup> shotgun slug. The XP<sup>3</sup> is another example of rifle bullet engineering crossing over to shotgun slugs.

Creating a polymer-tipped slug that works is a lot more difficult than it would appear, and this one proved to be no different. "We already had a product that we thought we could simply add a tip to and be done," said Winchester Engineer Steve Mayer. "But, it didn't work that way. With the addition of the tip the expansion was too dramatic and we found that the petals would simply break off."

So, Mayer redesigned the entire bullet. The jacket is 95-5 gilding metal, which is 95 percent copper and 5 percent zinc. The nose, the part that expands, is solid gilding metal. Actually, the bullet is completely lead-free. The nose features a large hollow-point that is plugged with the stem of the polymer tip. Any tipped bullet is simply a hollow-point design. The difference is that the hollow-point is covered by the tip. Tipped bullets tend to have large hollow-point cavities and so expand well at low velocity. In some cases, the tip helps initiate expansion by acting like a wedge on impact.

With the XP<sup>3</sup> bullet, the gilding metal nose splits along pre-stressed lines into six petals, which then



*The gilding metal nose of Winchester's XP<sup>3</sup> slug splits along pre-stressed lines into six petals. The 12-ga., 300-gr. projectile expanded to 0.99", and its retained weight was 294 grs. It delivered the highest muzzle velocity.*

expand to a very large frontal area. I measured a sample slug recovered from ballistic gelatin and the diameter of the expanded bullet was "0.99", and it weighed 294 grs. Less the weight of the tip, that's 100 percent weight retention.

The base of the XP<sup>3</sup> slug is hollow and contains a core of tin. Mayer chose tin because he wanted to keep the bullet lighter so it would attain a higher velocity. A bullet using a lead core would be too short, so by using the lighter material, he was able to maintain an acceptable bullet length and still bring the .50-cal. slug in at 300 grs. The focus for the Winchester Supreme Elite XP<sup>3</sup> is high velocity, and it delivered the highest muzzle velocity from both guns.

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## OTHER SLUGS

There are many other types, designs and styles of slugs on the market, and they all have a following. Perhaps the most common is the Foster slug invented by Karl Foster in 1931. These slugs are designed to use in a smoothbore shotgun and are by far the best choice for non-rifled shotguns.

It's commonly called a rifled slug because of the "rifling" on the slug itself. Some think this spins the slug, either by gripping the shotgun's bore or by the air catching the spirals in the slug as it flies. But neither happens, and the slug does not spin in flight. This style slug has a hollow base so that the weight is forward, and it flies like a badminton shuttlecock. In years past, Foster slugs have been notoriously undersized and would rattle down a shotgun barrel and exit with heartbreaking randomness. That's been corrected to some degree with today's slugs fitting a bit better than back in "olden times."

New technology like the Federal Truball helps ensure a better fit. The Truball uses a round plastic ball fitted into the hollow base of the slug. When the gun is fired, the ball helps keep the slug centered for better accuracy. I have been shooting Truball slugs in several smoothbore shotguns that are used for three-gun competition and have been amazed at the accuracy they are giving me at 50 yds.

The next category of slugs is the full-caliber lead slug with an attached wad. These are also weight-forward slugs. Perhaps the most famous of these is the legendary Brenneke,

which was the first shotgun slug on the market in 1898. The Brenneke is designed to be used in a smoothbore or rifled bore.

The Remington BuckHammer and the Hastings Slugs use a slightly different approach with an attached sabot-type wad behind the full-caliber slug and are designed to be used in a rifled barrel or with a rifled choke tube. That last option is a low-cost way to turn your bird gun into a deer gun. I have tested the BuckHammer in a Remington 870 smoothbore with a rifled choke and got some excellent 100-yd. groups.

Finally, we have all the other sabot/slug shotgun loads. The sabot acts as a liaison between the slug and the shotgun's bore and the slug never touches the shotgun. This means it can be made out of any material from lead to Kryptonite. Many of these slugs are highly developed bullets with outstanding terminal performance. The Winchester Nosler Partition Gold, Federal Barnes Expander HP and the Remington Core Lokt Ultra are three popular choices. Winchester and Federal still offer the old wasp-waist slugs that started this sabot revolution, and perhaps the most interesting is the Brenneke Super Sabot. That one uses a .63-cal., lead-free, two-part slug that looks like no other I have ever seen.

No matter what your preferences and/or biases, there is enough diversity in slug ammunition today to satisfy just about anybody.

—BRYCE M. TOWSLEY

## FEDERAL BARNES EXPANDER TIPPED SABOT SLUG

Some things just work, and the partnership between Federal Premium Ammunition and Barnes Bullets is one of them. Barnes' X-Bullet concept has been expanded, improved and developed into a wide range of outstanding bullets for any legal hunting firearm. The company's solid copper slug has been a well-respected performer in Federal ammo for years. The partnership took that a



step further with the addition of the Barnes Tipped Slug.

In the 12-ga., 2¾" load, the .50-cal. slug weighs 328 grs., while the new 3" version weighs 428 grs. Like most Barnes bullets, the 328-gr. projectile is made out of solid copper; only this one is fitted with a blue polymer tip. The slug has a deep hollow-point that is more than half the length of the bullet. This hollow-point is tapered so that the walls grow thicker as the cavity grows deeper. This helps control expansion, and it supports the expanded petals. A sample slug recovered from water, which is a very hard test medium, measures just slightly over an inch. It weighs 325 grs. and, when you account for the weight of the tip, retains 100 percent of its original weight. In my tests, this ammunition proved to be the most accurate in both shotguns.

*Made of solid copper, the Barnes Tipped Slug in Federal Premium's 12-ga., 2¾" factory loading weighs 328 grs. Its hollow-point cavity is more than half the length of the projectile. It proved one of the most accurate slugs tested.*

## HORNADY SST SHOTGUN SLUG

Hornady is not really in the shotshell business. The company makes bullets, tools and rifle and handgun ammunition, and there is nothing resembling birdshot in the catalog. The shotshells Hornady makes is for self-defense or large game. The company makes a couple of 12-ga. buckshot loads and a couple of slug loads, one in 12 gauge and the other in 20 gauge.

Its SST slug employs technology originally developed for muzzleloader bullets, which operate under external and terminal ballistics similar to sabot shotgun slug. Hornady's SST muzzleloader bullets have an outstanding reputation for accuracy and terminal performance. The SST was the leader in tipped muzzleloader bullets, and that bullet technology has also been used in Hornady's hunting handgun ammunition and in the SST shotgun slug loads. The bullet in the 12-ga. slug is a .50-cal, 300-gr. SST,

the same bullet loaded in its .500 S&W handgun ammunition and the same design as its muzzleloader bullets.

Like all the SSTs, it is a lead-alloy core wrapped in a relatively thin gilding metal jacket. The jacket nose is skived for easy

expansion, and then it's crimped to form the ogive. This creates small pegs of metal inside at each of the skived areas, which hold the tip in place. The bullet uses Hornady's Flextip plastic tip. These flexible tips were developed for use in tubular-magazine, lever-action rifles and were introduced in the LeverEvolution line.

The SST bullets are generally considered to be "soft." That is to say, they expand easily, which is something that a lot of deer hunters want in a bullet. The expanded sample I have was recovered from a proprietary ballistic testing medium. It has expanded to 0.80" and retained 220.4 grs. of weight.

The Remington 870 didn't seem to like this ammunition for some reason. Every gun is unique, and I suspect it was simply one of those match ups that didn't work. The ammunition did, however, shoot well out of the H&R shotgun.

*The Hornady SST slug is based on the firm's muzzleloading bullets and employs a gilding metal jacket. It expands easily—to 0.80" for the 12 gauge in the author's tests.*



## SUMMING UP

Each of these four high-performance shotgun slugs represents a different technology concept and design philosophy. In fact, they really only have two things in common. First, they all employ plastic tips. The second is that each in its own right represents the cutting edge of shotgun slug technology. While each one is different, they all take their own design concept to the current extreme of shotgun slug design.

There is only one true way to determine which slug is best for you, and that is by shooting them. No matter which slug you choose, you can rest easy that you are hunting with one of the most advanced shotgun slugs ever offered.