

Something For Nothing?





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lmost without exception, the oft-quoted, “There is no such thing as a free lunch,” holds true—especially when it comes to shooting. Sooner or later there’s a cost to be paid for every benefit gained, and typically that cost is not just monetary in nature. This is particularly true for velocity-craving riflemen who, even at the expense of additional recoil, report and cost, demand enhanced external ballistics from their cartridges and rifles. Fortunately, things have changed, and for the better.

Hornady’s new Superformance ammunition not only rewrites the performance standards for popular center-fire rifle cartridges, but it also challenges the notion that, “There is no such thing as a free lunch.” How? Let’s find out.

Previous Practices: Increasing Performance Through Pain And Price

“In the past, small arms performance has been limited—particularly with lengthy, lead-free projectiles—by the propellant’s inability to be completely burned by the time the bullet exits the muzzle,” explained David Emary,

Hornady’s chief ballistics scientist. “Until now, center-fire ammunition performance has been based on the IMR series of propellants developed in the 1930s and ‘40s.”

As such, the ability to enhance external ballistics or, in some instances, attain Sporting Arms and Ammunition Manufacturers’ Institute (SAAMI) standards, without exceeding established Maximum Average Pressures (MAP) has proved difficult, if not impossible. This is especially true with copper and gilding metal bullets, which not only occupy additional case capacity, thereby displacing propellant but, with longer bearing surfaces, also increase pressure.

Higher velocities have been, and still are, achieved primarily through the use of large, heavily compressed charges of slow-burning propellants, which also require solid crimping to prevent bullet migration. In its Mark V-series rifles, Weatherby further enhanced external ballistics through longer-than-normal freebore. Problem is, propellants used in such loads are of insufficient progressiveness, and therefore unlikely to be consumed before the bullet exits the muzzle—especially when



Hornady Superformance

Through advances in propellant technology Hornady has found a way to enhance the external ballistics of existing cartridges without increasing pressures. But, that’s only the beginning.

BY AARON CARTER, Managing Editor

using lightweight projectiles. The result: For a modest increase in velocity, the trade-offs are generally increased recoil and report, oftentimes lackluster accuracy, and higher ammunition prices. With its Light and Heavy Magnum-series ammunition, Hornady experienced these trade-offs, too.

Loaded via a dual-mechanical-compression procedure, not only was consistency difficult to maintain, but the process was also time-consuming and, requiring greater amounts of costlier propellants, forced prices significantly higher than those of the company's Custom ammunition. With this, Light and Heavy Magnum was unsuitable for semi-automatic rifles and, according to Emary, "... resulted in fierce recoil and concussion" It also proved finicky at times—especially when used in light-barreled and poorly bedded rifles.

Certain cartridges also proved problematic. "We never understood why, but with the 7 mm-08 Rem. and 7 mm Rem. Mag. Light and Heavy Magnum loads we struggled with accuracy," said Emary. "We tried flat-base and boattail bullets but never got what we expected on a consistent basis."

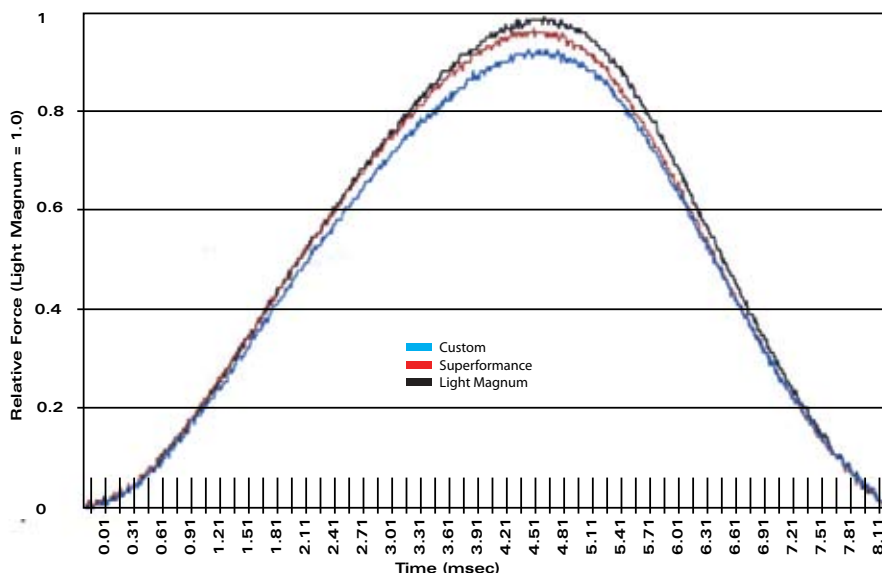
"Light and Heavy Magnum was something I wanted to address for a long time," said Emary. And that he did.

Changing The Rules: Superformance

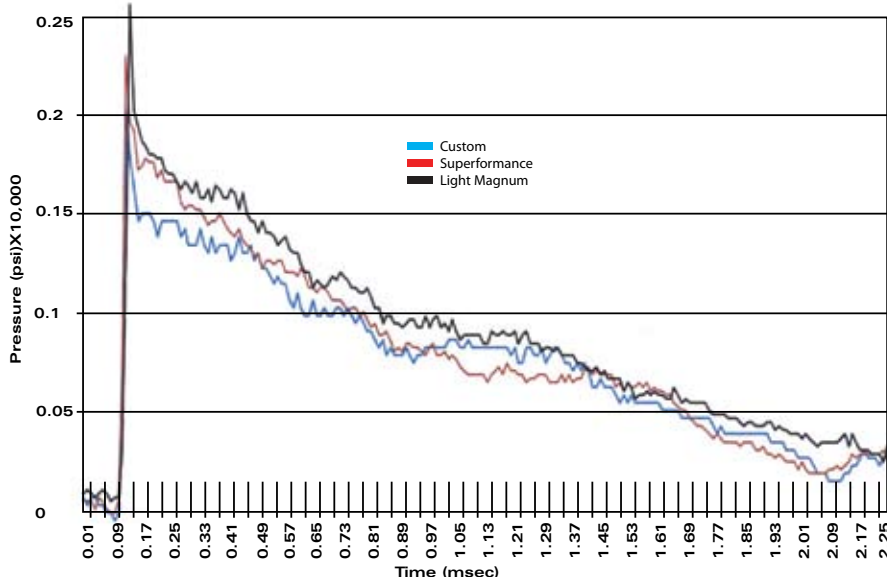
"When developing the .35 Rem. LeverEvolution load in 2004, we needed a propellant that yielded high performance, yet burned quickly, as it is a low-pressure cartridge and typically chambered in short-barreled lever-actions. Essentially, we needed a highly progressive powder," explained Emary. As no such propellant existed, Emary, working with Hornady's supplier, manipulated one of the company's propellants to meet his performance requirements.

In 2006 propellant technology used in LeverEvolution was

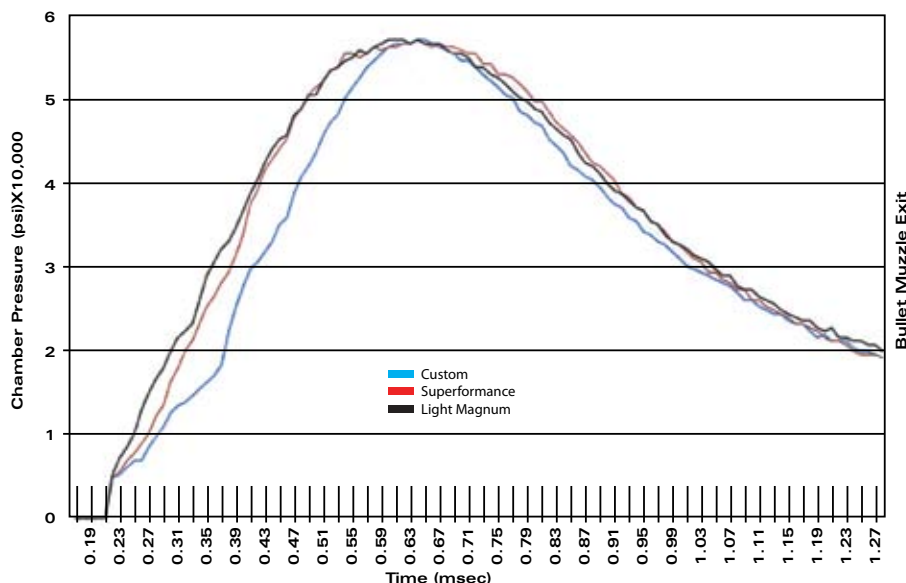
Relative Recoil Force 30-'06 Sprg. 150-gr. SST

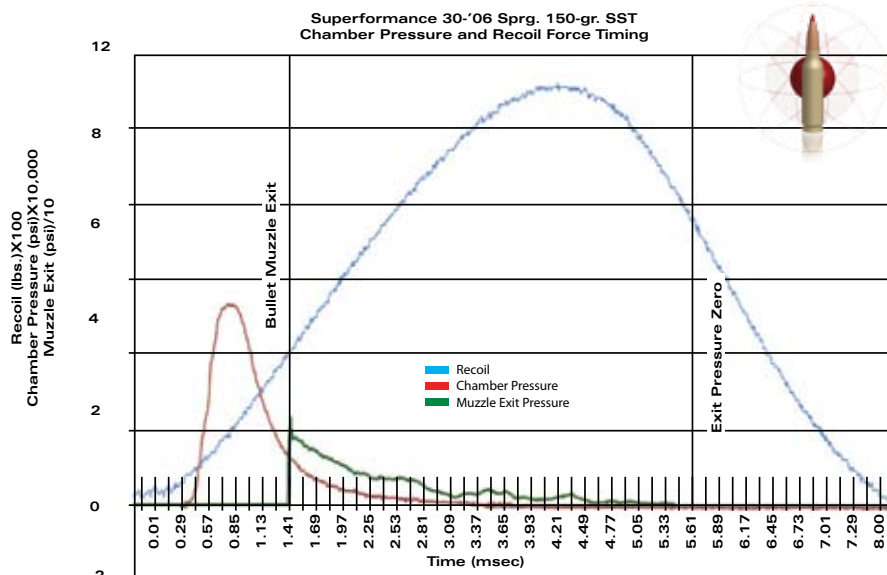


30-'06 Sprg. 150-gr. SST Muzzle Exit Approach



Chamber Pressure 30-'06 Sprg. 150-gr. SST





Tables courtesy of Hornady Mfg. Co.

reapplied in the development of the .300 and .338 Ruger Compact Magnums (RCM) (September 2008, p. 68). As the RCMs featured short, squat cases, and the rifle that would chamber them, the Ruger M77 Hawkeye, was set to have a short, 20" barrel, once again a highly progressive propellant was required.

By using technology from the LeverEvolution and RCM projects, combined with his understanding of propellants, Emary concluded that by working with a range of burn rates, along with technological advancements in propellant chemistry and mechanical processing, he could address the problems associated with Light and Heavy Magnum loads. Five years' research and testing of propellants culminated in Superformance ammunition.

Featuring custom blends** (see note, p. 85) of propellants that fill the case, but are not compressed, and representing upward of 15 percent less propellant than comparable

Light and Heavy Magnum loads, Superformance typically achieves 100 to 150 f.p.s. higher velocities than SAAMI standards in all cartridges and bullet weights and types—without exceeding listed MAPs. The largest gains are in light-for-caliber and solid copper and gilding metal bullets. Better yet, the loads are extremely temperature insensitive—from 15 below zero to 140° F—and produce less recoil. How so?

According to Emary, "The flattened-shaped propellants, which have a deterrent specifically placed to optimize progressiveness, as well as a surface coating to improve temperature insensitivity, are designed to be consumed before the bullet exits the muzzle. This allows a higher percentage of the available propellant energy to be transferred to the projectile rather than be blown out of the end of the barrel, and results in a lower muzzle exit pressure and velocity of muzzle gases, thereby reducing recoil."

Superformance Strikes From The 6.5 Creedmoor

Superformance's true value comes in the form of enhanced external ballistics, which in turn betters terminal performance, making said loads superior in the field to the company's previous offerings—particularly for recoil-intolerant individuals. Simply stated, increased velocity translates to flatter trajectory and additional downrange energy, both of which are desirable for hunting.

To field-test Superformance I participated in Nebraska's special three-day antlerless whitetail deer season last October. Hunting during, and immediately after, an unusual early season snowstorm, wildly swinging temperature changes would normally make one doublethink variances in downrange performance—not so with Superformance, as it is temperature-insensitive. Combined with excellent accuracy and less trajectory guesswork, Superformance gave me greater confidence when an opportunity arose.

When, in the waning light, a dry doe 128 yds. distant presented an appropriate angle, the 129-gr. SST from a 26"-barreled Ruger M77 Hawkeye in 6.5 Creedmoor (March 2009, p. 40) performed as advertised. The SST, which wasn't recovered, penetrated the shoulder, heart, lungs, and liver, and the deer left no ground disturbance, indicating the much-desired "instant" death.

While the SST's terminal performance was admirable, so too were the external ballistics and recoil of the 6.5 Creedmoor. For those desiring excellent downrange performance without the unnecessary recoil, be it for the recoil-shy, individuals of small stature, or even those desiring something different, the 6.5 Creedmoor is just the ticket—especially when loaded with Superformance ammunition.

—AARON CARTER

PERFORMANCE COMPARISON OF HORNADY'S .30-06 SPRG. LOADS

LOAD	BULLET WEIGHT/TYPE	VEL. @ 15' (F.P.S.)	ENERGY (FT.-LBS.)	PRESSURE (P.S.I.)
CUSTOM	150-GR. SST	2927	2,853	59,000
LIGHT MAGNUM	150-GR. SST	3067	3,133	58,100
SUPERFORMANCE	150-GR. SST	3065	3,129	57,800

VELOCITY, ENERGY AND PRESSURE MEASURED USING AN OEHLER SYSTEM 83, MODEL 55 INFRARED SCREENS, AND CHAMBER PRESSURE TRANSDUCER WITH A STANDARD SAAMI TEST BARREL. ABBREVIATION: SST (SUPER SHOCK TIP).





How are Superformance loads optimized? "For each load the first thing is to establish a maximum charge weight that can be reasonably machine-loaded trouble free," explained Emary. "We then blend propellants to achieve this charge weight and a specifically shaped pressure curve, flat top peak or as near to that as possible, and then do a series of tests to evaluate temperature sensitivity and accuracy. The tests are repeated a number of times with different primers to arrive at the highest possible performance from the standpoint of velocity, accuracy and uniformity."

As can be expected, Superformance's higher velocities make bullet selection critical. Unlike Light and Heavy Magnum, Superformance does not include Hornady's flagship InterLock bullets; rather it employs only the "premium" Super Shock Tip (SST) and Gilding Metal eXpanding (GMX) (see p. 26) projectiles. "The introduction of the GMX couldn't have come at a better time," emphasized Emary.

Superformance's Benefits In Detail

Emary's findings show that, when comparing Hornady's three 150-gr. SST .30-'06 Sprg. options, the chamber pressure of the Superformance load drops to, or below, that of Custom before the bullet exits the muzzle, and is significantly less than that of Light Magnum. That said, in a SAAMI-standard barrel and with 58.5 grs. of propellant, the Custom load attained 2927 f.p.s. at 15', while Superformance, with 61.0 grs., reached 3065 f.p.s. With a 67.0-gr. charge weight, Light Magnum's SST hit 3067 f.p.s.

According to Emary, "The maximum muzzle exit pressure of Superformance falls in between that of Custom and Light Magnum; however, the muzzle exit pressure for Superformance quickly drops to the same level or less than Custom and is always less than Light Magnum. The lower exit pressure, along with the rapidly dropping chamber pressure, results in low-velocity gases at

the muzzle, which reduces the recoil of Superformance ammunition."

Using the same SAAMI test barrel fitted with chamber pressure and muzzle exit pressure transducers mounted in rests on a linear bearing—thereby allowing only rearward movement—Emary evaluated the aforementioned Hornady .30-'06 Sprg. loads. His findings were remarkable. Within 1.46 milliseconds (msec)—1 msec equals one-thousandth of a second—the bullet exited the muzzle, and it took 5.68 msec for the muzzle exit pressure to drop to zero, indicating all gases were expelled. From this, Emary concluded that recoil force after the bullet exits the muzzle and before the muzzle exit pressure drops to zero was from gases and propellant residue leaving the barrel. Emary attributed recoil force after muzzle pressure reaches zero—in this case, approximately 8 msec—to final momentum transfer from the remaining recoil velocity. The results show 85 to 90 percent of recoil occurs *after* the projectile exits the muzzle.

How does this apply to Superformance? Reduce the volume, pressure and velocity of the gases, and the forces exerted on the gun will also be reduced, thereby lessening recoil. That's exactly what Superformance's highly progressive propellants are designed to do. Emary reports, "Superformance produces significantly less maximum and total recoil impulse than Light Magnum yet produces the same velocity, and reaches recoil levels at or below those of our Custom loads on the back side of the pressure curve." Interestingly, Superformance is also safe for use in semi-automatic, lever-action and pump-action rifles.

Besides enhancing external ballistics in standard-length barrels, Superformance's propellants minimize velocity loss in shorter barrels. Testing with a .300 Win. Mag.-chambered barrel revealed through progressive shortening that



the average velocity loss is 18 f.p.s. per inch, which is about a third that of standard loads. Slow-burning propellants need barrel length to be consumed—not so with Superformance's progressive blends.

Comparing Superformance To Existing Loads

How does Superformance stack up to existing loads? To answer this question, I recently visited Hornady's factory, where Emary and I compared Superformance to standard, off-the-shelf ammunition: the competition's, as well as Hornady's. To say it was an eye-opening exercise would be an understatement.

Using a SAAMI-standard 24" .243 Win. barrel and an Oehler System 83 with Model 55 Infrared screens, Hornady's 95-gr. SST Light Magnum load attained 3159 f.p.s. at 15', while producing an average 57,600 p.s.i. chamber pressure. With the same bullet, Superformance achieved 3175 f.p.s. at 55,900 p.s.i. A competitor's load, also with a 95-gr. projectile, averaged 3093 f.p.s. at 55,600 p.s.i. Further testing revealed that Hornady's 80-gr. GMX reached 3397 f.p.s. at 57,300 p.s.i., while a competitor's 80-gr. load averaged 60,000 p.s.i.—the SAAMI-listed MAP is 60,000 p.s.i.—to attain 3427 f.p.s. A single 85-gr. load hit 3270 f.p.s., but did so with a 55,900-p.s.i. average. SAAMI standard for an 80-gr. projectile is 3335 f.p.s., while a 95-gr. bullet is listed at 3060 f.p.s. The increase in velocity was obvious, as was the competition's proximity to the MAP with certain loads.


Velocity gain occurred across the spectrum of loadings with Superformance. Take the .300 Win. Mag. for example. With a 150-gr. GMX, at 15' Superformance attained 3400 f.p.s. with a 61,200-p.s.i. average, and a 180-gr. SST reached 3112 f.p.s. at 59,600 p.s.i. In comparison, a competitor's 150-gr. projectile reached 3232 f.p.s. at 57,700 p.s.i., while a different competitor achieved 3001 f.p.s. with a 180-gr.

bullet and a 61,500-p.s.i. average. Considering the SAAMI-listed .300 Win. Mag. MAP is 64,000 p.s.i., and SAAMI standard for said projectile weights are 3285 f.p.s. and 2960 f.p.s., respectively, Superformance's velocity gains are readily apparent and significant.

Pressure curves—including Light Magnum's—of the various .243 Win. loads revealed what was felt from behind a range safety door: concussion. Superformance's was noticeably less than that of Light Magnum, as well as that of the majority of the competition, due to the progressive nature of the propellants. True to Emary's findings, trigger time also revealed noticeably less perceived recoil than with the other loads—especially Light Magnum, but with other loads as well. This allows shooters, particularly those who are recoil-shy or intolerant, to get better performance without significantly increasing recoil.

How does Superformance perform in terms of accuracy? From a 24"-barreled Remington Model 700 Alaskan Ti in .30-'06 Sprg. fitted with a Zeiss Conquest 3-9X 40 mm scope, five consecutive, five-shot groups with the 165-gr. GMX load averaged 1.18" at 100 yds. As this was pre-production ammunition, one can only imagine the potential of the final loads.

What's equally as impressive as Superformance itself is its price. According to Hornady, it will cost approximately \$1.50 to \$2 more per box than Custom, and \$4 to \$7 less than Light or Heavy Magnum. As can be expected, Superformance is replacing Light and Heavy Magnum, so these loads will no longer be manufactured.

So, does the axiom, "There is no such thing as a free lunch," hold true? While Superformance may not be a "free lunch," at least in monetary terms, its numerous practical benefits are well worth the small additional cost over its Custom predecessor. 

****Under no circumstances should a handloader attempt to blend propellants. Always follow handloading data from reputable resources exactly.**