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KING OF THE DEUCES

The .224 comes into its own as a long range cartridge

By L.D. Standish

What if I told you I have a .22 that makes a .220 Swift look like a defective mortar, and leaves a .224 Clark standing in the dust? What if I told you it would even equal or better the 6-.284's statistics, and the brass is available from all the major suppliers, including Norma, Lapua, Winchester, RWS, and Remington? What if I said the brass is easy to form, with no case loss or headspace problems? You're probably thinking "Yeah, anyone can put together a barrel burner, but they usually don't shoot that well, and who wants to be a chronograph king, anyway?". Well, what if I said accuracy is superb, 1,000 yard ballistics are impressive, and barrel life is probably right up there with the .22's and 6 mm's that can't keep up? Would you be interested then? If so, read on.

My wife says I'm way past obsessed with guns in general, and rifles in particular, and she's probably right. But, when George Vais called to ask me if I wanted to help him experiment with a new long-range cartridge he had dreamed up, I couldn't "just say no". George is quite allergic to some of the pollens around here, sagebrush being among the worst, which limits his opportunities to field-test rifles. He is also a one-man shop, so he is tied down with business much of the time. As a result, he asked if I would be interested in having a custom-built, long-range .224 varmint rifle dirt cheap. He explained that he had an idea for a high velocity .224 set up to shoot 80 grain VLD bullets, but he needed some help with the load development and field testing of his new baby. I agreed (immediately, and with no arm twisting) to defray the cost of parts and materials, and do the loading and shooting.

Next day, I drove over to the shop to talk more about the project. When I got there, George was on the phone with Dave Kiff, at Pacific Precision Grinding, describing the forming and finishing reamers he would need for chambering and die making. To be dubbed the .224 Vais (what else?), the new cartridge was to be a necked-down, blown-out 6.5 x 55 Swedish Mauser with a 35 degree shoulder, for which there is a plentiful supply of brass. Rifle bolt faces for the .243 would fit with no alteration. George had designed the case with dimensions which would eliminate the headspace problems sometimes associated with the Ackley-type "improved" cartridges by moving the shoulder back slightly from its location on the parent case, rather than attempting to blow it forward. Cases could then be formed by simply running them through a standard sizing die (also made by him), which would reduce the neck and shove the shoulder back the necessary amount. Following this, the necks would be turned, and the case would be ready to be fire-formed. After George had explained what he wanted, Dave responded "no problem", and promised to get started on it right away.

A short digression on the case may be in order here. Some of you may be questioning the choice of the 6.5 Swede as a parent case, noting that it was not originally used for the kind of pressures which might be anticipated with the .224 Vais. I can tell you that, after 150 rounds, I have not experienced any problems in this regard. Some of my cases have been fired 6 times at this point, and some have had the necks sized and expanded more than twice that while fiddling with loading procedures. None have failed in any manner. The only pressure signs noted were extractor hole marks on the base when a load 3 grains over what was ultimately determined to be maximum (velocity over 3,900 fps) was tried during initial load

development. Granted, many of the early telltale signs, such as difficult bolt lift and extraction, don't always show up along with excess pressure when using cases with minimum taper and a powder like Reloader 22, but cases were watched carefully, and no danger signs were noted when proper loads were used. Obviously, George's meticulous work on the chamber and dies must get part of the credit, but I also believe the case is completely safe for this application. I took the liberty of asking the Lapua importer what he thought on this point, and was told that Lapua brass is formulated of a true 72% copper and 28% zinc alloy, with dimensions conforming to European CIP specifications. I was also told that all brass is tested to 30% overpressure. CIP specs for the 6.5 x 55 list pressure as 330 MPa, which translates to 47,862 psi. At 30% overpressure, this would be about 62, 220 psi. Remember, that is what it is tested to, not necessarily where it fails. George also cut the base off some cases, including Winchester, Remington, and Lapua, and did some measuring. Winchester .284 cases of recent manufacture were a little thicker at the base (presumably to compensate for the wider extractor groove), but there was not a tremendous difference between .30-06, .22-250, .243, .270, 6.5 x 55, and other cases at this location. Wall thickness was also essentially the same. The only notable difference is in the quality of manufacture, where the Lapua cases are far and away the best, showing great uniformity of flash holes without burrs, and with a smooth, level surface surrounding the flash hole (see photo). Norma brass is very similar to the Lapua in this regard, but seems a little softer. I picked some cases at random and sectioned them longitudinally at the base to photograph for this article, and found some differences between Lapua and U.S. brass which I feel are probably due to tolerances employed by the U.S. manufacturers. These differences can be more or less pronounced, with variations between different lots produced by the same U.S. manufacturer. The photo illustrates several interesting features of the different cases, the particular R-P .25/06 case pictured being the worst in terms of both strength and uniformity. The key thing to remember is that if the chamber is properly cut so that a significant portion of the web is enclosed by the chamber, rather than protruding from it, the danger of case failure at the web is very greatly reduced.

Meanwhile, after getting the reamer ordered, it didn't take too long to decide what the launch pad for his new rocket would be, as George already had it pretty well figured out. As usual, he would start with a Remington 700 short action, trued and fitted with a Sako extractor and Davidson ramp. To this, a stainless Kreiger 1.25" x 30" barrel in a 4-groove, 8 twist would be fitted, complete with the Vais Muzzle Brake for which George is so well known. Chambering and setup would be done with the intent to use 80 grain VLD's. A 6-inch aluminum barrel block would be carefully machined, epoxied to the barrel just ahead of the action, and inletted and bedded into a McMillan stock of the Tooley MBR persuasion.

A couple of weeks later, the reamers arrived as promised, and George's vision began to take shape as the other components were delivered. The barrel block was bedded and attached to the stock via two cap screws running through machined stainless steel escutcheons in the stock, and the barrel and action were floated. George even made "dummy" action screws to help keep solvents and dirt from getting into the stock and trigger. Did someone mention "trigger"? When George had the rifle pretty well along, he told me to try the trigger. He explained that Remington had changed their manufacturing to use a sear that is plated metal of some kind which doesn't permit the stoning, etc. that he normally does to smooth and reduce the pull on one of these jobs. The upshot was that the trigger was kind of stiff, but there was nothing else to be done -- one either liked it, or didn't. I was a little distracted at the time, as I was getting ready to go antelope hunting, but I told him it would be okay. I must have been frowning a little when I said that, because when I returned to his shop a week later, George had the rifle ready to go and told me to try the trigger again. This time, it was crisp and light -- the kind that makes you let out an involuntary chuckle when you try it the first time. George had taken another Remington trigger and reworked it into a lever type, with a pull of 4 ounces or less. What that guy can do with a factory trigger!

For this rifle, I wanted a scope that would give me considerable magnification, along with a reticle which could also help some with range finding and holdover. I debated custom reticles and high dollar scopes, but costs led me to give the Mil-Dot system a try. I wound up with the new 8.5X - 32 X from Pentax, with the mil-dot reticle. This unit worked very well, and I'll possibly elaborate on it in the future, after I have a chance to test it further. The whole job with scope weighed in around 18-1/2 pounds, which was about where we wanted it.

In actual practice, the case forming worked out exactly as George had planned. There is no case loss whatever. On the softer brass, such as Norma, moving the shoulder back results in a very slight bulge at the shoulder/body junction as it expands to where the sides of the case will be when fire formed. This is purely cosmetic, affecting nothing, and disappearing during fire-forming as the sides of the case straighten out. The chamber length is based on the case length of the 6.5 Swede, so cases will chamber as they come out of the dies, and can be trimmed for uniformity after the first firing. The process results in a case with a fairly long neck which, combined with the 35 degree shoulder, is thought by many to increase barrel life. The sized Lapua brass (prior to fire-forming) will hold slightly over 49 grains of Reloader 22 to the base of the neck, and fire-formed cases will comfortably hold about 54 grains when filled to the same level, all making for a very efficient cartridge when compared to others delivering less performance.

Neck diameter of the .224 Vais chamber is .254", so we determined loaded rounds should probably measure about .252" at the neck. Our reasoning was that the relatively slow Reloader 22 would seem to be the powder of choice for this little screamer, so neck tension would likely need to be a little on the heavy side for good ignition. As a result, some care would have to be exercised in turning the necks to achieve the right amount of tension without making the bullets so difficult to seat that noses would be deformed, or uniform seating depth not achieved -- not unusual for the smaller calibers. Norma and Lapua brass was chosen for testing because they tend to be more uniform and dimensionally true than brass of American manufacture. Also, the neck wall thickness is usually greater, allowing the whole neck to be turned down to achieve a uniform thickness for the entire length and circumference. The neck expander mandrel/die setup marketed by Sinclair International is a big help in this department, as the reduced neck is a little hard to get over the turning mandrel. Cases are sized again after turning to restore the neck to proper diameter.

Having prepped and primed some cases according to this plan, I set off for the range, where a 15 - 20 mph tail wind promised to spend the afternoon with me while trying to decide from which side of my tail it wished to blow. After reminding myself that the ability to buck wind was one of the main reasons behind this new cartridge, I clamped the powder measure down and got set up to find out what George's brainchild would do. Using Reloader 22 powder, and 80 grain JLK VLD bullets, fire-forming was going along nicely with a conservative charge and bullets seated .010" off the lands. Seating was accomplished with the in-line hand seater he had made (tolerances of which are such that the bullet slowly floats down to the cartridge neck on a cushion of air when dropped into the seater). Groups, with the barrel cleaned after every shot, were running a little less than _ inch. Being the impatient person that I am, I decided to up the charge a little, so I started creeping up until I began to see signs of pressure. At this point, the chronograph was steadily showing velocities in the neighborhood of 3,860 fps+ (!), but the accuracy was falling off slightly, so I backed off the charge by about a grain and a half. The rifle had now begun to settle in, and was delivering groups in the low 3's while fire-forming and keeping the bullets .010" off the lands. The 1-1/2 grain reduction in powder resulted in an average velocity of 3750 fps, which is still plenty fast. The Kreiger barrel was breaking in nicely, and cleaning was a snap, with almost no copper fouling after the first few shots. The rifle's weight, combined with the (almost) straight-bottomed buttstock and George's muzzle brake, made it possible to watch bullet impact most of the time. I headed home feeling pretty smug about the whole thing.

Although capable of making any type die, George had initially furnished standard press dies for sizing and seating, plus a hand seating die, all of which had already been heat treated. During the initial testing, I determined to get a bushing type sizer. To avoid the delay associated with having George make a new die and ship it for heat treatment, etc., I sent the already-hardened sizing die off to Jim Carstensen for conversion to a bushing type die. Jim advertises this service in PS's Trading Post, and I like bushing dies because they offer more control over neck tension. There is a fine line between too much and not enough with this cartridge, and standard dies just can't provide the range of control I wanted. Jim's conversion involves machining the inside upper portion of the die to remove the neck, and rethreading it to accept an aluminum insert (which he also provides) to retain a Wilson type neck bushing. The aluminum insert is also threaded to accept the original decapping stem and retainer (with ground-down expander ball). Jim does a nice job, and even went to the trouble to stamp the top of the aluminum insert ".224 Vais". George then made up four different sized bushings so we could experiment to find which worked the best. In general, I had found that a neck thickness which resulted in a loaded round with neck diameter of .253" was required for the standard type die to reduce the neck sufficiently for the expander ball to create the proper neck tension when pulled back through the case. Use of the bushing die allowed the neck thickness to be reduced more. In turn, the reduced neck thickness permitted easier seating of the somewhat delicate JLK's, and improved accuracy.

My next sessions at the range allowed me to use previously fire-formed brass, and to fine tune loads for charge weights and seating depths. As the barrel completed breaking in, velocity and accuracy increased a little, while safe charge weights remained the same. For some reason, seating depth of .004" off the lands seemed best with the JLK's. With the barrel broken in and load testing and tuning complete, the .224 Vais is consistently turning in groups mostly averaging in the low to mid 2's at a measured average velocity of 3,773 fps (10 feet from the muzzle). I believe the gun will do even better in the accuracy department, as I'm not the best wind doper, and a fairly stiff, changing wind has attended every shooting session so far. Most bullet manufacturers will also tell you that this kind of accuracy at 100 yards is very good for the VLD's, which are designed to shine more brightly at longer ranges.
Shown in Table 1 is a comparison of the ballistic performance of this cartridge with some well-known "benchmark" cartridges. The difference in performance is significant. My 6 mm/.284 turns in an honest average velocity of 3,412 fps, so I used that figure for the chart. I will admit right now that a 6 mm/.284 can be goosed up a little faster, but my experience indicates that pressures start to stretch pockets and enlarge flash holes when velocities are pushed much higher -- a practice I'm not comfortable with. I couldn't find any good data for the .220 Swift using 80 grain bullets, and so was forced to use

data for 60 grain bullets; however, it's obvious that the Swift wouldn't look any better with data for the heavier pills. In similar fashion, the .224 Clark data was taken from Layne Simpson's article published in "Wildcat Cartridges, Volume II". Downrange velocity, wind drift, and drop were calculated with Sierra's "Sierra 3" ballistics program using a sight height of 2.1 inches, a 100 yard zero, and typical altitude and climate for Boise, Idaho. The B.C.'s of the bullets used for the Swift and the Clark were unavailable, so were assumed to be the highest B.C. available for the given weight, while wind drift calcs were based on a 10 mph cross wind at 90 degrees to the line of sight.

	.220 Swift w/60 grain B.C. = .280 (B.C. assumed)	.224 Clark w/80 grain B.C. = .510 (B.C. assumed)	6 mm/.284 w/107 gr. Sierra B.C. = .555	**.224 VAIS w/80 gr JLK VLD B.C. = .510**
Muzzle Velocity	3,600 fps	3,609 fps	3,412 fps	**3,773 fps**
500 yd. Velocity	2,068 fps	2,694 fps	2,604	**2,828**
500 yd. Drift	23.8 inches	11.6 inches	11.3 inches	**11.0 inches**
500 yd. Drop	33.7 inches	25.3 inches	28.7 inches	**22.4 inches**
1,000 yd. Velocity	1,093 fps	1,927 fps	1,942 fps	**2,039 fps**
1,000 yd. Drift	130.4 inches	54.4 inches	51.6 inches	**51.0 inches**
1,000 yd. Drop	300.9 inches	172.7 inches	187.0 inches	**155.3 inches**

TABLE 1

The table speaks for itself. The .224 Vais has significantly less drop at longer ranges than any of the others, and a flatter-shooting cartridge obviously has the best chance of helping the varmint shooter overcome errors in range estimation. The .224 Vais isn't giving anything away in the wind department either, and handles both these tasks with considerably less powder than either the .224 Clark or the 6 mm/.284; a further indication of its efficiency and tendency to be easier on barrels. I have not listed my personal load data for this cartridge, and would prefer you have that discussion directly with George Vais, but I will tell you that this cartridge consumes significantly less powder than other 22's that are surpassed by its performance. It is quite efficient for such a high-velocity round!

While I was wringing out this cartridge, the rumor surfaced that Jimmy Knox would cease production of JLK bullets in January of 1998. Like many others, I panicked. I called him to confirm, and found that he will continue to produce bullets, but is trying to reorganize his business to relieve himself and his wife of the distribution end of things. During that conversation, I also learned that he had done a limited run of 90 grain .224 bullets. Although the bullets shot well, Jimmy was not satisfied with the shape. As a result, new dies are being made to produce the 90 grain bullet in a "little pointier" configuration in order to achieve the highest possible B.C. Jimmy says this bullet will be "like hen's teeth" for a while, but will have a B.C. of .580 (!), and will probably require a 7 twist to completely stabilize it. Barrels in .224 with a 7 twist are available, but I will certainly be trying it in my Kreiger 8 twist, just in case. Consider that such a bullet, assuming a conservative muzzle velocity of 3,500 fps, would theoretically show up at 1,000 yards (on Table 1) with a remaining velocity of 2,043 fps, drop of 172.3 inches, and drift of 47.3 inches. While the increased drop might be a small disadvantage for the varmint hunter, it seems the reduced drift might interest someone fighting the wind in a 1,000 yard match.

In summary, the .224 Vais brings the .22 centerfire into its own as a long range cartridge. With its impressive ballistics and inherent accuracy, it certainly deserves a look from the 1,000 yard clan, or anyone wanting to reach way, way out there. The 6.5 x 55 case would also make a damn good 6 mm, with ballistics pretty close or equal to the 6mm/.284 (probably with better efficiency). I'll bet one of these 6 mm's shows up soon, as the remaining supply of .284 brass will rapidly be gone. The .224 Vais is a joy to load and shoot, and I have to admit it's a lot of fun owning the only one around, but something tells me I won't have that distinction very long. My only regret is that I have to wait for spring to try it out on chucks.

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