Load Development for the Precision Rifle. By Jim See

I'm going to assume most of the readers here have at least an intermediate level of experience in hand loading ammunition. My previous articles covered brass prep and what I do to ensure my brass is ready to load, so no need to repeat any of that. What I am going to cover in this article will be based off the assumption that you just received a new custom rifle with 0-1 rounds fired through it.

Typically if it is a cartridge you worked with before, you know what bullet primer and powder has worked well in the past. Stick with those proven components and normally things will go pretty easy and predictable. When switching to a new cartridge there are many ways to get starting load info; reloading manuals, calling the 800 # from the powder suppliers, asking guys you know and trust who use the cartridge. Some rifle jockey who claims 2950 fps with 140s out of his 6.5x47 is not a reliable source. The Internet is still a good place to research rifle data, just look at enough data to get a true general consensus on what works. Don't rely on information from one individual. When 10 different shooters say 91 grains of H1000 under a 300 grain SMK is the go to load in a 338 Edge, you can have a pretty good feeling about that load selection.

My first goal in working with a new barrel is to "break it in" that doesn't mean I clean it every other round for 20 rounds. What it means is I shoot a very standard load through it until the velocities stabilize. Many of you understand, and for a few of you this is probably new. As a new barrel is fired it tends to shoot on the slow side, as more rounds are fired the barrel will slowly speed up until it stabilizes at a velocity that could be as much as 100 fps faster than what that same load shot when the barrel was brand new. I'm not going to get in to my theory of how and why this happens; I have written pages on it in other forums over the years. Sufficed to say it is a common occurrence and not likely noticed; unless you use a chronograph, or you settled on a load with your new rifle early on and 100 rounds later you were getting ejector marks and pressure issues.

This barrel speed up is the reason I NEVER do an exhaustive load development in the first 100 rounds through a barrel. What I typically do is load a "break in batch" of ammo at what I know to be a reasonably safe load for the cartridge I am loading. So in a 6.5 Creedmoor I will seat a 140 HPBT on top of a charge of H4350 that is about 1 grain lighter than what I typically run in my match guns, and seated .030" off the lands. Now I know from experience this load will shoot really well in most barrels and will allow me to evaluate the potential accuracy of my rifle while at the same time "break in" the barrel. I am not really concerned if this load shoots under ¼ moa or ¾ moa. It will likely change as I fire 100 of these "standard loads" depending on the velocity node the barrel likes and velocity change the barrel produces. Just a quick note on cleaning, I typically clean the barrel of copper fouling after the first 10-20 rounds fired, I then clean it when I hit 50-60 round mark. Typically at that point, in most cartridges, that fire bullets from 2800-3000 fps, the barrels are not copper fouling much at all.

Ok so let's assume we seen our "standard load" produce a velocity out of the gate at 2705 fps and now that we have 100 rounds fired it has increased and leveled off at 2780fps. I am now comfortable that the barrel has settled in and I can do more accuracy centered load development.
My best example of how I handle load development for a new gun can best be summarized by the

occurrences 8 days before the Bushnell Brawl. I received my new Surgeon Scalpel team gun in 6.5x47, which is a cartridge I never loaded for.

I called a couple guys who I heard used Hodgdon Varget in their 6.5x47s because I had a good supply of it at the time. From there I received good data on charge weight and velocities, as well as distance off the lands, barrel manufacturer used, and bullets they used. The consensus was 36.0-36.4 grains were going to get you in the 2750fps range after the barrel is shot in. I measured my bullet to lands and set my first load at 35.8 grains of Varget .030" off the lands with a 140 hybrid. Velocity out of the new barrel was in the low 2600 range. By the time I had shot 100 of those loads my velocity had climbed to the low 2700 range. Accuracy was very good, so I felt like I only needed to climb the velocity to the area that was safe and running at a speed I was comfortable with. With-in the next 30 rounds I had increased the charge weight so the rifle was shooting 140's at 2780 with Varget and .030" off the lands. This load was consistently under .200" at 100 yards, and shot very low vertical, less than 1" at 500 yards which was the longest distance I was able to check it at. From there I loaded 270 rounds and headed to the Rifle Ranch for some LR data 2 days before the match. My LR vertical remained very tight and I was confident in the load and rifle.

Now it's not always that easy, and since that match I have re-worked the load because the original load went out of tune. That is not usually the norm with the 6xc and 6.5 Creedmoors that I have used in the past. But it all goes back to the fact that every barrel is different and that becomes the challenge, and the frustration with consistent shooting. We must be able to recognize when a barrel and load are no longer getting along and modify our loads accordingly.
Some predictable patterns in my loading routine include;

I always start .030" off the lands, and I rarely change this unless I have a load at my velocity limit that needs fine tuning or a good load that has gone out of tune.

I, in initial load development, always try and tune my loads by modifying the powder charge weight only, and in 90% of the barrels I have dealt with this usually will meet my accuracy expectations. 2780fps that shoots in the sub ¼ moa range will always get the nod over 2825 in the ½ MOA range.

If I have a rifle that refuses to shoot my chosen components the first thing I switch is the bullet. Most of the time this alone will show accurate results. It seems on occasion you will get a barrel that just refuses to give you the accuracy with your first choice of bullet type/manf.

If a barrel will not shoot 2 different bullets; only then will I switch to a different powder. By testing the 2 bullets I conclude that if either will not shoot then I am using the WRONG powder.

I typically do all my initial load development shooting 100 yard dots, and then once I find a promising load test it at long range.
When I shot f-class at primarily 600-1000 yards I did just the opposite. I would do a Ladder test at 600 yards and ignore 100 yard groups.

Since I brought up the Ladder Test I will describe the process, some people call it other things but basically if I had a load that produced good accuracy and I really wanted to fine tune the load, as to get it in a wide velocity node but still hold small vertical at distance, I would do the following.
I would load .1 grain increment loads with-in the velocity range I was expecting to operate. So for instance in my .284 I might start at 56.5 grains and load up to 58.0. I would load 3 of each charge and then shoot the ladder 3 different times, one evening, the next morning, and then that evening. As you shoot these loads in order, there location is plotted on the target. I used a video camera on

the target, and then when I finished the string I would review the tape and label or number each bullet hole to its corresponding load. By the end of the process I had 3 targets to analyze data, and draw conclusions on the powder charge window that gave me the most forgiving vertical window. By doing this I could realize that even if my powder charge varied .2 grains high to low from one round to the next, those bullets may still land in less than X amount of vertical dispersion.

Our goal in f-class was a load that would maintain ½ MOA vertical at 1000 yards. So for example if the load of 56.9, 57.0, 57.1 and 57.2 maintained 1.5" of vertical at 600 yards I was confident that if I settled on the load of 57.0 I would have a load that could have a variance of +- .1 grain and still remain in the accuracy node giving me sub ½ MOA vertical. This process takes patients and the ability to sit down and get consistent results. If your shooting form or comfort level is different during this test your results may not be super consistent. With an f-open rig on a Seb rest and a rear eared bag full of heavy sand a lot of the human error was removed. Trying this with your precision bolt gun on a bipod requires very good form. I have not done a ladder test with my PRS guns, it is a bit time consuming, but I feel like it would be a help in making a consistent and forgiving load.

The last thing is maintaining your accuracy through the life of your barrel. I tend to try and operate in the velocity range that gives me good accuracy so when bullet velocity diminishes as the barrel continues to erode and wear out, I add powder to my charge weight until I get in the velocity node that was shooting great with that barrel. I velocity check the new charge weight and once I'm back up to speed I load the batch of ammo. (200-350 rounds) This alone usually gets my data back on track for at least one more match out of the barrel. If the barrel is still shooting great I will repeat the process and try to get another match out of it. Some people adjust the seating depth closer to the eroded lands to re-tune a barrel that is ageing, I rarely or never do this, I found adding powder to be the easiest fix.

I hope you can draw something out of this article; none of it is witch craft, just a process I stick with because it has worked for me. 20 years ago I used to get all wrapped up in trying different powders and bullets because that was part of the fun. Now I look for the one easy load and stick with it.

Keep it on the steel, Jim