

U.S.I.M.L.T.

Long range Coaching update #3 2012

In the most recent update I reported on some of the experiences and testing that was going on with a few of our competitors. As I begin this update, I have no more exciting things to report other than there is a lot of shooting and testing going on by the competitors as the weather begins to get nicer around the country and they find time to get to the range.

I thought I would begin this update by expanding on something I mentioned at the end of the last one. My incremental approach to improved shooting.

I started everyone off by attempting to get them to prove how accurate their rifles are, not at long range where all the skills of a rifleman come into play, but at short range where anyone should be able to shoot well. Some have done so, others have not.

Even this simple test requires that many things must go just perfectly or accuracy even at this short range is impossible. Even this test is testing the rifle, the components, the cleaning and loading technique, and the shooting ability of the rifleman. If the performance of this simple test is not up to par, then we must begin to identify, isolate, and eliminate the problems.

I mentioned at the end of the last coaching update, that "everything" that affects where the bullet lands on the target falls into three simple categories;

- #1, The condition of balance of the bullet as it exits the muzzle.
- #2 Where the muzzle is pointed when the bullet exits.
- #3 The external forces such as wind that effect the trajectory of the bullet after it exits the muzzle.

When I asked everyone to shoot at short range it was simply to isolate problems by eliminating variables. At short range the external forces are minimized, so we can test and work on the other two remaining categories without the effects of the external forces making it more difficult.

Even though I asked for short range groups, I continue to get targets fired at 200 or 300 yards. That does not make it impossible to diagnose problems in the other two categories, as you will see later on in this update, but it does make it more difficult and less precise.

The first and most important category to work on is the first mentioned above. Bullet balance! Without that being correct, all the rest is a waste of time. That is why I have beat that drum so long and loud so far. If your bullets are tipping at 50 yards, and you go shoot a target at 200 or 300 yards, you are wasting your ammo and my time.

Once you have your bullets flying true and balanced then it becomes a

matter of getting good enough with your rifle to be able to put it all together for a dozen shots or more. That is where most of us are at right now. Some have moved beyond this point by proving that their rifles will shoot well, and they themselves have done it for a long series of shots, and are ready for the next skills tests. Others have more work to do.

For those that are ready to move on, I thought I would share my thoughts on the various skills that need to be perfected to be a technically fine shot at all the distances. It's simple from this point really.... you have proven that your rifle is accurate, you have proven that you can make it perform for a long series of shots, so now you just need to learn to support the rifle in such a way that it can perform to it's proven ability from the positions we use while shooting in competition, (sling and wrist rest).

Then prove that you can do that at the longest and most uncomfortable positions we use each of those positions at.

Just in case that didn't make any sense, you need to learn to shoot from the sling and the wrist rest at short range and perform as well as you did in your initial testing (or as near as possible), then prove that you can do it again with the sling with the sights set at 600 yards, then once again from the wrist rest with the 1000 yard setting on your sights, and maintain the performance you had at short range.

Once all those skills are perfected, there is just wind reading and mental preparation, and you are ready to win any match you go to. If you passed your initial testing while shooting from a wrist rest or sling, then you are already further along than those that passed while shooting from a bench.

So, as you can see, if you perfect the accuracy of your rifle, and perfect the techniques of "any" solid position before you start learning the proper techniques for the other positions, it makes learning them a lot easier. You just build upon what you learned at one stage as you move along to the next.

In the same way, if you learn the proper techniques for the sling and wrist rest at short ranges, then switch to the proper position for the longest distance, you can work out the bugs of your position and learn what it takes to make it work in the more difficult longer range positions. This does not need to be done at the longer distance, in fact it can be learned much easier at extremely short distances.

Once all those things are mastered, then it is time to learn to read the wind. Then we will work on mental preparedness, and etc. Common sense would show us that you can not learn to read the wind when shooting an inaccurate rifle, nor will mental preparedness help you win a competition when your rifle is not capable.

As I write these coaching updates, I find the hardest part about it just getting started. I tend to try to report what is being learned, what tests are being done and etc, and when I report all of it up to date in one update there is nothing to write about for some time. So getting started on the next one is hard to do.

When I started putting this update together, there was nothing new to report, so it was slow going. In the weeks since I started this update there has been quite a bit of stuff going on that I want to share with you, and I feel like I should start writing some position tips for those who are ready to move on, so this update may be a long one.

Shooting reports

Let's begin with a personal coaching weekend I had a couple of weeks ago with Brice Harper.

Most of you do not know Brice. He is relatively new to our crowd, he has shot at Oak Ridge a time or two, and this spring he did well there at the 1000 yard distance with a borrowed rifle, by shooting an 80 for 3rd place at that distance.

I have known Brice for a several years and have shot with him a number of times. He is one of the finest natural shots I have ever known. Meaning he just shoots well a lot of times without actually knowing why he just shot so well. He is an excellent trigger puller, and an overall steady hand with a rifle.

He has shot a Pederosli sharps rifle for a number of years in black powder cartridge competitions, and has borrowed a rifle from Mom Yee to shoot a few muzzle loading rifle matches.

To give you an idea how steady he is, the first time he went to the black powder cartridge rifle matches at Raton, NM, he entered the mid range prone match with his Pedersoli sharps rifle, and on the first day he shot a 100 with 9 x's at 200 yards, on the second day he shot a 100 with 8 x's, to win the 200 yard aggregate match. Just think.... that means that in his first big match he shot 17 of 20 shots into a three inch circle at 200 yards. I personally have never shot more than 5 x's in 10 shots, at that distance. Granted he did it shooting from a set of cross sticks, and I did it with a sling, but that takes nothing away from his ability to shoot well.

Needless to say I was quite pleased when earlier this year he made up his mind he wanted to get more serious about the long range muzzle loading competitions, and make an attempt to start shooting international matches with us. We are always wishing we could get some younger people involved, and here is a 34 yr old fella with great potential, so when he wanted to put a rifle together I was quick to assist him. He lives in Dodge City, not far from Mon Yee, and one of them found a donor action just like the one on Mon's Wesson reproduction rifle. I offered I had a Green Mt. barrel that was not being used, Mon fixed him up with a nice piece of wood, and over a couple of weekends we put together a nice little rifle for him to shoot.

Once it was finished, Brice came over to spend the weekend and pick it up, and go to the range and shoot it with me to get some good zero's and basically get a good start in a place where the wind does not blow so much the trees all have a northern lean to them.

We had a .22 rifle silhouette match out to 200 meters scheduled for that Saturday, so Brice and I shot together during that match, then after it was over we broke out the muzzle loaders and went to work.

We went to the 100 yard range, and set up. That range is pushed back into a hill so there is a tall burm behind the targets, a cut of the hill on the right side, and fully surrounded by trees on three sides. The wind was pretty brisk and swirling that weekend, and sometimes you could hear a gust coming through the tops of the trees a full 30 seconds before it arrived. Because

of the hill this range is pushed into, a head wind is coming down the hill and becomes a bit of a down draft in most cases, so it has a few peculiarities about it like many other ranges.

Since Brice is experienced with shooting from a set of cross sticks, we decided he would start off shooting the rifle that way to prove it's potential before going on to other positions.

Mon had sent a bunch of his bullets along to get Brice started (they just happened to be the same bullets that Mon shot that sub moa group with that I reported last time), and I had a bunch of powder charges thrown, so the testing was done with Mon's bullets and my powder charges, and the loading and cleaning techniques that Mon and I have developed over the years. (And not with the cleaning solution that we decided was causing problems!)

His first shots were low and left. We got him on the 100 yard target in two shots, but as we moved the groups up onto the target, we realized that it was making a group about a half inch wide and three to five inches tall.

This type group is typically caused by a harmonic problem, so since he was shooting with the barrel on cross sticks, we checked a couple of spots for the sticks under the barrel and I tested it for a harmonic dead spot.

Normally there will be a nice dead spot in the barrel where you can put the sticks and the rifle will not bounce around in the sticks causing stringing like that, but on this rifle there was not a definite dead spot, So I decided perhaps we would go directly to the wrist rest, (which is the next best position to shoot from), and that might get us away from the harmonic problems that I thought were causing the vertical stringing of the group.

He had never shot much from a wrist rest so I showed him how it was done. He immediately started shooting groups that were a little over an inch high and maybe an inch and a half wide, so it was evident that the vertical stringing went away when he quit using the stick.

Since he was shooting a group about a half inch wide from the sticks I assumed the 1.5" width was his fault, so I discussed with him how tensions in muscle groups would change the hit location if the muscle tension was varied from shot to shot, and etc, and he shot another group that was about the same size.

After he had shot a couple of three shot groups to get the feel for it, we decided to shoot a five shot group. It ended up being a 6 shot group because he had one shot that was a flier nearly two inches from the main group. The main group was about 7/8" tall and 1 1/8" wide.

The wide was expected because the winds were swirling in from 1:00 to 3:00 and pushing the shots out to the left a little to widen the group out. The important thing I had seen up to this point was that the bullets were flying perfectly through the target with no tipping, so that told me we had no bullet balance issues.

We had no category #1 problems, so the only problems we were going to have getting good groups was the wind and where the barrel was pointed when the bullet left it. The wind was not too bad and we were shooting at 100 yards so the category #3 errors would be minimal and readable, so I knew that the category #2 errors were what we were going to be working on mostly.

He then took a little break while I fired a few shots with my rifle, and then we discussed the position and muscle tension problems again, and how that one shot he had out of his last group was most likely not the same muscle tension on the shot, and etc. We also discussed how to set up your natural point of aim to be most effective.

After that break he went back to shooting, and his first shot on a fresh target was right where his group had been before his break. This was to be a 10 shot group, and I let him shoot while I watched. I did not coach him, but I documented the hit of the shot, the wind and etc for each shot and other things as we went along, so I could remove the category #3 errors from the group, and leave only the category #2 errors for him to work on.

As I mentioned,... his first shot was right where his previous group had been, then the second was an inch low and a touch left again just like on his previous group. The third shot was about a half inch high and right of his first shot. So we had two shots close together and one a little out. I asked him what was different with the second shot, and he said that he had decided that he did not hold the rifle as tight for the second shot as he had for the first, so he tightened up again for the third shot.

We briefly discussed muscle tensions again and he was much more careful about that from then on.

I did not mention that the only real difference that I saw while watching the shots was that the first and second shots were fired in a 8 to 12 mph right-headwind from 1:30 to 2:00, while the third shot was fired in a much lighter headwind from 1:00 which would have allowed that shot to be higher than the first one.

I won't take you through the group one shot at a time, but before we were done he was calling his shots inside of a 3/8" group. He quickly got to the point where I could predict where the shot would land by watching the wind flag in front of us, and every time the bullet went where I expected.

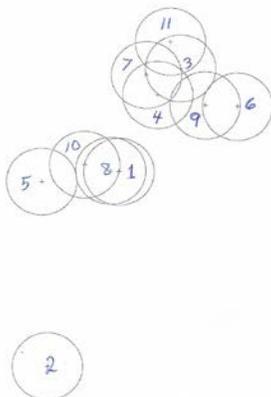


As you can see in this picture, there are two groups within a .95" x 1.2" group, and each shot landed just where the wind said it would with the exception of the low shot that was a results of not holding the rifle the same as the rest.

The conditions were perfect to spot the shots and I could watch every bullet pass through the target. I have shared the group here with you, because as you can see from the picture he had two groups in his ten shots. (He fired an extra shot to make up for the #2 shot that was out of the group for not holding it tight enough). The total ten shot group is just under one inch tall and about 1 1/4" wide, but the two groups representing the two different wind conditions are very much smaller.

Every time the wind changed the shot moved to the group the wind told me it was going to be in.

I have added a facsimile of the target for clarity of exactly what was done.



At one point he fired shot #3, and then fired shot #4 in the same exact wind but called it a tiny bit low and left. I have shared a facsimile of the target that will show you that shots 3 and 4 were overlapping with #4 about half a hole low and left of 3, just where he called it. Shot #7 and 11 were also fired in that same wind, but 11 was called high.

Shots 6 and 9 were fired with almost a perfect dead wind, and they are the ones out the right of the light wind group, just where they should have been.

Shot #5 was an error, and Brice reported that he noticed the front sight bounced to the left under recoil instead of to the right as it did on all the other shots, and I explained that was a muscle tension problem, or he had an elbow placed incorrectly. He did not make that mistake again, because the front sight bounced to the right from then on. That shot was fired in a wind that should have put it in the group with shots #1 and 8, and as you

can see it did go out the left side of that group. Shot #10 was also fired in this same wind, but he called it left just a tiny bit. As you can see it is out the left of the #1 and 8 group where I had expected it to go.

This is one of the most interesting spotting chances I have had in a long time, as every shot landed within a 1/4" or less of where the wind said it was going to be, and if you take into account the times he called the shots low or left, it is simply an amazing group that shows a reliability of well under 1/2 moa for the rifle/load combination. It also goes to show you that if he had just shot a 10 shot group at 100 yards, without a trained observer watching and documenting each shot, it might have been assumed that the rifle was capable of near moa accuracy at best, when in fact it is capable of half that or less.

When we finished that day, Brice had fired something like 30 shots out of a new and unfired rifle, and we already had one load shooting near perfection. That is just how hard it is to get a new rifle shooting well when you do it scientifically. My rifle was that way. I set a new 300 yard range record at Oak Ridge with the first 15 shots out of a new and unfinished rifle that had never been fired before I got there. That is how easy it really is guys and gals.

Not only had we proven the rifle shoots one hole groups, but Brice got a good lesson in wrist rest shooting, and now could trust his rifle enough to know that when a shot did not land where it was supposed to, there must be a reason for it, and he had a good idea where to look. He actually made a statement to me that he was getting the idea that he should be trying to find something wrong with every shot fired, so if it does not land in the same hole, you will have an idea why. I think he is getting the idea!

The next day was Sunday and we went back to the range to spend the afternoon testing some more loads, shoot some more groups, and maybe get started on sling techniques, but when we got to the range Brice realized he had left his shooting glasses at the shop, 30 miles away. They were not actually shooting glasses, but were an old prescription that he thought he shot better with than his good glasses that he was wearing. We decided to make do with his regular prescription glasses and see what happened.

Well.... to say that we learned something is an understatement!

No matter what he did that afternoon, he could not make two holes get close to one another, even though he thought he was shooting as well as he had been the day before. I finally shot the rifle myself just to make sure it was not the rifle. It was not! I made holes touch every time I held it centered and squeezed the trigger.

We even experimented with him shooting with no glasses, and the groups were the same size as they were with his prescription glasses, even though he is quite near sighted.

I asked him what was different about the new prescription glasses and he said the old ones were just plain with nothing special about them, and the new ones were "Transitions" lenses with anti-glare coatings, and maybe polarized as well.

I have never had any luck shooting with any kind of color to my lenses personally, so that could be part of it, but it is entirely possible that

if they are polarized it might be a real problem.

We do not yet know what aspect of his new glasses is causing the problem, but I mention it here just in case you get some new glasses and notice a change in your shooting ability. It is possible that it might be the glasses. I can assure you that I will be sticking to my plain old fashioned kind of glasses for shooting after witnessing this.

I want to mention here that Brice has been to my house before and we have been friends for a number of years, and I was happy to have him come over for a weekend, pick his rifle up and go to the range to get started shooting it. If nothing else it gave me a reason to go to the range myself and do some shooting.

This is the kind of stuff I do for a living, so it does not take me very long to figure out an accuracy problem when I can see what is going on.

What I want to make clear is that I will do the same for any member of the team. (long range or short range)

If you want to come over for a weekend of shooting and training, then you are certainly welcome to do so. You never know what you will learn, but you will learn something if you are willing.

There are also times when we will all be at the same competitions, and there will be time for me to assist you before or after the match. If you are signed up for this coaching experiment and need or want help all you have to do is ask.

If you are signed up for this coaching experiment, you are welcome to send targets for evaluation, call or email for advice, or come over for a weekend, and my time will cost you nothing. That is what this experiment is all about.

The worst that can happen is that you might have to load up and go to the old fashioned Drive-in theater with us on Saturday night like Brice did. ;-)

I should clarify that my advise is free as your coach, and if I do a little something to your rifle while you are here on a weekend I will not charge you for that either, but if your rifle ends up needing a bunch of work..... well..... that is what I do for a living. ;-)

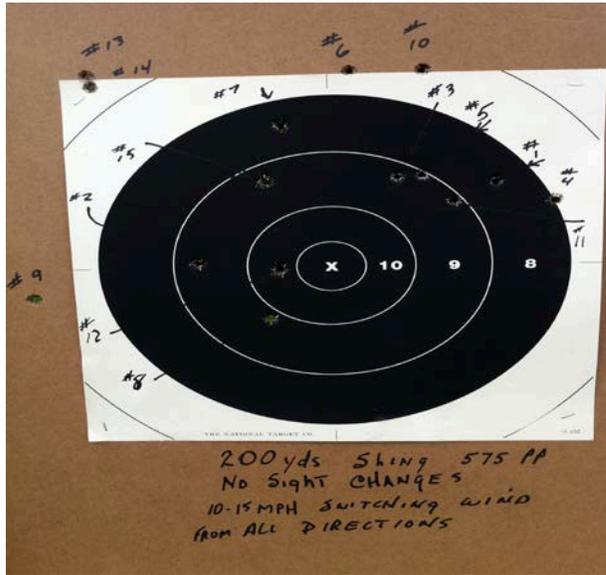
Evaluating targets

Since I am on the subject of evaluating targets. I think I will share a few with you that I have received and evaluated lately, to give you an idea what to look for when you are shooting your own practice targets.

The first one is one that was shot at 200 yards in a blustery swirling wind that was blowing from every direction at one time. I'm sharing it with you because it was not fired at short range (because he did not have a short range place to shoot), but also because I want to use it to teach you how to separate the three categories of error on a target to learn what to look for when looking at your own targets. Fortunately he shot the entire group without ever touching his sights. If he had chased the shots around with the

sights it would have been extremely difficult to do much with this group.

This group looks like he threw gravel at the target at first glance, but if we take into account the information he gave us about the conditions he shot it in, and the information the target gives us, we can find a flaw in what he was doing, and at least make a suggestion on what is wrong.



He had previously sent me a target fired at 100 yards, and his bullet holes are perfect on that target and this one. Which tells us that his bullet is balanced when it leaves the muzzle, so he has no category #1 problems.

The simple fact that he was shooting at 200 yards in a swirling 10 to 15 mph wind that was blowing from both directions tells us that the group should be up to 12 to 18 inches wide just because of wind drift, which fits into the category #3 (external effects) category.

We also know that the same wind as a head or tail wind will not typically make more than an inch or two difference in elevation of the shots, so we know that the majority of the width of the group was most likely cause by the wind, while most of the vertical errors in the group were not caused by the wind.

The big question then is what did cause it. Since it was not category 1 or 3, then it has to be #2 (where the muzzle was pointed when the bullet left)

To clarify the target for you, I made a facsimile of the target after removing the category #3 (wind) effect, and put the shots all on one vertical plane.

When shots were in a tight cluster I moved them out a little from one another so you can clearly see the shots.



You can now see that there are four shots at the top of the group in basically one hole, then a gap between that small group and the next cluster below it, that has only one shot in the middle of the gap. The central cluster has six shots into a less than one MOA group, then another gap and another cluster down low.

From experience I know that this is typically the patterning you get when you are not placing the rifle on your shoulder the same each time, or it is not staying in place under recoil. It is similar to what you get when you have harmonic problems, but the large gap between the three groups is usually a give away that you are not seating the butt the same each time on your shoulder, or you are holding it in such a way that it is trying to get away from you during recoil.

He had told me that he fired the group from a sling only, so that was also an indicator that it was likely a shoulder placement problem, as these problems tend to be made worse when shooting from a sling only.

If what I was suspecting was true, then any one of those small clusters of shots is actually a better indicator of the accuracy potential of the rifle than the group as a whole was.

The untrained eye might look at a target like that and think the rifle and rifleman were hopeless, but because he gave me enough information about the conditions he shot in and I know how to read a target, I was able to give him this advise;

"These rifles have a long heavy recoil that will move the rifle over an 1/8" rearward before the bullet leaves the muzzle. That rear thrust caused by the recoil is pushed straight back along the bore line, . . . but our shoulder is not behind the bore line, it is lower .by far, and because of that the rear thrust is turned into an upward push on the muzzle as the rifle moves back."

"Anything that effects that upward thrust will effect where the barrel is pointed when the bullet leaves the muzzle."

"Because of this when I see two or three groups as you have here, scattered vertically, I see a possibility that your shoulder is not the same behind the rifle each time."

The next day he wrote back that he was indeed in a less than a perfect position and the butt of the rifle was nearly in his arm pit at times when he was trying to shoot, and that the rifle did indeed jump down off his shoulder at times during recoil.

I learned some years ago that if I raise the butt up out of the pocket of my shoulder, and up onto my shoulder to the point where the heel of the butt plate is actually above my shoulder a little, I do much better. I'll do some pictures of this for a future update.

Basically I raise the stock up to my face each shot and then let my face bring it back down into position as I get into the rifle. I then make sure that my rifle is mounted exactly the same. A difference of as little as 1/4" in how the rifle is mounted can show up on the target.

A second thing that can do similar things to groups when shooting with a sling, is if you pull backward with the forward hand for one shot and relax into the sling the next.

Speaking of which, I always pull back pretty snug with the trigger hand in order to compress my coat and pad as much as possible so the rifle will move rearward less under recoil, then I hold a neutral pressure with the front hand. Not pulling back, but not allowing it to push forward on the rifle and counteract what I am doing with the rear hand either.

If I relax that forward arm and let it push into the sling it will move the shot at least an inch low at 100 yards. I did it this past weekend on a target and will be using that target as a demo piece when I write up some sling shooting tips.

Another set of targets

This next set of targets is a most interesting set, and entirely different from what we just discussed, so I thought it might make a good discussion point.

This person went to the range with his buddy and did a series of tests. All of them shot from the bench, and all very scientifically done as you will see as we go along.

There is very little or no tipping of the bullets so we can assume that there is no category #1 errors in the group, and it was fired in a light and manageable wind with an occasional gust, so we can assume that there is little if any category #3 error in it, so once again we have a situation where it is mostly category #2 problems that we are looking for.

As I discuss the targets I will call them shooter, bullet, and rifles, "A" and "B".

The first target is 10 shots fired by "A" with his bullets and rifle.



The second target is shooter "A" with his rifle and "B"s bullets.



Next "A" shot "B"s rifle and bullets.



Lastly "B" shot his own rifle and bullets.



When I began to analyze this set of targets, the first thing I want to point out that I noticed, was that the five shot group fired by "A" with "B"s bullets, just looks like a bad group, but when he shot the 10 shot group with

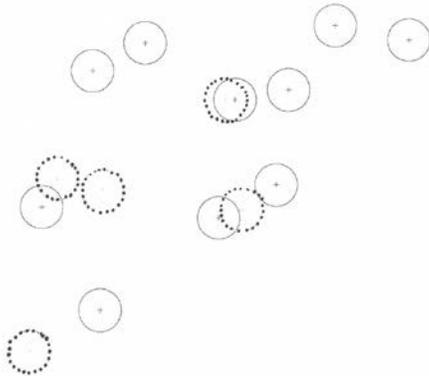
his own bullets a pattern began to emerge.

If you look at the first 10 shot group you will notice that there seems to be a number of two shot groups scattered all over among the group as a whole. In reality these two shot groups may come closer to indicating the accuracy potential of the barrel, bullets, loading technique and etc, than the entire group does.

When you see clusters in a group like this there is always a reason for it, and when it is this many different clusters I begin to suspect a bedding issue with the rifle. Basically a perfectly fine shooting barrel is rattling around in the stock, and wherever it is laying in the stock when it is fired defines where the barrel is actually pointed.

It would have been nearly impossible to diagnose the problem with a five shot group as you can see, but when you shoot a ten shot group it starts to become evident what the problem might be, and with 15 shots it becomes even more clear.

I noticed that if I moved group # 2 to the left 5 moa, it landed right on top of the first group, and I have made a facsimile of the two groups together and you will see that each shot of group #2 landed in a cluster already in group #1. So, even though he was using a different bullet, it seems to back up what I was seeing in the first group already. The five shot group is overlaid on the ten shot group here.



At this point I was convinced it was most likely bedding problems, but the fact that "A" shot "B"s rifle and bullets on another target, and shot much better than with his own rifle with any combination of his or "B"s bullets, pretty much cinched it for me. When they swapped rifles it just proved beyond a doubt that the problem with "A"s groups would be found in his rifle. The second rifle may not be perfect, but "A"s rifle has some real problems.

I made some recommendations as to what to do and look for in the in-letting and I have no doubt that between the two of them, they will soon have it worked out. I hope I get to report that problem cured next time. If not, I will report what we do learn, even if I was wrong. ;-)

Bedding problems

I have had three rifles with this similar problem lately. It is typical of Pedersoli Gibbs rifles, because there is a flaw in the bedding and the fit of the hook breech.

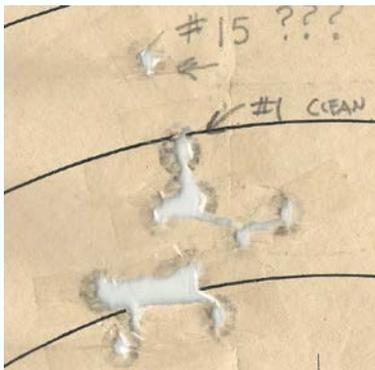
The real problem with the Gibbs bedding is that the barrel only touches the in-letting at a few little spots around the bottom lug, and sometimes a little spot in the bottom just forward of the lug. The cure is to clear cut the bottom of the inletting so the barrel does not contact anything directly in the bottom of the in-letting and then shim it on either side of the lug with paper shims, or glue in some veneer, or wood strips so the barrel rests in a "V" at that point, and is pulled in tight with the wedge. Even if you have to bend the wedge a little to get it tight. You just do not want the barrel touching the bottom of the in-letting in the area of the lug or forward of it.

The barrel hook on the breech also needs to be a tighter fit, which can be done by shimming the sides of the hook, or peen it with a hammer to swell it up for a better fit. The hammer job is best left to those who are brave of heart. ;-)

I have another trick I have devised, but I have not yet tested it on a Gibbs. I think the sling mount just forward of the trigger guard can be replaced with a longer screw that will make contact with the bottom of the hook in the breech. This should clamp it tight inside the breech to make it immobile.

Common misconceptions

Before we move on, I want to share one more target with you that was sent to me. once again it had no category #1 errors because the bullets pass through the paper nearly perfectly everytime. There is also none or very little category #3 errors because it was fired from a bench in a very light tail wind at 100 yards, and we know a very light tail wind would not move the bullet around much at that distance.



Once again you can see that there are two groups within his group as is typical of a shoulder placement or muscle tension inconsistency, so I briefly

discussed that with him, because I believed that either one of those two groups might reflect the accuracy potential of his rifle.

His response was that "his eyes aren't what they used to be". His response leads me to believe that he either truly believes that he can not do any better, or he does not believe that a muzzle loader can do better than that.

I'm not picking on this shooter, but I tell you this only because it seems to indicate a problem that is a fairly typical problem among muzzle loader shooters.

As a whole, muzzle loading shooters tend to think that a 2" group is pretty good at 100 yards, but I have been showing you targets that prove that the rifles that fired them have potentials well under an inch at that distance.

Maybe we as a team do not understand that the accuracy potential of a fine muzzle loader is..... ONE HOLE! Just as my group I sent out with the very first coaching update would show, and every shot that does not go in that one hole has an error associated with it that fits into one of those three simple categories. The sooner we as a team understand what our rifles can do and should do, the sooner we will start winning medals.

Even at extended ranges they are extremely accurate. My personal best five shot group at 1000 yards is about 8 inches, but that was because one shot went high when I called it high. Otherwise the group would have been about 5 to 6 inches wide and 4 inches high. That is 1/2 moa at 1000 yards.

I once called a shot to be 2:00 on the edge of the five ring at 1000 yards, and it cut the line at 2:00. That is what I expect from my rifle, it was not an accident.

So my point is that not only can these rifles be much more accurate than most people think they can, but when you see a couple of groups or clusters of shots within a group there is always a reason, and always a way to bring them together.

Another common misconception among black powder shooters and muzzle loader shooters in particular, is that when the group is not all that good, the first thing I often hear is that "I need to tweak my loads a little more", or "I need to get my chronograph out and do some load development".

You need to get it through your heads that these are not light weight bolt action rifles burning smokeless powder, that need tweaked a grain or two. If a grain or two of black powder makes a difference in the way you rifle shoots, there is most often another underlying problem. The only problem that might be fixed with a few more grains of powder is if you are shooting groups that are slightly elongated in one direction or another. That elongation may be caused by a movement of the muzzle caused by the harmonic vibration of the barrel. If the bullet is exiting the muzzle while it is in motion the group will be elongated. A few more or less grains of powder may allow for the bullet to exit the muzzle at the end of it vibration induced swing, where the barrel is basically motionless.

If you are shooting groups at 100 yards that are two or three inches in diameter... a few more grains of powder is not the answer.

I have several powder charge weights that I use in all my rifles, and those same charges work wonderfully in all the good rifles I have used them in. All were carefully selected by pulling them out of my butt. I basically use a 45-70 equivalent load for short range up to 300 yards, then switch to a 45-90 type load for the 500 and 600, then a heavy load for the long range. So I use 75, 90, and 105 grains of powder..... Just because they sounded good.

I have never noticed that a few more or less grains of powder makes any difference in the way my rifles shoot, but I have noticed that the heavier charges effect the way I shoot my rifles, because of the recoil. For this reason I do not weigh my powder charges, not even the first one when setting the powder measure.

If your rifle seems to be susceptible to variations in powder charge or velocity, there is more than likely an underlying problem that needs to be fixed so the rifle will not leave you high and dry at some point .

Visual tricks for accuracy

Even when the rifle is accurate, shooting sub MOA groups is not easy. There are some visual tricks that make shooting sub MOA groups possible, and perhaps I should share those with you here.

Your eyes have the ability to define a 1/2 moa if you are looking at something and it is not moving, but that is about the limit. It just has to do with the way our eyes are made.

If it is moving you have the ability in most cases to define as small as 1/8 moa. A perfect example of this is if you have ever hunted whitetail deer in the woods. You can see a deer at 150 yards and not be able to tell if it has antlers or not as long as it stands still, but if it once moves it's head a little you can suddenly see that it has a bunch of points on it.

What this means is that if you are the kind of shooter that lines his sights up carefully and then likes to stare at them for a few seconds while you double check the sight alignment to the target as you are squeezing the trigger..... your visual ability is going to be about 1/2 moa as far as grouping is concerned. On the other hand if the sights are moving ever so slightly, you can align them much more precisely and the groups can be smaller accordingly.

I shoot in such a way that I set up my natural point of aim just above the bull, and then I inhale very slowly to move the sights down on the target very slowly. The moment the sights are aligned with the target I squeeze the trigger, and my call can be more precise because of that slight movement than those who hold steady.

One other little challenge you will run into if you like to stare at the sights too long is that the mind has the ability to move circles and dots into alignment even though they are not aligned.

If I set a rifle up on a bench rest with the sights misaligned with the target (but stationary) as much as an inch or more misaligned, and then stare through the peep sights for about ten to 15 seconds, my mind will move all the circles and dots into alignment.

If I blink a couple of times the circles and dots go back where they were to start with.

If I fire a shot during the time my mind tells me the sights are aligned, that shot will go where the sights were actually pointed, and not to where the sights appeared to be pointed.

Mon and I have proven this repeatedly, by purposely aiming as much as three inches from center on a 100 yard target, then waiting for our mind to align the circles and then pulling the trigger, and the shot always goes where we knew the sights were actually pointed.

During one period of testing this theory, we were able to shoot groups over 3", or under one inch with the same rifle and load, just by changing the length of time in which we stared at the target.

There are actually many little tricks like that, and I will be glad to teach you all of them that I know. Many of them I have been using for so long that they are second nature to me and I don't even realize that not everyone one knows them. So I suppose they will come out occasionally as I think of them, like these did. ;-)

Odds and ends test results

Now I would like to report the results of some testing that has been going on lately, Just because I find the results of the tests to be interesting and thought that perhaps you would too.

I enjoy theoretical discussions, but I really only trust practical testing, so when possible I like to back up theory with real world tests, so that is what we are doing here.

Alloy test

When I first started shooting long range muzzle loaders I was very politely give a lot of free advice that was worth what I paid for it. Much of it made little sense as to why we "had" to do certain things certain ways, so a mental list was made of the advice I was given, and I decided that I was going to do everything wrong till I could figure out how to win doing it wrong. I did it all wrong till I won the world match aggregate in 2007. Since then I occasionally go back and test some things that were on that initial list.

One of those things I was told I must do was to use pure lead or 50-1 alloy at the hardest. I have used 20-1 for years and did not change that when I started shooting muzzle loaders.

I had read of tests performed in the 1800's in England, where they were convinced that they got higher velocity with harder bullets, because the harder bullets did not press against the inside of the bore as hard during the obturation phase of the bullets path up the bore, so the harder bullets were not retarded as much, and had higher velocity.

We decided to test this idea by making some identical paper patched bullets with 2% and 5% alloy, then shooting them at 900 yards to see if there was any obvious difference.

We sighted the rifle in with the soft alloy and then fired the hard ones, and saw them hit at the top of the target.

After this initial test that showed some promise, we went to the chronograph and found that the harder bullets had a 30 fps higher velocity with an 85 gr load of powder. So it appears that what the old Englishmen did so long ago, is still correct.

I do not know at what point a harder bullet will not gain you more velocity, but I have read of some that were far harder than 5% used in the old days.

Heavy bullets

The next test was done because there has been a real trend toward heavier bullets in this sport every since the South African shooters ran away with the 900 yard distance at the world championships in 2009 using some whopping sized bullets near 600 grains. Everyone seems to not notice that we beat them at the 1000 yard distance, but the fact that they shot so well in the middle of that range has started a trend that I believe may be the wrong thing to do.

When I built the rifle I am using now, I actually built it with the thought that I was going to do some experimenting with some heavy bullets. I even designed a heavy bullet of 575 gr. and shot it for a couple of years. I set some national records with it at long and middle distances, so it obviously shot well.

This winter I wanted to play with some swaged bullets, and paper patching, and the bullet mold I bought to make my swaging slugs with was much lighter than the bullet I had been using, so the bullet I am using right now is only 535gr.

My first chance to compare the new lighter bullet with the heavier bullet was this year at Butner. I won the match with that little bullet, and then when I began to compare my sight settings for that range with the last time I shot there with the heavier bullet, I noticed that my sight settings were nearly the same up through the 600 yard distance, but by the time I got to the 1000 yard distance I noticed that it took 8 moa less sight to get the lighter bullet on target than it did the big one. That was not exactly a head to head test, but it certainly seemed to call for some more testing.

So far the only testing that has been done to follow up on this idea was to sight in a rifle at 900 yards with a 595 gr bullet, and then shoot an identical, but shorter/lighter 575 gr bullet at the same target. The results were that the 575 gr bullet hit significantly high on the target compared to the 595 gr bullet. We have plans right now to test even lighter bullets to see at what point the shots no longer go higher on the target.

The basic premise for using heavier bullets is because they retain energy better at long range, and do not slow down so much.

In theory, if you launch a heavy bullet with the same velocity as a

lighter bullet, it will drift less in the wind. The problem with the idea is that it is only true if you maintain the same launch velocity with the heavier bullet that you were getting with the lighter one. Most of us are not using powder charges heavy enough to really take advantage of the heavier bullets, and are actually launching the heavier bullets enough slower than the lighter ones that the lighter ones are overtaking the heavy bullets and outperforming them at the longest distances.

I think that what we will find is that for each powder charge weight, we will find an ideal weight of bullet that will be the best combination of muzzle velocity and retained energy to get it to the longest distance in the shortest amount of time, and therefore give us a bullet with the least wind drift for that given powder charge.

Wind drift

Let me address wind drift here for just a minute if you don't mind me getting technical.

There are two ways in which wind drift is calculated mathematically.

The most common method uses lag time to estimate the drift. Lag time is basically the time difference between actual time of flight to the target with the bullet slowing down as it flies, and the theoretical time of flight if the bullet did not slow down on the way to the target.

The second and more accurate method for our velocity ranges is a formula that takes into account time of flight, and actual velocity of travel.

Many shooters mistakenly believe that the wind blows a bullet left or right, but in actuality, the side wind only turns the bullet nose into the wind till the bullet no longer sees a side wind. The drag of the bullet then basically pulls it towards the base of the bullet. Since the majority of the drag is from the vacuum behind the bullet, it is more accurate to say the bullet is sucked off track than blown off.

The important thing to remember is that the faster a bullet is moving towards the target, the less it rotates into a given side wind, and the less it is sucked off course. Because of this effect, the lighter bullets traveling at 800 fps may drift less in a side wind than a heavier bullet traveling at 750 fps. It is also true that the heavier bullet with more mass will be effected less by the same amount of drag, so to find the bullet with the least wind drift we have to find a happy medium where we can maintain velocity all the way to the target to limit the turning moment of the bullet in the cross wind, but at the same time have enough mass to resist the drag that pulls the bullet down wind.

Like I mentioned earlier though, I only trust practical experiments, so once we have those done I will report the findings when I am writing about wind drift and wind reading.

Wad tests

Another quick test that has been done is to test the velocity change for using various kinds of wads under the bullet. Some shooters use felt wads, other use oiled felt wads, and still others use heavy card wads like I do.

We tested them over a chronograph, and there was little difference in velocity between the oiled and dry felt, but the card wads gave an average of 8 fps more velocity than the felt did. That test was performed just for curiosity sake more than anything else, but I have documented that if I leave my wad out or get it tipped edgewise my shots will go low at 600 yards and beyond.

Nose shapes

One final test I wanted to share has to do with nose shapes. When I won the 2007 match in Africa, I was using a grease grooved bullet on the Paul Jones Creedmoor design. It was a bullet that I had used for years in the black powder cartridge game, so I had him make me a mold to use with my muzzle loader. It worked well. I think I set a half dozen national records with that bullet, one world record, and a long range and grand aggregate world championship as well.

One of the things I was doing at that time was to pound it down hard with the loading rod till the rod would sing to me. I can't tell you now why I did that, but it was working, so I kept doing it. Mon Yee was also loading his basically the same way, and he had set more national records than I had.

One day Mon had to blow a loaded bullet out of his rifle with a discharger, then picked it up later and we noticed that it now had a 5/16" flat spot on the nose because of the pounding.

That got me to thinking that perhaps I was cheating myself by beating my bullet up so much while loading it and ruining the aerodynamics of the bullet, so I sighted in at 1000 yards with the bullets beat into the bore and flattened, then shot a few with the bullets carefully slid down with no damage so I could take advantage of having the proper nose on the bullet. To my surprise it made no noticeable difference in elevation at all, even at 1000 yards.

I had read some data that lead me to believe that nose shapes made little if any difference at the velocities we shoot at, and it certainly seemed to be true from what I saw that day. Since then I have worried much less about nose shapes and more about proper fit and support of the bullet.

When I designed my heavy bullet I put a nose on it that many would consider to be "old school". It does not have the new fancy long noses that have been designed by guys that like to play with computers. I just copied it off a 727 Boeing, because they fly those planes at the same basic velocities as our bullets.

I figured if nose drag was a problem at those velocities they would change the nose shape on the planes for fuel economy reasons. The better ballistic programs will tell you that the nose drag coefficient goes completely away just below the speed of sound, so it made sense that my damaged noses would fly as well as the good nose as long as the damaged ones were not thrown out of balance.

We recently had a chance to do a better job of testing the nose shape theory. We used three bullets with various nose shapes. They were all swaged and paper patched from the identical batch of lead, and all came from the same batch of lead slugs with the same weight. They were just swaged to different

nose shapes. One had a nice long nose on it like the middle bullet pictured below from the Corbin web site. The second one has a short and rounder nose. The third one was similar to #2, but with a round nose to it instead of the flat on the end like the #2 bullet has.



The test was simple as most of the good tests are. Shoot them at the longest distance possible, on the same target, with the same powder charge and see if one flies better than the other. The results were just what I had learned to expect. All the bullets hit the same spot on the target with no noticeable difference in elevation or windage.

This test just vindicated what I was already doing. Just ignore the fancy nose shapes and go with the bullet that fits the best and shoots the most accurately.

Misc.

I had intended to include some tips on sling shooting in this update, but I see that it is already exceptionally long, so I have decided to save the sling tips for next time. It will give me something to start writing on so I won't have to wait for more targets and testing to come in before I can write again.

We have several members of the short range team that will be going to Germany shortly, so I do promise to get those sling tips written up soon even though it maybe too late to help them.

I just received notice that the location of the long range world championships in South Africa next year has been finalized. It will be in Cape town. So you can begin your planning accordingly.

I also want to note that I have arranged with Jonathan Leighton at the NRA to allow us to have two days of squaded team practice with me coaching on the Monday and Tuesday (August 20-21) of the NRA black powder target rifle competitions at Raton, NM. The three position match is to be held on those two days, and anyone that brings their muzzle loader to Raton, NM and does not want to shoot the three position match is welcome to take part in this coached team practice at 200, 300, and 600 yards. There will be no extra cost associated with it according to Jonathan.

The NRA staff will be manning the range, and we will shoot to one side of the competitors under regular match timing. Jonathan said he would be more

than happy to have us there and the NRA would be proud to do their part to help team USA in any way they could.

Have a great summer and shoot well, and if you need help, just let me know,

Lee Shaver