

U.S.I.M.L.T.
Long Range Coaching update

#2 2012

In my first coaching update, I left you with a bit of homework to do. I asked that everyone shoot a 15 shot group at short range. To make it the best group they could shoot, with no time limit.

A few people have done that, and I will share what we have learned later on in this update. To begin with, I want to share with you why it is I chose to begin with such basic ideas as to require that you prove your rifle is accurate, and you can fire 15 shots accurately. To do that I need to back up a ways.

There are two ways to fire a team match, and we used both of them at the last world championships.

One way is to take four good shooters, pair them up so they can work together, and turn them loose. This is typically what has been done for the past ten years. It is easy really. You just identify who you think the best four individual riflemen are at the distances the team match is to be fired at, and then stay out of their way.

Years ago it actually worked pretty well. Team USA won the long range team gold medal in 2005 at Bisley, and set a world record that was well above the old one while doing it just as described above. Since then we have been second to the South African team in every long range world team event, because they have been better trained, and organized than we were.

In 2009, we were within a couple of points of our own world record and we were beaten by something like 75 points by the SA team. The time for an untrained "pick-up" team is past.

It never did work well in the mid range matches, because we just never had enough good mid range competitors to pair up.

The other way of shooting the team match is to use a coach that actively guides the competitors on the team as they compete. This was first instigated on team USA, by our team captain, Ray Hopkins, for our most recent world match, in an attempt to figure out how to get the team to work together better.

Which gets us back to why we are where we are at this time,..... While coaching the four shooters on our mid range team, I learned that even our best riflemen have problems that could be worked on and improved. Enough that we could have easily won that match if things were just a little different. Many of those problems I saw require going back to the basics to fix. I figure if even some of our best shooters have problems, the rest probably do as well. So we find ourselves starting with the most basic question of all. How accurate is your rifle, and how well can you load and fire 15 shots consecutively.

Once we get that figured out, and fixed, then we can move on to the stuff that most competitors would rather work on like winning techniques for sling shooting, or wind reading secrets. Till we know your rifle is truly accurate, there is no way to know if you are learning anything from the more interesting stuff though.

Funny thing about good competitors. They are always the first ones to say that they will do what is asked of them, because they actually see the need for it. When I asked everyone to go shoot a group at short range, most of us found a reason not to do it. We are drowning in rain here in Missouri, up north there are places that still have snow, some just don't see the need, and etc

etc, but Ed Decker went right out to the range and shot a 20 shot group at fifty yards from the bench, and sent it to me right away. Even better, he gave me permission to use him and what we learn as part of this coaching update, so everyone else can learn from it as well.

Before I start this little bit of the story, let me remind you that Ed was the highest scoring American shooter at the 300 and 500 yard distances at the most recent world championships. He was just out of the medal range even though he shot in the rainstorm that slowed everyone else down considerably. I'm not sure, but I think he had the high scores on those bad relays. He also shot on both the mid range and the long range teams, shooting as well as most of the competitors on those teams. So the fact that he is willing to see if he has an accuracy problem, and put himself on display here as he does so, speaks volumes about the kind of team player he is.

I had shot with Ed at the NRA national championships last summer, and what I noticed then was that he had a number of very good shots, intermixed with some wild shots that went well out of the group, or well away from where I thought they should go.

When I coached the mid range team at Bisley, I saw and documented that same thing. After we got home from Bisley I discussed it with him, and told him I thought perhaps the paper was not releasing properly from his paper patched bullets. He went to work and investigated that possibility, and decided that indeed his paper was not always coming off the bullet easily. The test was as simple as pulling the paper off by hand and seeing if the paper was stuck to the bullet. If the paper sticks to the bullet at all, it will change the trajectory of the bullet as it peels away.

He dealt with those paper issues before he went out to shoot the 50 yard group for me, but even though he had that issue dealt with, he still shot a group that was nearly two inches in diameter. That would be nearly 4 minute of angle. By comparison the bull on our targets are half that size at all distances, so his group would fit just inside the four ring on our targets.

You might even ask yourself how he could shoot so well at the world championships when his best group is so large. It is a simple matter that the conditions at the world championships were miserable during the two distances he shot well on, and he waited till the conditions were about the same each time, and gave it his best shot possible. In those conditions, about any shot inside the 4 ring would be considered pretty good, so he never started chasing his shots when the shot didn't land in the center of the target. For that reason a group as large as the four ring can actually score well, but with a group that large you will never gain a great trust in the accuracy of your rifle, nor will you ever learn to have faith in your wind reading ability.

When Ed shot that 50 yard group and emailed the target to me, I saw right off that he had a good cluster in the middle of the group, but then had a series of shots around the outside of the core group that opened the group up a bunch. I noticed that those outer shots showed to have been tipping as the bullets past through the target.

There are only a few things that can cause a bullet to tip and yaw as it flies.

At extremely long ranges, when the bullet has slowed down considerably, a good strong side wind will cause the bullet to turn into the side wind, and it will then pass through the target in that turned position and appear to have been tipped.

If the bullet is too long for the twist rate of the barrel, the bullet will eventually loose stability and begin to wobble like a gyroscope, or child's top that is about to fall over, but it will most likely not be tipping early in it's flight unless the bullet is severely unstable.

More typically the bullet is just out of balance. When the bullet is tipped as they pass through the target at 50 yards, that is always the problem, pure and simple, which gives you a clue as to why I wanted short range testing to begin with.

A tipped bullet may not seem like a big deal, but it is actually a major problem, and the largest theft of rifle accuracy there is, not because the bullet is tipped, but because of the reason it is tipped... that is the problem. If the bullet is tipped at short range, that means only one thing, that the bullet was out of balance as it exited the muzzle of the barrel.

If a bullet is out of balance as it passes down the bore of the rifle, the bullet is being forced to spin around its axis by the barrel itself, much as if you were spinning a rock on the end of a string. When the bullet exits the barrel it has the same effect as if you cut the string while spinning the rock.

Imagine if you will for just a minute that you are driving down the highway at a high rate of speed while spinning that rock on a string out the side window of the car. Now if you were to cut the string that holds the rock, you would see that it will continue on down the road in the same general direction as the car, but it would be headed off on a tangent to the direction of your forward motion because of the force applied to it by the spinning. The direction of the tangent would be controlled by the point at which the string was cut, and the angle of the tangent path would be controlled by the amount of energy given to the rock by the spinning motion.

This is basically what happens when an unbalanced bullet leaves the bore of your rifle. A good rule of thumb is that the bullet's path will be deflected in a direction approximately 120 degrees rotation from the location where the heavy side of the bullet is when it exits the bore, and in the direction of the twist rate. A faster twist rate will not effect the general direction the bullet heads towards, but the tangent angle will be greater with the faster twist rate. In other words a 20 twist and a 16 twist will throw the same bullet the same direction from the center of the group, but the 16 twist barrel will throw the bullet further from the group center.

Now that I have given you that little science lesson, and explained to you how we use tipped bullet holes to watch for bullet balance problems, you can begin to see how it is that the bullets further from the center of Ed's group showed tipping as they went through the target. Typically the bullets that land in the center of a group will show less tipping and the shots furthest from the center of the group will show more tipping..... IF the only reason for the dispersion of the group is the balance problems in the bullets. Unfortunately there is often more than one reason for shot group dispersion.



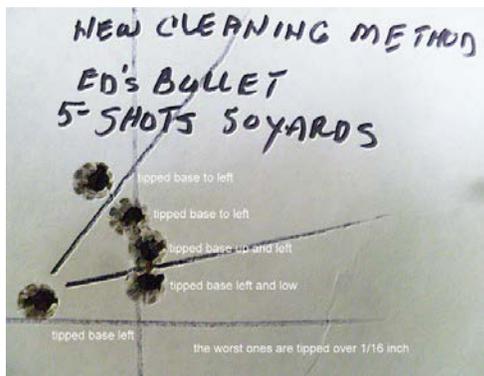
Picture of tipped bullet hole.

In the case of Ed's group, I saw evidence of tipping in some of the bullet holes around the group, and I asked him to go back to the range and shoot a small number of shots while cleaning vigorously between shots. I wanted to clearly see if the shots were all tipping from the beginning and not actually a fouling problem that began causing a problem after a few shots. That would give me a clue as to whether the problem might lie with the bullets, or a loading/cleaning issue.

Ed then went out and shot a couple of five shot groups with his bullets, and some that were given to him to try by another competitor. Ed's bullets were cast and paper patched, where the others were swaged then patched.

The five shot group Ed fired with his bullets showed that all the shots had some amount of tipping, and therefore some amount of balance/accuracy problems. It did not seem to get

worse nor better as the shooting continued. The five shot group was just about 2 1/2 MOA



He also included a five shot group fired with swaged bullets that were given to him. I must admit I really expected much better out of the swaged bullets, and it was better, but I still saw some minor tipping of the bullets in some of the holes. The group fired with these swaged bullets is about 1 1/2 MOA. It is only five shots, but it is less than half the size of his initial 20 shot group. It shows much promise, but I was curious as to why those swaged bullets tipped occasionally.

Here is a close up of the top hole in the group shown above. Ed was shooting into white cardboard, and you can clearly see that the nose of the bullet went through the cardboard a little right of center, and if you measure the black circle made by the bullet as it passed through the paper, you will see that the black circle is about 1/16" out of round, because the base of the bullet dragged out the left side of the hole to make it oversize. This is a sign that your accuracy is being stolen.



I then asked Ed to send me a handful of each of the bullets so I could have a look at them, measure them, and test them for balance. It was time to see if there was a reason found on the bullets that would make a difference in accuracy, or if we should be looking somewhere else.

When the bullets arrived I carefully took the paper off of them, and gave them a good inspection. First I gave them a good visual inspection, followed by measuring them from end to end, and measuring to see if the base is square with the axis of the bullet. What I found was that the cast bullets tended to have flaws in them, and all of the bullets had too much taper in the main body of the bullet for my personal taste.

The casting flaws tended to be bases that were not filled out properly. So the bases were rounded on one side but sharp on the other, which is an instant indication of a balance problem. I selected the worst of those bullets with casting flaws and I fired them in my own rifle, and the holes showed that the bullets were tipping near 1/16 if an inch.

While loading those bullets into my bore, I noticed that the bullet was tapered enough that the nose of the bullet could be wiggled noticeably even though the bullet was nearly fully in the

bore of the barrel. The cast bullets and the swaged bullets were about the same. This led me to deduce that the bullets with that much taper could have a problem where the bullet is not properly aligned with the axis of the bore because the nose of the bullet can easily be a couple of thousandths of an inch off center of the bore when the rifle is fired. If this happens the bullet nose will slump to one side more than the other. Which means that the bullet nose starts out being off center and out of balance, but will get worse when the bullet obturates to fill out the grooves. This would probably be worse with softer alloys than it will with hardened bullets, because the nose will slump easier with the softer alloys.

This theory would explain why the swaged bullets showed minor tipping in some of the holes, but none in the others. It was a simple matter of where the bullet nose lies in relation to the center of the bore when the rifle was fired that defined if the bullet would be tipping as it flew down range.

Since the bullet was so loose at the nose end, I decided to try a little experiment. I took the best of Ed's cast bullets, and the remainder of the swaged bullets, and took the paper off, and added a narrow strip of paper around the forward end of the bullet. I put it around the forward end of the body of the bullet like a wedding band, and then added the paper patch back over the bullet, trapping the band in place. With the extra band of paper under the patch, the bullet then fit perfectly in the bore of my rifle. It was snug enough at the front that it could not be wiggled, so the bullet nose would be centered perfectly in the bore. I tested it with a few shots, and it did seem to cut the tipping down to near zero, but the limited number of shots I had would prove very little.

To make a long story a little shorter, I recommended to Ed that he needed to do a better job of casting and sorting his bullets, use a bullet with less or no taper so the bullet will be properly aligned with the bore prior to obturation, or better yet use a swaged bullet that is properly fitted.

He is in the process of making those changes, and I look forward to seeing what his groups sizes are once he has perfect bullets that fit perfectly.

A tale of two cleaning problems.....

I recently took part in the USILMT championships at Butner, NC, along with a number of other shooters. A couple things took place there that I thought would fit in nicely here.

We started at 300 yards on the first day, then on to 500 along in the middle of the day when it started warming up just a little. After the 500 yard target second relay, Dave Gullo and I were standing on the firing point chatting when Ed Decker came over to visit with us, and wanted to ask a question. He said he was shooting along doing well, and suddenly his next shot went low and right, in the corner of the target, and just stayed there. He said that he started adjusting the group back to center on the target, but that it would not come back as fast as he was adjusting it.

I told him that my rule of thumb in those cases is; If in doubt.... scrub the rifle.

I explained to him that it was either leading or fouling building up, and since I knew he was using paper patch bullets it would not be leading. I went on to explain that he was not cleaning well enough, and the fouling has started building up in a rifling groove, and it was continuing to build up as he fired the next shots, so it prevented the subsequent shots from answering the sights as they should.

He went back and cleaned his rifle well, and on the remaining targets for the two day match, he cleaned twice as much as he has been cleaning. He never again had a shift of his

group like happened at 500 yards, even though it got quite a bit warmer yet on the second day.

The real results of proper cleaning are better shown in the outcome of the remainder of the match. I don't have the stats in front of me, but I think Ed placed at every distance after he changed his cleaning method, and placed in the aggregates as well. It is safe to assume that if he had continued cleaning as he had been doing previously, he might well have fouled out to some extent on each of the targets during the warmer part of the day, and might not have placed in any of those distances or aggregates.

A related but opposite problem was haunting Mon Yee. Mon and I had driven out to the match together, and like usual we were in a rush to get on the road, and short on time. We drove all night to get to the match, and Mon found that he was out of his regular cleaning solution, so I just offered to let him use mine. My cleaning solution is quite a bit different than his, but I have been using it because it seems to do a very nice job of cleaning the barrel. Better than about anything else I have ever used.

All through the first day of shooting, Mon was having problems with hang fires and poor ignition. A complicating issue was that he has had that rifle loaned out for a while, and thought maybe there was a problem that had developed with the rifle. He tried about everything that day, but no matter what he did he had hang fires on about half his shots. Something he had not experienced in years with this rifle.

That afternoon after the match, we were chatting as we drove back to the motel, and we were going over the problem and what he had done to fix it, to no avail. We just discussed all the basics, and then he mentioned that he had been using my cleaning solution, and it dawned on me that I had seen something similar in an antique rifle I had used that cleaning solution on. That antique rifle was having some pretty bad ignition problems even though the breech was an old tried and true design, and I was cleaning and loading it identical to the way I do my own rifle. I was not sure what was causing the ignition problems till I cleaned the rifle with two wet patches and noticed that I had cleaning solution running out the nipple. The breech on Mon's rifle is very similar in design to the breech design on the original rifle I had been working with, so I suggested that perhaps my cleaning solution might be the problem with his ignition.

Mon tried cleaning his rifle with two of my wet patches, and sure enough he had the same problem... the cleaning solution was running out the nipple.

The ignition problem turned out to be my cleaning solution and the fact that it is lower in viscosity, and has a better surfactant in it, so it wets and creeps into the breech further,..... it was contaminating the powder.

In reality I have some ignition problems with my rifle occasionally too, so there is reason to believe that if I change cleaning solutions I may eliminate my occasional hang fires as well. Something I will have to try for sure.

This past weekend, Mon spent the weekend shooting groups with his two rifles, and doing his homework from the last coaching update. He went back to his old cleaning solution and actually mixed it up thicker than usual because of our theory as to why my solution was causing problems. He reports that he shot about a hundred shots without any sign of slow ignition of any kind.

Once again the results of that match might well have been considerably different if Mon had been cleaning with a solution he was familiar with.

And the winner is!.....

Last month I gave you homework to do...to prove how accurate you and your rifle are for 15 shots. Several guys went out and actually did it. Some shot nice groups, others did not. We have learned a few things already from some of those tests that I shared in this email, mostly we have learned that few are shooting as well as they would like to think they can.

Because of the frustration of the match at Butner, Mon spent most of two days shooting his rifles and fine tuning every aspect of what he does to clean, load and shoot the rifles. By the time he was done he shot a 15 shot group that I share here because it is the best of all the groups I have seen.



Out of the 15 shots fired, the top one is his fouling shot, the next 13 shots went in a hole that is about 5/8" tall and 1/2" wide center to center, then his last shot is the low one. He had several different loads he was testing, and he believes that he used a powder charge on that last shot that was several grains lighter than the rest. He was shooting his reproduction rifle with the Badger barrel on it, and a grease groove bullet, with 85 grains of powder.

He fired this group from a bench with a wrist rest in front of several witnesses. It took him about an hour and a quarter to do it, but his effort was well rewarded. The first shot, which is the high one, was fired from a thoroughly clean and oiled barrel. If you look closely you will note that the nose of that bullet was a touch off center. The remainder seem to show no tipping in the holes.

Oh..... Yeah.....Did I mention that he shot this at 100 yards, in an 8 to 10 mph wind from 5:00?

Mon went so far as to thank me for forcing him to go back to the basics and actually shoot 15 shot groups, and not to quit after a few good shots, like most of us are prone to doing. He was reminded that being forced to shoot 15 shots all the time forces him to develop the mental ability to focus for that long, where shooting five shot groups teach us to quit mentally after a few good shots.

I appreciate Mon and Ed for allowing me to share the lessons they have learned recently. I hope that the rest of us can learn from what has been shared in this email because of them.

In Summary.....

There are only three things that affect group size. It doesn't matter if you are shooting from a bench at a 100 yards, a sling at 600, or from a rest at 1000. It doesn't matter if we are talking about our muzzle loaders, or a bench rest rifle. Those three things are;

1. Where the muzzle of the barrel is pointed the instant the bullet exits the bore.
(technique, bedding, harmonics, and etc)
2. The condition of balance of the bullet as it exits the muzzle.
(accuracy potential)
3. Trajectory deflection after the bullet leaves the muzzle.
(wind, paper not coming off properly, and etc.)

In this coaching update I have touched on bullet balance mostly. Later we will be dealing more with the other issues we must master to put all the shots in one hole.

For now I will continue to work (with all those interested), to shrink group size at short range. The next goal for those that have passed the accuracy tests, will be to perfect the sling techniques at short range, then on to sling techniques at longer ranges, wind reading techniques, and so on.

My goal for our team shooters is to get their sling accuracy potential down to 2 moa or less, and their wrist rest accuracy potential down to less than that. Once we have team shooters that can perform to those levels, then we can be the force in this sport that we should be.

Till next time, Shoot well,

Lee Shaver