

Precision Rifles for Long Range Shooting

What is a Precision Rifle?

Precision rifles are rifles are sold on the basis that you can use them for target engagements at long range. The majority of users out there consider long range to be around 800 to 1000m with small arms ammunition. Long range however can vary with the type of cartridge used.

To call a rifle, a long range rifle or tactical rifle is somewhat ambiguous and is directed at marketing and sales. It is ambiguous because the rifle accounts for only 1/3 of its ability to be used for long range shooting. A rifle can shoot long range without actually looking like a long range or tactical rifle. In fact some long range shooters or hunters that may take shots and longer than normal ranges, use rifles that look nothing like these rifles so often advertised. The majority of precision rifles however, used for long range shooting do have the same characteristics. These are the Prone – Tactical style stocks, quality heavy barrels, precision machined and tuned actions and competition quality triggers.

In this game there are many trade-offs that one has to consider in the quest for long range accuracy. One of these is the weight of the rifle. Do I buy that rifle which weighs 6.5kg? Will I get sick of carrying it around? Do I purchase that 3.5kg rifle in the same cartridge expecting to get the same accuracy out of it? These are some of the questions the Author is always getting asked. To put it quite simply, the heavy rifles made to very close tolerances WILL shoot better then lighter rifles made to lesser tolerances. In fact, heavy rifles made to the same tolerances as lighter ones, will generally shoot better. Why?

Well, disregarding the stock design(1), barrel harmonics(2), lock time¹, shooting position, twist rate, projectile design, barrel run-out etc etc, rifles that are heavier, have a lower recoil velocity. This means that the recoil is not as sharp and this is one of the keys points to keeping group sizes down. Most average rifles will move around 2.5mm (0.1") under recoil(3) while the projectile is still in the barrel. If the rifle does not move rearward in line with the axis of the barrel then the projectile will generally print in the direction of that movement. Add weight to the rifle and this 2.5mm movement is reduced. Reduce this movement and you reduce the group size. It is simple as that. An example of this is shown in Figure 1.



Figure 1. American custom built Benchrest rifle in 6mmBR capable of shooting 5-7" groups at 1000 yards.

Of course the rifle illustrated in Figure one is not designed for carrying around in the field. Move the weight around a bit, by lengthening

¹ Lock Time – Time elapsed from the release of the trigger sear, until the strike on the primer by the firing pin.

the barrel, reducing action and stock weight and you can have a precision rifle that now can be taken in the field. Yes that's right, lengthen the barrel. This will increase the velocity of the cartridge but that will not necessarily produce tighter groups. What extra barrel weight does is fight the rifles urge under recoil to want to jump in an upwards direction, causing dispersion².

These tactical looking, factory made or custom rifles are brilliant in their application. The new South Australian custom made APRS line of rifles (Fig 2.) and ones made by Geoff Grenfell or Grenfell Armouring Services (Fig 3.) are prime examples of this.



Figure 2. Custom .308Win APRS-LR Long Range rifle tested by the Author. 0.3MOA groups were the norm.



Figure 3. Custom Long Range rifle by Geoff Grenfell, Bendigo in Victoria, Australia

Rifle is a System

The rifle is really a system, which includes of course, the rifle itself, the telescopic sight (scope), cartridge and projectiles, barrel twist rate, the scope mounting components, bipod and other accessories.

A common denominator of rifles that shoot well at long range is that they are all "Precision Rifles". A precision rifle is really one that shoots very consistently by showing us the evidence of tight groups at shorter distances of say 100 yards or 100 metres. A rifle that groups under 1/2 minute of angle can be called a precision rifle. Not all precision rifles are long range rifles, why? A rifle that shoots tight groups amounts to only about 30% of what is actually needed to shoot long range. Let's break it down.

² Dispersion - the spatial property of being scattered about over an area or volume [syn: distribution] [ant: concentration]. In simpler terms it means the scattering of shots when shooting for groups.

Firstly in long range shooting there are two areas we like to call “The Science” and “The Art”.

The Science

This involves everything that is needed to get the projectile onto the target the vertical plane or otherwise described as (the correct elevation). Physics with algorithmic based calculations will tell us the trajectory after effects from the atmospheric conditions, distance to the target (lasered) etc have been accounted for. Expensive velocity measuring equipment provides us with the exact velocity of the projectile and computer software predicts the fall of shot from the rate of velocity degradation, spin drift and Coriolis effects.

The Art

The skill in using this precision rifle to produce tight groupings also lies with the shooter. The ability to predict the wind away from the shooting position by observation of mirage, lay of the land and wind effects on objects is no science, believe us. These skills can be taught but are only mastered from patience and a lot of practice.

Let’s break down the Science component in percentages of what constitutes a precision rifle capable of shooting long range.

1. Rifle - 30%
2. Scope / Mounts - 30%
3. Cart/Projectile - 40%

Rifle

Accurate long range shots cannot be achieved if the rifle itself groups 2MOA at 100m. Equate this to 800m with no wind and we are looking at an 18.32” group.

Scope/Mounts

No point in trying to shoot longer range if the scope can’t get you there. Scopes can either have mechanical elevation or optical elevation or both. A scope with just a plane cross style reticle only has mechanical elevation (Elevation Turret). Any reticle with measured, graduated marks that appear below the horizontal central axis are examples of optical elevation. In order to utilise the optical elevation after the mechanical elevation has run out, the values of the reticle must match the values of the elevation turret.

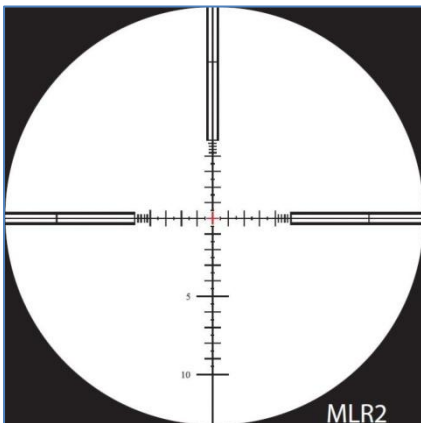


Figure 4. Nightforce MLR2 Milrad reticle

Depending on the cartridge used in the rifle, there is a considerable amount of elevation required to have your bullet cross your line of sight that second time at the 1000m mark. For a 308 WIN 175gn SMK an average of 11.5 Milrad or 39

MOA is needed. For the 300WM firing a 210gn Berger, 8.5 Milrad or 29 MOA is required.

If your scope does not have this elevation in the top turret, or enough stadia below the cross, you aren’t going out there. Even if you have purchased a \$4500 S&B PMII scope you must also look at using a sloped rail of at least 20MOA to get the entire elevation out of the turrets. Most scopes out there soak up (6 Milrad) or 20MOA of elevation just to zero them at 100m. Scope selection is critical in long range capability.



Figure 5. Nightforce NXS High Speed Milrad turrets. Each number value corresponds with the number value on the MLR2 reticle in Fig 4.

Cartridge/Projectiles

There are two rules to projectiles that can be applied here. If you want to shoot long range then;

1. Your projectile should still be supersonic when it meets the target, or
2. If your projectile drops below the speed of sound, then it should be dynamically stable⁽⁴⁾.

A good deal of projectiles suitable for long range shooting are not dynamically stable³. Long slender high ballistic coefficient (BC) projectiles with Secant ogives tend to have less dynamically stable properties than shorter lower BC projectiles with Tangent ogives. To achieve acceptable results with high BC secant projectiles, they should only be used in the supersonic régime. If you want to use these projectiles and wish to shoot 1200m then you will need a cartridge powerful enough to drive these. A 7mm Remington Magnum is an example of this. A .308Cal Berger 210gn VLD suffers when used outside the supersonic zone. A .308Cal Sierra 175gn Matchking does not. This 30cal projectile is brilliant for extended range shooting well past the transonic and into the subsonic zones.

Your rifles twist rate MUST be fast enough to stabilise your chosen projectile. Using long slender projectiles requires rifle barrels with fast twist rates. The good deal of hunting rifles out there have barrel twist rates that are too slow for long rang shooting.

OK now we have broken down this area, here is how to select a rifle precision rifle for Long Range Shooting.

Precision Rifle System Selection

1. Determine where you are going to shoot this rifle and what you are going to shoot. This will give you an idea of the distance needed for the maximum shot you may have to take and the energy needed to take down your game or drop that steel target.

You have now selected your Cartridge!

2. Your target is inanimate! Find your most accurate dynamically stable target projectile available. If your target is game, then you must also select the highest BC hunting projectile you can find that retains enough energy at these distances to be able to perform within the performance velocity band that it was intended.

You have now selected your Projectile!

3. Find the highest quality scope you can afford (at least half the cost of the rifle) with enough elevation on its turrets with a good reticle. Note: Your click values must match your reticle values. Try an avoid getting ¼ MOA scopes with Milrad reticles, you will just end up confusing yourself. If you are set on imperial measurements and love the MOA then get an MOA reticle, they are out there. If your turret values match your reticle then you have just increased your elevation by adding optical elevation to the mechanical. If you have a 30 Milrad of mechanical elevation on your Nightforce NXS F1 Milrad scope, you also have an extra 10 Milrad of optical elevation on the MLR2 reticle. Easy.

You have now selected your Scope!

4. If you can find a rifle with what money you have left then fantastic, If not, start saving. This rifle

³ Dynamic Stability is the projectile's ability to overcome forces exerted on it, usually when travelling through the transonic zone between Mach 1.2 and Mach 0.8. Shorter projectiles with tangent ogives are more dynamically stable than longer ones with secant ogives.

must first appeal to you. It must also have the correct twist rate, shoot nice tight groups and be able to be carried to where to want to shoot it. The stock should fit you off the shelf or be adjustable. The stock should also be designed around shooting in the prone position. Your rifle selection may be based on hunting in the mountains of New Zealand or driving it to the 10,000 acre property out west to shoot your favourite 1100m rock target with your mates.

You have now selected your Rifle!

So when looking at purchasing rifle for this sport try buying in this order for a change and we promise you success in the right equipment choice.

1. Select Cartridge then the projectile.
2. Find the scope and mounts you need.
3. Buy the rifle capable of delivering the goods.

Glen Roberts
Chief Instructor
Precision Shooting Australia
www.precisionshooting.com.au

References

1. Roberts G. Rifle Stocks - Pick the Right One 2011: Available from:
<http://www.shootingnews.com.au/Features/General/Rifles/FEATURE%20Rifle%20Stocks%20Pick%20the%20right%20one-PG1.php>.
2. Vaughn HR. Barrel Vibration. *Rifle Accuracy Facts*. Manchester, Connecticut: Precision Shooting; 1998. p. 69-74.
3. Vaughn HR. Recoil Effects. *Rifle Accuracy Facts*. Manchester, Connecticut: Precision Shooting; 1998. p. 46-54.
4. Litz B. Extended Long Range Shooting. *Applied Ballistics for Long Range Shooting*. 2nd ed. Cedar Springs, MI: Applied Ballistics LLC; 2011. p. 149 -163.