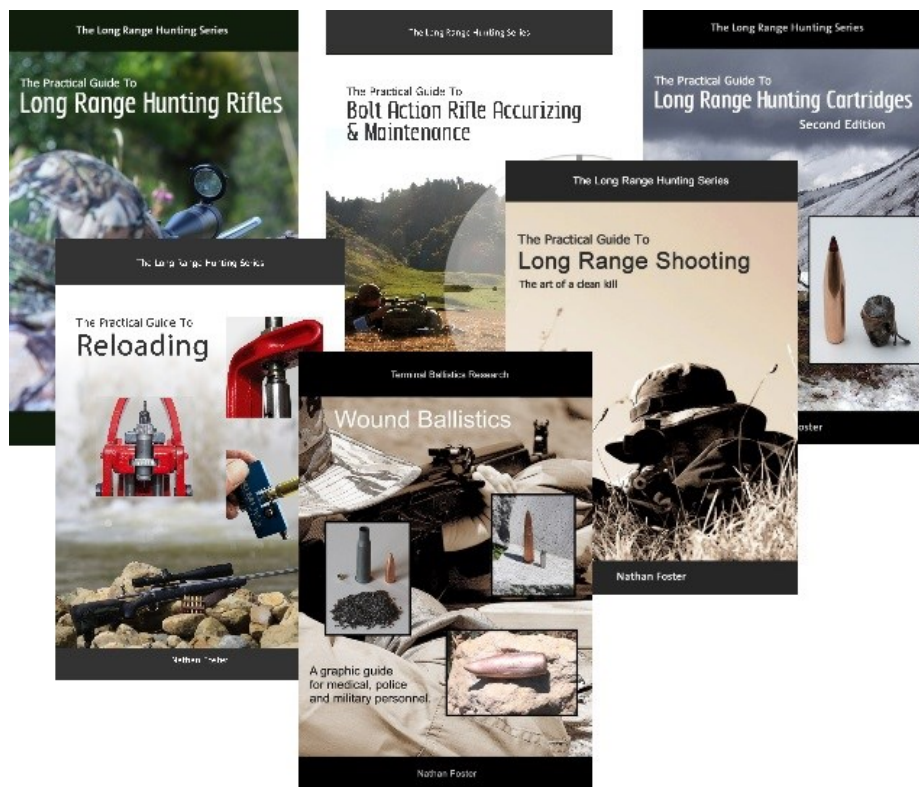


Terminal Ballistics Research - Who are we?

Nathan and Stephanie Foster, we are a husband and wife team who have dedicated our lives to researching rifle accuracy and cartridge performance. We are based in New Zealand which due to its temperate climate and the resulting effect on game numbers, has allowed us to hunt all year round. Throughout our many years of hunting, we have now taken well over 11,000 head of game. We have no time for theory, all of our research is based on field experience, acid testing rifles, cartridges and equipment.

What do we do?

We have published a vast amount of our research freely on our <http://www.ballisticstudies.com> educational website. The website contains information on wound ballistics and cartridge performance. The 'Practical Guide' book series walks the reader through the fundamental aspects of rifle selection, cartridge selection, rifle accurizing, reloading and field shooting technique. No other book series contains this level of practical information for today's shooter. We have also produced videos based on the books. We provide one on one tutorial services and have provided books, educational and consulting services to ammunition manufacturers, police and military groups worldwide. We are the designers of Matchgrade bedding and stock stabilizer products.



New for 2019 – Foster Manson Reamers (FMR)



A series of enhanced performance reamers designed by David Manson and Nathan Foster, tested with the help and support of Grant Lovelock, co-owner of True-Flite NZ.

- .280 Remington FMR
- .280 Remington Ackley Improved FMR
- 7mm Remington Magnum FMR
- 7mm Practical
- .30-06 Springfield FMR
- .30-06 Ackley Improved FMR
- .300 Winchester Magnum FMR
- And re-introducing the M-852 Match

Optimized for universal usage including general hunting, long range hunting and match applications.

Although many of our cartridges appear to be tried and true, new projectile designs such as the Hornady ELD-X, ELD-M, A-TIP and the Sierra TMK have created a number of problems. Many of these new long for caliber bullets produce outstanding results both on target and game out to exceptional ranges. These new projectiles are cruise missiles capable of exceptional, jaw dropping performance. However, the new bullets designs have also created conflicts within existing magazine fed rifle designs.

In plain terms, many rifles (or more specifically the chambers) simply aren't up to the tasks that we want to put them too. The bullets are continually evolving but rifle chambers have remained much the same. The OAL's are too long for the rifle magazines while the throat leade angles can create finicky performance.

Those of you who work within the industry will know just what it is like when you have put all of your effort into a job, only to find that the customer's rifle turns out to be extremely temperamental. Those of us who care about our customers can end up losing a lot of sleep and a lot of money over these jobs.

Through my research and with the tireless help of Dave Manson and Grant Lovelock (True-Flite barrels, New Zealand), I have been able to determine that a major proportion of these problems stem from the original chamber designs. A barrel maker can for example, waste a lot of time fretting over poor performing barrels when instead, the reamers have been the cause of issues. These issues effect both those who make the barrels and those who fit them. Many barrel makers, gunsmiths and end users simply do not understand the gravity of this, blaming for example the barrel maker when it is the decades old reamer design at fault. These issues have created a great deal of unnecessary stress and

animosity between gunsmiths, clients and barrel makers for no other reason than a misalignment of technologies.



Dave Manson and I have set about correcting these issues via the creation of a small line of optimized reamers. I am eternally grateful to David Manson for his commitment to the shooting sports and for going the distance on this mind-numbing project. I am also immensely grateful to Grant Lovelock for supplying us with barrels, helping us greatly with the costs of testing.

The new reamers are in essence an overhaul of some now very old designs, enhancing their performance with modern long-range projectiles. Some tolerances have been maximized while others have been minimized but without reducing tolerances to the point of excessive pressures with +P type factory ammunition. The new reamers help to guide these long projectiles into the lands with minimal upset, resulting in optimum accuracy while at the same time complementing power generation.

Direct benefits include:

- Rifle manufacturers and barrel makers will find that these reamers compliment their barrels as opposed to having customers complain about a finicky barrel.
- Gunsmiths will enjoy the same benefits of non-finicky long-range rifles. This means less time spent with either load development and / or potential customer complaints.
- Hand loaders will find load development somewhat easier. For example, rather than the rifle being picky to the last .2 grains of powder and with groups ranging from 1.5 MOA down to .5 MOA (or simply poor accuracy), group spread across the load spectrum is more uniform.
- Complimentary to both hand loading and factory ammunition use (no requirement to neck turn if the end user does not want to do this).
- Optimum power and accuracy with modern long-range bullet designs.
- Potential reduction of plasma-like copper fouling (depending on barrel / chamber finish work).
- Room to chase throat wear without LR bullets sitting out into the case neck.

Dave Manson and I set about this project to help rifle and barrel makers, smiths and end users. I very much hope that this helps bring people together, helping to build positive relationships between those who build the rifles and those who use them.

M-852 Match

Just before I go into further explanations of each cartridge, I would like to make readers aware of one of Dave Manson's previous and highly successful universal reamer designs, the M-852 match. Designed many years ago, this reamer creates a chamber suitable for 7.62 match service rifles while also being ideal for .308 Winchester general hunting and long-range hunting rifles. The M-852 features tight tolerances and gentle angles, without creating excessive pressures. In Dave's words, it had to handle whatever ammo was thrown at it - and it did, producing great accuracy with both factory ammunition and hand loads. This reamer has won many competitions but is perhaps not as widely known as it could be among long range hunters. Even if you are not planning on buying a reamer, I would suggest that .308 users make a note of the name of this reamer (perhaps in the back of your reloading journal) just so that you have this as a future option.

.280 Remington and .280 AI FMR

Example of max OAL:

162gr ELD-M – 3.456" (87.8mm).

(NB: Will require an additional .040 / 1mm mag space for smooth magazine feeding / long term wear if seating close to the lands):

WARNING: Do not seat to this maximum overall length. Please follow normal reloading procedures. The quoted max OAL is an example only and does not indicate the exact OAL of any given chamber.

I have worked on a good number of .280 rifles over the years and while most of us have probably read great gun rag reviews about the 06 necked down to 7mm, the reality is, not every job turns out to be 'gun of the week'. In some instances, a .280 or .280 AI might boast fairly high velocities, but the accuracy sweet spots required for true long-range shooting are often at lower velocities than many people would like to admit. I have encountered both excessively long and short throated .280's, either of which can cause problems. The leade angle at the throat has also been problematic with some reamers. By applying lessons learned from the 7mm Practical, we have been able to create an excellent .280 and .280 AI reamer design.

Key factors for end users:

- Mixture of maximum and minimum dimensions for maximum power, minimal error.
- OAL had to be made long to ensure safe operation with loads in Hornady / Nosler manuals.
- The OAL is not however excessive as per some reamers / rifles. The reloader can seat close to the lands without having the projectile hanging out of the case neck.
- Suitable for factory ammo (soft point ammo) or hand loads with match bullets.

7mm Remington Magnum FMR

Example of max OAL:

162gr ELD-M – 3.425" (87mm).

180gr ELD-M – 3.472" (88.2mm).

(NB: Will require an additional .040 / 1mm mag space for smooth magazine feeding / long term wear if seating close to the lands):

WARNING: Do not seat to this maximum overall length. Please follow normal reloading procedures. The quoted max OAL is an example only and does not indicate the exact OAL of any given chamber.

Factory rifles chambered for the 7mm Remington Magnum can prove to be finicky as to which bullets they like. On the other hand, the max OAL's for this cartridge are already very good. Like the .280, this reamer has been given an overhaul based on lessons learned from the 7mm Practical rifle cartridge.

By applying the 7mm Practical body, neck and throat geometry to the 7mm Remington Magnum, the enhanced Rem Mag remains within SAAMI specs (no need to neck turn) but sees a meaningful improvement in accuracy when using long range bullets along with optimal power generation. The maximum OAL's for this reamer are identical to typical factory rifles such as the Remington Sendero, therefore this reamer suits long actions with generous magazine boxes. A good minimum internal magazine box length for this cartridge is 3.500" (89mm). Having said this, in a budget rifle such as the Tikka T3 with its short plastic magazine, the enhanced geometry of this reamer offers much greater potential for accuracy than standard reamers when ammunition is jumped by .120" or more. This reamer is all about maximum power, excellent accuracy versus minimum fuss.



Everyone likes to see nice groups, but the reality is, not all rifles shoot that well. In the above picture, the barrel of this 7mm Rem Mag factory rifle was actually quite good, but the throat design let it down,

compounded further by the final finish. This rendered the rifle hopeless with SST and ELD-X factory ammunition.

Key factors for end users:

- Mixture of maximum and minimum dimensions for maximum power, minimal error.
- Max OAL is unchanged from factory rifles. End user notices no difference.
- Better performance with factory ammo (soft point ammo or tipped).
- Extremely good long range performance / less fussy with load development. Can utilize both tangent and secant profiles without issues.

7mm Practical

Example of max OAL:

162gr ELD-M – 3.583" (91mm).

180gr ELD-M – 3.630" 92.2mm).

(NB: Will require an additional .040 / 1mm mag space for smooth magazine feeding / long term wear if seating close to the lands):

WARNING: Do not seat to this maximum overall length. Please follow normal reloading procedures. The quoted max OAL is an example only and does not indicate the exact OAL of any given chamber.

Most of our readers are now familiar with my own wildcat creation, the 7mm Practical. This cartridge is now several years old but I have included it in this newsletter due to the fact that we used the math and lessons learned from R&D for this cartridge during the development of the FMU series of reamers.

As a quick recap, the 7mm Practical is based on the .300 Winchester magnum necked down to 7mm. The body is slightly blown out, the shoulder angle is slightly steeper and the neck is allowed to grow long. It was initially developed between the years 2010 and 2011, then underwent further R&D towards optimum throat geometry with batch reamer production beginning in February 2017. More than simply 'magnum power', the 7mm Practical has been engineered to produce a high degree of inherent accuracy, versatility, long term wear and user friendliness. Power, accuracy and usability are its key factors. It is for these reasons that the 7mm Practical cannot simply be compared to the likes of the .28 Nosler. Velocity is only one part of this equation.

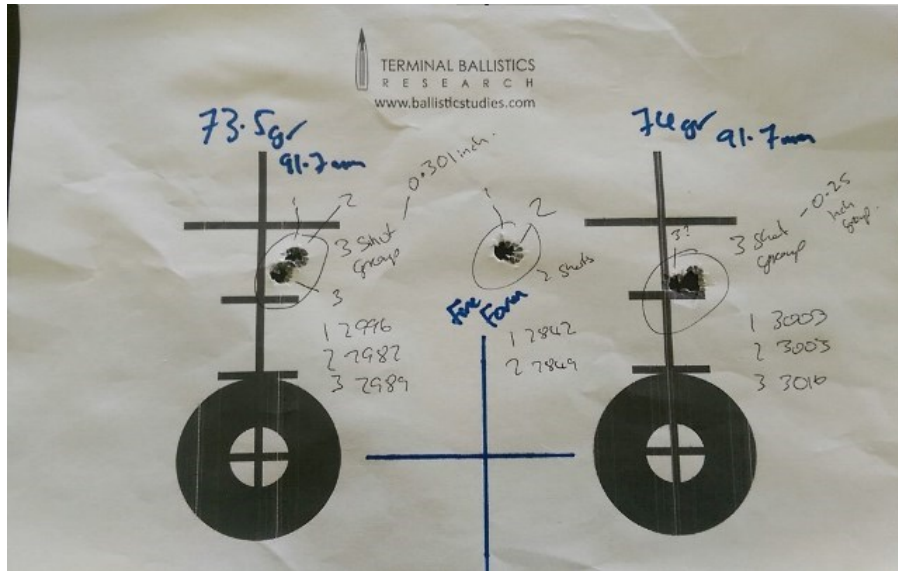


Left, 7mm Remington Magnum, right, 7mm Practical.

Typically, the 7mm Practical produces 3225fps with a 162 grain bullet and 3000 to 3040fps with 175 to 180 grain bullets. Taking the BC's of modern bullets into consideration, the Practical shoots like a laser, boasting immensely low wind drift. Once you have shot the Practical, it's hard to go back to anything else.

The 7mm Practical is a very easy cartridge to load for but is best housed in actions with generous magazine lengths (M700 and clones). A typical working OAL after 700 rounds is 3.660". A magazine length of 3.700" allows this OAL to feed smoothly. It can therefore pay to avoid detachable magazines. The recoil of this cartridge is also not so bad provided one holds the rifle properly and not in the modern lax fashion utilized by those who have never shot truly high-powered rifles. For field use, it does not need a muzzle brake or any device that might cause the muzzle to swell at a later stage. It also pays to avoid fast twist bores as this can rip up the jackets on several bullet designs at such high velocities, leading to poor accuracy. The optimum bore design for this cartridge is the 4 groove (canted) 9 twist bore as produced by True-Flite and also Bartlein and Kreiger. All told, this cartridge is at its most satisfying when housed in a clean, bare and simple rifle design. To me, it is like a Samurai sword. It needs no further adornment (whistles and bells) and success lies in the efforts and discipline of the shooter.

Reamers and dies can be obtained from Dave Manson. Dies can also be purchased from our ballisticstudies.com website.



Load work for a 7mm Practical. This rifle was a factory new Remington 7mm Rem Mag Long Range Hunter, reamed to 7mm Practical. The middle group shows a couple of fireforming shots (70gr H1000) while the left and right groups show initial load development with H1000. The final sweet spot for this rifle was 73.7gr, boasting extremely good accuracy and a very low ES, sitting right on 3000fps once the bore had finally settled. Not bad considering the risky business of reaming an off the shelf factory rifle.



The 7mm Practical is an immensely fast killing cartridge and can be used out to considerable ranges.



How it should be, my own rifle, clean and simple, yet effective out to ranges in excess of 1100 yards.

Key factors for end users:

- Maximum power from 7mm bore without excessive wear.
- A simple wildcat, ensuring ease of components (easily sourced brass etc).
- Reamer design helps to ensure non fussy load development / non finicky rifles.

[.30-06 and .30-06 AI FMR](#)

Example of max OAL:

208gr ELD-M – 3.440" (87.4mm).

(NB: Will require an additional .040 / 1mm mag space for smooth magazine feeding / long term wear if seating close to the lands):

WARNING: Do not seat to this maximum overall length. Please follow normal reloading procedures. The quoted max OAL is an example only and does not indicate the exact OAL of any given chamber.

Maximum OAL's for factory .30-06 rifles tend to vary widely, anywhere from 3.307" (84mm) all the way out to an excessive 3.503" (89mm) with sleek bullet designs. The long throated variations certainly offer some potential in long magazine rifles, but this still does not address issues with leade angles.

For the .30-06 and .30-06 AI, we used the same max / min recipe while optimizing its performance with heavy projectiles, choosing a generous but not excessive maximum OAL (remaining within SAAMI maximum). The throat design of this (and our .300 Win Mag) reamer is entirely unique, its dimensions selected for max power development with heavy bullets and optimum accuracy with a wide range of projectile designs.

Loaded with the 195gr TMK, the 200gr ELD-X or the 208 grain ELD-M combined with Superformance powder, it is possible to achieve velocities of up to and over 2700fps from a 24 to 26" .30-06 barrel. For those who want to push the limits, a 26" barreled AI variant offers further potential. As an aside, although the .300 Winchester Short Magnum can normally exceed these velocities, most light weight rifles generate too much recoil to be much use over 2650fps. In other words, when it comes to real

world shooting, away from theory, this reamer allows for WSM velocities from the old 06 and its AI companion, whether the shooter wishes to use a more traditional powder such as H4831 or a modern high performance powder.

Please note that as suggested, the throat of this reamer is long. With ordinary soft point projectiles seated flush to the neck / shoulder junction of the .30-06 case, bullet jump is akin to the .308 Winchester which utilizes very similar throating for power generation. By the same token, we have experienced great accuracy with factory soft point ammunition in .30-06 chambers simply due to the excellent geometry. Note also that in order to take advantage of this or the AI chambering with long projectiles (plus room for throat wear), the rifle must have a relatively generous magazine length of at least 3.480" (88.4mm). Examples of suitable long actions include the Howa (WBY VGD / Nosler M48), Winchester, older model Sako rifles, Bergara, savage and the Remington M700. The Foster / Manson .30-06 will just fit inside the Ruger M77 but will have to be jumped by around .020 to .040".

Used this way, the .30-06 and .30-06 AI have much the same trajectory as the 7mm-08 and 6.5 Creedmoor but packs a whole lot more punch.



Above, David Manson used a .30-06 driving a heavy weight High BC bullet at over 2700fps to secure this excellent kudu. With new bullet designs, the .30-06 is now better than ever. Those who are willing to go beyond ballistics calculators and theory will find that when loaded optimally, the 06 hits extremely hard, rendering deep and broad wounds on a very wide range of game body weights out to ranges exceeding 800 yards. These factors simply cannot be appreciated when studying theoretical models which these days, seem to rate much smaller bores as the be all and end all of long range shooting. Know this - Hitting and killing are simply two very different things.



This rifle was producing terrible performance with modern factory ammo (165gr SST Superformance) and hand loads but after rechambering, it settled right down. These groups were shot before and after using the 165gr SF SST factory load. The new chamber produces 3000fps (26") with the FMU reamer.



The entire shoulder (head to left, spine at top) of a Red stag, pulverized by the 208 grain ELD-M. The .30-06 / 208gr combo is simply awesome.

Key factors for end users:

- Mixture of both max and min dimensions.
- Completely unique throat design (also utilized within our .300 Win Mag reamer).
- Huge increase in accuracy with modern projectiles compared to previous chamber designs.
- Massive power with heavy bullets.
- Excellent long range performance
- The excuse you were looking for to build kick-ass a .30-06 rifle!

.300 Win Mag FMR

Example of max OAL:

208gr ELD-M – 3.583” (91mm).

225gr ELD-M – 3.642” 92.5mm).

(NB: Will require an additional .040 / 1mm mag space for smooth magazine feeding / long term wear if seating close to the lands):

WARNING: Do not seat to this maximum overall length. Please follow normal reloading procedures. The quoted max OAL is an example only and does not indicate the exact OAL of any given chamber.

The .300 Win Mag is a seemingly tried and true design but has several inherent errors within the original chamber design. After conducting a study of the various chambers in circulation, we found huge discrepancies in dimensions. If you have had problems with a Win Mag in the past, it may well have been the chamber at fault, not the barrel. This cartridge needed a major overhaul in light of recent bullet designs which have proven finicky in some rifles.

To enhance the .300 Win Mag we again selected a combination of both maximum and minimum dimensions. But in order to enhance the design further, we made radical changes at the throat. This allowed us to obtain shorter than SAAMI spec OAL's (for the sake of magazine space) but without sacrificing power. With a shorter OAL, the .300 is a better fit in the Bergara, Winchester and M700 actions. As an example, if the throat is made any longer (as per standard chambers), hand loaders simply cannot reach close to the lands (magazine fed ammunition) with the 225 grain ELD-M in the M700 action. The newly released A-TIP will most likely cause further problems.



The 225 grain ELD-M is a wonderful bullet, but it's too long for most magazine boxes when trying to seat close to the lands, having a max OAL of around 3.720" (94.5mm) in SAAMI spec chambers. This combined with some rather rustic lead angle geometry within the original design made the 225 grain Hornady entirely too finicky in some rifles. To remedy this and other problems with long match bullets, we changed the dimensions for a better fit, room for throat wear, creating tack driving accuracy without any loss in power.

Howa / Nosler M48 / Vanguard considerations: When hand loading for the Howa action using this enhanced reamer, bullet jump with 195 to 208 grain projectiles ranges from zero to around .040 as opposed to the previous huge jumps. These positive changes cannot be understated, helping to enhance accuracy and usability in a meaningful manner.

Tikka rifle considerations: There is only so much that can be achieved with these reamers. The Tikka magazine is unfortunately too short for those who wish to hand load the .30-06, 7mm Rem Mag and .300 Win Mag to optimum potential. Unfortunately, cost cutting throughout the industry (medium length actions with cheap plastic magazines) is in conflict with the new bullet designs. The Tikka can however be fitted with Accurate Mag bottom metal and Accuracy International magazines which allow for a working cartridge length of 3.615" (91.8mm).



Factory .300 Win Mag ammo versus a 208gr ELD-M. The caliper is set to the magazine length of the Tikka action. As you can see, the ogive of the ELD-M is forced into the neck of the .300 case when trying to make it fit the Tikka. Although we have developed this new line of reamers to help optimize performance, there is only so much we can do. If you buy plastic, you get what you get.

Key factors for end users:

- Mixture of both max and min case dimensions.
- Shorter OAL to ensure a better fit in factory rifles.
- Completely unique throat design for power generation and accuracy.
- Huge increase in accuracy with modern projectiles compared to previous chamber designs.
- Can utilize both factory ammo and hand loads.
- Up to and over 2900fps with 200 to 208 grain bullets.
- Over 2700fps with 225 grain bullets, close on the heels of the new .30 PRC (which also suffers excessive OALs).
- Non finicky hand load performance.