TUBB 2000

[from concept to finish]
David Tubb, 10-time National High Power Rifle Champion

FOCUS

Our "new" rifle, the TUBB 2000 (which we usually call the "T2K") has been out now for nearly three years. There are several hundred 2000c ("competition" model) rifles in the hands of competitors nationwide, and a good number in use in the 2000t ("tactical" model) configuration. There have been several published articles and write ups, but so far not one that's really gotten to what I think is the heart of this rifle: the reasons behind its design, the motivation behind its function. That's the direction this article will take.

In our T2K promotional literature, the first statement you'll read is that I designed this rifle to encompass everything I liked and to avoid things I didn't like about the various rifle designs I have used. Considering the array of firearms I have competed with over the past 25 years, this gave us a lot of elements to consider.

I started off in NRA High Power Rifle using a Winchester Model 70 Match Rifle. I stayed with that brand although changed to the "new" shorter action in the late 1980s. As many of you know, I have won numerous NRA National Silhouette Rifle championships using either a McMillan short action or Remington 700. In 1996 I picked up one of Reid Knight's SR-25s and ran it for three years, winning with it at Camp Perry in 1998. For the NRA Long Range events (Palma® and 1000 yard matches) I used a Hall action and, later, two different Gilkes-Ross actions. (All the bolt action across the course and Long Range rifles I used were eventually fitted to my carbon graphite High Power stock — I used wood prior to 1989.)

There have been traits and features I have liked about all those designs, and, coupled with work I put into stock design, sight mounting, rifle weight and balance, and my shooting positions themselves, the manifestation of each year's competition arm resulted from making it the best I could make it — at that specific point in time. However, I was on my own: it was essentially up to me to come up with the parts and modifications on all these rifles to suit my needs.

Concept Goals

Rock McMillan of McMillan Bros. (the T2K's manufacturer) and I first talked about what was to become the TUBB 2000 four years ago. Prior to that, I had conceived of something very similar to the final design, and Rock and I worked together to reach a consensus on several desired elements with respect to production. In my mind, I had set four major goals for the new rifle. These were, again, conceptual goals. Many smaller specific details would have to be met to attain them.

One was that the rifle had to be "done" — options would be available, but certainly nothing that had to be modified, replaced, or purchased (except a sighting system) to make the T2K competitive *at any level*. There have been a few available "semi-custom" rifles from others, but these were no more than common modifications on standard

If rifle adjustments are not easy to make, they may not benefit the shooter. If the rifle won't readily allow a change, then the adjustable stock becomes only a "feature" rather than a tool. All T2K stock adjustment fittings run off one wrench and are accessible from the shooting position (they are also reversible). We made the cheekpiece very easy to adjust from position, and that is because it should be the last adjustment made prior to shooting to align the shooter's eye perfectly with the rear sight aperture.

actions bundled into a package, and none were up to my standard. On our new rifle there wouldn't any outside-sourced component sets or parts used, except for its Anschutz trigger and the Gary Schneider barrel blank.

Next, I wanted the rifle to be owner-serviceable. With the machinery in use by McMillan Bros., we saw no reason that tolerances and consistency couldn't be held closely enough to make all maintenance, including rebarreling (you can order chambered barrels from McMillan), a do-it-yourself proposition — and you wouldn't have to be a gunsmith. You also don't have to be without your rifle, and, furthermore, you eliminate the cost of shipping your rifle to and from the gunsmith. One reason we set this goal was to accommodate the skilled competitor who rebarrels frequently, and also to expand the flexibility of the system by making caliber changes very easy (across the course to Palma to Long Range to varmint, and so on, all on the same basic rifle). Further, this was to extend to encompass all components on the T2K. We envisioned being able to literally take the customer's order and put his or her T2K together from components picked out of parts bins, and have all these rifles perform the same. (Various parts on the T2K come in seven differ-

We built in the SofShot recoil reducer. It uses elastomer inserts and is fully adjustable via a screw. This unit is incredibly effective, especially when firing from a benchrest or bipod. For position shooting I set constraints on its movement potential since I'm using a handstop, but the quarter inch or so it's compressing on my across the course rifle has a very noticeable influence. It takes the place of an efficient muzzle brake.

ent colors, so not only do you pick the caliber, you can also your color scheme.) We certainly exceeded that goal even though the wait for delivery is still measured in months, not days. It still takes time to make the 80-plus precision parts for each rifle (not including the barrel and trigger).

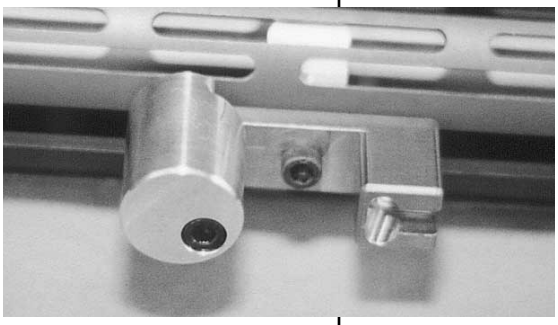
Third, I wanted a rifle that shot as well as anything I could put together using all my shop know-how coupled with quality components. Essentially, we have a close tolerance action fitted to a quality barrel, and the T2K shoots as well any rifle I've ever owned. McBros shoots all the rifles at 100 yards and it's common for a T2K in .308 Winchester to shoot under .5 inches with factory ammunition (the last batch of 6BRs were shooting in the .2s and .3s, which just shows what good ammo does). From my machine rest at 600 yards, it is not uncommon (under 5-10 mph conditions) for me to consistently get 10 shot groups which hover around 2 inches of vertical elevation out of any of my various calibered T2Ks.

Fourth, I wanted a truly adjustable rifle. There are adjustable stocks available for bolt

actions, but not only do I usually dislike their contours and feels, I normally find their adjustment means and limitations (range of movement) unacceptable. Several years ago I designed my own carbon fiber stock for my Model 70s. I also used this stock on my Long Range rifles (I have recently seen that carbon fiber is in use now for benchrest stocks). My stock design reflected some of the contouring and fitting characteristics I had pioneered in Silhouette Rifle, as well as incorporating what I still believe is the best buttplate and adjustable cheekpiece design available.

The tubular stock on the TUBB 2000 is fully adjustable both in front of as well as behind the action. This rifle can literally be molded to fit the shooter, no matter what his or her needs might be. Aside from the adjustable cheekpiece, length of pull, and buttplate fittings (360 degrees of movement), it also has cast adjustment and a fully adjustable recoil reducer (the patented SofShot elastomer buffer which effectively takes the place of a muzzle brake). All of the adjustable parts are scaled (indexed) for repeatable adjustment settings. The forend can be rotated and has a 5-position (for placement of the web of the hand) adjustable handstop of my own design. Of course, the full-length forend rail allows the handstop, or weight system, to be positioned at any point along its full length. The T2K tactical model even comes with an adjustable muzzle-mounted level which allows clear viewing while both of your eyes are focused on infinity (try that with one of those scope mounted levels). Some adjustments require nothing but the fingers, and those requiring wrenches all use the same size allen head and can be done from the shooting position. Additionally, the design of the T2K makes the buttstock easily detachable, making it possible for the shooter to own more than one pre-adjusted assembly. This feature, while it adds cost, aids in position shooting convenience when changing yard lines (I'm always looking for ways to save time so I can better spend it getting myself ready to shoot the next event).

The handstop is my own design. Going the popular "oversized" handstop route was a mistake for me due to the pressures those place against my hand. The smaller diameter is more comfortable. My stop is also made shorter so the sling can contact the back of the hand and increase the shooter's holding power. Relieving some of the pressure from the hand itself makes for a more secure hold that is actually more comfortable. The stop is adjustable for offset over a range of five different positions.



I'm making an accessory laminated wood grip for this rifle (as well as for AR15s) that can take its fit and fitting potential one more step. We call it the "Tiger Grip." This contour resulted from my experimentation and works very well as is, but since it's wood it is easily customizable to the individual shooter's wishes.

Comparing a TUBB 2000 stock to a conventional stock brings me to another point we were firmly committed to: the elimination of conventional bedding. I think I used the best bedding system available on my conventional carbon fiber stocks, which was a aircraft grade graphite epoxy with carbon fibers, but it still had to be done and always presented an extra piece in the puzzle when it came to how well a rifle could be made to shoot. A properly done bedding job can be reliable for a time (it is always a suspect area), but it will never be as good as a glued in action, and coupled with the inarguable need to maintain it we realized that stock bedding would disallow the goal of owner maintenance. More importantly, stock bedding — regardless of the system or materials used — is inferior to no bedding at all, since no bedding means no varying stresses on the action.

Rock and I have tested the T2K extensively and can tell you that there are NO zero changes following assembly/disassembly of the magazine housing (which is screwed to the action) whether the screws are torqued to the same tightness or just just barely snugged up — by design there are no bedding-type stresses imparted to the T2K action. As Rock's dad, Gale, said shortly before his passing, "You guys [Rock and myself] have made a rifle

The bolt on the TUBB 2000 is designed all the way around to be run using only the trigger finger. We managed to reduce lift effort, shorten necessary movement, and apply several specific elements to the action and bolt design to attain what is, without question, the fastest, smoothest, and easiest running bolt rifle made. I'm not going to say you can send bullets downrange as fast as an AR-10 will, but I will say that in timed rapid fire events there is no appreciable difference in speed from shot to shot.

that could effectively put me out of the stock business." This was quite a statement from a McMillan family member who had made much of his livelihood from the manufacture of synthetic stocks.

SR-25 Influence

To fully understand the development process behind the TUBB 2000, it's important to know more about my relationship with the SR-25. I worked over that rifle many times in efforts to get it to my accuracy and reliability standards (it was truly a love/hate relationship). I did succeed (winning Camp Perry in 1998), but never got a the 100-percent reliability I was looking for. What I ended up liking, though, about the SR-25 was its overall configuration, sight mounting options, magazine box, and the absence of bedding. Its mediocre accuracy and inconsistent function, plus its poor treatment of brass (extraction under pressure) and very slow lock time, could only be solved, in my opinion, by something with a manually operated bolt.

Some have looked at the T2K and suggested that it's a "bolt action AR" and that's hardly fair, or accurate. It shares its basic receiver contour and forend style with my SR-25, but not much else. Both those items were improved on: the T2K receiver is shorter in length, not as tall, and the forend is a smaller diameter. The SR also had a detachable pistol grip, but this too has been improved on in the T2K: the grip orientation and resultant hand positioning is now more ergonomic. We retained the Picatinny (mil. spec.) rail for sight mounting, although we elevated it slightly from what I used on the SR. We added a 3-position cant adjustment so the rail itself could be moved in front of the shooter's aiming eye (leveled) after the shooter has found his optimum position. This unique feature further allows specific adjustment of the sighting device, whether scope or iron sight, to the shooter.

We also wanted the T2K to be magazine fed. This allowed a closed top receiver configuration, which is a superior system to the top loading (stripper clips) action on the Model 70 and Model 700.

We've always known that a precision-built bolt action would shoot better than a semi-automatic. With the SR-25, though, there is a perceived advantage in Rapid Fire events. Despite not having the out-and-out grouping capacity of my Model 70, the SR-25 provided the advantages of the shooter not having to move his head on and off the stock each shot (no bolt manipulation) and of semi-automatic bolt cycling. Both things added up to more time for me to focus on each specific shot during Rapid Fire. However, I still hold the rapid fire aggregate record at Camp Perry shooting a Model 70 (1199/162X), so a good performance in these events is not only a matter of speed. With the T2K, we not only avail ourselves of the SR's advantages in Rapid Fire but also surpass the Model 70 in shot

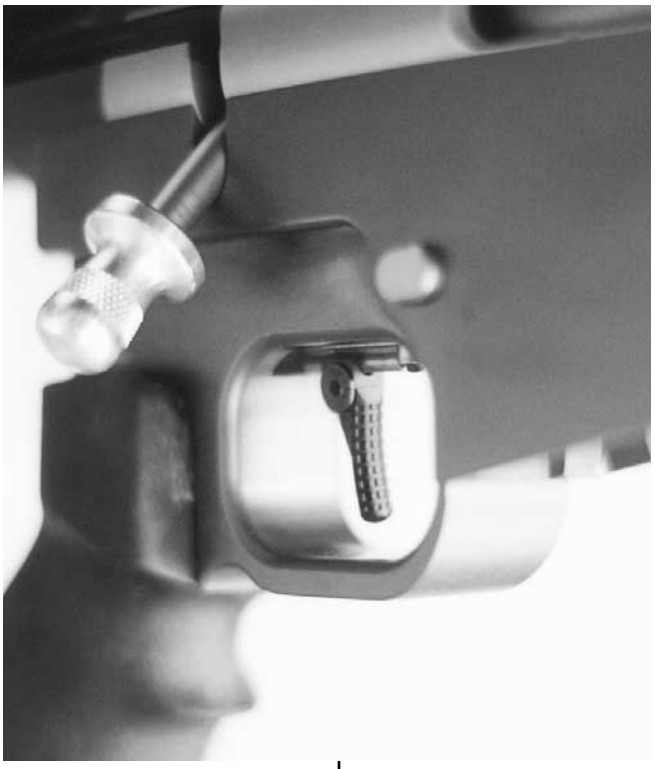
The small ported, round receiver on the T2K is very strong and rigid, effectively on par with the oversized single shot actions and far superior to a Model 70. I can flex a Model 70 action with one hand. The bolt mechanism is engineered like no other I know of: we attained feeding capability, lock up quality, and ease of operation second to none.

grouping potential by increasing the aiming time for each individual shot in the Rapid Fire string.

One of the standout features of the T2K is the fact that its bolt runs inside the butt extension. That means the shooter's face can stay down on the cheekpiece during bolt manipulation. There is no effective time difference for me in shooting a string of timed rapid fire with the T2K and with my SR-25. The semi-automatic is functioning more rapidly, certainly, but the T2K is functioning more smoothly. I cannot detect any perceptible difference in the amount of time I have between shots to get an acceptable sight picture using either rifle. Compared to a Remington 700 or Winchester 70, though, the T2K shooter has a good deal more time between shots.

Also because of this internal bolt path, we were able to move the cheekpiece further forward to allow the shooter more latitude in positioning his head nearer the rear of the action. This results in a more ergonomic head position for most shooters. I look at all the bolt action rifles that have a large distance (gap) between the back of the action and the front of the cheekpiece and wonder if the shooter knows that in prone he is sympathetically retracting his head to place it on the cheekpiece. That, of course, causes muscle tension, but the very fact the shooter is having to retract his head means his head position is not what it naturally wants to be. Good examples of shooters who can attain a more natural head position are a smallbore prone shooter who can put his face right behind the action and the AR-15 shooter who puts his face very close to the rear sight (yes, I know the AR stock is somewhat short). The limitation we faced with a Model 70 is a combination of two things that both revolve around action design, not stock design. One is the aforementioned bolt path — the cheekpiece cannot be moved very far forward before it obstructs bolt opening. Also, the rear sight can't be positioned any farther forward than the stripper clip slot opening (impedes Rapid Fire reloading).

Although my shooting positions have been ingrained over many years, they do change, and I am shooting prone with my head slightly farther forward, closer to the action, on my T2K. My rear sight is also positioned forward of what it was with the Model 70. Much more than that, though, I have watched my kids, Christie and Wyatt, shoot their T2Ks for the last three years and their chosen prone head position or placement would now be touching the back of a conventional action. Being younger shooters, they had less "history" to overcome than I and more readily exploited the new potentials made possible by their new rifles. Both also have mounted their rear sights well forward of the point they



The Anschutz trigger was the easiest decision we made. It's the best, and the TUBB 2000 is the only centerfire rifle I know of that has this unit as its native trigger. This is a fully adjustable match two stage that uses the secondary sear arrangement I developed on my Winchester and Remington rifles: reliability in this system is second to none. The adjustment range on the Anschutz trigger is incredible. Even the "feel" of the let off and trigger positioning are customizable.

used on their Winchesters, and to a position that would be a good deal forward of the clip slot location. The point is that this change in head positioning and sight placement developed naturally, as would anyone's, when they were able to move their heads more forward in prone, and their sights along with it.

As before, the focus of this article is discussing the concepts behind the T2K with the goal of overcoming limitations imposed or forced by other rifle designs. Cheekpiece positioning is a perfect example.

The SR-25 also allowed me to attain a better offhand position than I could previously with my Model 70. Despite my efforts to elevate the sights (I used several offhand-only sight set ups over those years) I never was able to get the upright or more elevated rifle plane with the Winchester that I had with the SR (the magazine well helps the left hand better elevate the rifle). The result was that my offhand position with the Model 70 had a good deal more backbend; this extra bend was done in an effort to get the rifle up to my face. The prone position with the SR was superior as well. I liked the tubular forend (it fits your hand better) and the higher sights which allowed a lower rifle position coupled with a more erect head position — all positives.

We took everything I liked about the SR-25 with respect to my shooting positions and further tweaked them in the T2K. As a result, all my shooting positions are better with the T2K than with the SR, and considerably better than what I had attained with the Model 70. More specifically, the narrower receiver area (absence of stock material on either side of the action) on the T2K, superior pistol grip positioning, better weight balance, and improved butt-end configuration — plus the higher sighting plane — have allowed me to attain my best offhand position yet. Prone is more of the same: I have a better head position with the T2K and an overall more comfortable and stable position on the mat. There are many specifics or details involved in making these statements, but suffice it to say that the superior adjustability and ergonomics of the T2K have made all my shooting positions what I want them to be rather than having them dictated by constraints caused by rifle design.

Technical Goals

Some of the technical goals we set for the rifle had to do with structuring the action operating design and enhanced firing mechanism engineering. These were more difficult to attain because things that have to do with accuracy or firing mechanism are sometimes less flexible in their engineering constraints. A rifle has to work, and work all the time. A forend or sight mounting platform, for examples, might be shaped and fabricated over a wider, more flexible range of options than could a firing pin or bolt.

The action on the T2K is made of 17-4 stainless steel, age-conditioned to a 42-43 Rockwell hardness. The bolt is made from 9310 and the firing pin from H13 tool steel. The

round style, side-ported action offers excellent rigidity and since it isn't bedded, the magazine cut out poses no strength (bedding) questions. (By the way, a single-shot, solid-bottom T2K won't shoot any better.)

The bolt and its operation was another component of the T2K that I probably put as much, if not more, thought into than any other element. I wanted to create the ultimate rapid-fire bolt action. My idea was to have a bolt that could be easily run using only one finger and required the least amount of shooter (position) movement possible. The idea was to preserve the control, reliability, and accuracy of a bolt action while having it operate easy enough that semi-automatic function honestly wouldn't be missed. The T2K I shoot across the course will cock with less than 5 pounds of upward bolt lift pressure from fired position (5 pounds is the weight of the trigger on many hunting rifles).

One of the first questions Rock and I undertook was whether to go with multiple bolt locking lugs or stay with two as was common on actions used in across the course rifles. We ended up using two lugs, but engineered them somewhat differently from those in the Model 70 or Remington 700. The bolt lugs on the T2K are much taller and narrower. We also reduced the diameter of the bolt body since a smaller diameter bolt allowed the magazine to be positioned high in the receiver, positioning the round nearer to chamber centerline for a better feeding path.

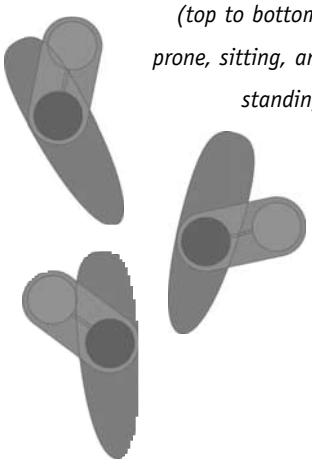
Three and four lug actions have gotten a lot of attention by Long Range shooters with their thought being that the spreading of firing forces with more lugs creates less barrel deflection. This is said to improve accuracy with sub-standard ammunition, as has in the past been used in Palma championships. In my experience, the problems with 3- or 4-lug actions are that, first, the bolt opening stroke is shortened and, second, the increased locking surface area and less cocking surface area means more effort is required to open the bolt.

Some might assume that a shorter lift arc to open the bolt would be an asset to rapid fire performance, but that is not the case. A 45-degree opening (4-lug) is too abbreviated to allow the comfortable wrist and hand motion, as is the 60-degree throw of a 3-lug. We engineered the T2K to open with a 75-degree lift (not 90 as on most 2-lug actions), which was my optimum configuration for hand and wrist movement during rapid fire.

As for the accuracy trade-off comparing two lugs to more, there is none. A well-designed, well-made 2-lug action shoots every bit as well as a multi-lug action, something that benchrest shooters prove day in and day out. Again, ammunition quality is (or was) the issue and I have to believe that most people serious about Long Range competition will have addressed necessary details to ensure that their ammo is good. The T2K had

I wanted adjustment features in the rifle that would allow a shooter to run countless experiments and combinations of cants, lengths, weights, cast-on or -off, and so on, that he would find the perfect balance, and his best position — and do so without making permanent alterations to the rifle. The T2K can accommodate anyone.

These illustrations show how I use the cast adjustment and buttplate rotation to find my best positions in (top to bottom) prone, sitting, and standing.



We chose Gary Schneider custom stainless steel barrels as standard equipment on the T2K. These hand lapped barrels have been on my championship rifles for years. The barrel has what we're calling the "Tubb" contour, which is a profile that resulted from my testing to find the smallest contour barrel that still shot as well as the largest. In other words, we have a contour that won't shoot one bit better if it's one bit bigger. This opens up new avenues in tuning weight and weight distribution in the rifle for optimum position shooting.

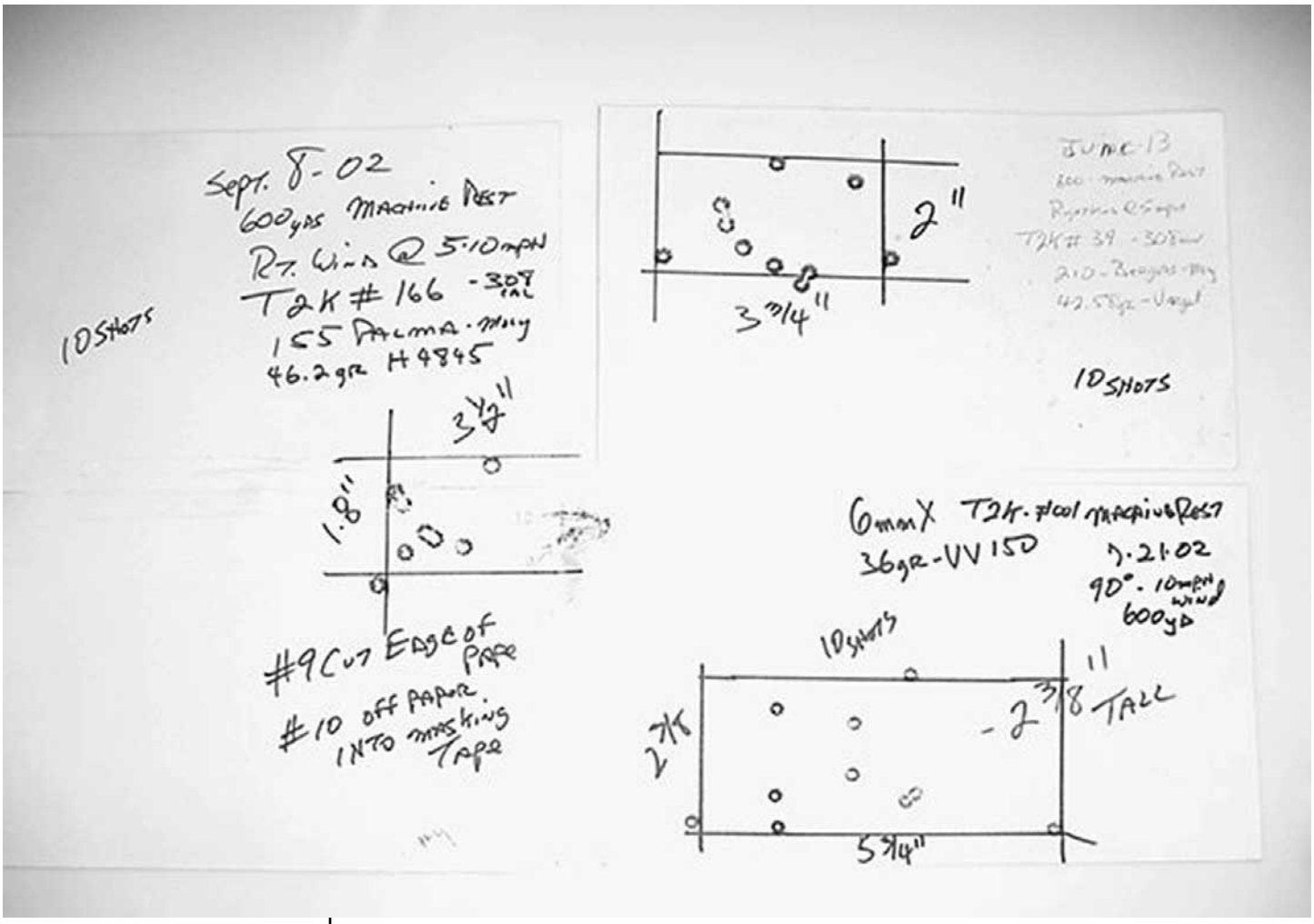
great success in 2002 at Camp Perry in the NRA Long Range Rifle events. My daughter, Christie, won her relay in the Leech (1000 yard) using her T2K Palma rifle (.308 Winchester) with a 200-10X (highest score of any of the divisions — Palma, Service, Any Rifle — for that match). Additionally, Norm Houle from Rhode Island shot a 199-13X with his T2K in 6.5x284 for his relay (Any Rifle, Iron Sight) win in the Leech, and collected that championship by winning the shoot off with 100-5x. Furthermore Mr. Lee Land won

his Wimbledon Cup (1000 yard Any Rifle, Any Sight) relay shooting his T2K, also in 6.5x284, with a 200-7X to secure his slot in the shoot off. He went on to win the shoot off, and the championship, with a 99-7X. Having two different individuals win both of the prestigious 1000 yard matches at Camp Perry with their respective T2Ks shows what the rifle is capable of doing in the right hands.

[The T2K also did quite well in the across the course matches, I won my tenth title this year after winning my ninth last year using a T2K, and CWO Dennis Demille (USMC) finished third in the NRA High Power Rifle Championship. Dennis had shot his T2K for only three months before the nationals and won the first aggregate with a 798-29X.]

There are two cam angles (most bolt action rifles have one) on the rear of the T2K bolt to assist in opening; these mate up with the two cam fingers on the rear of the (hollow) firing pin and aid to ease of bolt lifting by keeping the firing pin centered in the bolt body. The lug design, handle design, extra cam angle and cam finger, plus additional opening ease made possible through our firing pin design, and a chrome silicon firing pin spring, all make the bolt on the TUBB 2000 comparatively effortless to operate. We also incorporated a 25-degree cone bolt face into the design; this configuration is a proven asset to feeding as the angled entry helps to better align the round with the chamber during the loading cycle.

The firing mechanism is another accomplishment I'm proud of. I have worked for years to reduce lock time (time from trigger break to primer strike) in the rifles I use and, to that end, developed several SpeedLock Systems kits for popular bolt action rifles. Lock time reduction on a conventional bolt action comes from lightening the firing pin or striker and increasing the spring pressure that drives it. More can be done, and having the chance to help engineer the TUBB 2000 system from the onset opened other avenues. First, we designed a lightweight, comparatively small firing pin (remember, no cocking piece or bolt shroud) and built it with an internal spring (firing pin spring fits inside of



Here is a collection of groups I have fired at 600 yards from my machine rest. All these are 10-shot and fired in typical Texas Panhandle conditions (a very nice day is breezy). I pay more attention to elevation than wind because of the inevitable influence of conditions, in these cases a 5-10 mph wind. In other words, by measuring elevation dispersion in a group we get an accurate assessment of the grouping quality. My experience has been that a load, and rifle, that holds elevation will hold windage just as well.

the hollow firing pin), similar to what a G.E. mini-gun uses. We were also able to reduce striker fall distance. A Model 70 or Remington 700 striker falls approximately 0.250 inches to impact; a T2K falls just 0.160 to impact. These differences combine to give the T2K a lock time of less than 1.5 milliseconds (ms) compared to the normal 3.0 ms of the Model 70 (and the 15+ ms of the SR-25). That amount of lock time reduction is a huge improvement, and very noticeable.

Since the T2K design allows a close fit of the firing pin to the interior of the bolt body, and the fact that the bolt is internalized in the butt assembly, you are able to run the bolt, firing pin, and spring with all the lubrication you would want and be assured on not having to wipe excess lubricant off your shooting glasses each time you fire the rifle. Being that there is no bolt shroud (or cocking piece) as found on conventional rifles, the T2K goes a long way in effectively eliminating firing pin/cocking piece drag on the bolt shroud/bolt body. We also reduced the firing pin hole diameter from the common .075-plus inches to .065. This creates a lot more impact energy onto a smaller spot, so the T2K firing pin is striking the primer with more than adequate amount of inch-ounces of energy to reliably ignite even the hardest primers.

The TUBB 2000 shares nothing in common with its competition. Each of the single parts in it, as well as any one of a dozen more features it has, could easily be written up in other articles, but, again, the focus here was to look at the concepts behind the design

of the TUBB 2000. We have a lot of material available on line at www.zediker.com [the Zediker Publishing web site] including a downloadable users manual and several pages of technical information. Please feel free to call, write, or e-mail if you have further questions. Complete information and contact references can be found on my web site, www.davidtubb.com.

This is a TUBB 2000t ("tactical") model. It's identical to the competition rifle but is available in all black and comes with fewer accessories. Like the "c," though, it is ready for service out of the box. Put a scope and rings on it and head to the range!

CONTACTS

McMillan Bros. Rifle Co.
1638 W. Knudsen Road, #102
Phoenix AZ 85027
Contact: Ron Fuchs
623-780-2115

David Tubb
Superior Shooting Systems Inc.
801 N. Second St.
Canadian TX 79014
806-323-9488