A Question of Compensation

By Patrick Kelley, Ty-14401

As practical shooting competitors, our ability to reduce the time interval between shots accurately delivered on one target is something that we perhaps focus too much attention on. "Double Tap," "Double Hammer," or "Controlled Pair" - pick your phrase and prepare to defend your definition in the tactical wannabe internet chat rooms. Or simply understand it matters little what you call it, just as long as you can do it, and preferably faster than the competition.

While proper technique is *the* most important aspect in the delivery of accuracy at speed, our equipment choices, including compensators, or muzzle brakes if you like, play a vital role. I spent many years as a devout Limited division pistol competitor and had little use for the gadgets until the world of 3-Gunning demanded my attention. At that time the only major 3-Gun event I was attending is the now defunct Soldier of Fortune (SOF). Their rules prohibited the use of compensators, as did the USPSA Limited division during the same period. This was fine with me as I was plenty happy with my finishes at SOF and other less notable matches. And besides, who needed a compensator on a .223!

Fast-forward a number of years to the height of the 1994 - 2004 Assault Weapons Ban. USPSA is pressed (as were other match organizers) to allow muzzle brakes in the Limited division to accommodate the many permanently-attached factory-braked ARs sold during the period. The new rules approved compensators, provided they were no more than 1 inch in diameter and no longer than 3 inches.

Now AR muzzle brakes are showing up everywhere and creative marketing campaigns abound. The following are clipped quotes from various internet sites.

"This allows the brake to negate recoil and muzzle climb"
"Best we have ever seen!"
"Rapid fire on target without loss of sight picture or sight alignment is no problem"
"The finest AR-15 / M-16 Muzzle Brake in the world"
"Stops all muzzle climb"
"Virtually eliminates muzzle jump"
"Corrects sight misalignment and makes you look slimmer"

Patrick Kelley lights up the night sky with a Hill comp.

Okay, that last one is not a direct quote but how do you pick one out of the field?

A few months ago I mentioned to *Front Sight's* assistant editor that I had some ideas about how to objectively test and compare muzzle brakes using a test fixture. Robin, ever eager to offer you, The Reader, something to help you in your quest for better shooting said, "Go for it. If it reads well and works we'll try to get it in!"

"Try" was the operative word here. After assembling four test fixtures, one remote trigger release unit, expending 300 rounds of 55 grain 5.56 ammunition, driving some 400 miles to and from my most local range, I have some data to share with you and some ideas on what makes a muzzle brake work and who makes those brakes.

Before we get too much further I would like to deeply thank the participants in this test. All of these fine folks sent me a compensator on my word that I would fairly test each and report the findings here in the pages of *Front Sight*. Each knew that a ranking of sorts would result and that someone would be first, and accordingly, last. While the list may not include your favorite comp I chose to limit the test to those available "over the counter" and I was limited to those who responded to my request.

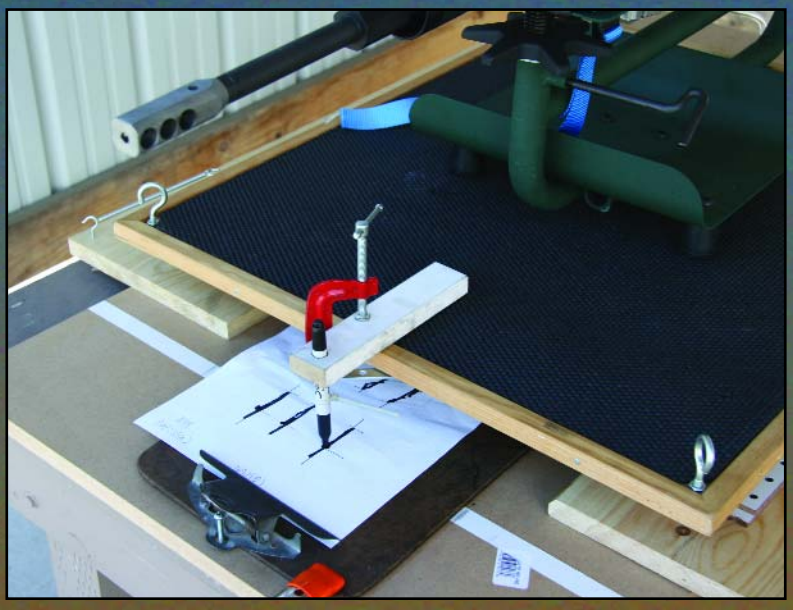
Test fixtures and testing protocol.

My initial idea was to buy a rifle rest that incorporated a built-in recoil scale. Yes, a company makes one but a few things shied me away from its purchase. #1 -the ad copy led me to think it was designed for "real recoil" and may not offer useable data at the low end of the scale. #2 - it only measured in one plane: rearward thrust. For a thorough test I felt it necessary to ascertain lateral and downward movements as well. # 3 - the remote trigger device looked cumbersome.

So I attempted to build a better mousetrap.

Of the four devices I built, two were used to gather data for this article.

The first item to build was a remote triggering device. I played around with a couple of remote trigger ideas, including an electrical solenoid and a camera pressure bulb, but ended up making a simple pump-to-bladder unit that slipped into the trigger guard. Inflation of the bladder presses the trigger to the release point.



Roller Ball 2 in action. Kelley's rest rode on a bed of material-handling ball bearings, allowing the rest to slide easily both front-to-back and left-to-right. Note the recoil-tracking Sharpie™ in the foreground.

The little comp that could. The TTI comp surprised Kelley with its effectiveness and shootability. Its dust signature was not meaningfully worse than the other seven.

The first test fixture, "The Sled," was designed to offer enough scale of movement to make effective comparisons in the rearward recoil reduction between the un-braked (naked) rifle and each compensator. In its final version The Sled proved it could repeat this accurately over many tests.

The second fixture, "Roller Ball One," would have allowed me to graph lateral and rearward movements over the horizontal but it turned out to be too sensitive for field use, e.g., it moved in response to temperature changes and range breezes.

The third fixture, "Chain Gang," suspended a platform via chains from a truss work that was coupled to an electronic strain gauge. While this set-up generated some useful numbers, I could not get repeatable data so they were not included in the test.

The last fixture (a modified version of Roller Ball One), "Roller Ball Two," used dampeners to attenuate the previous sensitivity issues. An attached pen was used to graph the results for lateral and downward force independently. This also served as secondary proof of rearward thrust data collected from The Sled.

The AR used for the tests was one of my Frankenstein guns. Many of you have at least one of these assembled from bits and bobs collected over the years. This 20" flat top was strapped and bolted into a Caldwell rifle rest for all the tests. Israeli 55 grain mil-spec ball provided the motive force. For each test I would singly feed the chamber and close the bolt, set the fixture in the start position and verify the fixture was level. My wife Karen would trip the trigger on the signal "Hit It" and I would then record the data. This was repeated for all rounds fired. After a representative sample was collected, I would refit the muzzle with the next compensator and repeat. It is worth noting that to verify the accuracy of our testing methods we would fire a string between each compensator with the muzzle naked to confirm our set-up had not changed.

Our goal was to demonstrate by comparison the percentage of recoil reduction offered by each brake reflected versus the naked barrel.

For example, during the rearward thrust test The Sled would roll 10" without a brake attached. Each brake was compared to that "full pull" value to calculate a percentage of reduction. A roll of 5" would be a 50 percent reduction.

The downward and lateral testing used the Roller Ball Two. This set-up had the Caldwell rifle rest firmly set upon a platform that was balanced on a group of 1" material-handling roller balls. Attached to the platform was a

"The Sled" consisted of a Caldwell rifle rest on rollers. Smooth rollers gave repeatable results with even the modest recoil of a compensated .223.

set of springs to control and dampen modulations. A marking pen was fixed to record the modulations on a sheet of graph paper.

As you *may* expect the naked barrel test showed no lateral or downward travel. However, the pen did lift off the paper under recoil, leaving a dotted line in the process. It was very important to have the assembly balanced so that the recoil energy was evenly directed, and thus not skew the results. This balance was checked as before by shooting a series of shots sans muzzle appurtenance between each compensator.

Since all the compensators vented lateral gases symmetrically, the data I collected from my graphs showed no discernable difference in sideways motion from that of the naked muzzle.

In the down force tests compensators were indexed 90 degrees clockwise from "normal" directing the force to move the graph pen to the left, if at all. I can only submit a ranking of compensators using the amount of movement off the center line produced by the plain barrel as useable information. Seven of the eight brakes tested had some specific redirection of gas to reduce muzzle lift. The difference between comps was subtle indeed.

I have also included a series of photos depicting the "dust signature" produced by each brake. I will let the photos speak for themselves.

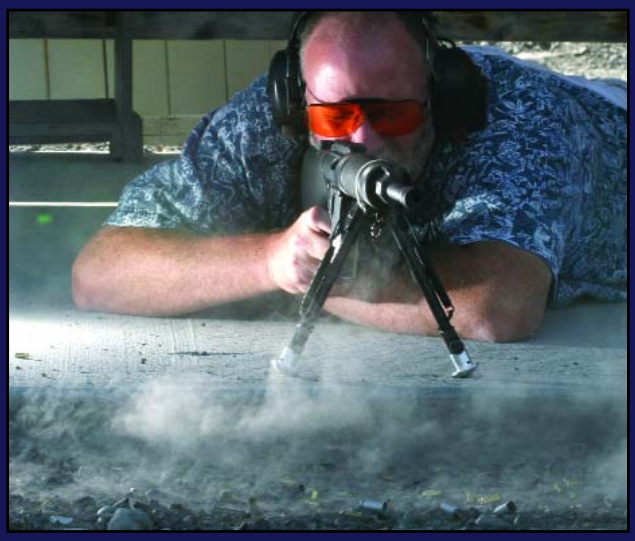
The Participants.

The JP Recoil Eliminator resembles the muzzle brakes found on some artillery pieces and tanks, thus giving us its alternate name, "the Tank Brake." I requested this Open division compensator to use as a benchmark for effectiveness. While it ranked well in our tests at 2nd with a 61% reduction in rearward movement and 5th for down force, my bet is the .223 does not offer enough gas energy to make full use of its large surface area.

JP's Tactical/Limited division offering, the Cooley compensator, is arguably most popular unit with 3-Gunners. It ranked 5th in our tests at 56% in recoil reduction and 4th in down force performance.

The DNTC (David Neth Training Concepts) brake offered by AK Concepts was designed from a different point of view - that of shooter comfort. Applying David's logic that there is more impact on the competitive shooter than just recoil, the crew at AK Concepts created a brake that reduced both recoil and muzzle blast. My testing ranked this brake last, with a 43% reduction in recoil movement and tied for 3rd with respect to down force.

The Rolling Thunder comp was designed and is manufactured by master gunsmith and veteran 3-Gunner Benny



WHACK! Kelley reports the Sabre defense comp directed considerable amounts of blast toward the face. (Hence the involuntary blinking after the shot, above.)

Hill. This comp is employed by some of the more notable 3-Gunners on the circuit. That fact alone may say more than the test fixtures. Nonetheless my data put this stainless steel seven-port brake in 4th place for recoil reduction at 57%, and 1st for down force.

What may be the best brake for the buck is the simply effective DPMS Miculek compensator. At less than $50, this three-slot brake has cleverly regulated the size and placement of the oval slots, putting itself in 3rd place for recoil reduction at 58% and tied for 2nd for down force. Instead of separate holes directing gas to produce down force the Miculek brake narrows the bridge at the top of the first slot to vector a portion of the gas upward.

Sabre Defense builds a full line of high quality AR rifles and offers its own competition-labeled "Gill Brake." Nicely machined and finished, this compensator sports three "gills" on each side. These "gills" have flat surfaces that are used as gas impact plates and also vector the exhaust gas rearward to complete its recoil reduction effort. While I detected no change in down force versus the un-comped barrel, this brake managed a 54% reduction in rearward thrust ranking it 6th place.

The last two compensators tested used very similar gas vectoring techniques to tie for first place in the reduction of recoil.

A brake I would not have tested (nor had heard of) until a got an email from John "Mig" Migliaccio, an active East coast 3-Gunner, was one offered by Yellow Tavern Custom. Their TTi Eliminator comp is the slimmest of the group at just under 3/4" in diameter. My sample was fitted with eight ports, two on top to focus on down force and three per side to handle recoil. My initial impression was "How can this little guy work?" It did not follow conventional wisdom that maximizing gas impact surface area was crucial in reducing recoil. Instead this effective compensator relies on the redirected jets of exhaust gas to garner a 63% reduction in rearward movement. It also ranked 2nd in down force.

The award for most stylish yet effective compensator tested goes to the Titan Comp of SJC Custom. United States Shooting Academy instructor Erik Lund had a hand or two in the design of this beautifully machined and finished muzzle device. Employing both exhaust gas vectoring and impact surface plate areas along with two jet nozzles on the top rate this a tie for 1st with TTi for recoil reduction and 6th for down force.

So that's it, just run out and buy the SJC or the TTi comp and you are good to go, right? Not necessarily. In the end it is not the rifle with the most recoil reduction or a particular level of down force that lets you shoot faster. It is the "predictability factor" if you will, in the muzzle movement of your rifle, that cues your vision to break the next shot.

Without straying too far into the subject of another article, recoil follows the path of least resistance — and as resistance changes, so does the muzzle movement. A compensator that works perfectly for you shooting offhand may not work as well from a different position.

Let us say that when shooting a rifle from the prone position the muzzle and thus the sights move up and right in a circle the size of a dime. As the resistance changes with a shift from prone to offhand, so changes the size, shape and path of our sights in recoil. Accordingly our visual cues will have to adjust to suit the new feedback.

We expend great efforts tuning our pistols' spring rates, slide weight, and loads to achieve the visual feedback that suits our shooting style. Most of us don't monkey with our AR's spring rates, but we do tune our loads and gas impingement system to suit us. Consider your muzzle brake as more than a one-size-fits-all device. The tuning of your rifle's muzzle gases can be an important part of the equation. Getting the best out of your rifle may be a question of compensation.

	Rearward Movement	Down Force
TTI Eliminator	63% (tie)	2nd
SJC	63%	6th
JP Tank	61%	5th
Miculek	58%	2rd (tie)
Hill's Thunder	57%	1st
JP Cooley	56%	4th
Sabre's Gill	54%	7th
DNTC Neth	43%	3rd