What Are You Compensating For?

A 2nd Look At Compensator Performance

By Patrick Kelley, TY-14401

Most every multigun competitor's rifle has some kind of compensator or muzzle brake adorning the end of the barrel; but how well do they work? Some of you may remember the article "A Question of Compensation" from the Nov./Dec. 2007 issue of *Front Sight*. This article continues where that one left off, only adding a space-age twist. (The original article appears at www.multigun.com/articles.)

For that first article, seven different compensators were tested for recoil reduction and down force using test fixtures that I created to collect objective data. I stress objective because if you peruse the internet halls of AR wisdom you will find dogmatic allegiance to brand "X" or "Y" based solely on feel and opinion. My effort then and now is to bring you clear and repeatable data and let you do the feeling and opining after you have made what I hope is a more informed decision. As I stated near the close of the first article "one size does not fit all" and that maxim has not changed. There is no ONE best brake. Too many variables exist between competitors and their choice of equipment. The top 20 3-

Kelley's recoil "sled." The trigger is pulled by way of an inflating balloon. The transparent air line leads to a pump. The laser pointer used for the remaining tests is shown attached to the handguard.

Gunners use five or six different compensators to win on any given day. Honestly, you could just pick one, practice, and never look back. However, competitors always seem to be looking for an edge. My endeavor here is to help you look.

My first article relied heavily on a test fixture called "The Sled." I took a Caldwell rifle rest with a set of wheels attached, and set it up to roll rearward under the effects of recoil. The trick here was to balance the affair to offer enough scale of movement to make effective comparisons between the un-braked (naked) rifle barrel and that

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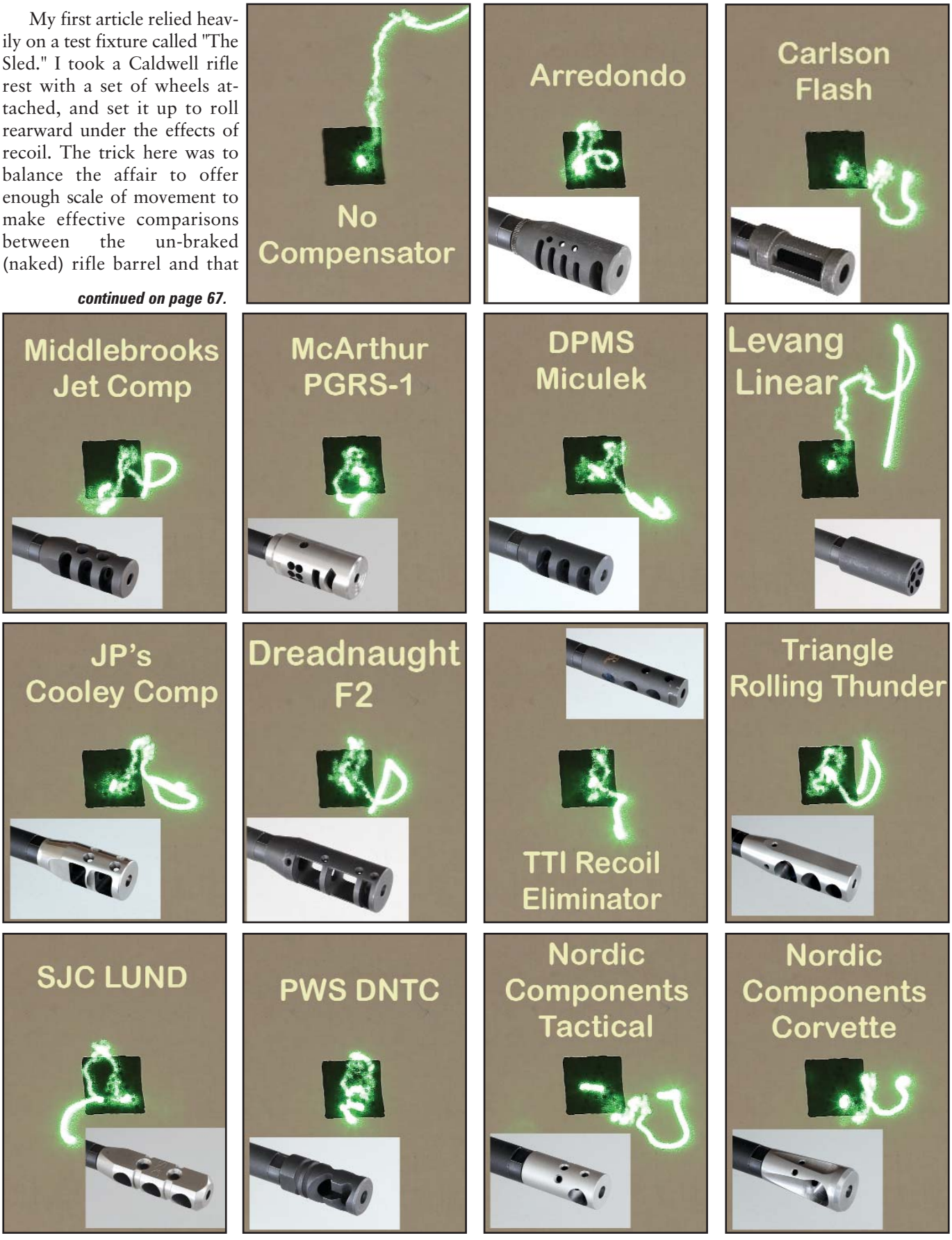

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with each compensator attached. The Sled proved it could repeat this accurately over many tests. I expressed those differences as a percentage of rearward movement, e.g. if the unbraked carbine moved the sled 10 inches, and with brake "X" the sled moved 5 inches, that's a 50 percent reduction.

While the Sled worked marvelously for measuring gross recoil reduction, I was not wholly pleased with the test fixture for downward and lateral movement used in the first article. While it did show subtle differences between brakes, it did not tell the whole story.

Sometimes working too many 12-hour night shifts (at my real job as a power plant operator) can lead to interesting ideas! One of my transitions from night to day shift had me awake when sleep was truly needed, musing on the downward-and-lateral data collection problem. I'd also been tinkering with capturing muzzle flash images, so it wasn't long before my insomniatic mind put the two together. I reasoned that by employing a darkened range, still photography, a laser equipped carbine and a target, one could show exactly where the muzzle moves during recoil! Great idea, brain, now shut off and go to sleep!

To bring that sleep-deprived idea to life I affixed a handheld laser to the hand guard of the test rifle -a 16-inch leftover parts-built Frankenstein gun firing IMI 55-grain FMJ-BT ammunition at 3050 fps. Then firing offhand I would trigger a shot immediately after giving the command to open the camera's shutter. A tripod mounted camera and I stood 12 feet from the one-inch black aiming square pictured in the graphs.

The meaning of what you see in the graphs may not be readily apparent. At least it was not immediately clear to me. Keep in mind that the laser is moving within my wobble zone before and after the camera shutter is opened. After calling (to my lovely wife) for the shutter's release, I took the shot as soon as possible. You might think that I could just leave the shutter open for a long period. I could, and I did, but the results were unusable.

We as competitors are "programmed to hold center and follow through to center." With the shutter open the laser "draws" my pre-shot wobble zone, the muzzle's movement through pulling the stock military trigger, and finally, driven by the effects of recoil, traces the graph you see here including my follow-through. Too long a shutter duration had my follow-through drawing back over the recoil impulse trace, rendering it useless. I settled on one half-second as a good compromise, minimizing my trace-over due to follow-through.

Three test sessions (with slight variations in protocol) were completed with multiple graphs created for each brake. This resulted in a lot of photos!

Compensators Tested:

	Street Price	Recoil Reduction
Arredondo	120	RR=60%
Nordic Corvette	47	RR= 55%
Nordic Tactical	35	RR=50%
McArthur PGRS-1	175	RR=65%
Carlson Flash	55	RR=20%
Levang Linear	32	RR=0%
SJC Lund	90	RR=75%
TTi Eliminator	90	RR=75%
DPMS Miculek	35	RR=65%
JP Cooley	94	RR=62%
Dreadnaught F2	85	RR=57%
Triangle Rolling Thunder	82	RR=57%
PWS DNTC	65	RR= 50%
Middlebrooks Jet	85	RR=65%

After many hours comparing images, here is how I interpret the information. In each photo, you will notice well-defined sections, and sections that are less dense. This less dense area is due to the "screen door" effect that results from the laser passing though the pre bullet impact powder gas. Understand that the fastest thing out of the muzzle is the expanding powder gas that drives and passes the bullet out of the muzzle. The "screen door" patterns shown in the selected photos represent the best and most concise recoil trace pattern for each of the brakes. Study the photos and you will

A closer view of Kelley's firing balloon system.

see a short defined starting point (pre-shot), the compensator's initial influence on muzzle movement (screen door) and a second longer defined (post-shot) follow-through.

Each image is a complete "bang, extract, eject, feed and close cycle." What I have not shown you is the trace created when bolt locks back on the last shot fired. I do not have the time at this point to cover it, but carrier weight makes a difference! Not necessarily good or bad, just a difference. It did however give me an additional tool to better interpret the graphs once contrasted with the others, as it illustrated when each compensator had "finished" compensating.

Having tested, designed, built, tuned and retested many varieties of rifle compensators over the last couple of years, I am confident in being able to predict what attributes are effective in reducing recoil. But I learned the rest of the story after digesting what was revealed in the graphs.

The greater the recoil reduction the less the muzzle moves, right? Not necessarily. Several of the comps ranked near the bottom in the recoil reduction tests proved very controllable in the graphic tests. Recoil reduction may be THE factor for a .338 Lapua bolt gun, but not for our AR bullet hoses. Our performance criterion places a greater emphasis in making fast and accurate follow-up shots. To this, the graphs tell much but not the entire story.

It is a safe bet that each brake that holds its tracing within the one-inch square would serve you well, but unless you share my physical attributes, shooting technique and equipment the same result is not a given. A tall and lean competitor may want a compensator that does drive the muzzle below the aiming square. Reduced mass tends to offer less resistance to recoil, and muzzle lift would be more pronounced. A compensator tracing that moves to the right (a normal physical reaction for a right shoulder shooter) may the cat's meow for the southpaw. Spend some time looking over the data, I bet you will find a combination based on the information that will fit you!

Provided the performance is there what other aspects are important to you? Short, long, heavy, light, loud? Brand, cool factor or price? As stated previously too many variables exist for me to pronounce one brake the best, so I will not. I will say there are some excellent values if you take cost into account. There are other factors that affect controllability but we'll leave those for the subject of another article. For now, I would suggest that you pick a couple of brakes and conduct your own subjective field-testing. In the end, it is not whose compensator you are using, it is using the right compensator for you.

"If you think it makes a difference, it does."

Tips for tuning your AR compensator.

BY PATRICK KELLEY, TY-14401

I believe Jim Clark Senior (the patriarch of Clark Custom) was the first to apply that title quote to firearms. Following that logic, I will outline a few methods to change the way your muzzle brake behaves.

It is about moving gas, or more specifically directing gas movement. If you want to your comp to influence the muzzle to the left you must release a greater percentage of gas on the right. Keep in mind you are working with a finite amount of gas. Any change in flow favoring one direction reduces the gas flow and its ability to produce work in all other directions.

How do you adjust gas flow? Break out a drill, Dremel®, mill or file and remove material! Make a port bigger; drill a "jet port" through a baffle or two. Tim Ubl of Nordic Components offers this "by incrementally drilling out the hole in the last baffle you can adjust the amount of down-force our Tactical Comp produces". Master gunsmith and all around good guy Benny Hill volunteers this advice on the tuning of his Rolling Thunder comp. "I've built this new comp to be tuned….While at the range, drill the jet ports at 12 and 3 o'clock a little at a time until the muzzle quits moving". The JP Enterprises "Benny Cooley" comp can be found with a jet port located at 9 or 3 o'clock depending on which shoulder the shooter uses. The DPMS Miculek brake has created a legion of tuners. Due to its reasonable price and early entry into the market, this brake is often found in some modified form. Heck, I use the 223 version, reamed, re-threaded, and tuned to fit my Springfield Armory M1A!

The ubiquitous Miculek comp.

You can make effective changes without removing material through "Clocking". This is simply indexing where the comp is positioned at final assembly. Many a right shoulder shooter will report an "up and to the right" movement in recoil. To combat that, "clock" the comp (very near the 1:30 position) to vent its upward gas flow in the same direction.

Whatever the comp or method,

Clock and try,
Drill, cut or buy;
Only you know what you are compensating for!