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VERY High Power

Dedicated to the Sporting Uses of the .50 BMG Cartridge

THE MAGAZINE OF THE FIFTY CALIBER SHOOTERS ASSOCIATION

"We're the Good Guys"

GOODBYE SHREVEPORT

The last shoot at Shreveport.

Break out the physics books! These shooters talk barrels.

WARNING: *All technical data in this publication, especially hand-loading, reflect the limited experience of individuals using specific tools, products, equipment, and components under specific conditions and circumstances not necessarily reported in the article and over which the Fifty Caliber Shooters Association, Very High Power Magazine, its Editor, and staff have no control. The data has not otherwise been tested or verified by the Fifty Caliber Shooters Association , its Officers and Board Members and employees, Very High Power Magazine, its Editor, and staff accept no responsibility for the results obtained by persons using such data and disclaim all liability for any consequential injuries or damages.*

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WORDS from the PRESIDENT

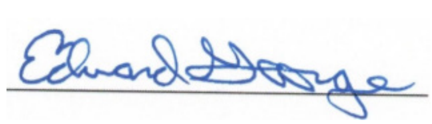
Hello everyone, let me introduce myself. My name is Edward George. I am the new incoming President for the FCSA. I am incredibly pleased to represent this organization. I became a member of the FCSA in 2008. I have a wife, a son and 2 daughters. We live in Baytown, Texas. Since I joined the FCSA, I have met many new friends. During this period, I was the match director for the South Central Shooters Club at Long Range Alley in Shreveport, Louisiana for eight years. I have also been the match director for our World Championship at the NRA Whittington Center in Raton, New Mexico. I have held the position on the board of directors as well.

I want to say thanks to Roy Thompson for his past services as president and his support of me as new president. My apologies for getting off to a slow start this year. Roxanne Myers, the secretary, has been invaluable for her help and efforts in moving the club forward. I have many new challenges ahead with the number of matches we lost this past year.

Hopefully, new opportunities will come our way and be developed. We continue to work on getting the VHP up and running in a new digital format. I welcome any feedback you may have on making our club run successful.

Please walk with me in this leadership so we may continue to support and promote the usage of the .50 Bmg cartridge.

Best Regards,



From the firing line

Roxanne Myers

Hello from FCSA head quarters and larger than life state of Texas.

FCSA has concluded the last match of the year at Shreveport Louisiana at Long Range Alley. We had a bittersweet ending as the Range will be closing and gates will be locked for good. This year the FCSA only held nine sanctioned matches as three were cancelled. We are working on coordination to have another range to host matches hopefully here in the East Texas area. Our club has shrunk a bit over the years, which is no secret to anyone. The last batch of chevron patches will be in the mail soon.

Speaking of MOA chevrons, the nine matches we had in 2025 resulted in 132 total screamers shot. To qualify for a chevron, you must shoot five record shots at 1000 yards with a group of 6.999 or less. In Skip Talbots words "this would be quite a feat!" Here is the breakdown of this year's screamers shot, (73) .6 MOA'S, (36) .5 MOA'S, (14) .4 MOA'S and (9) .3 MOA'S. Five 5x 50s were shot as well.

Our membership numbers are still low. As of November 1st, we have 710 members, of which 346 are Life members. In 2025, we had 25 new members sign up. Membership renewal income for this year so far has been $11,200.00. Even though the numbers are low we will continue to have matches and execute our mission of promoting the sporting use of the 50 Bmg cartridge.

Come shoot with us and have some real fun with a wonderful group of people. Please do not hesitate to call me at the office if you should need anything. Hours of operation are Monday- Friday 8am-4pm central time excluding holidays. I'll see you at the line soon.

Happy Holidays!

Roxanne Myers

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The editor's bench

It is done.

The last shoot at Shreveport is in the books. This and the South Central shoote Shooters Club wondering. go next.

For those in Louisiana and west of the Mississippu and points west, Raton is about a day's drive. You could stretch that to maybe a few places on east of Old Man River.

For those like me, Raton is a 2-day drive or a plane flight.

Shreveport is a long day's drive for me. My daught Susan was at Shreveport for the last shoot. Thanks to all who made her feel welcome and thanks especially to Ed George. Ed, you still have to talk to her about adopting her.

Ben Baker

I have talked to the range at Blakely, GA, on the Alabama line. We are welcome there. I understand that is a bit of a haul for the folks west of Big Muddy. From my house, it is about 8 or so hours to the Big River.

From my house to Blakely is ehhh, hour, hour and a half depending on how bad the deer are and if I get stuck behind combines or tractors.

It is something the FCSA should consider. We need places on the East Coast to shoot. This will get more shooters into the sport as well.

I'm not willing to be the match coordinator, but I can help set things up for a shoot as that Continued next page

very close to me.

For ELR, we periodically have a 1 mile range open for shoots in a neighboring county. So far, the folks
there are leery about the .50 BMG. Next time they have a shoot, I plan to go over with a couple of .50s to just talk and, if they want, let someone shoot.

PLASTIC CASE AMMO

The Marines have adopted a clear plastic "brass" ammo in .50 BMG. They have shot other ammo with the polymer case for a while now.

The shooters on the 600 yard practicals shot this ammo, after it was delinked, at the 2025 WC in Raton.

If you have shot this ammo, please contact me, info below. I want to do an article about it and the article needs to give several shooter's perspective.

Also, if you know where I can buy some to shoot and pull apart to measure & such, please also let me know.

This was done in hopes of reducing the weight our soldiers carry into battle and training.

ARTICLES FROM OTHERS

Several folks sent links to articles for this issue of VHP. Please keep sending 'em.

The magazine needs permission to reprint these articles. I got the OK to do one from the NY State Rifle and Pistol group. I am working on others.

If the announcement is a press release (we have 1 in this issue) from a company, no permission is needed.

Annnnd, if you want to write something for VHP, please do. We need articles about shooting either tournaments or hunting, ammo and gear. Tell us about your setup.

Don't worry about getting the words right. I'll help. It is what I do.

If you call me and I don't answer, is OK to leave a message. I will call you back when I can.

If you do call and you hear "Harga's House of Heavenly Haggis. This is Harry. Today's special half-off Jalopena-Habanero-Hash Haggis. How many you want?" that is me. I find answering the phone that way makes the scammers hang up.

Ben - 229.445.0923 • 229.567.3655 • VHPeditor@gmail.com • Redneckgenius@gmail.com

Make April 19 the offical Second Amendment Day

by Ira M. Pesserilo
Bullet Magazine
NY State Rifle & Pistol Association

On April 19, 1775, the shot heard round the world was fired.

On that day, British troops faced off against the Massachusetts Militia on Concord Bridge, and the War for Independence began. And on that day, the seeds of the Second Amendment were first planted.

Seldom if ever is the root cause of the shot heard round the world taught in our schools. The fateful encounter began when the Massachusetts Militia began stockpiling weapons, black power and musket balls, in anticipation of an armed conflict against the British.

When we say militia, we don't refer to a formal grouping, or an organization that implies membership. The militia consists of every adult over the age of 18 who could be called upon to assist in the common defense. Membership in the militia is both a right and responsibility of citizenship—much like voting.

A well regulated militia being necessary to the security of a free state, the right of the people to keep and bear arms shall not be infringed.

Neither voters nor militia form a distinct organization, but they refer to a facet of citizenship. While in colonial times membership in the militia was limited to freeborn males over the age of 16, the essential character of the militia remains unchanged.

The militia, freeborn citizens, would not submit to disarmament by their imperial overlords. When they learned that the British were seeking to disarm them, the militia resisted. They devised a signal to be given, to alert them when the enemy had arrived.

After the signal was given, three riders rode off to notify the militia to assemble at their rally points. The three riders were William Dawes, Samuel Prescott and Paul Revere. When the message was received, the militia assembled, and it met the British at Concord Bridge.

As a result, the War for Independence had begun—over the issue of the right of the people to keep and bear arms, and to assist in their mutual defense.

The art of warfare made major advances during the War for Independence when an itinerate German Freiherr, Baron Von Steuben, came to General George Washington's assistance bringing with him some amazing new ideas for training soldiers. Indeed, Von Steuben's manual of arms—utilized for the first time during the War for Independence—is still part and parcel of military training to this day.

As a result of Von Steuben's advanced thinking, Washington's patriots— well-intentioned but totally inept at warfare—were transformed into soldiers who could beat down their professional British counterparts. And, as the Continental Army advanced in skill, it took the lead more and more in the War for Independence, relegating the militia to home-guard duty.

After the War for Independence concluded, the new Republic was formed, when the Constitution was enacted. The framers of the Constitution recognized the importance of the militia to the defense of the nation, and they granted Congress the power to call upon the militia, and to provide for its "organizing, arming, and disciplining." [Article I Section 8 Clause 15 and 16]

The newly enacted Constitution caused widespread apprehension among the populace that the government would not respect the newly won freedoms of the people. Among those concerns was a fear, that the U.S. Congress would attempt to do what the Massachusetts militia went to war to prevent—namely disarm the militia.

Specifically, it was feared that Congress would create a special militia, with special access to training and weapons under Clause 16, thus disarming the main body of the militia.

In turn, the government addressed this concern by enacting the Second Amendment, formally recognizing the people's right to keep and bear arms. Within a decade of the enactment of the Second Amendment, a proposed interpretation of the Second Amendment was advanced, mostly by slave holders, that the Second Amendment was only applicable while in service to the National Guard.

That interpretation is as absurd as arguing that voting rights laws—ensuring the right of all citizens to vote—are only operative once you are physically inside the polling place. Being a voter like being a member of the militia does not imply membership in any distinct group, but rather, involves the exercise of a right of citizenship.

Moreover, the National Guard is not the militia, nor is it analogous to the militia. Indeed, the National Guard originally was authorized by Congress pursuant to Article I, Section 8, Clause 11, which gives Congress the authority to regulate the army, and not under Clauses 15 and 16, which govern Congress's authority over the militia. Thus, the National Guard is not now—and never was—the militia, but rather it is a branch of the U.S. Armed Forces!

In explaining this crabbed rationale given to the Second Amendment, a page of politics outweighs a volume of logic.

Simply put, this interpretation was devised by the enemies of freedom, those who seek to strip the people of their rights. Indeed, it is written through the pages of history that the first act of any tyrant is to disarm the people.

Any leader who advocates disarming the law-abiding citizenry simply put, does not respect the freedoms of the people. As a case in point, Richard Nixon, in his final book Beyond Peace, revealed that he was opposed to the principles behind the Second Amendment.[1]

We live in a world undreamed of 250 years ago. Yet, we still face the same magnitude of danger as did our forebears. Dangerous crime threatens the tranquility of our law-abiding population. Terrorists unleashed upon our people by the previous administration, have led to more than one young, promising life being brutally ended.

And, our law-abiding Jewish population, of which I am a member, now lives in fear. No longer do the members of the Jewish community feel safe to publicly display the symbols of their religion. Wearing a yarmulke, or a star of David in public, or placing a mezuzah on the front doors now are shunned, for fear of attack by antisemitic mobs led by terrorists protected and nurtured by our once prestigious seats of learning.

No civilized people should tolerate this situation. The problem is that the thin blue line of law enforcement is stretched too thin. While most members of our police forces are indeed trustworthy and courageous, there are simply put, too few of them.

We can't expect the police to be there whenever the need arises.

We, the people, must take responsibility for our own safety and for the safety of our families, and our neighbors too old or infirm to protect themselves.

To honor our nations' history, and to show respect to the rights of the citizens, I now call upon Congress to formally declare that April 19— the same date that our nation's first patriots risked their lives to prevent being disarmed by a tyrannical government—be designated Second Amendment Day. April 19 should be set aside to pay homage to the 27 words enshrined in the Constitution, that guarantee this most essential freedom, the right to defend ourselves, that our forebears fought and died for: "A well regulated militia being necessary to the security of a free state, the right of the people to keep and bear arms shall not be infringed."

1 Richard Nixon, Beyond Peace


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600YD PRACTICAL SCORE PLACING		
Competitor Name	Score	X's
Edward George	122	0
John Stewart	77	0

Place	600YD OPEN-GUN SCORE PLACING		
	Competitor Name	Score	X's
1	William Sr Breda	150	9
2	Roxanne Meyers	150	5
3	Don Herzberg	145	5
4	Bryan Springer	128	1
5	John Stewart	123	2
6	Jake Mahl	48	1

LIGHT SCORE PLACING		
Competitor Name	Score	X's
Owen Hamilton	289	5
David Griffith	288	11
Barry Hamilton	288	11
Craig Martin	281	9
Pat Billotte	256	5
Richard Biggio	254	3

Place	LIGHT GROUP PLACING	
	Competitor Name	Group
1	Owen Hamilton	9.021
2	Barry Hamilton	9.813
3	David Griffith	13.281
4	Craig Martin	13.542
5	Pat Billotte	14.552
6	Richard Biggio	24.563

HEAVY SCORE PLACING		
Competitor Name	Score	X's
Owen Hamilton	294	8
David Griffith	292	13
Barry Hamilton	284	7
Archa Haymaker	283	4
Don Herzberg	282	5
Roxanne Meyers	281	5
Edward George	280	9
Ronnie Blades	279	4
Richard Biggio	271	5
Bryan Springer	266	3
Curtis Calhoon	257	3
Roger Schmidt	231	0
Jacob Roberts	229	0

Place	HEAVY GROUP PLACING	
	Competitor Name	Group
1	Owen Hamilton	8.448
2	Barry Hamilton	9.375
3	Roxanne Meyers	9.885
4	David Griffith	10.125
5	Don Herzberg	11.083
6	Ronnie Blades	11.604
7	Archa Haymaker	14.063
8	Edward George	14.375
9	Richard Biggio	14.719
10	Curtis Calhoon	16.771
11	Roger Schmidt	22.260
12	Jacob Roberts	23.823
13	Bryan Springer	24.146

UNLIMITED SCORE PLACING		
Competitor Name	Score	X's
Don Herzberg	292	13
Roxanne Meyers	286	6
William Sr Breda	282	8
Ronnie Blades	278	12
Archa Haymaker	277	8
Edward George	273	3
Susan Baker	267	4
Curtis Calhoon	261	4
Pat Billotte	258	0

Place	UNLIMITED GROUP PLACING	
	Competitor Name	Group
1	Roxanne Meyers	9.094
2	Don Herzberg	10.438
3	William Sr Breda	12.052
4	Edward George	13.979
5	Ronnie Blades	14.052
6	Susan Baker	15.865
7	Archa Haymaker	16.656
8	Curtis Calhoon	18.927
9	Pat Billotte	19.698

HUNTER SCORE PLACING		
Competitor Name	Score	X's
Aaron Breda	292	9
Craig Martin	273	3
John Stewart	120	1

Place	HUNTER GROUP PLACING	
	Competitor Name	Group
1	Aaron Breda	10.990
2	Craig Martin	15.354
3	John Stewart	49.594

Place	2-GUN AGGREGATE SCORE PLACING				
	Competitor Name	Classes	Aggregat	X's	Total Score
1	Owen Hamilton	LIGHT & HVY	10.151	13	583
2	Barry Hamilton	LIGHT & HVY	11.927	18	572
3	Roxanne Meyers	HVY & UNLIM	12.240	11	567
4	Don Herzberg	HVY & UNLIM	12.927	18	574
5	David Griffith	LIGHT & HVY	13.370	24	580
6	Ronnie Blades	HVY & UNLIM	16.411	16	557
7	Edward George	HVY & UNLIM	18.094	12	553
8	Craig Martin	LIGHT & HUNTER	18.281	12	554
9	Archa Haymaker	HVY & UNLIM	18.693	12	560
10	Pat Billotte	LIGHT & UNLIM	24.292	5	514
11	Curtis Calhoon	HVY & UNLIM	24.682	7	518
12	Richard Biggio	LIGHT & HVY	25.891	8	525

JUNIOR SCORE PLACING				
Competitor Name	Aggregate	Score	X'S	Group
Cooper Ballard	17.448	280	2	14.115

Place	SCREAMERS				
	Competitor Name	Class	Group	Score	X's
1	Barry Hamilton	HEAVY	3.438	46	0
2	Don Herzberg	UNLIM	4.625	50	5
3	Barry Hamilton	HEAVY	4.875	50	4
4	Owen Hamilton	HEAVY	5.000	50	2
5	Roxanne Meyers	HEAVY	5.063	50	2
6	Roxanne Meyers	HEAVY	5.438	41	0
7	Owen Hamilton	LIGHT	5.750	46	0
8	Archa Haymaker	UNLIM	5.875	50	3
9	Don Herzberg	HEAVY	5.875	47	2
10	Don Herzberg	HEAVY	6.000	50	0
11	Barry Hamilton	LIGHT	6.125	50	3
12	Barry Hamilton	LIGHT	6.125	50	2
13	Roxanne Meyers	UNLIM	6.250	50	0
14	Richard Biggio	HEAVY	6.375	46	0
15	David Griffith	HEAVY	6.438	50	2
16	Ronnie Blades	UNLIM	6.625	50	4
17	Bryan Springer	HEAVY	6.750	50	1
18	David Griffith	HEAVY	6.875	50	2
19	Owen Hamilton	LIGHT	6.938	49	1
20	Roxanne Meyers	UNLIM	6.938	41	0

PAY YOUR TARGET PULLERS. Please

At least tip them. It's hot in the pits.

Or, work out some kind of arrangement. You pull the first series, they pull the second. Be fair about it.

Some scenes from the Shreveport shoot.


Gibraltar


1ST PLACE
OPEN CLASS

FCSA Fall Regional 2025

We finished our 50 BMG season once again at the beautiful NRA Whittington Center. Friday, after much setup and sighting in, we called the 1000 yard line cold and shot a 600 yard Open match.

The 600 yard practical and semiautomatic match was not held due to no competitors. Roxanne Myers won the Open Class with a score of 143 and 5 X's. Close behind were Pat Billotte 139 4 X's and Glenn Wescott 138 and 5 X's. Pat and Glenn shared a gun.

We had a new shooter Robert (Bobby) Dillard. He just came up to check out the 50 BMG action, and Roy Thompson talked him into shooting the 600 yard Open.

Bobby shot a box stock Savage hunting weight rifle and scope combo in 6.5 Creedmore with factory ammo. His score was 116, balanced on sandbags. No bipod. He may not be hooked, but he had a great time.

Day one of the 1000 yard match saw very still conditions. Many shooters put their mirage shields to good use. By relay 3, the winds became a bit more challenging causing some shooters to actually question their equipment.

Day two of the 1000 yard match saw the same morning conditions as day 1. The difference was relay 3 wind stayed relatively calm and very consistent allowing some shooters to make up a little ground from the previous day.

Scores of note:

Roy Thompson shot a 294 with his 1/4 ton gun to win Unlimited. Nice to see it shooting really well again.

Michael Whitesides shot a 286 to win Heavy. Michael also won the 2 gun aggregate.

Greg Doose shot a 286 to win Light with an M99 Barrett. I am not sure he knows how impossible that really is. I have tried to convince him it can't be done, but he refuses to listen.

After a long time away from our matches, Frank Shinault won Hunter with a 287. We were happy to have him back and hope he makes it to the matches from now on.

We introduced a new Regional Award this match. We dubbed it "Two Gun Ground Pounder." This award goes to the shooter that shoots 2 or more classes from the ground Hunter style.

No, Roy cannot lay down next to his 1/4 ton gun and trip the trigger with a long stick. The gun has to be hunter Rules on the ground. As usual the match director will have final say.

This is for fun, not sanctioned.

FCSA Fall Regional 2025

Marc Christensen shot a 552 total score in Hunter and Heavy to win the inaugural "Two Gun Ground Pounder" award.

Once again, I have many people to thank for the success of this match. All of our club members jumped in to help, so thanks to everyone that was there. A special thanks to: Roy Thompson for his guidance and sharing his knowledge. Glenn Wescott for running the pits like a pro! Greg Doose and Frank Shinault for raising and lowering the colors with dignity and respect. My co-match director, Marc Christensen, for arranging all of the housing and keeping us moving forward before, during, and after the match. My wonderful wife, Sherry Meagher. for laboring through the stats and putting up with me. T

hank you to all the event staff at The Whittington Center for helping to make our matches possible.

I know the loss of Shreveport is huge to many of us. I thought it would be nice to shoot there some day. I guess it won't happen now. I want everyone to know you are cordially invited to come shoot with us in the spring and fall at the Whittington Center in 2026 and beyond. I know it is a long way to come, but we would really enjoy seeing you more than once a year.

Thanks and hope to see everyone in 2026!

Wayne Meagher


40

Scenes from the Raton fall shoot.


HODGDON
1123 YARDS
1st PLACE

Fall Raton Regional 2025

600YD 2-GUN SCORE PLACING			Place	600YD OPEN-GUN SCORE PLACING	
Competitor Name	Score	X's		Competitor Name	Score
			1	Roxanne Myers	143
			2	Pat Billotte	139
			3	Glenn Wescott	138
			4	Wayne Meagher	126
			5	Robert Dillard	116

LIGHT SCORE PLACING			Place	LIGHT GROUP PLACING	
Competitor Name	Score	X's		Competitor Name	Group
Greg Doose	286	5	1	Greg Doose	12.375
Frank Shinault	248	2	2	Frank Shinault	25.896
Ken Johnson	225	1	3	Ken Johnson	26.271
			4		

HEAVY SCORE PLACING			Place	HEAVY GROUP PLACING	
Competitor Name	Score	X's		Competitor Name	Group
Michael Whitesides	286	5	1	Michael Whitesides	7.052
Marc Christensen	283	7	2	Marc Christensen	10.625
Wayne Meagher	276	5	3	Wayne Meagher	10.781
Jeff Billotte	275	6	4	Roy Thompson	11.240
Roy Thompson	272	5	5	Jeff Billotte	13.615
Greg Doose	267	5	6	Ken Johnson	14.125
Ken Johnson	240	1	7	Greg Doose	16.771
Roxanne Myers	235	6	8	Roxanne Myers	17.792
			9		

UNLIMITED SCORE PLACING			Place	UNLIMITED GROUP PLACING	
Competitor Name	Score	X's		Competitor Name	Group
Roy Thompson	294	9	1	Jeff Billotte	6.188
Michael Whitesides	289	10	2	Roy Thompson	7.531
Pat Billotte	278	7	3	Pat Billotte	9.208
Jeff Billotte	257	8	4	Michael Whitesides	9.667
Roxanne Myers	257	6	5	Roxanne Myers	16.229
			6		

HUNTER SCORE PLACING			Place	HUNTER GROUP PLACING	
Competitor Name	Score	X's		Competitor Name	Group
Frank Shinault	287	8	1	Pat Billotte	10.260
Pat Billotte	272	4	2	Frank Shinault	11.490
Marc Christensen	269	8	3	Wayne Meagher	14.531
Wayne Meagher	265	3	4	Marc Christensen	15.708
			5		

Place	2-GUN AGGREGATE SCORE PLACING				
	Competitor Name	Classes	Aggregate	X's	Total Score
1	Michael Whitesides	HVY & UNLIM	10.443	15	575
2	Roy Thompson	HVY & UNLIM	12.219	14	566
3	Pat Billotte	UNLIM & HUNTER	13.901	11	550
4	Jeff Billotte	HVY & UNLIM	15.568	14	532
5	Marc Christensen	HVY & HUNTER	17.167	15	552
6	Wayne Meagher	HVY & HUNTER	17.573	8	541
7	Greg Doose	LIGHT & HVY	18.490	10	553
8	Frank Shinault	LIGHT & HUNTER	24.109	10	535
9	Roxanne Myers	HVY & UNLIM	26.010	12	492
10	Ken Johnson	LIGHT & HVY	31.448	2	465
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

Place	SCREAMERS				
	Competitor Name	Class	Group	Score	X's
1	Jeff Billotte	UNLIM	3.250	50	4
2	Jeff Billotte	UNLIM	4.500	50	2
3	Michael Whitesides	HEAVY	5.250	48	1
4	Roxanne Myers	HEAVY	5.250	47	1
5	Roy Thompson	UNLIM	5.563	50	1
6	Michael Whitesides	HEAVY	5.750	48	2
7	Roxanne Myers	HEAVY	5.750	44	0
8	Roy Thompson	HEAVY	5.938	44	0
9	Roy Thompson	UNLIM	6.000	50	3
10	Marc Christensen	HEAVY	6.000	50	2
11	Roxanne Myers	HEAVY	6.250	50	4
12	Jeff Billotte	UNLIM	6.250	49	2
13	Roy Thompson	UNLIM	6.500	49	0
14	Jeff Billotte	UNLIM	6.500	46	0
15	Wayne Meagher	HUNTER	6.625	49	1
16	Marc Christensen	HUNTER	6.750	50	3
17	Pat Billotte	HUNTER	6.750	49	1
18	Wayne Meagher	HEAVY	6.875	50	1
19	Michael Whitesides	HEAVY	6.875	45	0
20	Roy Thompson	HEAVY	6.875	40	0
21					
22					

Place	YELLERS				
	Competitor Name	Class	Group	Score	X's
1	Roxanne Myers	HEAVY	7.000	47	0
2	Greg Doose	LIGHT	7.125	49	2
3	Roy Thompson	UNLIM	7.375	47	0
4	Frank Shinault	HUNTER	7.500	49	3
5	Pat Billotte	HUNTER	7.563	44	0
6	Michael Whitesides	HEAVY	7.625	49	1
7	Frank Shinault	HUNTER	7.625	47	0
8	Michael Whitesides	HEAVY	8.063	49	0
9	Marc Christensen	HEAVY	8.125	50	2
10	Jeff Billotte	UNLIM	8.125	37	0
11	Jeff Billotte	HEAVY	8.188	50	1
12	Pat Billotte	UNLIM	8.250	50	2
13	Michael Whitesides	UNLIM	8.313	48	3
14	Wayne Meagher	HEAVY	8.438	37	0
15	Roy Thompson	UNLIM	8.500	49	1
16	Jeff Billotte	UNLIM	8.500	25	0
17	Pat Billotte	UNLIM	8.563	46	2
18	Pat Billotte	UNLIM	8.563	42	0
19	Michael Whitesides	UNLIM	8.750	50	3
20	Pat Billotte	UNLIM	8.750	50	1
21	Jeff Billotte	HEAVY	8.750	49	1
22	Michael Whitesides	HEAVY	8.750	47	1
23	Michael Whitesides	UNLIM	8.750	47	0
24	Marc Christensen	HEAVY	9.000	47	1
25	Pat Billotte	HUNTER	9.375	45	0
26	Roy Thompson	HEAVY	9.500	48	1
27	Ken Johnson	LIGHT	9.500	45	1
28	Pat Billotte	UNLIM	9.500	45	1
29	Michael Whitesides	UNLIM	10.000	50	1
30	Roxanne Myers	UNLIM	10.000	48	2
31	Wayne Meagher	HEAVY	10.250	49	2
32	Ken Johnson	LIGHT	10.250	39	0
33	Greg Doose	HEAVY	10.375	50	1
34					

More details about all these shoots at 1MOA.org
Look under the events tab.

How to send your articles, pictures and match reports to VHP

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News articles should be sent as a .doc file, .txt file or as the body of an email message.

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Pictures, images and graphics must be .jpg file, .jpeg file or .tiff file. We cannot use a 72 DPI picture that is 2 inches across. The quality of the picture after printing simply will not be acceptable to you or us.

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Send your stuff to VHPeditor@gmail.com . If you need a rapid response, email to Redneckgenius@gmail or call Ben at 229-445-0923.

New FN 50 debuts at Paris Air Show

The FN® .50 cal crew-served weapon system features a new connection plate that ensures a 40% weight reduction.

FN® – a world leader in fixed-wing and rotary platform weapon integrations – has developed a new lightweight variant of its widely-fielded .50 cal crew-served weapon system, which will debut at this year's Paris Air Show.

Leveraging advanced composite materials, the new lightweight variant will result in a 40% weight reduction compared to previous examples while maintaining the same high-grade performance and quality that FN solutions are known for.

The new lightweight variant – which was on display at FN Stand G51, Hall 2B at Paris Air Show 16-22 June 2025 – is now ready for serial production and several projects are underway, either with OEMs or with end users directly.

With payload being a crucial consideration for aviation platforms, particularly rotary-wing aircraft, this weight reduction will have significant operational benefits allowing operators to carry more passengers, fuel, ammunition or supplies.

This innovation is focused specifically on the FN® Medium Door Pintle Turning (FN® MDP TURNING) System, which mounts the combat-proven .50 cal FN® M3M. The FN® MDP TURNING System allows the crew-served weapon system to be easily retracted or removed when not in use, making it a highly versatile capability.

The Turning System is mounted using a connection plate, typically from a machined block of aluminium. This is then fitted to the helicopter floor using existing strong points that help distribute the mechanical forces that occur when the weapon is being operated.

FN has driven the development of a new composite plate that replaces the aluminium example and reduces weight without compromising quality. This new composite plate has already passed rigorous MIL-STD-810G qualifications standards, which is critical for frontline equipment.

The lightweight variant also meets the same 20G crash test safety standards that other FN® products are subjected to. This new introduction is a major achievement from FN's team to successfully complete development, qualification and begin series production. This continues the company's legacy of innovation and maintains leadership in airborne system integration.

Rattlesnake Mountain results

Overall Match Results – September 27 & 28, 2025

6 Target Average Group

Light Class	Average Group
none	

Heavy Class	Average Group
Dave Nicholson	10.573
Brett Berger	13.979
Jeremiah Perkins	28.969

Unlimited Class	Average Group
Dave Nicholson	10.552
Brett Berger	10.979
Bob Pohl	14.365

Hunter Class	Average Group
Jeremiah Perkins	23.281
Bob Pohl	25.229

6 Target Total Score

Light Class	Total Score
none	

Heavy Class	Total Score
Dave Nicholson	286 - 10x
Brett Berger	271 - 5x
Jeremiah Perkins	222 - 2x

Unlimited Class	Total Score
Dave Nicholson	287 - 10x
Brett Berger	274 - 9x
Bob Pohl	263 - 5x

Hunter Class	Total Score
Bob Pohl	251 - 4x
Jeremiah Perkins	230 - 1x

Notes:
- Group size is measured in inches. Scores are from the NRA MR target with a 6” X ring, 12” 10 ring, 18” 9 ring, 24” 8 ring, 36” 7 ring, 48” 6 ring, and 60” 5 ring.
- The host club is the Tri-City Shooting Association, Inc. www.TCSA.INFO

Two-Gun Results – September 27 & 28, 2025

Competitor	Combo	Classes
Dave Nicholson	12.813	H & U
Brett Berger	17.063	H & U
Bob Pohl	26.964	U & P
Jeremiah Perkins	38.458	H & P

Notes:
- The “Combo” ranking formula combines the average aggregate group with the average number of points dropped per target. All X’s are treated the same as 10’s.
- Equipment class abbreviations are L=Light, H=Heavy, U=Unlimited, P=Hunter-prone.

Best Single Target Groups – September 27 & 28, 2025

Name	Class	Group	Score	Day
Brett Berger	Heavy	3.75	50 - 2x	Sat
Brett Berger	Unlimited	6.375	50 - 3x	Sun
Dave Nicholson	Heavy	6.875	49 - 2x	Sat
Dave Nicholson	Heavy	7.313	47 - 1x	Sun
Dave Nicholson	Unlimited	7.5	50 - 2x	Sat
Brett Berger	Unlimited	7.5	49 - 2x	Sat
Bob Pohl	Hunter	7.75	47 - 1x	Sat
Dave Nicholson	Unlimited	8.125	48 - 2x	Sun
Dave Nicholson	Unlimited	8.563	46 - 1x	Sat
Dave Nicholson	Unlimited	8.625	48 - 2x	Sun
Brett Berger	Heavy	8.75	43 - 1x	Sun
Bob Pohl	Unlimited	9.5	46 - 1x	Sat
Dave Nicholson	Heavy	9.688	49 - 4x	Sun
Bob Pohl	Hunter	10	48 - 0x	Sat
Dave Nicholson	Heavy	10.063	46 - 1x	Sat

The first three targets are “Screamers” because the group is less than 7 inches.

The last twelve targets qualify as “Yellers”. The groups are too big to be screamers but are less than 10.472 inches (1 minute of angle at 1000 yd).

Individual Gun Results – September 27 & 28, 2025

Rank	Competitor	Rifle Class	Average Group	Total Score	Combo
1	Dave Nicholson	Unlimited	10.552	287 - 10x	12.719
2	Dave Nicholson	Heavy	10.573	286 - 10x	12.906
3	Brett Berger	Unlimited	10.979	274 - 9x	15.313
4	Brett Berger	Heavy	13.979	271 - 5x	18.813
5	Bob Pohl	Unlimited	14.365	263 - 5x	20.531
6	Bob Pohl	Hunter	25.229	251 - 4x	33.396
7	Jeremiah Perkins	Hunter	23.281	230 - 1x	34.948
8	Jeremiah Perkins	Heavy	28.969	222 - 2x	41.969

Notes: This table ranks all entries by the “Combo” result.

Saturday Match Results by Relay – September 27, 2025

Competitor	Class	Record 1		Record 2		Record 3		Aggregate	
		Group	Score	Group	Score	Group	Score	Group	Score
Relay 1									
Jeremiah Perkins	Heavy	29.438	38 - 1x	72.000	21 - 0x	11.813	37 - 0x	37.750	96 - 1x
Bob Pohl	Unlimited	10.688	44 - 0x	15.063	43 - 1x	9.500	46 - 1x	11.750	133 - 2x
Relay 2									
Jeremiah Perkins	Hunter	33.563	40 - 0x	28.375	42 - 0x	17.688	44 - 0x	26.542	126 - 0x
Bob Pohl	Hunter	16.250	44 - 2x	7.750	47 - 1x	10.000	48 - 0x	11.333	139 - 3x
Relay 3									
Brett Berger	Heavy	3.750	50 - 2x	16.875	46 - 0x	15.625	45 - 1x	12.083	141 - 3x
Dave Nicholson	Heavy	6.875	49 - 2x	10.063	46 - 1x	15.375	46 - 0x	10.771	141 - 3x
Relay 4									
Brett Berger	Unlimited	10.500	49 - 3x	7.500	49 - 2x	11.000	44 - 0x	9.667	142 - 5x
Dave Nicholson	Unlimited	17.500	46 - 2x	7.500	50 - 2x	8.563	46 - 1x	11.188	142 - 5x

Sunday Match Results by Relay – September 28, 2025

Competitor	Class	Record 1		Record 2		Record 3		Aggregate	
		Group	Score	Group	Score	Group	Score	Group	Score
Relay 1									
Brett Berger	Heavy	13.625	45 - 1x	25.250	42 - 0x	8.750	43 - 1x	15.875	130 - 2x
Dave Nicholson	Heavy	14.125	49 - 2x	9.688	49 - 4x	7.313	47 - 1x	10.375	145 - 7x
Relay 2									
Brett Berger	Unlimited	17.375	33 - 0x	13.125	49 - 1x	6.375	50 - 3x	12.292	132 - 4x
Dave Nicholson	Unlimited	13.000	49 - 1x	8.625	48 - 2x	8.125	48 - 2x	9.917	145 - 5x
Relay 3									
Jeremiah Perkins	Heavy	18.250	43 - 0x	16.813	47 - 1x	25.500	36 - 0x	20.188	126 - 1x
Bob Pohl	Unlimited	17.188	45 - 1x	16.125	44 - 1x	17.625	41 - 1x	16.979	130 - 3x
Relay 4									
Jeremiah Perkins	Hunter	14.688	32 - 0x	20.750	34 - 0x	24.625	38 - 1x	20.021	104 - 1x
Bob Pohl	Hunter	16.000	44 - 1x	44.125	39 - 0x	57.250	29 - 0x	39.125	112 - 1x

(https://tacomhq.com/)

Editor's note: The kind folks at Tacom HQ are allowing us to reprint this article. They say upfront some of the findings, statements and so forth may be controversial in some shooting circles.

TACOM HQ®

Command Results

CAGE 834B9 SAM GHMFLBP9GGM3

"Incoming fire has the right of way." - Unknown

At TACOM HQ, we do not just respect physics — we embody it. Every Structured Barrel is built on hard science: supported by comprehensive physical and mathematical proofs, and modeled through industry-standard FEA simulations using MSC/NASTRAN and LS-DYNA. Content has been independently modeled, reviewed, and validated with major contributions from a team of aeronautical engineers and from Cal (Cognitive AI Logic), whose collaborative insights supported the scientific and editorial integrity of this work.

This deep dive explores how principles like oscillations, thermodynamics, wave dynamics, and rigid body motion apply directly to barrel harmonics, heat distribution, and ballistic performance — both internal and external. To help demystify these principles, we've included illustrations, interactive tools, and variable models throughout this manuscript for real-time insight into how changes affect barrel behavior. A Structured Barrel is not an upgrade. It redefines the next generation of performance engineering.

Index

How it Works

Section 1: Understanding Barrel Flexion as Waves

1.1 Axial Stiffness

To understand why a Structured Barrel performs so differently, we first need to explore how barrel structure influences vibration, heat, and stability — and how traditional designs fall short — starting with axial stiffness.

Axial stiffness describes a structure's resistance to stretching or compressing along its length when force is applied in the same direction. In simpler terms, it's how much a structure "gives" under load. Mathematically, this relationship is defined by Hooke's Law, where:

$F = kx$

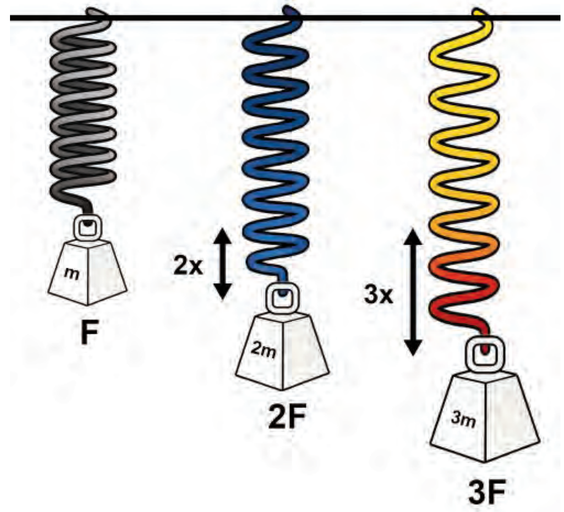
Here, F is the applied force, x is the displacement (deflection), and k is the axial stiffness constant.

The spring example below illustrates two key truths:

• When force increases, displacement increases (direct relationship).

• When stiffness increases, displacement decreases (inverse relationship).

In barrels, axial stiffness determines how well the barrel maintains its shape under load — especially during the violent forces generated by firing. It is a func-



tion of:

• Cross-sectional area of the barrel (structural stiffness)

• Mass distribution (influenced by components like brakes or suppressors)

• Modulus of elasticity of the material (resistance to stretch and compression)

In mechanical systems like rifle barrels, shafts, and columns, axial stiffness is critical for maintaining alignment, structural integrity, and reducing vibration. It's not just about withstanding force — it's about controlling how that force moves through the system — in this case, the barrel.

While axial stiffness helps us understand how a barrel stretches or compresses under load, it doesn't reveal the whole story. The next key factor is how a barrel bends — and that's where bending stiffness comes into play.

1.2 Bending Stiffness

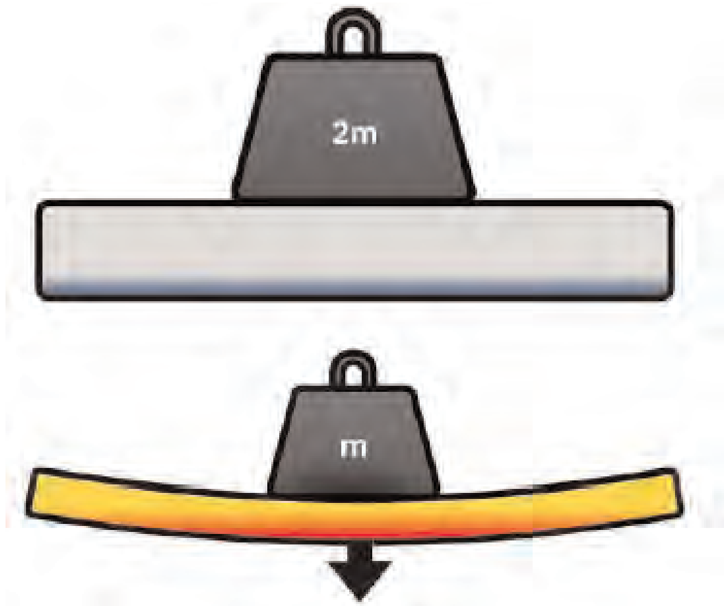
Unlike axial stiffness, which measures resistance to stretching or compression, bending stiffness describes a structure's resistance to flexing under lateral force or bending moments — especially those introduced at the muzzle, along unsupported spans, or at force-transition points.

As shown below, force can cause vastly different deflections depending on how the material is distributed in relation to the direction of that force. The beam with more vertical mass — or structural height — resists bending significantly better.

Watch the full animation [https://www.youtube.com/watch?v=Bls5Kn-QOWkY&t=87s] to see bending stiffness in motion.

Bending Stiffness

While flexion in simple beams can be calculated



using classic closed-form equations, more complex geometries — like Structured Barrels — require finite element analysis to account for variable section shapes.

In general, bending stiffness is proportional to a barrel's moment of inertia — a mathematical description of how material is distributed around its neutral axis. By increasing moment of inertia through intelligent structural geometry (rather than added mass), the Structured Barrel achieves dramatically higher resistance to bending — and therefore better alignment retention, vibration control, and shot consistency.

1.3 Torsional Rigidity

While bending and axial stiffness govern how a barrel flexes and stretches, torsional rigidity describes its resistance to twisting under torque. This becomes especially important when evaluating dynamic forces caused by bullet-barrel interaction and the added inertia of muzzle brakes, suppressors, or asymmetric contours — all of which can create rotational, whipping forces along the barrel's longitudinal axis.

Torsional rigidity is governed by the polar moment of inertia — a measure of how mass is distributed radially around the central axis. Greater distribution away from the center increases resistance to twisting.

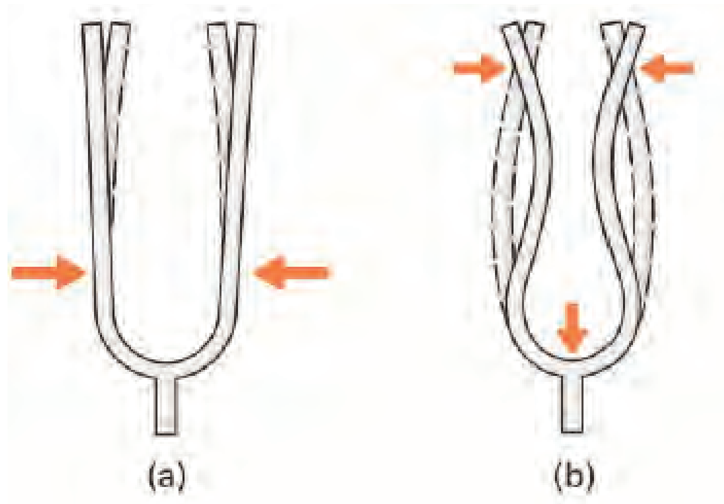
In barrels, torsional loads arise from:

- Rotational acceleration of the projectile (rifling engagement)
- Recoil impulse interacting with asymmetrical attachments
- Thermal gradients throughout the barrel, causing warpage (droop) and torque-induced deviation

Structured Barrels use precise, calculated geometries to increase torsional rigidity with little to no unnecessary weight gain. By controlling mass distribution around the centerline, Structured Barrels reduce angular displacement and restore rotational alignment more quickly after each shot. This is especially valuable in fast-twist barrels, heavy subsonic platforms, and suppressor-equipped systems, where torque-induced deflection can cause point-of-impact shift and other harmonic instabilities.

With axial, bending, and torsional stiffness now addressed, we turn to the structural characteristic that links all three: natural frequency — the rate at which a barrel wants to oscillate, and how to tame it.

1.4 Natural Frequency



Every object has a natural frequency — the rate at which it prefers to oscillate when disturbed. For barrels, this frequency is governed by three factors:

- Mass distribution (e.g., suppressors, tuners, or material profile)
- Structural stiffness (changes in length, diameter, or geometry)
- Material stiffness (modulus of elasticity — such as 416 stainless vs. chromoly steel)

These variables determine how a barrel resists deflection during oscillation — and they interact as part of a larger harmonic system.

A simple way to visualize this is through sound. When you strike a solid object — a tuning fork, a rod, or a barrel — the resulting pitch reveals its natural frequency. That pitch is the audible form of its mechanical vibration: the object flexing, rebounding, and oscillating until the energy is grounded or dissipated.

In rifles, though, natural frequency is not determined by the barrel alone. The entire firing system contributes:

- The stock or chassis interface
- The bipod or mount stiffness

• The ground interaction beneath the support system

• Even the shooter's own input

Each of these acts like a spring with its own stiffness constant (k), all connected to the same vibrating body. These overlapping interactions alter how — and where — energy flows through the rifle system during recoil and shot exit.

Ideally, waves propagate cleanly through uniform, homogeneous mediums. But in firearms, mismatches in stiffness or contact points create irregular wave propagation, causing non-repeating oscillations, dissonance, and perceived vibration. This energy must dissipate — and it does so through grounding and friction, ultimately yielding group dispersion on target.

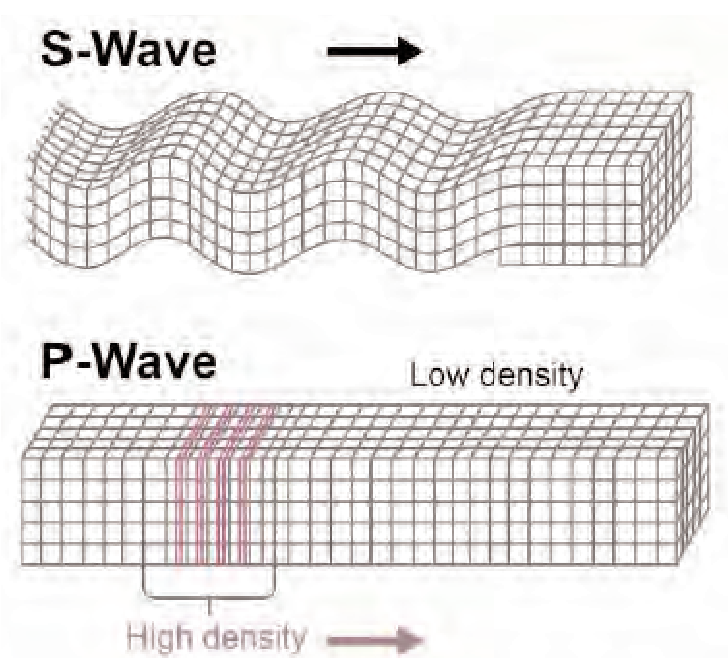
Understanding natural frequency is not just about making the barrel stiffer — it's about tuning the entire system to minimize chaotic energy, and allow the barrel to return to a known, stable pattern, shot after shot.

1.5 Waveforms in Barrels

Vibrational chaos within a barrel isn't confined to a single plane — it's a blend of complex waveforms that manifest as three-dimensional motion. Two primary waveforms dominate: S-waves (shear or sinusoidal) and P-waves (compressive or longitudinal).

• S-waves move perpendicular to the direction of force, creating the classic 'barrel whip' — lateral flexion reminiscent of a guitar string under pluck.

• P-waves compress and expand along the axis of motion. They are generated by the violent pressure spike from expanding gases and the mechanical interaction between the bullet and barrel — as the projectile forcibly engages the rifling, it compresses the steel ahead of it.



S and P Waves

These waves propagate at astonishing speeds — S-waves around 8,000 mph, and P-waves exceeding 13,000 mph — traversing the barrel multiple times before the bullet even exits the muzzle. This means the bullet's path is shaped not just by the shooter, but by the barrel's vibrational state — and the work being done to forcibly straighten a dynamic system. That very resistance amplifies wave interaction, compounding oscillations until the bullet exits.

When these waves interact, they don't always cancel out — they often interfere:

• Constructive interference amplifies vibration, increasing energy and deviation

• Destructive interference cancels vibration, stabilizing the system

Without intentional guidance, these interactions become chaotic and non-repeating, generating irregular flexion and forcing each shot to exit at a slightly different point in the oscillation cycle — resulting in point-of-impact unpredictability.

Structured Barrels are designed not to eliminate these waves, but to shape and guide them. The geometric channeling created by the deep hole drills — precisely machined and intentionally placed — promotes predictable wavefront reflection and damping, coaxing the waveforms to follow a preferred path rather than bouncing erratically throughout its structure.

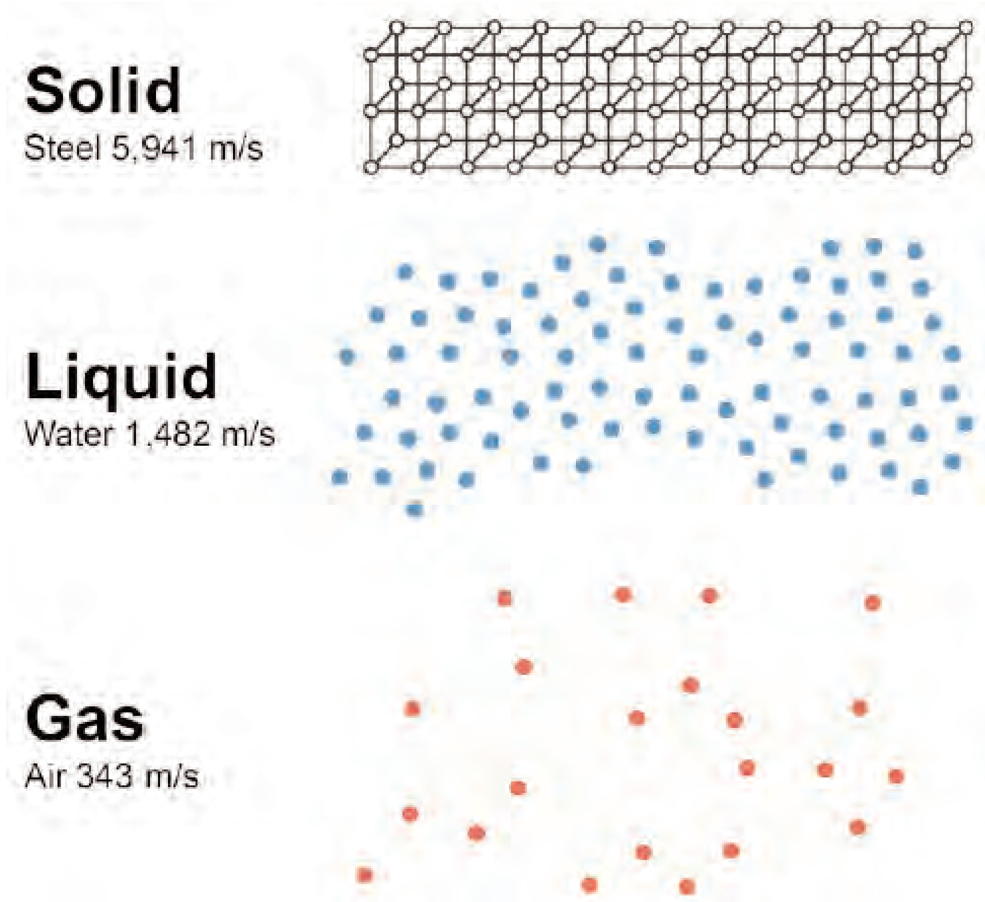
Instead of a barrel fighting itself, Structured Barrels behave more like tuned waveguides — with controlled interference zones, repeatable energy decay, and stabilized motion. This is conceptually similar to the science behind directional microphones, like shotgun mics, which guide waveforms through internal geometry to isolate and resolve signal from noise. Structured Barrels apply this principle mechanically, preparing the barrel to settle into a more predictable harmonic mode before the bullet exits.

Next, we examine how temperature interacts with wave propagation — altering density, elasticity, and ultimately, how energy moves through the system.

1.6 Temperature and Waves

The speed at which waves travel through a barrel isn't constant — it depends on temperature. As temperature increases, atomic vibration intensifies and this increases the average distance between atoms. While this may seem like a high-energy environment, it paradoxically slows wave transmission, because atoms take longer to collide and pass along vibrational energy.

This relationship explains why wave speed is fastest in solids, slower in liquids, and slowest in gases. In solids, atoms are tightly packed, so vibrations transfer with minimal energy loss. In gases, particles are far apart and moving freely, causing greater energy dispersion and longer transmission times.



Atoms in different Material States

Temperature doesn't change wave frequency — it changes speed, and therefore wavelength, as described by the wave equation:

v = □f

(Speed = Wavelength × Frequency)

Waves in different Material States

In a heated barrel, these shifts in wave speed and wavelength influence vibration timing, harmonic convergence, and energy decay — especially over prolonged firing strings where temperature changes rapidly. This makes understanding material thermal behavior critical to controlling flexion, dispersion, and return to zero.

Structured Barrels account for this through engineered geometry — achieving critical gains in surface area and structural rigidity that preserve both stability and harmonic alignment, even as temperature fluctuates. The result is consistent, shot-to-shot predictability across a wide thermal envelope.

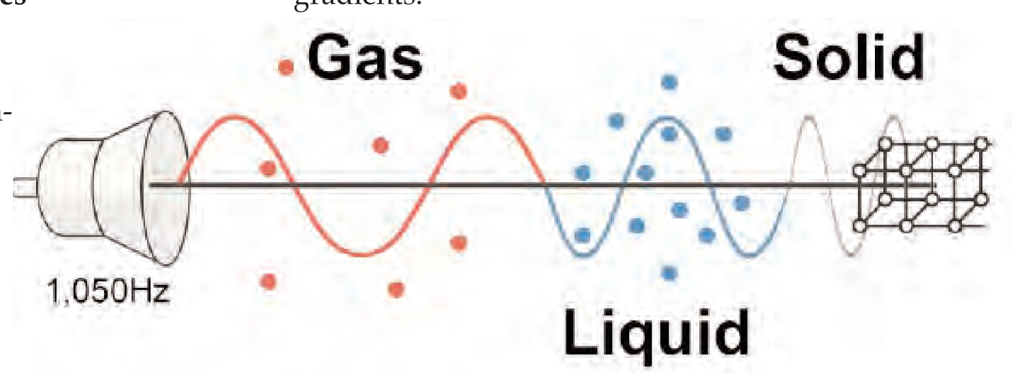
1.7 Barrel Flexion and Waves

These changes in material behavior, as heat flows from regions of high to low energy — and entropy increases — the barrel's material properties shift. With each incremental degree rise in temperature, the medium's ability to conduct waves subtly changes, as the steel undergoes infinitesimal phase drift toward a more fluid-like state. This is not full melting, but a measurable reduction in stiffness and energy transfer efficiency.

This affects sinusoidal S-waves and compressive P-waves that are repeatedly generated by violent mechanical forces like:

- Gas pressure at the breech and bore
- Recoil impulse
- Bullet interaction (rifling engagement, bore concentricity, and path straightness)
- Gravitational torque acting on a suspended, unsupported barrel length

These waveforms work in tandem to simultaneously push, pull, stretch, compress, and twist the barrel in highly dynamic patterns. Each mode of flexion propagates as a frequency of displacement, and these frequencies shift in response to localized temperature gradients.



ause S- and P-waves travel several times faster ıe bullet, they wrap the structure in variable os- ›n patterns. This can exaggerate the bullet's inter- with the barrel — introducing new deflections, gnments, and rotational accelerations. These ef- re often perceived as barrel whip — the visible estation of constructive and destructive wave in- nce happening in a material that is no longer uni- rigid.

his way, flexion is not just a product of firing — evolving function of temperature, structure, and vith the bullet caught inside the system's har- feedback loop.

Observational Harmonics

:rything we've discussed so far — waveforms, ı, temperature, and vibration — manifests in a , observable way on target: group size. And per- ıowhere is this more clearly demonstrated than in testing.

round count increases, barrel temperature rises, g stiffness, wave velocity, and harmonic behavior. hot adds incremental heat, subtly shifting the s vibrational mode and wave propagation char- tics — often enough to cause the point of impact t. This is why even consistent loads may open up string progresses.

lder tests, designed to identify optimal powder s or node windows, inadvertently expose the in- e of thermal and harmonic stability. Within a tight window, some groups cluster tightly — these ent moments when barrel and load are momen- 'in tune." Just outside that window, harmonic gnment causes shots to scatter — despite identical al conditions.

his way, ladder tests aren't just load development – they are diagnostic instruments that measure le's sensitivity to structural and vibrational incon- :y.

ing geometry and barrel condition influence nconsistencies, but the difference is typically ıal — on the order of 1–2% in even a "shot-out" Custom handloads further mitigate error from ›al axis tilt and pressure curve variability. So we observe meaningful differences in group size ıt-of-impact between load variants, it suggests orces are at play.

e common shooter response is to compensate op- — zeroing to the observed point of precision. If \ consistently centers at (x, y) and Load B at (x+1, y+1), the shooter may dial out that offset and call it zero. But that zero is now calibrated to a specific thermal and harmonic state, and will shift again with:

- Changes in ambient air temperature
- Sun exposure
- Round count over time

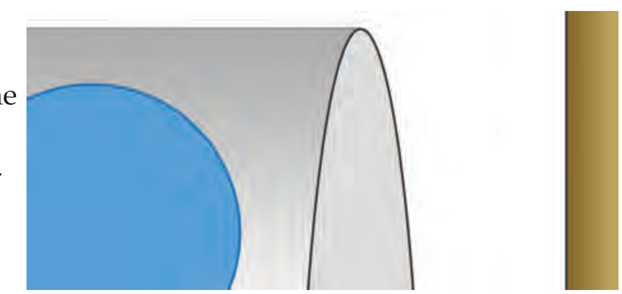
These changes influence barrel temperature, and thus material stiffness and flexion behavior. Barrels that exhibit noticeable horizontal or vertical dispersion under small thermal shifts are likely responding to wave amplification, structural resonance, or material expansion asymmetry.

To isolate the role of barrel flexion, we consider only the vertical plane in the below illustrations:

Barrel Scale 1

This is a 1.35□ diameter barrel. The next image is this same barrel, magnified 8×.

Barrel Magnified



The light gray line above the barrel represents only 0.001" of flexion — near-imperceptible, yet mechanically significant.

Using a 24□ barrel with a single point of deflection 6" from the chamber, the following vertical shifts at 100 yards were calculated based on various flexion values:

Flexion	POI Shift	Angular Shift	
		MOA	MIL
0.0005"	+.100"	0.0954	0.0278
0.0010"	+.200"	0.1909	0.0556
0.0020"	+.400"	0.3822	0.1110

Barrel Flexion Table Condensed

All of these values are easily discernible in a scope —

yet originate from movements nearly impossible to perceive in the barrel with the naked eye. A difference of just 0.0005□ (half a thousandth) in flexion corresponds to a 0.100□ shift on target — an amount one-third smaller than the thickness of a human hair, but measurable across 100 yards.

These calculations don't account for:

• Variations in CGI offset

• Thermal gradients during or exceeding a 5-shot string

• Multiplanar forces from bullet-barrel engagement (which impart xyz flexion vectors)

Thus, while ladder tests may not always isolate small changes like 0.0005□ vs. 0.0010□ flexion, they expose the Gaussian curve of dispersion — revealing both visible POI drift and the underlying harmonic sensitivity of the system.

What appears as "minor group growth" may, in fact, be the visible result of unseen mechanical movement, among other variables.

1.9 Instrumental Proof

Skeptics often reference high-speed footage as proof that barrels "don't move." At first glance, these videos seem compelling — no visible motion, no whip, no deformation. But this belief falls apart under scrutiny, for one simple reason: the limits of observation are not the limits of reality.

Visual systems — from high-speed cameras to optical scopes — operate within two competing constraints:

• Resolution (how much detail the system can capture)

•Magnification (how large the subject appears)

When you increase magnification to focus on the barrel, you lose resolution and temporal precision. When you maximize resolution (e.g., 100,000+ FPS), you must sacrifice magnification, field of view, or both. As a result, most high-speed footage:

• Captures flexion blurred across frames

• Misses the sub-millisecond elastic return between shots

• Fails to differentiate micro-deflection from camera shake or background noise

The scale of flexion we're discussing — 0.001□ or less — is often smaller than the pixel size of the sensor. It's like trying to measure the width of a human hair from a mile away with a Polaroid.

Some skeptics turn to oscilloscopes and accelerometers — hoping to "measure vibration directly." While this is technically possible, it introduces a paradox: In order to measure flexion, you must isolate the barrel from the system — but doing so creates an artificial condition that no longer reflects real-world use.

Here's why:

A barrel is not a standalone object. It is part of a dynamic system, including:

• Stock or chassis

• Receiver bedding

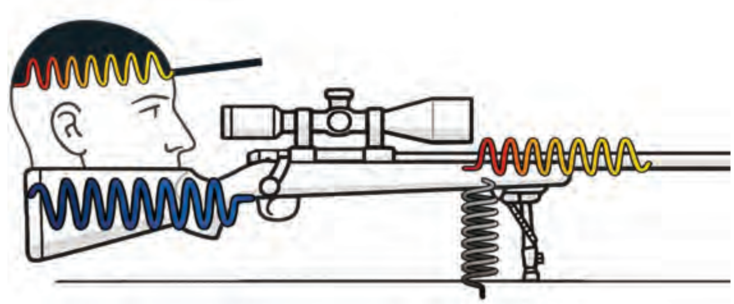
• Muzzle devices

• Bipods, tripods, or shooting bags

• Shooter input (shoulder pressure, grip torque, breath)

Each of these has its own spring constant, natural frequency, and harmonic decay. Attempting to isolate the barrel is not only extremely complex as each attachment affects behavior, but to get a "clean reading" strips away the very forces that contribute to real-world dispersion.

Variable Springs Shooting



Worse yet, accelerometers mounted on the barrel may:

• Add mass at non-neutral nodes, altering flexion behavior

• Fail to resolve motion in orthogonal planes

• Be overwhelmed by gas jet shockwaves and combustion harmonics

We may not always observe barrel flexion directly — but we regularly see its effects:

• Group widening as barrels heat

• POI drift over long shot strings

• Micro-adjustments in load development reflected at 100–1,000 yards

In other words, Structured Barrels deliver repeatability — consistency not just in theory, but on target. And that brings us to a key structural principle in understanding and managing barrel flexion and wave behavior: the Second Moment of Area — the geometric foundation of a barrel's resistance to bending.

1.10 Second Moment of Area

Recall, the S and P waves produced from gas pressure, recoil, and bullet-barrel interaction inject enormous energy into the system — compressing, stretching, and twisting the barrel at high frequency. As these linear and radial forces travel the length of the barrel multiple times, they induce flexion with corresponding accelerations about the barrel's center axis. While this motion is influenced by a barrel's moment of inertia, the magnitude of flexion is governed by its Second Moment of Area — a geometric measure of how effectively its cross-section resists bending.

To visualize how a barrel physically responds to these dynamic loads, we turn to structural simulations below developed by Al Harral, a former structural analyst at Lawrence Livermore National Laboratory with three decades of experience in complex system analysis. These simulations were conducted using LS-DYNA, a powerful Finite Element Analysis (FEA) tool used to model dynamic and static loading in mechanical structures.

Importantly, the following simulations assume a perfectly straight bore and amplify displacements significantly to make vibrational behavior perceptible. As Harral writes, these visualizations show how:

"Forced deformations from the high-pressure gas and recoil cause the muzzle to change where it is pointing at the target when the bullet exits the muzzle… The recoil and bullet motions 'pull' the rifle barrel to a new shape."

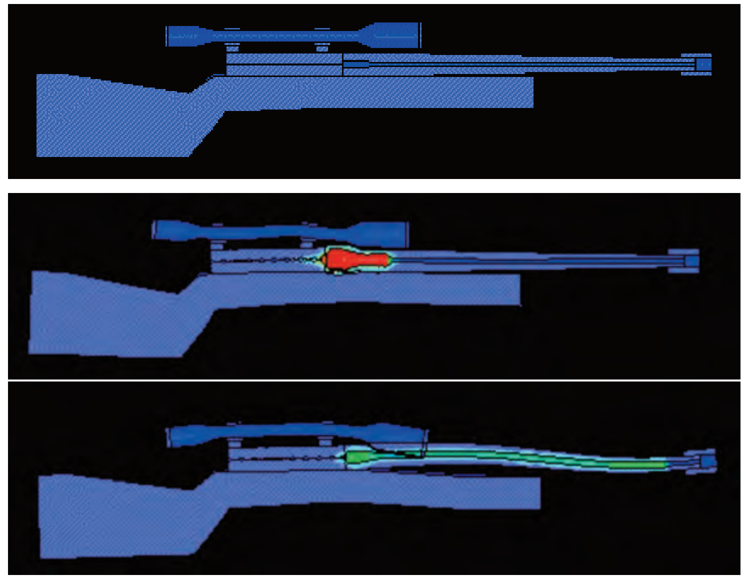
The takeaway: a barrel with superior stiffness exhibits far less deflection from gas pressure and recoil alone — a fundamental property that defines the behavior of waveforms and the precision of the system.

Perhaps most revealing is Harral's observation:

"The vertical amplitude of vibration is more heavily excited than the horizontal… because the center of gravity of the rifle is located below the barrel's centerline, and the bullet's travel down the barrel causes a vertical turning moment about the rifle's center of gravity. [This makes] the vertical vibration most important."

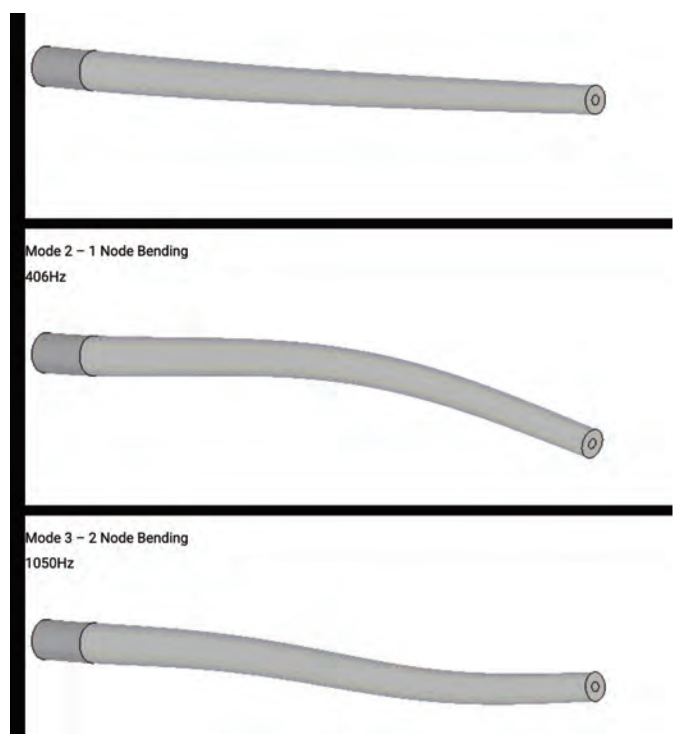
This vertical axis is crucial to understanding real-world dispersion patterns, as torsional acceleration exerted by the bullet attempts to straighten — or unscrew — the barrel, shifting point of impact away from point of aim. This phenomenon underlines the geometric principle realized in Structured Barrels.

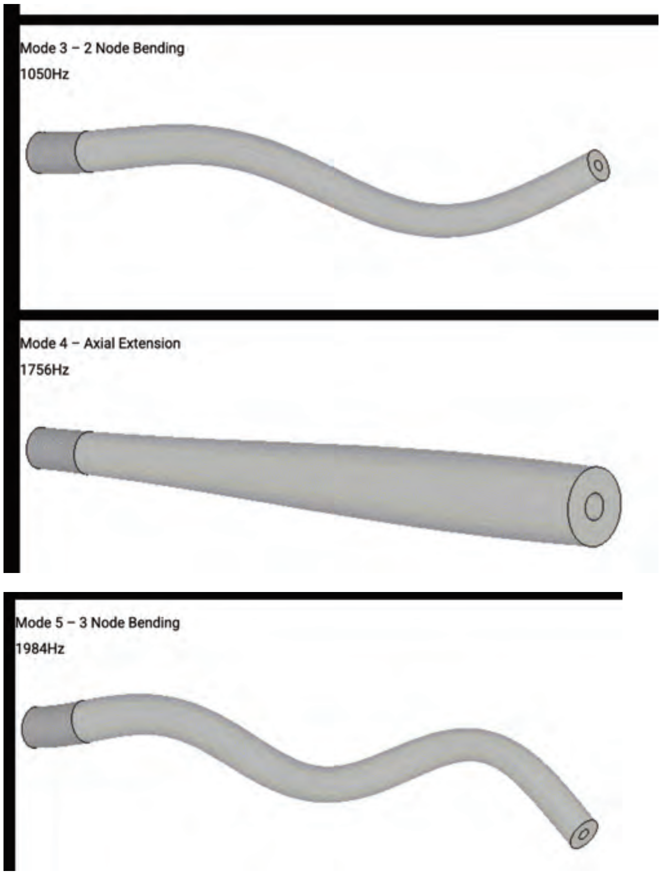
Simulations model a 6mm rifle with a 22" 416 stainless barrel with no rifling and straight taper from 1.24□ at the breach to a 0.935□ DIA at the muzzle. The modeled barrel, action, stock, scope, scope mounts, brass weight, etc. came within approximately 7oz of the real thing. Mesh detail is provided, consisting of 17,196 nodes and 12,080 elements. Despite only half of the mesh being used in calculations, each shot calculation still took about an hour to set up and simulate, outputting about 2.5Gb of data.



On the website, these three images are moving picture that shows the shot, recoil and exaggerated barrel movement.

Rifle flexion from recoil
LS-DYNA Light Rifle Mesh
Mode 1 – Cantilever Bending
82Hz
Barrel Flexion from Harmonic 1
Mode 2 – 1 Node Bending
406Hz





Barrel flex is exaggerated to show the effects.

Barrel Flexion from Harmonic 2
Mode 3 – 2 Node Bending
1050Hz
Barrel Flexion from Harmonic 3
Mode 4 – Axial Extension
1756Hz
Barrel Flexion from Harmonic 4
Mode 5 – 3 Node Bending
1984Hz
Barrel Flexion from Harmonic 5

The above simulations demonstrate how different frequencies manifest as physical movement along the barrel's length. It is important to note, while modes 1, 2, and 3 are shown in a single plane, they may exist in other planes, and exemplary modes 1-5 are – all – excited, simultaneously when firing a round. While the higher frequency modes have extremely small amplitudes, it is difficult to visualize just five modes acting at the same time, let alone many many more.

The amount of resistance a shape can exert to bending about its geometry on a particular axis is its second moment of area, and this is dependent on the area and material distribution to the axial moment. Cross-sections of an object that locate the majority of the material far from the bending axis have larger moments of inertia, making said cross section considerably more difficult to bend when force is applied. This is one reason I-beams, and not rectangular bars, are commonly used in structural applications, because they position sufficient mass in both x-y planes to resist force and deflection. Since Structural Barrels are analogous to I-beams reinforcing the bore in multiple planes, this creates a geometry that resists bending in multiple planes.

1.11 Mathematical Proofs for Increased Stiffness

We can mathematically define this geometry and the Second Moment of Area (J) for a cross section of a barrel as

$J = \int r^2\, dA$; where $r^2 = x^2 + y^2$ and $dA = 2\pi \cdot r\, dr$

$J = \int r^2 \cdot 2\pi \cdot r\, dr = \pi R^{□}/2$

Perpendicular Axis Theorem $J_z = I_x + I_y$; barrels are a symmetric object

$I_x = I_y = \pi R^{□}/4$

Evaluating the Second Moment of Area per Unit of Area — Rod (conventional barrel) versus Tube (Structured Barrel)

$S_{Rod} = I_{Rod} / A$; where A is the area $\pi R^2 = R^2/4$

$S_{Tube} = (I_{Rod} – I_{Tube}) / (A_{Rod} – A_{Tube}) – (I_{Tube} / A) = R^2(1+x^2)/4$; where $x = r(inner) / r(outer)$

We see as the x limit approaches a 1:1 ratio to the radius R in the STube, a tube exhibits twice the stiffness, but this also requires an infinitely small radius. Stiffness, in this context, governs how much a barrel will bend or resist displacement under the same applied forces. It's a function not just of material, but how far that material is distributed from the bending axis. These equations indisputably demonstrate a body of equal mass positioned farther from the bending axis has a larger moment of inertia, making it significantly more difficult to bend. This is further corroborated by an independent aeronautical CEL analysis using MSC/NASTRAN that found +50% greater stiffness in a simulated barrel of the same weight.

Using $R^2/4$, or the stiffness per unit area, we can evaluate this to a barrel that is X% larger, and the difference between a big and small barrel may be simplified as $R^2(1-X^2)/4$. Since X is the difference between two barrel diameters as a percent, it is important to note this value is driven by a square. So, procuring a 1.65□ blank

The website has a calculator to compute stiffness comparisons.
tacomhq.com/structured-barrel-science
You can also see the in-motion images there.

versus a 1.35□ blank yields 22.50% more (free) stiffness. Because stiffness scales with the square of radius, small increases in diameter yield disproportionately large improvements in resistance to bending. Compound this with added structural rigidity, and this value becomes rather significant. It is no secret bull barrels are typically more precise than a standard profile. Mathematically, this is one reason why.

2.1 Flexion and Energy

Now that we understand flexion as waves, let's now define its heat byproduct. Gas pressure, recoil, and the interaction between the bullet and the barrel are all exemplary forces that act on a barrel. The equation to describe force is the multiple of mass and acceleration, the rate velocity changes in respect to time. Since barrels have mass, the work done to accelerate a barrel onto a sinusoidal wave about its center axis via tensive and compressive forces requires energy. These relationships are described by the below equations:

$v = x/t$

$a = dx/dt$ (rate of change)

$F = m \bullet a$

$W = F \bullet$ □x

□$K = W$

K = Energy (kinetic)

2.2 Energy and Heat

Since energy is proportional to the work done on a system from an initial state to a final state (the First Law of Thermodynamics), and the Law of Conservation of Energy dictates that energy can neither be created nor destroyed, the work done on a barrel to accelerate it about its center axis due to flexion requires substantial energy. This energy creates atomic friction and thereby heat.

This raises barrel temperature, and while atomic vibrational rates vary per atom, Maxwellian distribution reveals thermal energy raises the average vibrational speed of all atoms, even in the presence of non-uniform heat gradients across the barrel. The average kinetic energy of the barrel's atoms define its temperature and thermoelastic behavior — a state where stiffness and stress-strain relationships become increasingly temperature-dependent. Each fast, follow-up shot thus encounters a barrel not only hotter, but softer, slightly more unpredictable, and increasingly chaotic.

2.3 Heat Flow

With every shot delivers another surge of energy — not just into the bullet's motion, but into the barrel's body itself. This energy does not remain static; it transforms into heat and spreads outward from the bore and from the chamber. To understand how heat physically migrates through a barrel, we must turn to heat conduction — the process by which thermal energy transfers from regions of high temperature to regions of lower temperature, atom by atom.

This flow is not instantaneous. Nor is it uniform.

In cylindrical bodies like barrels, heat flows radially outward, from the inner bore radius (r_1) to the outer surface (r_2). The rate at which this occurs depends on several variables:

- The temperature differential between these layers (delta T),
- The material's thermal conductivity (k),
- The contact area available for transfer ($A = 2\pi rL$),
- And inversely, the thickness of the material the heat must traverse (delta r).

This relationship is described by the heat conduction equation for a hollow cylinder:

$Q = 2\pi rkL \bullet (T_1 - T_2) / \ln(r_2 / r_1)$

Where:

Q = heat transfer rate in watts

r = radius at which the evaluation is made

k = thermal conductivity coefficient

L = length of the barrel segment

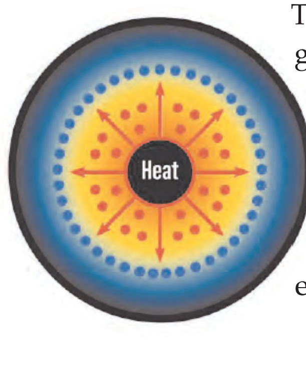
$T_1 - T_2$ = temperature difference between the inner and outer surfaces

$\ln(r_2/r_1)$ = natural log scaling for radial spread

This equation quantifies the energy required to raise the outer wall (r_2) to a target temperature (T_2), starting from an internal condition (T_1), and reveals something critical: thicker barrels resist rapid heating not solely due to thermal mass, but due to geometry.

As r_2 increases, the surface area for heat conduction grows linearly, while the conduction path (delta r) grows logarithmically. Thus, increasing a barrel's outer diameter and internally structuring it extends the conduction path (delta r), while reducing, equalizing, or only marginally increasing mass—depending on the selected deep-hole geometry.

Heat flow in a rod



This geometry creates a thermal guide: the narrow wall between each internal channel and the barrel's outer diameter, promoting unrivaled thermal stability during repeated or sustained fire. As excess energy passes from atom to atom, each retaining a slight vibrational increase, the excited electrons emit thermal radiation in all directions. Since Structured Barrels exhibit over 300% more surface area, they offer significantly more surface to radiate and evacuate heat from the system, rather than trapping it and relying solely on atomic absorption. Combined with the thin-walled segments acting as internal heat sinks, and the forced convection created by the low-pressure wave trailing the bullet through the muzzle, the result is substantial thermal control and endurance.

These dynamics matter because temperature changes do not remain isolated or isometric—they initiate measurable material changes. A barrel's geometry and elastic behavior begin to shift as localized regions expand differentially. In other words, the conduction curve sets the stage for thermal expansion. The faster the inner bore rises in temperature relative to the outer wall, the greater the risk for asymmetric stress. Thus, rapid heat flow—and ultimately, rapid heat evacuation—preserves material stiffness throughout the barrel without introducing unwanted variable change shot to shot.

From microscopic friction to macroscopic flexion and expansion, heat flow is not merely a thermal event. It is unequivocally a structural one.

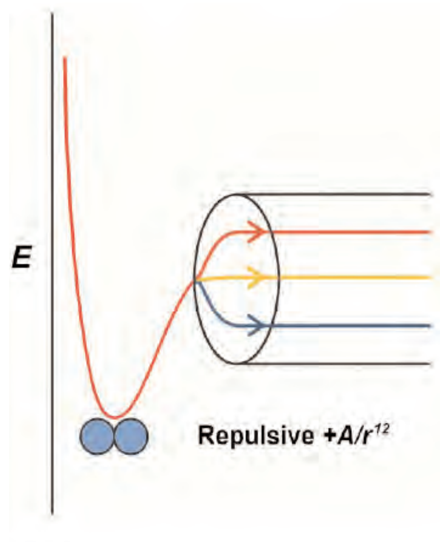
2.4 Thermal Expansion

The structural changes realized in the increase of atomic vibrational speeds directly impacts the kinetic energy of individual atoms, and thereby the macroscopic properties of the material. In solids, atoms are densely packed and bound by strong interatomic forces. These atoms primarily vibrate around their equilibrium positions without migrating past one another, giving solids a definite shape and volume.

These vibrations are governed by the Lennard-Jones Potential, which models the potential energy between two atoms as a function of their separation distance. Visualized like two masses connected by an asymmetric spring, the potential well is deeper and steeper on the compression side — meaning it requires significantly more energy to force atoms closer than to let them drift apart. As a result, atoms spend more time slightly separated than compressed during vibration, which shifts their average spacing outward as temperature increases.

This phenomenon at the atomic scale causes solids to expand when heated at the macroscopic scale, and since most crystalline solids are isotropic — expanding equally in all directions — their proportions stay consistent while absolute dimensions increase. The relationship is described by the thermal expansion coefficient, which defines the fractional change in size per degree of temperature rise. This is thermal expansion: the tendency of matter to change in shape, volume, or area in response to temperature.

Lennard-Jones Potential



The potential curve illustrates how atoms favor a certain equilibrium distance but shift outward as vibrational energy (temperature) increases.

To translate these atomic principles into something measurable, the following interactive calculator estimates bore diameter growth due to thermal expansion. The user inputs an initial bore diameter, a starting temperature, and a final temperature — revealing how even sub-degree changes can exceed 0.0001″ of radial movement.

Thermal Expansion

Change conditions to calculate Bore DIA movement.

The physics of thermal expansion is defined by:

delta L = aL • delta T

Where:

- delta L is the change in length
- a is the thermal expansion coefficient
- L is the starting length
- delta T is the change in temperature

The website has a calculator to the thermal expansions.
tacomhq.com/structured-barrel-science

Using a thermal expansion coefficient of 6.5×10^{-6} in/°F for 416 stainless steel, this equation reveals that temperature affects not only barrel length but also outer diameter and most critically its bore diameter. Superior bullet manufacturers segregate by tolerances well below 0.0001″, and this margin can be exceeded by something as simple as ambient air temperature, sun exposure, or a prolonged firing string.

However, this formula assumes a uniform thermal field, which is rarely the case. In real-world barrels, heat is distributed unevenly across both the longitudinal and radial axes. This creates thermal gradients —

. As each layer expands differently, it creates in-
ress fields that subtly shift the barrel's geome-
ıment, and vibration response. Thus, thermal
ɔn is not just a matter of "stretch" — it is a shift
ıal architecture, subtly altering how the barrel
resonates, and ultimately wears with every

hermal Expansion and Waves

thermal expansion decreases a barrel's density
omic arrangement increases, and while energy
ay be uniform per calorie, its effect is not
listributed along the barrel. Longitudinal and
mperature gradients emerge, driven by local-
spots near the throat, muzzle, and radial cross-
. Since mass remains constant, yet the average
between atoms increases, the time and dis-
quired for one atom to transfer vibrational en-
he next also shifts — and shifts differently
ach gradient.

esult? A medium whose wave-transmission
ristics are no longer constant. Thermal expan-
rupts the uniformity of stiffness, propagation
nd even resonance. In essence, the structure be-
ıe arbiter of its own vibrational response — al-
ot by shot.

scussed in Section 1.6, thermal energy and
havior are inseparably linked. Together, they
ıow a barrel absorbs, stores, and transmits the
s of recoil, gas pressure, bullet interaction, and
ional torque. Barrels are not static. They are
ly alive — continuously reshaped by changes in
ture.

ariable Heat (Q)

antify thermal energy transfer within a barrel,
lynamics uses the equation:

nc delta T

Q represents heat flow — positive for heat
gative for heat loss. While m is the material's
ıd c its specific heat capacity: the amount of en-
uired to raise one gram of the substance by one
Crucially, c is not fixed. Like stiffness and mod-
varies with temperature.

e atomic scale, added energy is distributed
ranslational, rotational, and vibrational motion.
emperatures yield less internal motion, mean-
naterial has greater potential to absorb energy
e excited. As temperature increases, atoms al-
motion require increasingly more energy to ac-
duct and retain heat, making the barrel more thermally dynamic with each shot.

While Q may exert minimal influence under light firing, prolonged sequences introduce non-linear accumulation:

$$Q_1 + Q_2 + Q_3 + \ldots + Q_n$$

Each shot doesn't simply add more heat — it adds more and more heat into a changing system. The initial Q_1 stems largely from detonation, pressure, and friction. But subsequent Q_N contributions stem increasingly from internal atomic friction. As the material heats, stiffness degrades, making the barrel more susceptible to force — and inciting higher-amplitude oscillations. More motion means more flexion. More flexion means more heat. Thus, the system enters an energy loop, where mechanical deformation and thermal accumulation feed each other — driving the barrel further from equilibrium with each shot.

Ultimately, this rising Q injects enough energy to not just alter stiffness, but to initiate (potentially permanent) thermal deformation. For some cartridges, this threshold may be reached in as few as 10 rounds. At this point, Q is no longer just a measure of heat — it becomes a signal of system fatigue and the onset of material failure.

2.7 Material Failure

Material failure in barrels starts not as visible damage, but at the atomic scale — where elevated temperatures and repeated stress subtly erode the structural bonds that define hardness, tensile strength, and elasticity.

Metallurgy, the domain for metallic material science, examines atomic structure to describe material properties like hardness, tensile strength, and elasticity and methods to enhance the limits of metals and metallic alloys. The principle of steels are alloys, consisting of a mixture of metals for greater strength or corrosion resistance. For example, stainless steel is purposely formulated to resist oxidation, but each blend is tailored for specific conditions like salt water or for machinability.

The current standard for barrel manufacturing uses 416 stainless or Chromoly for added strength. Both comprise iron, carbon, chromium, and (sometimes) molybdenum, but the small fractional percent additions of elements like phosphorous and manganese in 416 improve machinability and hardenability, respectively. In other words, the incorporation of each element yields unique changes to its final properties.

Manufacturing alloys to the correct compositional standard requires precision and craft. Small deviations in ratio or in the rate to cool dramatically affects the material's atomic structure. Solidification creates strong bonds with neighboring atoms, forming unique patterns and structural elements called grains. Crystalline grain structures vary in shape and size as atoms settle from a high energy Austenite liquid state to a low energy ferrite or Martensite state. Changes in atomic orientation create grain boundaries, and this too alters an alloy''s material properties.

Generally, smaller the grain, stronger and more resilient the material is to stress with each grain boundary inhibiting thermal conduction and atomic dislocation. The interlocking of these atoms into grains though is imperfect, and while heat treating, cryogenics, and surface hardening serve to alter grain structure, repair atomic misalignment caused by micro voids or tears, or diffuse atoms into the crystalline structure, respectively, defects in crystal lattice patterns are the failure modes in alloys. Dislocations enable atomic planes to sheer – gliding or slipping past each other, even at low stress values.

Detonation and bullet-barrel interaction generate axial, longitudinal, and torsional wave patterns of varying magnitudes and frequencies that uniquely interact each grain structure due to their unique shape, size, and orientation. Atomic imperfections within each gain structure yield dislocations allowing atoms to slip, generating friction. This slippage occurs as far as its grain boundary before a new frequency pulls the weak lattice to a new position. As vibrational amplitudes increase due to heat, atoms are driven further apart, weakening interatomic cohesion – further altering wave behavior and, ultimately, grain structure.

This thermal agitation accelerates the breakdown of strength-bearing structures, and unlike elastic deformation, thermal degradation is unidirectional — it cannot be undone by cooling. It is a structural loss, not a temporary shift.

When the internal energy of a flexion impulse exceeds the material's ability to elastically respond — given its temperature moment — failure occurs. The earliest sign may be molecular dislocation; the latest, fire cracking or throat/bore erosion. Either way, the material has crossed its thermomechanical limit.

Barrel Fire Cracking 1

Section 3: Understanding Barrel Flexion Effects on External Ballistics

3.1 Non-linear Acceleration

Now that we understand the internal effects of barrel flexion, we segway to its external effects. Extreme gas pressure, recoil, and bullet-barrel interaction inject enormous asymmetric energy into the barrel. Contrary to common belief, asymmetry is a common and natural consequence of barrel manufacturing. Tool wear, thermal flexion, and chip evacuation in deep-hole drilling introduce average tolerances of 0.001–0.0025" per inch. These deviations are rarely linear. Bore straightness may taper in multiple directions across its length, so the offset often increases exponentially with depth.

Accurately measuring such deviations is expensive. To compensate, manufacturers often turn the barrel's exterior profile using the two ends of the imperfect bore to "match" concentricity. Yet even a hypothetically perfect bore is still subject to barrel droop — the gravitational tendency of a suspended rigid object to deflect, described by torque (torque = r × F). This downward deflection pulls the bore off the longitudinal centerline.

Though these offsets may appear insignificant in scale, Newtonian physics (F = ma) reveals that even subtle asymmetry causes uneven acceleration. And given the immense forces released during detonation — enough to accelerate the barrel's mass to measurable velocity (K.E. = ½ • m • v^2) — these minor imperfections can scale into measurable performance losses.

To visualize the barrel's dynamic response, we turn to Al Harral, structural analyst at Lawrence Livermore National Laboratory:

"The barrel [itself] is initially slightly deflected downward due to gravity [torque]. When the round is fired, the [bullet and] pressure tends to straighten the barrel. As the barrel straightens, it over-shoots in the upward direction and this adds to the excitation of the Mode 1 vibration. As a side note, the axial extension vibration mode is also probably heavily excited." — *Al Harral, Barrel Tuner Analysis*

No system is perfectly rigid. A projectile accelerates through a constantly moving, expanding, and contracting barrel. This invokes irregular stutters — micro deflections — as the bullet briefly expends energy to straighten segments of an imperfect bore before continuing forward. These stutters manifest as dynamic deflection patterns that rob the system of energy otherwise dedicated to consistent acceleration and higher muzzle velocity.

These concepts are further examined in Ep. 057 of the Hornady Podcast: "One Hole Groups? Dispersion."

3.2 Ballistic Coefficient (BC)

Accelerating the barrel not only consumes energy for higher muzzle velocities, it also lowers a bullet's ballistic coefficient (BC), a dimensionless ratio that describes drag. Higher the BC, the more efficiently a bullet resists drag from air resistance and retains its velocity over distance. Drag, the aerodynamic force opposing an object's motion through a fluid like air, is influenced by shape, surface area, orientation, and spin.

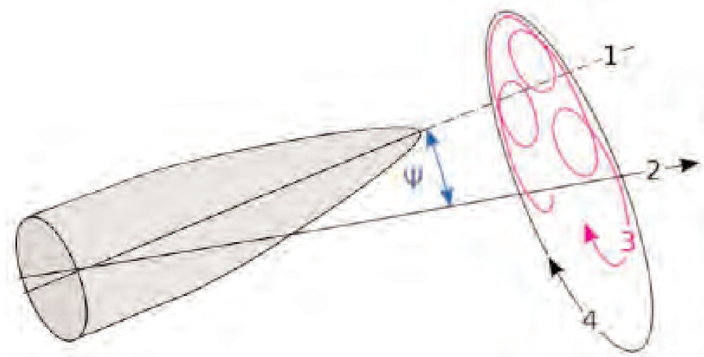
Ballistic computation typically treats a barrel as a static object and a bullet as a point mass centered on its center of mass — an infinitesimal location where all mass is considered concentrated. However, barrels are *not* static and bullets are *not* point objects. Specifically, bullets are three-dimensional, rotationally dynamic bodies affected by the launch conditions within a dynamically moving barrel. The barrel's motion during a shot — particularly deflection at the muzzle — imparts not just translational velocity, but angular momentum that causes the bullet to rotate or "tip off" about its center of mass.

This tip-off introduces yaw, nutation, and precession — rotational motions that shift the bullet's longitudinal axis away from its velocity vector. These changes increase drag and degrade the effective BC. Even a well-balanced bullet launched from a vibrating or imperfectly aligned barrel may undergo complex motion throughout flight, making theoretical BC predictions difficult.

The following excerpt from Sierra Bullets' *Section 2.4: Lessons Learned from Ballistic Coefficient Testing* reinforces this reality:

"Theoretically, the BC of a bullet depends only on its weight, caliber, and shape. But in a practical sense, the measured BC of a bullet also depends on many other effects. The gun can affect the measured BC value in two important ways: spin stabilization and tip-off moments. […] As the bullet flies, the point rotates in a circular arc around the direction of the velocity vector. Coning motion results in increased drag on the bullet, and any firing test method then yields an effective BC value for the bullet that is lower than the theoretical value. We have never been successful in accurately predicting BC values […] by any method other than firing tests."

Bullet Tip-off



1. Longitudinal axis
2. Velocity vector
3. Nutation
4. Precession
5. Yaw (that pitchfork looking thing)

Conclusion

At TACOM HQ, our goal is to create greater stability across conditions by harnessing immense surface area and structural rigidity to account for variable change and to unlock a new standard for internal and external processing.

Get your shoot on

4/17-19/2026
Reno, NV
Palomino Valley Gun Club
Reno, NV
Bruce Craik
norcalconstruction@yahoo.com
cell # (415)999-5350

5/15-17/2026
Rattlesnake Mountain
North of Benton City, WA
Dave Nicholson
253-973-9047
nicdj@comcast.net
Benton City, WA

5/29-31/2026
Whittington Center
Raton, NM
Wayne Meagher
505-228-5231
wrmeagher@comcast.net
Marc Christensen
marc@tenxaccuracy.com

5/29-31/2026
Coalinga Rifle Club
Coalinga, CA
Dale Jeong
dj50bmg@aol.com
Cell (510) 604-8455
Work (510)569-0858 Tues-Sat
Bob Pohl
50bmgbob@gmail.com
(925) 783-9856 after 12Noon PST

Spring regional
The Spring Regional at Whittington is set for Friday 5/29/2026 through Sunday 5/31/2026.

Our tentative dates 6/19-21/2026
Alliance shoots are conditioned on range improvements. If the range is not done, shoots may go to S. Dakota.
Alliance, Nebraska
Alliance Rifle Club
Patrick Bieck
(402) 772-3871
bieckpatrick@yahoo.com
Randy Ofstad

(605) 381-4959
rofstad@rap.midco.net
Shirley List
(918) 374-2337

7/1-2/2026
FSCA ELR King of the 50 BMG match Raton, NM
Match Registration Form
Tuesday July 1st 1:00 Match Registration ELR Fundamentals and Data Seminar at Eagles Nest
Tuesday July 1st Open 1000-yard range after Course is set up. Est 2:00
Wednesday July 2nd 7 AM Safety Meeting & Match Briefing.
Thursday July 3rd 7 AM Safety Meeting & Match Briefing.
Owen Hamilton
ohamilton727@gmail.com

7/3-5/2026
FCSA World Championships Raton, NM
Thursday July 3rd
Target making/ Pit supplies organization- After ELR 3pm (ish)
July 4th
Registration/ Sight in- 8am-3pm
600 yard- 3pm-5pm
4th of July Braai (BBQ) 5pm- Night Time (More detailed timeline to come)
July 5th
6am Targets up (Working on team)
7:00-7:30 shooters meeting
Match at 8am Latest
Match ends 1pm (I hope)
Members meeting after shoot/ lunch (so starts at 2pm - 3pm?)
July 6th
Same match times as July 5th for match
Everyone in the in Nest at 2pm for Reflection, Q&A, history lesson on FCSA, and Thank yous
Awards at 2:30-3pm start time - based on how quickly they can get everything done.
Awards over at 4pm (ish)
Owen Hamilton

8/14-16/2026
Reno, NV
Palomino Valley Gun Club
Bruce Craik

Our tentative dates Sept.4, 5, 6, 2026
Alliance, Nebraska
Alliance Rifle Club
Patrick Bieck
(402) 772-3871
bieckpatrick@yahoo.com
Randy Ofstad
(605) 381-4959
rofstad@rap.midco.net
Shirley List
(918) 374-2337

9/25-27/2026
Rattlesnake Mountain
North of Benton City, WA
Dave Nicholson
253-973-9047

10/9-11/2026
Fall Regional
Whittington Center
Raton, NM
Whittington Gun Club
Wayne Meagher
505-228-5231

Electronic targets show promise at Highmore range shoot

by Randy Ofstad

We held an FCSA sanctioned electronic target match at the Highmore High Power range on August 8th 2025. We had put in a ELR range on the property in the past year.

The landowner was fine with us adding a 1000-yard line in addition to our other targets. We built a 26 foot long by 10 high frame to hold 3 electronic targets. In the center of each target bay we installed a 30-inch square sheet of coroplast with our 24-inch black center painted on it.

We were using the Shotmarker target system. We had 7 shooters in attendance to shoot the match. We followed the same course of fire as a normal match.

Everyone fired their sighter shots during sighter period and then we were able to immediately able to go to record fire. After sighters you change your target to record fire and continue shooting. All your shots are displayed with the sighters having an S on them.

From the time you fire a shot opened your bolt and reloaded your rifle the shot was displayed on your target with the system set to normal delay. It was about the same time period as if you had a really good puller.

We ran out the full ten minutes of the relay to allow rifles to cool. We ran the match in similar fashion to the end. We started our shooting at 9:30 AM and were all done at 1:30PM. This included some down time figuring out the squadding. They added a new feature to the Shotmarker app that allows you to squad in the target system.

We were a little slow on figuring out how to operate that. The target system performed flawlessly through the event. One thing we need to address in the frame setup is to increase the aiming point target size to 4 feet square. That will move the 2x4 supports further out of the impact zone and less susceptible to damage.

There were only 2 items needing to be addressed in the target system. It didn't display a score for a shot outside the 5 ring but still on target and the measurement of groups 10 inches and under was only to 2 decimal places and groups over 10 inches to 1 decimal place.

I am working with Shotmarker on address these concerns. I think this is a very good alterative to shooting a match with pits. Once the hardware is in place to support the Shotmarker system match set up is a breeze. If anyone has any questions feel free to contact me.

rofstad@rap.midco.net 605-381-4959

Our target frame with the aiming points installed

Grand Lodge at Highmore High power Range

LIGHT SCORE PLACING			Place	LIGHT GROUP PLACING	
Competitor Name	Score	X's		Competitor Name	Group
Marty Nelson	231	2	1	Marty Nelson	29.133

HEAVY SCORE PLACING			Place	HEAVY GROUP PLACING	
Competitor Name	Score	X's		Competitor Name	Group
Chad Stevens	286	2	1	Chad Stevens	14.300
Kevin Klefsted	257	1	2	Kevin Klefsted	17.472

UNLIMITED SCORE PLACING			Place	UNLIMITED GROUP PLACING	
Competitor Name	Score	X's		Competitor Name	Group
Randy Ofstad	275	3	1	Randy Ofstad	12.447
Chad Stevens	265	3	2	Chad Stevens	16.550

HUNTER SCORE PLACING			Place	HUNTER GROUP PLACING	
Competitor Name	Score	X's		Competitor Name	Group
Randy Ofstad	261	5	1	Randy Ofstad	9.730
Garrett Fravert	241	1	2	Garrett Fravert	24.367

2-GUN AGGREGATE SCORE PLACING				
Competitor Name	Classes	Aggregate	X's	Total Score
Randy Ofstad	UNLIM & HUNTER	16.422	8	536
Chad Stevens	HVY & UNLIM	19.508	5	551

JUNIOR SCORE PLACING				
Competitor Name	Aggregate	Score	X'S	Group
Emerson Nelson	33.000	251	3	24.833
Hudson Nelson	41.117	234	1	30.117

Place	YELLERS				
	Competitor Name	Class	Group	Score	X's
1	Randy Ofstad	HUNTER	7.480	47	2
2	Randy Ofstad	UNLIM	8.450	49	0
3	Randy Ofstad	UNLIM	8.930	45	0
4	Randy Ofstad	HUNTER	9.670	32	0
5	Kevin Klefsted	HEAVY	9.930	42	0
6	Randy Ofstad	HUNTER	10.000	50	0
7					

Number of participants	7
Total 600 yard guns	0
Total 1000 yard guns	9
Total Targets	54
Total groups under 1 MOA (Add number of screamers and Yellers and input here)	60
% of targets with groups less than 1 MOA	1.11111111

Place	SCREAMERS			
	Competitor Name	Class	Group	Score
1	Randy Ofstad	HUNTER	6.030	41

Our aiming point target

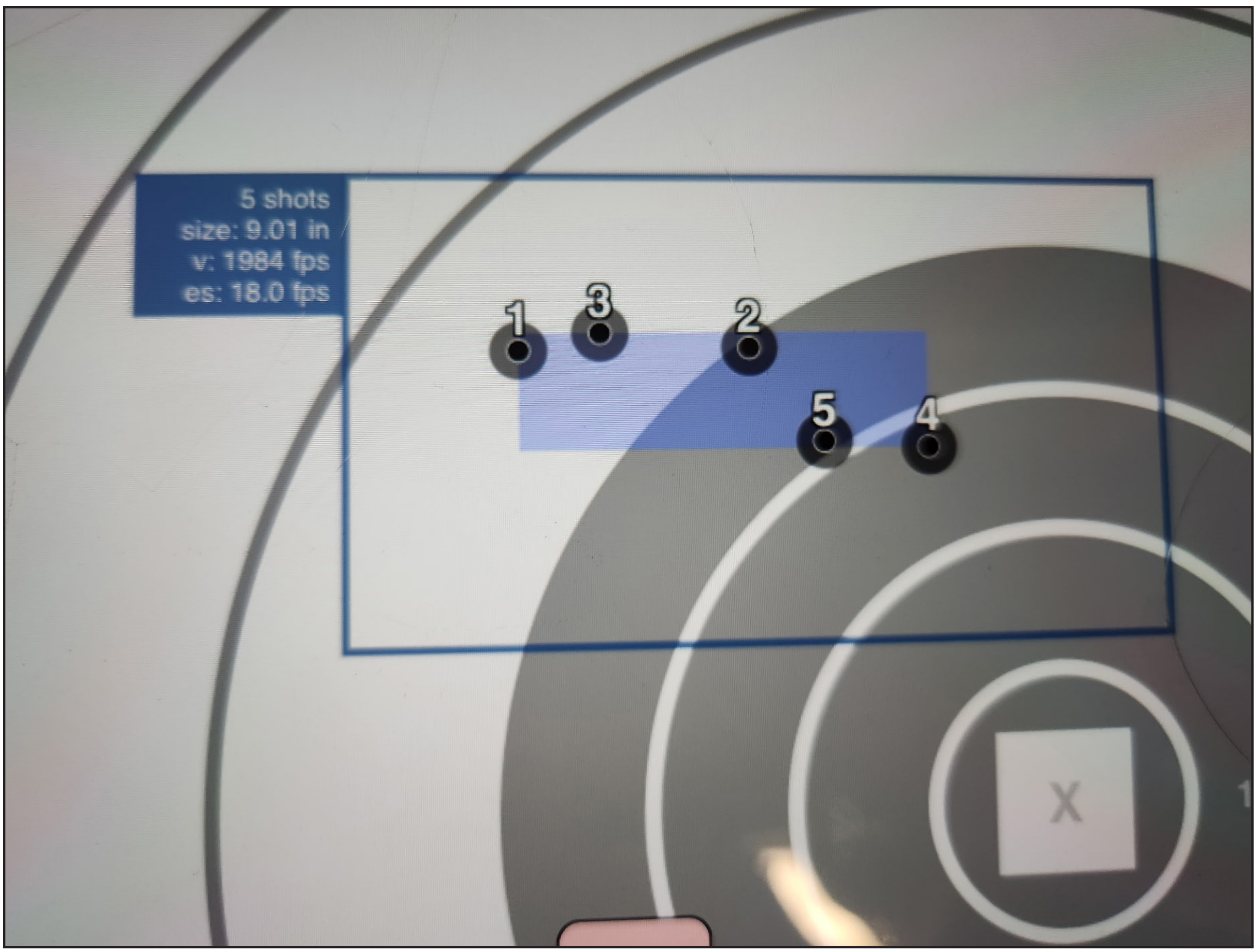
One of the aiming points after the match

The target frame

Aiming points with Shotmarker sensors attached

Another aiming point after the match

Target frame with aiming points and Shotmarker sensors attached.



Shot of the Shotmarker screen displaying 5 shots.

RANGE EQUIPMENT

CURRENT RULE

1. Targets: Only the Official FCSA Target will be used for Sanctioned Matches. The FCSA Official 1000 yard target is 67 inches by 72 inches and has a 24 inch black center that extends out through the 8th ring. The designation of this target is MR or MR-1. The replacement center for this target is described as MRC. The only approved change to these targets is the recommended addition of a white 3 x 3 white square to the center of the target. All competitors must use the same target during a match.

PROPOSED RULE CHANGE

1. Targets:

a. Paper: Only the Official FCSA Target will be used for Sanctioned Matches. The FCSA Official 1000 yard target is 72 inches by 72 inches and has a 44 inch black center that extends out through the 7th ring. The designation of this target is LR-F.

RING	DIAMETER (Inches)
BLACK AREA	
X	5
10	10
9	20
8	30
7	44
WHITE AREA	
6	60
5	72

The replacement center for this target is described as LR-FC. The only approved change to these targets is the recommended addition of a white 3 x 3 inch square to the center of the target. All competitors must use the same target during a match.

b. Electronic:

Electronic targets may be used in sanctioned competitions. However, these electronic systems may not be solely relied upon when it comes to recording each competitor's official score and group size. These systems may be used to expedite matches and to reduce or eliminate the necessity and cost of hiring people to perform pit duty.

Prior to use, these systems must be maintained, calibrated and inspected by individuals who are knowledgeable of the particular system being used. The physical target will consist of an official FCSA target with a white 3x3 inch square in the center.

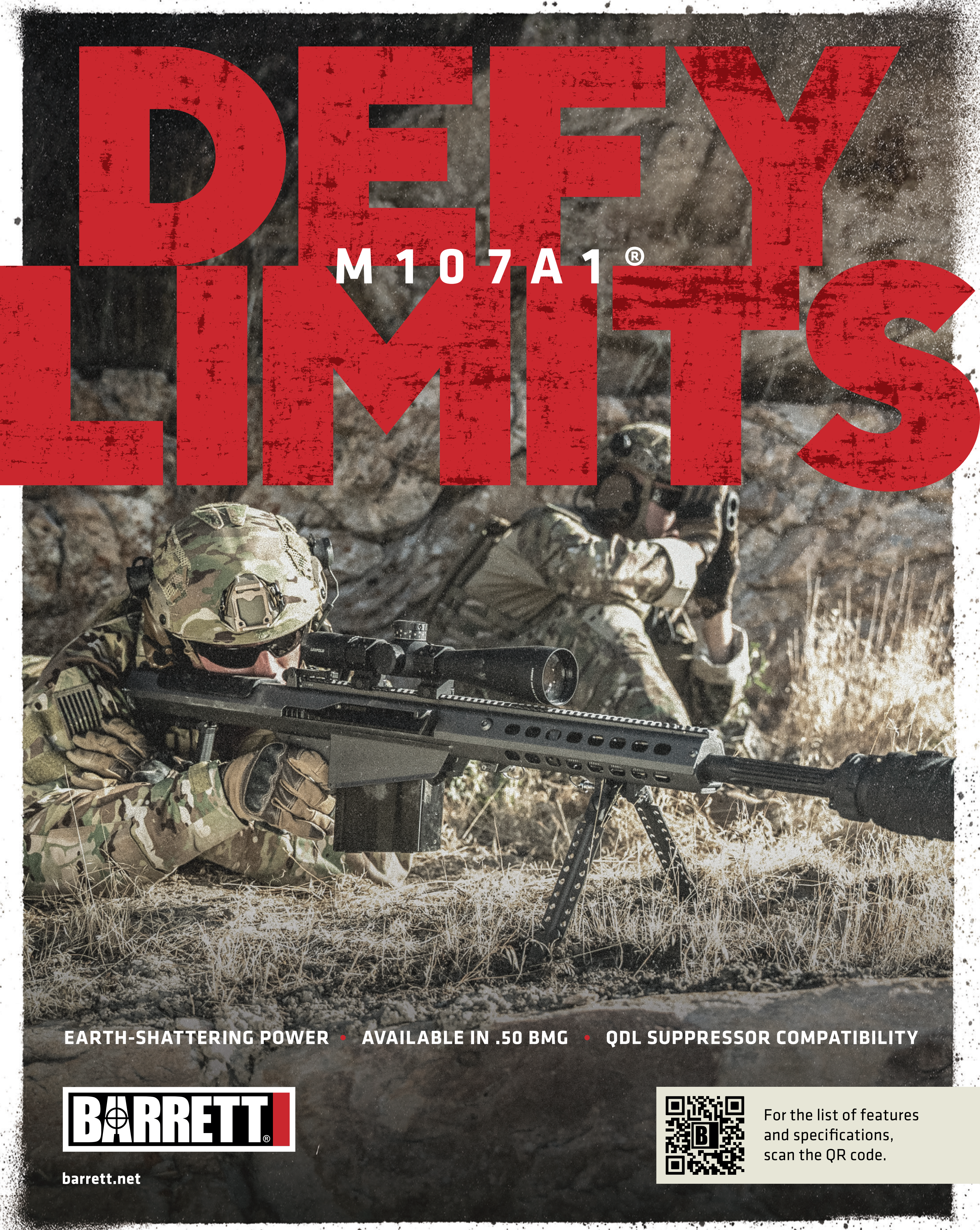
All electronic targets used in FCSA sanctioned matches must be programed with a 7 second delay. This is the time from when a shot is recorded on target to the time it is electronically displayed for the shooter to view. The purpose of this delay is to simulate the time required for a target to be manually marked with a spotter. In addition, the bullet size in the system must be programmed for the 50 BMG projectile (0.510 inches).

At least two people, assigned by the Match Director, must be present in the pits during each record string. These individuals are responsible for scoring and measuring the group size of each target. Once a target is scored and measured, all holes must be repaired before the target may be raised to receive the next volley of sighters or a record string of fire. The official score and group size of each target will be maintained in the pit.
NOTE: To verify system accuracy, the pit crew can compare the electronic screen shot of each target to the actual target it represents.

Bye Bye Shreveport

FCSA members went to Shreveport and dismantled the range. We are looking for a home for this stuff so we can have a 1,000 yards somewhere in the South-Souheast,


Delek
Tyler Refinery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