Miscellaneous Questions #16

This section contains brief discussions of various ballistics and shooting related topics as requested by correspondents. If you have a question you have been trying to find an answer to (keep 'em ballistics and shooting related--see your minister for the mysteries of life) email me by clicking here and I'll do my best to find the answer for you and if it is of general interest, publish it here. If you can contribute additional input to one of the answers I'd would appreciate hearing from you too.

Check back frequently as new topics are always being added.

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Q. What are the qualification tests for Federal Sky Marshals?

A. There have been 2 tests. The first was so difficult that few could pass it. The newer one is easier but the original qualification standards are still strived for.

Original FAM Qualification Test

All drills shot at 7 yards from either concealed holster or low-low ready (as in behind an airplane's seat.
Targets are set up as T1 T2 T3 7 yards from shooter and 2 yards apart with shooter centered on T2.

Individual Drill	Starting Position	Time Allowed	Total Rounds
One Round (twice).	Concealed from Holster	1.65 seconds (3.30 total)	2
Double Tap (twice)	Low Ready	1.35 seconds (2.70 total)	4
Rhythm; fire 6 rounds at one target; no more than 0.6 second between each shot.	Low Ready	3.00 seconds	6
One Shot, speed reload, one shot (twice).	Low Ready	3.25 seconds (6.50 total)	4
One Round each at two targets three yards apart (twice)	Low Ready	1.65 seconds (3.30 total)	4
180° pivot. One round each at three targets (twice). Turn left, then right.	Concealed from Holster	3.50 seconds (7.00 total)	6
One Round, slide locks back; drop to one knee; reload; fire one round. (twice)	Low Ready	4.00 seconds (8.00 total)	4

Qualification:

1. Time: Cannot exceed total time for each drill. Example: Drill #1 - 1st time 1.70 seconds, 2nd time 1.55 seconds; Total = 3.25 seconds = Go. Must achieve a "GO" on each drill.
2. Accuracy: Target is FBI "QIT" (bottle). Total rounds fired is 30. Point value inside bottle = 5. Point value touching line or outside bottle = 2. Maximum possible score = 150. Minimum qualifying score = 135.

Current FAM Qualification Test

Individual Drill	Starting Position	Time Allowed	Total Rounds
1.5 yds 2 rds (3 times)	Concealed from holster	2 seconds	6
3 yards2 rds (3 times)	Concealed from holster for first 2 rds then pointed in for remaining 4 rds	2 seconds	6
7 yards – 1 rd (5 times)	Concealed from holster	3 seconds	5
7 yards 1 round - Emergency reload - 1 round - 15 Seconds	Concealed from holster	15 seconds	2
7 yards 1 rd weak hand	Pointed in	3 seconds	5
7 yards 2 rounds COM & 1 round head (3 times)	Concealed from holster	3 seconds	9
7 yards 3 rds	Pointed in	5 seconds	3
15 yards 3 rounds - Standing - strong side barricade	Concealed from holster	7 seconds	3
15 yards 3 rounds - kneeling – weak side barricade	Pointed in	7 seconds	3
15 yards 3 rounds - Standing - weak side barricade	Concealed from holster	7	3
15 yards 3 rounds - Standing - weak side barricade	Pointed in	7	3
25 yards 3 rounds - Standing - strong side barricade	Concealed from holster	10	3
25 yards 2 rounds - Standing - strong side barricade	Pointed in	5	2
25 yards 1 rounds - Standing - strong side barricade	Pointed in	3	1
25 yards 3 rounds - Standing - weak side barricade	Concealed from holster	10	3
25 yards 2 rounds - Standing - weak side barricade	Pointed in	5	2
25 yards 1 rounds - Standing - weak side barricade	Pointed in	1	1

Qualification:

1. Time: Cannot exceed time for each drill.

2. Accuracy: Target is FBI "QIT" (bottle). Total rounds fired is 60. Point value inside bottle = 5. Point value touching line or outside bottle = 2. Maximum possible score = 300. Minimum qualifying score = 255.

Q. What is "subdued" or "dim" tracer ammunition?

A. Subdued tracer ammunition gives a lower level of visible trace for the first 75 to 100 yards of flight to avoid giving away the shooter's position. "Dim" tracers, give a very low level of trace for the entire flight and are almost invisible unless viewed through night vision equipment. Standard tracers are identified by a red tip, subdued tracers by an orange tip, and dim by a violet tip.

Q. Is the "super hot" 9 mm submachine gun ammunition dangerous to use in pistols?

A. The myth of the super hot 9 x 19 mm submachine gun ammunition seems to resurrect itself every couple of years. The NRA did some testing and found several things. First, the higher than normal velocity specification were based on lighter than normal bullets--typically 100 grs and less, and the velocity specs were derived from longer test barrels (nominally 8" - 12") that typified SMGs. Second, the usually very loud muzzle blast that occurred when fired in pistols was due to the use of slower powders optimized for long SMG barrels. Velocity and pressure testing gave pressures within what we call "standard" to +P ammunition and lower than expected velocities from a pistol barrel. One reason for the "SMG Only" warnings on some ammunition is that it is either steel cased rather than brass cased (like some WWII German ammunition which could give extraction problems in many pistols, or that it is loaded with extremely hard primers. While "SMG Only" ammunition may be unpleasant to shoot in pistols because of its muzzle blast it is safe to use in any modern pistol chambered for the 9 x 19 mm.

	Standard Loading or SAAMI spec Max Avg - PSI	+P Loading SAAMI Max Avg - PSI	+P+ Loading Non-SAAMI Max Avg - PSI	Proof (SAAMI) Min /Max
9 mm Commercial	35,000	38,500	42,000	52,000 / 55,000
9 mm US M882 124 gr	36,260 (Max) 32,200 (avg)	-	-	-
9 mm NATO 124 gr	37,000	-	-	-
Win 9 mm SMG 115 gr	35,400 (avg)	-	-	-
WW II 100 gr Gerrman m.E SMG	35,138 (avg)	-	-	-
TZ78 Israeli "SMG Only" 115 gr	37,200 (avg)	-	-	-

The international CIP specification for 9 x 19 mm ammunition is 34,083 psi with proof at 44,300. No +P specification is indicated

Q. What does leading in pistols or revolvers tell you about your loads?

A. Generally leading that occurs towards the muzzle end of the barrel indicates too high a velocity for the alloy or lack of lube issue. Leading that occurs towards the chamber or cylinder can indicate several things. First, if the bullets are undersized compared to the throat diameter of the cylinder, they may be entering the barrel slightly off center which can cause leading. Second, if the alloy used is too hard to obdurate (or upset the bullet base) gas can leak past the bullet base and cause leading. Third, too light a load can also create this same situation because it does not produce enough pressure to upset the base of the bullet. It is commonly believed that a harder alloy is the answer to stopping leading, but at times a softer alloy can actually help.

Q. How effective was the ancient sling compared to a firearm?

A. Some literature suggests that the sling was capable of accurate use to several hundred yards by an expert slinger but there doesn't seem to be any information to confirm this. There are several historical drawings showing slings being used to take birds in flight. Typical projectiles range from an almond shaped "sling shot," to cast round lead balls, and simple stones. There were also long dart-like projectiles used but I have no further information on them. Slings ranged in length from about 4 to 5 feet in length on the average.

1.4 oz slingshot
(1.5" x .8" x .6")

Several years ago some different types of projectiles were tested for distance by an admittedly "non-expert" and the results are given below. For the typical loop sling used the table below shows the ranges obtained with different weight projectiles in this test. Interestingly, velocity in all cases was between 100 and 125 f/s. At those velocities the 1.4 oz (612 gr) .75 caliber lead ball would have about 14 ft/lbs of kinetic energy, the 3.5 oz (1530 gr) 1" caliber lead ball would have about 35 ft/lb of kinetic energy, and the 5.6 oz (6560 gr) stone (probably about 2") would have about 146 ft/lb of kinetic energy.

Projectile	Approximate diameter (in)	Maximum Range (yd)
1.4 oz lead slingshot	.75	164
3 oz lead slingshot	1"	142
1.3 oz lead ball	.72"	125
3.5 oz lead ball	1"	131
1.6 - 2.6 oz stones	n/a	115
2.8 - 3 oz stones	n/a	115
3 - 5.6 oz stones	n/a	126

While not very impressive by shooting standards, a hit to an unprotected body part, especially the head or upper torso, could be quite damaging if not fatal. A rain of shot from massed slingers (who could each launch 4 to 6 balls a minute) would not be something to take lightly even at some distance. The modern world distance (not accuracy) record by a modern expert slinger is1450 feet for a oval projectile and 1550 feet for a dart shaped projectile so it is possible that trained slingers of old could be a serious concern at 300 to 500 yards. Interestingly, slings have been used in modern combat to throw grenades although I'm not sure I'd want to be whirling a grenade about with the pin pulled and the fuse burning.

Q. How do the various .38 cal/9 mm duty rounds compare to each other?

A. The table below summarizes the performance of the 9 x 19 mm (9 mm Luger), .38 Spl +P, .38 Super ACP, 9 x 23 mm, .357 Magnum, and .357 SIG, with two commonly used bullet weights. Data is the advertised ballistics from various factory tables. There is some discrepancy between manufacturers as to the velocities obtainable with +P and +P+ loads but this table gives a fairly accurate portrayal of the differences.

	Nominal Bullet Diameter (in)	Muzzle Velocity (4" bbl)	
		124/125 gr	145/147 gr
.38 Spl	.357	900	850*
.38 Spl +P	.357	945	900
.38 Spl +P+	.357	990	n/a
9 x 19 mm	.355	1120	975
9 x 19 mm +P	.355	1190	1000
9 x 19 mm +P+	.355	1290	1175
.38 Super (sometimes called a +P but it's not)	.355	1300	1200*
.357 SIG	.357	1350	1225
9 x 23 Win	.355	1420	n/a
.357 Magnum	.357	1450	1290
* Handload. Not commercially offered			

And while we're on the subject, you can see from the above table, that despite all the hype in the media the 9 mm Parabellum is not some kind of a magical super deadly round.

Q. Why are some cartridges loading to a lower pressure than others when the same gun is chambered for both high and low pressure rounds?

A. Several reasons for this. First, way back when, steel and powders weren't what they are today so they set max avg pressures to what were believed to be safe levels, and the standards just stuck. As an extreme example take the .30-40 Krag which is limited to about 40 k cup. In the guns of the day, including the Krag, going to 42 k cup started cracking locking lugs. Same thing with the .45-70 which was limited to 28 k cup. Both of these rounds can be loaded way up in modern rifles--the .45-70 is routinely loaded to over 35 k for use in modern lever guns. In a modern action with new brass I've seen the .30-40 loaded to about 55 k psi which would pretty much take a Krag apart. (But then, since one can easily take anything that walks in North America with the standard Krag load, why bother.)

Second, there are a lot of older firearms around that won't stand much above the original lower pressure loadings and the ammo companies run in fear of a lawsuit should someone stick a hot load in an old firearm. This is the reason that the .357 and .44 mag have cases longer than their parent cases to prevent chambering in a firearm not rated for their pressures as you can run a .38 or 44 Spl case at mag levels easily, and that's why lots of older rounds that could safely be run hotter, are not. Modern cartridges that were never chambered in "old" guns are produced with higher pressures.

Third, the cartridge case also plays a big part in the pressure limits. Some designs are not very thick in the base and head area. The generally accepted pressure limit for brass cartridge cases is about 70 K, assuming good tight headspacing and chamber dimensions. Using specially designed steel cases in a .30-06, apparently safe operations have been done at 80 k+ pressure levels--but velocities only went up about 300 f/s and muzzle blast and barrel wear were drastically increased.

As an interesting aside. SAAMI is pretty much a paper organization of good ol boys. Cartridge designers tell SAAMI what the specs will be and SAAMI's test procedures are archaic to say the least. The rest of the world follows CIP standards which are much more detailed and meaningful. Due to their different measuring protocols pressures are slightly different than SAAMI. As an example for the .308 Win SAAMI max avg is 62 k psi (piezo), 52 k cup (copper crusher) and CIP's standard is 60,190 k psi (piezo). Currently the highest official operating pressure in a commercial cartridge as listed by CIP as 68,200 k psi (.338 Lapua, and a couple of other esoteric rounds) which is just about at the brass limit.

Q. Why are there so many different cartridges with effectively the same performance?

A. Ah! The plethora of similar cartridges. As a friend says, "What are they for? Why to SELL, you silly goose!" Ballisticly it takes about a 200 f/s change in velocity to make a truly noticeable effect on performance. Of course nobody cares about that fact since most folk forget that marksmanship and not gadgets or trick ammo is what counts. They think that a new trick cartridge will automatically make them a better shooter. Besides, if you don't use the latest razzle-dazzle .337 Super Slam Bam cartridge you just aren't "in."

Sometimes new cartridges come about in an effort to get big cartridge performance from a smaller case. The Winchester short, and super short magnums are a good examples. However, such things come with a price. The WSM and WSSM run at quite high pressures and have very short necks. They are VERY hard on barrel throats--the .300 WSM has been reported to burn out throats in as little as 500 rds.

Q. How effective is the P90 "submachinegun" used on Stargate?

A. Despite all the manufacturer's hype and Hollywood glitz The P90 "Personal Defense Weapon" not as effective as they want you to believe. Weighing about 6.5 pounds with a loaded 50 rd magazine, it was originally designed as a "personal defense weapon" for rear echelon troops and vehicle crew members that would be easier to to shoot effectively than a handgun and that would penetrate most infantry body armor.

The SS190 ball penetrates between 11 and 13.5 inches of gelatin, but the wound resulting from this projectile is a relatively small. **The permanent cavity at its largest is either a .22 cal hole or simply a . 22 caliber flat slit the length of the projectile (2.1 cm) caused by the projectile tumbling.**

Although the 5.7 x 28 mm SS190 round penetrates soft body armor, its wound trauma incapacitation potential is at best like a .17 HMR or .22 Magnum. Even 9mm NATO FMJ makes a larger wound--and I'm sure you know of the awe inspiring incapacitation potential of M882 FMJ 9 mm ball from the M9. While it's stated "effective" range is listed as 200 meters this is pushing things a bit. While it can deliver a severe wound at that range, even up close it lacks the "stopping" ability of most regular pistol rounds and that is what you want when you shoot someone. There are some special purpose "Secret Service only" AP loads that will defeat level IIIA body armor with ease but their solid projectiles do no not make a very large permanent cavity.

The "civilian" 40 gr softpoint 5.7 mm rounds may be a bit more effective in creating a permanent cavity but penetration would be reduced. I haven't seen any tests of this round, but they too will reportedly penetrate some body armor.

The P90 is also available in a semiautomatic civilian version with a 16" barrel as opposed to the 10" military version. The 16" barrel gives about 140 f/s greater velocity with the SS197 ammunition. Below is a table of known ammunition variants. Only the now discontinued SS196 and the SS197 variants are available on the civilian market.

	SS190	L191	SS192*	SS193 Subsonic	SS195LF	SS196SR	SS197SR	SS198LF	10700004 Balnk	10700005 Dummy
Bullet weight	32 gr (*2.1 g*)	32 gr (*2.1 g*)	28 gr (1.8 g)	55 gr (*3.6 g*)	28 gr (*1.8 g*)	40 gr (*2.6 g*)	40 gr (*2.6 g*)		n/a	n/a
P90 MV (10")	2350 f/s (*716 m/s*)	2350 f/s (*716 m/s*)	2034 f/s (620 m/s)	1000 f/s (*305 m/s*)	2300 f/s (*701 m/s*)*	1800 f/s (*549 m/s*)	1950 f/s (*594 m/s*)**		n/a	n/a
P90 ME (10")	390 ft·lb (*529 J*)	390 ft·lb (*529 J*)	257 ft/lb (348J)	120 ft·lbf (*163 J*)	330 ft·lbf (*447 J*)	290 ft·lbf (*393 J*)	340 ft·lb (*461 J*)		n/a	n/a
Bullet type	FMJ aluminum core/steel tip	Tracer FMJ	JHP	FMJBT	JHP Lead Free	Hornady V-Max	Hornady V-Max	FMJ Lead Free	n/a	n/a
Effective range	200 m	200 m	100 m	100 m	200 m	200 m	200 m	200 m	n/a	n/a
Marking	Plain or black over white	Red or black over red	Plain JHP	White/grey tip	Plain JHP w/ silver primer	Red tip V-Max plastic tip	Blue tip V-Max plastic tip	Green tip	Red synthetic bullet with cone shaped nose	No primer and drilled case

*SS192 is restricted ammo for the FiveseveN pistol and velocity/energy figures given are from the pistol

* From the PS90 16" carbine this round gives 2415 f/s

** From the PS90 16" carbine this round gives 2090 f/s

There are also a frangible round and a training round (with a blue plastic bullet) available but I have no data on them.

Comparative Ballistics

.17 HMR 20 gr HTP - 2375 f/s
.22 WMR 30 gr - 2200 f/s
.22 WMR 40 gr - 1875 f/s

.22LR, 5.7 x 28 mm, and 5.56 x 45 mm. Not very impressive, eh?

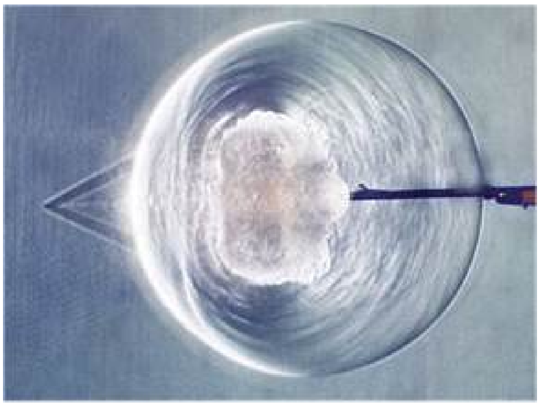
(I always wondered why FN had to "invent" that round. The .221 Rem Fireball is a known thing and easily gives a 40 gr bullet 2700 f/s from a 10" barrel. With a steel core 40 gr bullet it would defeat most soft armor easily and magazine capacity would only be reduced to 35 or so rounds. In a 10" Contender barrel you can get slightly over 2800 f/s. The 7.62 x 25 necked down would have worked too. Even in it's conventional form some loads reach close to 1900 in short barrels.

Now if they'd just chamber the P90 for the 10 mm ACP cartridge....and its little known of "penetrator" round.

Q. At what point is the bullet traveling the fastest?

A. One would assume that the bullet is traveling it's fastest at the moment it exits the muzzle and begins to shed velocity immediately, and for all *practical* purposes this is true. But for nit-pickers there is more of a story.

As the bullet exits the muzzle the expanding powder gases continue to exert some force on the base of the bullet until the gas has dispersed enough so that the force on the bullet's base dissipates. This occurs, according to researchers at Aberdeen Proving Ground, at a distance of between 6 inches and 1 foot from the muzzle of a rifle. The velocity increase is very small--being only a couple of f/s. However, there is also another effect. Powder gases have a velocity of between 3,000 and 5,000 f/s on their own and the gas cloud actually passes the bullet and creates a cavitation effect which lowers the drag of the bullet while the bullet is in the gas cloud. (Similar to the ultra high speed torpedoes that envelop themselves is a cloud of bubles.) Past the 1 foot max velocity distance from the muzzle the bullet actually has very little, if any, drop in velocity out to about 3 - 6 feet or so at the muzzle where the gas cloud has dissipated and thinned sufficiently that air drag can have an effect on the bullet.



Many shooters create an interesting fallacy whereby they attempt to "correct" the velocity readings from a chronograph (usually done at 10 feet) back to "muzzle velocity" simply by means of using the velocity loss computed from the bullet's BC. While this has little, if any effect on ballistics calculations, the premise is wrong.

Does all this really matter down range? Nope! Do your nits a favor and instead of picking them let them sleep, while you practice your marksmanship.

A sleeping "nit." 

Q. What were the ballistics of the pistol cartridges commonly used in the "wild west?"

A. The table below lists the characteristics of some of the more common pistol cartridges of that era. Note that published data on the early versions of these cartridges varies greatly. If you can supply any updated data for these or any other common cartridges of the era please let me know by clicking here. With the exceptions of the light .36 cap& ball, .32-20 and .38 Colt all were serious fight stoppers.

Cartridge	Bullet Type	Bullet Weight	Black Powder Charge	Velocity
.32-20	RNFP	115*	20	860
.36 Cap & Ball (1851 Navy)	.375 round ball	79	20	830
.36 Cap & Ball (1851 Navy)	.375 round ball	79	25	912
.38 Colt	RN	148	15.5	770
.38-40	RNFP	180	40	970
.41 Colt	RN	200	unk	730
.44-40	RNFP	200	40	850
.44 Colt	RN	225	23	640
.44 Cap & Ball (1860 Army)	.451 round ball	138	25	765
.44 Cap & Ball (1860 Army)	.451 round ball	138	35	965
.44 Cap & Ball (Walker)	.451 round ball	138	60	1300
.44 Merwin & HUbert	RN	220	30	800
.44 S&W	Conical FP	218	25	700
.45 Colt	RNFP	255	40**	850
.45 Schofield	RNFP	230	28	770

* Also listed with a 100 gr bullet

** Also known to have been loaded with 45 g for about 950 f/s

Please email comments to Fr. Frog by clicking here.

Disclaimer

As far as I know all the information presented above is correct and I have attempted to ensure that it is. However, I am not responsible for any errors, omissions, or damages resulting from the use or misuse of this information, nor for you doing something stupid with it. (Don't you hate these disclaimers? So do I, but there are people out there who refuse to be responsible for their own actions and who will sue anybody to make a buck.)

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