

Assessment of AR10 and AR15 Long Range Performance for Different Modern Cartridge Chamberings and Barrel Lengths

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Assumptions For Velocity Changes With Each 1" Change In Barrel Length

7mm PRC	30 fps
6.5mm CM	25 fps
6mm CM	25 fps
6mm GT	25 fps
6mm ARC	25 fps
223/5.56	25 fps

NOTES:

- * The goal is to provide a guide for AR fire arm configuration selection based on a general assessment of long range performance for various choices one might consider for AR platform, cartridge and barrel length. The chart and observations are intended to show general trends, not accurate specifics for any given rifle.
- * Values used for velocity change due to barrel length change are rough approximations. Actual velocity change will vary based on specific load, barrel configuration and bullet.
- * The 4DOF program was used for all cartridges because it provides some of the most accurate ballistic predictions available for factory ammo. The factory cartridges chosen are readily available Hornady ammo listed in the 4DOF library, with ballistic performance at or near the top of what's available in factory ammo.
- * All of the cartridges selected are good, but premium handloaded factory ammo can produce better accuracy. This is a ballistics analysis not an accuracy analysis. There are other factory cartridges, and handload recipes, that will have very similar ballistics performance and even better accuracy.
- * All mils are rounded to nearest 0.1 mil. The 7mm PRC bolt rifle chart values are provided as a reference example of an extended long range platform for comparison purposes. Energy estimated with Hornady "Standard" ballistics mode using G7 values. Cannot find G1 for GAP Hornady 109 ELDMS.
- * The supersonic range values are rounded down to the nearest yardage output in the 4DOF range steps where the bullet is still supersonic. The listed supersonic range data is intended as a general guideline, not exact subsonic range measurements.
- * No special care was taken to ensure that all the 4DOF ballistic parameters were optimized for each cartridge, for example optimum twist rate. The purpose is to show general relative performance, not to provide data a shooter would use in the field or at the range.

200 yd zero, 1.5" scope heigh, 10 mph 3-O'clock Wind																																							
	Platform	Cartridge	Bullet	Cartridge	Barrel Length in	Muzzle Velocity fps	BC1/BC7	Bullet Weight gr	500 yd Drop mils	500 yd 10 mph Wind mils	800 yd Drop mils	800 yd 10 mph Wind mils	800 yd Drop % Change Vs 24" Barrel	800 yd 10 mph Wind % Change Vs 24" Barrel	1,000 yd Drop mils	1,000 yd 10 mph Wind mils	1,000 yd Drop % Change Vs 24" Barrel	1,000 yd 10 mph Wind % Change Vs 24" Barrel	1,200 yd Drop mils	1,200 yd 10 mph Wind mils	1,500 yd Drop mils	1,500 yd 10 mph Wind mils	2,000 yd Drop mils	2,000 yd 10 mph Wind mils	Supersonic Range yds	Energy @ 300 yds	300 yd Energy % Change Vs 24" Barrel	Energy @ 500 yds	500 yd Energy % Change Vs 24" Barrel	Energy @ 800 yds	800 yd Energy % Change Vs 24" Barrel	Energy @ 1,000 yds	1,000 yd Energy % Change Vs 24" Barrel	Distance Where 10 yd Ranging Error = 5" Drop Error					
	Bolt (Reference)	7mm PRC	180gr ELD	7mm PRC	26	3,035	.796/401	180	1.7	0.5	4.0	0.8	-2%	-11%	5.8	1.1	-3%	0%	7.8	1.4	11.6	1.9	20.6	3.1	2,000	2,887	4%	2,436	4%	1,863	5%	1,542	5%	950					
	Bolt (Reference)	7mm PRC	180gr ELD	7mm PRC	24	2,975	.796/401	180	1.8	0.5	4.1	0.9	0%	0%	6.0	1.1	0%	0%	8.2	1.4	12.1	1.9	21.7	3.1	1,900	2,768	0%	2,332	0%	1,778	0%	1,469	0%	920					
	Bolt (Reference)	7mm PRC	180gr ELD	7mm PRC	22	2,915	.796/401	180	1.9	0.5	4.3	0.9	5%	0%	6.3	1.2	5%	9%	8.6	1.5	12.7	2.0	23.0	3.2	1,900	2,651	-4%	2,229	-4%	1,694	-5%	1,397	-5%	900					
	Bolt (Reference)	7mm PRC	180gr ELD	7mm PRC	20	2,855	.796/401	180	2.0	0.5	4.5	0.9	10%	0%	6.6	1.2	10%	9%	9.0	1.5	13.4	2.1	24.3	3.4	1,800	2,537	-8%	2,129	-9%	1,613	-9%	1,327	-10%	870					
	Bolt (Reference)	7mm PRC	180gr ELD	7mm PRC	18	2,795	.796/401	180	2.1	0.6	4.8	1.0	17%	11%	7.0	1.3	17%	18%	9.5	1.6	14.2	2.2	25.7	3.5	1,800	2,425	-12%	2,031	-13%	1,534	-14%	1,259	-14%	850					
	Bolt (Reference)	7mm PRC	180gr ELD	7mm PRC	16	2,735	.796/401	180	2.2	0.6	5.0	1.0	22%	11%	7.3	1.3	22%	18%	10.0	1.7	15.0	2.4	27.3	3.6	1,700	2,316	-16%	1,936	-17%	1,457	-18%	1,193	-19%	820					
AR10	6.5mm CM	140gr ELD	6.5mm CM	26	2,760	.646/326	140	2.2	0.7	5.4	1.3	-4%	0%	8.0	1.7	-5%	-6%	11.3	2.3	18.0	3.3	35.0	4.8	1,400	1,728	4%	1,382	4%	964	5%	745	5%	780						
AR10	6.5mm CM	140gr ELD	6.5mm CM	24	2,710	.646/326	140	2.3	0.7	5.6	1.3	0%	0%	8.4	1.8	0%	0%	11.8	2.4	19.0	3.5	36.5	4.9	1,400	1,661	0%	1,325	0%	922	0%	710	0%	760						
AR10	6.5mm CM	140gr ELD	6.5mm CM	22	2,660	.646/326	140	2.4	0.8	5.8	1.4	4%	8%	8.7	1.9	4%	6%	12.4	2.5	20.0	3.6	38.2	5.0	1,300	1,596	-4%	1,270	-4%	880	-5%	676	-5%	740						
AR10	6.5mm CM	140gr ELD	6.5mm CM	20	2,610	.646/326	140	2.6	0.8	6.1	1.4	9%	8%	9.2	2.0	10%	11%	13.0	2.3	21.0	3.7	39.9	5.1	1,300	1,532	-8%	1,217	-8%	840	-9%	643	-9%	720						
AR10	6.5mm CM	140gr ELD	6.5mm CM	18	2,560	.646/326	140	2.7	0.8	6.4	1.5	14%	15%	9.6	2.0	14%	11%	13.7	2.7	22.1	3.8	41.7	5.2	1,250	1,469	-12%	1,164	-12%	800	-13%	610	-14%	700						
AR10	6.5mm CM	140gr ELD	6.5mm CM	16	2,510	.646/326	140	2.8	0.8	6.7	1.5	20%	15%	10.1	2.1	20%	17%	14.5	2.9	23.3	3.9	43.6	5.3	1,250	1,408	-15%	1,113	-16%	762	-17%	579	-18%	680						
Platform	Cartridge	Bullet	Cartridge	Length	Velocity	BC1/BC7	Weight	Drop	Wind	800 D	800 W	800 D %	800 W %	1000 D	1000 W	1000 D %	1000 W %	1200 D	1200 W	1500 D	1500 W	2000 D	2000 W	Supersonic	300 E	300 E %	500 E	500 E %	800 E	800 E %	1000 E	1000 E %	5" D Error						
AR10	6mm CM	108gr ELD	6mm CM	26	3,010	.536/270	108	1.9	0.8	4.8	1.4	-4%	-7%	7.2	1.9	-4%	-5%	10.4	2.5	16.9	3.9	33.2	5.0	1,300	1,505	4%	1,156	4%	752	4%	551	5%	820						
AR10	6mm CM	108gr ELD	6mm CM	24	2,960	.536/270	108	2.0	0.8	5.0	1.5	0%	0%	7.5	2.0	0%	0%	10.8	2.6	17.7	3.6	34.5	5.0	1,300	1,451	0%	1,112	0%	721	0%	526	0%	800						
AR10	6mm CM	108gr ELD	6mm CM	22	2,910	.536/270	108	2.1	0.8	5.2	1.5	4%	0%	7.9	2.0	5%	0%	11.3	2.7	18.5	3.7	35.9	5.1	1,250	1,398	-4%	1,068	-4%	690	-4%	501	-5%	780						
AR10	6mm CM	108gr ELD	6mm CM	20	2,860	.536/270	108	2.2	0.9	5.4	1.5	8%	0%	8.2	2.1	9%	5%	11.8	2.8	19.3	3.8	37.3	5.2	1,250	1,346	-7%	1,026	-8%	660	-8%	477	-9%	760						
AR10	6mm CM	108gr ELD	6mm CM	18	2,810	.536/270	108	2.3	0.9	5.6	1.6	12%	7%	8.6	2.2	15%	10%	12.4	2.9	20.2	3.9	38.7	5.3	1,200	1,295	-11%	985	-11%	630	-13%	454	-14%	740						
AR10	6mm CM	108gr ELD	6mm CM	16	2,760	.536/270	108	2.4	0.9	5.9	1.6	18%	7%	9.0	2.2	20%	10%	13.0	3.0	21.1	4.0	40.2	5.3	1,150	1,245	-14%	944	-15%	601	-17%	431	-18%	720						
AR10	6mm GT	109gr ELD	6mm GT	26	2,950	.7/295	109	2.0	0.8	4.9	1.4	-4%	0%	7.4	1.9	-4%	0%	10.6	2.5	17.0	3.5	33.1	4.9	1,400	1,502	4%	1,180	4%	799	4%	603	5%	810						
AR10	6mm GT	109gr ELD	6mm GT	24	2,900	.7/295	109	2.1	0.8	5.1	1.4	0%	0%	7.7	1.9	0%	0%	11.0	2.5	17.8	3.6	34.4	5.0	1,400	1,447	0%	1,134	0%	765	0%	576	0%	790						
AR10	6mm GT	109gr ELD	6mm GT	22	2,850	.7/295	109	2.2	0.8	5.3	1.5	4%	7%	8.1	2.0	5%	5%	11.5	2.6	18.6	3.6	35.7	5.0	1,300	1,393	-4%	1,090	-4%	732	-4%	549	-5%	770						
AR10	6mm GT	109gr ELD	6mm GT	20	2,800	.7/295	109	2.3	0.9	5.6	1.5	10%	7%	8.4	2.1	9%	11%	12.1	2.7	19.5	3.7	37.1	5.1	1,300	1,341	-7%	1,046	-8%	700	-8%	524	-9%	750						
AR10	6mm GT	109gr ELD	6mm GT	18	2,750	.7/295	109	2.4	0.9	5.8	1.6	14%	14%	8.8	2.1	14%	11%	12.6	2.8	20.4	3.8	38.5	5.2	1,300	1,289	-11%	1,004	-11%	669	-13%	498	-14%	730						
AR10	6mm GT	109gr ELD	6mm GT	16	2,700	.7/295	109	2.5	0.9	6.1	1.6	20%	14%	9.2	2.2	19%	16%	13.2	2.9	21.3	3.9	40.0	5.3	1,200	1,239	-14%	962	-15%	638	-17%	473	-18%	720						
Platform	Cartridge	Bullet	Cartridge	Length	Velocity	BC1/BC7	Weight	Drop	Wind	800 D	800 W	800 D %	800 W %	1000 D	1000 W	1000 D %	1000 W %	1200 D	1200 W	1500 D	1500 W	2000 D	2000 W	Supersonic	300 E	300 E %	500 E	500 E %	800 E	800 E %	1000 E	1000 E %	5" D Error						
AR15	6mm ARC	108gr ELD	6mm ARC	26	2,800	.536/270	108	2.3	0.9	5.7	1.6	-3%	-6%	8.7	2.2	-4%	-4%	12.5	2.9	20.4	3.9	39.0	5.3	1,200	1,285	4%	977	4%	624	5%	449	5%	740						
AR15	6mm ARC	108gr ELD	6mm ARC	24	2,750	.536/270	108	2.4	0.9	5.9	1.7	0%	0%	9.1	2.3	0%	0%	13.1	3.0	21.4	4.0	40.5	5.4	1,150	1,235	0%	936	0%	596	0%	427	0%	720						
AR15	6mm ARC	108gr ELD	6mm ARC	22	2,700	.536/270	108	2.5	1.0	6.2	1.7	5%	0%	9.5	2.3	4%	0%	13.8	3.1	22.3	4.1	42.1	5.4	1,100	1,186	-4%	897	-4%	568	-5%	405	-5%	710						
AR15	6mm ARC	108gr ELD	6mm ARC	20	2,650	.536/270	108	2.6	1.0	6.5	1.8	10%	6%	10.0	2.4	10%	4%	14.4	3.2	23.4	4.2	43.7	5.5	1,100	1,139	-8%	859	-8%	541	-9%	384	-10%	690						
AR15	6mm ARC	108gr ELD	6mm ARC	18	2,600	.536/270	108	2.7	1.0	6.8	1.8	15%	6%	10.4	2.5	14%	9%	15.1	3.3	24.5	4.3	45.3	5.6	1,050	1,092	-12%	821	-12%	514	-14%	363	-15%	670						
AR15	6mm ARC	108gr ELD	6mm ARC	16	2,550	.536/270	108	2.9	1.1	7.1	1.9	20%	12%	11.0	2.6	21%	13%	15.9	3.4	25.6	4.3	47.0	5.6	1,050	1,046	-15%	784	-16%	488	-18%	343	-20%	650						
AR15	223	73gr ELD	223	26	2,840	.398/200	73	2.5	1.3	6.8	2.4	-4%	-4%	11.2	3.5	-4%	-3%	17.2	4.4	29.0	5.6	56.9	7.3	900	778	4%	530	5%	275	5%	185	2%	670						
AR15	223	73gr ELD	223	24	2,790	.398/200	73	2.7	1.3	7.1	2.5	0%	0%	11.7	3.6	0%	0%	18.0	4.5	30.2	5.6	58.7	7.4	850	747	0%	507	0%	261	0%	181	0%	650						
AR15	223	73gr ELD	223	22	2,740	.398/200	73	2.8	1.4	7.5	2.6	6%	4%	12.3	3.7	5%	3%	18.8	4.6	31.4	5.7	60.6	7.4	850	717	-4%	485	-4%	247	-5%	177	-2%	630						
AR15	223	73gr ELD	223	20	2,690	.398/200	73	2.9	1.4	7.8	2.7	10%	8%	12.9	3.8	10%	6%	19.7	4.7	32.6	5.8	62.6	7.5	850	688	-8%	463	-9%	234	-10%	173	-4%	620						
AR15	223	73gr ELD	223	18	2,640	.398/200	73	3.0	1.5	8.2	2.8	15%	12%	13.6	3.9	16%	8%	20.6	4.8	33.8	5.9	64.5	7.6	800	659	-12%	442	-13%	222	-15%	170	-6%	610						
AR15	223	73gr ELD	223	16	2,590	.398/200	73	3.2	1.5	8.7	2.9	23%	16%	14.3	4.0	22%	11%	21.5	4.8	35.1	6.0	66.6	7.7	800	631	-16%	421	-17%	211	-19%	166	-8%	590						

Some Observations:

- * The velocities and bullet ballistic coefficients in the chart above are among the best offered in factory ammo for each cartridge as of this date. All of the observations that follow apply only to cartridges with similar velocities and ballistic coefficients as compared to the factory cartridges charted above. There are a vast number of hand load bullets and factory cartridges on the market and many have worse performance compared to those listed above. The observations that follow apply to the cartridges charted above and