1500-1900 ft., depending on size, with larger buckshot such as 00 and 000 going the farthest. Rifled slugs of all gauges have a maximum range of about 2500 ft. at sea level, or a bit less than a half mile. Buckshot and slugs retain enough terminal velocity to be dangerous.

Rifle and pistol bullets have longer maximum ranges. Typical handgun loads can travel 1 to 1½ miles at sea level, .38 Spl. wadcutter 5000 ft., 9 mm Luger 5700 ft., .357 Mag. 7100 ft., and .45 ACP hardball 5100 ft. The mass of typical handgun bullets is great enough to cause potentially dangerous terminal energy.

A .22 Long Rifle bullet has a maximum range of 4870 ft. at sea level and would fall to earth with 5 ft.-lbs. of energy. This approximates the striking force of a single No. 2 shot pellet from a 3" Mag. 12-ga. load at 50 yds. While not necessarily lethal, it could certainly cause serious injury. Heavier rifle bullets launched at higher velocities have greater maximum range. A .223 Rem. 55-gr. boattail bullet has a maximum range of 11,530 ft. and would fall to earth with 17½ ft.-lbs. of energy. A .30-'06 180-gr. flatbase bullet will travel about 10,250 ft. and retain 51 ft.-lbs. at impact. However, when a boattail bullet is substituted at the same velocity and bullet weight, maximum range is over 17,000 ft., and terminal energy over 100 ft.-lbs! At 12,000 ft. elevation, maximum range increases about 38% for most bullets, compared to sea level.

The only safe course is to be sure of your target and your backstop, because even a so-called "spent" bullet is potentially dangerous.—C.E.H.

MAXIMUM RANGE OF BULLETS AND SHOT PELLETS

Cartridge	Bullet Wt. (grs.)	Muzzle Velocity (f.p.s.)	Maximum Range At Sea Level (ft.)
.22 LR hollow-point	36	1280	4520
.22 LR solid point	40	1255	4870
.22 WMRF	40	2000	5400
.223 Rem. boattail SP	55	3240	11600
.243 Win. flatbase	100	2960	12000
.30-30 Win.	170	2200	11000
.30-'06 flatbase	180	2700	12500
.30-'06 boattail	180	2700	17000
.38 Spl. wadcutter	148	770	5000
.38 Spl. +P	158	890	6400
9 mm Luger	123	1120	5700
.357 Mag.	158	1235	7100
.45 ACP	230	855	4400
.44 Mag.	240	1390	7500
No. 9 shot (per pellet)	0.75	1350	670
No. 8 shot	1.06	1350	720
No. 7½ shot	1.25	1350	740
No. 6 shot	1.94	1350	820
No. 5 shot	2.57	1350	870
No. 4 shot	3.22	1350	910
No. 2 shot	4.86	1350	1010
BB shot	8.75	1350	1160
No. 4 buck	20.6	1350	1440
No. 3 buck	23.3	1350	1490
No. 1 buck	40.0	1350	1700
No. 0 buck	48.3	1350	1770
No. 00 buck	53.8	1350	1830
12-ga. slug	437	1560	2450

The above figures are based on nominal velocities of common loads fired at sea level. Shooters must be aware that the maximum range of shot pellets can be affected greatly by a tail wind, a 10 m.p.h. tail wind increasing range by 10–15% and a 20 m.p.h. tail wind by 20–30%. Higher elevations also increase maximum range, which is about 38% greater for most bullets at 12000 ft. than at sea level. For purposes of range planning a 20% safety factor above the maximum range is suggested.

Heavy Bullets In M14/M1A

I have been told not to handload bullets heavier than 180 grs. for 600-yd. target work in my M1A rifle, because this will damage the rifle mechanism. J. B. Roberts' response to a question on slow powders in the M1 rifle in the June, 1983, issue stated the problem was one of higher port pressure, which increases bolt velocity. If this is the case, shouldn't it be possible to load heavier match bullets such as 190-gr. with powders of moderate burning rate, which should give acceptable port pressure for the M14 or M1A? Please comment.

Answer: An important difference exists between the M1 rifle and the M14/M1A rifle in the design of their gas systems. The M1 employs a simple impingement gas system, in which the impulse produced by the initial surge of gas into the system sets in motion the simple piston, and all of the other recoiling parts, while the gas system remains connected to the bore via the gas port throughout the gun cycle. The M14 and M1A, on the other hand, employs a gas cutoff/expansion system, generally called the "White gas system," after Joseph C. White, who patented it in 1933. In this ingenious system, gas is admitted to the gas chamber only during the initial stage of piston movement, whereupon the passage between the bore and gas chamber is closed. The expansion of the gas trapped in the system continues to exert force on the piston until nearly the end of its rearward travel, whereupon the trapped gas is vented to the outside so that the piston can return to its forward position in preparation for firing the next round. One feature of this system is that it is self-regulating, at least in some degree, because higher port pressure tends to effect the gas cutoff sooner, and thereby to limit the amount of gas admitted to the gas chamber.

It would be extremely difficult to predict quantitatively the effect of a change in load on the bolt-recoil velocity of the M14 or M1A. While it is probable that bolt-recoil velocities would be increased somewhat by use of maximum charges of the "slow" powders that are advantageous in loads employing heavy bullets, that could be determined with confidence only by taking a kinematic time-displacement record of the recoiling parts while the gun is cycling. Making such time-displacement records requires sophisticated equipment, and it is expensive.

It has been determined that the bolt-recoil velocities are not excessive if M118 Match ammunition is fired in the M14. It can be predicted with confidence that use of the same types of propellant as used in the M118, in charges developing comparable peak pressures with heavier bullets, would not cause an increase in bolt-recoil velocity. Although the ingenious gas system of the M14 might permit maximum charges of "slower" powders with heavy bullets, that has not yet been proved. The safest course at present, therefore, is to utilize IMR-4895, IMR-4064 or IMR-4320, or spherical-grain powders such as Winchester 748, 760, or Hodgdon B1 C2 in loads for the M14 or M1A.

The velocities obtainable at acceptable peak pressures will unavoidably be lower for heavy bullets than for lighter ones. Since the gyroscopic stability of the bullet is affected by the velocity, and marginal stability does not produce best accuracy in the M14, it is possible that some bullets much heavier than the 173-gr. M118 might be unsuitable for use in M14 or M1A match rifles. Custom barrels having a 10" twist are available for the M1A/M14, and they would probably be more desirable than the standard barrel with its 12" twist if the use of heavy bullets is contemplated. Use of commercial 190-gr. match bullets at reduced velocities may not provide a meaningful reduction in wind deflection, compared to M118 ammunition, as shown in the accompanying table.—W. C. D., Jr.

COMPARISON OF WIND DEFLECTION
7.62 mm M118 Vs. 190-gr.

Range	M118 173-gr. FMJ BT MV = 2550 f.p.s.	Sierra 190-gr. HP BT MV = 2450 f.p.s
600 yds. remaining velocity (f.p.s.)	1566	1532
time of flt. (sec.)	.9025	.9314
wind deflection (ft. per m.p.h.)	.28	.28
800 yds.	1294	1284
	1.3239	1.3595
	.56	.56
1000 yds.	1079	1078
	1.8350	1.8722
	.95	.96

Where Can I Get?

Bronze cleaning brushes for .50 cal. rifles
Bruno Shooters Supplies, 10 Fifth St., Kelayres, Pa. 18231

Rifle bolt jeweling
Lowell Manley Shooting Supplies, 3684 Pine St., Deckerville, Mich. 48427

FN-FAL 7.62 mm Rifle Parts
Pacific Int'l Merchandising Corp., 2215 J St., Sacramento, Calif. 95816

Full-sized drawings with sectional details for making sporter stocks for Mauser Model 1898 and Winchester Model 70 rifles
Jerry A. Fisher, 1244 4th Ave., W., P.O. Box 66, Kalispell, Mont. 59901

Used "small action" BSA Martini rifles, barreled actions and actions
Adams International, P.O. Box 28101, Denver, Colo. 80228

Gunsmith's machine to channel stocks for octagon barrels
Barrel Channeler, 1061 W-400S Kokomo, Ind. 46902

In My Experience

CAUTION: Technical data and information contained herein are intended to provide information based upon the limited experience of individuals under specific conditions and circumstances. They do not detail the comprehensive training, procedures, techniques and safety precautions which are advisable or necessary to properly carry on similar activity. READ THE NOTICE AND DISCLAIMER ON THE CONTENTS PAGE OF THIS MAGAZINE. ALWAYS CONSULT COMPREHENSIVE REFERENCE MANUALS AND BULLETINS TO DETAILS OF PROPER TRAINING REQUIREMENTS, PROCEDURES, TECHNIQUES AND SAFETY PRECAUTIONS BEFORE ATTEMPTING ANY SIMILAR ACTIVITY.

Pistol Shooting Sticks

Editor:

The extended eye-relief pistol scopes have too short an eye relief for me to get into any of the feet-forward or Creedmoor handgun shooting positions and still have enough field left to tell which eye — right or left — of the animal I'm shooting at. In calm wind and relaxed, non-pulsing or hard-breathing two-handed sitting, I can get five-shot groups of 5" at 100 yds., using my knees for arm rests, but under any stress the 4X scope makes this a jiggly uncertain operation at best.

While I have shot good groups in the wind without the scope on my 14" Contender Super .357 Herrett, the whole purpose of the scope of higher power was to enable at least equally accurate shooting in poor light at milling animals where the horns didn't stay put.

I finally proved the solution: shooting sticks, which hearken back to black-powder days. I have found that two 3 ft. x 5/16" maple or birch dowels, crossed and held by a multiply doubled innertube band, lets me shoot those same 5" groups I need for hunting big game. Working the technique out, sitting in snow, hiding behind the parked car to minimize wind and cold, all bundled up in three layers of feathers, isn't the best shooting situation, so when my required groups started to appear, I knew I had what I needed.

I get in my normal two-handed, double knee-rest, non-stick position, feet maybe 6" apart, knees supporting arms in front of elbows. This gives me nearly full field with the eye lens forward of the current T/C rear sight blade. Then the feet of the crossed sticks go outside my feet, and the cross-notch supports the T/C barrel just in front of the forearm. The sticks should be in a plane nearly perpendicular to the properly aimed barrel, so that upon recoil there is no significant tendency for the rather jumpy-feeling activity of the gun to dive down or get cammed up by angled sticks.

I can spread or narrow the interception angle of the sticks and/or raise or lower my knees and thus arms and rear end of the gun by moving the feet a bit forward or backward. Spreading the sticks, of course, lowers the notch. Since the sticks are joined by the heavy rubber band, irregularities of ground or slope to target relative to slope of position can be adjusted easily by moving the sticks one at a time to get a higher or lower crossnotch.

Except for use on moving game, I believe my set of shooting sticks makes the Contender as accurate as a rifle.

Bender Hash, Laramie, Wyo.

Improved AR-15 Sights

Editor:

My shooting partner and I recently began highpower rifle competition with our AR-15s. This allowed us to "get our feet wet" without further investment. We have developed several simple modifications which are inexpensive and do not depart greatly from the rifles' original configuration. With these modifications, the AR-15 would not qualify as a Service Rifle, but it remains usable in the NRA Match Rifle category. The improved sights work very well.

STAGE I — FRONT SIGHT

The issue front sight is too wide for a good six o'clock sight picture and does not have a uniform width top to bottom, which distracts the shooter in his hold. We simply took a standard front sight and turned it down to a more narrow, uniform profile (see Fig. 1). We used a jeweler's lathe, chucking the sight in a collet. Turning the sight with the lathe, we used a handheld file, taking care to keep the file parallel to the axis of the sight. A diameter of 0.090" seemed to work best for us.

STAGE II — REAR SIGHT

With our new front sight in place, it became apparent that the aperture of the rear sight was far too large for an accurate hold. The issue rear sight has an aperture of approximately .086". To correct this, a piece of metal stock was silver-soldered to the rear face of the sight (see Fig. 2). After