How Effective Is Automatic Fire?

Extensive testing at the Army's Aberdeen Proving Ground suggests automatic fire exacts a heavy toll from accuracy.

BY L. F. MOORE

To some, the word "automatic" appears to imply that a weapon not only has a self-loading and firing mechanism, but it also hits the target with no effort on the part of the shooter except pulling the trigger. Automatic military weapons are now common, and some civilians would probably buy one for hunting if it were permitted.

When the first developmental rifles having automatic-fire capability were tested at the Army's Aberdeen Proving Ground, there was considerable interest by visiting personnel in the rifle's automatic-fire feature. I generally asked, "Would you like to shoot it?" The reply was always positive. I was a test director, and I had a group of well-trained technicians. When a shooter without previous experience in automatic fire took his position to fire the new "light rifle" automatically, one of the technicians would step behind him to prevent him from moving to the rear sufficiently to endanger others in the area. Only a few bursts were required to show the individual that the rifle was relatively ineffective when fired full-automatic.

A U.S. Army infantryman is shown during a test of the then-experimental M16 in 1966. The rifle has automatic-fire capability.

Two courses of fire were developed to evaluate the relative effectiveness of rifles using automatic fire. In one part of the first, fired at 25 yds., three highly trained shooters each fired 10 three-round bursts from both the prone and standing positions. The data in **Table 1** show that the first shot in each burst impacted near the aiming point as for semi-automatic fire. This is to be expected, because the shot was fired in the same manner. The second shot in each burst impacted at some distance from the first shot, and these shots formed a group above and to the right of the aiming point for a right-hand shooter. This group was larger than the group of first shots. The third shot in each burst developed a group which was in line with the first and second shot groups, but it was still larger and farther away.

It was observed in preliminary tests that inexperienced shooters and shooters attempting to correct alignment of the rifle during the burst produced no uniform or useful data. Some individuals attempted to apply a force to the rifle at the start of the burst to correct the misalignment caused by rotation of the rifle about the shoulder. The effect was worsened when they applied force to the rifle before the first shot exited the muzzle and, consequently, no effective shots were obtained in that burst. This was demonstrated during the endurance test phase.

The endurance test procedure called for firing 100 rounds semi-automatically and then 100 rounds automatically, with a cooling period between. It was boring to fire rifles without a target, so I suggested that the shooters fire on an "E" (kneeling silhouette) target at a range of 100 yds. The exercise called for firing five 20-round bursts. A number of shooters fired this exercise, and several fired it numerous times. The record number of hits for the 100 rounds fired automatic was four.

Author L. F. Moore test fires experimental 7.62 mm automatic rifle at Aberdeen Proving Ground about 1952. Note cases in mid-air.

The second test of automatic fire accuracy called for firing for a period of one minute from the prone position on the "E" target at a range of 100 yds. The shooter was permitted to fire an unlimited number of rounds. Each shooter fired three exercises with both semi-automatic and automatic fire. Three shooters were also employed in this test phase.

Test results given in **Table 2** and **Table 3** show reasonable consistency, considering the variations in time, rifle, cartridge lot and shooter. They show that a highly skilled shooter firing from the prone position, using semi-automatic fire, can

ABOUT THE AUTHOR

Larry F. Moore is a registered professional engineer with 40 years of experience in weapons systems. A long-time competitive shooter, Moore won the Wimbledon Cup with a .30-'06 Winchester Model 70 in 1963. The views of the author do not purport to reflect the positions of the Department of the Army or the Department of Defense.

obtain 40 hits per minute with the M1, 60 hits per minute with the M14, and 70 hits per minute with the AR15 on the "E" target at a range of 100 yds. Magazine capacity and recoil are major factors in this variation in rate.

When the M14 rifle was fired automatically, the hit rate was reduced 59% from that obtained semi-automatically. In all tests with the 7.62 mm cartridge, the average number of bursts exceeded the number of hits. Were the shooter to fire using the same technique as for semi-automatic fire, he would obtain one hit for each burst (the first shot). However, the shooter sometimes reacted before the first bullet had left the bore. The number of hits obtained when firing the AR15 rifle automatically was 50% less than when firing semi-automatically, although 47% more rounds were fired. The number of hits exceeded the number of bursts, which shows that the recoil is reduced sufficiently from that of the M14 to permit an occasional shot other than the first in the burst to hit the target.

These data show that about 12% of the shots fired automatically (first shots excluded) with the AR15 rifle hit the target. The data obtained in the 25-yd. test showed that the dispersion of individual groups (dispersion of the 10 first shots, dispersion of the 10 second shots, and dispersion of the 10 third shots) and the distance between groups is dependent on the rifle and ammunition characteristics, the physique and technique of the shooter and shooter training. A more highly trained shooter will have smaller dispersion for the first-, second- and third-shot groups, but the groups made by the second and third shots may be farther from the first shot group.

Experience in firing automatic weapons does not result in a significant improvement in effectiveness when firing automatically. Some Aberdeen Proving Ground gunners fired many thousands of rounds from numerous rifles using automatic fire over a period of years, probably more rounds than any professional soldier has fired. Data developed by these individuals are given in the accompanying tables.

Some notable individuals have observed the relative inefficiency of automatic fire. Gen. Merritt A. Edson's editorial in the February 1952 *American Rifleman*, "Quantity or Quality?" covered that subject well. Acknowledging that "firepower is an essential element of success in battle," Gen. Edson warned that ". . . the element of accuracy is forgotten or neglected . . ." by those who wrongly construe "firepower" to be synonymous with "volume of fire." Putting that message more bluntly, Gen. Edson stated: "A fully automatic rifle fired from the shoulder is inherently inaccurate. Only the first shot can be an aimed shot."

Considerable effort and taxpayers' dollars have been expended in an attempt to improve the accuracy of automatic fire by developing special firing techniques, muzzle devices, rate reducers, burst control devices, special stock configurations, low mass projectiles, and so forth. From an engineering point of view, the use of automatic fire to obtain a hit on a particular target is a difficult way to accomplish a simple job. The path of a bullet fired singly from a rifle accurately aligned with a target can be estimated with a high degree of precision, but that for shots fired automatically cannot.

The reasons why automatic fire in

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TABLE 1

Burst Number	Distance from Target Center to First Shot		Distance from Target Center to Second Shot		Distance from Target Center to Third Shot	
	Vert.	Hor.	Vert.	Hor.	Vert.	Hor.
1	+0.2	-0.1	+53.9	-13.3	+124.8	-45.4
2	+0.2	-0.1	+54.4	- 9.8	+117.3	-36.4
3	-0.3	-0.1	+50.7	-11.0	+122.5	-42.9
4	-0.3	+0.9	+55.4	- 9.3	+121.5	-44.9
5	-0.2	+0.7	+56.4	-17.0	+118.6	-45.8
6	-0.3	+0.3	+58.1	-10.3	+130.1	-38.4
7	-1.2	+1.1	+51.5	-11.1	+116.4	-40.5
8	-0.5	+0.7	+54.0	-13.0	+122.2	-44.4
9	+0.1	+0.5	+47.8	- 9.9	+111.0	-45.7
10	+0.4	+0.4	+48.6	- 7.4	+108.0	-35.8
Average	-0.2	+0.4	+53.1	-11.2	+119.2	-42.0

TABLE 2

Rifle	Date	Semi-automatic Fire		Automatic Fire		
		Shots Fired	Hits Obtained	Shots Fired	Bursts	Hits Obtained
M1	July 1952	39.9	38.2	—	—	—
"	July 1954	41.3	36.2	—	—	—
"	Jan. 1959	40.6	40.0	—	—	—
T44	July 1952	58.5	52.7	94.3	19.1	17.2
(1)	July 1954	27.1	26.2	—	—	—
(2)	July 1954	60.1	59.2	93.8	20.1	42.8
M14	Dec. 1962	66	58	97	25	24
AR15	Jan. 1959	59.6	56.6	81.7	16.4	25.0
"	Nov. 1960	84.2	77.8	128.7	26	41.3
"	Dec. 1962	73	69	109	29	35
M1918A2 (3)	Oct. 1955	—	—	107.0	—	80.3
(4)	" "	—	—	126.3	—	88.2

(1) Lightweight (2) Heavy barrel later designated M15 (3) Slow rate (4) Fast rate

TABLE 3

Rifle	Date	Firing Position	Mean in inches for shots fired automatically*
AR 15	Jan. 1959	Prone	28.2
"	" "	Standing	76.2
"	Nov. 1960	Prone	34.2
"	" "	Standing	68.9
"	Dec. 1962	Prone	32.6
"	" "	Standing	56.7
M14	Dec. 1962	Prone	65.9
"	" "	Standing	109.4

*First shot in each burst is considered a semi-automatically fired shot.

Table 1 shows three-shot spread in automatic-fire test with experimental AR15 in 1958. Measurements are in inches. Tables 1 and 2 show the average number of hits achieved with both semi- and full-automatic fire. The T44 became the M14, while the M1918A2 is the BAR.

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shoulder weapons is relatively ineffective are well known. When fired automatically, the rifle rotates around the shoulder because of misalignment of the bore (line of recoil force) with the shoulder (opposing force). During the burst, the rifle moves off its original alignment and it continues to move away until a sufficient force is applied to the rifle to change its direction of movement.

During the burst, the rifle moves rapidly, smoke develops from burning propellant, and, consequently, the shooter cannot observe his sight alignment with the target. Therefore, the shooter must correct the rifle's alignment by feel. Shots fired automatically are uncontrolled with respect to sight alignment with the target.

The automatic-fire-burst group is biased by successive forces applied to the rifle, and therefore its characteristics differ from those of a shotgun pattern. However, assuming that it would be possible to control the group made in automatic fire so that the group center and size could be predicted, automatic fire would still be relatively ineffective because group size is related to range (an optimum group size would be obtained at only one range) and therefore there is a probability that several shots would hit the target or that none would make a hit. Other disadvantages of automatic fire are excessive ammunition expenditure and an increase in bore erosion.

Records of ammunition expenditures since automatic weapons have been generally issued demonstrates the ineffectiveness of automatic fire. Figures given in the July 26, 1971, issue of *US News and World Report* from a study compiled by the Library of Congress for the Senate Foreign Relations Committee show an average expenditure of 31,900 lbs. of ammunition per enemy casualty in Vietnam and a cost of over a quarter million dollars per enemy casualty for ammunition alone.

Why do we have an automatic-fire feature on any shoulder-fired weapon when there are numerous disadvantages and no advantages? It is obvious that some of the decision makers have spent inadequate time on the rifle range. ■

Editor's Note: Time has not stood still since the Aberdeen Proving Ground tests described in L. F. Moore's new article were held. The world's armies are increasingly being equipped with lighter recoiling small caliber shoulder arms with automatic fire capability. This is a reality against which the author's report must be read.

PAF "Junior"

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S. Africa's first domestic pistol, this early PAF came in a leather-grained box. The instructions sheet is in English and Afrikaans.

of an attempted alteration of this marking, but all other known specimens still have this marking intact.

BRF pistols are found numbered throughout the full PAF range, but most fall between A4000 and A6000. The total number of completed BRF pistols is thought to be less than 100. A small quantity were refinished in chrome, a finish not found on any PAF "Junior."

A few BRF-marked pistols exhibit modifications that indicate some improvements were considered. The PAF "Junior" incorporated a pin that locked the slide when the safety was applied. That pin would at times stick and keep the slide locked when the safety was released. This required the user to exert considerable force to retract the slide. By shortening the pin and enlarging the top of its hole in the frame, some BRF pistols were fitted with a small steel ball that acted as a slide lock. Even when fouled with dirt and grease, the ball would release the slide without sticking.

Another improvement, found only on a few BRF pistols, was the incorporation of a cocking indicator. The small knob-shaped firing pin support at the rear of the frame was drilled and countersunk. An indicator pin was fitted to the rear of the firing pin spring so that when the firing pin was held back by the sear, the indicator pin projected from this hole.

Because of their relative scarcity, all PAF pistols can be considered collector's items. Treasury Department records indicate that approximately 2000 PAF "Junior" pistols, including some marked BRF, were imported prior to the Gun Control Act of 1968. Because of this relatively low number, a low survival rate, and their unique position as the first produced in Africa for the commercial market, those pistols have been officially classified as curios and relics. ■