ARMY SMALL ARMS PROGRAM

A review of developments of modern U.S. military small arms

By E. H. HARRISON, Senior Technical Advisor, NRA
& WALTER J. HOWE, Editor, "The American Rifleman"

UNITED STATES Army troops are equipped with M1, M14, and M16 rifles. Assets of these 3 arms are sufficient to satisfy present requirements.

A program is under way in the Department of the Army to study the entire problem of small arms and what should be their characteristics in the light of present and future tactical doctrine and concepts of the employment of infantry in combat. All available weapons will be tested and studied. The result should be a well-documented recommendation on what is the best small arms weapons system for the U. S. Army.

The great interest of the subject makes this a suitable time to summarize developments which led up to the present Army study.

THE AMERICAN RIFLEMAN has since 1957 published 12 major articles on our current military small arms and more than 30 other important articles and items. However, new NRA members and others have not seen all this material.

Modern U. S. infantry weapons began with the Browning machine gun and Browning automatic rifle of World War I, and the M1 rifle.

Efforts to obtain a satisfactory semi-automatic rifle as the weapon of the infantryman began in the early 1900's. All inventors were encouraged to submit rifles, and many did so, but they all broke down or otherwise failed under the severe Service tests.

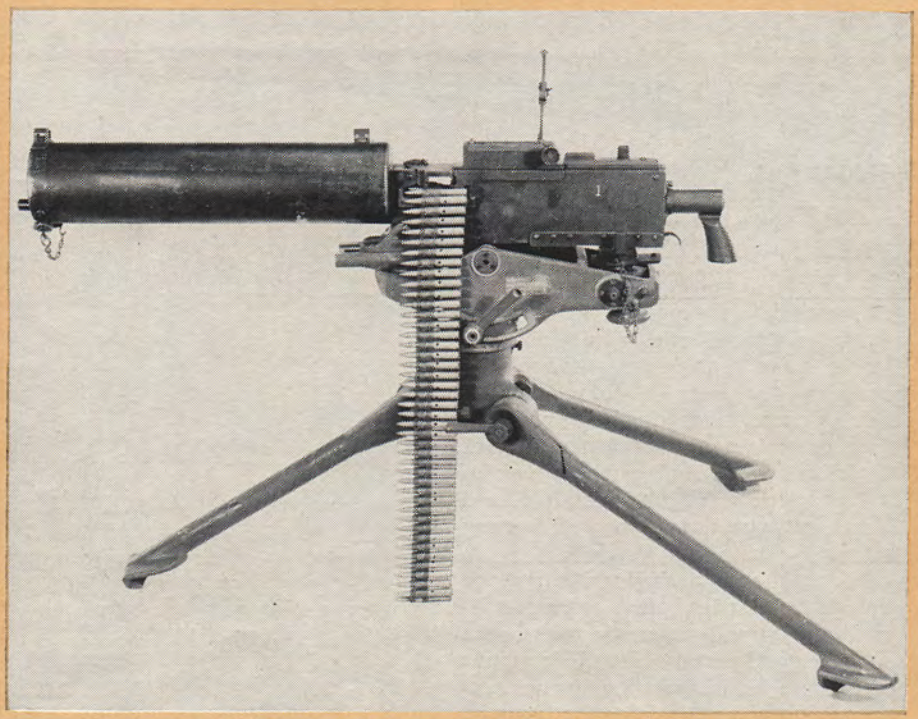
Eventually one semi-automatic rifle passed all tests and satisfied requirements. It was the product of John C. Garand, an able designer who was an employee of the Springfield Armory. It was adopted in January 1936. The official name is U. S. Rifle, Cal. .30, M1—popularly called the Garand.

Soon thereafter, while the Johnson rifle was being pushed for adoption, the M1 rifle became the object of an intensively publicized campaign to prevent its manufacture. Some "experts" stated that the M1 rifle could not be manufactured. Then it was asserted that the authorities had insisted on gas operation, though a gas-operated semi-automatic rifle could not succeed. Still other claims were that the rifle was weak and required low-pressure ammunition, and that its design prevented its shooting accurately. These successive statements were made with such assurance that many people believed them.

The War Department continued with its program for the M1 rifle. With the outbreak of World War II, efforts were stepped up and in 1941 the Springfield Armory and Winchester Repeating Arms Co. were in large-scale production. Eventually Winchester made up to 750 M1 rifles per day and Springfield reached 5000 per day. More M1 rifles were made than of any other small arm except carbines.

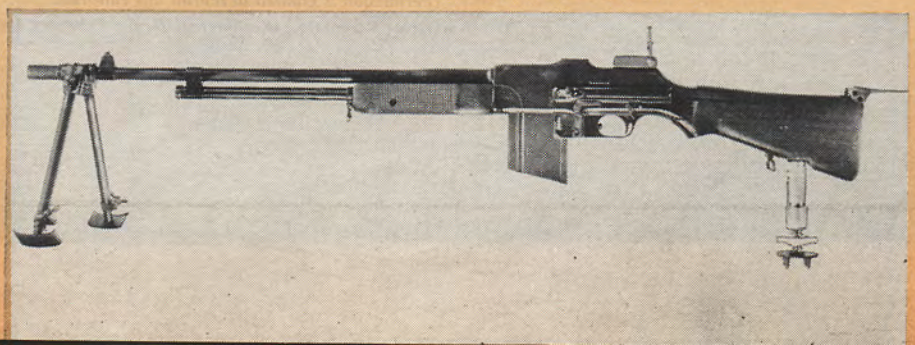
Approximately 1½ million additional were produced by Springfield Armory and commercial manufacturers during and after the Korean fighting. In all, about 5½ million M1 rifles were made before production ceased in 1957.

The M1 rifle was a notable combat success during World War II, in both Europe and the Pacific. The United



U. S. Browning Machine Gun, Cal. .30, M1917A1.

U. S. Browning Automatic Rifle, Cal. .30, M1918A2.



States was the only nation whose soldiers had the great advantage of being fully armed with semi-automatic rifles. This success was repeated in the Korean fighting.

The rifle showed itself to be very strong and reliable. When adjusted for target shooting, as in the M1 National Match rifle, it gives an excellent performance in competitive shooting.

Combat use eventually brought out a demand for several improvements. Soldiers in combat desired large magazine capacity and the capability of full-automatic fire. Late in World War II these features were added in a development of the M1 rifle designated the T20. Undoubtedly this would have been manufactured and used in quantity if the war had continued beyond 1945. After the war's close, the development was continued in similar rifle types through the T20E2. It was then discontinued in favor of a more comprehensive solution. The M1 however has remained an important weapon.

After considering combat results and projected requirements, the Army in 1949 decided on a broader approach. Development of the M1 rifle had been completed at a time when infantry weapons were still of comparatively few and simple types. Weapon types multiplied from World War II onward. At the same time it was desirable to minimize the over-all complexity of their application as much as possible. The decision was to retain the power of the infantry rifle and cartridge, which had proved successful in both World Wars, but cut down on proliferating weapon types.

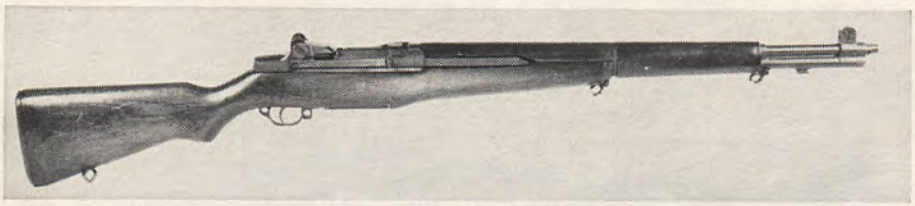
The goal was a single rifle type to replace the standard rifle, carbine, submachine gun and automatic rifle; and a single general-purpose ground machine gun. These 2 basic weapons would simplify manufacture, training, and supply, while providing troops with increased fire power in combat.

The basis of such a weapons system was necessarily the cartridge, and that was undertaken first.

The result was a cal. 7.62 mm. (.30) cartridge of substantially the same power as the .30-'06, but ½" shorter. This materially shortened and lightened the corresponding automatic gun mechanisms. On Dec. 15, 1953, the 5 NATO powers announced this as their common rifle and machine gun cartridge. Each nation makes it in types and styles as desired, the only requirement being that all must function interchangeably in standard military arms of these nations. The United States makes 2 types of ball cartridge in cal. 7.62 mm. NATO, the M59 with steel-cored ball bullet and the M80 with lead-cored bullet. Tracer, armor-piercing, and other common military types are also standard, and a 2-bullet cartridge for the important purpose of improving hitting rates. (Winchester, which had a major part in development work on the 7.62 mm. NATO cartridge, brought it out in sporting loadings as the .308 Winchester, and it has become one of the most successful sporting cartridges.)

The British had already developed a new rifle, the EM 2, with a special team set up for that mission. This quite unconventional design was of modified "bull pup" form with short straight stock and a telescope sight integral with the top carrying handle. Performance was excellent. It was a remarkable development done in a very limited period of time.

The EM 2 rifle was made for a short cal. .280 cartridge which the British had decided on after a study of requirements. While the rifle team was doing its work, another team developed the cartridge. It fired a 140-gr. bullet at 2300 f.p.s., later increased to about 2500 f.p.s. In 1950 the British (for the second time) offered their cartridge to the United States. After test the United States again rejected it, desiring a single cartridge of full power to permit simplification of the rifle and machine gun system. The British Government then gave up the .280 rifle and cartridge and adopted the U. S. cartridge, considering it most important that the 2 nations use one caliber. This consideration ultimately caused the nations of the NATO alliance to standardize on the U. S.-developed cartridge in 1953.

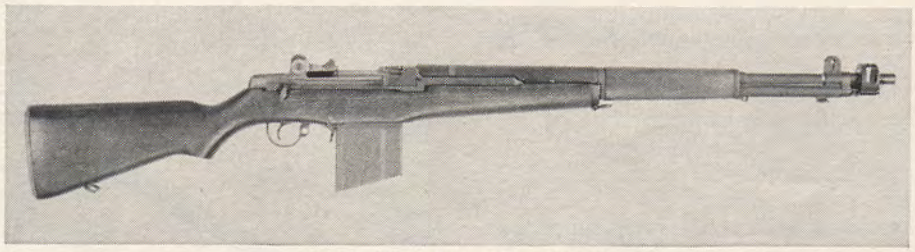


U. S. Rifle, Cal. .30, M1.

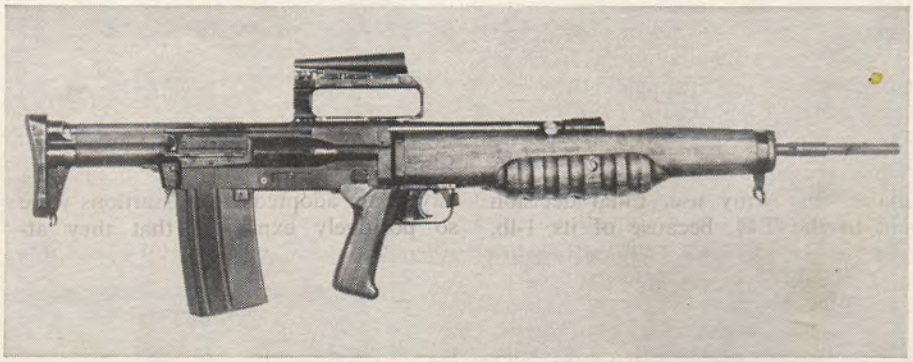
Belgian design tested

Another rifle was offered by Fabrique Nationale d'Armes de Guerre, the Belgian Government manufactory of military and sporting arms. The mechanism dated from the early 1930's and was in a good state of development. For the U. S. tests it was made up for the new cartridge, in a regular shoulder rifle and a heavy-barrel rifle with bipod for the automatic-rifle function. In substantially this form it was adopted in 1954 by the United Kingdom, Belgium, Canada, and Australia, and it has also been used by other nations. As tested in the U. S. it was designated T48.

For its rifle development, the U. S. made up and tested types from 1945 onward. The search progressed through 7 different designs. The one settled on

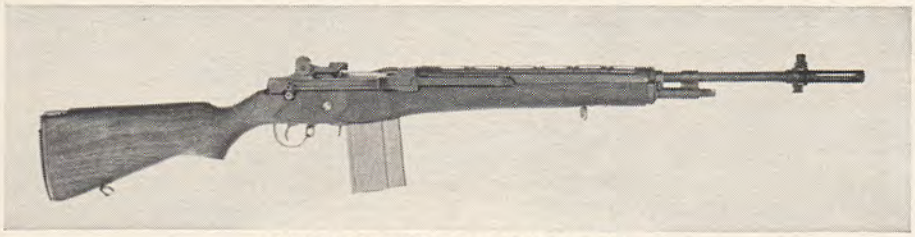


U. S. Rifle, Cal. .30, T20E2.



British Rifle, Cal. .280, EM 2.

U. S. Rifle, 7.62 mm. NATO, T48 (FN).



U. S. Rifle, 7.62 mm. NATO, M14.

in 1952 returned to many details of the M1 action, but simplified by a conventional 20-round magazine and lightened by moving the gas cylinder back to midpoint of the barrel. A gas expansion action gave desirably smooth impulse. This rifle was designated T44. Like the T48, it was made up in both a regular shoulder rifle and a heavy-barrel rifle with bipod as an automatic rifle.

Competitive testing of T48 (FN) and T44 rifles continued through several years and was of unparalleled thoroughness. It included large-scale trials in the Arctic as well as under temperate and tropical conditions. Five hundred of each rifle were built to determine whether they would perform satisfactorily when made by mass-production methods. This included preparation of a complete production study for each. Several minor changes were made in both rifles to correct weaknesses brought out in all these tests. The Army purchased 3000 of the FN Model 1953 rifle in light-barrel and 200 in heavy-barrel style for an operational research test of the practicability of a single infantry rifle replacing the conventional rifle, carbine, submachine gun, and Browning automatic rifle. The result was favorable to the basic single-rifle concept.

Some further defects were brought out in the T48 by tests intended to reproduce very severe combat conditions. Nations which had adopted the FN were invited to submit their latest rifles for test, and the British and Belgians did so. The defects were corrected, and the FN without any doubt is an excellent military rifle. The T44 did not require final corrections. Both rifles were found suitable for Army use. Final decision went to the T44, because of its 1-lb. weight saving over the T48 and because of being better suited for U. S. mass production and training. This referred to its manufacturability with machinery and methods for making the M1 rifle, and to ease of training for users who were already familiar with the M1.

On May 1, 1957, the Secretary of the Army announced adoption of the T44 as the U. S. Rifle, 7.62 mm., M14 and M15 (the latter being the heavy-barrel type to replace the BAR).

Earlier in 1957 the Army had announced adoption of a lightweight general-purpose ground machine gun designated the M60. This was developed by Inland Division of General Motors Corp., Dayton, Ohio, and Bridge Tool and Die Works, Philadelphia. It successfully passed very severe tests. The gun weighs 23 lbs. with attached bipod and is fed by disintegrating link belt. It is adapted to continuous fire from bipod or hip position, or from ground machine gun tripod.

The M14-M15 rifle and M60 machine gun replaced 4 shoulder weapons and 3 machine guns. Simplification of the infantry weapons system in both production and use was thus attained.

Springfield Armory began production of the M14 soon after its standardization. Between February and April 1959, when funds became available, production and facilities contracts were awarded to Winchester-Western Division of Olin, New Haven, Conn., and Harrington & Richardson, Inc., Worcester, Mass. The M14 contracts provided that deliveries begin in 12 months and continue at an increasing rate.

Despite the undoubted qualifications and experience of these leading small arms makers, both suffered serious delays in their initial production. Criticism of these delays, passing from one writer and publication to another, soon became statements that the rifle could not be manufactured and should not have been adopted. The assertions were so positively expressed that they attracted national attention. Because this was a matter of special interest to NRA members, a RIFLEMAN team in August 1961 visited all major M14 manufacturing facilities and interviewed responsible officials in Government and industry connected with the M14 program. These gave the most wholehearted cooperation throughout, and no limitation or censorship was even suggested. One of the first things the team discovered was that the press reports had been written without such a check.

Both Winchester and Harrington & Richardson attributed their initial difficulty in part to excessively strict specifications. This claim was weakened somewhat by the fact that they knew these specifications before bidding, and had been given complete production directions from Springfield Armory where manufacture of the M14 proceeded regularly. They unquestionably were on better ground when they cited a change in the metallurgical specifications after contracts were awarded, and still more the undue slowness with which Government contract authorities answered requests for changes or exceptions. The price per rifle ($68.75) was markedly less than that of the M1 almost 20 years before. While the manufacturers were influenced in bidding so low by the unfavorable economic conditions of the time, it led them into initial attempts to make the rifle within that price, with consequent rejections. The Government probably should not have ratified the contracts at such a level—it is usually unwise to accept excessively low bids.

Commercial production improves

With the aid of M1 rifle production machinery intentionally left by the Government in its plant, Harrington & Richardson was able to catch up to its contract schedule at end of August 1961. Not having this advantage, Winchester decided to design and install special production machinery instead of using conventional one-operation-at-a-time machine tools. Delays in receipt of some of this automated machinery at one time brought Winchester production to a complete halt. Eventually they too caught up with their contract requirements. Both commercial producers were enthusiastic and both desired additional M14 contracts.

Springfield Armory considered there had never been a real doubt, pointing out that the M14 was designed to be mass-produced, that to test this a pilot lot was manufactured by production methods before the rifle was standardized, and that the Armory was steadily producing at the rate allowed to it. All 3 manufacturers pointed out that they were actually in mass production.

At the time of the delays, the Army appointed a general officer as Project Manager for the M14 rifle. He brought the whole matter into proper perspective, instituted reforms to make help

available to manufacturers when they requested it, and urged that an additional manufacturer be brought in for added competition. Project managers are now used on more than 30 major development and manufacturing projects for the Army.

Statements on non-manufacturability of the M14 ceased after THE AMERICAN RIFLEMAN published in detail the results of its check. The same thing could have been found out by others, if the trouble had been taken to do so before publishing conclusions.

To secure competition the Government then brought in a third commercial producer. The contract was bid on by 42 major firms. The Jet Division of Thompson Ramo Wooldridge (TRW) submitted the next to lowest bid, and on the basis of competence received the award. TRW is a large, diversified corporation carrying on research, development, and production of items for aircraft, automotive, nuclear, space, ordnance, and industrial applications. The Jet Division, a part of the Electro-Mechanical Group within TRW, organized M14 rifle production in its Tapco plant in Cleveland, Ohio. Production was on large, modern tools by methods considered most appropriate to large-scale precision manufacture. TRW earned a bonus by beginning block deliveries in October 1962, a month before the required date.

M14 production ceases

Springfield Armory ended its production of M14's in 1963, since its function is not competition with private manufacturers. Production by the 3 commercial manufacturers continued until their contracts were completed in the first half of 1964. At that time the Defense Department considered that it had enough rifles for current requirements, and manufacture of M14 rifles ceased with a total production of about 1,380,000 weapons.

While this is a large figure by most standards, it is only about ¼ the total production of M1 rifles (which extended over nearly 20 years and included 2 major wars).

All 3 commercial manufacturers were understandably much disturbed at this end of M14 procurement. The manufacturers had been invited to set up for large-scale rifle production, which is very different from making a few thousand, and they had done so. Now they were cut off when they were rolling and could begin to realize some return. Nevertheless the Defense Department decided against procuring any more rifles than were necessary for filling present requirements in a manner judged acceptable.

After the affair about manufacturability, statements appeared that the M14 rifle was mechanically unreliable and that it would not shoot accurately. In fact it proved to be extremely strong and reliable, even in continuous full-automatic fire for which only a heavy automatic rifle is usually considered suitable. An accuracy test through several months by selected members of the National Rifle Association Board of Directors, Executive Council, and High Power Rifle Committee (nearly all civilians) on Service M14's taken off the production line resulted extremely favorably.

In 1964, the first large-scale use of the M14 National Match rifle at Camp Perry gave the same target accuracy as the M1 National Match rifle.

Some public attacks against the M14 were thus similar in many respects to those originally made against the M1 rifle. The outcome of each controversy has also been the same.

Unfavorable aspect appeared

At this point, however, a new and unfavorable aspect appeared. This is inability of the M14 to deliver accurate full-automatic fire. Its cause is the development of more recoil, from the full-power Service cartridge fired at the M14's unmodified cyclic rate of about 750 rounds per minute, than can be controlled in a shoulder rifle.

It has been mentioned that the T44 rifle, which became the M14, and the T48 or FN were each really a pair—a shoulder rifle of weight under 10 lbs., and an automatic rifle with the same mechanism but a heavy barrel, a bipod, and consequent slightly greater over-all weight. These 2 forms of the T44 were standardized in 1957 as the M14 and M15 respectively.

Making these automatic rifles basically identical with the shoulder rifles brought maximum simplicity in manufacture and in user familiarization. This, however, gave up some known characteristics of good automatic rifles, including the U. S. BAR M1918A2 and the British Bren which have been especially successful. These guns are quite heavy, with heavy mechanisms of favorable operating characteristics for the purpose.

The T48 automatic rifle weighs only 13.4 lbs. and has a comparatively high cyclic rate, both unfavorable to control in full-automatic fire. The difficulty is partly eased by the design of this rifle with gas cylinder above the barrel, which lowers the barrel and the consequent recoil line, and lessens the tendency to rise in full-automatic fire. This automatic-rifle form of the FN has been retained by some of the nations which adopted the FN rifle. While by no means so controllable as heavy automatic rifles designed as such, it can give good results in the hands of well-trained users.

The M15 automatic-rifle form adopted with the M14 shoulder rifle in 1957 weighs 14.1 lbs. It is of conventional rifle configuration. Soon after-

U. S. Automatic Rifle, 7.62 mm. NATO, M15.

U. S. Machine Gun, 7.62 mm. NATO, M60.

ward it was proposed to drop the M15 and use the M14 for both purposes. After tests, the Army and the Marine Corps concluded that the degree of control given by the M14 was sufficient. The M15 therefore was dropped. The M15's folding buttplate was put on all M14's, and its bipod (which was readily attached and detached) was retained for use on the M14 as required.

Since that time it has been the general opinion that M14 control in full-automatic fire is not sufficient. The operational significance of this matter never has been settled.

Accuracy improved

The problem of full-automatic control in the M14 has been dealt with in several ways. The Army's solution has been to equip a suitable number (about 8500) of M14's during production with straight-line stocks and a hold-down muzzle brake for the automatic-rifle function. The resulting M14E2 rifle is markedly more controllable. A procedure tested on division scale by the Marine Corps is rapid semi-automatic fire. With the folding buttplate, which many users like, the M14 can be fired very accurately at one shot per second or faster. It is reported that in a given time more hits can be made in this way than with full-automatic fire of the BAR. Finally, the 23-lb. M60 machine gun can be used to provide accurate full-automatic fire at squad level. This is done with the corresponding guns in some other major armies. Such a belt-fed gun can outperform any magazine-fed rifle of equal caliber.

There have also been some important developments in addition to these standard weapons.

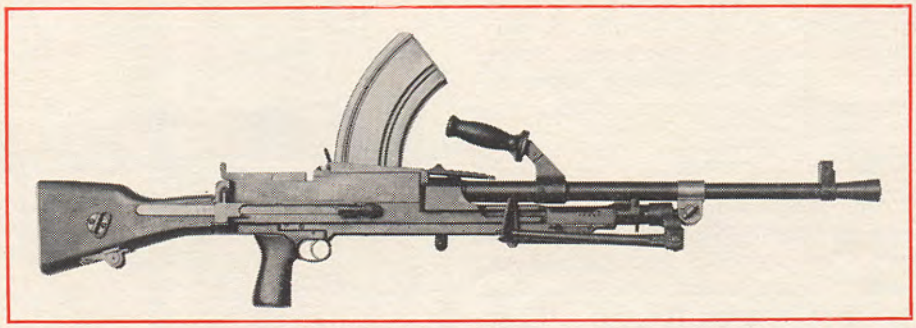
The most fundamental of these began with a long-term research initiated by the Army in 1951. The purpose was to improve hit probability, which is by far the greatest limitation on the effectiveness of small arms.

An early result was a recommendation for improving the hitting rate of the 7.62 mm. NATO cartridge. This caused development of a 2-bullet cartridge usable in all standard arms of that caliber. Eventually it was adopted on May 7, 1964, as the 7.62 mm. Duplex Ball Cartridge M198. Careful tests indicate 25% to 100% increase in hits in various situations, an important increase.

To carry out final recommendations of the study, Springfield Armory and 3 industrial firms each began development in 1963 of a special purpose individual weapon (SPIW) for the Army. The weapon was to have both a point and an area target capability. After extensive test and evaluation, one of the 4 models would be selected for further development. The results so far have not been made known. Various non-conventional approaches are possible. Development of such a radical concept to the stage of a completed weapon may require long time and effort.

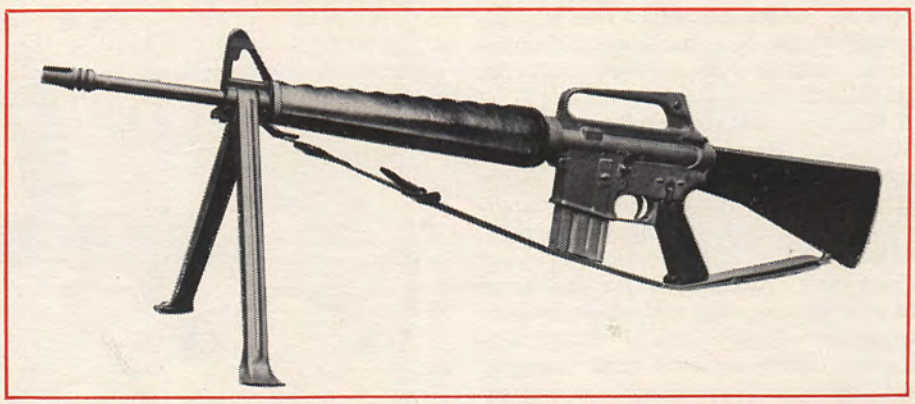
In the meantime, developments by conventional means have provided several possibilities for interim weapons. These all require a radical reduction in size and power of the cartridge.

Such reductions are not new. Rifles of cal. 6.5 mm. were adopted by several nations between 1891 and 1905. From 1895 to 1906 the U. S. Navy used a 6 mm. (.236) rifle. These cartridges were all of medium size. The bullets, though of small diameter, were proportionately long and heavy, and gave excellent penetration and good long-range performance. They have now nearly all been dropped as primary standards of their countries, in general



British Light Machine Gun, Cal. .303, Bren.

U. S. Rifle, 7.62 mm. NATO, M14E2.



Colt Armalite AR-15 Rifle, 5.56 mm., M16 (Air Force) and XM16E1 (Army).

Armalite AR-18 Rifle, 5.56 mm.

having been considered inadequate in World War II.

Between 1926 and 1932 the United States was close to adopting a reduced-size cal. .276 rifle cartridge, to ease the problem of developing a satisfactory semi-automatic rifle. After experience in World War II, it has generally been considered that the decision to retain the full power cal. .30 cartridge was the correct one.

The British adoption of a medium-power .280 cartridge after World War II has already been mentioned. They dropped it for the 7.62 mm. to gain standardization with the United States, considering that to be more important than detailed questions of caliber.

Soviet small arms

After World War II, the Soviet Union replaced practically all its military small arms. Its present SKS short rifle and AK assault rifle are made for the Soviet 7.62 mm. short cartridge. This fires a 122-gr. bullet at 2400 f.p.s., and was patterned on the 8 mm. short cartridge which the Germans introduced during World War II. The Soviet squad automatic rifle uses the same round. On the other hand, the Soviet post-war company and battalion machine guns are made for the old rimmed 7.62 mm. (.30) full-power cartridge.

Still another possible solution of the caliber problem is a .22 center-fire cartridge shooting a light bullet at relatively high muzzle velocity. In 1953 the Army tested the .30 carbine cartridge necked to cal. .22 and fired in fully operational carbines for this cartridge. This was followed by trial of a shortened .222 Remington cartridge, then of cal. .22, .25, and .27 cartridges made on the 7.62 NATO case and fired in fully operational M1 rifles. Remington Arms Co. designed a .222 cartridge on Army contract, and later offered it commercially as the .222 Remington Magnum.

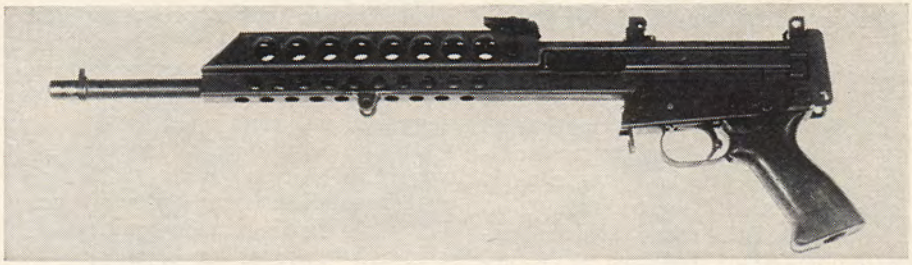
In 1957 the U. S. Continental Army Command requested 2 manufacturers to provide new rifles and a new military cartridge of this kind for test. Extensive testing resulted very favorably for both rifles, considered as mechanisms. One of the developers, Winchester-Western Division of Olin, then dropped the development. The other, Fairchild Engine & Airplane Co., vigorously promoted their rifle and it attracted wide attention. Fairchild named it the Armalite AR-15.

The U. S. Air Force tested the Armalite AR-15 in 1960, and adopted it for use when replacing cal. .30 carbines.

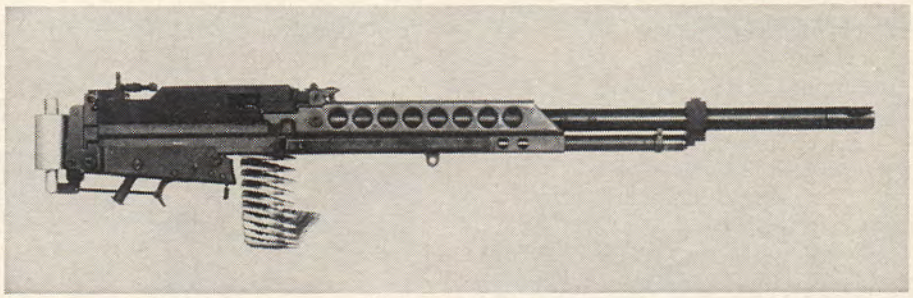
The Armalite AR-15 is the product of Eugene M. Stoner, a highly talented and versatile designer. Its weight is 6.6 lbs. It is in general a scaled-down copy of the designer's 7.62 mm. AR-10 which had been available for some time. The stock is straight, with separate pistol grip. Many of the design features were new to American rifles though used in a number of military weapons abroad; they are excellently handled in the AR-15 and have worked out well. Aluminum alloy anodized to a very durable finish is extensively used in the construction, and the stock and fore-end of the rifle are constructed of a strong plastic.

The cartridges used in the Winchester and AR-15 rifles differed slightly, but both are similar to the .222 Remington Magnum except slightly shorter.

STONER 63 WEAPONS SYSTEM, 5.56 MM.



Basic components group.



Fixed machine gun.

Light machine gun, belt fed.

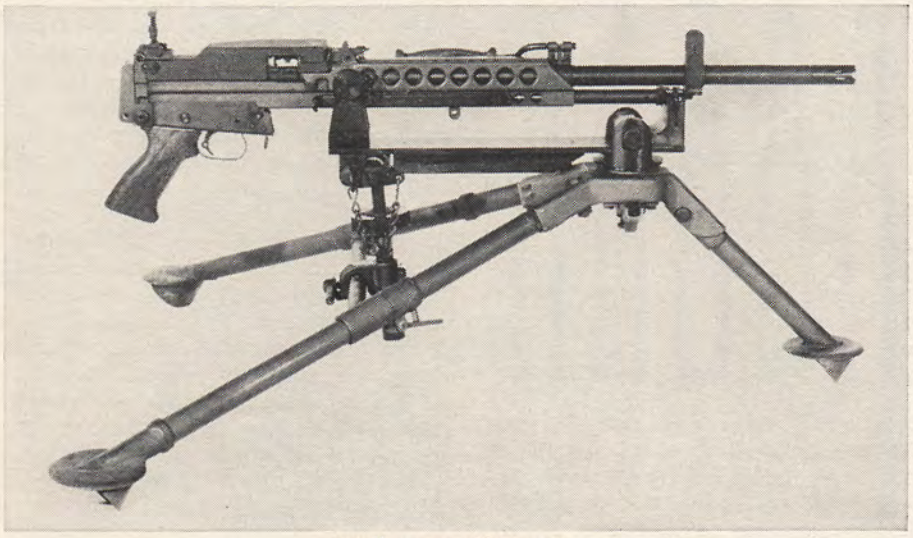
Light machine gun, magazine fed.

The Army testing was carried out at Aberdeen Proving Ground; at the Infantry Board at Ft. Benning, Ga., on a comprehensive plan including infantry, airborne, and tank considerations; in the Arctic at Ft. Greeley, Alaska; and at the Combat Development Center at Ft. Ord, Calif. The rifles were well liked by individual users for their lightness and easy handling. Mechanical functioning was excellent. Shooting accuracy was, under some conditions, extremely poor. Improvement in hitting rate, which had been expected from the rifles' lightness and easy handling, was limited and disappointing.

NRA test of several AR-15 rifles confirmed the excellent functioning and handling qualities. Contrary to all press and magazine reports up to that time, the accuracy was erratic and under some conditions extremely poor. Investigation by the NRA Technical Staff established the reason for inaccuracy in the rate of rifling twist used, and indicated the twist which would be correct. This information was included in the NRA report in May 1962. Air Force test then confirmed that that rifling twist did correct the inaccurate shooting. AR-15 rifles manufactured since July 1963 have been made with the corrected rifling, and their shooting accuracy is very good.

After the official tests, manufacturing and patent rights to the AR-15 rifle were acquired from Fairchild Stratos Corp. by Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn., a subsidiary of Fairbanks Whitney Corp.

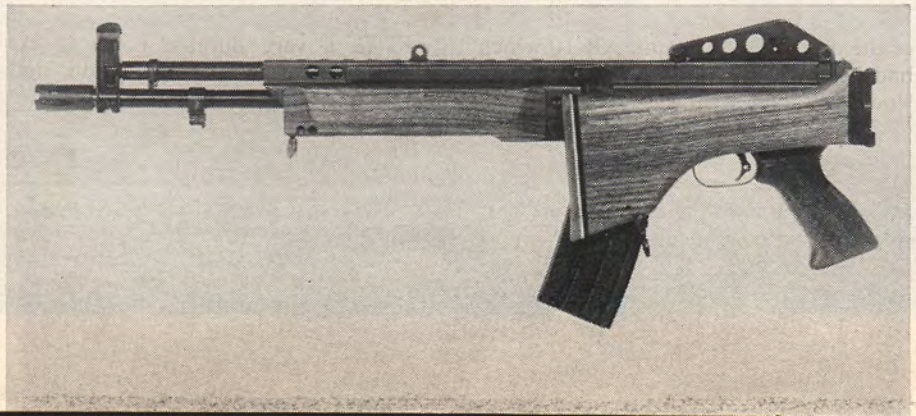
In 1963 the Army ordered 104,000 AR-15 rifles from Colt's, with accessories and spare parts. Of these, 19,000 were for the Air Force under the designation M16, and 85,000 for the Army designated XM16E1. The XM16E1 and the M16 are the same except for addition of means on the XM16E1 to close the bolt positively when required. Both are commonly referred to as M16's. The Army's portion was for use in Army Special Forces, in 2 airborne divisions, and in an air assault division trying out new concepts in air mobility. There have been a number of smaller orders.



Medium machine gun.

Rifle.

Carbine, stock folded.



M193 ball cartridge

On Feb. 18, 1964, the Army standardized the ball cartridge for this rifle as the 5.56 mm. Ball Cartridge M193. This is substantially same as the .223 Remington military cartridge used in the AR-15. Following are velocities and energies of the new standard 5.56 mm. military cartridge, in comparison with those of the standard 7.62 mm. NATO:

5.56 mm. Ball M193, 55-gr. bullet, 3250 f.p.s. at 15 ft.

Range, yds.	0	300	500
Velocity, f.p.s.	3270	2193	1629
Energy, ft.-lbs.	1307	588	324

7.62 mm. NATO, M59 and M80 Ball, 150-gr. bullet, 2750 f.p.s. at 78 ft.

Range, yds.	0	300	500
Velocity, f.p.s.	2808	2182	1809
Energy, ft.-lbs.	2627	1585	1090

A considerable number of people urged that the Army adopt the AR-15 as its standard rifle. The tests had shown that it is a fine little rifle. It offers the advantage of light weight, which is always desirable. On the other hand, such adoption would destroy the simplification of the weapons system which had been attained after much effort, there remained the question as to extent to which the small cartridge could be a satisfactory infantry round for general use, and adoption would accomplish nothing of importance toward a radical improvement in hitting, the fundamental need in small arms. For these reasons the Army has used the M16 only for special purposes. In 1964 the U. S. Marine Corps stated that it did not intend to take any action with respect to the M16 rifle.

Eugene M. Stoner has more recently designed a number of cal. 5.56 mm. military weapons. Among these is the Armalite AR-18 rifle of Armalite, Inc., Costa Mesa, Calif. This is intended for the same use as the AR-15 but planned for manufacture at lower cost. It is based on extensive use of sheet-steel pressings and parts made by automatic screw machines. Though of steel construction, the over-all weight is slightly less than that of the AR-15.

Of wider interest, however, is the Stoner 63 designed for Cadillac Gage

Co., a subsidiary of Ex-Cell-O Corp. Its fundamental characteristic is that it is not a single weapon, but a system in which one basic components group makes up into a family of 6 weapons which in the past have usually been quite different types. These include belt-fed machine guns, magazine and belt-fed automatic rifles, a shoulder rifle, and a carbine. The assemblies are (weights given by the manufacturer):

Type	Wt. (lbs.)	Feed	Mount
Fixed MG*	10.4	Belt	Fixed
Light MG	11.9	Belt	Bipod
Light MG	11	Magazine	Bipod
Medium MG	10, plus 19-lb. mount	Belt	Tripod
Rifle	7.9	Magazine	Attachable bipod
Carbine**	7.7	Magazine	—

* Combat vehicle fixed mounting
** 15.7" barrel, folding and removable stock

The rifle and carbine mechanisms are inverted, with gas cylinder above and magazine below. The machine-gun assemblies have quick-change barrels and fire from an open bolt, and the rifle and carbine fire from a closed bolt, these being appropriate modes of operation for the respective types. Belt feed is disintegrating metallic link. Magazines contain 30 rounds.

Advantages of system

Great simplicity in manufacture and training result from a single basic components group which is the foundation of all 6 weapons in the system.

The designer has a similar system, the Stoner 62, for the 7.62 mm. NATO cartridge. However, present interest is in the Stoner 63, and it is certainly a remarkable development.

The machine-gun members of the group are only slightly heavier than the shoulder rifle, which is practicable because of light recoil of the 5.56 mm. cartridge. On the other hand, the shoulder rifle and the carbine are nearly as heavy as a 7.62 mm. full-power rifle. This means they are very heavy in proportion to the projectile—the 7.9-lb. Stoner 63 rifle weighs more than 1000 times as much as its bullet. The result is very light recoil and comparatively easy control.

Any comparison of the Stoner 63 with the present standard M14-M60 weapons system involves factors of a fundamental kind. The M14-M60 replaced 7 weapons with only 2. The Stoner 63 is designed to carry this simplification still farther, replacing 2 with only one basic type. The machine guns in the Stoner 63 family are very light, and the guns and ammunition in combination are materially lighter than the corresponding 7.62 mm. Light recoil of the 5.56 mm. in these weapons gives easy full-automatic controllability.

On the other hand, the simplification of such a system can be obtained only by taking it all. This raises the fundamental question as to whether such a small cartridge is adequate for all purposes fulfilled by the present standard system. The one major power which has so far adopted a reduced-power cartridge, the Soviet Union, has avoided depending on it for all purposes, and has retained the full-power cartridge in new machine guns for some uses. The general experience in World War II and Korea was that men in actual combat did not object to the weight of the M1 rifle and BAR, but desired these weapons for their effectiveness.

Question is difficult

While the question of necessary power is a difficult one, it is to a considerable extent a matter of how the individual infantryman and small infantry units are viewed. Since World War II, the continual increase of automatic and other infantry and close-support weapons has left a narrower place for the individual rifleman. The complete use of a reduced-power cartridge would carry that process farther.

Both the Army and the Marine Corps have tested the Stoner 63 and are carefully considering the results. Other weapons are also available. Undoubtedly they will all have a place, in proportion to their readiness and promise, in the study referred to at beginning of this article. ■

Important full-power rifle cartridges in recent and current use: (l. to r.) 7.92 mm. German (Mauser) 1888-1905; 7.62 mm. Russian 1891-1908; .30-'06 U. S. 1903-1906; 7.62 mm. NATO 1953. In first 3 cartridges, first date is year of adoption, second is year of modernization with pointed bullet at higher velocity.

Early small-caliber rifle cartridges and year of adoption: (l. to r.) 6.5 mm. Italian (Carcano) 1891; 6.5 mm. Norwegian-Swedish 1894; 6 mm. U. S. Navy 1895; 6.5 mm. Japanese 1897; .276 U. S. Pedersen 1926 (extensively tested but not adopted). Second and fourth cartridges shown as eventually modernized with pointed bullets at increased velocity.

Recent and current reduced-power rifle cartridges and year of adoption: (l. to r.) 7.92 mm. Kurz (German) 1942; 7.62 mm. Soviet 1943; .280 British 1951; 5.56 mm. U. S. 1964 (for special purposes).

Components of 7.62 mm. Duplex Ball Cartridge M198, showing hollow base of forward bullet and slanted base of rear bullet to give desired dispersion.

For developments in military rifles up to 1948, a detailed and authoritative source is *The Book Of The Garand*, by Maj. Gen. J. S. Hatcher. Since that date the only complete published record has been the articles of THE AMERICAN RIFLEMAN. Because of their great interest, certain of these articles were reprinted, but heavy demand has exhausted the supply, and back issues are not available from NRA.