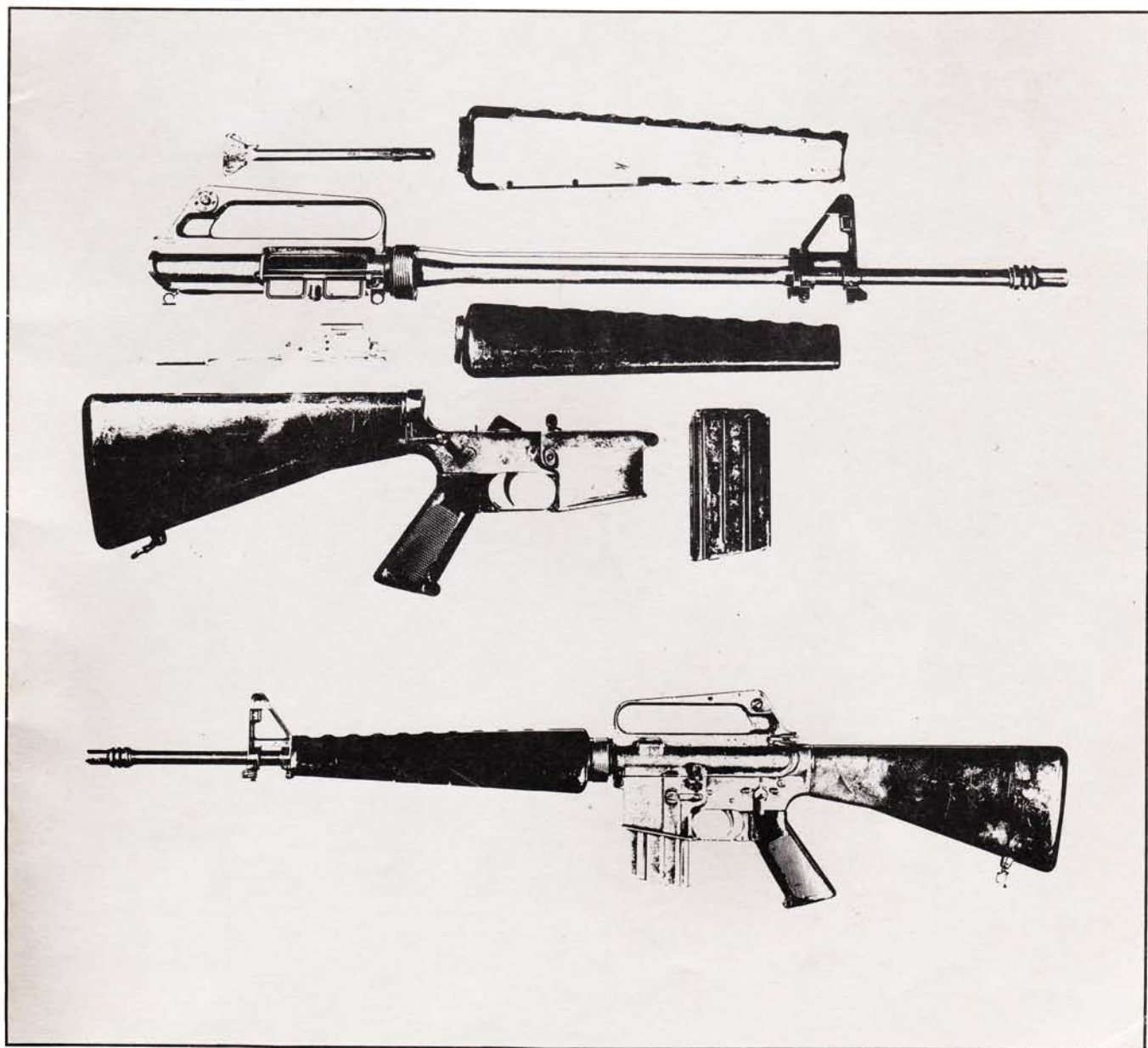


# SMALL ARMS PROFILE

# 22

## ARMALITE WEAPONS



## Glossary of terms



Beretta Model 1934

**Automatic** The common name for a self-loading or semi-automatic pistol. This has been used throughout the Profile Series to denote the above.

**Backstrap** (18) The part of the frame which forms the rear of the grip.

**Barrel** (2) The tube down which the bullet is guided.

**Bent** (13) Notch in hammer.

**Breech** Rear portion of barrel.

**Chamber** Part of the gun that receives the charge or cartridge.

**Disconnect** (11) A device to prevent multiple shots being fired on a single pull of the trigger.

**Ejector** A part designed to assist the removal of the empty case.

**Extractor** (20) Same as ejector but more often applied to automatic weapons.

**Firing Pin** (19) The pin that detonates the cartridge priming.

**Follower** (16) Part of the magazine that guides the cartridges upwards.

**Frame** (6) See Receiver.

**Hammer** (3) A device to detonate the priming of the cartridge or actuate the firing pin.

**Magazine** (10) A container for cartridges used to feed a gun automatically.

**Magazine Catch** (8) The catch that holds the magazine in place in the gun.

**Mainspring** (12) The spring that actuates the hammer.

**Muzzle** The open end of the barrel.

**Receiver** (6) The main housing for the major components.

**Recoil Spring** (5) The spring that controls the movement of the slide or other moving components upon firing.

**Recoil Spring Guide** (4) A guide that prevents the recoil spring from becoming damaged.

**Safety Catch** (9) A device to prevent the gun being fired.

**Sear** (14) A lever that transmits movement from the trigger to the hammer.

**Slide** (1) The sliding breech block often containing the extractor and the firing pin, used to close the rear of the barrel.

**Stocks (Grips)** (7) Wooden or plastic pieces used as a handle.

**Trigger** (15) A lever which is used to release the hammer mechanism.

**Trigger Bar** (17) A lever connecting the trigger to the sear.



The AR-7. Top picture shows the rifle assembled and the bottom shows it stowed for carriage (Author)

# Armalite Weapons

by Major F. W. A. Hobart (Retd.)\*

## Introduction

Armalite became a Division of Fairchild Engine and Airplane Operation on 1 October 1954. For several years prior to this the Armalite Corporation had been funded privately. The two individuals who started Armalite initially were Charles Dorchester—the present Chairman of the Armalite Board—and George Sullivan a patent counsel who is now connected with Lockheed Aircraft Corporation. Sullivan used his contacts with the late Richard Boutelle president of the Fairchild Engine and Airplane Corporation of Hagerstown Md to get Fairchild interested. The original concept was to produce top quality sporting firearms for the commercial market using advanced designs of light weight, incorporating modern alloys and plastics and making use of the most economical quantity production methods. This plan was changed because of the success achieved by a military venture. Armalite was asked to design a replacement for the standard Air Force survival rifles M4 and M6, and produced the AR-5

·22 Hornet rifle. This design was accepted and designated the MA-1 Survival Rifle in 1955. (No rifles were purchased in quantity due to the large stocks of M4 and M6 rifles held by the Air Force). This early success led to the decision to postpone commercial ventures until the Armalite Division had established its reputation—and improved its financial standing—with military sales, and for the next five years all activity was concentrated on military projects.

One of the first acts of the new Armalite Division of Fairchild was to engage Eugene Stoner, a former Marine, as Chief Engineer. Stoner has proved himself to be one of the foremost armament designers of the century. During his period with the company, 1954-1961 Stoner worked with L. James Sullivan (not to be confused with George Sullivan already mentioned) a talented designer and Robert Fremont who was responsible for design tolerance studies required for mass production.

The following Armalite weapons have been produced. The three most important are the AR-10, AR-15 and AR-18 which will be described in greater detail later.

\* The views expressed are those of the author and do not reflect official opinion.

### AR-1

Work started in 1947, some years before Stoner joined Armalite, and was completed in 1954. This weapon was called the 'Parasnipier Rifle' and it was designed to be used either as a military or a high quality sporting rifle, using the 7·62mm NATO cartridge or any convenient sporting round with about the same characteristics. It was a bolt operated rifle with a steel lined aluminium alloy barrel. The stock was of fibre glass foam filled. After completion of the prototype it was decided to proceed no further with its development.

### AR-3

This was a 7·62mm self-loading rifle with a forward locking Mauser action. It was brought to Armalite by Eugene Stoner when he joined the Company. It had an aluminium body and a fibre glass butt. It was regarded as a test vehicle for certain design features to be incorporated in subsequent models and was never taken beyond the prototype stage.

### AR-5

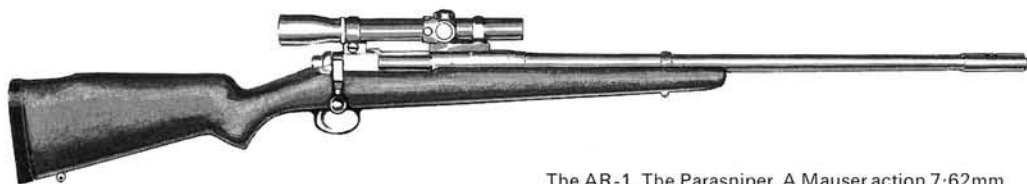
This was built to a broad specification laid down by the United States Air Force for an aircrew survival rifle. It was a bolt operated rifle weighing only 2½ lbs

and had an overall length of 30½ inches. The action, barrel and magazine were readily detachable and fitted into the interior of the hollow fibre glass butt which reduced its stowed length to 14 inches. The weapon would float either assembled for use or packed away into the buttstock. Using the ·22 Hornet cartridge it had a very reasonable performance and grouped into a four inch circle at its maximum effective range of 100 yards. The original Patent No 179499 of 1 Jan 1957 was ascribed to George Sullivan. The AR-5 was designated the MA-1 but was never ordered in quantity due to the large stocks of M4 and M6 Survival Rifles already held by the Air Force.

### AR-7

The 'Explorer'. This is a commercial ·22 LR blow back operated sporting rifle. It retains the breakdown characteristics of the AR-5 and packs similarly into the hollow buttstock. Like its predecessor it will float in either configuration. It has a steel lined aluminium alloy barrel and an 8 round box magazine and groups in a 5 inch circle at 100 yards.

The gun weighs 2¾ lbs, is 34½ inches overall and when collapsed has an overall length of 16½ inches. When first marketed it sold for \$49·95 with extra



The AR-1. The Parasnipier. A Mauser action 7·62mm Military or high quality sporting rifle (Armalite Inc)



The AR-5 and AR-7. The AR-5 was a bolt operated USAF survival rifle—known as the MA1 using the ·22 Hornet cartridge. The AR-7 is a blow back operated self-loading sporting rifle using the ·22 LR cartridge (Author)

magazines at \$2.45. It was extremely easy to stow away in a car or aircraft and has sold in large quantities. It is still available and has given a great deal of pleasure to lots of sportsmen at a very low cost. It is currently selling for \$59.95

#### AR-9

A 12 bore automatic shotgun with an aluminium barrel with an integral compensator and an aluminium body. It incorporated the rotating bolt design of the AR-10 and weighed 5½lbs when developed in 1955. It was decided to concentrate on further development—which led to the AR-17—and not to market the gun in its present form.

#### AR-10

This military rifle was originally designed in 1953 for the 30-06 cartridge and in 1955 it was modified to take the 7.62mm NATO cartridge. It was the first Armalite rifle to dispense with the gas piston and



Right: Eugene Stoner holding the AR-7 rifle (Armalite Inc)

Below: Charles Dorchester—Chairman of Armalite Inc—showing the AR-7 with its barrel, body and magazine inserted in the hollow plastic buttstock (Armalite Inc)







AR-9 shotgun (Armalite Inc)

use direct gas action. In 1956 Fairchild licensed Artillerie-Inrichtingen of Hembrug, Holland, to manufacture. This state arsenal had some difficulty in raising capital to tool up for a weapon that had not been accepted for service with the Dutch armed forces and there was a considerable delay before they were ready to proceed. In the meanwhile there had been a strong sales effort which was largely wasted and sales went to competitors which although both technically less advanced and sometimes inferior in performance, were readily available. In 1959 Colt's Patent Firearms were licensed to manufacture the AR-10A. This had a stronger extractor, an improved magazine layout and a cocking handle placed over the rear of the body. A prototype was produced but Colt's decided the AR-15 had greater market potential and concentrated their efforts on that weapon which incorporated the improvements of the AR-10A. The basic AR-10 was used as the basis of a bipod mounted magazine-fed LMG and a belt-fed LMG which although generally bipod mounted was also seen on a tripod.

#### AR-11

This was a rifle designed for the high velocity .222 cartridge. It resembled the AR-3 and had a Garand type safety. It had an excessive rate of fire and with a conventional stock it climbed badly at full automatic. It was basically a test vehicle for the high velocity light bullet and was a forerunner to the AR-15.

#### AR-12

This was an inexpensive version of the AR-10 rifle and was chambered for the 7.62mm NATO cartridge. It was intended to utilise stampings rather than machined alloy forgings. It was anticipated that production costs would be 50% of those of the AR-10. It never reached the hardware stage.

#### AR-13

This was a hyper-velocity gun system for aircraft. It was a multi-barrel type weapon.

#### AR-14

The AR-14 was an auto-loading sporting rifle and was a commercial version of the AR-10. It was designed to utilise a Monte Carlo stock and in appearance was similar to the AR-17, incorporating a streamlined body of much the same

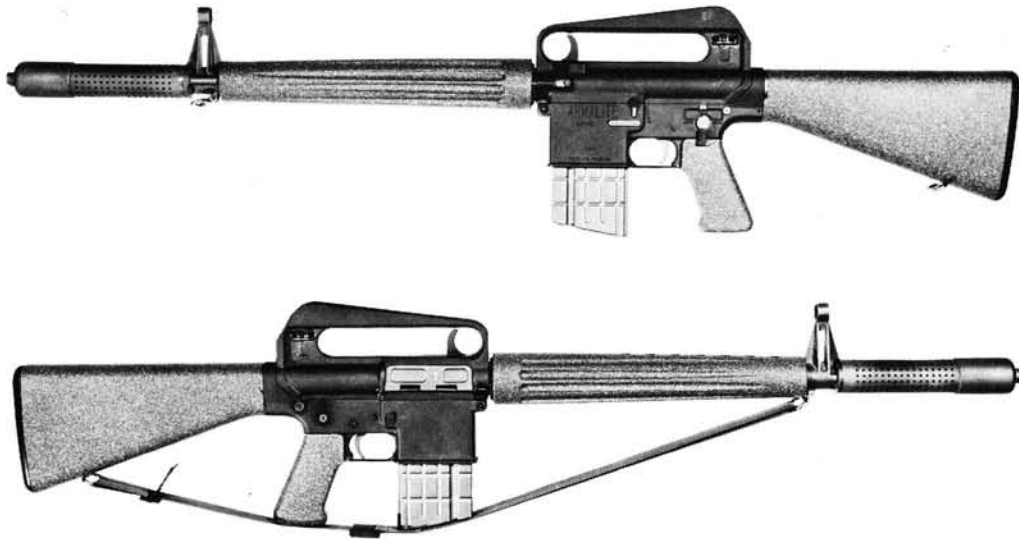
shape. The barrel was of conventional design with iron sights and was chambered for .308, .243 and .358 calibres. It had a two piece stock and forearm.

#### AR-15

This rifle was designed between 1956-9. It uses the .223 cartridge. This round was an Armalite designed round using initially a .222 Remington case with a 55 grain boat tail bullet developed by the Sierra Bullet Co to Armalite's specification. The volume was inadequate to produce the desired velocities and the case was lengthened to increase the internal volume. The cartridge was then known as the .222 Special. When Remington produced the .222 Magnum the Armalite cartridge was re-named the .223 Remington to prevent confusion. The AR-15 is discussed in more detail later. The weapon in its service version is known in the US Army as the M16A1 and in the USAF as the M16.

#### AR-16

This rifle was developed and prototyped in 1959-60 by the Armalite development staff with Arthur Miller. Eugene Stoner was Chief Engineer. The calibre chosen was the NATO 7.62mm which at this time was without rival. The AR-16 was designed not to replace the M14 in the US Army but to be manufactured by emergent nations to issue to their own armies. With this in mind the emphasis was placed on ease and economy of production using machine tools that could subsequently be employed in the production of agricultural machinery, office machinery and other requirements of a young nation. The AR-16 made use of sheet steel pressings and automatic screw machine operations as much as possible and reduced the need for milling machines to a minimum. This policy was so successful that only the boltcarrier, barrel, barrel extension and a pair of brackets were completely machined and machine finishing was required only for the bolt, extractor and flash suppressor. The gun was gas operated using a conventional piston, operating rod, a rotating bolt lock and a 20 round magazine. The barrel was 20 inches long and the overall length was 44½ inches. In a carbine version it was 36.9 inches long — 27 with the butt folded. The standard gun weighed 8.75lb and fired at approx 650 rounds per minute with a choice of semi or auto fire at will. It was a nice looking gun and there appeared to be every prospect of wide sales but the emergence of the



An early version of the AR-10 (*Armalite Inc*)



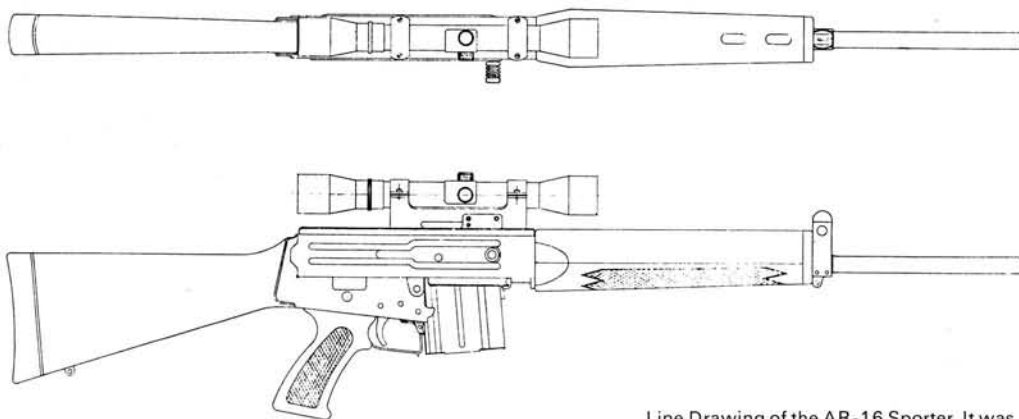
The first version of the AR-15. Note the cocking handle under the carrying handle and the reinforced plastic used in the butt and hand grip (*Armalite Inc*)



AR-16. This was a 7.62mm designed for ease and cheapness of production using the minimum of machine tools. It was not manufactured in quantity (*Armalite Inc*)



Carbine version of the AR-16  
(*Armalite Inc*)



Line Drawing of the AR-16 Sporter. It was  
not produced in large number  
(*Armalite Inc*)



5.56mm cartridge led to the interest of potential customers switching to the smaller calibre and Armalite decided to produce a .223 version which in due course became the AR-18. An AR-16 sporter was proposed but was never in large scale production.

#### **AR-17**

The 'golden gun'. This is a commercial 12 bore automatic 2 shot shotgun—usually supplied in a golden anodized finish. A black finish is also available. Using the experience gained with the AR-9, the very strong multi lug locking system of the military weapons, is employed. The bolt and chamber are of steel but the barrel and body are of 7001 aluminium alloy with a claimed ultimate tensile stress of 70,000psi. The butt and forearm are made of polycarbonate plastic. It is a recoil operated arm and so the force exerted on the firer's shoulder is less than that experienced with a conventional double-barrelled shotgun. The barrel is 24 inches in

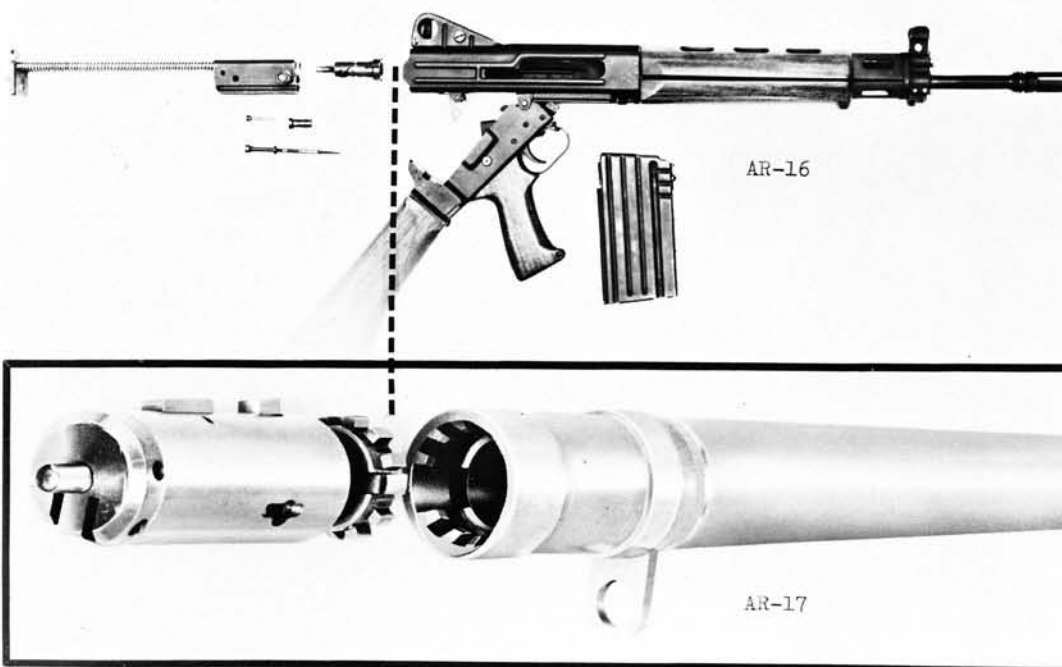
Colonel Burton T. Miller Vice-President of Armalite with the  
AR-17 shotgun (*Armalite Inc*)





The AR-17 broken down  
(*Armalite Inc*)

The locking system of the AR-17 came from the AR-16 (*Armalite Inc*)

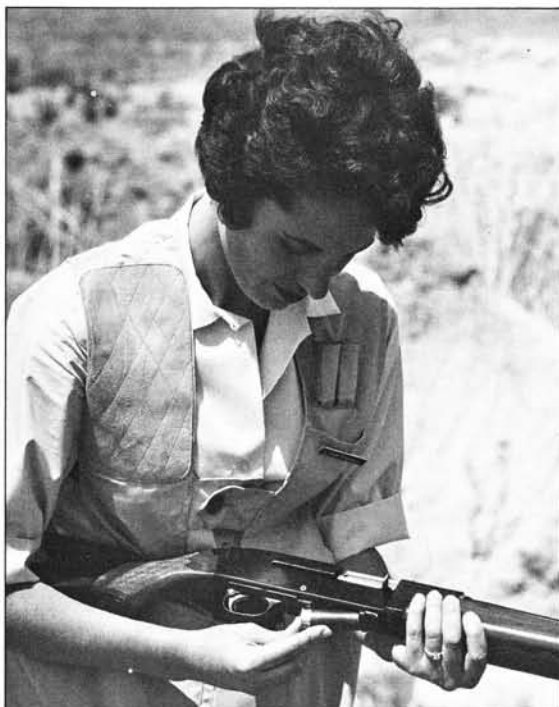


length and three choke tubes—modified, improved cylinder and full choke—are supplied with each gun. The gun not only caters for the normal shot but by making provision for the addition of weights both in the stock and forearm, allows the enthusiast to vary the position of the centre of gravity to suit his individual requirements.

The gun weighs 5.6lb and is 45 inches long assembled—24 inches when taken down. The body is 10 inches. There is a rubber recoil pad on the butt. When first marketed in 1964 it cost \$159.50.

### AR-18

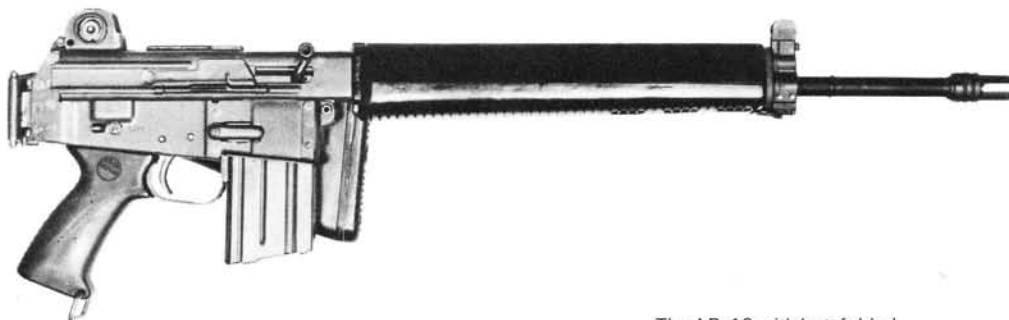
This came out in 1964 after two years of development subsequent to the finalisation of the basic design. It is a .223 version of the AR-16 with the same virtues of simplicity, economy and ease of production. In 1967 the Howa Machinery Company of Nagoya, Japan, started production but the program encountered difficulty when the Japanese Government would not permit exports to any country remotely involved in the Vietnam conflict. When a number were required for US testing, the



Loading the AR-17. A two shot automatic recoil operated shotgun largely made of aluminium alloy (Armalite Inc)



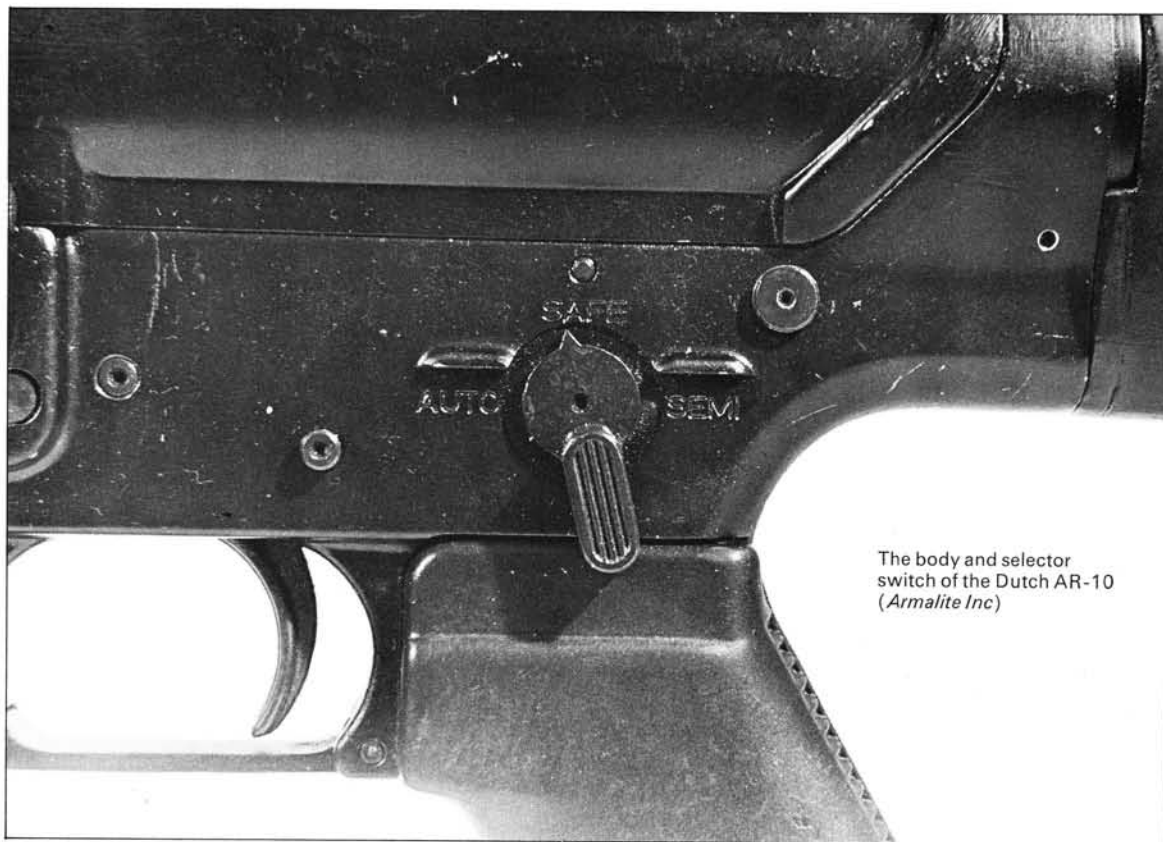
The AR-18. An inexpensive, accurate, sturdy .223 military rifle with a straight through design producing accurate fire both at single-shot and full-auto (Author)



The AR-18 with butt folded (Armalite Inc)



The standard AR-10 manufactured by Artillerie-Inrichtingen at Hembrug, Holland (Author)



The body and selector switch of the Dutch AR-10 (Armalite Inc)

Japanese Government denied Howa permission to supply them and the gun is now also in production by Armalite Inc at Costa Mesa in California. The Japanese Government subsequently approved delivery of AR-18 rifles to European, Latin American and even some non-combatant Asian countries.

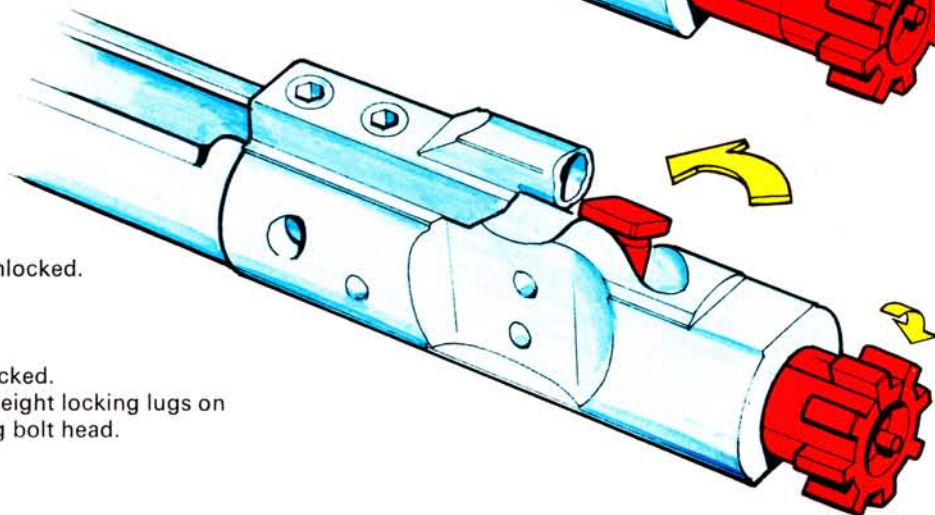
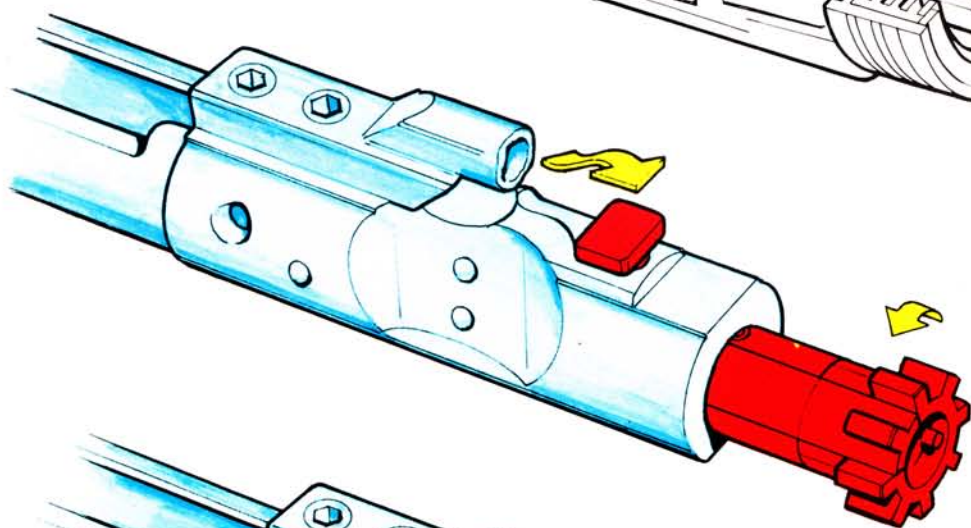
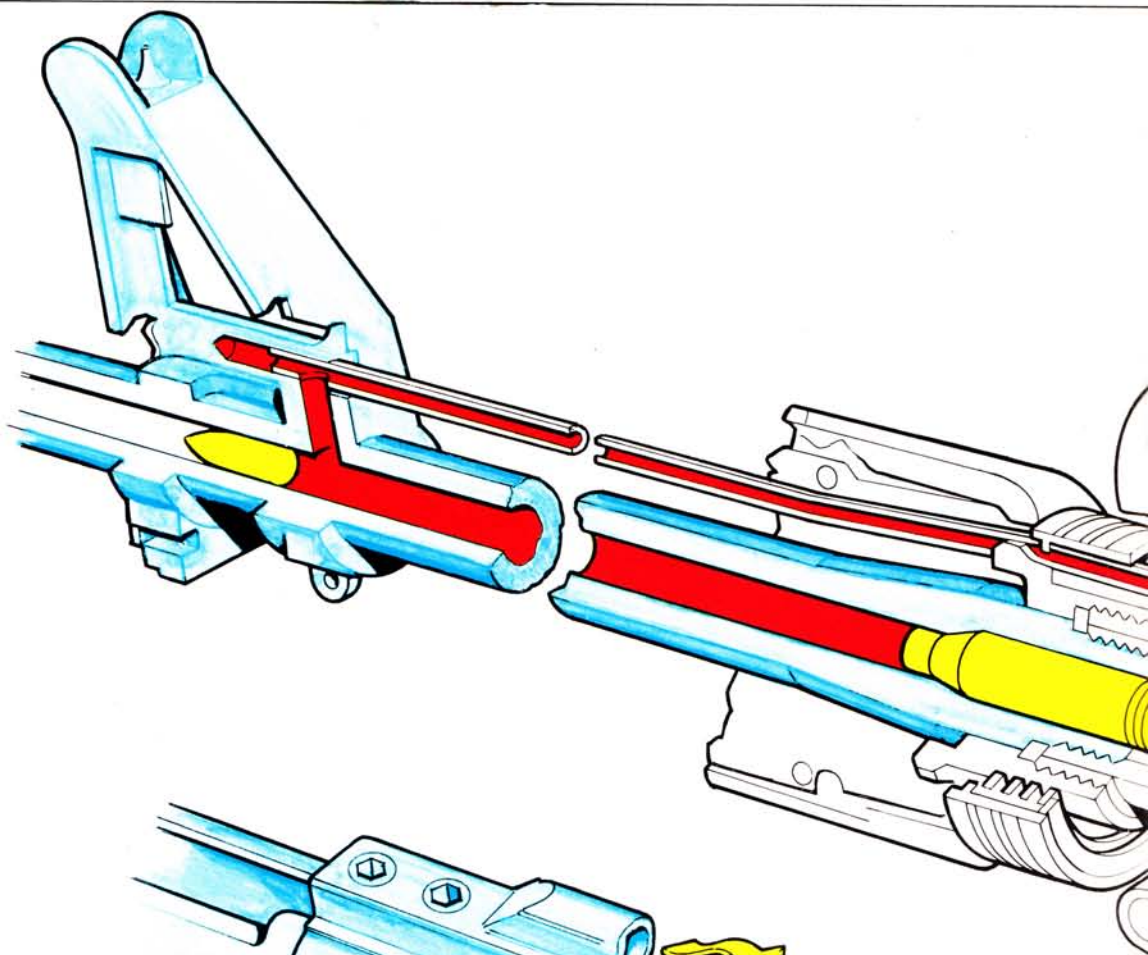
#### **AR-180**

This is a self loading version of the AR-18 designed for sporting use and employment by police forces. It has a modified trigger mechanism embodying seven changes to make it impossible for anyone to convert it to full auto, and to conform with US regulations features a reduced capacity magazine. Howa Machinery Company is presently manufacturing the AR-180 and delivering to Armalite for sale in the United States and other countries.

#### **The AR-10**

The feature of greatest interest in this gun is the gas system. The earliest designers of automatic weapons Maxim, Browning and Von Odkolek all became interested in gas operated weapons. Maxim obtained a British patent for a short stroke piston adaption of a Martini-Henry but concentrated largely on recoil operation and did not pursue the line of his patent. Browning evolved the swinging arm method in his 'potato-digger' in the Colt model 1895 and Von Odkolek sold his patents to Hotchkiss who produced a gas piston operated model in 1895.

The first 'direct action' gas system—eliminating the piston altogether was designed by Ljungman—a Swedish engineer. It was incorporated in the Halvautomatiskt Gever Ag-42, a rifle firing the Swedish 6.5mm cartridge. The principle was used



*Top*  
The bolt unlocked.

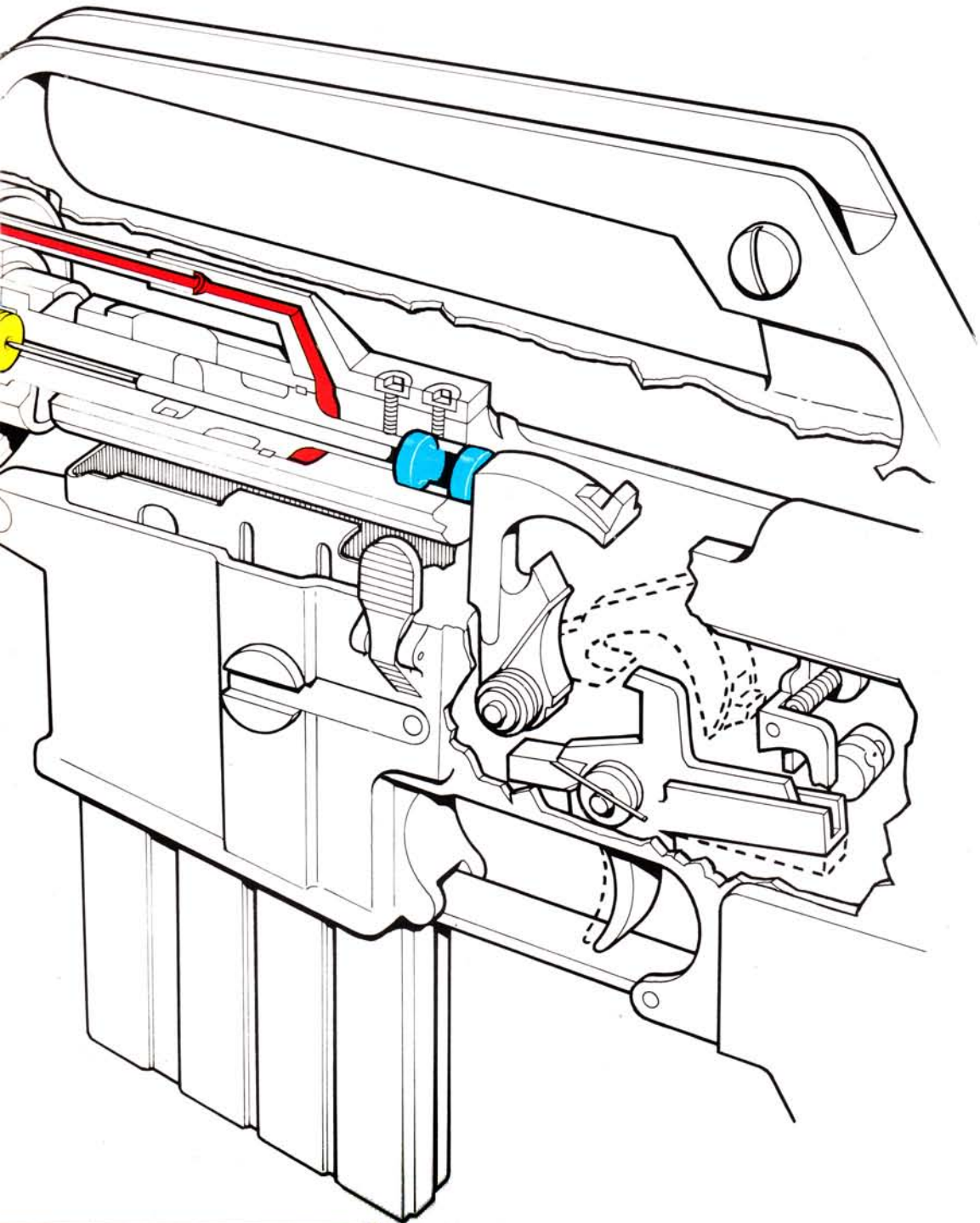
*Bottom*  
The bolt locked.  
Notice the eight locking lugs on  
the rotating bolt head.



### **The Armalite AR15 (M16) Rifle.**

The Stoner designed direct gas system is shown immediately after firing but before the breech has unlocked.

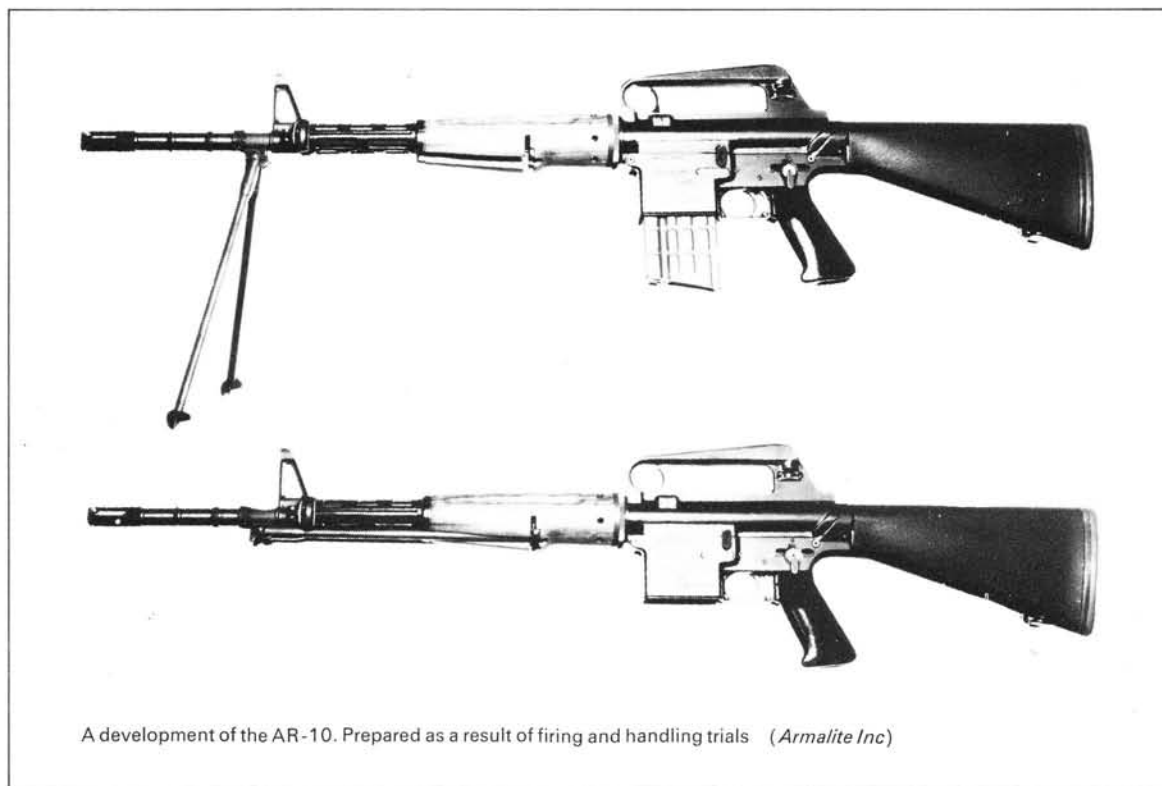
*T. Brittain © Profile Publications Ltd.*

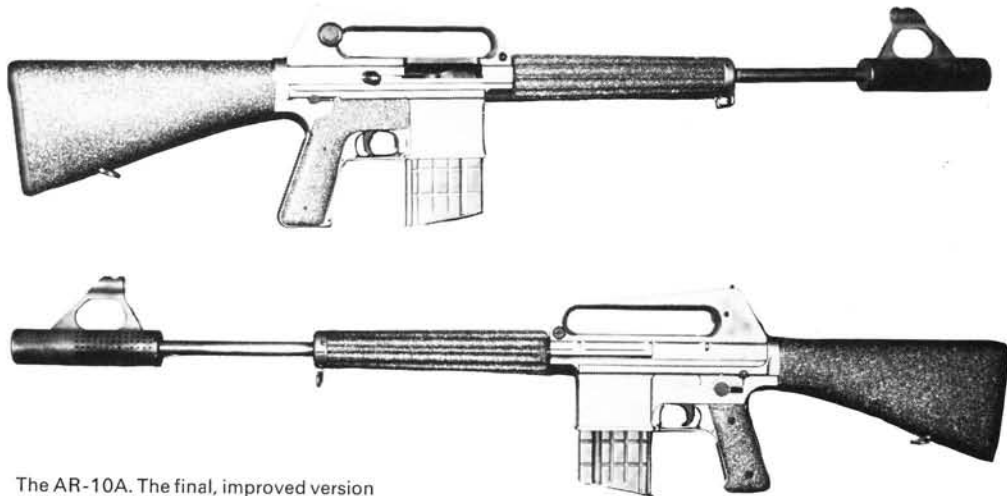




in the Madsen-Llunjman rifle, later the Hakim rifle and in the French MAS 59. From this it can be seen that the AR-10 followed a well tried pattern in which gas tapped off from the barrel flows back along a tube and produces a force to unlock the bolt. In the AR-10 the gas passes along a stainless steel tube and enters a space within the cylindrical shell of the bolt carrier. Here it forces the carrier back. After about  $\frac{1}{8}$  in of free travel to allow the chamber pressure to fall, a cam path cut in the carrier causes a pin on

the bolt to revolve about the longitudinal axis of the bolt and thus rotates the bolt locking lugs out of engagement with the barrel extension. The carrier then pulls the bolt bodily to the rear to start the operating cycle. There is no primary extraction and the empty case is pulled sharply out of the chamber and ejected from the gun. The bolt carrier stores energy in the return spring and comes forward again to chamber a round from the 20 round box magazine. When the cartridge is fully chambered





The AR-10A. The final, improved version which Colt's Patent Firearms would have produced (*Armalyte Inc*)



The AR-10 belt fed mounted on a tripod. The belt can just be seen feeding into the right hand side (*Armalyte Inc*)

Barrel changing on the machine gun version of the AR-10 (*Armalyte Inc*)

the seven locking lugs on the bolt head are rotated through  $22\frac{1}{2}$  degrees and lock behind abutments in the barrel extension. The hammer cannot be released until locking is completed. The weapon will fire at either single shot or full automatic with a selector lever on the left of the body. The aperture back sight is in the rear pillar of the carrying handle and is raised or lowered by a horizontal drum graduated from 200 to 700m by 100m divisions. Stripping the AR-10 is a simple matter. After the gun is made safe a pin located at the rear of the body is pulled out. The upper receiver then pivots up and the bolt and carrier assembly can be withdrawn and separated.

The AR-10 features the use of alloy forgings in the two parts of the receiver, fibreglass pistol grip and a



plastic butt. The magazine is of light alloy. These materials allow an unloaded weight of 9.0lb. Some variations on the AR-10 have been made. The principle variations are:

- 1 Short-barrelled carbine.
- 2 Magazine-fed LMG.
- 3 Belt-fed LMG.

None of these is in production.

The AR-10 has been singularly unfortunate in that it was developed when the emphasis was on the change to a smaller calibre and when there was a market the Dutch were very tardy in tooling up. In all only 5000 guns were made by Artillerie-Inrichtingen. Thus a potentially good gun never saw service.

### The AR-15

The .223 (5.56mm) AR-15 was designed by Eugene Stoner. It uses the same method of gas operation as the AR-10 and, broadly, is derived from that gun. To understand the reason for the adoption of this gun it is necessary to be aware of the user's needs. The Infantry Board, Fort Benning laid down the following as its requirement:

- 1 Loaded weight not to exceed 6lb.
- 2 Accuracy and maximum height of trajectory to be at least equal to that of the M1 rifle at ranges up to 500 yards.
- 3 Selective fire capability.
- 4 Penetration of body armour, steel helmet or 10 gauge steel plate at 500 yards.
- 5 Lethality not less than the M1 carbine at 500 yards.

These led to the design of a lightweight low impulse rifle firing a lightweight bullet at high velocity. No round of a suitable type existed so Armalite had to start by obtaining a cartridge. Whether the calibre and weight—.223in and 55 grains—selected were the best possible, is open to debate. In retrospect a calibre of .26 and perhaps 80 grains would have produced a round which could have the range and lethality required for a light machine gun. As a result of the requirements and the acquisition of a cartridge the AR-10 was scaled down for testing. The earliest prototypes even had the cocking handle on top of the body. Ten AR-15 rifles were delivered to the Infantry Board on 31 March 1958. They were tested at Aberdeen Proving Ground with satisfying results and the Board recommended that the AR-15 be considered as a replacement for the M14 7.62mm rifle. After arctic tests at Fort Greely modifications were made including strengthening the barrel to allow for firing with water in the bore, the trigger guard was modified to allowing firing in arctic mittens and the cocking handle was removed from inside the carrying handle and located behind it. Various other tests followed and a procurement programme started. The US Air Force was very interested and Lt-Col Burton T. Miller, then serving, tested the AR-15. The Air Force took 8500 in 1961, the Army took 85,000 in the same year followed by 85,000 in 1963, 35,000 in 1964, 100,000 in 1965 and a further 100,000 in 1966. The Vietnam

struggle undoubtedly increased the demand. Colt's Patent Firearms Company had been licensed to produce the gun in January 1959 and they manufactured the quantities mentioned. On 30 June 1967 the US Government and Colt made a contract whereby the Government agreed to pay \$4,500,000 for a license to use technical data and all patents relating to the M16 rifle. This enabled them to set up additional production from other firms and both General Motors and Harrington and Richardson have each manufactured the AR-15.

The original AR-15 was designated the M16. The Air Force version still has this nomenclature but the Army rifle was modified in 1966 to become the M16E1 and in 1967 this became the M16A1. The differences are chiefly that the M16A1 has a bolt with serrations on the right hand side and a plunger protruding from the body can be used to force the bolt home if the return spring for some reason is unable to do so. This device allows the firer to close his bolt when a dirty cartridge produces a high friction force and thus saves fitting a reciprocating cocking handle such as that used on the Russian AKM. Whether such a device is correct in principle is doubtful, because eventually forcing rounds into the chamber ignores the reason for the difficult chambering and may result in scoring the chamber, feeding a malformed cartridge or otherwise damaging the mechanism.

The original AR-15 had a twist of rifling of one turn in 14 inches. An unclassified US report produced by the Ballistics Laboratory entitled 'Exterior Ballistics of the AR-15 Rifle' showed that although the bullet was marginally stable in air at 60°F, when fired in Arctic conditions the bullet was totally unstable. This led to the production of a twist of one turn in 12 inches and with this increased rotation of the bullet it is now just stable at below zero air temperatures. This has resulted in some loss of lethality but not to a significant degree.

When the M16 was initially issued to troops in Vietnam—and particularly to the US Marines—they were told that the gun was self-cleaning. A spate of complaints about the case failing to eject led to a Congressional Enquiry. The causes were found to be associated with an unannounced change from tubular IMR propellant to ball propellant, and lack of cleaning. There is no doubt that ball powder does have several different effects to IMR. Chiefly, these are an increased rate of fire and depositions of fouling in the cavity between the bolt carrier and the bolt head. This carbon when hot is soft but after a short while it cools and hardens to produce a bond strong enough to prevent the bolt unlocking; nor can the rifle be hand operated. As a result the weapon became inoperative. Following from this enquiry several changes were made.

The soldier was issued with a cleaning kit, the buffer was modified to reduce the rate of fire and the chamber was chromium plated. The net effect of these innovations was to produce a rifle which now is at least as reliable as any other in service. Technically the AR-15 is much the same as the AR-10. It uses the direct gas action system and the same bolt system as its predecessor and has the



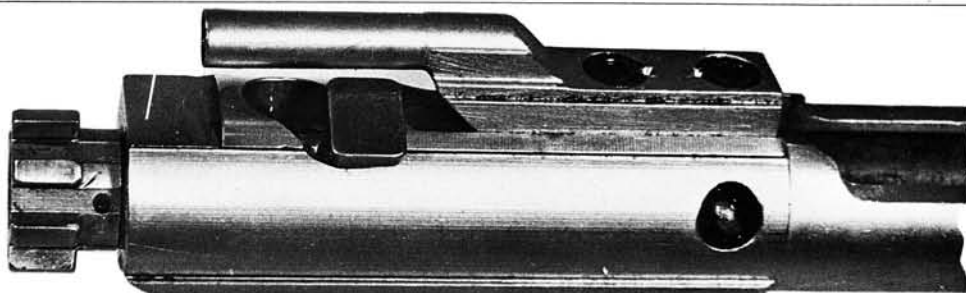
The standard M16A1 used by the US Army  
with a XM204 40mm Grenade Launcher  
(Author)



AR-15 (Author)



AR-15 Stripped  
(Author)



AR-15. Bolt carrier and cam pin (Author)

same butt giving a straight through action and thus reducing the tendency for the muzzle to rise at full automatic fire.

There is a civilian version firing as a self loading sporting rifle, known as the Colt Commanche. This name was later dropped due to objection by an Aircraft Manufacturer already using that name. There are also various military adaptations. These include a heavy barrelled version known as the Colt Automatic Rifle which can be magazine fed (M1) or a later version belt fed (M2). Both are bipod mounted. There is also the Colt Commando which is a short-barrelled version of the AR-15 with a very practical telescoping butt stock, designed as a submachine gun and used extensively in Vietnam by the Green Berets, the Special Forces Unit of the US Army.

### The AR-18

In early 1961 Eugene Stoner left Armalite and became a consultant working with Colt, Cadillac Gage and on the TMW 25mm cannon. The AR-18 was not his work but was designed after Armalite separated from Fairchild Aeroplane Company in 1961. (Arthur Miller was Armalite's Chief Engineer after Stoner left.) The patents for this gun are registered in the names of Miller, Dorchester and Sullivan. (The connection of the two latter named with Armalite has already been mentioned.) The AR-18 comes directly from the AR-16 which fired the 7.62mm NATO round and was never produced in quantity as interest in most countries was beginning to be directed to the .223in round. It is, I think, true to say that the AR-18 owes something to nearly all of its Armalite successors



The AR-18 with telescopic sight  
(Armalite Inc)

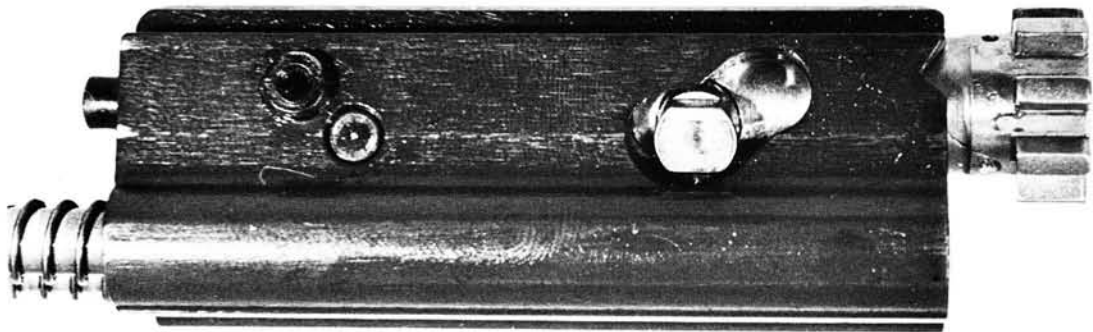


First stage of field stripping the AR-18  
(Author)

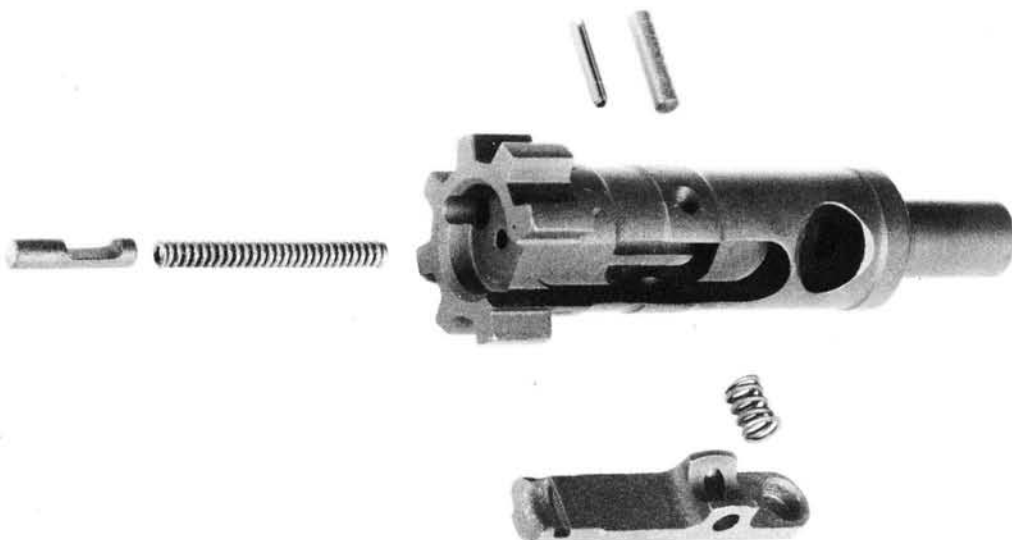




Colt Commando. A short barreled submachine gun with a neat telescoping butt, used by the Green Berets in Vietnam (Author)



AR-18 Bolt carrier and bolt (Author)



AR-18. Bolt stripped (Armalite Inc)

but in particular it was designed for simple, cheap quantity production by countries with limited facilities. The manufacturer says that it is produced from 14 stampings, 28 automatic screw machine operations, three machined castings, six mouldings, and four machined parts. These latter are the barrel, barrel extension, bolt carrier and extractor. Springs, washers, pins etc are bought out from commercial firms. The gun uses steel stampings instead of the alloy forgings of the AR-15. Armalite state that a run of 50,000 AR-18s is required to justify, economically, local production. This is less than any comparable weapon.

### System of Operation

The weapon is gas-operated with a vent located  $12\frac{3}{4}$  in from the breech face and  $5\frac{3}{8}$  in from the muzzle. The cylinder is of stainless steel mounted above the barrel with  $\frac{3}{16}$  in clearance. It is  $1\frac{3}{8}$  in long. The cylinder takes the form of a hollow spigot over which fits a female piston  $1\frac{7}{8}$  in long. The male member has a gas ring around the end. When the piston has moved back  $\frac{1}{2}$  in, four vents pass over the gas ring and the gas is evacuated under the top of the fore grip. Thus the working impulse is imparted to the piston over only  $\frac{1}{2}$  in travel. The actuating rod is in two parts; a short head 1 in long which fits into the main rod  $9\frac{7}{8}$  in in length. This rod has a collar  $3\frac{3}{4}$  in from the end which forms the forward housing of the actuating rod return spring. This short stroke piston action is similar in design principle to that of the German war-time Gewehr 43. There is no gas regulator. The rod is in contact with the top of the front face of the bolt carrier and in its  $\frac{1}{2}$  in movement imparts enough energy for the completion of the entire cycle of operations. The bolt head carries seven locking lugs which are rotated for locking through  $22\frac{1}{2}^\circ$  to engage in front of corresponding locking shoulders in the barrel extension. On the shaft of the bolt is a pin which projects to enter a cam way on the carrier. When the carrier moves back impelled by the piston thrust, the pin first moves across the width of the camway—a distance of  $\frac{1}{8}$  in—to provide mechanical safety, and is then forced down to rotate and unlock the bolt head. The pin rides in a spot welded guideway which prevents any movement. The continued rearward movement of the carrier pulls the bolt with it to the rear. The extractor is mounted at 3 o'clock on the bolt face and withdraws the empty case which is ejected through an opening on the right of the receiver by the action of a spring-loaded plunger set in the bolt face at 9 o'clock which acts as soon as the case is free of the barrel extension. The bolt moves back along two guide rods which pass through it, compressing the two return springs mounted around the rods.

On the forward movement of the carrier the lowest of the bolt locking lugs pushes the top round of the 20 in the magazine forward and it is guided up into the chamber. The bolt reaches the limit of its forward travel and is then rotated to lock by the action of the camway on the pin. After locking is completed the carrier travels forward a further  $\frac{1}{8}$  in to provide mechanical safety before firing. Until this last  $\frac{1}{8}$  in is completed the firing pin mounted in the carrier

cannot reach the cap. The firing pin is strongly spring retracted and so 'g' forces cannot produce an unintentional firing—as was the case in the early AR-15 which had a heavy free-floating pin.

### Trigger and Firing Mechanism

The weapon will fire at either single shot or full automatic.

### Full Auto

Lying along the bottom of the receiver is a spring-loaded rod which at its front end carries a vertical hook which is driven forward by the bolt carrier as locking is completed. This forward movement rotates the automatic sear backwards and releases the hammer. Thus the weapon can only fire when locking is completed. Pulling the trigger lowers the trigger extension which is engaged on a bent on an extension of the hammer below its axis pin. This fires the first shot. Thereafter firing is controlled, whilst the trigger remains pressed, by the spring-loaded rod which activates the automatic or 'safety' sear.

### Single Shot

The trigger extension releases the hammer and the round is fired. The hammer comes back and through a hole in it passes a secondary sear which is spring-loaded and grips the front edge of the aperture in the hammer. The trigger must be released to free this sear and the hammer is then gripped by the trigger extension. This in principle is an adaptation of the double bent system used on the Garand and M14. Putting the change lever to 'semi' rotates the spindle which holds the safety sear out of operation. This means that the trigger can be operated with the bolt only partially forward. The gun is completely safe because the hammer energy is then used to close the bolt and a misfire results.

### Safety

The hammer must be cocked before the safety can be applied. The change lever spindle forces the secondary sear down and locks it. At the same time it rotates over a backward extension of the trigger and locks that.

In general it is a very pleasant weapon to handle and fire. It is accurate and consistent. There is a submachine gun version with a shortened barrel and also a self loading sporter rifle known as the Armalite AR-180 which has received very favourable comment in the US magazines.

### Conclusions

Prior to World War II nearly all design, development and production in the USA was concentrated in the Arsenal.

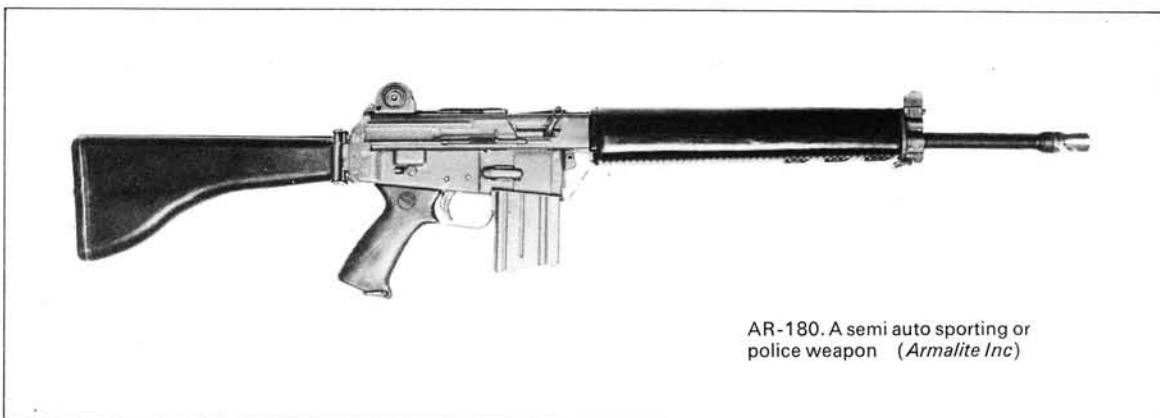
The Armalite Corporation has shown that private enterprise can do a fine job and in producing the AR-15 at the crucial moment when the inadequacies of the M14 were very apparent, it stepped into the role of provider for the US Forces in Vietnam. When the time comes for the next generation of rifles to be adopted Armalite will doubtless have something ready for consideration.



AR-18. Flash hider and bayonet  
(*Armalite Inc*)



AR-18S. A submachine gun version  
of the AR-18. With shortened barrel  
and butt folded it makes a very  
handy close quarter weapon  
(*Author*)



AR-180. A semi auto sporting or  
police weapon (*Armalite Inc*)

# ARMALITE WEAPONS COMPARATIVE TABLE

	AR-10	AR-15	AR-18
<i>Calibre</i>	7-62mm NATO	.223in	.223in
<i>Type of Ammunition</i>	Any approved NATO	Remington, Norma, Federal etc	Remington, Norma, Federal etc
<i>Muzzle Energy</i>	2340ft lb	1285ft lb	1285ft lb
<i>Recoil Energy</i>	10½ft lb	4-4ft lb	4-13ft lb
<i>Muzzle Velocity</i>	2750ft/s	3250ft/s	3250ft/s
<i>Overall length</i>	40½in	38½in	38½in
<i>Length stock retracted</i>	—	—	29in
<i>Weight empty</i>	9-0lb	6-5lb	7-0lb
<i>Weight with full 20 rd magazine</i>	10-6lb	7-25lb	7-75lb
<i>Barrel length</i>	20in	20in	18½in
<i>No of grooves</i>	4	6	6
<i>Direction of Twist</i>	RH	RH	RH
<i>Pitch of Twist</i>	1 in 10in	1 in 12in	1 in 12in
<i>Locking</i>	Rotating bolt	Rotating bolt	Rotating bolt
<i>Gas system</i>	Direct action	Direct action	Piston
<b>Sights</b>			
<i>Front</i>	Fixed blade	Cylindrical post	Cylindrical post
<i>Rear</i>	Aperture 200-700	Aperture Flip	Aperture 200 and 400 Flip
<i>Windage</i>	Nil	Variable plate	Milled knob
<i>Zeroing</i>	Elevation—Rear sight Line—Rear sight	Elevation—Foresight Line—Foresight	Elevation—Foresight Line—Windage scale
<i>Sightbase</i>	20½in	20in	19½ and 20in
<b>Effective Range</b>			
<i>Single shot</i>	400m	400m	400m
<i>Full auto</i>	150m	300m	300m
<b>Rate of Fire</b>			
<i>Single shot</i>	40rpm	40rpm	40rpm
<i>Auto (bursts)</i>	80rpm	80rpm	80rpm
<i>Cyclic</i>	700rpm	650-850rpm	800rpm

AR-18S. Photograph showing accuracy and penetration achieved at 300 and 365 yards  
(Armalite Inc)

