

MODERN FIREARMS

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9A-91 compact assault rifle (Russia)

Caliber: 9x39 mm

Action: Gas operated, rotating bolt

Overall length: 605 mm with open butt, 383 mm with folded butt

Barrel length: ??

Weight: 2.1 kg empty

Rate of fire: 600-800 rounds per minute

Magazine capacity: 20 rounds



The 9A-91 9 mm compact assault rifle was originally developed as a part of the A91 family of compact weapons, which included versions chambered for 7.62 x 39, 5.45 x

39, 9 x 39 and 5.56 x 45 ammunition. Of those, only the 9 mm version survived and entered small-scale production at the Tula Arms Factory in 1994. Designed by the famous KBP design bureau in Tula, the 9A-91 was originally intended for an Army PDW (Personal Defense Weapon) role, but instead found some favor in the ranks of MVD and Russian police troops, as a less expensive (and somewhat more versatile) equivalent of the SR-3 "Vikhr" compact assault rifle. The 9A-91 also served as a basis for a silenced "para-sniper" weapon, the VSK-94, also chambered for 9 x 39 ammunition.



9A-91 compact assault rifle (current production model) with attached silencer and red-dot sight

The 9A-91 rifle is a gas operated, rotating bolt weapon, which utilizes a long stroke gas piston, located above the barrel, and a rotating bolt with 4 lugs. The receiver is made from steel stampings; the forend and pistol grip are made from polymer. The steel buttstock folds up and above the receiver when not in use.

The charging handle is located on the right side of bolt carrier (it was welded solid on early production guns, or can be folded up on current production guns). The safety / fire selector lever was located at the left side of the receiver on early guns, but was since relocated to the right side, to clear space for the sight mounting rail. Safety / fire selector lever has 3 positions and allows for single shots and full automatic fire.



9A-91 compact assault rifle (current production model) with silencer detached and shoulder stock folded

The flip-up rear sight has settings for 100 and 200 meters range, but the relatively short sight base and steep trajectory of the subsonic bullet effectively restricts the 9A9-1 to ranges of about 100 meters, at which the 9 x 39 ammunition is clearly superior in penetration and hitting power to either 9mm pistol ammunition from submachine guns, or 5.45 and 5.56 mm ammunition from compact assault rifles like AKS-74U or HK-53. To aid aiming, current production 9A-91 rifles are fitted with mounting rail on the left side of receiver, which allows instalation of mounts with day (telescope or red-dot) or night (IR) sights.



A-91 assault rifle (Russia)

Caliber: 7.62x39mm and 5.56x45mm NATO

Action: Gas operated, rotating bolt

Overall length: 660 mm

Barrel length: ??

Weight: 3.97 kg empty (with integral grenade launcher)

Rate of fire: 600-800 rounds per minute

Magazine capacity: 30 rounds

The A-91 bullpup assault rifle (also known as A-91M) was developed during the 1990s by KBP (Instrument Design Bureau) in Tula, as an offspring of the A-91 family of compact assault rifles described above in the 9A-91 article. While the A-91 retains the basic gas-operated, rotating bolt action and a trigger unit design from 9A-91, it features a bullpup polymer housing, with an integral 40 mm single-shot grenade launcher mounted under the barrel. The earliest prototypes of the A-91 bullpup were fitted with the grenade launcher above the barrel, and with a front vertical foregrip; current models are fitted with the underbarrel launcher, which also serves as a forearm. The A-91 features a forward ejection system, initially developed in Tula by designers like Afanasiev during the early 1960s. In this system, the ejection port is located above the pistol grip, and points forward. Extracted cases are fed from bolt head through the short ejection tube to the ejection port, and fall out of the gun well clear of the shooter's face, even when firing from the left shoulder. As for now, the A-91 is made in small number and, probably, is used by some elite law enforcement units in Russia; it is also offered for export and domestic military and police sales.



7.62mm prototype A-91 bullpup assault rifle, as made in mid-1990s. The integral 40mm grenade launcher is mounted above the barrel

The controls include double triggers (front for grenade launcher, back for rifle), and a large fire mode / safety lever at the right side of the receiver, above the magazine housing. The rifle trigger is fitted with an additional automatic trigger safety.

The charging handle is located above the receiver, under the carrying handle, and is easily accessible for either hand. The sights include a front post, mounted on a high base, and an aperture rear, adjustable for range, which is mounted on the integral carrying handle. The top of the carrying handle is shaped as a Weaver-type rail, and can accept a wide variety of scopes and sights. Folding grenade launcher sights are mounted at the front of the barrel.

Originally developed for 7.62 x 39 ammunition and standard AK-pattern magazines, the A-91 bullpup is now also available in 5.56 x 45 NATO chambering, which uses proprietary 30 round polymer magazines.



5.56mm NATO A-91 assault rifle, most recent version (2003).

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AICW - Advanced Infantry Combat Weapon (Australia)

Caliber: 5.56x45mm NATO + 40mm

Action: Gas operated, rotating bolt + Metal Storm patented stacked-projectile caseless

Overall length: 738 mm

Barrel length: n/a

Weight: 6.48 kg unloaded, w/o sight; 7.85 kg loaded w/o sight (30 5.56mm + 3 40mm rounds); 9.9-9.9 kg loaded w. electronic sight

Rate of fire: 650 rounds per minute (for 5.56mm barrel)

Capacity: 30 rounds (5.56mm) magazine plus 3 40mm rounds in the G/L barrel

The AICW (Advanced Infantry Combat Weapon) is a joint development of the Australian DSTO (Government operated Defence Science and Technology Organisation), and private companies Metal Storm and Tenix Defence. This development has been carried out since the turn of 21st century, closely following the concept of the American XM29 OICW system. Overall, AICW represents the modular weapon system that combines the 5.56mm rifle/carbine component as a host (basic) platform with 40mm multi-shot grenade launcher (G/L) module and multi-purpose electro-optical sighting system, which can be used to fire either rifle or G/L component, and also can provide recon data to external "consumers" such as tactical computers.



2003 concept of the AICW system

The host rifle component of the AICW is the updated Australian-made F88 rifle, which is a license-built Steyr AUG. However, the basic F88 rifle has been extensively modified to accept other elements of the system - for example, receiver has been upgraded to receive the G/L module at the top, and the buttstock has been enlarged to accommodate G/L electronic fire control module. Other changes include modification to the safety and trigger arrangements - AICW system has a single trigger for both weapon components (5.56 and 40mm), and a three position (safe - rifle - G/L) safety / selector switch at the side of the pistol grip.



2001 concept of the AICW system

The most interesting part of the AICW weapon is the multi-shot Metal Storm 40mm grenade launcher, which looks like a single 40mm G/L barrel but contains three 40mm projectiles stacked one behind the another. These projectiles are launched using the electric ignition impulses, provided by the fire control module built into the buttstock of the host rifle. Since the muzzle velocity of these projectiles is slightly more than usual for 40mm handheld G/L (95m/s instead of 75m/s), host rifle incorporates the recoil reduction buffer, that allows the Metal Storm G/L barrel to recoil against the spring, decreasing the peak recoil impulse.

The top of the receiver hosts the multi-role sights of various type and make. At the AICW VX3 live fire demonstrations that took place in the summer of 2005, AICW prototypes were displayed with ITL Viper multi-purpose rifle sight (that incorporates laser range-finder and digital compass), or with Vinghong Vingsight Fire Control System. At the present time (late 2005) AICW prototypes have not yet fired 40mm grenades with live warheads, nor incorporated an airburst facility.

However, it is stated that it is possible to easily adapt most of the existing 40mm grenade warheads to the Metal Storm technology, including air-bursting grenades that are now in development in several countries.



2005 testing prototype AICW VX3 weapon

At the present time AICW weapons are available only as the "3rd generation technology demonstrators", that completed first live-fire trials (as a complete system) in the summer of 2005. Current Australian MOD plans state that ADF may start to purchase AICW systems in around 2010-2012.

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ADD / Daewoo K11 dual-caliber air-burst weapon (South Korea)

Caliber: 5.56x45mm NATO + 20x30B mm

Action: Gas operated, rotating bolt for 5.56mm and manually operated for 20mm

Overall length: 860 mm

Barrel length: 310 mm (5.56mm); 405 mm (20mm)

Weight: 6.1 kg (with optics and battery but less magazines)

Rate of fire: ?

Magazine capacity: 30 rounds of 5.56mm and 5 rounds of 20mm

The K11 dual-caliber air-burst weapon was first shown to public in 2009, during DSEI military expo, although information on its development was available since about 2006. The K11 (XK11 during early development) weapon is being developed under direction of the Agency for Defense Development of the Republic of Korea. The K11 shows more than passing similarity to the ill-fated American XM-29 OICW weapon, but it appears that K11 has better chances to see the service - it is believed that first unit of South Korean army could receive the K11 weapons in 2010. This is not surprising, considering the fact that Republic of Korea is among world's leading countries in the field of design and production of advanced micro-electronics, and also has an established defense industry and strong motivation for constant upgrade of military equipment. As of now, the K11 dual-caliber air-burst weapon is proposed for infantry squad support role, multiplying soldiers capabilities to engage enemy personnel in defilade and soft-skinned vehicles and equipment, using 20mm air-burst grenades with pre-programmed fuse and 5.56mm ammunition for short- to medium range direct fire.



K11 dual-caliber air-burst weapon, left side

K11 dual-caliber air-burst weapon consists of three major units, linked into one weapon. Those are 20mm multi-shot grenade launcher (which serves as a bone to the system), the 5.56mm automatic rifle with firing controls, and an electronic fire control unit. The grenade launcher is a manually operated, bolt action weapon that is fed from detachable box magazines. It is built in bullpup layout, with aluminum alloy receiver and titanium alloy barrel. The trigger system of the grenade launcher is mechanically linked to the trigger / selector / safety unit of the integral rifle component. The rifle component is more or less conventional, gas operated, rotary bolt selective-fire weapon which uses M16-type magazines. Its layout is more or less similar to US-made M16 or Korean-made K2 rifles. The trigger unit is a common part between grenade launcher and rifle components, with single safety / fire selector lever providing fire from grenade launcher (single shots) or rifle (single shots or 3-round bursts). The third component is an electronic fire control unit, which includes laser rangefinder, environmental sensors, ballistic computer, and day (optical) and night (IR) sighting channels.



K11 dual-caliber air-burst weapon, right side

The ballistic computer output is fed to the electronic aiming reticle (providing visible point of aim pre-set for proper range) and to the fuse-programming unit in the grenade launcher, which sets the 20mm grenade to explode at specified range, above or to the side of the target, to provide maximum kill effect from explosive fragmenting warhead. At the present time, two types of 20mm ammunition are specified for K11 grenade launcher - the K167 HE air-burst grenade and K168 TP target practice grenade. Rifle component can use any NATO-standard 5.56mm ammunition.

ADS dual-medium/amphibious/underwater assault rifle **(Russia)**

Caliber: 5.45x39mm 7N6 / 7N10 / 7N22 for above-water fire and 5.45x39 PSP or PSP-U
for under-water fire

Action: Gas operated, rotating bolt

Overall length: 660 mm

Barrel length: 415 mm

Weight: 4.6 kg (with integral 40mm grenade launcher)

Rate of fire: 600-800 rounds per minute

Magazine capacity: 30 rounds

For several decades, Soviet and then Russian combat divers and Naval commando units were armed with special weapons for underwater combat, including the SPP-1 pistol and APS underwater assault rifle. The main drawback of these weapons is that their effectiveness (and life expectancy) for use above the water is severely degraded compared to standard 'above water' weapons. Therefore, combat divers and other Spetsnaz units, when engaged in amphibious operations (below the water and above), had to carry on the mission two types of weapons - one for underwater use and another for use when on shore or on board of enemy surface vessels.



early prototype of the ADS dual-medium / amphibious assault rifle configured for above-water fire, with standard AK-74 magazine loaded with 5.45x39 ammunition

The first known attempt to produce a single weapon which could be effectively used either below or above the water was the ASM-DT experimental 'dual-medium' or amphibious assault rifle, developed in Tula in around 2000. The main problem with ASM-DT was that it still had to use extremely long, specially designed underwater ammunition when submerged, which necessitated overly long receiver, complicated magazine well of adjustable size and two types of magazines.

This was found unsuitable for combat use, and further development commenced at the famous arms development facility KBP (Instrument Design Bureau) in Tula. By 2005, design team at KBP has successfully developed effective underwater ammunition which retains the compact size of the standard issue 5.45x39 7N6 ball (as well as 7N10 and 7N22 AP) rounds, and thus can be loaded and fired from standard AK-74-type box magazines, and, more importantly, fired from the same chambers and barrels that would accept the 'above-water' 7N6 ammunition.



early prototype of the ADS dual-medium / amphibious assault rifle configured for under-water fire, loaded with special magazine with underwater ammunition with long, needle-like bullets; it was based on the earlier ASM-DT experimental dual-medium / amphibious assault rifle

This new cartridge is known as 5.45x39 PSP, and is externally similar to standard 5.45x39 ammunition except that it has a different bullet shape. Internally it differs in having a long bullet, which has specially calculated shape and protrudes back into the cartridge case all the way to the bottom, with overall bullet length being about 53mm (2.1 inch), compared to overall cartridge length of 57mm. There are two types of PSP ammunition, the 5.45 PSP (combat ammunition) with hardened steel projectile weighting 16 gram (muzzle velocity on air about 330 m/s) and 5.45 PSP-U (practice / training ammunition) with bronze projectile weighting 8 gram (muzzle velocity on air about 430 m/s). Effective range with PSP ammunition varies from 25 meters at 5 meters depth to 18 meters at 20 meters depth; effective range of the PSP-U training ammunition when below the water is about 2 times shorter.

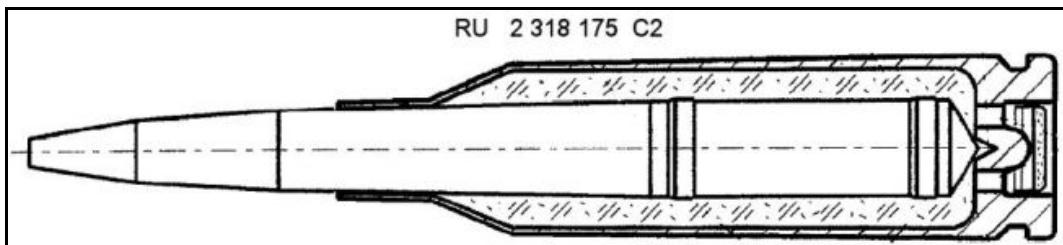


Diagram from original Russian patent, issued in 2006, for the design of the 5.45x39 PSP underwater cartridge and bullet, which protrudes down the cartridge case all the way to its base

Having settled on new ammunition, designer at KBP commenced work on the new weapon, well suitable for both surface and underwater combat. This new rifle was designated as ADS (АДС - *Автомат Двухсредный Специальный* - *Avtomat Dual-medium, Special*). They used the A-91M bullpup assault rifle as a starting point, retaining its bullpup layout, gas operated action with rotary bolt locking and forward ejection through the short tube running above and to the right of the barrel. Some parts of the weapon were necessarily redesigned and materials revised to work reliably when submerged in water, gas system was modified with addition of the environment selector ("air / water"). Integral 40mm grenade launcher (which fires VOG-25 type 'caseless' grenades using additional front trigger inside the trigger guard) is fitted with removable barrel which can be removed when it is not needed by the mission profile. Muzzle of the barrel is threaded to accept muzzle brake / compensator, tactical silencer or blank-firing adapter. Rifle is fitted with adjustable iron sights, and an integral carrying handle is provided with Picatinny type rail on the top to accept various day and night optical sights. The ADS can fire any standard issue 5.45x39 ammunition (ball, tracer, AP) when above the water, with accuracy and effectiveness similar, if not better than of AK-74 / AK-74M general issue assault rifle. When submerged and loaded with 5.45 PSP ammunition, ADS outperforms APS underwater assault rifle in terms of accuracy and ease of handling.



ADS dual-medium / amphibious / underwater assault rifle, current model, which can be used in same configuration either above or below the water, with only change being ammunition type (in similar magazines)

As of now (mid-2009), the ADS is said to be under extensive field trials by undisclosed units of Russian Naval special forces. If adopted, it will replace APS underwater weapons and, possibly, some AK-74M general issue assault rifles in service with Russian Navy special operation units and other Russian special forces, which might be engaged in underwater operations (security, counter-terrorism in the sea, etc).



ADS dual-medium / amphibious / underwater assault rifle configured for above-water "Spetsnaz" use; grenade launcher barrel is removed, and a silencer and night sight are installed for special operations

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AEK-971 assault rifle (Russia)

Caliber: 5.45x39mm (AEK-971), 5.56x45 (AEK-972) and 7.62x39mm (AEK-973)

Action: Gas operated, rotating bolt, balanced

Overall length: 965 mm

Barrel length: 420 mm

Weight: 3.3 kg without magazine

Magazine capacity: 30 rds, all standard AK-47 or AK-74 magazines depending on caliber

The AEK-971 assault rifle was developed at Kovrov Machinebuilding Plant (formerly known as Kovrov Machineguns Plant) by chief designer S.I. Koksharov. Originally designed and tested during 'Abakan' trials of late 1980s, it failed in trials, but its development was continued in hopes to sell the gun to police forces and for export.



Prototype AEK-973S rifle in 7.62x39mm with telescoped butt

During early 2000s small batches of AEK-971 rifles in 5.45x39 caliber were manufactured for Russian MVD (internal affairs ministry) troops, but its production has ceased in 2006, as Kovrov Machinebuilding Plant got rid of all military production and switched to civilian products only. All plans, tools and technological packages for AEK weapons were transferred to the ZID plant in the same city, but production of the AEK-971 was not resumed due to the lack of orders that might warrant expensive tooling and production setup at new factory.



early model AEK-971 rifle in 5.45x39mm

The AEK-971 assault rifle has a gas driven, balanced action with rotating bolt locking. Balancing mean that AEK971 gas drive has two gas chambers and two gas pistons. The first gas piston is linked via a gas rod to the bolt carrier and operates as usual. The second gas piston is linked to a balancing steel weight and moves in the opposite direction to the main gas piston. Both pistons are synchronized through a simple gear. This design is intended to eliminate three of the four elements of action impulses, which cause a rifle to move during full-auto fire. The first impulse is received when the bullet moves along the barrel - this is the basic recoil itself. The second impulse is received when the heavy bolt carrier/bolt group moves along the receiver back and forth. The third impulse is received when bolt carrier/bolt group slams against the receiver in the rear position, and the fourth when this group is stopped in the forward position after a new cartridge is chambered.



late production model AEK-971 rifle in 5.45x39mm with red-dot sight

The synchronous and opposite movement of the balancing weight eliminates all except the recoil impulse, so the rifle becomes far more stable during full-auto fire. The gain in accuracy in full auto is about 15-20%, when compared to the AK-74 assault rifle in the same caliber. The AN-94 assault rifle, which was officially adopted by Russian army, has a slight edge over the AEK-971 only in short burst (2 rounds only) mode. In full-auto medium or long burst fire mode (3-5 or 7-10 rounds per burst) AEK-971 wins hands down, being also some 0.5kg lighter than the AN-94, and much simpler and cheaper to manufacture.



early model AEK-973 rifle in 7.62x39mm

AEK-971 has a side-folding plastic buttstock, a plastic forearm and fire control grip, and uses standard AK/AKM or AK-74 30-round magazines (depending on the chambering). It also features a safety switch/fire mode selector of different appearance from the Kalashnikov design. The fire selector allows 3 modes of fire - single shots, 3-round bursts and full auto.

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APS 95 (Croatia)

Caliber: 5.56x45 mm NATO
Action: Gas operated, rotating bolt
Overall length: 980 mm; (730 mm with stock folded)
Barrel length: 450 mm
Weight: 3.8 kg empty
Rate of fire: 650 rounds per minute
Magazine capacity: 35 rounds

The APS 95 assault rifle was developed in mid-1990s by Croatian company RH-Alan to replace aging M70 assault rifles of Yugoslavian origins then in service with Croatian army. Rifle was adopted in 1995 and was acquired by Croatian army in some numbers, but due to financial limitations the rearming was not complete. APS 95 is still in service, and it seen some action during 1995 Yugoslavia - Croatia conflict.



APS 95 is a licensed copy of the Israeli Galil assault rifle (some sources said that it is a copy of the South African Vektor R-4 rifle, but it is, basically, the same Galil). APS 95 differs from Galil mostly in external appearance, having installed a 1.5X optical scope, which also serves as a carrying handle. Handguards and pistol grip also were redesigned.

APS 95 is a gas operated, long piston stroke, rotating bolt locked selective fire weapon. Gas system featured a gas cut-off, which is activated to fire rifle grenades. Fire-selector / safety is of Galil type, metallic buttstock is folding to the right side of the gun. 1.5X fixed scope featured ring and dot aiming reticle and allows for effective shooting up to 400 meters distance. Backup iron sights also provided as a standard.

APS underwater assault rifle (Russia)

Caliber: 5.6x39 mm MPS

Action: Gas operated, rotating bolt

Overall length: 823 mm (butt retracted), 615 mm (butt collapsed)

Barrel length: n/a

Weight: 2.4 kg less magazine; 3.4 loaded

Rate of fire: 600 rounds per minute (in air)

Magazine capacity: 26 rounds

The APS (*Avtomat Podvodnyj Spetsialnyj* = Special Underwater Assault rifle) was developed during the early 1970s at TSNIITOCHMASH (Central Institute for Precision Machine building) by the team lead by V. Simonov. APS has been in active service with combat divers of the Soviet and Russian Navy since circa 1975.



The APS is designed for special underwater cartridges, which fire 5.66 mm needle-like projectiles 120 mm long. The projectiles are stabilized using a hydrodynamic cavity, generated by the flat point of the projectile. The cartridges use standard 5.45 x 39 cases, sealed from water. The APS itself is a relatively crude, smoothbore arm, with a gas operated, rotating bolt action, fired from an open bolt. Single safety / selector switch is located at the left side of the receiver and allows for single shots and full automatic fire. The gas system features a patented self-adjusting gas valve, which allows the gun to be fired both underwater and in atmosphere. The simple trigger unit allows for single shots and full automatic fire. The rate of fire under water, as well as the effective range,

depends on the actual depth. Sights are crude: a non-adjustable open notch rear and post front. The retractable buttstock is made from steel wire.

The most complicated thing in the whole design is the feed system, which includes several parts to avoid double and even triple feed with the extremely long projectiles. Unusually deep (front to back) magazines are made from polymer and hold 26 rounds.



It must be noted that while APS could be fired "above the water", it should be done only in the case of emergency. According to the available sources, the expected service life of the APS when fired "in the air" degrades severely, and the effective range is limited only to several tens of meters. So, the APS is useful only under the water, where it is quite effective.

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Armalite / Colt AR-15 / M16 M16A1 M16A2 M16A3 M16A4 assault rifle (USA)

	M16A1	M16A2	M16A4
Caliber	5.56x45mm (.223 Remington), M193	5.56x45mm NATO / M855	5.56x45mm NATO / M855
Action	gas operated, rotating bolt		
Overall length	986 mm	1006 mm	1000 mm
Barrel length	508 mm	508 mm	508 mm
Weight, empty	2.89 kg	3.77 kg	3.4 kg
Magazine capacity	20 or 30 rounds standard		
Rate of fire, cyclic	650 - 750 rounds per minute	700 - 950 rounds per minute	

The story of the M16 rifle is one of most turbulent and controversial episodes in the whole history of US small arms. It was hastily adopted as an interim measure, but eventually soldiered on to see more than 40 years of active service. Its early days were full of controversy and scandals, its present is full of competition, but it appears that this weapon will serve with American armed forces and abroad for at least several years (if not decades) more. Today it can be considered as adequate military rifle with good current service record. Obviously, it is far from being ideal, but no rifle in the world is ideal as well. We only have to see, if the American armed forces will eventually step up and produce a better rifle and / or cartridge in a foreseeable future.



First model ArmaLite Ar-15 rifle, with original 25-round magazine. Note the position of charging handle

The origins of the M16 rifle lay in the research, conducted soon after the Korean war by Operations Research Office (ORO), founded at Hopking University and sponsored by US Army. Among the reports, produced by the ORO, two are most significant in this respect, the so called Hall and Hitchmann reports. One report stressed the fact that most hits, achieved by soldiers in battle, were made at relatively short ranges (within 300 meters) and, mostly, at random. This significantly undermined the obsession for long-range aimed fire, promoted by the Army.

Second report suggested, that the most effective way to increase the probability of hits in the battle is to fire multiple small caliber, high velocity projectiles with controlled dispersion instead of one, relatively heavy and large projectile as used in conventional rifles at the time. The latter concept initiated so called "Project SALVO", which was conducted between 1952 and 1957 to develop a proper concept of a new, small bore military rifle. There were several basic concepts, including different projectile types (standard bullets or small, arrow-like finned projectiles known as "flechettes"), fired by score from single round (to achieve 'shotgun' effect) or in rapid bursts of several rounds, each firing single projectile. Eventually, army selected the concept of weapon, firing controlled bursts of single flechettes (steel arrows with body diameter of about 1.5mm) to go ahead, and called this APHHW - All Purpose Hand Held Weapon, later renamed to SPIW - Special Purpose Individual Weapon. In the meantime, some elements within Army also sponsored a more conventional approach to the same problem, and ordered development of conventional automatic rifles, firing ordinary small-caliber bullets. During late 1950s and early 1960s there was a lot of experimentation and development in regard of new ammunition, optimal calibers and rifle designs. The problem was, that widely promoted SPIW program seemed to have no end, and the recently adopted "full-power" 7.62mm M14 rifle faced serious production problems.



Early model M16 rifle, as used by US AF, with early military issue 20-round magazine. Note the three-prong flash hider and the lack of forward assist

Enter the Armalite. In the year of 1957 The US Army requests the Armalite Division of the Fairchild Aircraft Corp to develop a rifle of .22 caliber, lightweight, select-fire, and capable to penetrate the standard steel helmet at 500 meters. The Eugene Stoner, then a designer at the Armalite, began to develop this rifle, based on his earlier design, 7.62mm AR-10 battle rifle. At the same time, experts at the Sierra Bullets and the Remington, in conjunction with Armalite, began to develop a new .22 caliber cartridge, based on the .222 Remington and .222 Remington Magnum hunting cartridges. This development, initially called the .222 Remington Special, was finally released as .223 Remington (metric designation 5.56x45mm). Next year Army tests new rifles, known as Ar-15, and rejects these in favor of the M14. Feeling that the Ar-15 rifle has poor chances to compete with the recently adopted M14 in the US Military, in 1959 the Fairchild Corp, a parent company of the Armalite, sells all rights and manufacturing documentation for this rifle to the Colt's Patent Firearms Manufacturing Company, which had long-time relations with US Military and proven track of selling military guns both in USA and abroad. Colt instantly begins aggressive marketing campaign for the new rifle, stressing its accuracy, low recoil, light weight and modern design.

In the 1962, US DoD Advanced Research Projects Agency (ARPA) purchases 1000 AR-15 rifles from Colt and sends those rifles to the South Vietnam, for field trials. Same year brings glowing reports about the effectiveness of the new "black rifle", used by South Vietnamese forces.

Following the delays in introduction of the ill-fated 'next generation' SPIW system and production troubles with M14, in 1963 Colt receives contracts from US Government for 85 000 rifles for US Army (designated as XM16E1) and for further 19 000 rifles for US Air Forces (designated M16). The US AF M16 was no more than an AR-15 rifle with appropriate markings. The XM16E1 differed from AR-15/M16 by having an additional device, the so called "forward assist", which was used to manually push the bolt group in place in the case of jams. Next year US Air Forces officially adopted new rifle as M16. Same year US Army adopted the XM16E1 as a limited standard rifle, to fill the niche between discontinued 7.62mm M14 rifle and the forthcoming SPIW system (which newer got past the prototype and trial stages).



M16A1 rifle with 30-round magazine and bayonet, right side

With rapidly growing presence of US troops in Vietnam, in 1966 US Government makes the first large purchase of the Ar-15 / M16 rifles, ordering 840 000 rifles for US Armed forces, worth almost \$92 millions, and in 1967 US Army officially adopts the XM16E1 rifle as a standard "US Rifle, 5.56mm, M16A1".

During immediately following years, a number of negative reports appears from Vietnam. M16A1 rifles, issued to US troops in the Vietnam, severely jammed in combat, resulting in numerous casualties. There were some causes for malfunction. First of all, during the introduction of the new rifle and its ammunition into the service, US Army replaced originally specified Dupont IMR powder with standard ball powder, used in 7.62x51mm NATO ammunition. The ball powder produced much more fouling, that quickly jammed the actions of the M16 unless the gun was cleared well and often. It also had different pressure curve, resulting in increased stress on operating parts of the gun. This pitifully combined with the fact that the initial M16 rifles were promoted by the Colt as "low maintenance", so, for the sake of economy, no cleaning supplies were procured for new M16 rifles, and no weapon care training was conducted fro the troops. As a result, soldiers did not knew how to clean their rifles, and had no provisions for cleaning, and things soon turned bad. Another cost-saving measure on the part of the Army was to give up with cromium plation of the barrel bore and bolt group, which made these parts much more sensitive to corrosion and rust that originally designed.

After several dramatic reports in US press and Congressional investigation of the troubles, several actions were taken to remedy the problems. The 5.56mm ammunition was now loaded using different powders that produce much less residue in the gun action. The barrel, chamber and bolt of the rifles were chrome-lined to improve corrosion resistance. Cleaning kits were procured and issued to troops, and a special training programs were developed and conducted ever since. Earliest cleaning kits could be carried separate from rifle only, but since circa 1970 all M16A1 rifles were manufactured with the containment cavity in the buttstock, that held the cleaning kit. At the same time (circa 1970) the new 30 rounds magazines were introduced into service instead of the original 20 rounds ones, to equal Soviet and Chinese AK-47 assault rifles, which had 30-rounds magazines from the very beginning.



M16A1 rifle with 20-round magazine, left side

Therefore, by the end of the US involvement in Vietnam war, the M16A1 rifle eventually became more or less mature. It gradually replaced older rifles in US service, and also influenced the work on the small-caliber ammunition and automatic firearms in other countries, including the USSR. This work culminated in the NATO trials, held in 1977 - 79, with intent to adopt a small-caliber, high-velocity cartridge to replace the potent, but somehow overly powerful 7.62mm NATO round as standard infantry rifle ammunition for the whole NATO organisation. Not surprisingly, the winner of the trials was the American 5.56x45mm cartridge, although in a version loaded with Belgian SS109 bullet, which provided better long-range ballistics than the original US 5.56mm M193 ammo. In 1981, Colt developed a variation of the M16A1, adapted for the SS109/5.56mm NATO cartridge, and submitted it to the military trials as the M16A1E1. This rifle differed from the M16A1 by having the heavier barrel with faster 1:7 rifling, a different type rear sights (adjustable for both range and windage), round handguards instead of triangular ones, and by replacing the full-auto fire mode with the burst (limited to 3 rounds per trigger pull), to preserve the ammunition. It was officially adopted by US DoD as the "US Rifle, 5.56mm, M16A2" in 1982, which still is the primary infantry rifle for US Armed forces and a number of other armies and law enforcement organizations. The development of the M16 rifle continued. By the mid-1990s, Colt, at the request of the US Special Forces, produced a carbine version of the M16A2, designated M4. This carbine traces its roots back to the 1960s vintage Colt CAR-15 carbine, but has several improvements. Actually, it was the M16A2 rifle, fitted with a shorter barrel and handguards, with the gas port moved back. The fixed buttstock was replaced by a retractable telescoping buttstock, originally designed in the mid-1960s by a Colt employee, Robert E. Roy for the Colt "Commando" carbines.

The M4 was supposed to become the standard US Special Forces rifle, and could be fitted with the standard M16A2-type bayonet and the M203 40mm grenade launcher. By 1996, the two newest versions of the M16 appeared, the M16A3 and M16A4. These differ from the M16A2 by having a removable carrying handle, with the upper receiver being fitted with a Picatinny-type accessory rail. Otherwise the M16A4 is similar to the M16A2, while the M16A3 also replaced the infamous three-round burst mode with a full auto mode. The key advantage of both the M16A3 and A4 rifles is the ability to quickly mount and re-mount a wide variety of optical, red dot or night vision / IR sights with MIL-STD 1913 (Picatinny-type) compatible mounts. The M4 carbine was also upgraded to "flat top" configuration, which is now standard. The M16 is still a general-issue rifle with the US Armed forces. It is also widely used by the US Law Enforcement agencies, either in military form (for example, the LAPD had some M16s, retired from the Army), or in "civilian" semi-automatic only form. The AR-15 style rifles are made in the USA by at least a dozen large companies, such as ArmaLite, Bushmaster, Colt, FN Manufacturing, Hesse, Les Baer, Olympic, Wilson Combat, and by a number of smaller companies, many of which assemble their rifles from components made by other major manufacturers. M16-type rifles are also manufactured outside the USA, most notably in Canada, by Diemaco Co (now Colt Canada). China also makes some AR-15 type rifles at the NORINCO state factories, known as CQ. M16 rifles are used by many foreign military groups, most notably the British SAS, who preferred the M16 over the infamous L85A1 rifle, and by many others.



At the present time almost all of the initial flaws of the M16 have been removed and it is considered among the best assault rifles in the world. While its reliability in harsh conditions cannot match that of its main rival, the Kalashnikov AK-47 and AK-74, it is still a quite reliable weapon, especially when well maintained. It is also comfortable to fire and quite accurate.

It must be noted that during recent operations in Afghanistan and Iraq (2002 and 2003, respectively), there were several controversial complaints about the effectiveness and reliability of the M16A2 and M4 rifles. It seems that most complaints about the reliability of the M16A2 rifles came from inadequate troop training and the resulting improper handling of the rifles. The M4 carbines are a somewhat different story, since the problems can be partially traced to the shortened gas system, which now operates at higher pressures, thus more violently. The M4 also rapidly overheated. Another general complaint was about the poor effectiveness of the standard M855 ammunition, which lacked stopping power especially from shorter M4 carbine barrels.

To partially cure this problem, the US SOCOM recently issued a new type of 5.56 mm ammunition, the Mk.262 mod.0, which is loaded with heavier Sierra Match King bullets, weighing 4.99 gram compared with the 4.0 gram bullet in the M855 cartridge. The most recent experience also clearly showed the excessive length of the M16A2 rifles, which are too clumsy for motorised troops, riding in cars, armored carriers and helicopters. At the present time, many M16A2 rifles are being replaced in the hands of US troops with more compact and maneuverable M4A1 carbines.



One of the key advantages of the Stoner design, that must be especially stressed, is the extreme flexibility of the construction. At the present time the interchangeable complete upper receiver assemblies ("upper" in short) are available in various barrel lengths and profiles (from 7 to 24 inches long, slim and heavy), in dozens of rifle and pistol calibers (from tiny but fast .17 Remington and up to monstrous .458 SOCOM, and from .22LR and 9mm Luger up to mighty .50AE). Special, manually single-shot uppers are commercially available in the extremely powerful .50BMG (12.7x99mm) caliber. Various "lower receiver" assemblies offer a broad variety of trigger units, buttstocks and other options. This advantage is viable for both military (especially Spec Ops), Law Enforcement, and civilian applications, as it allows to tailor any particular AR-15 type rifle to the current situation and tactical needs.

M16 / AR-15 Technical description

The original AR-15 rifle is a gas operated, selective fire, magazine fed weapon. Every rifle from the M16 family is generally the same, but most civilian AR-15 type rifles are semi-automatic only.



M16A1 rifle with M203 40mm grenade launcher

The heart of the AR-15 is the direct gas system, developed by the Eugene Stoner in the early 1950s. This system uses no conventional gas piston and rod to propel bolt group back after the shot is fired. Instead, the hot powder gases are fed from the barrel and down to the stainless steel tube into the receiver. Inside the receiver, the rear end of the gas tube enters into the "gas key", a small attachment on the top of the bolt carrier. The hot gases, through the gas key, enter the hollow cavity inside the bolt carrier, and expands there, acting against the bolt carrier and the collar around the bolt body. The pressure of the gases causes the bolt carrier to move back against initially stationary bolt. The linear rearward movement of the carrier initially transferred into the rotation of the bolt, via the cam slot in the bolt carrier and the cam pin, attached to the bolt, that followed the slot. As soon as the bolt is rotated to unlock from the barrel, the bolt group continues its rearward travel under the inertia and the residual pressure in the barrel, extracting the spent case and compressing the buffer return spring, located in the buttstock. The forward movement of the bolt group first strips the fresh cartridge from the magazine and, on the final stage of the movement, rotates the bolt to lock into the barrel extension. The bolt has 7 radial locking lugs, eight lug is located on the extractor claw. Since the introduction of the XM16E1 rifle, the forward assist device is used on all military and most civilian AR-15 type rifles. This device consist of the spring-loaded button with internal claw, that engages the serrations on the right side of the bolt carrier to push it forward, if the pressure of the return spring is insufficient to do so (for example, due to the fouling inside the receiver or chamber). The rifle will not fire unless the bolt is locked and the bolt carrier is in its forwardmost position. The bolt carrier and the bolt itself are chrome-plated. Another feature of the AR-15 type rifles is the bolt catch device, that locks the bolt group in the open position when the last round is fired. To release the bolt group one must push the button, located at the left side of the receiver, above the magazine. The "T"-shaped cocking handle is located at the rear of the receiver, above the buttstock, and does not reciprocate when gun is fired.

The trigger/hammer group is basically similar to one, found in M1 Garand rifle, and, actually, traces its roots back to the early 1900s, when the great John M. Browning developed his famous Auto-5 semiautomatic shotgun. This basically consists of a hammer, a trigger, a disconnector, a full auto sear and some springs. The fire selector / safety switch is located at the left side of the receiver, above the pistol grip, and is easily operated by the right hand thumb. This switch has 3 positions: "safe", "semi" (single shots), and "auto" (full automatic on M16A1 and M16A3 rifles) or "burst" (3 rounds bursts, on M16A2 and M16A4). In the latter case (on the M16A2 and M16A4 rifles), the trigger unit also includes the ratchet device to count the shots fired.



M16A2 rifle with 30-round magazine, right side

The ejection port is located at the right side of the receiver, and is closed by the spring-loaded dust cover, which automatically pops open when bolt carrier is pulled back. The M16A2 also featured the spent case deflector - a triangular bulb on the receiver, just behind the ejection port, that allows the gun to be safely fired left-handed.

The M16 is fed using box magazines. Earliest magazines were made from aluminum and held 20 rounds. Circa 1970 the new, 30 rounds magazines were introduced into service and these magazines are still in service now. An extremely wide variety of magazines available on the commercial market, starting from the "US post-ban" 5 and 10 round magazines, and up to 40-rounds box, 90-rounds helical, 100-rounds dual drums (Beta-C) and 120-rounds single drums.



The receiver is made from aluminum alloy, and consists of two parts - "upper receiver" and "lower receiver" (sometimes referred simply as "upper" and "lower"). Most receivers are made from aluminum forgings by machining, but some commercially available receivers are made from aluminum castings with final drilling and machining. The upper and lower receivers are linked by two cross-pins - one at the front (pivot pin), and one at the rear, above the pistol grip (takedown pin). To field strip the AR-15, one must push the rear pin to the right as far as it will go, and then hinge the upper receiver around the front pin. This will allow the bolt group and the carrying handle to be removed from the upper receiver. For further disassembly, the front pin also must be pushed out, and the upper and lower receiver can be separated. The key benefit of this design is the great flexibility - if all components available are made to the same specifications (in most cases they are), one can easily swap various upper receivers on one lower receiver and vice versa.



M16A4 rifle with 30-round magazine and carrying handle installed over the Picatinny rail, right side

Since the complete "upper" module consists also of the bolt group and the barrel with the gas system, one can easily have different barrel lengths, styles (light, heavy, fluted, bull), and even calibers, for one "lower" group, that consists of the lower receiver with the trigger/hammer unit, recoil buffer, pistol grip and the buttstock.

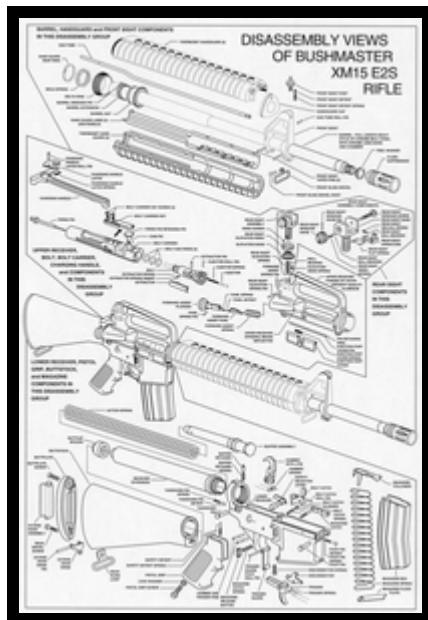
The furniture on military rifles is made from the black plastic, hence the common name "the black rifle". On the early AR-15 and M16A1 rifles, the handguards were of triangular cross-section, and were made from two non-interchangeable parts. On the M16A2 and latter rifles, the handguards are of round cross-section, and have two interchangeable upper-lower sections. The buttstock on the M16A2 is similar in design to one of M16A1, but slightly longer. The one disadvantage of the Stoner system is that it can not be adapted for conventional folding buttstock. Instead, if required, a telescoped stock is used, that allows to shorten the rifle when required by about the half of the length of the standard stock. M16 is usually equipped with sling, and can accept a knife - bayonet, either an old style M7, or a newer style M9. The flash hiders on the earliest AR-15s and M16s were prong-type, with three open slots, but later were replaced with "birdcage" flash hiders with four (M16A1) or five (M16A2) slots.

Both M16A1 and M16A2 can be equipped with underbarrel 40mm M203 grenade launcher. M203 mount replaces the standard handguards on the rifle and requires a grenade launcher sight to be mounted on the carrying handle.



M16A4 rifle with RIS (Rail Interface System) installed around the barrel, and the Aimpoint red-dot sight installed on the rail instead of the detachable carrying handle

Standard sights of the M16A1 consist of a protected front post, mounted on the gas block, and of an aperture flip-up rear, with 2 range settings. Rear sights are mounted within the carrying handle and are adjustable for windage. The A2 style rear sight also features an flip-up, dual aperture sights, with one smaller aperture for daylight usage, and another larger aperture for low light conditions. The range adjustments are made by the rotating knob, located just under the sight. The front sight is generally the same as on the M16A1. The M16A3 and A4 rifles have detachable carrying handles with A2 sights, and the Picatinny-type MilStd rail on the top of the receiver, that can accept a wide variety of sighting devices and mounts. The most common military sighting equipment beyond basic iron sights is an Trijicon ACOG low-magnification telescope or Aimpoint or EOTech 1X magnification red-dot sight, often complemented by removable back-up iron sights (BUIS), installed on the same Picatinny rail.



Armalite AR-10 (USA)

Caliber: 7,62mm NATO (7.62x51mm)

Action: Gas operated, rotating bolt

Length : 1016 mm

Barrel Length: 508 mm

Weight: 4.31 kg empty, without magazine and sling

Magazine: 20 rounds

Rate of fire: 700 rounds per minute (original military version)

The AR-10 rifle, designed by the Eugene Stoner at the Armalite division of the Fairchild Engine and Airplane Corp, seen no significant success at the time it had been introduced, but it still had some historical significance since the AR-10 served as a basis for the further development of the much more successful AR-15 / M16 series rifles. Basically, earliest AR-15 prototypes were no more than a scaled-down AR-10. The AR-10 was intended for the US Army trials for a new battle rifle, to replace the venerable M1 Garand. AR-10, with the first prototype built in 1955, came too late for these trials, and was too unconventional for conservative minds in the US Army, and consequently lost the trials to the T44 rifle, which was adopted in the 1957 as the M14. The AR-10 was ready for mass production by the 1960, but very few were made in USA.



the original AR-10 of the late 1950s. Note the three-prong flash hider and a bayonet lug under the barrel

A manufacturing license had been sold to the Dutch company Artillerie Inrichtingen. Only Sudan and the Portugal apparently bought some AR-10 rifles for their military, and the production of the AR-10 had been ceased in the early or mid-1960s, with only about 10 000 military AR-10 being ever made.



AR-10A2 is, basically, an upscaled AR-15A2 rifle, chambered for the .308 Winchester (7.62x51mm) cartridge. Note that the charging handle is above the buttstock, as on AR-15 / M16 rifles. The furniture is similar to the M16A2 rifle, except for the muzzle brake

Some two or three decades later, the reorganized Armalite company brought the modified AR-10 rifle back to civilian and police markets. Unlike the original AR-10, the new AR-10B is a semi-automatic only rifle, and it is available in four basic versions. The AR-10B itself is more or less a copy of the original AR-10, with the similar brown plastic furniture and short buttstock, and with the trigger-like charging handle under the carrying handle.



AR-10(T) - a target grade version of the "new" AR-10, with Picatinny-type rail instead of the carrying handle, and the match barrel

The other three models look more like the scaled up M16A2 derivatives, with the same A2-style furniture, sights, and M16-type charging handles. The AR-10A2 has all the A2 furniture and options, while the AR-10A4 has the "flat-top" style receiver with the Picatinny rail instead of the carrying handle. The AR-10(T) is a target grade rifle, with match barrel and trigger and A4-type flat-top receiver.



the AR-10B rifle, a modern "civilian" re-creation of the AR-10. Note the lack of the bayonet lug and the M16A2-type rear sight and pistol grip

Technically, the AR-10 differs very little from its direct derivative, the AR-15/M16, so for a complete description please refer to the AR-15 / M16 article on this site.



The original AR-10, partially field-stripped. The similarity to the latter AR-15 / M16 rifles is obvious

Armalite AR-18 assault rifle (USA)

Caliber: 5.56x45 mm (.223 Remington M193)

Action: Gas operated, rotating bolt

Overall length: 940 mm (738 mm with folded stock)

Barrel length: 464 mm

Weight: 3.09 kg with empty 20 rounds magazine

Magazine capacity: 20, 30 or 40 rounds

The AR-18 rifle had been developed by the Armalite company (USA) by the George Sullivan, Arthur Miller and Charles Dorchester in the early 1960s. This rifle was designed for the international military market as a replacement for the AR-15 project, which had been sold to the Colt in 1959 by the Armalite's parent company, Fairchild Aircraft and Engine Corp. The AR-18 was designed as a competitor to the AR-15, which could be made at much less expenses and on simplified machinery, with the view to sell the manufacturing licenses for AR-18 to the third world countries.

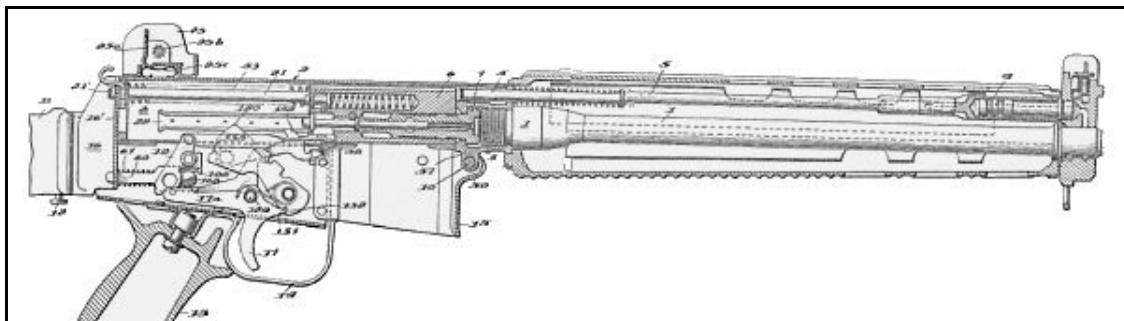


original AR-18 assault rifle, made by the Sterling Armaments of UK

The AR-18 was a really successful design from a technical standpoint, but it came out too late to compete with both officially accepted and adopted AR-15/M16 rifle of American origin and already widespread AK-47 rifle of the Soviet origin. The Armalite company by itself made very few specimens of this rifle. The manufacturing license was consequently sold to the British company Sterling Armaments Co and to the Japanese company Howa Machinery co, but all three companies produced hardly over 20 000 rifles total, and the production of the AR-18 was ceased circa 1979 for some 20 years. It was originally available in the military AR-18 (selective fire) and AR-18S (selective fire, with short barrel) versions, and in AR-180 semi-automatic only version. But in the year 2001 the Armalite company resurrected the AR-180 design, in somewhat modified form. New rifle, intended mostly for the civilian and law enforcement markets, featured the same AR-18 layout and action, but discarded the stamped steel lower receiver and replaced it with the plastic lower, with AR-15-compatible magazine housing and AR-15-type trigger unit, which allowed for wider spare parts availability. The original folding buttstock and flash suppressor are replaced with the plastic fixed buttstock of the same shape and the muzzle recoil compensator, to comply with the current US firearms laws.

The price of AR-180B is slightly lower than of the similar basic AR-15 type rifle, and the available user reports about AR-180B are generally quite positive.

The most interesting point about the AR-18 is that, while being a commercial failure, it served as a platform for some further development, which took place in various countries. First, the AR-18 design obviously served as a starting point for the ill-fated British SA80 / L85 bull-pup assault rifle, which can be loosely described as a bullpup-ed and weakened AR-18. Second, the AR-18 served as a starting point for the Singapore SAR-80 assault rifle, designed by the Chartered Industries of Singapore with the help of the George Sullivan (who designed the AR-18 itself). And third, the relatively new German Heckler - Koch G-36 assault rifle bears a lot of similarity internally to the AR-18.



Schematic view of the AR-18 (from the original Armalite patent, issued in 1968)

Technical-description.

The AR-18 is a gas operated, magazine fed, air cooling selective fire rifle. The gas action features a short piston stroke, rotating bolt locking mechanism. The gas chamber and piston are located above the barrel, and the piston has the cupped head and its own return spring. The square-shaped bolt carrier is mounted inside the receiver on two guide rods, with each rod carrying its own return spring. Both rods are linked by the special end plates so the whole bolt / bolt carrier / return springs / guide rods assembly can be removed from the rifle as a single unit, which greatly simplifies the field maintenance. The rotating bolt is somewhat similar in construction to the AR-15 bolt, and is rotated by the bolt pin, which is engaged in the curved cam track, cut in the bolt carrier. The charging handle is fixed to the right side of the bolt carrier and reciprocates when gun is fired.

The receiver is made from stamped sheet steel and consists of two parts - upper and lower. Both halves of the receiver are hinged one to another at the front of the receiver. The upper and lower parts are interlocked by the rear ends of the bolt carrier guide rods. AR-18 is field stripped by pressing the guide rods forward by the special lever at the rear of the receiver, then by the folding the lower receiver down and forward.

The controls consist of the trigger, safety - fire mode selector at the left side of the receiver (similar to one found on AR-15 / M16 type rifles), and the bolt stop.

The available fire modes are single shots and full auto, or only single shots in AR-180 and AR-180B.



the "reincarnated" AR-180B of recent manufacture. Semi-automatic only and with plastic lower receiver with integral pistol grip

The forearm, the pistol grip and the buttstock are made from black plastic. The buttstock folds to the side to save the space, if required, and AR-15 can be fired with butt folded. The sling attachment points are located on the barrel, just ahead of the forearm, and at the butt of the pistol grip, so the sling position is not affected by the position of the foldable buttstock.

The sights consist of the hooded front post and the "L"-shaped flip-up diopter rear, also protected from sides by large "dog ears". Each AR-18 also was fitted with the scope mount at the top of the receiver by standard.

SPO-JGAS 2010

AS "Val" silenced assault rifle (USSR / Russia)

Caliber: 9x39 mm (SP-5, SP-6)

Action: Gas operated, rotating bolt with 6 lugs

Length: 875 mm / 615 mm (stock open / folded)

Barrel length: 200 mm

Effective range: 400 meters

Weight: 2,96 kg empty

Magazine capacity: 10 or 20 rounds

The Special Forces, generally known as “Spetsnaz” (after the Russian term “*Voiska Spetsialnogo Naznacheniya*” – Special Purpose Troops), always played a key role in Soviet Military Doctrine. One of the aspects of every Special Forces is that they prefer to operate stealthily, with as little sound and flash as possible from their weapons. The first



generation Spetsnaz weapons were no more than AK and AKM rifles, fitted with quick-detachable sound suppressors, and loaded with special subsonic ammunition with heavy bullets. Apparently, this was not enough, since in the mid-1980s the development of new, more effective silenced weapons was initiated.

At first, designers from TSNIITOCHMASH in the city of Klimovsk developed a special-

purpose 9 mm subsonic cartridges, known as 9x39 SP-5 and SP-6, based on necked-out 7.62 x 39 case. These cartridges were fitted with heavy (about 16-17 gram) standard “ball” or armour piercing bullets, with muzzle velocities about 280-300 metres per second.



AS "Val" silenced assault rifle, with shoulder stock opened

Having the ammunition, the team at TSNIITOCHMASH, lead by P. Serdyukov, developed a family of integrally silenced 9 mm weapons, which included the VSS “Vintorez” silenced sniper rifle and the AS “Val” silenced assault rifle. Both weapons are based on the same action and integrally silenced barrel. AS is widely used by Russian Army recon units, as well as by MVD (Internal Affairs Ministry) and FSB (Federal Security Bureau) Special Forces.

The AS is a gas operated, integrally silenced weapon. The receiver is machined from steel forging for improved strength. The long stroke gas piston is located above the barrel, and rigidly attached to the bolt carrier. The rotating bolt has six lugs and locks into the receiver. The front part of the barrel, ahead of the gas port, has several sets of holes, drilled at the bottom of the rifling grooves. These holes are used to bleed some of the gun gas into the integral silencer. The trigger unit is somewhat similar to that of the Czech-made Sa. Vz.58 assault rifle, and is striker-fired. The safety lever is similar to the one found on all Kalashnikov-type rifles, but the fire mode selector is a separate cross-bolt type button, located within the trigger guard, just behind the trigger.



AS "Val" silenced assault rifle, partially disassembled; note that barrel is significantly shorter than integral silencer

The open sights are graduated up to 400 meters in 25 meter increments, but the actual effective range is about 200-300 meters due to the rainbow-shaped trajectory of the subsonic bullets. The AS is optimized for high performance armor piercing 9 x 39 ammunition, designated as SP-6, but can also fire "ball" type SP-5 ammunition, intended for VSS sniper rifles. The pistol grip and the short forearm are made from polymer, the skeletonized, side-folding butt is made from steel tubing. The AS rifle has a standard side-mounted rail for optical, night vision or red dot scopes. It has no provision for mounting a bayonet or a grenade launcher. The integral silencer could be easily detached for maintenance, repair, or compact storage, but the rifle shall not be fired with the silencer removed due to safety and reliability issues.



AS "Val" silenced assault rifle, with shoulder stock folded

SPO-JGAS 2010

ASM-DT "Morskoj Lev" [Sea Lion] dual medium (underwater and above water) assault rifle (Russia)

Caliber: 5.45 mm (5.45x39 for above water firing and 5.45mm special underwater ammunition for submerged firing)

Action: Gas operated, rotating bolt

Overall length: n\ a

Barrel length: n\ a

Weight: kg

Rate of fire: ~600 rounds per minute

Magazine capacity: 30 rounds (for above water config) or 26 rounds (for underwater config)

In mid-1970s, Soviet Navy adopted an underwater APS assault rifle for its combat divers, to provide underwater security against enemy frogmen and specially trained sea animals (i.e. dolphins). The APS, while successful in its narrow niche, had its set of inherent flaws, so, during the late 1990s, a severely modified version of it appeared in Tula, in the form of the experimental ASM-DT “dual medium” amphibious assault rifle.



One of ASM-DT assault rifle prototypes, with underwater magazine and additional equipment (above) and with standard "above water" magazine (below)

The key improvement of the ASM-DT is that it uses a 5.45 mm rifled barrel with relatively shallow rifling, which allows to fire both standard 5.45 x 39 spin-stabilized ammunition, and modified underwater hydrodynamically stabilized ammunition, which is also based on 5.45 x 39 case, with long projectile of about 5.4 mm in diameter. To achieve this, the magazine housing of the ASM-DT is fitted with a sliding magazine catch, which can be positioned at the rear of the long magazine port to hold the deep underwater magazines, or in the middle of the magazine port to hold the relatively shallow (front to back) AK-74 magazines. In the latter mode, the rear, unused part of the magazine housing is closed by a spring-loaded dust cover. To avoid problems with the remaining water in the barrel when firing the 5.45 x 39 in air, the chamber has special grooves that lead from the chamber forcing cone forward, into the rifling grooves. When the standard 5.45 mm cartridge is fired, a small amount of powder gases run through the grooves ahead of the bullet, effectively blowing the remaining water out of the barrel. The rest of the action is similar to the APS, but the muzzle is fitted with AKS-74U-style muzzle device / flash hider. The overall performance of ASM-DT with underwater ammunition is similar to the APS, while in air and with standard 5.45 x 39 ammunition, it is roughly on par with the AKS-74U and greatly outperforms the APS.

SPO-JGAS 2010



Baryshev AB-762 and AVB-762 assault rifles (Russia)

	AB-7,62 / LCZ B10	AVB-7,62 / LCZ B20
Caliber	7,62x39 M43	7,62x54R or 7,62x51 NATO
Overall length (stock open / folded)	960 / 710 mm	1000/ 750 mm
Barrel length	415 mm	455 mm
Weight, empty	3,6 kg	3,9 kg
Rate of fire	750 rounds per minute	750 rounds per minute
Magazine capacity	30 rounds	10 or 20 rounds

Anatoly F. Baryshev designed its original delayed-blowback action in early 1960s. His design was very unusual for the time, mostly in the fact that it was a private effort - a thing, rarely encountered in Soviet Union. Nevertheless, Baryshev managed to find some support in the higher ranks of Soviet Army. Several prototypes were built and tested. New action showed its major advance - a significant decrease in felt recoil, but otherwise it proved to be unreliable under harsh conditions and inaccurate in single shots. Army rejected the design, but Baryshev and his supporters had been trying to promote this design till late nineties.



Baryshev AB-7,62 prototype assault rifle, chambered for 7,62x39 ammunition

During early 1990s Baryshev also cooperated with Czech company LCZ Group, which manufactured several prototype rifles in calibers such as 7,62x39 and 7,62x51. These rifles were displayed on several military exhibitions, but found no buyers, and apparently were dropped by late 1990s. In the mean time, Baryshev designed an unique large handheld caliber weapon, which fired 12,7x108mm heavy machine gun of 30x25B grenade ammunition (change of caliber required change of barrel, magazine and bolt). Because of Baryshev recoil-reducing action, this weapon can be fired from the shoulder,

but it still had all drawbacks of all other Baryshev weapons - that is, insufficient reliability and insufficient accuracy in single shots, and accurate burst fire was also all but impossible from such large-caliber but lightweight gun with limited magazine capacity. It must be noted that Baryshev system allowed to build lightweight fully automatic weapons in powerful "rifle" calibers such as 7,62x54R or 7,62x51, which were controllable in full automatic fire; but this was the only significant advantage of the system over other, more conventional systems.



Czech-made LCZ B20 (AVB-7,62) prototype automatic rifle, chambered for 7,62x51 NATO ammunition

Baryshev action is a delayed-blowback system which is fired from open bolt only. Bolt group consists of four parts - bolt with tilting head, inertia piece and locking lever. When gun is fired, bolt group is released and goes forward at once, stripping a fresh cartridge from magazine. At the end of loading cycle, bolt with its head was stopped at the breech, while inertia piece still moved forward, rotating the locking lever and bolt head. The

pivoting locking lever struck the firing pin, and fired the cartridge. Recoil of the shot tried to pivot the bolt head, but this movement was resisted by the mass and velocity of the inertia piece. Once the inertia piece was stopped and its movement reversed by the blowback action of the cartridge, it turned the locking lever to disengage the bolt from receiver. Once bolt is released, entire bolt group is moved back under residual pressure in the chamber. This sounds complicated as is, and the system never impressed anyone other than few high-ranking officers in Soviet army.

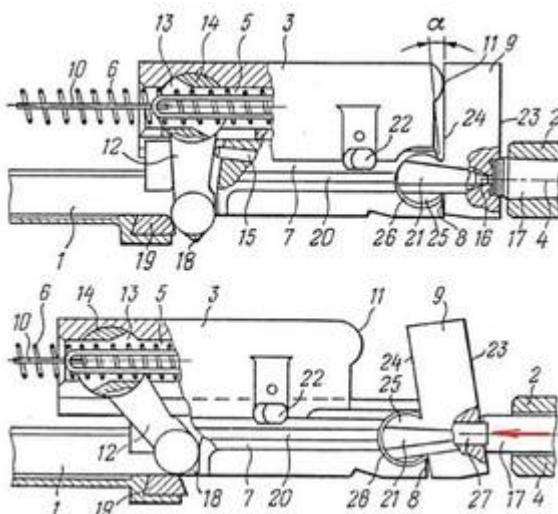


Diagram from original patent, issued to Baryshev for his delayed-blowback action

Beretta AR-70/223 and AR-70/90 assault rifle (Italy)

	AR-70/223	AR-70/90, SC-70/90	SCP-70/90
Caliber	5.56x45mm M193	5.56x45mm NATO (SS109/M855)	
Length	995 mm	998 mm 756mm SC-70/90 with folded butt	908 mm 663 mm with folded butt
Barrel length	450 mm	450 mm	360 mm
Weight, empty	3.8 kg	4.07 kg	3.80 kg
Magazine capacity	30 rounds		
Rate of fire	650 rounds per minute	670 rounds per minute	
Effective range	400 meters	500 meters	350 meters

Famous Italian arms company Pietro Beretta Spa began to develop a new assault rifle, chambered for American 5.56mm cartridge in 1968. The resulting design appeared circa 1972 and after trials was adopted by the Italian Special forces, as well as by some foreign armies, like those of Jordan, Malaysia and others. The rifle was designated AR-70/223, and was available in three basic versions (standard assault rifle AR-70/223, carbine SC-70/223 with same barrel and folding butt, and a special carbine SCS-70/223 with shortened barrel and folding butt). The Squad Automatic (light machine gun) variation of the basic 70/223 design, with the heavy, quick detachable barrel also was developed but never produced in quantity.



Beretta AR-70/223 assault rifle

The basic design showed some minor flaws, and when Italian army decided to replace its ageing 7.62mm Beretta BM59 automatic rifles with the new 5.56mm NATO assault rifle, Beretta entered the contest with the upgraded version of the 70/223. This upgraded version appeared in 1985, and eventually won the following trials.

In 1990 it was adopted as the basic AR-70/90 assault rifle, with the available modifications of SC-70/90 (same rifle but with the folding buttstock for Special Forces) and SCP-70/90 (Airborne troops carbine with shortened barrel and folding butt). A squad automatic version with heavy, non-detachable barrel and detachable bipod is available as AS-70/90. The Beretta AR-70/90 is a general issue shoulder arm with the Italian Army, and also is offered for export. Both 70/223 and 70/90 rifles are available in semi-automatic only versions, for police or civilian markets.



Beretta SCS-70/223 carbine - partially cut out view

Technical description
The AR-70/223 and AR-70/90 rifles are very similar in basic design, but with some differences. The description below is for AR-70/90, with differences to 70/223 noted, where appropriate.

The AR-70/90 is a gas operated, magazine fed, selective fire weapon. The receiver is made from stamped sheet steel, and consist of two halves, upper and lower, connected by two cross-pins, at the rear and at the front. For maintenance and field stripping the rear pin is pushed out and the receiver is hinged around the front pin. If required, the front pin can be removed too, so the receiver halves will be separated completely. On the AR-70/223 the upper receiver is of square cross-section, with stamped bolt guides. This design proved to be not strong enough, so the AR-70/90 features a trapezoid-shaped upper receiver cross-section, with separate bolt guides welded in place.

The gas operated action of the AR-70/90 is fairly conventional, with the long stroke gas piston, located above the barrel. The gas piston rod is linked to the bolt carrier by using a cocking handle as a lock, and the return spring is located around the gas piston, above the barrel. The gas block featured a two positions gas regulator (for normal and adverse conditions), and the gas cutoff, integral with raising grenade sight. When grenade sight is raised into the firing position, it automatically closes the gas port. The rotating bolt is somewhat similar to one, found in the Kalashnikov AK-47 rifles, and has two massive lugs, which are locked into the barrel sleeve, which is welded into the receiver. The charging handle is attached to the bolt carrier.

The barrel is fixed to the receiver using the threaded barrel nut, allowing for quick barrel replacement (for repair purposes only, not in the field), without the extensive headspace adjustments. The barrel bore is chrome-plated.

The conventional trigger / hammer mechanism allows for single shots and full auto on the AR-70/223 rifles and for single shots, 3 rounds bursts (optional) and full auto on AR-70/90 series rifles. The safety /selector switch is ambidextrous on AR-70/90 series rifles, and is located on the right side of the receiver on the AR-70/223 series rifles.

The feeding of AR-70/90 series weapons is achieved by using STANAG (M16-type) compliant magazines, with the ambidextrous magazine release button located at the both sides of the magazine housing in the lower receiver. On the AR-70/223 rifles, feeding was from the proprietary 30 rounds magazines, with the magazine release lever located between the magazine and the trigger guard. Both AR-70/90 and AR-70/223 series rifles featured a bolt stop device, which holds the bolt open when the last round from the magazine is fired. The bolt release button is located at the left side of the receiver, above the magazine housing.



Beretta AR 70/90 assault rifle. Installation of the folding stock, shown below the rifle, will convert it into SC-70/90 carbine configuration

The sights of the AR-70/90 rifles consists of the hooded front blade, mounted on the top of the gas block, and the flip-up aperture rear, marked for 250 and 400 meters range. The top surface of the receiver is fitted with the NATO-standard scope / accessory rail. A detachable carrying handle with the see-through base is available for all AR-70/90 series rifles. The AR-70/90 also can be equipped with Zeiss "Orion" night-vision sight or the Aimpoint 4X telescope sight (any other sights with compatible mountings also can be easily installed, if required).

The furniture on all rifles is made from plastic, with the standard rifles having the fixed plastic buttstocks. The SC-70/223 and SC-70/90 Special Forces carbines are different from AR rifles only by having the side-folding, skeleton type metallic buttstocks, covered with plastic. The SCP-70/90 carbine is similar to the SC-70/90 except that it has a shortened barrel which cannot be used to launch rifle grenades directly. However, a special detachable rifle grenade launcher is available for short barreled carbines,

which could be easily clamped onto the muzzle of the gun. The hollow pistol grips of all AR-70/90 series rifles is used to store a cleaning kit.

A wide variety of accessories is available for AR-70/90 rifles, including knife-type bayonets, lightweight, foldable and detachable bipods, blank firing adaptors etc.



Beretta SCP 70/90 assault carbine. The detachable barrel adaptor is used to launch rifle grenades.

SPO-JGAS 2010

Beretta ARX-160 assault rifle (Italy)

Caliber: 5.56x45mm NATO

Action: Gas operated, rotating bolt

Overall length: 820-900 mm with 406 mm barrel and butt in ready position; 700 mm with butt folded

Barrel length: 305 mm / 12" or 406 mm / 16", quick changeable

Weight: ~ 3 kg with 406 mm barrel, w/o mag

Rate of fire: rounds per minute

Magazine capacity: 30 rounds

The Beretta ARX-160 assault rifle is, as of mid-2008, still in prototype / development stage. It is a part of the Italian Army's '*Soldato Futuro*' program, and is developed by famous Italian company Beretta in close cooperation with army. The rifle is a part of a massive soldier equipment package, which, among other items, will include an advanced rifle sight which will combine day and night time (optical, TV and IR) view / sight capabilities and laser pointer (also visible and IR). Another component of the *Soldato Futuro* system is an advanced 40mm single-shot grenade launcher, which will be either installed on the rifle (using Picatinny rail interface) or used as stand-alone weapon (by adding a detachable pistol grip and telescoped stock to it).



Beretta ARX-160 assault rifle, with buttstock in unfolded, extended position

The Beretta ARX-160 assault rifle is a gas-operated weapon that utilizes conventional piston-operated action, with the gas piston located above the barrel. Barrel locking is achieved by more or less conventional rotary bolt. Unlike most other assault rifles, the Beretta ARX-160 assault rifle features quick-detachable barrels, which can be changed by operator in the field by depressing the barrel release button (located on right side of receiver, in front of magazine housing), pulling the barrel forward and out of the gun, and then inserting another (or same) barrel back. The receiver consists of two parts, upper (which holds barrel and bolt group) and lower (which hosts magazine housing, trigger unit and pistol grip). Both halves are made from impact-resistant polymer and connected using special quick-release locks, so there are no pins to push out (and lose).



Another interesting and unusual feature of the Beretta ARX-160 assault rifle is that it has selectable left / right side ejection system with dual ejection ports (on either side of the gun) and user-switchable left / right position of cocking handle. To change the direction of empty case ejection, user has to push the cross-bolt button, located above and slightly to the rear of pistol grip, by the tip of the bullet (or other pointed item).

This affects dual extractor-ejector claws, installed on the bolt, forcing them to eject spent cartridge to the desired side without any further disassembly of the gun or parts change. Charging handle, which is attached to the bolt carrier, also can be installed on either side of the gun.



Beretta ARX-160 assault rifle, with buttstock folded and collapsed

The Beretta ARX-160 assault rifle fires from closed bolt, in single shots and full automatic mode, and has ambidextrous safety / fire mode selector switch conveniently located above pistol grip. Upper receiver is fitted with full-length Picatinny type rail, made of aluminum, which can accommodate a wide variety of sighting equipment, including iron, telescopic, red-dot or electronic sights. Standard open sights are mounted on folding bases using rail interface. Additional lengths of Picatinny rail are installed on the forend on 3-, 6- and 9- o'clock positions. Lower (6-o'clock) position rail is strong enough to host GLX 160 40mm single-shot grenade launcher. Standard buttstock is also made of plastic, and folds to the right side. The buttstock is of telescoped, user-adjustable design.



Drawing of the Beretta ARX-160 rifle along with GLG-160 grenade launcher and set of opto-electronic equipment which includes TV/IR/Optical sight, laser rangefinder, laser pointer and ballistic computer for grenade launcher

SPO-JGAS 2010

Beretta BM 59 (Italy)

Caliber: 7.62x51 mm NATO (.308 Winchester)

Action: Gas operated, rotating bolt

Overall length: 1095 mm

Barrel length: 491 mm

Weight: 4.4 kg empty

Rate of fire: 750 rounds per minute

Magazine capacity: 20 rounds

Since the end of the World War 2, Italy adopted the US-designed M1 Garand rifle in .30-06 (7.62x63mm) and manufactured it under licence. This semi-automatic rifle proved itself very well during WW2 but in the late 1950s it was seriously outdated and obsolete, so Italian military wanted a new rifle, chambered for the NATO-standard cartridge, 7.62x51mm. The most cost-efficient way to build a new rifle was to redesign the old good M1, and this was done by Pietro Beretta SPa. New gun, designated as Beretta BM59, was adopted in 1959 and served with Italian, Indonesian and Morocco armies. It should be noted that earliest BM59s were manufactured from available M1 parts, including rechambered barrels. In the late 1980s BM59 was replaced in Italian service with Beretta AR70/90 assault rifles.



Beretta BM59 - civilian semi-auto version without gas cut-off and flash-hider / grenade launcher

Basically, the BM59 can be described as re-chambered M1 Garand, with addition of the removable 20 rounds magazine and select fire trigger. Another addition was a flash-hider of NATO-standard diameter, which also served as a rifle grenade launcher.



Beretta BM59 - left side view, bayonet (in sheath) and bipod attached

To launch grenades, one must turn on gas cut-off valve by raising grenade front sight, mounted on the gas block. If it will not be done, the excessive gas pressure will damage the rifle. BM59 is a gas operated rifle, with gas chamber and gas piston located under the barrel.



right side view

Chamber locks by the rotating bolt with two massive lugs. Fire mode selector/safety switch is located at the front of the triggerguard, charging handle is attached to the gas rod and reciprocates during the fire cycle.



Beretta BM59 Para (folding buttstock)

BM59 was available in 4 modification:

- * BM59 Mark I had a wooden stock with semi-pistol grip.
- * BM59 Mark II had a wooden stock with pistol grip to achieve a better control during the full-auto fire;
- * BM59 Mark III, or Ital TA, was a gun with a pistol grip and a metallic folding buttstock, and was intended for Mountain troops; BM59 Para was similar to BM59 Ital TA but had shorter barrel and shorter flash-hider, and was intended for paratroopers.
- * BM59 Mark IV, had a heavier barrel and plactic stock, and was used as a light squad automatic weapon.