

# Bofors 40 mm

## Bofors 40 mm gun



**Bofors 40 mm/L60.** This example includes the British-designed *Stiffkey Sight*, being operated by the aimer standing to the right of the loader (turned sideways). It operates the trapeze seen above the sights, moving the sights to adjust for lead.

**Type** Autocannon

**Place of origin**  Sweden

### Service history

**In service** 1934–present

**Used by** *See users*

**Wars** World War II, Indo-Pakistani wars and conflicts, Arab-Israeli conflict, Korean War, Indonesia-Malaysia confrontation, Vietnam War, South African Border War, Falklands War, Gulf War, Yugoslav wars, Iraq War, Lebanese Civil War

### Production history

**Designer** Bofors Defence

<b>Designed</b>	1930
<b>Manufacturer</b>	Bofors Defence (1932–2000) United Defense Industries (2000–2006) BAE Systems AB (2006 onwards)
<b>Produced</b>	1932–present
<b>Variants</b>	See <i>variants</i>
<b>Specifications</b>	
<b>Weight</b>	L/60: 1,981 kg (4,370 lb) L/70: 5,150 kg (11,400 lb)
<b>Crew</b>	dependent on use
<b>Shell</b>	Complete round: - L/60 40×311mmR (1.57 in), L/70 40×364mmR
<b>Caliber</b>	40 mm L/60–70 (actual caliber varies from 56–70, based on model)
<b>Carriage</b>	522 kg (1,150 lb)
<b>Elevation</b>	L/60: -5°/+90° (55°/s) L/70: -20°/+80° (57°/s)
<b>Traverse</b>	Full 360° L/60: 50°/s L/70: 92°/s
<b>Rate of fire</b>	L/60: 120 round/min L/70: 330 round/min
<b>Muzzle velocity</b>	L/60: 881 m/s (2,890 ft/s) L/70: 1,021 m/s (3,350 ft/s)
<b>Maximum range</b>	L/60: 7,160 m (23,490 ft) L/70: 12,500 m (41,000 ft)

The **Bofors 40 mm gun** is an anti-aircraft auto-cannon designed by the Swedish defense firm of Bofors Defence (the company was acquired in

September 2000 by United Defense Industries but is now a part of BAE Systems AB since March 2005). It was one of the most popular medium-weight anti-aircraft systems during World War II, used by most of the western Allies as well as by the Axis powers. The cannon remains in service as of 2011, making it one of the longest-serving artillery pieces of all time. It is often referred to simply as the ***Bofors gun***.

The Swedish Navy purchased a number of 2 pounder *Pom-Poms* from Vickers as anti-aircraft guns in 1922. The Navy approached Bofors about the development of a more capable replacement. Bofors signed a contract in late 1928. Bofors produced a gun that was a smaller version of a 57 mm (6-pounder) semi-automatic gun developed as an anti-torpedo boat weapon in the late 1800s by Finspong. Their first test gun was a re-barreled Nordenfelt version of the Finspong gun, to which was added a semi-automatic loading mechanism.

Testing of this gun in 1929 demonstrated that a problem existed feeding the weapon in order to maintain a reasonable rate of fire. A mechanism that was strong enough to handle the stresses of moving the large round was too heavy to move quickly enough to fire rapidly. One attempt to solve this problem used zinc shell cases that burned up when fired. This proved to leave heavy zinc deposits in the barrel, and had to be abandoned. In the summer of 1930 they began experimenting with a new test gun that did away with controlled feed and instead flicked the spent casing out the rear. A second mechanism reloaded the gun by "throwing" a fresh round from the magazine into the open breech. This seemed to be the solution they needed, improving firing rates to an acceptable level, and the work on a prototype commenced soon after.

During this period Krupp purchased a one-third share of Bofors. Krupp engineers started the process of updating the Bofors factories to use modern equipment and metallurgy, but the 40 mm project was kept secret.

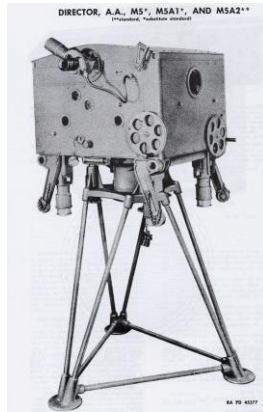


Finnish Bofors 40 mm. This gun mounts the original reflector sights, and lacks the armor found on British examples.

The prototype was completed and fired in November 1931, and by the middle of the month it was firing strings of two and three rounds. Changes to the feed mechanism were all that remained, and by the end of the year it was operating at 130 rounds per minute. Continued development was needed to turn it into a weapon suitable for production, which was completed in October 1933. Since acceptance trials had been passed the year before, this became known as the **40 mm Akan M/32**. Most forces referred to it as the **Bofors 40 mm L/60**, although the barrel was actually 56.25 calibers in length, not the 60 calibers that the name implies.

The gun fired a 900 g (2.0 lb) high explosive  $40 \times 311R$  (rimmed) shell at 850 m/s (2,800 ft/s). The rate of fire was normally about 120 rounds per minute (2.0 rounds per second), which improved slightly when the barrels were closer to the horizontal as gravity assisted the feeding from the top-mounted magazine. In practice firing rates were closer to 80–100 rpm (1.3-1.7 rounds per second), as the rounds were fed into the breech from four round clips which had to be replaced by hand. The maximum attainable ceiling was 7,200 m (23,600 ft), but the practical maximum was about 3,800 m (12,500 ft).

The gun was provided with an advanced sighting system. The trainer and layer were both provided with reflector sights for aiming, while a third crew-member standing behind them "adjusted" for lead using a simple mechanical computer. Power for the sights was supplied from a 6V battery.



M5 gun director 1944

In order to supply both the Army and Navy with much greater numbers of the guns, Chrysler built 60,000 of the guns and 120,000 barrels through the war, at half the original projected cost, and filling the Army's needs by 1943. Over the lifetime of the production, their engineers introduced numerous additional changes to improve mass production, eventually reducing the overall time needed to build a gun by half; most of these changes were in production methods rather than the design of the gun itself.

There were many difficulties in producing the guns within the United States, beyond their complexity (illustrated by the use of 2,000 subcontractors in 330 cities and 12 Chrysler factories to make and assemble the parts). The drawings were metric, in Swedish and read from the first angle of projection, with lower precision than needed for mass production. Chrysler had to translate to English, fix absolute dimensions, and switch to the third angle of projection. "It should be noted that the USN considered the original Bofors Model 1936 design to be completely unsuitable for the mass production techniques required for the vast number of guns needed to equip the ships of the US Navy. Firstly, the Swedish guns were designed using metric measurement units, a system all but unknown in the USA at that time. Worse still, the dimensioning on the Swedish drawings often did not match the actual measurements taken of the weapons. Secondly, the Swedish guns required a great deal of hand work in order to make the finished weapon. For example, Swedish blueprints had many notes on them such as "file to fit at assembly" and "drill to fit at assembly," all of which took much production time in order to implement. Thirdly, the

Swedish mountings were manually worked, while the USN required power-worked mountings in order to attain the fast elevation and training speeds necessary to engage modern aircraft. Fourthly, the Swedish guns were air-cooled, limiting their ability to fire long bursts, a necessity for most naval AA engagements. Finally, the USN rejected the Swedish ammunition design, as it was not bore safe, the fuse was found to be too sensitive for normal shipboard use and its overall design was determined to be unsuitable for mass production. US manufacturers made radical changes to the Swedish design in order to minimize these problems and as a result the guns and mountings produced in the USA bore little resemblance their Swedish ancestors." Chrysler engineers also tried to simplify the gun, unsuccessfully, and to take high speed movies to find possible improvements, but this was not possible until near the end of the war.



A MK 12 quadruple mount of Bofors guns fires from *Hornet*

The United States Navy's Bureau of Ordnance purchased a twin-mount air-cooled example directly from Bofors, which arrived in New York on 28 August 1940. During that month another Dutch ship, the *van Kinsbergen*, demonstrated the Hazemeyer mount to Navy observers. The gun was quickly chosen as the Navy's standard anti-aircraft weapon, and the Navy secretly imported a set of Imperial designs from England and started production illegally. A formal contract with Bofors followed in June 1941. The resulting Mark 1 and Mark 2 weapons were intended for the left and right side of a twin mount, respectively, and were adapted by Chrysler for water cooling. It was eventually replaced by the 3"/70 Mark 26 gun due to its problem with kill-stopping Japanese kamikaze aircraft.

The Navy's satisfaction with the weapons was demonstrated by their practice of telegraphing Chrysler Corporation with the serial numbers of guns when they shot down an aircraft.

The United States Army had recently introduced a 37 mm gun of their own design, but found it to be of limited performance. Six British Bofors were imported for testing, along with the Kerrison Directors, and proved to be superior in all areas.

In U.S. Army service, the single mount Bofors was known as the **40 mm Automatic Gun M1**. The U.S. version of the gun fired three variants of the British Mk. II high-explosive shell as well as the M81A1 armor-piercing round, which was capable of penetrating some 50 mm of homogeneous armor plate at a range of 500 yards.



40mm Automatic Gun M1

The dual version of the gun was mounted on an M24 Chaffee tank chassis and was called the M19 Gun Motor Carriage.



M19 Gun Motor Carriage

Although the L/60 was later replaced in production by the L/70, the L/60 remained in front-line service well into the 1980s. In most cases these were the ground anti-aircraft versions, as a suitable replacement in this role did not come along until the introduction of truly effective MANPADS missiles in the 1980s.

In US Army service, the M19 Gun Motor Carriage was replaced by the M42 Duster, using the same turret but based on the chassis of the M41 Walker Bulldog tank.



M42 Duster

L/60s are still used in the United States Air Force's AC-130 gunships in the air-to-ground role.



AC-130



Airmen loading ammunition in the Bofors of a Lockheed AC-130.