

Bofors 40 mm gun

The **Bofors 40 mm gun**, often referred to simply as the **Bofors gun**,^[2] is an *anti-aircraft/multi-purpose autocannon* designed in the 1930s by the Swedish arms manufacturer *AB Bofors*. 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. A small number of these weapons remain in service to this day, and saw action as late as the *Gulf War*.

In the post-war era the original design was not suitable for action against jet powered aircraft, so Bofors introduced a new model of significantly more power, the 40 mm L/70. In spite of sharing almost nothing with the original design other than the calibre and the distinctive conical *flash hider*, this weapon is also widely known simply as "the Bofors". Although not as popular as the original L/60 model, the L/70 remains in service, especially as a multi-purpose weapon for light armoured vehicles, as on the *CV 90*.

Bofors has been part of *BAE Systems AB* since March 2005.

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Bofors 40 mm gun



British Bofors 40 mm L/60 on a 360 degree turret mount, England.

| Type | Autocannon |
|--------------------|---|
| Place of origin | Sweden |
| Service history | |
| In service | 1934–present |
| Used by | See <i>users</i> |
| Wars | World War II, Indo-Pakistani wars and conflicts, Arab–Israeli conflict, Korean War, Indonesia-Malaysia confrontation, Vietnam War, Yom Kippur War, South African Border War, Falklands War, Lebanese Civil War, Gulf War, Yugoslav wars, Yemeni Civil War (2015–present), Saudi-led intervention in Yemen |
| Production history | |

Development

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 19th century 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 experiments were made with a new test gun that did away with controlled feed and instead flicked the spent casing out the rear whereafter 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

| Designer | Bofors Defence |
|----------------------|---|
| Designed | 1930 |
| Manufacturer | Bofors Defence (1932–2000) Zastava Arms (1970–present) United Defense Industries (2000–2006) BAE Systems AB (2006–present) |
| Produced | 1932–present |
| Variants | See <i>variants</i> |
| Specifications | |
| Weight | L/60: 1,981 kg (4,367 lb) L/70: 5,150 kg (11,350 lb) |
| Length | L/60: 6.5 m (21 ft 4 in) L/70: 6.3 m (20 ft 8 in) |
| Barrel length | L/60: 2.2 m (7 ft 3 in) L/70: 2.8 m (9 ft 2 in) |
| Width | L/60: 1.8 m (5 ft 11 in) L/70: 2.3 m (7 ft 7 in) |
| Height | L/60: 1.9 m (6 ft 3 in) L/70: 2.4 m (7 ft 10 in) ^[1] |
| Crew | dependent on use |
| Shell | Complete round: L/60 40×311mmR L/70 40×364mmR |
| Shell weight | .9 kg (2 lb 0 oz) ^[1] |
| Caliber | 40 mm L/60–70 (actual length varies from 56–70 calibers, based on model) |
| Carriage | 522 kg (1,151 lb) |
| Elevation | L/60: -5°/+90° (55°/s) L/70: -20°/+80° (57°/s) |
| Traverse | Full 360° |

"40 mm akan M/32". Most forces referred to it as the "Bofors 40 mm L/60", although the barrel was actually 56.25 calibres in length, not the 60 calibres that the name implies.

The gun fired a 900 g (2.0 lb) high explosive 40 × 311R (rimmed) shell at 2,960 ft/s (900 m/s)^[3] 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).

| | |
|-----------------------------|--|
| | L/60: 50°/s L/70: 92°/s |
| Rate of fire | L/60: 120 round/min L/70: 330 round/min |
| Muzzle velocity | L/60: 881 m/s (2,890 ft/s) L/70: 1,021 m/s (3,350 ft/s) |
| Maximum firing range | L/60: 7,160 m (23,490 ft) L/70: 12,500 m (41,000 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.



British 40mm L/60 includes the British-designed *Stiffkey Sight*, being operated by the gun layer standing on the right. The layer operates the trapeze seen above the sights, moving them to adjust for lead. The loader stands to the layer's left, and the two trainer/aimers are sitting on either side of the gun.

In spite of the successful development, the Swedish Navy changed its mind and decided it needed a smaller hand-swung weapon of 13 mm–25 mm size, and tested various designs from foreign suppliers. With the 40 mm well along in development, Bofors offered a 25 mm version in 1932, which was eventually selected as the Bofors 25 mm M/32

The first version of the 40 mm the Navy ordered was intended for use on submarines, where the larger calibre allowed the gun to be used for both AA and against smaller ships. The barrel was shorter at 42 calibres long, with the effect of reducing the muzzle velocity to about 700 m/s (2,300 ft/s). When not in use, the gun was pointed directly up and retracted into a watertight cylinder. The only known submarines that used this arrangement was the Sjölejonet-class boats. The guns were later removed as the subs were modified with streamlined conning towers.

The first order for the "real" L/60 was made by the Dutch Navy, who ordered five twin-gun mounts for the cruiser *De Ruyter* in August 1934. These guns were stabilized using the Hazemeyer mount, in which one set of layers aimed the gun, while a second manually stabilized the platform the gun sat on. All five mounts were operated by one fire control system.

Bofors also developed a towable carriage which they displayed in April 1935 at a show in Belgium. This mount allowed the gun to be fired from the carriage with no setup required, although with limited accuracy. If time was available for setup, the gunners used the tow-bar and muzzle lock as levers, raising the wheels off the ground and thereby lowering the gun onto supporting pads. Two additional legs folded out to the sides, and the platform was then leveled with hand cranks. The entire setup process could be completed in under a minute.

Orders for the land based versions were immediate, starting with an order for eight weapons from Belgium in August 1935, and followed by a flood of orders from other forces including Poland, Norway, and Finland. It was accepted into the Swedish Army the next year, known as the "40 mm Ivakan m/36", the lowercase "m" indicating an Army model as opposed to the capital "M" for Navy

Because of the labour shortages some of the Bofors 40mm factories were opened in Poland.

The Swedish Navy adopted the weapon as the m/36 in hand-worked single air-cooled, and power operated twin water-cooled version. A twin air-cooled mounting, probably hand-worked was also used by the navies of Sweden and Argentina and a twin air-cooled wet mounting was developed for Polish submarines.

British versions

Army and RAF Regiment versions

The British Army had first examined the weapon when they received a number of Polish-built examples in 1937 for testing, known as the "QF 40 mm Mark I" (QF standing for "quick firing"), or "Mark I/2" after a minor change to the flash hider. A licence was acquired and the gun was converted from metric to imperial measurements. They also made numerous changes to the design to make it more suitable for mass production, as the original Bofors design was intended to be hand-assembled, and many parts were labeled "file to fit on assembly", requiring many man-hours of work to complete.

Testing showed that aiming the guns against high-speed aircraft was a serious problem. Although the gun could be trained quickly, aiming accurately while doing so proved difficult. In order to address this, the British introduced a complex mechanical analogue computer, the Kerrison Director, which drove the laying electrically. A three-man team operated the director simply by pointing it at the target whilst dialing in estimates for speed, range, and various atmospheric conditions. The director then aimed the guns directly through powered mounts, as the gunners loaded the clips. This eliminated the need for the lead-correcting reflector sights, which were replaced with a backup system consisting of a simple ring-and-post sight known as a "pancake".

In this form, the "QF 40 mm Mark III" (Mk II was a designation used for a Vickers "pom-pom"), became the Army's standard light AA (anti-aircraft) weapon, operating alongside their 3-inch and 3.7-inch heavy weapons. The gun was considered so important to the defence of Britain after the fall of France in 1940 that a movie, The Gun, was produced to encourage machinists to work harder and complete more of them. British production started slowly by September 1939 only 233 equipments had been produced but by the end of the war total production from British, Canadian and Australian factories was over 19,000. Peak production year was 1942 when British factories produced 5,025 and Canadian factories produced 1,311. [4]



Bofors L/60 sighting system, left side.

In combat it was found that the Kerrison was difficult to set up to use in many situations, as well as making logistics more complex due to the need to keep its electrical generator supplied with fuel. In most engagements only the pancake sights were used, without any form of correction, making the British versions less capable than those used by other forces. Eventually an anti-aircraft gunnery school on the range at Stiffkey on the Norfolk coast delivered a workable solution, a

trapeze-like arrangement that moved the pancake sights to offer lead correction, operated by a new crew-member standing behind the left-hand layer. The "Stiffkey Sight" was sent out to units in 1943, arriving in Canadian units in the midst of the Battle of the Aleutian Islands. A final wartime change to the elevation mechanism resulted in the "QF 40 mm Mark XII". They also designed a much lighter two-wheeled carriage for airborne use.



Q.F. 40 mm Mk. 1 displayed at CFB Borden. This example mounts a Stiffkey Sight, and displays the additional armor protecting the gunners.



Bofors gun on the Ley-class minehunter HMS Isis (1978)

The Army also experimented with various self-propelled anti-aircraft systems based on various tank chassis. Changes to the breech for this role created the "QF 40 mm Mark VI", which was used on the Crusader to produce the Crusader III AA Mark I. The main self-propelled version of the Bofors used the gun set on the chassis of Morris Commercial four-wheel drive lorry, this was known as the "Carrier, SP, 4x4 40mm, AA (Bofors) 30cwt". Such guns were used in support of Army divisions to provide swift protection against air attack without the need to unlimber. They saw service in North West Europe, where six SP Bofors of 92nd (Loyals) Light Anti-Aircraft Regiment, Royal Artillery, landed with the British 3rd Infantry Division on Sword Beach on D-Day to protect the vital bridges over the Caen Canal and Orne River (Pegasus Bridge and Horsa Bridge), shooting down 17 German planes. Later in the campaign, SP Bofors were used extensively for ground shoots as well as in an anti-aircraft role. In British army service the Bofors found a highly specialised role: during the North Africa Campaign at the Second Battle of El Alamein, they were used to fire tracer horizontally to mark safe paths for units through the German minefields. This practice was further developed during operations in North-West Europe, where bursts of colour-coded tracer were used to define the axis of advance of the different formations in large-scale night attacks.

The formation of the RAF Regiment in February 1942 (in response to the Army's failure to defend airfields on Crete, which resulted in strategic defeat on the island to numerically inferior German forces) signalled the transfer of responsibility for defending airfields to the RAF from the Army. This included low-level air defence and the Bofors L60—to the same design as the Army version—was the principal weapon for the RAF Regiment's Light Anti-Aircraft squadrons in North Africa, Malta, Italy, the Balkans, the UK (including the allocation of fifty-two squadrons to Operation DIVER), and North Western Europe (from D-Day through to the cessation of hostilities). No 2875 Squadron RAF Regiment, employing the L60, became the first unit to shoot down a jet aircraft, a Me 262, with ground-based anti-aircraft fire, at Helmond in the Netherlands on 28 November 1944. Although the Allied air forces had achieved air superiority after D-Day, forward airfields continued to be high priority targets for the Luftwaffe when the opportunity presented and this ensured that the RAF Regiment's L60s continued to be heavily used. For example, during the Ardenne Offensive, RAF Regiment Light Anti-Aircraft squadrons shot down 43 German aircraft and damaged 28 others during attacks on eleven RAF forward airfields on New Year's Day 1945. After World War 2, the RAF Regiment continued to employ the L60 as its principal anti-aircraft weapon until it was replaced by the L70 gun in 1957. The guns were deployed in the UK, Germany, Cyprus, the Middle East, and the Far East (there had been insufficient L60s available to equip the RAF Regiment's squadrons in the Far East during the war; these having to make do mostly with Hispano and Oerlikon guns).

Naval versions

The Royal Navy also made extensive use of the Bofors. Their first examples were air-cooled versions quickly adapted to ships during the withdrawal from Norway. With the fall of the west in 1940 the Dutch mine-layer Willem van der Zaan brought them their first example of a water-cooled gun on their Hazemeyer tri-axially stabilized mounting. Locally produced examples started arriving in 1942, known as the "QF 40 mm Mark IV" for use in twin-mounts, or the "QF 40 mm Mark V" for single mounts. The Navy ran through a variety of versions of the basic Bofors gun over the war, including the Mark VII to Mark XI. The Royal Navy's home-grown light anti-aircraft weapon, the QF 2-pounder gun, also had a caliber of 40 mm, but was referred to as the QF 2-pdr

The designation of models in Royal Navy service is confused as the gun and its mounting received separate mark numbers. The following mountings were used;

- Mark I: twin mounting based on American design and using American built guns, not widely fitted. Fitted for remote fire control.
- Mark II: quadruple version similar to Mark I
- Mark III: a navalized version of the Army single mounting, hand worked elevation and training.
- Mark IV: a tri-axially stabilized twin mounting copied from, and usually known as, the "Hazemeyer". It had on-mounting fire control, and was usually fitted with Radar Type 282 to provide target range information.
- Mark V: twin mounting, that superseded and eventually replaced the Mark IV often referred to as the "utility" mounting. This was a simplified, unstabilised mounting based on the American twin mounting Mark I, and was



Twin Bofors 40 mm aboard ORP *Błyskawica*, a WWII destroyer of the Polish Navy.

designed for remote fire control.

- Mark VI: a six-barreled weapon feeding from large trays instead of clips and designed for remote control from a dedicated radar-equipped director.
- Mark VII: a single barreled, hydraulically powered mounting that superseded the Mark III and entered service in 1945.
- Mark IX: Mark VII mount modified to electrical power as the Mounting Mark IX, and in this form saw service in the Falklands War.

The Mounting Mark V (Mark VC for Canadian built examples) for the 20 mm Oerlikon and QF 2 pounder guns was also adopted initially as an interim mount for the Bofors. It was a single-barreled mounting with hydraulic power, and was known as the "Boffin".

The final British Bofors mounting that saw service was the "STAAG" (stabilized tachymetric anti-aircraft gun) which was twin-barrelled, stabilised, and carried its own tachymetric (i.e. predictive) fire control system, based around the centimeter Radar Type 262, capable of "locking on" to a target. This mounting was heavy (17.5 tons) and the high-vibration environment of the gun mounting was poor location for sensitive valve electronics and mechanical computers. STAAG Mark I carried the radar dish over the gun barrels where it was subject to damage during firing, therefore STAAG Mark II shifted the set to the roof of the control cabin. STAAG was ultimately too difficult to maintain in the harsh environment of a warship and was later replaced by the Mounting Mark V with the fire control equipment located remotely, the single Mark VII and ultimately, with the Sea Cat missile. The final version of STAAG was fitted to the RN Type 12 Whitby a/s frigates and the Type 41/61 diesel frigates completed 1956–1958. HMNZS Royalist was also fitted with STAAG Mk 2 during modernisation, completed in 1956. Initially it had 3 STAAG CIWS, the STAAG in Q position was removed in 1960, but it carried two mounts until the end of its service in South East Asian waters, in 1965. The crew of Royalist appeared to find the STAAG a reasonably effective and impressive anti-aircraft weapon during Operation Musketeer in 1956, off Egypt.



Single Bofors 40 mm Bofin mounting, displayed at CFB Borden. In 1996 museum pieces like this cannon were pressed back into service to serve as the main armament of the Kingston-class minesweepers.^[5]

U.S. versions

Manufacturing

In order to supply both the US Army and US 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.^[6] 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.^{[6][7]} York Safe & Lock also produced the weapons, though its attempts to coordinate drawings across the program were unsuccessful, and this responsibility was transferred to the Naval Gun Factory in July 1943.^[8]

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. Chrysler had to translate to English, fix absolute dimensions, and switch to the third angle of projection. 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.^[6]

Naval

The United States Navy's Bureau of Ordnance purchased a twin-mount air-cooled example, spare parts and 3,000 rounds of ammunition directly from Bofors, which arrived in New York on 28 August 1940 aboard the Army transport USAT American Legion, which had evacuated 897 people, including members of the Norwegian royal family, through the Finnish port of Petsamo.^[9] 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 over the British 40mm calibre, 2-pounder pom-pom; however, negotiations with Bofors for licensed production stalled when the Swedes requested airplane export and manufacturing licenses in return.^[8] Reportedly, the Navy secretly imported a set of imperial designs from Britain and started production illegally. A formal contract with Bofors was reached 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.^[6]



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

Following the attack on Pearl Harbor on 7 December 1941, the existing 1.1" (28 mm) quad mount and .50 caliber machine guns were determined to be inadequate against modern aircraft, and their replacement by 40 mm Bofors and 20 mm Oerlikon weapons was accelerated. The water-cooled version was used almost exclusively by the US Navy and Coast Guard. The 40 mm quadruple mount was developed by essentially mounting two twin mounts side-by-side.^[8] A major improvement was the addition of power operation to both twin and quadruple mounts. Essentially all US naval mountings were twin or quadruple. 40 mm weapons were eventually mounted on virtually every naval and armed auxiliary vessel larger than a small landing craft.^[8] After the war, the 3"/50 caliber gun Mark 27 twin mount began to replace the Bofors, because the "VT" proximity fuse would not fit a 40mm projectile, and the 40 mm weapon was considered inadequate against the emerging anti-ship missile threat. The twin 3" mount was intended to be the same weight as the 40mm quad mount, but was somewhat heavier in practice, which had to be compensated for. Except on destroyers and new construction, the Navy was slow in phasing out the 40 mm gun, and it continued in active Navy service through the Korean War. It remained on inactive Reserve fleet ships at least through the early 1970s.^[10]

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.^[6]

Army

In 1938 the United States Army introduced a 37 mm gun of their own design, but found it to be of limited performance. In early World War II, six British Bofors were imported for testing, along with Kerrison Predictor directors, and they proved to be superior in all areas. By the middle part of the war, most of the 37 mm guns had been replaced by the 40 mm.

In U.S. Army and Marine Corps 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.

In the Army, each Anti-Aircraft Artillery (AAA) auto-weapons battalion was authorized a total of thirty-two 40 mm guns in its four firing batteries.^{[11][12]} Each US Marine division had a "special weapons battalion" that included sixteen 40 mm guns; in early 1944 these were replaced with anti-aircraft battalions with twelve 40 mm guns. Marine defense battalions also used the 40 mm gun!^{[13][14]} All of these unit types also included other AA weapons.



Two 40 mm M1 guns on US Army mountings

During World War II, the twin mount version of the gun was mounted on an M24 Chaffee tank chassis as the M19 Gun Motor Carriage. In the 1950s, the M41 Walker Bulldog tank was heavily modified into the M42 Duster with the same twin 40 mm mounting. After being largely withdrawn from service in the early 1960s, the M42 was re-introduced beginning in 1966 for the Vietnam War, where it was mostly used for ground fire support. Following the withdrawal from Vietnam in the early 1970s, the M42 was retained in National Guard service until finally retired in 1988.

Air Force

See "Variants/Gunships" below

Captured examples

In World War II Germany, the Wehrmacht used a number of Bofors guns which had been captured in Poland and France. The Kriegsmarine also operated some guns obtained from Norway. In German naval use, the gun was designated the "4 cm Flak 28", and was used aboard the cruisers Admiral Hipper and Prinz Eugen toward the end of the war^[15] Beginning in 1942, several E-boats were equipped with the Flak 28 to enable them to fight against British MGBs and MTBs on equal terms.

Japan captured a number of Bofors guns in Singapore and put them into production as the Type 5.

Both Japan and West Germany continued to use the Bofors gun throughout the Cold War. The Federal German navy used it in destroyers, frigates, and fast patrol boats until 1984, and in minesweepers to the present day

Variants

40 mm L/60

Although the L/60 was later replaced in production by the L/70, it 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 United States 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.

The L/60 saw active service with the Argentinian and British Navies in the 1982 Falklands War and continued to be used into the 1990s, when it was replaced by modern 20-mm and 30-mm artillery

The Canadian Forces also used Bofors on their surface fleet, but removed the guns in the late 1980s when they were considered to be outdated. Bofors continue to be the main armament of the Kingston-class coastal defence vessel, although the navy is in the midst of a search for a suitable replacement^[5]

As of August 2006, the French navy uses L/60s on more than twenty ships (patrols and auxiliaries). Ships of the Norwegian and Icelandic Coast Guards continue to use the 40mm Bofors gun. The L/60 continued in use in the Irish Army until recent years, when it was retired in favour of the radar-controlled L/70. The Irish Naval Service P20 class retained L/60s on board as their main weapon until the 1990s but



The L/60 Bofors fitted to the Kingston-class coastal defence vessel HMCS Nanaimo



Twin L/60 dismounted from an Argentinian corvette which saw service during the Falklands war

were rearmed with L/70s. The last remaining P20-class patrol vessel, (LÉ Aisling) due for decommissioning in 2016, is now the only vessel fitted with the L/70. Two retired L/60s can be seen adjacent the square in Sarsfield Barracks, Limerick.

The last 40 mm/60 Bofors in service with the Royal Australian Navy (RAN) were used as the main weapon aboard the Attack class and Fremantle class patrol boats and for training purposes at the West Head gunnery range at HMAS Cerberus.^[16] These were removed from service during 2007; Bofors were used aboard almost every RAN ship to operate between the 1940s and the 1990s, including the aircraft carriers Sydney and Melbourne.^[16]

As of 2012, the L/60 is still in use by the military of Brazil, Indonesia, Paraguay and Taiwan.

40 mm L/70

By the end of World War II, jet aircraft had so increased the speed of attack that the Bofors simply could not get enough rounds into the air to counter the aircraft before it had already flown out of range. In order to effectively engage these threats, the gun would have to have longer range and a higher rate of fire, thereby increasing the number of rounds fired over the period of an engagement. Bofors considered either updating the 40 mm, or alternately making a much more powerful 57 mm design. In the end they did both.

The new 40 mm design used a larger 40 × 364R round firing a slightly lighter 870 g shell at a much higher 1,030 m/s (3,379 fps) muzzle velocity. The rate of fire was increased to 240 rounds per minute (4.0 rounds per second), similar to the German Flak 43. Additionally, the carriage was modified to be power-laid, the power being supplied by a generator placed on the front of the carriage. The first version was produced in 1947, accepted in 1948 as the "40 mm Ivakan m/48", and entered Swedish service in 1951. Additional changes over the years have improved the firing rate first to 300 rpm (5.0 rounds per second), and later to 330 rpm (5.5 rps).



Bofors 40 armed Swedish Combat Vehicle 90 (CV90)

Foreign sales started, as they had in the past, with the Netherlands and the United Kingdom. In November 1953 it was accepted as the NATO standard anti-aircraft gun, and was soon produced in the thousands. The L/70 was also used as the basis for a number of SPAAGs, including the U.S. Army's failed M247 Sergeant York. The UK's RAF Regiment adopted the L70 to replace its L60 guns in 1957, retiring its last examples in 1977 and replacing them with the Rapier system.

In 1970's Zastava Arms acquired from Bofors license to produce L/70 version together with laser-computer group. ^[17] Ammunition 40mm for L/70 is locally produced for domestic use and export in Sloboda Čačak ^[18]

In 1979 the Royal Netherlands Air Force acquired 25 KL/MSS-6720 Flycatcher radarsystem and upgraded 75 of their 40L70s to create 25 firing units for static air base defense. The improved guns had an increased rate of fire (300 rounds/min) and the loading mechanism was provided with extended guides so that it could hold 22 cartridges. A 220V diesel generator was mounted onto the undercarriage. This generator was powered by a Volkswagen diesel engine.



Some of HMAS Sydney's 40 mm L/60 guns firing off Korea in 1951.



New Serbian hybrid SPAAG 40mm and SAM - PASARS 16.



Brazilian Marine Corps shooting a Bofors L/70.

In 1989 the Royal Netherlands Army acquired 30 Flycatcher systems. Each Flycatcher was fielded with two modified Bofors 40L70G guns. The 'G' stands for 'Gemodificeerd', which is the Dutch word meaning 'modified'. In the 40L70G version the loading mechanism was further improved and could be recognized by open rear guides. The 40L70G guns were also provided with muzzle velocity radars.

Early in the 1990s the Royal Netherlands Air Force 40L70s were upgraded to the 'G' version.

In the Swedish Army Combat Vehicle 90 there is a cartridge fed, automatic version of the L/70 gun installed. In order to fit inside the vehicle, the gun is mounted upside down. New armour piercing and programmable ammunition have also been developed. Germany has used L/70 guns on its Class 352, Class 333 and Class 332 mine hunting vessels, although these will be replaced by Rheinmetall MLG 27 remote-controlled gun systems until 2008. Until the early 80s L/70 guns guided by D7B radars were in widespread use in the anti-aircraft role in the German Navy and German Air Force until replaced by Roland SAMs.

DARDO

Breda (now Oto Melara) of Italy uses Bofors 40 mm L/70 gun in its anti-aircraft weapon systems Type 64, Type 106, Type 107, Type 564 and Type 520. Also they have developed a CIWS system named DARDO for the Italian Army and Navy. A newer development from Breda, the Fast Forty (essentially a DARDO gun mount with twin 40mm/L70 guns), has nearly doubled the rate of fire to 450 rpm (7.5 rounds per second) (2 × 450 in twin mount), normally equipped with a 736-round magazine and a dual feed mechanism for naval use.

Gunships

Since the beginning of the 1970s Bofors L/60s have been used in the United States Air Force's AC-130 gunships in the air-to-ground role.^[19] There were plans to remove these and the M61 Vulcans from newer AC-130U variants and replace them with 30-mm autocannons. However, these plans did not come to fruition, and the Bofors and Vulcans are still in service!^[20]

When four additional AC-130Us were to be converted from 2002, the necessary 40 mm L/60 guns had to be salvaged from old M42 targets at the Nellis AFB range.^[21]



Bofors guns on Spectre gunship

Users

-  [Algeria](#)
-  [Argentina](#)
-  [Australia](#)
-  [Austria](#)
-  [Bahrain](#)
-  [Bangladesh](#)
-  [Belgium](#)
-  [Bosnia and Herzegovina](#)
-  [Belize](#)
-  [Brazil](#)
-  [Brunei](#)
-  [Cambodia](#)
-  [Canada](#)
-  [Chile](#)
-  [Croatia](#)
-  [Cyprus](#)

-  Czech Republic
-  Denmark
-  Djibouti
-  Dominican Republic
-  Ecuador
-  Egypt
-  Finland
-  France
-  Germany
-  Georgia: Used on Coast Guard ships and vessels
-  Guatemala
-  Greece
-  India
-  Indonesia
-  Iceland
-  Ireland: Taken out of use in 2016 on decommissioning of last naval vessel using it.
-  Iraq
-  Israel
-  Italy
-  Japan
-  Jordan
-  Kenya
-  Lebanon
-  Libya
-  Latvia
-  Lithuania
-  Malaysia
-  Mexico
-  Malta
-  Montenegro
-  Myanmar
-  Netherlands
-  Nigeria
-  Norway
-  New Zealand
-  Oman
-  Pakistan
-  Panama
-  Papua New Guinea
-  Paraguay
-  Peru
-  Philippines
-  Poland
-  Portugal
-  Qatar
-  Saudi Arabia
-  Serbia
-  Singapore
-  Sudan

-  [South Africa](#)
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-  [Timor-Leste](#)
-  [Turkey](#)
-  [United Arab Emirates](#)
-  [United Kingdom](#)
-  [United States](#)
-  [Soviet Union](#)^[22]
-  [Uruguay](#)
-  [South Vietnam](#)
-  [Venezuela](#)
-  [Yemen](#)

See also

- [Bofors 57 mm gun](#)
- [List of anti-aircraft guns](#)
- [List of naval anti-aircraft guns](#)
- [Lockheed AC-130](#)
- *The Bofors Gun*– 1968 movie about British airmen in Germany; the gun's role is incidental

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Notes

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External links

- [1940 Popular Science cover illustration of twin 40mm Bofors in Swedish service](#)
- "[New Tools For Army Power](#)", October 1941, *Popular Science*, pages 73–74 on testing of US version of 40mm Bofors
- [40-mm Automatic Gun M1 \(AA\) and 40-mm Antiaircraft Gun Carriages M2 and M2A1 TM 9-252](#)
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- [Data and spec comparison of various marks of Bofors 40mm L/60](#)
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