

# ARCHIVED REPORT

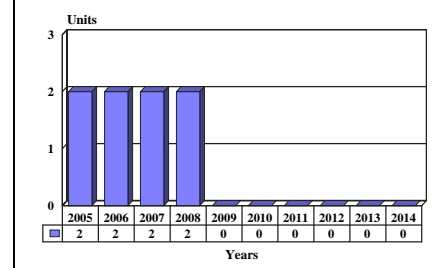
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## Oto Melara Compact 40/Fast 40 Systems - Archived 5/2006

### Outlook

- Only Chinese licensed production now current
- Most customers prefer 25 – 35mm weapons for surface work
- Anti-aircraft role now handled by 57 – 76mm guns
- Ammunition supplies extensive and cost-effective
- Any future requirements likely to be met by refurbished guns

10 Year Unit Production Forecast  
2005 - 2014



### Orientation

**Description.** Radar or optical-guided or manned 40mm naval gun.

**Sponsor**

General Direction for Naval Constructions and Naval Weapons  
 Piazza della Marina  
 1-00196 Rome  
 Italy

**Status.** Production and service.

**Total Produced.** More than 500 systems are estimated to have been built by the year 2001.

**Application.** On small craft, the Oto Melara 40mm weapons form the primary anti-surface armament for

use in combat against similar vessels, and provide point defense against aircraft and missile attacks.

**Platform.** This gun can be installed on warships that are approximately 200 tons or more in size. Such platforms have traditionally ranged from OPCs up to aircraft carriers.

**Price Range.** Based on a comparison of similar systems and the 1995 contract price for eight mounts, it is estimated that the gun system itself costs between \$1.5 and \$2 million. However, a complete Dardo system with target acquisition radar, fire control radar, and four 40mm mounts is highly unlikely to be obtainable for less than \$10 million.

### Contractors

Oto Melara SpA, <http://www.otomelara.it>, Via Valdicocchi 15, La Spezia, 19136 Italy, Tel: 39 0187 5811 11, Fax: 39 0187 58266, Email: [info@otomelara.it](mailto:info@otomelara.it), Prime

China National Electronics Import and Export Corp, <http://www.ceiec.com>, Electronics Building, 49 Fuxing Road, Beijing, 100036 China, People's Republic of, Tel: 86 861810910, Licensee

### Technical Data

Specifications	Metric	U.S.
Caliber	40mm L70	1.57 in
Maximum Recoil	100 mm	9.8 in

	<u>Metric</u>	<u>U.S.</u>
Muzzle Velocity	1,000 m/sec	
Maximum Range/Surface	12,500 m	13,670 yd
Maximum Range/Height	8,700 m	9,514 yd
Working Radius	2,902 m	114.3 in
Training	Unlimited	
<b>Specifications</b> (continued)		
Rate of Fire	450 rpm, 120 rpm, or single shot	
Maximum Elevation/Depression	+85/-13 deg	
Elevation Speed/Acceleration	75 deg /sec, 200 deg/sec <sup>2</sup>	
Training Speed/Acceleration	130 deg/sec, 200 deg/sec <sup>2</sup>	
Feeding Mechanism	Fully automatic, dual	
Ammunition Capacity	144 rounds	

**Design Features.** The Twin Fast 40 gun mount consists of two modified 40mm L70 Bofors guns, each firing 450 rounds per minute. The mount is fitted with a new recoiling mass, a dual-feed system, and digital servo control. The effect of the new recoiling mass is to reduce the recoil stroke of the guns more than 50 percent, speeding the firing cycle accordingly. The dual-feed system employs a lower magazine under the mount platform, plus a ready-service magazine split between the two guns, and located just beneath the mount.

Two versions are available: Type A, which contains 736 rounds in seven horizontal layers; and Type B, which contains 444 rounds in four horizontal layers. When the mount is in action, elevators transfer the ammunition from the magazines to two shifters, which feed the gun breeches.

The Dardo system generally uses an Alenia Orion RTN-20X fire control radar cued to target by an RTN-30X target acquisition radar. Many ships have the

40mm L70 gun, but not the Dardo system with its target acquisition and fire control radars. The RTN-20X is an I/J-band monopulse radar; it is frequency and Pulse Repetition Frequency (PRF) agile, permitting it to operate in a high electronic countermeasures (ECM) environment.

**Operational Characteristics.** Normally, the ship's search radar acquires a target and passes it to the Elsig fire control computer, which automatically evaluates the target and sends it to the RTN-20X. The system can handle 10 targets simultaneously. The operator can control the gun manually from a below-decks control console. The gun can be slaved to other search and tracking radars and optical directors.

Proximity-fuzed prefragmented rounds are generally used, but the gun can also employ armor-piercing tracer and impact-fuzed high-explosive rounds. The mount has unlimited traverse with depression/elevation limits of -13 and +85 degrees. The system serves as an anti-surface weapon aboard fast attack craft.

## Variants/Upgrades

**Compact 40.** This version has ammunition capacity similar to that of the Twin Fast 40 and is rated at around 600 rpm (300 per gun). Total weight without ammunition is 5,500 kilograms for mounts with Type A magazines and 5,300 kilograms for mounts with Type B magazines. The training rate is 90 deg/sec and the elevation rate is 60 deg/sec. The system has substantially improved reaction times and has a reduced manpower requirement. The most important enhancements are greatly improved accuracy and reduced shot dispersion, which permit engagement of sea-skimming missiles at ranges in excess of 3,000 meters.

**Dardo.** This is the CIWS based on the Otobreda Twin 40mm Compact gun mount. It is integrated with a separate Selenia Orion RTN-20X J-band radar, which also has a TV camera. The system is fully automatic, with an option for manual operation as well.

The operational features include automatic detection of targets based on search radar video extraction; the ability to evaluate the priority target within a preset guard ring, followed by automatic engagement of that target; a specialized tracking prediction model for the missile threat; automatic acquisition and tracking of a missile launched by the tracked platform; automatic firing action; fast target shifting in case of multiple threats; alternative semi-automatic or manual operational modes; and a TV camera mounted on the radar director for monitoring and visual control.

More than 180 systems had been bought by the early 1990s.

**Fast 40 Type A.** This is a remote-controlled version of the Fast 40 model, using unmanned targeting and firing where a dedicated fire control system is available. The weight of this type is 4,350 kilograms with ammunition, and 4,000 kilograms without ammunition.

Fast 40 Type B. A local-control version of the same, with the gunner being seated in the gunhouse to control the weapon by means of a hand controller. Aiming is done through a natural line of sight. The weight of this type is 4,550 kilograms with ammunition, and 4,200 kilograms without ammunition.

Fast 40 Type C. The Fast 40 Type C weapon is equipped with an integral micro fire-control system. The FCS comprises a TV line of sight, independent of the line of fire; zoom magnification; continuously variable, three-axis zero-drift stabilization; computer-aided tracking of rapidly moving air targets; and complete lead-angle and ballistic computation. The weight of this type is 4,600 kilograms with ammunition, and 4,250 kilograms without ammunition.

Korean Twin 40mm/70 K(T) Version. South Korea's Daewoo, which manufactures the Twin 40 locally on license, has developed a new version, dubbed the Twin 40mm/70 K(T). The mount fires at 330 rpm per gun and carries 768 rounds of ready-use ammunition on-mount. It went into production in June 1994.

Modernization Kit for Twin 40. A modernization kit for the Twin 40mm/70 Model 64 became available at the beginning of the 1990s. The main improvements over the standard model reportedly include the substitution of the hydraulic servo system with an electrical one, and introduction of a converter to reduce the power feed needed for the operation of the system during slewing. The local control system was replaced by a hand controller (a joystick?) that converts the operator's

movements into electrical signals, which helps to control training and evaluation. Furthermore, an EPROM was employed for the correction of parallax, climb-over, and blind arcs. Visually, the most significant difference was the introduction of a cupola that covers the entire mount.

Type 106 and Type 107. These are conventional open loop gun systems. These systems are in service with the Italian and German navies.

Type 64. This is a twin-mount system with each gun carrying 100 rounds of ammunition. This system is much heavier (7,900 kg), with a train rate of 85 degrees per second and an elevation rate of 95 degrees per second.

Type 564 (Breda-Bofors 350P). This is a single-barrel mount outfitted with a Model 1971 144-round automatic magazine. This unit is much lighter, with a total weight (less ammunition) of 3,300 kilograms. The unit has a train rate of 80 degrees per second and an elevation rate of 45 degrees per second.

Type 76A. Chinese license-built point defense system apparently based on Dardo CIWS but chambered for 37mm ammunition. The Chinese 37mm round is a copy of an original Russian shell, which was itself derived from the 37mm predecessor to the Bofors 40mm L60. Thus, the use of the 37mm round is of no real consequence other than a small loss of lethality. This system has also been designated the Type 88C; the differences (if any) between the two are unclear.

## Program Review

**Background.** In the early 1970s, most Western navies were evaluating various Close-In Weapon Systems for provision of last minute anti-air defense. The Italian ordnance manufacturer Breda Meccanica had been manufacturing the Bofors 40mm gun under license since the 1950s. Breda and Alenia formed a partnership in 1971 to produce a radar-guided CIWS version. Field tests were successfully conducted in the summer of 1974.

While the field tests were being conducted, the Italian Navy was considering means for close-in defense of its warships. The Navy tested the Breda system in 1976. In 1977, eight systems, designated the Dardo, were ordered for the Lupo class frigates. Advanced development continued while the first production models were being installed. During tests in June 1980, the frigate RIM *Sagittario* engaged six jet-towed targets. Four were downed in four bursts, while the last two were heavily damaged. Dardo sales increased in the late 1970s. The Breda Dardo system was also chosen by the French firm Constructions Mecaniques de Normandie (CMN) as the secondary gun armament for the

Combattante fast attack craft. The Dardo's ability to engage both surface and air targets played a major role in its selection.

In 1992, a senior Chinese admiral addressed a group of naval officer cadets on present and future Chinese naval programs, implying that the Chinese Navy had already adopted the Breda 40mm L70 Dardo system as equipment for the Luda III, Jianghu IV, and Jiangwei class frigates. It was also suggested that this equipment was being produced under license in China. This information was subsequently confirmed by examination of photographs of the Jiangwei class frigates. These pictures clearly showed the 40mm L70 turrets and the fire control radars. Subsequent information indicated that the gun mounts in question were chambered for 37mm ammunition.

In January 1995, Finmeccanica finalized its takeover of seven companies, including both Breda and Oto Melara. As part of a major corporate reorganization to integrate the new acquisitions with existing divisions, the gun businesses of Oto Melara and Breda were merged to

form a new entity, designated Otobreda. By this time the 40mm CIWS solution had fallen out of favor with the Italian Navy, which strongly favored the 76mm solution for CIWS work. The Dardo system used on the Francesco Mimbelli class missile destroyers had been re-engineered to handle 76mm L62 guns. In December 2001, the name changed back to Oto Melara.

The Fast 40/Compact 40 systems continued to hold a position as the primary armament of small craft and secondary duties ships. Kuwait specified a single such mount for each of its P-37BRL (Um Al Maradim) class ships in 1996, and these ships are now in service with the Kuwaiti Navy. The Italian Navy did make a concerted effort to have a 40mm gun solution adopted as the CIWS system for the Anglo-Italian-French

Project Horizon Common New Generation Frigate. However, this program collapsed, and the Franco-Italian Horizon design now features three 76mm L62 guns. The Franco-Italian FREMM program also uses the 76mm gun in the point defense role, rather than the 40mm twin.

Early in the evolution of the program that culminated in the production of the new aircraft carrier *Andrea Doria*, the 40mm twin mount was proposed as the close-in defense system. Later this application, too, was rejected in favor of a pair of 76mm guns backed up by three single 25mm L87 Oerlikon-Oto Melara KBA AA guns. Later, the 76mm guns were also deleted. The CIWS function on this ship is being filled by the ASTER-15 missile.

## Funding

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This program is funded by the Italian MoD.

## Recent Contracts

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<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Otobreda	15.6	Nov 1995 – A contract from Kuwait for first installation of eight Fast 40 L/70 guns on the new patrol boats being procured from France.
Otobreda	N/A	Summer 1996 – Contract for 8,000 rounds of ammunition for Italian Navy.

## Timetable

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<u>Year</u>	<u>Major Development</u>
1971	Research started to develop a CIWS system
1974	Field tests completed
1976	Italian Navy tests the Breda CIWS system
1977	First systems ordered
1980	First successful test from a ship completed
1992	Licensed production by Chinese disclosed
1994	Korea's Daewoo begins licensed production of new Twin version
1995	Kuwaiti contract for installation on the eight missile boats (first Fast 40 customer)

## Worldwide Distribution

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The following list shows the numbers of twin mounts currently in service. No distinction is made between Twin Fast 40 and Compact 40 mounts. These systems are not part of the Dardo CIWS unless specifically indicated. Chinese versions are all chambered for 37mm.

**Algeria.** 2 on Kalaat Beni Hammed LST

**Argentina.** 16 on MEKO-360 FF, 12 on MEKO-200 FFL, 3 on A-69 FFL

**Bahrain.** 2 on TNC-62 FAC-M, 4 on TNC-45 FAC-M, 2 on TNC-38 FAC-G

**Bangladesh.** 1 on Bangabandhu FF

**China.** 8 Dardo on Luhui class FF, 4 Dardo on Luhai class FF, 8 Dardo on Luda III FF, 4 Dardo on Jianghu IV FF, 8 on Jianghu III FF, 8 Dardo on Jiangwei FF, 32 Type 76A on Houxin FAC-M, 6 Type 76A on Houjian FAC-M

**Colombia.** 4 on FS-1500 FF

**Ecuador.** 6 Dardo on Esmeraldas FF

**Egypt.** 6 on Ramadan FAC-M

**Greece.** 4 on P-100 OPV

**Italy.** 3 Dardo on Giuseppe Garibaldi CH, 3 Dardo on Vittorio Veneto CHL, 16 Dardo on Maestrale FF, 10 Dardo on Lupo FF, 1 on Etna AOR

**Kuwait.** 1 on TNC-57 FAC-M, 1 on TNC-45 FAC-M, 8 on P-37BRL

**Libya.** 7 on Combattente II FAC-M

**Malaysia.** 4 on Laksmana FFL

**Nigeria.** 4 on MEKO-360 FF, 2 on Erinomi FFL, 3 on Combattente III FAC-M, 2 on TNC-57 FAC-M

**Oman.** 4 on Province FAC-M

**Peru.** 4 on Almirante Grau CL, 2 on Daring FF, 8 Dardo on Lupo FF, 6 on Velarde FFL

**Qatar.** 3 on Combattente III FAC-M

**Saudi Arabia.** 8 on Al Madinah FF

**South Korea.** 15 on Ulsan FF, 40 on Pohang II FFL

**Thailand.** 2 on Ratanakosin FFL, 2 on Chonburi FAC-G, 8 Type 88C on Nareusan frigates

**Tunisia.** 3 on Combattente III FAC-M

**UAE.** 6 on TNC-45 FAC-M

**Venezuela.** 12 Dardo on Lupo FF

## Forecast Rationale

It appears almost blasphemous to suggest that a representative of the long-standing Bofors 40mm family has reached the end of the line and is being outmoded by later developments. The 40mm has been a part of the naval armament scene for so long that it has become almost iconic of the warship world. However, it does seem that the Oto Melara representative of this enduring group of weapons is indeed out of production. Only the license-built Chinese versions remain in production and these are chambered for the people's Liberation Army Navy (PLAN) 37 x 225mm round, as distinct from the Bofors 40 x 365mm round.

The 40mm round owed its existence to international legal agreements that outlawed explosive ammunition in calibers below 37mm. That agreement is now long-obsolete and effectively void. As a result, a range of new autocannon has been introduced to the naval market. These have calibers of 25, 30 and 35mm and are as effective in anti-surface applications as the much heavier and manpower-intensive 40mm. In the anti-aircraft role, the 40mm, in both its L60 and L70 variants, is obsolescent and incapable of dealing with modern threats in a convincing manner. It has been replaced by the 57mm and 76mm guns. In its last

possible role, as an anti-missile weapon, it has also been replaced by heavier guns and by missiles.

The Oto Melara Compact 40 and Fast 40 do still have merits. They are solid, reliable pieces of engineering, robust and well-suited to operations where long-term durability and functioning in adverse conditions are at a premium. In addition to being proven and cost-effective weapons, their ammunition is so widely available that users have no cause for concern over supply; if one supplier decides not to sell, there are plenty more to take their place. It should also be noted that the robust design of the Oto Melara 40mm family means it can tolerate ammunition standards that would jam a more sophisticated weapon.

These considerations suggest that there should be a small niche market for the Oto Melara 40mm guns left. The problem is that so many guns of this type have been produced, and sold so widely, that existing refurbished mounts are available at very economic rates to those countries that wish to stick with a reliable, trusted and robust solution. For those who wish to buy new weapons and gain the advantages of weapons designed with the benefits of modern technology, there are many better options now to choose from.

## Ten-Year Outlook

### ESTIMATED CALENDAR YEAR PRODUCTION

Designation	Application	Thru 04	High Confidence Level				Good Confidence Level				Speculative		Total 05-14	
			05	06	07	08	09	10	11	12	13	14		
OTO MELARA 40 MM GUN	FF/DD (PLAN)	216	2	2	2	2	0	0	0	0	0	0	0	8
OTO MELARA 40 MM GUN	Prior Prod'n:	349	0	0	0	0	0	0	0	0	0	0	0	0
Total Production		565	2	2	2	2	0	0	0	0	0	0	0	8