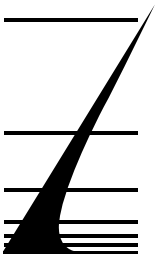
The Market for Naval Surface Warfare Systems

Product Code #F675

A Special Focused Market Segment Analysis by:



FORECAST INTERNATIONAL

Analysis 3
The Market for
Naval Surface Warfare Systems
2010-2019

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Introduction

Over the last year, two events have taken place that have a direct bearing on the issue of naval surface warfare. One is the sinking of the Korean corvette *Cheonan* by a North Korean torpedo. While the balance of evidence is that, in this case, the torpedo was launched by a submarine, the lesson for the surface warfare market is the sheer ship-killing power of modern anti-ship weaponry. The *Cheonan* was literally blown in half by the torpedo hit that sent her to the bottom in just a few minutes. It was a classic one-shot kill and the *Cheonan* did not stand a chance of survival. The interesting point here is that, during the Second World War, destroyers similar in size to the *Cheonan* frequently survived torpedo hits, were repaired and returned to service. The destruction inflicted by the torpedo in the *Cheonan* case was much greater than was experienced in those older cases, and this change has implications across the naval surface warfare sector. Weapon lethality has increased dramatically.

The second event was the Israeli boarding of a merchant ship convoy on its way to Gaza. Gaza has been declared by Israel as being under blockade, which brings into play a series of international agreements dating back to the Paris Declaration of 1854 and the Hague Conventions of 1907. A blockade is a means by which certain categories of cargo can be denied to a specific area. A nation that claims to be enforcing a blockade has the legal right to stop a ship heading for a blockaded port and inspect it for cargo that falls into the barred categories. Contrary to many statements made recently, it is quite legal to make such an interception in international waters – during the Second World War, the British intercepted blockade runners in the South Atlantic Ocean, thousands of miles from British territorial waters. If ships are found to be carrying prohibited cargo, they can either be turned back or forced to proceed to a port operated by the country enforcing the blockade.

The Israeli Navy carried out its interception and transferred troops armed with non-lethal weapons (paint-ball guns) to the blockade runners by helicopter. On five of the six ships involved the detention was carried out without problems, but on the sixth, the boarding party was attacked by a number of passengers on the ship in what appeared to be a pre-planned ambush. After several Israeli troops had been severely injured and three more were in danger of being held hostage, the Israelis used lethal force to defend themselves, killing nine of the attackers.

Despite the fact that their actions were entirely legal (in fact, once their boarding party was attacked, the Israeli Navy would have been within its rights to sink the merchant ship in question), there was an immediate uproar and international protests over the action. This has tended to highlight the problems facing navies attempting to carry out maritime policing actions in today's environment. Even an action that is completely in compliance with both treaty obligations and centuries of maritime practice may be condemned and subject to international denunciation.

Everything and Nothing Changes. Boarding actions are the earliest form of naval surface warfare. The action involved a ship coming alongside another, with crew from one swarming over, attempting to seize control of the enemy ship. Marines first evolved in response to the requirement for a body of armed and disciplined troops to carry out such actions. Today, boarding is still a routine action with which any warship is familiar. Although no longer a primary means of driving enemy ships from the seas, boarding is a vital part of maritime policing and law enforcement. Ships suspected of smuggling contraband or acts of piracy are routinely boarded. As the Israeli boarding of the six blockade runners showed, such actions are always inherently risky. Quite apart from the political aspects of the situation, a small craft carrying a load of cocaine may be worth millions to its owners, and the crew may well be equipped to defend it.

Automatic rifles are commonplace, and heavier weapons such as RPG-7s and even surface-to-air missiles are not unknown. Note that these are land combat weapons that have been secured for use at sea, again a reflection of a very old trend. The Sri Lankan Navy has suffered a number of losses in its patrol craft fleet due to such weapons and has lost more craft to ships that smuggle arms, munitions, and drugs, and blow themselves up when apprehended. This latter trend is a result of the growth (and institutionalization) of terrorism.

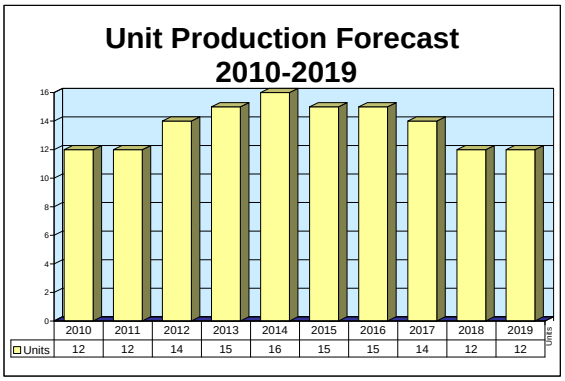
The fact that the crew of a suspect ship may be (possibly suicidal) terrorists has added to both the frequency and risks of stopping to board merchant ships. Whether due to criminal involvement or terrorist objectives, every so often a boarding action is opposed. The resulting scene is often reminiscent of the age of sail, but using steam hoses and point-blank fire from assault rifles in place of cutlasses and boarding pikes. One effect of this has been to place renewed importance on warships carrying a detachment of marines, after many decades in which such detachments were regarded as archaic and often abandoned as a cost-cutting

Continued…

Oto Melara 76mm Naval Gun

Outlook

- Production continues for wide range of applications
- Multirole capability ensures wide platform base
- Represents ideal gun for most naval applications
- Continued development keeps weapon in line with changing operational requirements.



Orientation

Description. Medium-caliber automatic naval gun.

Sponsor
General Directorate for Naval Constructions
and Naval Weapons
Piazza della Marina
I-00196 Rome
Italy

Status. Production and service.

Total Produced. A total of approximately 768 Oto Melara and FMC-produced guns are in service as of the end of 2009. The number produced is at least 840 and may well exceed this figure.

Application. The Oto Melara 76mm naval gun has been primarily designed for anti-missile and anti-aircraft roles, with anti-surface warfare (anti-ship) and naval gun support capability a secondary role.

Platform. The gun is suited for all types of warships, ranging from patrol boats to air-capable ships.

Price Range. The unit cost of these guns ranges between $1.5 million and $2 million, depending on the number of units ordered and the customer.

Contractors

Prime

BAE Systems Land & Armaments, Armament Systems Division	http://www.baesystems.com/Businesses/LandArmaments, 4800 E River Rd, Minneapolis, MN 55421-1498 United States, Tel: + 1 (763) 571-9201, Fax: + 1 (763) 572-9826, Licensee
Bharat Dynamics Ltd	http://bdl.ap.nic.in/, Ministry of Defence, Kanchanbagh, Hyderabad, Andhra Pradesh, 500 058 India, Tel: + 91 910402434008184, Fax: + 91 910402430660, Email: bdlitd@ap.nic.in, Licensee
Navantia Shipbuilding	http://www.navantia.es, Velázquez St, 132, Madrid, 28006 Spain, Tel: + 34 91 335 84 00, Fax: + 34 91 355 86 52, Email: navantia@navantia.es, Licensee
Oto Melara SpA	http://www.otomelara.it, Via Valdilocchi 15, La Spezia, 19136 Italy, Tel: + 39 0187 5811 11, Fax: + 39 0187 58266, Email: press-office@otomelara.it, Prime

Oto Melara 76mm Naval Gun

Rheinmetall Denel Munitions - Naschem	http://www.denelmunitions.co.za, Private Bag X1254, Potchefstroom, 2520 South Africa, Tel: + 27 18 299 8500, Fax: + 27 18 298 1145, Email: gm@naschem.denel.co.za, Licensee
Simmel Difesa SpA	http://www.simmeldifesa.com, Via Ariana 5,2, Colleferro, 00034 Italy, Tel: + 39 06 97 09 2400, Fax: + 39 06 97 09 2350, Email: info@simmeldifesa.com, Co-producer

Comprehensive information on Contractors can be found in Forecast International's "International Contractors" series. For a detailed description, go to www.forecastinternational.com (see Products & Samples/Governments & Industries) or call + 1 (203) 426-0800.

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

Technical Data

	Metric	U.S.
Characteristics		
Caliber	76mm L62	3-in L62
Rate of Fire	10-120 rpm + single fire	
Muzzle Velocity	925 m/s	3,034 ft/s
Maximum Range (standard ammunition)	16 km	10 mi
Maximum Range (extended-range)	20 km	12.5 mi
Training/Elevation Rate	60/35 deg/s	
Training Range	360 deg	
Elevation/Depression	+85/-15 deg (AD: +70/-15 deg) (a)	
Ammunition Capacity	80 ready service (AD: 50) (a)	
Weight of Mount (unloaded)	7,500 kg (AD: 5,500 kg) (a)	16,800 lb (AD: 12,320 lb)
Working Circle	5.28 m (radius)	208 in (radius)

(a) AD refers to the above-deck version.

Design Features. The single-feed drum, holding 70 rounds, surrounds the screw feeder hoist leading up to a station below the left trunnion. Two arms alternately pick up rounds and place them in a loading drum (with a capacity of four rounds) at the gun breech. The drum feeds rounds into a loading tray that receives the spent cartridge as the gun recoils. As the gun runs out after recoiling, the tray feeds in the next round. The drum around the base of the hoist can be reloaded while the gun fires. Light overall weight is achieved by using light alloys and a fiberglass shield stressed to 0.5 kg/cm^2.

Oto Melara produces three types of ammunition for its Compact and Super Rapid guns. The multirole Oto Melara munitions (MOM) can be used against aircraft and anti-surface cruise missiles, as well as for shore bombardment. The Semi-Armor-Piercing Oto Munition (SAPOM), which has a delayed-detonation impact fuze, is designed for use against surface ships. The Semi-Armor-Piercing Oto Munition, Extended Range (SAPOMER) is similar to the SAPOM except that the reconfigured shell is somewhat larger and heavier.

Operational Characteristics. The gun has a reaction time of three seconds from a cold startup, and it can be energized from the control panel. The gun is normally controlled by one man in the Operations Room (Combat Information Center). There are provisions for emergency local control, and a stabilized line-of-sight local-control system can be fitted.

In the anti-aircraft role, the gun can use special pre-fragmented ammunition, which is highly effective against sea-skimming missiles and aircraft. For a surface role, a particular type of armor-piercing ammunition is offered, optimized for surface targets, including extended-range rounds. With extended-range guided munitions (ERGMs), the maximum firing range is 20 kilometers.

The gun can propel a 13-pound shell a distance of 4.5 nautical miles against a surface target, or 2.2 nautical miles against an air target. The firing rate is adjustable from 10 to 85 rounds per minute. On the Super Rapid, the firing rate is more than 120 rpm.

The elevation/depression limits are +85 and -15 degrees, respectively. The gun has unlimited traverse, but the firing limits are electrically set by the no-firing zone. The gun has a working circle with a 208-inch radius. Training and elevation speeds are 60 and 35 degrees per second, respectively. On the Super Rapid, the training range is unlimited, thanks to a slip ring for off-mount connections. Elevation limits are from -15 to +85 degrees. The gun is equipped with a muzzle brake and fume extractor. The gun's watertight fiberglass construction reduces the weight of its mount to only 7.5 tons. A hatch in the rear allows access for maintenance.

Oto Melara 76mm L62

Source: Forecast International

Variants/Upgrades

Oto Melara 76mm Strales. The latest version of the 76mm L62, the Strales is optimized for firing the new guided DART projectile. It is fitted with a double ammunition feed system, a digital control console, a guidance antenna, a new gun shield and the control equipment needed to accommodate the DART rounds.

Oto Melara 76mm Super Rapid. This is the current production version of the standard gun. It has selectable firing rates of 1, 10, or 120 rounds per minute. The total firing cycle has been reduced from 0.7 to 0.5 seconds, and the accuracy has been improved from the previous versions. The Super Rapid version of the 76mm L62 is similar to the Compact in a number of respects. The hydraulic motors that power the ammunition feed and hoist have been upgraded to cope with the increased firing speed. The rocker arms in the new gun are made of titanium, instead of the high-grade steel of the older mount. Meanwhile, the feed drum loading tray (with a capacity of 85 rounds) and spent-case ejection trays have been redesigned to move shorter distances, thus decreasing vibration. Training and elevation speeds are the same for both types. Training range is unlimited, thanks to a slip ring for off-mount connections. Elevation limits are from -15 to +85 degrees.

Oto Melara 76mm Retrofit. Since the feed system has been modified to such an extent in the Super Rapid gun that it is impossible to upgrade the Compact guns to Super Rapid status, Oto Melara has a retrofit kit for upgrading the Compact gun mount to fire 100 rounds per minute.

Oto Melara 76mm Naval Gun

Oto Melara 76mm Above-Deck Gun Mount. The above-deck gun mount of the Oto Melara 76mm gun is a lightweight, extra-compact stealth configuration, automatic rapid-fire weapon specifically designed for installation on any type and class of ship, from major units such as frigates down to hydrofoils and hovercraft. It is intended for engaging both sea-skimming missiles and surface targets.

The mounting is unmanned and fully remote-control – 50 ready-to-fire rounds are loaded from an automatic magazine. The complete mount is a single-piece construction that does not require deck perforation for installation. It includes a turret to house the gun and loading system. Training and elevation movements are controlled through electric servosystems, with plug-in modular electronics and identical training and elevation drive motors. The elevation of the above-deck version is slightly more limited, at -15 to +70 degrees.

Feeding and loading systems are hydraulically operated through a self-contained hydraulic power unit. Firing rates are selectable from a maximum of more than 120 rounds per minute to a minimum of 10 rounds, and there is a single-fire option. Tracking is continuous with the aid of an obstacle-contouring and firing cut-out device, and an inverse slewing device. The mount operates unmanned and can be controlled by any type of naval fire control system. The automatic magazine can be quickly reloaded through a hinged and sealed hatch located on the turret side.

Electric Drive. An electric drive option was developed for the 76mm gun in the early 1990s, and trials were completed by the South African Navy in 1997. The all-electric drive offers a substantial increase in the accuracy of the gun, reduces maintenance requirements, and lowers the operating costs of the gun. Furthermore, the electric drive makes use of a high-precision planetary elevation and training mechanism, using three-phase brushless motors and a switch-mode high-efficiency power amplifier.

Program Review

Background. The immediate post-World War II generation of Italian warships was equipped with U.S.-built, 5-inch L38 twin mounts and quadruple 40mm guns as standard equipment. The Italian Navy was fortunate in that it used a prewar, small, light cruiser as the basis for its destroyer designs. Thus, when design work started on a new generation of naval weapons, the generous dimensions of the hulls permitted the use of both 127mm and 76mm guns. The initial Oto Melara 76mm gun mount was designed for the Italian Navy in 1960, and was produced in both single and twin mounts. It can be distinguished from later weapons by its angular mounting. The Oto Melara 76 was a reasonably successful weapon, and reconditioned mounts removed from decommissioned warships were installed on some Italian new construction.

The New Generation. During the mid-1960s, attention began to focus on missile-armed fast attack craft forces. While the 76mm had many desirable characteristics for ships in this class, the existing gun mount produced by Oto Melara was large, complex, and deficient in rate of fire. This led Oto Melara to begin design studies, commencing in 1964, to reduce the size and complexity of its 76mm mount. The initial firing tests were conducted in 1968, and by 1969, the mount was in production.

Licensed Production

The first mounts were ordered by the Italian Navy, and went to sea in 1972 aboard Audace class destroyers. In 1973, the U.S. Navy was in the process of designing the FFG-7 Perry class. These were originally conceived as low-cost all-missile ships with an area defense anti-aircraft missile system forward, and a point defense system on the hangar roof aft. However, the planned point defense missile system, Sea Mauler, turned out to be unsuccessful, and it was decided to mount a gun in its place. Provision for this eventuality had already been made. A competition initiated for this requirement pitted the 76mm Oto Melara against the Bofors 57mm and the Oerlikon twin 35mm weapons. In 1975, the Oto Melara 76mm L62 Compact won the competition.

The following year, FMC Corporation signed an agreement with Oto Melara to produce the gun under license in the U.S. Eventually, FMC produced 101 gun mounts for the U.S. Navy and Coast Guard, and for the Australian, Spanish, and Saudi Arabian navies. By 1984, more than 35 navies had ordered or bought the Oto Melara 76mm L62 Compact gun.

During this time, Oto Melara had only one major setback. The Canadian Navy was evaluating several lightweight medium-caliber guns for the new Halifax class frigate program, and the final two contenders were the Oto Melara 76mm L62 and the Bofors 57mm gun. Contrary to widespread expectations, Canada chose the Bofors.

Upgrading the Favorite

In 1984-85, Oto Melara began working on several major upgrades to the 76mm L62 gun. The first was an

increase in the firing rate, from 85 to 120 rounds per minute. The new gun was designated the Super Rapid, to distinguish it from the Compact. Shore trials of the new gun were held in 1985 and 1986, at nearly the same time as the guns were being marketed. The new gun was immediately ordered by the Italian Navy as the secondary armament of the Mimbello class destroyers instead of the 40mm Dardo system. The Super Rapid was also ordered by Singapore for its fast attack craft, by Denmark for the Flyvefisken class (Stanflex 300) patrol/mine vessels, and by Canada for the Tribal Upgrade and Modernization Program (TRUMP) (which involved upgrading four Tribal class destroyers).

Course-Corrected Projectiles. In 1985, British Aerospace and Oto Melara, later joined by Alenia-Elsag and Ferranti, initiated a joint research program to develop a 76mm course-corrected projectile for the 76mm L62. The result was a projectile with a 51 percent increase in length, with corresponding reductions in propellant charge, reducing muzzle velocity by 85 meters per second. The new round has a datalink that provides a one-shot, 10-degree course correction from the firing ship. Upon firing, the shell deploys stabilizing fins that slow its spin rate so that course corrections can be sent to the shell. A ring of six small thruster charges are detonated to provide the actual change of course. The shell's course is determined by its projected ballistic trajectory. If, tracking the target, the fire control system determines that the shell will not pass near the target, course correction signals are sent.

In 1991, these new course-correctable shell rounds were tested on an Italian Navy ship. The trial results were reported as promising, and development work continued. This was one option offered for the medium-caliber gun on the Project Horizon Common New-Generation Frigate.

In 1987, a second course-corrected shell program was undertaken by the Dutch company Signaal, in collaboration with the German firm Diehl. The shell controller unit is coupled to the ship's fire control system, which continuously computes a predicted hitting point and relays this information to all shells in the air via a simple radio datalink. The shell alters its trajectory by releasing gas, as with the Bofors 40mm system. In 1989, this program was designated CORAS (Correctable Ammunition System). Signaal soon began to approach additional partners, leading to speculation that the two guided-shell programs might merge. Firing trials of CORAS began in 1989.

Combat Proven

The Oto Melara 76mm L62 was put to tough testing in August 1990 when the Kuwaiti FAC-M *Istiqlal* fought her way out of Kuwait City harbor during the Iraqi invasion of that country. The volume of fire put down by the 76mm and 40mm guns decimated an Iraqi mechanized infantry company and supporting elements that tried to capture the ship. This combination of 76mm L62 and 40mm Twin Fast Forty became virtually the standard fit for corvettes and FAC-M.

In 1993, Oto Melara introduced a new variant of the 76mm L62, designated the 76mm above-deck mount. This is a wholly self-contained system – including gun, mount, magazine, and loading system – that can be installed on any platform and requires no deck penetration. The complete unit is about 2,000 kilograms lighter than the existing Compact, yet has similar rates of fire. The ammunition capacity of the magazine is, however, more limited.

In late 1993 and early 1994, the Greek Navy purchased three Kortenaer class frigates from the Dutch Navy. On delivery, these ships were refitted with an additional 76mm L62 gun (bringing the total on each ship to two) and two 20mm Mk 15 Phalanx guns. The guns for this program were obtained by using existing 76mm units mounted on obsolete Gearing class destroyers. This reflects a growing trend of fitting new-construction ships with 76mm L62 guns removed from the hulls they are replacing.

More Domestic Orders

Italy continued its backing of the 76mm L62 when it selected the gun as the primary armament of the Commandante Cigala Fulgosi class offshore patrol vessels (OPVs). Ireland made the same decision, selecting the 76 as the primary armament for its new OPV, the LE *Roisin*. Early in 2000, this pattern continued when Greece selected the 76 for its new class of 62-meter corvettes.

This continued string of successes was paralleled by a number of orders for major warships. The German Navy specified the Oto Melara 76 for its new F-124 class destroyers, and the South African Navy followed suit for its new MEKO class corvettes. Perhaps the most significant development has been the specification of the Oto Melara 76 as the gun armament for the Franco-Italian Project Horizon class frigates. These ships will mount three Oto Melara 76mm guns each in a rather eccentric layout, with the forward two guns winged out, side by side, on the 01 deck, while the aft gun is positioned on the centerline. This arrangement was last used on the old Russian battleship *Sinop*, launched in 1887. This decision marks the adoption of the Oto Melara 76mm into the French Navy, where it will probably replace the mediocre 100mm gun.

Oto Melara 76mm Naval Gun

The success rate of the Oto Melara 76mm L62 continued throughout 2001 and into 2002. The gun was specified for the new Singapore La Fayette class light frigates and for the Malaysian patrol vessels. The Norwegian Fridtjof Nansen class destroyers (a derivative of the Spanish Alvaro de Bazan class) also will be armed with the Oto Melara 76. Although some anticipated contracts have been lost to the 5-inch class guns (most notably the Alvaro de Bazan class), the 76 continues to be the weapon of choice for corvettes and smaller ships. Most recently, the 76mm gun has been adopted by Romania for installation on two ex-British Type 22 frigates.

Dominant Weapon in Its Class

As of early 2010, the 76mm L62 remains the dominant naval weapon in its class. To enhance its performance, Oto Melara has introduced two new rounds. One is an extended-range guided bombardment shell, called the Dart. This is guided by a radio frequency beam, and is also intended to counter threats such as cruise and sea-skimming missiles and small swarming boats that are favored by terrorists. The Dart has a range in excess of 8,000 yards. The other new round is a derivative of Dart, called Art. This uses the same aerodynamic configuration as the Dart but is a solid, unguided shot intended for paramilitary and marine policing organizations. The Art round is intended to disable ships by punching holes in their diesel engines, while minimizing the danger of killing crew members. According to the original production schedules, Art was to have been available for deployment in 2005, and Dart in 2007. However, development fell far behind this schedule and the Dart guided round was only successfully demonstrated in 2009.

The Oto Melara 76mm L62 continues to attract attention, being the preferred armament for offshore patrol craft, patrol vessels and light frigates. In the most recent application of the gun, it will equip four offshore patrol vessels ordered by the Venezuelan Navy.

In many applications, the 76mm Oto Melara gun is being deployed as an air defense weapon, essentially a long-range substitute for the 20mm and 30mm CIWS that are now being outpaced by advanced anti-ship missile developments.

Funding

The Oto Melara 76mm L62 Compact program was originated as a private venture using corporate funding. Subsequent Italian Navy procurement was funded by the Italian Ministry of Defense and export orders by the navies of the purchasing countries. The research for enhanced ammunition is also funded by the MoD.

Contracts/Orders & Options

Sponsor or Contractor	Award ($ millions)	Date/Description
Elefsis	320.0	Jan 2000 – Three guns for Greece's new 62-meter Super Vita FAC class (contract value for entire fleet of boats).
ADSB	N/A	Nov 2004 – Four 76mm L62 Super Rapid guns for Baynunah corvettes.

N/A = Not Available.

Timetable

Month	Year	Major Development
	1960	First 76mm gun enters service
	1964	Design study commenced to reduce the size of the gun mount
	1968	Compact gun tested
	1969	Compact gun enters production
	1972	Compact gun in service
	1976	Production license granted to FMC
	1984	Upgrade program launched
	1985	Shore trials begun on Super Rapid type
	1986	Super Rapid enters service
	1989	Italy tests Super Rapid against a towed sea-skimming target
	1991	India signs licensing deal for local production, which fails to take off
	1993	Above-deck version introduced

Month	Year	Major Development
Feb	1999	Italy specifies 76mm Super Rapid for NUMC; Germany chooses it for F-124
Late	1999	Compact, stealthy above-deck version ready for production
	2001	Three 76mm guns specified for each Franco-Italian Project Horizon frigate
	2003	76mm guns installed on ex-British Type 22 frigates purchased by Romania
	2007	Ordered for Netherlands Patrol boats
	2008	Ordered for Venezuelan OPVs
Apr	2009	Dart guided round demonstrated

Worldwide Distribution/Inventories

It is almost impossible to keep track of the number of 76mm Oto Melara guns produced by the parent company and its licensees. The gun has dominated the market for so long that any naval reference book opened at random is almost certain to show at least one ship armed with one of these weapons. Many of the early platforms for these weapons have now been scrapped; others have been lost in action or transferred to new owners. The guns themselves have been retained in service, refurbished, and cross-decked to new platforms or sold to new owners. A careful count of the mounts actually in service reveals an inventory of 768. However, allowing for weapons that have been lost, withdrawn from service, or are held in store, it is reasonable to assume that total production exceeds 900. The current user list includes the following:

Algeria 2 on El Yadekh OPV

Argentina 6 on MEKO-140 FFL, 2 on TNC-45 FAC-M

Australia 4 on Perry FFGs

Bahrain 1 on Perry class FFG, 2 on TNC-62 FAC-M, 4 on TNC-45 FAC-M

Bangladesh 1 on Khalid bin Walid

Belgium 2 on ex-Dutch Karel Doorman class

Brunei 3 on Nakhoda Ragam class (delivery of ships refused and currently up for sale)

Canada 3 on Tribal-Trump DD

Chile 2 on ex-Dutch Karel Doorman class, 6 on 3 on Sa'ar 4 FAC-M, 4 on Riquelme FAC-M

China 1 supplied for Type 343M FAC-M

Colombia 4 on FS-1500 FFL

Denmark 3-6 on new patrol ships**,** 3 on Niels Juel FFL, 4 on Thetis FFL, 8 on Flyvefisken OPV

Ecuador 6 on Fincantieri FFL, 3 on TNC-45 FAC-M

Egypt 4 on Perry class, 2 on Descubierta FF, 6 on Ramadan FAC-M, 4 on Ambassador FAC-M, 5 on Type 148 FAC-M

France 4 on two Horizon class destroyers, up to 11 on FREMM class frigates

Germany 3 on F-124 Sachsen class DDG, 4 on F-123 Brandenburg FF, 8 on F-122 Bremen FF, 5 on K-130 class FFL, 10 on Type 143A FAC-M

Ghana 2 on TNC-57 FAC-M

Oto Melara 76mm Naval Gun

Greece	6 ordered for FREMM frigates, 12 on 10 Kortenaer FF, 7 ordered for 62-m Super Vita FFL, 18 on 9 Combattante IIIM FAC-M, 6 on Type 148 FAC-M, 4 on Pirpolitis OPV, 2 on Osprey OPV, 5 on Jason LST
India	3 on Project 17 FF, 3 on Brahmaputra FFG, 3 on Kora class FFL, 4 ordered for Project 28 FFL, 2 on Project 1241 FAC, 3 ordered for new OPV, 4 on Samar class OPV
Indonesia	6 on Leander FF, 4 on Sigma class OPV
Iran	3 on Sima-1 FAC-M, 10 on Combattante II FAC-M, 1 on Kharg AOR
Ireland	2 on Roisin class OPV, 2 on Peacock class OPV
Israel	8 on Sa'ar 4.5 FAC-M
Italy	6 on 2 Horizon DDG, 6 on 2 Luigi Durand de la Penne DDG, up to 10 on FREMM FF, 8 on Minerva FFL, 6 on Fulgosi OPV, 3 on San Giorgio LPD, 1 on Etna AOR
Japan	9 on Murasame class DD, 6 on Asagiri DD, 11 on Hatsuyuki DD, 6 on Abukuma FF, 2 on Yubari FF, 6 on Hyabusa FAC-M, 2 on Yamagiri ATS, 1 on Shimayuki ATS, 1 on Tenryu ATS, 1 on Kashima ATS, 1 on Kurobe ATS
Kenya	2 on Nyayo FAC-M, 2 on Shupavu class OPC
Kuwait	1 on TNC-57 FAC-M, 1 on TNC-45 FAC-M
Libya	6 on Combattante II FAC-M
Lithuania	3 on Flyvefisken class
Malaysia	4 on Laksamana FFL, 6 on Kedah OPV
Mexico	2 on two Oaxaca gunboats
Morocco	2 on Mohammed V class FF, 1 on Descubierta FF, 4 on Lazaga FAC-M, 2 on PR-72 OPV
Myanmar	3 on Sinmalik FFL
Netherlands	3 on Karel Doorman FF
Nigeria	1 on Enymiri FFL, 3 on Combattante IIIB FAC-M, 3 on TNC-57 FAC-M
Norway	5 on Fridtjof Nansen FFG, 6 on Skjold FAC
Oman	2 on Qahir FFL, 4 on Province FAC-M, 3 on Al Bushra OPV
Peru	6 on PR-72 FAC-M
Philippines	3 on Peacock OPV
Poland	2 on Perry FFG, 6 ordered for Gavron FFL
Portugal	2 on 2 Karel Doorman
Qatar	4 on Barzan FAC-M, 3 on Combattante III FAC-M
Romania	2 on modified ex-British Type 22 frigates
Saudi Arabia	3 on Al Riyadh FF, 4 on Badr FFL, 9 on Al-Siddiq FAC-M
Senegal	2 on 1 PR-72M OPV

Singapore	6 on Formidable FF, 6 on Victory FFL, 11 on Fearless class OPV, 4 on Endurance class LST
South Africa	4 on Amatola FF, 6 on 3 Sa'ar 3 FAC-M
South Korea	18 on 9 Ulsan FF, 44 on 24 Pohang FFL, 4 on Dong Hae FFL, 1 on Yoon Young-ha FFL (up to 40 may be ordered), 1 on Hang Kan class OPV
Spain	6 on Santa Maria FFG, 6 on Descubierta FFG
Taiwan	8 on Perry FFG, 8 ordered for Knox FF, 6 on Kang Din FF, 2 on Lu Chiang FAC-M
Thailand	2 on Ratanakosin FFL, 2 on Tapi FFL, 3 on Ratcharit FAC-M, 2 on Pattani OPV, 3 on Khamronsin OPV, 3 on Hua Hin class OPV, 6 on 3 Chonburi OPV, 3 on Sattahip class OPV
Tunisia	3 on Combattante III FAC-M, 12 on 6 Type 143B FAC-M
Turkey	8 on Perry class FFG, 12 ordered for Milgem FFL, 2 on Yildiz class FAC-M, 8 on Dogan class, 9 on Kilic class FAC-M
United Arab Emirates	2 on Kortenaer class FF, 6 on Baynunah FFL, 2 on TNC-62 FFL, 2 on TNC-44 FAC-M, 6 on TNC-45 FAC-M
United States	30 on Perry FFG, 12 on Hamilton/Hero WHEC, 13 on Famous WMEC
Venezuela	4 on 2 Clemente FFL, 3 on Constitucion FAC-G, 4 ordered for new OPV

Forecast Rationale

The OTO Melara 76mm L62 has become an iconic naval weapon. It has been used on virtually every type of warship – from AEGIS-equipped destroyers to small, offshore patrol vessels. It fills almost every imaginable naval role – from air and missile defense to anti-piracy and maritime law enforcement. Indeed, the question is not why this gun should be selected for any specific program, but why anyone would want to install anything else.

It is hard to overestimate the extent to which the 76mm L62 dominates the naval gun market. At least 56 countries have ships equipped with 76mm L62 guns, with a minimum of 768 guns in service or ordered for future construction. This number far understates the number of guns that have actually been produced. In addition to those identified as being on active platforms at some time either now or in the past (the number on which our production estimate is based), a large number may have been built as spares while others have been used for test programs. The gun has been advertised in coastal defense configuration so it is not improbable that examples have found their way to shore defense batteries.

57mm vs. 76mm

The only real rival to the OTO Melara 76mm L62 is the Bofors 57mm L70. Although the competition between the 57mm L70 and the 76mm L62 appears evenly matched with both guns similar in terms of installation weight, ship impact and throw weight (the 57mm throws a shell half the weight of that thrown by the 76mm but at twice the rate of fire), the 76mm has met and matched the challenge mounted by the smaller gun. The deciding factor was that, while the 76mm shell is twice the weight of the 57mm, it is much more than twice as destructive; the explosive content of the bigger round is proportionally much greater.

As a general-purpose weapon, the 76mm had an undeniable advantage that was demonstrated in a Canadian Navy Sinkex (navy exercise to practice sinking ships more commonly known as target practice). This used a decommissioned destroyer to demonstrate a variety of weapons effects. The ship was sent down by an Oto Melara 76mm in short order after a 57mm had failed to achieve the same result. The Sinkex was televised on U.S. cable television and the film of the 76mm sinking a ship when the 57mm had failed made its way around the world from there.

Oto Melara 76mm Naval Gun

A Shifting Market

The trend upward in naval gun caliber is exemplified by the move from the 76mm to the 127mm gun. A single 127mm gun is now the standard main armament for most frigate/destroyer-sized ships. This is not necessarily a bad thing for the Oto Melara 76mm since it is moving into the role of a secondary gun armament, primarily tasked with being a long-range anti-missile gun, filling the role once filled by 20mm and 30mm weapons. This adds an interesting aspect to this gun in terms of future sales; when the 76mm was the primary gun armament, usually only a single weapon per ship was procured. When the same gun serves as a secondary armament, the installation of two or three weapons per hull is becoming normal.

The problem for the OTO 76mm in this situation is that, while it has convincingly demonstrated its superiority over the 57mm as the main armament of a ship, its position as a secondary gun is by no means so clearly established. As an anti-missile weapon, both guns have more or less the same range while shell weight is of lesser importance. On the other hand, rate of fire is more valuable in the surface-to-air role. Therefore, the 57mm remains a viable challenger for the role of secondary gun. The U.S. Navy has already followed this path by adopting the 57mm as the Mk 110 despite a license-built version of the OTO 76mm already being in the inventory.

A Secure Future

Overall, it is hard to see any real challenge being mounted to the Oto Melara 76mm L62 Super Rapid. It is suited to too many different roles and offers a flexible, multidimensional capability at a very affordable price. At the lowest end of the market, it can be installed on small patrol craft and gives them the punch they need to bring a recalcitrant merchant ship to heel, while at the highest end, the 76mm L62 provides a valuable terminal defense and secondary weapon addition to the ship's primary armament. Although further improvements to the gun are likely, we have little doubt that its production future is secure.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program		**High Confidence**				**Good Confidence**			**Speculative**			
	Thru 2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**
Oto Melara SpA												
Oto Melara 76mm L62 **<> Worldwide <> Multi-agencies**												
	842	12	12	14	15	16	15	15	14	12	12	137
Total	842	12	12	14	15	16	15	15	14	12	12	137

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