

Corvette Cutting Edge Gets Sharper



The Oto Melara 76 mm gun is one of the most common weapons found on corvettes

The corvette has not just replaced the fast attack craft, which dominated the export market some 20 or 30 years ago, but it continues to evolve into a multi-role platform, which further enhances its value. The weapon systems associated with corvettes are a yardstick for marking the importance of these ships.

E.R. Hooton

Oman's recent signing of a contract with VT Shipbuilding for three 'Ocean Patrol Vessels' underlines the growing importance of corvettes in the world's export markets.

But there are signs that the major navies are also beginning to appreciate their value as general-purpose warships for medium- and low-intensity operations. Recent stories about plans for the Royal Navy's surface combatant force clearly indicates that a substantial part of it will be either corvettes or light frigates.

As with the fast attack craft the prime role of the corvette is anti-surface warfare (ASuW) and the main weapon for this is the surface-to-surface missile with radar seeker. The most common remains the rocket-powered MBDA Exocet MM 40 Block I and II, which has a launch weight of some 870 kilograms and a maximum range of about 40 nm (70 km). The Block II weapon features an improved J-band (10 to 20 GHz) seeker and Global Positioning System or Galileo satellite navigation for improved target discrimination and accuracy, especially against targets either close to shore or in harbours. One of the latest customers for this well-established weapon is the Indonesian Sigma class ships being built by Royal Schelde.

The improved Block 3 missile replaces the rocket motor with a turbojet, which

extends range to 97 nm (180 km). This weapon retains the electronics of Block II but provides a limited land-attack capability, although customers such as Oman (Project Khareef) and the United Arab Emirates (Al Baynunah) are probably hoping to enhance the traditional anti-ship role of this weapon. Interestingly Oman uses the earlier weapon in its Qahir class corvettes.

Saab Bofors Dynamics' turbojet-powered RBS 15 missile has been selected for Poland's Orkan and Gawron (Project 621) class ships as well as the German Navy's Braunschweig (K 130) class. This 780 kg weapon (800 kg for the Mk 3) also has a range of some 40 nm although this is extended in the Mk 3 to 110 nm (200 km) through the introduction of higher-energy JP-10 fuel. As with the later Exocets the Swedish missile also benefits from GPS satellite navigation and because it was designed specifically for use in Sweden's coastal archipelago, being used in the Stockholm, Göteborg, and Visby class corvettes it is capable of operating in a very demanding radar environment. Although the missiles have land-attack potential, Saab does not appear to have made provision for this feature in the current generation.

The Boeing Harpoon, which is one of the most common anti-ship missiles, has been selected for relatively few modern corvette designs. It is being used in Israel's Eilat and Singapore's Victory class and has been selected for Turkey's

Milgem ships. The latest Block 1 D and Block 2 weapons weigh some 924 kg and have a range of up to 130 nm (240 km) and the latter are designed specifically for littoral operations. The weapon has improved seeker and GPS while the Block 3 currently under development for the US Navy will have a datalink for in-flight targeting. Israeli weapons (Block 2-I) apparently already have this feature and possibly an improved seeker and, as with later Exocets, the newest versions of the Harpoon also have a land-attack capability.

The Russian equivalent of the Harpoon, the 3M24 Uran (SS-N-25 'Switchblade') is used in India's Kora class corvettes and some older ships such as Algeria's Nanuchka class and India's Tarantul I (Veer) class corvettes. This is a 603-kg turbo-jet powered weapon with a range of 70 nm (130 km). However, the longer-ranged Novator 3K54TE Granat (SS-N-21 'Sampson') has reportedly been selected for India's latest corvettes; the Project 28. This weapon is part of the Club family and is unusual in being vertically launched as well as weighing a whopping 3665 kg, yet its range is only 120 nm (220 km). This weapon uses inertial navigation and active radar homing as does the Chinese C-802 (CSS-N-8 'Saccade'), a weapon akin to the Exocet and Harpoon, in Algeria's later Djebel Chenoua class. The 715-kg turbo-jet powered missile has a range of up to 65 nm (120 km).

All these weapons are sub-sonic, with a maximum velocity of about Mach 0.9, but Russia's latest Scorpion class use the ramjet-powered supersonic 3M55 Oniks or Yakhont (SS-N-26). A similar weapon has been developed with India as Brahmos and is in volume production for the latter's forces, although at present none



In the context of the Franco-Italian Fremm frigate programme, MBDA is developing a ship-launched derivative of the air-launched land-attack Scalp missile. While retaining most of its innards, the missile, known as the Scalp Naval, is totally repackaged to fit in vertical launchers. (MBDA)

are known to be for corvettes. The 3000-kg weapon can travel in excess of Mach 2.2 but has a useful range of 160 nm (300 km) using inertial and active seeker guidance. India is known to be planning dual-use (anti-shipping/land-attack) roles for the missile. It is possible that one of these Russian-designed weapons will be selected as the prime armament of Venezuela's Patrullero Oceanico de Vigilancia de la ZEE (EEZ Ocean Patrol Ships) being built by Navantia, for it seems unlikely that most Western manufacturers would supply these ships with modern surface-to-surface weapons without incurring Washington's wrath.

Barrels

The other element of the ASuW weapon suite is the medium-calibre gun. The smallest weapon used is the BAE Systems Bofors SAK 57, a single barrel 70-calibre gun capable of 220 rounds/min. Weighing less than seven tonnes it is the main armament of Croatia's Kralj class together with all the Swedish corvettes, although many potential customers may feel that the 6.5-kg ammunition lacks weight for proper ASuW and does not have the range for modern anti-air warfare (AAW) missions. However, it is worth noting that the US Navy and Coast Guard have selected the Mk 3 mounting as prime armament of the Legend (WMSL-750) class National Security

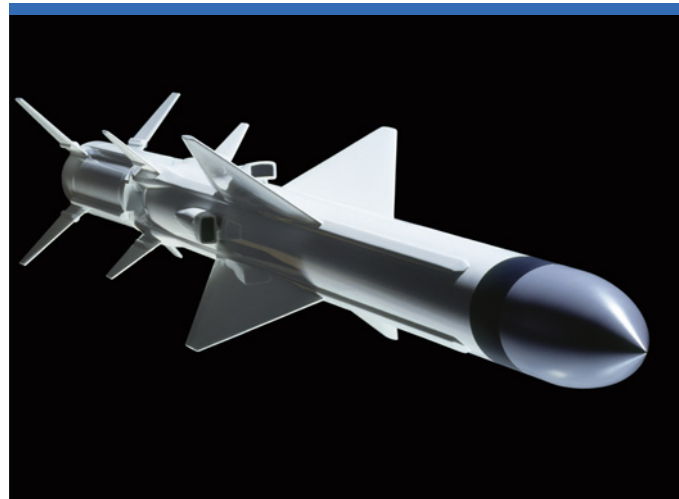
Cutter and as secondary armament for the Zumwalt (DDG 1000) class destroyers. The Visby Mk 3 mountings have shaped turrets with radar absorbent materials to reduce the radar cross-section and when the guns are not used the gun retracts into it.

A very common ordnance is the Oto Melara 76-mm 62-calibre gun seen in the



The Harpoon, with the latest Block 1D and Block 2, is also in the range and land attack capability race. Their reach is now extended to 240 km. (Boeing)

title picture. The 7.5-tonne Compact Mounting is on Germany's Braunschweigs, most of India's Koras and Israel's Eilats. The 76-mm gun offers the optimum between low mass and high effect with the twelve-kg rounds being useful not only in the ASuW role but also



The Exocet MM 40 Block 3, now powered with a turbojet engine, promises longer range, but has been given a land-attack capability. It has recently passed its second and final qualification test, which included a littoral attack profile following a multiple waypoint course of 160 km. (MBDA)

in the Naval Gun Fire Support (NGFS) role at ranges up to 10.75 nm (20 km) while the high rate-of-fire (85 rounds/min) provides a degree of AAW capability. But corvette customers increasingly select the Super Rapid version of the mounting with improved feed and hoist systems, which permit 120 rounds/min. This mounting has been selected by Brunei, India (Project 28), Oman, Singapore, Turkey and the United Arab Emirates (Al Baynunah).

The Russian equivalent of the Compact is the AK-176, a 59-calibre weapon that has a similar firing rate to the Super Compact but whose mounting weighs 11.2 tonnes. However, the gun has a range of only 8.5 nm (16 km) and while used in many of the older Soviet-designed corvettes such as the Tarantul and Pauk classes its most recent corvette customers have been Algeria with the Djebel Chenoua and Poland with the Orkan. However, the Russian Navy's Scorpion class ships will carry the AK-190 mounting which weighs 16.1 tonnes and has a 70-calibre, 100-mm gun capable of 80 rounds/min with a range of 11.5 nm (21.5 km).

Air Defence

The greater size of the corvette compared with the fast attack craft means there is better provision for AAW missions. The ships are too small for a wide or local area defence but many are capable of self-defence. The Israeli Barak system is typical and has been selected by Israel for the Eilat class, by Singapore for the Victories and by India for the Project 28. The missile features command-to-line-of-sight guidance with Elta EL/M-2221GM weapon control radars and is housed in vertical cell clusters which may be inserted in the hull or superstructure or distributed around the deck. The missile has a range of 6.5 nm (twelve km) and, like many, it can be used not only against manned or unmanned aircraft but also to help shield against anti-ship missiles.

The Raytheon Rim-116 Rolling Airframe Missile (Ram) is based upon the Sidewinder air-to-air missile but features both electro-optical and radar-homing sensors making it a fire-and-forget weapon. It is housed in a rotatable 21-cell



With the Club series, Novator offers an extensive range of anti-ship missiles with ship-launched (background), submarine-launched (centre) and air launched derivatives. The latest Club-M (not seen here) is a land-launched land-attack version, which has an air-defence avoidance capability. (Armada/YL)

launcher which may be installed on the superstructure and the missile has a range of five nm (9.5 km). The latest version Block I Has (Helicopter, Aircraft and Surface) is designed to engage a wider range of targets including small attack craft in a demanding environment. The Ram has been selected for the Braunschweigs, the Al Baynunah and the Milgem corvettes.

Raytheon also offers the Rim-162 Evolved SeaSparrow Missile (ESSM) with the Mk 57 system launcher cells installed within, or attached to, the superstructure. These missiles feature semi-active radar guidance and have a range of ten nm (18 km). Raytheon have just received a \$ 105 million contract to produce the Block 2 weapon, which will be able to intercept manoeuvring missiles.

MBDA has had several surface-to-air missile systems selected for corvettes. The Seawolf VL (Vertical Launch) has been selected for Brunei's Brunei class ships while the new VL Mica has been selected for Oman's Khareef. The Seawolf is a command-to-line-of-sight missile supported by the Type 911 radar and has a range of 3.2 nm (six km) while VL Mica features a combination of com-

mand, inertial and either active radar or infrared seeker. The missile is also in vertical cells that may be arranged to meet the customer's requirements and it has a range of up to 10.75 nm (20 km).

Derivatives of man-portable surface-to-air missiles with electro-optical guidance have also been selected for some ships offering a light weight but more restricted capability. The Russian Strela 2

(SA-N-5 'Grail') is used in India's Kora class and Poland's Orkans in multi-round launchers, while Indonesia's Sigmas will have the MBDA Mistral in the Tetral remotely operated launcher.

Combos

An unusual mounting selected for Russia's Scorpions is the Kortik/Kashtan missile-gun system (Cads-N-1). This features twin 30 mm Gatling-principle guns and eight Launchers for 9M311 (SA-N-11 'Grison') radar-to-command-line-of-sight missiles supported by 3R87 'Hot Flash' radar on the mounting. The missiles have a range of 4.5 nm (eight km).

Light (40 mm and below) gun systems are used for point defence against air threats and for operations against smaller surface vessels. The Bofors 40 mm L/70 gun has been used extensively by corvette designs in the past, with mountings from both Bofors and Oto Melara, but does not appear to be finding favour with modern designs and among them it



At the Defendory exhibition in October 2006, Brahmos displayed a number of sea- and land-based models of its Brahmos missile, including this one featuring a missile being launched from the Kolkata frigate. (Armada/EHB)



Arsenal Machine-Building Plant produces the AK-190 Universal which, with its 100-mm bore, can deal a deadly blow to air, (including low-flying types), surface and coastal targets according to its manufacturer. (Rosoboronexport)

is found only in Brazil's Barossos. The latter use the latest, Mk 3, version which features improvements to the elevated mass designed to provide a ten % increase in firing rate to 330 rounds/min and can also use the 3P (Prefragmented Programmable Proximity) round which can be adjusted for proximity, impact or post-impact detonation.

Given the ASuW role of corvettes it comes as no surprise that Close-In Weapon Systems (CIWS) are to be found in a number of new ships. Russia's AK-630, with associated MR-123 ('Bass Tilt') radar, is used extensively by Algeria's Djebel Chenoua, Croatia's Kralj, India's Project 28 and Kora as well as Poland's Orkan. It is a compact mounting weighing only 3.7 tonnes (loaded) and the Gatling-principle 30 mm gun of 5000 rounds/min and a range of up to 2.5 nm (five km). The Western equivalent is the Raytheon Phalanx with on-mount Lockheed-Electronics AN/UPS-2 radar. This weighs between 5.6 and 6.12 tonnes with a rate of fire between 3000 and 4500 rounds/min depending upon the version, the latest updates providing a capability



Remotely operated guns, such as the Rheinmetall MGL and Nexter-DCNS Narwhal mounts, were not taken too seriously when they were introduced or being developed a few years ago. However, due to their ease of installation (deck-penetration free) and the fragmentation rounds they fire in conjunction with high-performance optical trackers, they are likely to represent valuable assets for the protection of not only corvettes, but also humanitarian support ships in waters infested with pirate boats. (Rheinmetall and Nexter)

against small surface vessels. However, of the most recent corvette designs only Israel's Eilat has this gun system, another version of which replaces the guns with Ram missiles as SeaRam.

Remotely-operated stabilised gun mountings capable of accepting different guns are especially well adapted to the modern corvette market. Rheinmetall has developed the MLG (Marineleichtgeschütz) and its MLG 27 with BK 27 27 mm revolver gun has been selected for the German Braunschweig class. Kuwait was the first launch customer in June 2006 with twelve units to arm its fast interceptor boats and has recently placed a follow-on order for another three. Weighing only 850 kg this mounting has a rate of fire of up to 1700 rounds/min up to two nm (four km) and versions are also available with 25 mm and 30 mm guns.

MSI Defence Systems has the DS family of mountings which can accept 25 mm to 30 mm guns, the latest being the DS 30M Mk 2 with the Bushmaster II, which has reportedly been selected for Oman's Khareef class corvettes. The mountings weigh less than 1.5 tonnes and versions are available with man-portable surface-to-air missiles and even surface-to-surface rockets.

Anti-Sub

The corvette also has potential for Anti-Submarine Warfare and many now carry launcher systems for lightweight (32 to 40-cm diameter) torpedoes. These weapons have passive sonar to detect the target while travelling at relatively low speeds in a search pattern and then an active sonar which can be used to engage it. The Raytheon Mk 46 is either used or has been selected for the Barossos, Sigmas, Eilats and Milgems and having a range of up to five nm (9.25 km) and a maximum speed of 45 kt, while the Whitehead Alenia Sistemi Subacquei (Wass) produces the A 244/S which is used by Singapore's Victory class and will probably be used by India's Project 28. The weapon, which is licence-produced by Bharat Electronics in India, has a maximum range of 7.25 nm (13.5 km) and a maximum speed of 38 knots. Wass and

DCNS have combined its efforts to produce the MU-90 Impact which may also be used in India's Project 28s and possi-



Adaptability of air-to-air missiles for other surface-launch air-defence missiles applications, a sport demonstrated inter alia by Denel and Raytheon, is here exemplified by MBDA with the VL Mica – originally a Matra-era air-to-air missile. (MBDA)

bly Poland's Gawrons. This has a similar range to the A 244/S but a maximum speed of up to 50 knots and a more advanced guidance system.

Swedish corvettes are equipped with unique, domestically designed, 40 cm weapons such as the Saab Bofors Underwater Systems' Tp 43. They also feature a lightweight submarine disablement launcher system ASW 600 Elma, which is capable of firing a pattern of shaped grenades. The Project 28 ships will have a more lethal Russian RBU 6000 (Raketnaya Bombometnaya Ustanovka) Smerch 2 (Whirlwind 2). This weighs 3.1 tonnes and has twelve launcher tubes firing rocket-propelled rounds with 25-kg warheads that may be launched in patterns of four, eight or twelve rounds at ranges up to 1.5 nm (2.8 km).

One feature of a corvette's weapon system which is likely to see greater expansion is the addition of unmanned underwater vehicles (UUV). Corvettes are increasingly seen, even by major navies such as Britain's Royal Navy, as prospective mine countermeasures platform using UUVs, and the way is being shown by Sweden's Visbys, which will operate the Saab Double Eagle for reconnaissance and the Atlas Seafox for mine destruction. Unmanned Surface Vessels (USV) may also be operated in the future both for the AsuV and the ASW roles, but this is very much in the future. □



Rheinmetall is developing the Monarc based on the PzH2000 turret to endow corvettes with proven 155-mm coastal support fire capability. (Rheinmetall)