

Mine Warfare: Programmes, Platforms, Vulnerabilities

Bob Nugent

In the last ten years, there has been an increasing trend from purpose-built Mine Countermeasures Vessels (MCMVs) to mine warfare modules and multi-capability ships. Will global navies continue to shift from single-mission mine warships to multi-mission and modular mine defence capabilities?

The recent announcement that steel has been cut on the first of 12 Australian ARAFURA class (SEA 1180) OPVs marks another significant development in the evolution of the mine warfare vessel market. The ARAFURA class will replace the RAN's purpose-built HUON class MCM vessels, while also performing patrol and survey missions.

This shift away from purpose-built MCMVs to mine warfare modules and multi-capability ships is a trend that has accelerated over the past decade. The use of the Mine Warfare mission package for the multi-mission US LCS is another example of this approach to mine warfare. The LCS configured for mine countermeasures will entirely replace the USN's current OSPREY class mine warfare ships. The UK, France and other European countries are also investing in a new mine warfare capability that relies heavily on unmanned platforms.

Will navies continue to shift away from single-mission mine warfare vessels toward multimission and modular mine countermeasures capabilities? This article draws on AMI's proprietary naval market data on ships in service and forecast to be built over the next 20 years to answer that question.

It first assesses the general naval mine warfare vessel market—current and future. Next it looks in detail at the mine warfare ships forecast to be built through 2039, including subsegments, numbers, tonnage, and assessed expenditures on these ships. Lastly, it reviews recent developments in the most significant mine warfare ship and capability programmes.

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Current and Future Mine Warfare Fleets

AMI tracks 490 mine warfare ships and craft in service today. That represents less than 5% of the world's inventory of commissioned ships and craft in service with navies, coast guards and other maritime government agencies and departments. AMI's future market projections forecast the number of dedicated mine warfare ships is set to decline significantly in the

life, both OPV and frigate fleets will drop off much less rapidly than mine warfare ships by 2040.

The projected investment in new dedicated mine warfare ships is just short of US\$22Bn over twenty years. This represents about half of projected spending on new OPVs and a mere 12% of the projected expenditure on new construction frigates (acknowledging that the cost of the weapons and sensor systems on frigates are significantly higher on a per-hull basis).

Existing Naval Market (Ships currently in Navy or Coast Guard service)	MCMV	Forecasted New Builds Estimated Ships to be Procured by Navy or Coast Guard)	MCMV
Asia & Australia	168	Asia & Australia	74
Caribbean & Latin America	6	Caribbean & Latin America	6
Middle East & North Africa	29	Middle East & North Africa	21
NATO	191	NATO	54
Non-NATO Europe	35	Non-NATO Europe	9
Russia	45	Russia	29
Sub-Saharan Africa	5	Sub-Saharan Africa	0
USA	11	USA	0
Totals	490	Totals	193

Graphics: via author

next 20 years, with fewer than 200 MCMVs expected to come into service through 2038. This is well short of a one-to-one replacement rate for today's MCMV fleet, many of which are near or at the end of their service lives now.

Mine warfare ship projected build rates contrast sharply with forecast OPV and frigate acquisitions. Today mine warfare, OPV and frigate current fleets each number about 500 ships in service globally. New build projections for OPVs and frigates are each about 300 new ships over 20 years, compared to 200 for mine warfare platforms. Using a projected 30-year hull

Viewed by region, mine warfare capabilities are concentrated in NATO countries, in Asia-Pacific and in Russia. Forecasted Russian investment in mine warfare ships remains robust, and the Asia-Pacific region is funding mine warfare ship replacements at about 44% of current inventory. However, the fall-off in NATO spending on these ship types is marked, with replacement ships representing only 28% of the current fleet.

While the MENA region's mine warfare fleet is much smaller than that of comparable NATO or Asia-Pacific regions, new ship build rates are over 70% of the



Photo: Brian Burnell / George Hutchinson

A classic MCMV: Royal Navy minehunter HMS CHIDDINGFOLD entering Portsmouth Naval Base, UK

current fleet. This reflects the maritime geography of the region, with multiple critical chokepoints (straits, narrow seas) especially vulnerable to closure with mines.

The large majority (about 90%) of mine warfare ships in service and projected to be built are defensive — employed to detect, sweep, and otherwise neutralise the mine threat to enable other naval operations. However, a few select navies are building offensive capabilities in the form of mine laying ships. On the smaller end of the size spectrum, Taiwan is expected to acquire up to 20 250-tonne fast minelayers — an asymmetric sea denial option against China’s naval numerical advantage. Similarly, the Republic of Korea is forecast to build what are the largest ships in AMI’s mine warfare category — 4,000-tonne FLD mine-laying ships.

Segment Analysis: Mine Warfare Ships

The future mine warfare market ranges from USVs and small craft of 25 tonnes to the previously mentioned 4,000-tonne minelayer planned by the ROK. The table below breaks the sector into sub-segments of below 500 tonnes FLD; 500–1,000 tonnes; and above 1,000 tonnes.

The sector is heavily concentrated in ships of 500–1,000 tonnes, representing 70% of total market value, 64% of total tonnes and 74% of total value (acquisition costs of ships and systems). Large ships

make up the next largest subsegment, and small platforms and craft make up only 5% of the total market, measured by tonnes or acquisition cost.

Significant Mine Warfare Ship Programmes and Platforms

Measured by cost and numbers of hulls forecast to be built, significant mine warfare programmes are found in Germany, Belgium and The Netherlands, Russia, Poland, and India. Sweden, Australia and Singapore are among the navies investing significantly in unmanned, modular and reconfigurable mine warfare systems.

Germany

The German Navy’s current mine hunting force consists of FRANKENTHAL (Type 332), KULMBACH (Type 333) and ENSDORF (Type 352) class coastal mine hunters (MHCs) commissioned from 1989 through 1998. Based on a 35-year service cycle, these ships will require replacement beginning in 2020.

Most of Germany’s mine warfare vessels were built at Abeking & Rasmussen, Lürsen Werft and Kröger Werft (Lürssen). Future mine hunting procurements are expected to go to these yards, possibly involving a work-share agreement.

The German Navy appears committed to maintaining a force of purpose-built ships for mine related missions. This does not preclude development and deployment of USV and modular mine warfare systems such as those offered by ATLAS ELEKT-RONIK. The large MKS-180 Multi-Purpose Surface Combatant could operate as a host platform in this approach to mine warfare. AMI anticipates that Germany could issue a Request for Proposals (RfP) for new mine warfare platforms in 2021, followed by a construction contract in 2022. This will allow the first unit of the class to commission by 2025.

Belgium and The Netherlands

In January 2018 the Belgian Government approved the acquisition of six Mine Countermeasures Vessels (MCMV), with procurements to begin in 2020. This approval enables a joint Dutch/Belgian MCMV programme. The Belgian share of the programme is expected to cost around US\$1.36B for the six vessels, which includes off-board systems. The Royal Netherlands Navy (RNIN) will also procure six hulls under the joint effort.

The programme began in 2014 and was a three-year plan to work on common operational concepts and a set of common requirements for the future MCMV forces. The RNIN and BN are currently planning for this joint effort that will primarily use off-board Unmanned Maritime Systems (UMS) to provide an MCM capability that will allow the host platform to remain out of the minefield during clearing operations.

The Request for Proposal is expected to be out in time to provide for a preferred builder and construction contract to be awarded in 2020. This timeline would allow the Belgians to receive the first hull in 2023 according to schedule. The Royal Netherlands Navy (RNIN) would receive its first hull by 2025.

MCMV	Hulls	%	Tons	%	Value	%
500-1000	135	70%	94,140	64%	16,276	74%
MCMV <500	33	17%	6,645	4%	975	4%
MCMV >1000	25	13%	47,400	32%	4,700	21%
All	193		148,185		21,951	



In June 2018, the Belgian and Dutch defence ministers signed two Memorandums of Understanding (MoUs) ratifying the plan to jointly procure the MCMV as part of a 16 ship programme. The 16 ships will also include four frigates. Belgium and the Netherlands will each receive two frigates and six MCMVs. The entire project is worth an estimated US\$4.7Bn.

STX France and Socarenam have publicly acknowledged the formation of a consortium with Belgium's EDR in order to bid for the MCMV programme. The consortium is known as Sea Naval Solutions and will offer the design for the 12-hull programme following the release of the RfP. Saab (MCMV 80 design), BMT Group (Venari 85 design) and Sea Naval Solutions are leading

contenders for the programme award. Belgium will manage the 12-MCMV programme. The new MCMVs will be larger than the traditional platforms as they will need a large storage and operating area for Unmanned Maritime Systems (UMS). All MCMV activities will be conducted by UMS. Search and identification of mines will be conducted through the use of Autonomous Underwater Vehicles (AUVs), Remotely Operated Vehicles (ROVs), USVs and mine destruction through the use of one-shot Unmanned Underwater Vehicles (UUVs). Each MCMV will also have one organic mine hunting sonar. The ships will be large enough to embark equipment and staff sufficient for any of the hulls to act as an MCM command ship.

Poland

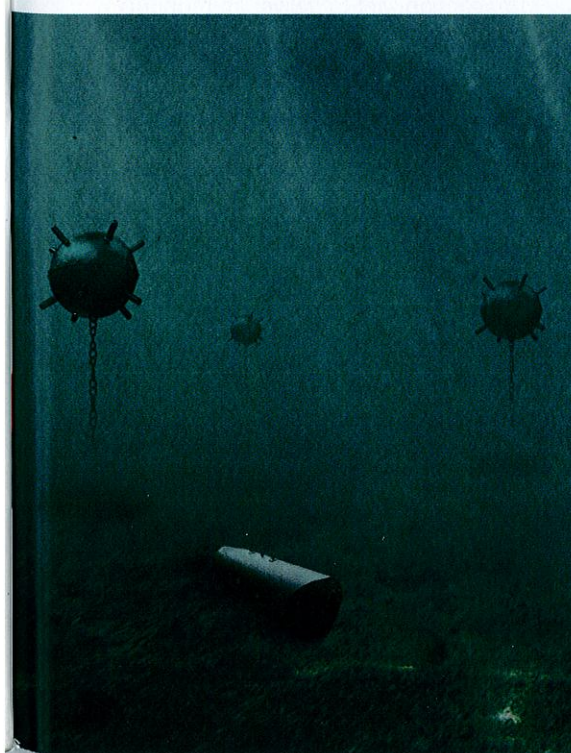
In September 2018, steel was cut for the Polish Navy's (Marynarka Wojenna – MW) second KORMORAN II class Mine Countermeasures Vessel (MCMV), ORP ALBATROS (602), at Remontowa Shipbuilding. It will be delivered in 2020.

Russia

In July 2018, the Russian Navy laid the keel for the sixth ALEKSANDRIT (Project 12700) class MCMV, RFS PETER ILYICHEV, at the Sredne-Nevisky Shipyard in St Petersburg.

India

In January 2018, the Indian Navy (IN) cancelled its 12-ship US\$3.4Bn Mine



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Countermeasures Vessel (MCMV) programme with Kangnam Corporation of South Korea and its Indian partner Goa Shipyard Ltd (GSL).

Kangnam Corporation had been selected on a single vendor basis to provide design and technology transfer assistance to India's GSL. It appears that disputes between the Indian Government and Kangnam over the design and technical transfer fees contributed to the programme's cancellation.

The Indian MoD has ordered GSL to develop and release a new global Expression of Interest (Eoi) in order to restart the MCMV programme that has languished since 2005. The technology transfer terms of the new Eoi will probably

Netherlands); Naval Group and Thales (France); Intermarine and Selex (Italy); Navantia (Spain); Istanbul Naval Shipyard (Turkey); Kangnam (South Korea); Saab Kockums (Sweden); Sredne-Nevsyky (Russia); and Lockheed Martin, Raytheon and Northrop Grumman (US).

India's historical ties with Israel as a naval supplier makes USVs from Rafael or Elbit leading contenders to provide unmanned mine warfare capability.

Sweden

Saab MCMV 80: First displayed at the Undersea Defence Technology (UDT) exhibition and conference in May 2017, Saab Kockums continues to offer the

and many of the features of previous designs find their way into the MCMV 80.

The MCMV is equipped with two stern ramps and a launching crane for the deployment of various sized USVs, UUVs and AUVs as well as small craft. Optionally, it can have a flight deck and UAV hangar for the operation and storage of vertical take-off and landing (VTOL) unmanned aerial vehicles.

The MCMV 80 has been proposed for the joint Belgium/Netherlands MCM replacement programme that will see a total of 12 units built, six for each country, and is anticipated to have a contract in place by 2020. Additionally, Sweden will need to replace the five KOSTER and two STYRSO class MCMVs beginning about 2025, meaning a construction contract will have to be in place by 2023. The Kockums design should be considered a front-runner for the programme.

Australia

In March 2018, Steber International of Australia was identified as the winner of the contract awarded in late 2017 worth AUS\$6M (US\$4.7M) for the delivery of five USVs for the Royal Australian Navy (RAN) as part of the Deployable Mine Countermeasures programme (SEA 1778 Phase 1).

The five USVs will each measure 11.6 m (38 ft) in length and will be capable of a top speed of 25 knots. They are to carry a payload of three tonnes that will include a towed sonar and an ROV for mine classification and disposal.

Steber International is working with Thales Australia who is the prime contractor for the project that includes a 15-year contract to deliver and support a deployable MCM capability as well as conduct a service life extension of the HUON class MCMVs.

Singapore

In March 2018, the Republic of Singapore Navy (RSN) revealed that it is in the process of introducing USVs to patrol the nation's waters and to detect and neutralise mines. The USVs will be operated from shore-based facilities or from mother ships and controlled by a team of two personnel. The vessels will be either equipped with sensors and a gun for the maritime patrol mission or with mine countermeasures (MCM) equipment to detect, classify and neutralise sea mines. Although no specific



Photo: US Navy

The US Navy littoral combat ships USS INDEPENDENCE (LCS-2), rear, and USS CORONADO (LCS-4) under way in the Pacific Ocean: the use of mine warfare mission packages for the multi-mission US LCS is evidence of a new approach to mine warfare.

be the same as with Kangnam, except now issued on a global scale rather than a single vendor basis. The new Eoi is expected to specify a programme of 12 hulls, with an additional 12 hulls expected to be acquired later. The Indian builder is expected to release an RfP sometime in 2020.

The programme is expected to attract interest from the shipbuilders and systems companies with particular strengths in naval mine warfare, including Lürssen Werft, Abeking & Rasmussen, ATLAS ELEKTRONIK (Germany); BAE Systems (UK); Damen (The

MCMV 80 design as a "next generation" MCM platform. Containerised modules enable the system to meet a wide array of different missions both in the minefield as a hunter/sweeper or outside of the minefield as a mothership for ROVs or autonomous underwater vehicles (AUVs).

The MCMV 80 is 80 m (262.5 ft) in length and has a displacement of 1,250 tonnes. It has a top speed of 15 knots and is manned by a crew of 40-60 sailors. Kockums has extensive experience in the production of both MCMVs as well as other composite-hull vessels



Photo: Saab

Saab Kockums is offering the MCMV 80 design as a "next generation" MCM platform. Containerised modules enable the system to conduct a wide array of missions both in the minefield as a huntersweeper or outside of the minefield as a mothership for remotely operated vehicles (ROVs) or autonomous underwater vehicles (AUVs).

timeline has been stated by the RSN, Navy officials have stated that the new capability will be introduced in the "near future". AMI believes that this means the new USVs could enter service as early as 2022, following testing and evaluation of existing systems.

Conclusion

This review of the naval mine market offers several conclusions. First, mine warfare continues to be a relatively low priority for new platform investment compared to other mission areas such

as anti-air or anti-submarine warfare. Mine warfare ships are not being built at rates sufficient to replace inventories in service now.

Technology is influencing this shift away from purpose-built mine warfare ships. Navies are applying unmanned

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underwater and surface vessels to mine warfare missions. This is understandable as unmanned platforms are especially suitable in mine warfare, with operations typically being isolated from other shipping, and labour and platform intensive.

Changes in key mine warfare sensors and technology, notably sonar sensors, have also supported this trend away from dedicated single-mission mine warfare ships. As key mine warfare sensors become smaller and more precise, navies have been able to shift to mo-

dular configurations and USV-mounted systems able to deploy as needed from a wide variety of ships or shore-based infrastructure.

While technologies have enabled a shift away from purpose-built mine warfare ships, the last quarter century has also been marked by declining budgets among NATO navies and most other fleets worldwide. This has added pressure to the continuous naval challenge of allocating scarce resources to achieve an optimum balance of capability in many mission areas.

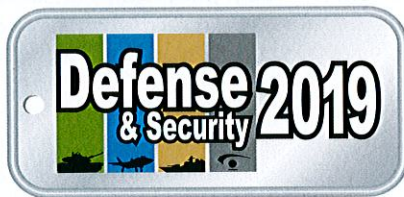
A shift away from purpose-built mine warfare ships to multi-mission platforms gives navies a chance to make a virtue of the necessity of retaining some mine warfare capability, if not on mine warfare ships with lower budgets. In an era of relative maritime peace, which has generally marked the post-Cold War era, this short spend on mine warfare ships has been a calculated, and evidently acceptable, risk. Nevertheless, the market for mine warships remains active and dynamic. The nearly 200 new mine warfare ships forecast to

be built in the coming two decades, representing almost US\$200bn in new hull and systems spending, indicates many navies are not shifting to the modular and multi-mission approach.

Multi-mission platforms represent an operational risk. They have to be ready and available for mine warfare missions when that call comes. The short-notice onset of a major naval contingency requiring mine warfare capability may find multi-mission ships committed elsewhere and therefore unavailable.

So navies are likely to continue to hedge their mine warfare requirements with MCMVs. The naval portfolio manager will balance investments in modular and multi-mission MCM with continued MCMV new construction programmes and modernisation.

This "hedge" strategy for mine warfare makes sense, as the next quarter-century promises to bring about a different operational environment than the 25 years since the end of the Cold War. It looks to be a naval era marked by near-peer rivalries and increased likelihood of major navy-on-navy conflicts. In this setting, shortfalls in counter-mine capability and platforms are likely to give planners and commanders pause, while encouraging advocates for purpose-built and dedicated MCM ships and personnel trained to operate them.



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