

The Balance of Power in the Persian Gulf

- European Patrol Corvette
- Logistic Support Ship Programmes
- FREMM Design
- Russia's Baltic Fleet



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A Complex Voyage from Vulnerability to Renewal

2020 was an unusual year. A tiny virus demonstrated the vulnerability of our global village. Governments across the globe shut down plants and traffic systems. The economic impact has been devastating for numerous sectors, resulting in losses, layoffs and cutbacks. In January 2021, the International Monetary Fund (IMF) estimated the global growth contraction for 2020 at -3.5 percent. The strength of the recovery is projected to vary significantly across countries depending on access to medical interventions, the effectiveness of policy support and exposure to cross-country spill-overs, not to mention the structural characteristics of economies when they entered the crisis (see Figure 1).

The global shipping industry is expected to play a key role in the global economic recovery. Maritime traffic will underline its vital role as an enabler of international supply chains. However, a number of emerging considerations may act to revise the way these supply chains are structured. The pandemic revealed that the reliance on a single point of origin for goods and resources is not optimal. Hence, the sourcing of goods may trend towards diversification. As the alternative option, building up self-sufficiency may become a desirable way out of the dilemma. Put these together and we may well see some changes in trade patterns, which will inevitably be reflected with regard to global supply chain designs in the longer term.

Environmental trends will be superimposed over these developments. A piece of good news from the pandemic was that air pollution dropped; at least for a limited time span. According to Nature Research, daily global CO₂ emissions (by early Apr 2020) went down by -17% compared with the mean 2019 level. In a kind of reverse thinking, one might conclude that the pandemic allowed us to attain our decarbonisation goals by a snap of the fingers – something happens if the global village pursues its ambitions decisively! Ambitions to cut greenhouse emissions certainly have the characteristics of a beauty contest. Beyond the EU's Green Deal that aims to make Europe the first climate-neutral continent by 2050, China has declared its objective to reach carbon neutrality by 2060. Denmark – the EU's largest oil producer after Brexit – will stop the extraction of oil and gas by 2050. These moves towards global decarbonisation will leave us with significant consequences for the two largest commodities transported: crude oil and coal. In the upcoming 30-40 years, we could well see a shift in trade and shipping from fossil fuels to hydrogen and/or ammonia with effects on shipbuilding, propulsion and volumes globally traded.

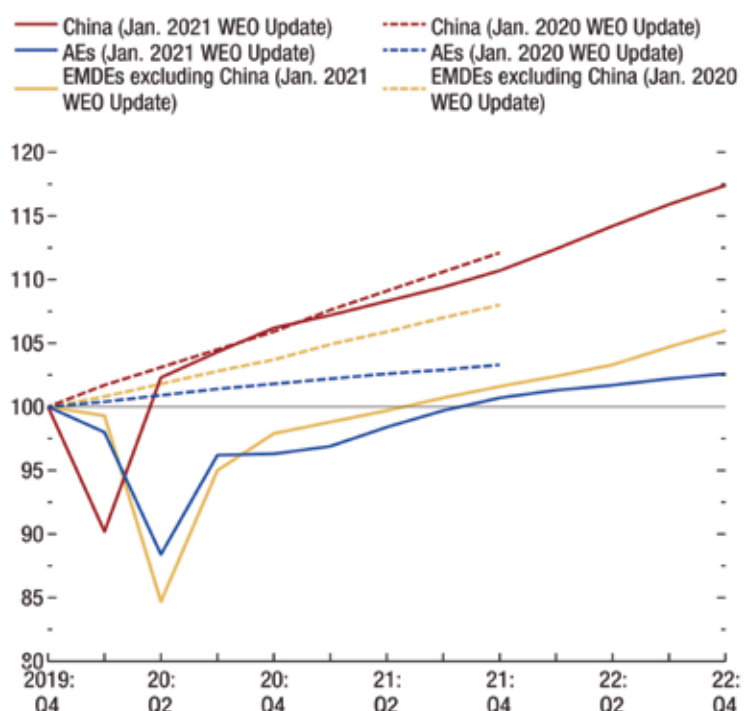
In any case, to meet the demands of 2050, shipping must undergo a global transition to alternative fuels and energy sources. Greenhouse gas emissions from ships were not included in the 2015 Paris Agreement on climate change. However, in 2018, the International Maritime Organisation (IMO), the United Nations' body regulating international shipping, adopted an Initial Greenhouse Gas (GHG) Strategy for international shipping. It seeks to reduce GHG emissions from international shipping and phase them out as soon as possible. The aim is to reduce average carbon intensity (CO₂ per tonne-mile) by at least 40% by 2030 and by 70 % in 2050, as well as to cut total emissions by at least half by 2050 compared with 2008. Within the EU, this is recognised by the Fuel EU Maritime initiative.

The geopolitical constellations are another layer in an intertwined or taxonomical assessment of the years to come. Although the new US president is expected to improve the style of US-China relations, the substance of Great Power competition is unlikely to change in its essentials. Similarly, in both the EU and NATO, European nations see in China – whilst still an economic partner – a global competitor and a systemic rival. Beyond the framework for trade and commercial affairs which will be determined by the direction of relations between China, the European nations and the US, the EU has to address the challenges to maritime security and its potential to assume a more prominent role. As the world's second largest exporter and the third largest importer, the bloc relies heavily on maritime transport and infrastructure for its future prosperity.

Thus, EU's maritime incentives have become a 'Schwerpunkt' of this issue.

**Yours, aye,
Hans Uwe**

Figure 1. Divergent Recoveries: WEO Forecast for Advanced Economies and Emerging Market and Developing Economies (Index, 2019:Q4 = 100)



Source: IMF staff estimates.

Note: AEs = advanced economies; EMDEs = emerging market and developing economies; WEO = World Economic Outlook.

Quelle: IMF World Economic Outlook, January 2021

Photo: Bundeswehr



The European naval construction sector is currently experiencing significant demand for new logistic support ships. **Page 26**

Photo: Italian Navy



The French-Italian FREMM programme is among the most important multi-national naval programmes to date. **Page 32**

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Babcock Appoints New Marine CEO

Photo: Babcock



(jh) Babcock has announced that Will Erith has been appointed as CEO of its Marine sector. Will was previously Managing Director of the Surface Ships Business Unit within the Sector, and before this held a range of leadership roles at Rolls Royce, including international appointments based in the Asia Pacific region. He succeeds Derek Jones who will return to his role of Corporate Services Director, Marine. Babcock Chief Executive David Lockwood said: "Our Marine business offers significant opportunities for growth both in the UK and internationally, underpinned by our close relationship with the Royal Navy. This appointment supports this ambition."

Lars Hoffmann Strengthens the Mittler Report Team

Photo: Lars Hoffmann



(jh) Lars Hoffmann joined the team at Mittler Report Verlag in Bonn at the beginning of November. In addition to his role as Deputy Editor-in-Chief of the magazine "Europäische Sicherheit & Technik", he has been appointed Group Editorial Director. In this newly created function, he contributes to the planning and control of content for the various publications of the publishing house as well as K&K Medienverlag-Hardthöhe. He also oversees the online presence of Mittler Report Verlag and, as the Editor-in-Chief, the new portal "hartpunkt.de", which he brought into the publishing portfolio.

Hensoldt Stake for German Government



Logo: Hensoldt

(jh) In order to protect the national key security and defence industrial technologies defined in the Federal Government's Strategy Paper for Strengthening the Security and Defence Industry, Germany plans to acquire a 25.1 per cent stake (blocking minority) in Hensoldt AG at a price of €450M, subject to checks under anti-trust and state aid law. Ensuring key security and defence industrial technologies as defined in the above mentioned Strategy Paper of the Federal Government is of national interest. For this reason, the Federal Government has decided in favour of a strategic participation in Hensoldt AG.

Furthermore, it is of importance that Germany's role as a cooperation and alliance partner in Europe within the framework of globalised supply chains is technologically and economically secured and further strengthened.

Particularly noteworthy are:

- the company's importance in terms of industrial, security and defence policy
- its relevance for Germany's technological and digital sovereignty
- its crucial importance for the performance and operational readiness of the Bundeswehr

The continued development of the sensitive activities of the Hensoldt Group and their availability for the civil organisations with security tasks and the Bundeswehr must not be impaired by future entrepreneurial measures of Hensoldt AG or its current and future owners. Therefore, the Federal Government has decided to acquire 25.1 per cent of the shares, the so-called blocking minority, putting the Federal Government in a position to ward off unwanted structural decisions. This means that the Federal Government will have considerable influence, regardless of whether strategic investors directly or indirectly acquire a majority of the shares and thus exert a directing influence.

An appropriate fixed price has been agreed with the investor KKR for the shares in question. The Federal Ministry of Defence, in close consultation with the Federal Ministry for Economic Affairs and Energy, the Federal Ministry of the Interior and the Federal Ministry of Finance, has created the necessary preconditions for the Federal Government to acquire a stake in Hensoldt AG and submitted them to Parliament. This procedure was approved by the Government on 17 December 2020.

Stefano Sannino Appointed EEAS Secretary General

Photo: Wikipedia



(jr) Stefano Sannino has been appointed as the next Secretary General of European External Action Service (EEAS). Sannino has worked as EEAS Deputy Secretary General for Economic and Global Issues since February 2020 having previously been Italy's Ambassador to Spain and the Italian Permanent Representative to the EU. Mr. Sannino also served as Director General for Enlargement in the European Commission. He will be following Helga Maria Schmid, who has been Secre-

tary General of the EEAS since 1 September 2016 and EEAS Deputy Secretary General/Political Director since 2011. High Representative/Vice-President Josep Borrell, said, "I want to express my profound gratitude to Helga Maria Schmid for the remarkable achievements she has accomplished as Secretary General and for having built the EEAS into what it is today. Her contribution to the European Union's global action is unrivalled. I look forward to continue working with Stefano Sannino, as new Secretary General of the EEAS. He brings with him a long and rich European diplomatic experience from his senior service to both the European Union institutions and the Italian government. I cannot think of a better candidate to steer the EEAS into its second decade." Sannino took office on 01 January 2021.

Boaz Levy Appointed CEO of IAI

Photo: IAI



(jr) The Board of Directors of Israel Aerospace Industries Ltd. (IAI), chaired by Harel Locker, has approved the search committee's recommendation to nominate Mr. Boaz Levy as IAI's Chief Executive Officer (CEO). Levy succeeds Maj. General (ret.) Nimrod Sheffer, who stepped down as CEO on 31 October 2020. Boaz Levy's career at IAI spans over 30 years. In 1990, he joined the company as an engineer for the ARROW Project and in 1999 became the project's Chief Engineer. From 2003 to 2006, Mr. Levy headed the induction of the ARROW-2 into operational service after going through numerous successful test flights. From 2006 to 2010 he headed the BARAK-8 programme, which evolved into one of the world's most advanced air defence systems and became one of IAI's most significant growth engines. In 2010, Boaz Levy was appointed as general manager of IAI's air defence division and in 2013, he became Vice President of the Systems Missiles and Space Group, leading the group to become IAI's most profitable and successful business unit. Over the years, Levy has pursued groundbreaking technological developments that are cornerstones of Israel's defence. Several of those programmes have won the Israel Defence Prize, presented annually by the President of Israel to people and organisations who made significant contributions to the defence of the State of Israel. Levy is also responsible for some of the largest defence export sales in Israel's history, including the sale of the BARAK Weapon System, which has been worth over US\$6BN.

Naval Group Delivers the Lead SUFFREN Class Submarine

(cw) On 6 November 2020, Naval Group delivered the first Barracuda type nuclear-powered attack submarine, SUFFREN, to France's armament procurement agency, the Direction Générale de l'Armement (DGA). One of a class of six submarines intended to replace the existing RUBIS class on a like-for-like ba-



Picture: Marine Nationale; Axel Manzano

sis, SUFFREN has a submerged displacement of c. 5,200 tonnes, a length of 99 metres and a hull diameter of 8.8 metres. Initially launched by the DGA in 1998, the Barracuda programme has previously been subject to a number of delays and there will undoubtedly be relief over the apparently smooth progress achieved with the testing and trials phase that has followed the boat's technical launch on 1 August 2019 (the formal ceremony was held on 12 July 2019). The remaining members of the class are all currently at various stages of construction prior to completion of the programme towards the end of the decade and are expected to form the core of France's underwater forces until at least 2060.

UAE to Buy Defence Equipment Worth About US\$23 Bn from U.S.

(J C Menon) According to reports in November last year, the United Arab Emirates plans to buy various equipment worth about US\$23 billion. In one of the major deals, UAE will buy 50 F-35 Joint Strike Fighters and related equipment from the U.S at an estimated cost of US\$10.4 billion. The State Department has made a determination approving the possible Foreign Military. The F-35A fighters will be the Conventional Take-Off and Landing (CTOL) aircraft and will be powered by Pratt & Whitney F-135 Engines. A State Department spokesman says, "This proposed sale will support the foreign policy and national security of the United States by helping to improve the security of an important regional partner. The UAE has been, and continues to be, a vital U.S. partner for political stability and economic progress in the Middle East." The UAE will also buy Munitions, Sustainment and Support, and related equipment for an estimated cost of US\$10.0 billion. The munitions include 802 AIM-120C8 Advanced Medium Range Air-to-Air Missiles

(AMRAAM); 16 AIM-120C8 AMRAAM guidance sections spares; 2,004 MK-82 500LB General Purpose (GP) Bombs; 72 MK-82 Inert 500LB GP Bombs; 1,000 MK-84 2,000LB GP Bombs; 1,002 MK-83 1,000LB GP Bombs; and 2,500 Small Diameter Bomb Increment 1 (SDB-1), GBU-39/B. The principal contractors will be Raytheon, and Northrop Grumman Information Systems. The proposed sale will improve the UAE's capability to meet current and future threats by providing enhanced capabilities to various aircraft platforms in effective defence of air, land, and sea. The proposed sale of the missiles/munitions and support will increase interoperability with the U.S. and align the UAE Air Force's capabilities with existing regional baselines. In yet another proposed deal, the UAE plans to buy MQ-9B Remotely Piloted Aircraft and related equipment for an estimated cost of US\$2.97 billion. UAE has requested to buy up to 18 Weapons-Ready MQ-9B, Remotely Piloted Aircraft; 25 Raytheon Multi-Spectral Targeting Systems-D (MTS-D) EO/IR Sensors; 19 LYNX AN/APY-8 Synthetic Aperture Radars (SAR) with Ground Moving Target Indicator (GTMI); 18 RIOTM Communication Intelligence Systems; 66 Embedded Global Positioning System/Inertial Navigations Systems (EGI) with Selective Availability Anti-Spoofing Modules (SAASMs); 515 AGM-114R Hellfire Missiles and 12 KMU-572 Joint Direct Attack Munitions (JDAM). The proposed sale of F-35s will provide the Government of the UAE with a credible defence capability to deter aggression in the region and ensure interoperability with U.S. forces. The UAE has demonstrated a commitment to modernising its military and will have no difficulty absorbing these aircraft into their armed forces. The prime contractors for the F-35 deal will be Lockheed Martin Aeronautics Company, and Pratt & Whitney Military Engines. There are no known offset agreements proposed in connection with this potential sale. On 27 January, the Washington Post reported that the Biden administration is scrutinising purchases by the United Arab Emirates as it reviews billions of dollars in weapons transactions approved by former President Donald Trump.

PNS TABUK for Pakistani Navy Commissioned in Romania

(jh) On 12 November, the Pakistan Navy commissioned its new Corvette – a Damen OPV 1900 – named PNS TABUK at the Port of Constanta, Romania. The ship is part of a contract award for two vessel signed by the Pakistani Ministry of Defence in 2017. Both ships are built at Damen Shipyards Galati in Romania. The

Photo: Damen



first unit, PNS YARMOOK, entered service with the fleet in February this 2020. Like her sister ship, PNS TABUK is a multipurpose platform, capable of performing a variety of operations in a complex maritime environment. She is able to launch a helicopter and a UAV, as well as two RHIBs simultaneously. Damen will continue to provide support to PNS TABUK during her service. Damen's yard in Galati has built more than 40 vessels for the defence and security segment, including the last seven complex naval vessels for the Royal Netherlands Navy and the STEFAN CEL MARE offshore patrol vessel, the flagship of the Romanian Border Police.

Saab Combat System for Bulgarian MMPV

(jh) Saab is to supply the combat system for the Bulgarian Navy's new Multipurpose Modular Patrol Vessels (MMPV). Lürssen is the prime contractor and will build the two new ships at the Bulgarian shipyard MTG Dolphin JSC with the vessels to be delivered to the customer between 2025 and 2026. "We are proud to continue our successful cooperation with Lürssen. We look forward to contributing to strengthen Bulgaria's defence and national security for years to come with our proven technology and solid naval combat system expertise", says Anders Carp, deputy CEO of Saab and Head of Business Area Surveillance. Saab will carry out the work at its premises in Sweden, Denmark, Australia and South Africa.

France Selects Nuclear Propulsion for its Next Aircraft Carrier

(cw) On 8 December 2020, the President of the French Republic, Emmanuel Macron, announced during a visit to the Framatome factory at Le Creusot that it had been decided to equip the country's new porte-avions nouvelle génération (PANG) aircraft carrier with nuclear propulsion. The decision marks the con-

clusion of the initial study phase of the project and will be followed by separate preliminary and detailed design phases prior to the launch of construction at Saint Nazaire. This is expected to commence in 2025 to allow entry into service when the existing CHARLES DE GAULLE is retired around 2038. Naval Group, Chantiers de l'Atlantique, TechnicAtome and Dassault Aviation will be major industrial partners in the project. The new aircraft carrier is expected to be Europe's largest warship, with a displacement of around 75,000 tonnes, an overall length of 300 metres and a beam of 80 metres. It will be equipped with electromagnetic catapults and be able to embark around 30 of the next generation SCAF combat aircraft.



Picture: Naval Group.

New Schiebel CAMCOPTER UAVs for the French Navy

(jh) The French Navy has obtained new Schiebel CAMCOPTER S-100 Unmanned Air Vehicles (UAVs) which will be deployed on the MISTRAL class amphibious helicopter carriers (Porte- Hélicoptères Amphibie – PHA) TONNERRE and MISTRAL. The acquisition comes after the successful integration of the CAMCOPTER® S-100 on the French Navy MISTRAL class vessel DIXMUDE, which was finalised in 2019. This was the first time in Europe that a rotary wing UAV had been connected to the combat system of an amphibious heli-



Photo: Schiebel

copter carrier. Over the next few months, the newly acquired CAMCOPTER® S-100 UAVs will be integrated onto the TONNERRE and the MISTRAL, significantly enhancing the Intelligence, Surveillance and Reconnaissance (ISR) capabilities of the ships. Hans Georg Schiebel, Chairman of the Schiebel Group, said: "After the successful integration on the DIXMUDE, we are very proud of the confidence the French Navy has in the proven and reliable CAMCOPTER® S-100 and we are looking forward to the integration on the TONNERRE and MISTRAL and their operational deployment."

Ultra Awarded Subcontract for Variable Depth Sonar

(jh) Ultra has been awarded a contract award to deliver the Variable Depth Sonar (VDS) system for the Canadian Surface Combatant (CSC) programme – named the Towed Low Frequency Active Sonar (TLFAS). This subcontract moves the development of CSC's anti-submarine warfare (ASW) capability from the program definition phase into the full manufacture and delivery of the vessel's suite of sonars. TLFAS is a optimised for the detection and tracking of stealthy submarines. When de-



Photo: Ultra

livered it will provide a level of sonar capability never before enjoyed by the Royal Canadian Navy. The TLFAS system is fully designed and manufactured by Ultra in Nova Scotia, Canada.

Japan Awards Kongsberg Second JSM Contract



PICTURE: MSD ARCHIVES

(jr) Kongsberg Defence & Aerospace AS has entered into a second follow-on contract with Japan to supply the Joint Strike Missile (JSM) for their fleet of F-35 fighter aircraft in a contract valued at 820 MNOK. The JSM is a fifth generation stealth air-to-

surface missile developed to fill F-35A anti-surface warfare (ASuW) and land attack capability gaps. The JSM has superior performance against well-defended sea and land targets across long distances, while it can be carried inside the F-35, ensuring the aircraft's low-signature capabilities.

Royal Navy Carrier Strike Group Achieves IOC

(cw) On 4 January 2021 the United Kingdom's Ministry of Defence announced that the Royal Navy's carrier strike group had reached initial operating capability (IOC). Focused on the new aircraft carrier QUEEN ELIZABETH, the achievement of IOC means that all elements of the group,



Picture: Crown Copyright 2020.

from fighter jets through radar systems to anti-ship weapons have been successfully brought together and operated. The group is scheduled to undertake its maiden operational deployment to the Indian Ocean and Far East later in 2021, during which time it will be complemented by US Marine Corps F-35B strike fighters and the US Navy destroyer THE SULLIVANS (DDG-68) amongst other allied units. Full operating capability for the group is not targeted until December 2023, when the full potential for the Royal Navy's renewed strike carrier capability will have been achieved.

Russian Military Plans for 2021 Unveiled

(yl) The Russian Army plans to take part in nine international drills in 2021, eight of which will be held in Russia, the Defence Ministry said in a recent statement. Russia is expected to host six bilateral training operations, including:

- Russian-Algerian drills
- INDRA 2021 Russian-Indian exercise
- FRIENDSHIP 2021 Russian-Pakistani exercise
- Russian-Vietnamese tank exercises
- LaRos 2021 Russian-Laotian drills
- Russia-Sri Lanka anti-terrorism exercise.

"In addition, the Peace Mission 2020 joint anti-terrorist drills involving Shanghai Cooperation Organisation (ShOS) nations



Photo: MoD Russia

Navantia to Build a New OPV for Morocco:

(cw) On 8 January 2021, Spanish ship-builder Navantia announced that it had received an order for a single offshore patrol vessel from the Royal Moroccan Navy. Although no details of the selected design were released, reports in the Spanish press speculate the new ship will be derived from the Avante 1400 type currently in Venezuelan service. The order marks a further recovery in the fortunes of the group's shipyards in the Bay of Cadiz,

Picture: Navantia



which are currently building AL JUBAIL (Avante 2200) series corvettes for Saudi Arabia and hope to receive a contract for the Spanish Navy's BAM-IS submarine rescue vessel variant shortly. The Moroccan contract is expected to provide one million hours of work for the Cadiz yards, sustaining 250 jobs over the next three and a half years.

U.S Navy to Deploy HELIOS this Year

(J C Menon) For the first time the US Navy will field a High-Energy Laser with Integrated Optical dazzler and Surveillance (HELIOS) on one of its destroyers this year. US destroyer PREBLE will be the first to be equipped with HELIOS, which with high-energy fibre lasers will function as a faster close-in weapon that uses light beams to defend against enemy cruise missiles. The 60-kilowatt HELIOS, much more powerful than the 20-kilowatt laser weapon system the Navy tested aboard afloat forward staging base USS PONCE six years ago, is designed to counter small attack boats and small unmanned aerial vehicles. This will be the only deployed laser system integrated with an operational Flight IIA DDG, following Lockheed Martin's and the Navy's recent demonstration of full laser power in excess of the 60 kW requirement. The scalable laser design architecture spectrally combines multiple kilowatt fibre lasers to attain high beam quality at various power levels. Lockheed Martin completed the Critical Design Review and Navy Factory Qualification Test milestones in 2020. In March 2018, Lockheed Martin was awarded a US\$150 million contract

Image: Lockheed Martin



to develop two of the systems – one for shore testing and a second to be installed on a destroyer. The Navy initially planned for the installation in 2020 for what it is calling the Surface Navy Laser Weapon System (SNLWS) Increment 1. HELIOS will serve as an early test case to integrate a laser system with the Aegis combat system of the Navy's surface fleet. Additionally, the laser system provides a new capability as a sensor to give more precise targeting data than a ship's combat system.

GA-ASI Completes Full-Scale Static Testing on MQ-9B Wing Structure

(jr) General Atomics Aeronautical Systems, Inc. (GA-ASI) has recently completed Full Scale Static (FSS) testing on the MQ-9B

Image: GA-ASI



Remotely Piloted Aircraft (RPA) wing after three months of extensive trials. The MQ-9B includes the SkyGuardian® and SeaGuardian® RPA produced by GA-ASI. The testing included multiple load cases to 150 per cent of expected maximum flight loads, with the wing loaded using specially designed fixtures to apply a distributed load across the wingspan. This simulated gust and manoeuvre flight conditions with no failures. This particular wing design is the culmination of a large development effort from multiple areas within GA-ASI and represents a major milestone in qualifying the MQ-9B SkyGuardian and SeaGuardian RPA to fly in non-segregated airspace. The wing test success also establishes the baseline wing design for the entire MQ-9B product line. This is critical as GA-ASI starts deliveries to the multiple customers pursuing the MQ-9B including the UK, Belgium and Australia.

General Dynamics NASSCO Launches first JOHN LEWIS (T-AO-205) Fleet Oiler:

(cw) On January 12, General Dynamics NASSCO launched the future USNS JOHN LEWIS (T-AO-205), the first of an initial order for six vessels under the JOHN LEWIS class fleet oiler programme designed to support and sustain US Navy combat operations, from their San Diego yard. Construction of the new ship began in the autumn of 2018 and the technical launch is due to be followed by a more traditional christening ceremony later in 2021. Replenishment vessels are likely to be increasingly in demand as the US Navy progresses its distributed maritime operations (DMO) concept, with acquisition as many as 20 of the class forming part of the fleet's longer term plans.



Picture: General Dynamics NASSCO

Saab Signs Next Generation Corvette Contracts

(Jack Richardson) Saab and the Swedish Defence Materiel Administration (FMV) have signed two agreements concerning the next generation of surface ships and corvettes. This concerns the Mid-Life Upgrades (MLU) of five VISBY class corvettes, as well as a



Photo: Saab

Product Definition Phase for the next generation VISBY Generation 2 corvettes. The contracts include requirements' analysis and are respectively the start of the modification work of the five corvettes and the acquisition of the VISBY Generation 2. Collectively, the agreement is valued at 190 MSEK. "The contract is a major step forward for Sweden's surface combat capability, with the upgrade of current corvettes and the creation of the

next generation vessels. The VISBY corvettes have been pioneers for 20 years, and after Mid-Life Upgrades they will be well equipped for future assignments. The experience and knowledge that the VISBY class has gathered over the years will feed into the development of Visby Generation 2," said Lars Tossman, Head of Business Area Kockums. The first VISBY class corvette was launched on 8 June 2000 and five examples are currently in oper-

ational service. The product definition phase regarding MLUs aims to make the five ships in the class operationally relevant beyond 2040. In addition to modifying the ships' existing systems, an air defence missile system will be added as a new capability. The RBS15 anti-ship missile system will be upgraded to the latest version as well as will the torpedo system with the new Saab Lightweight Torpedo.

Future Fleet Oilers of the German Navy

(hum) At the beginning of February, further details about the German Navy's future fuel tankers were disclosed. The floating replenishment stations of the class 707 stand out clearly from their predecessors RHÖN and SPESART (Class 704) both visually and in terms of performance - and not only because of their double hull. They also meet NATO requirements for NBC protection.

Core data:

	Class 707	Class 704
Length	160 metres	130 metres
Width	23 metres	19 metres
Draught	9.5 metres	8 metres
Displacement	20,000 tonnes	14,200 tonnes
Speed	18 knots max.	16 knots
Range	8,000 nautical miles	n.a.
Complement	42 (civilians)	42 (civilians)
Embarkment	23	14
Capacities:		
Fuel	12,000 m³	10,400 m³
Lubricants	100 m³	55 barrels
Aviation fuel	500 m³	
Container capacity	10 TEU	2
Flight deck	NH90 SEA LION	./.
	MERLIN HM Mk2	

Compared with previously announced parameters, the specifications have changed significantly in two positions. The top speed of 20 knots formerly required has been reduced to 18 knots. Conversely, draught has grown to 9.5 metres. On the one hand, this enables shipyards to submit tenders on the basis of a wider range of established designs, which could have a favourable effect on pricing. On the other hand, the navy now has to deal with the stationing of the ships. The requirement so far has been that the vessels' draught should not exceed eight metres in order to avoid dredging the Wilhelmshaven naval base.



Image: MTG Marinteknik / BAAINBw

The Balance of Power in the Persian Gulf

Bob Nugent

The Persian Gulf is a region of critical geopolitical importance, continuing to serve as a vital channel for energy and other trade flows in the Indian Ocean and beyond. At the same time, enduring bilateral and regional frictions, active armed conflicts such as those in Yemen, and other security challenges such as terrorism and infrastructure security also beset the region. The security issues prevalent in the Gulf region are influenced by the region's distinctly maritime characteristics, where the Persian Gulf itself provides both opportunities and threats for strategic planners in all eight countries having sea access.

These elements have driven substantial investments in naval capabilities across the region, and will continue to shape the balance of naval power. This article examines that balance, focusing on data and trends in naval ship acquisitions in the region over the next 20 years. The article draws on proprietary naval market forecast data and analysis provided by AMI

International to examine projected naval acquisitions by each of the eight Gulf countries. It further assesses patterns in naval acquisitions by types of ships and craft, concluding with some observations about patterns and possible disruptions in the Gulf naval balance by 2040.

Overview

AMI tracks Persian Gulf naval acquisitions as part of the Middle East and North Africa (MENA) region. The summary forecast in Table 1 notes that the MENA region, made up of 17 countries, is a naval market of some 264 ships and craft, representing a market value (acquisition cost) of US\$39.5BN. This represents a relatively small portion of the world naval market; in the order of 4%.

Within the MENA area, the eight countries AMI tracks in the Persian Gulf make up more than half of the region's new naval platform purchases. As noted in Table 2, the US\$23.6BN in forecasted spending on

new ships and craft is 60% of the MENA total, while the 184 new platforms is 70% of MENA projected acquisitions by hull count.

Regional Balance by Country

Looking at the region as a whole, it is marked by a distinct split between "major" and "minor" naval forces. Historically, Kuwait, Bahrain, Qatar and Oman were numbered among the latter, based on constrained geography, small populations, and limited budgets. The turmoil in Iraq over the past two decades has sharply limited that country's naval growth as well, although some recovery is noted in the past half-decade.

One of the more notable developments in the regional naval balance is Qatar's emergence as a robust naval force in the Gulf, dating from the original DIMDEX naval exhibition in 2008. Table 2 reflects this change. Qatar is now second in the region by tonnage of new naval ships expected to be acquired over the next two decades, surpassing both Iran and

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Photo: Navantia

Saudi Arabia continues to lead the Gulf region in both new ship numbers and new ship budgets. This image shows two AL JUBAIL class corvettes under construction by Spain's Navantia in mid-2020.

the UAE. Qatar is also nearing Iran and the UAE in terms of forecasted spending on new naval platforms, with US\$3.1BN compared to US\$4.8BN for Iran and US\$4.0BN for the UAE.

As has been the case for the past two decades, Saudi Arabia continues to lead the region in both new ship numbers and new ship budgets. The country's planned acquisition of 75 new hulls represents 41% of the regional forecast, while the US\$9.7BN in planned spending represents an identical 41% of the regional total.

One measure of the seriousness of a nation's naval ambitions is how many planned programmes advance to contract award and construction. AML reflects this in their characterisation of programmes as planned, programmed or in-progress. By this measure Saudi Ara-

TABLE 1 – Middle East and North Africa (17 Countries)

Total Number of Projects	In Progress	Planned	Total Value	Total Build 2021 to 2040
55	26	15	39,518.60	264

There are a further 14 projected programmes for which no formal requirement yet exists.

bia is also the clear leader in realising its naval plans among Gulf countries, with some 92% of programmes in progress. Similarly, Qatar and Oman also show high percentages of active programmes (80% and 70% respectively), while UAE trails at just 40% of programmes currently building. Of note, Iran's oft-announced intentions to field more robust and capable ships is not reflected in their progress in actually moving programmes to construction, with only 14% of forecasted hulls currently in the construction phase.

Regional Balance by Ship Type

Destroyer/Frigate: Saudi Arabia and Iran lead in new programmes for these ship types among Gulf countries. Iran's 6,000 ton NEGIN class represents the largest design and, should it be built, would represent the largest surface combatant among Gulf navies. More typical are frigate/corvette designs of 2,000-4,000 tons, represented by the Saudi Arabian Multi-Mission Surface Combatant, a modified Lockheed Martin littoral combat ship design), Qatar's

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TABLE 2 – Persian Gulf (8 countries)

Country	Total Ships Forecasted to be Acquired 2021-2040	Total Tons Forecasted	Total Programme Value (US\$M)	Average Programme Value/Hull (US\$M)	% of Country's New Ships Building Now	% of Regional Total (Hulls)	% of Regional Total (Value)
Bahrain	11	452	100.1	9.10	45%	6%	0.42%
Iran	21	27260	4775	227.38	14%	11%	20.24%
Iraq	8	6100	1200	150.00	0%	4%	5.09%
Kuwait	18	6030	285	15.83	0%	10%	1.21%
Oman	20	2780	376	18.80	70%	11%	1.59%
Qatar	19	30404	3126	164.53	79%	10%	13.25%
Saudi Arabia	75	62148	9729	129.72	92%	41%	41.24%
UAE	12	17000	4000	333.33	33%	7%	16.96%
Total	184	152174	23591.1			100%	100%

DOHA class (based on the Fincantieri 107 m Corvette design), and the UAE GOWIND.

Corvette: With many of the Gulf corvette programmes classified as frigates by AMI, the smaller corvette type is something of an outlier. The five corvettes in Table 5 represent two classes of 1,400 ton corvette design being acquired by Iran and Iraq respectively.

Submarine: Previous analysis indicated a Saudi Arabian interest in submarine procurement. However, AMI International's latest market intelligence assesses that only Iran and UAE have active submarine acquisition plans. In Iran, the Gulf's only navy with submarine operating experience, the 1,000 ton FATEH class is in the course of construction, while the larger 1,500 ton BESAT class is expected to begin building by mid-decade. In the UAE, a smaller 1,000 ton submarine is said to be in the planning stages but not expected to advance to contract award for at least another 4-5 years.

Fast Attack Craft (FAC): The FAC (typically equipped with anti-ship missiles) remains a relevant part of many Gulf nations' fleet structures, despite the move towards building larger corvettes and frigates. The 18 FACs forecasted are part of programmes in Iran, Iraq, and Qatar. They represent 10% of regional naval acquisitions by hull count and over 6% by value.

Patrol: Patrol ships and craft remain a core element in all Gulf navy fleets, and the principal component of smaller navies such as Kuwait and Bahrain. Separate Coast Guard organisations in Saudi Arabia, Qatar and Oman are in the course of executing several new patrol boat acquisitions, while Bahrain and Kuwait are also buying new patrol

vessels. Designs vary from 2 tons to 600 tons, with seven of 10 new patrol ship programmes in the region acquiring ships of 100 tons or larger.

Amphibious: Amphibious ships and craft serve a wide variety of missions in Gulf navies, most related to transport and logistics. That said, the scope of future amphibious-capable acquisition is currently limited to Qatar and Oman. The Qatari programme is

noteworthy as being an 8,000 ton landing platform dock (LPD) based on the Fincantieri Enhanced SAN GIUSTO class LPD in service with the Algerian National Navy. The addition of this ship will significantly expand Qatari capabilities across the spectrum of maritime lift and transport, amphibious assault, sea-based helicopter and naval command and control operations.

Mine Warfare: The history and prevalence of the mine threat to naval and

CHART 3

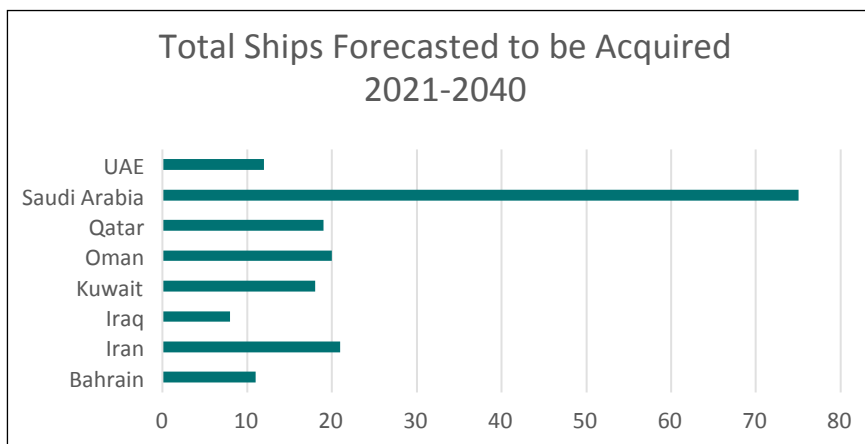


CHART 4

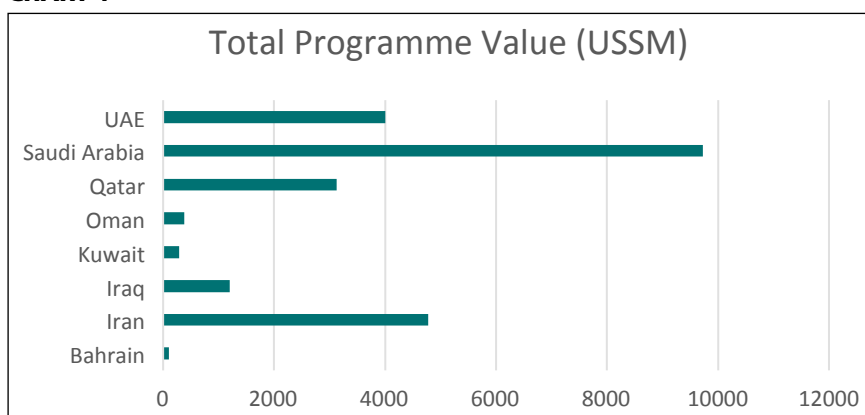


TABLE 5 – Forecast Acquisitions by Ship Type

Ship Type	Total Ships and Craft Forecasted to be Acquired 2021-2040	Total Tons	Total Value (US\$M)	Average Programme Value/Hull (US\$M)	% of Ship Type Building Now	% of Regional Total Ships	% of Regional Total (Value)
Destroyer/Frigate	19	60000	12500	657.89	89%	10%	52.99%
Corvette	5	7060	975	195.00	60%	3%	4.13%
Submarine	10	11900	3800	380.00	30%	5%	16.11%
Fast Attack	18	8250	1500	83.33	11%	10%	6.36%
Patrol	106	13264	2026.1	19.11	80%	58%	8.59%
Mine Warfare	14	8200	1350	96.43	0%	8%	5.72%
Amphibious	7	10600	480	68.57	14%	4%	2.03%
Auxiliary/Support	5	32900	960	192.00	40%	3%	4.07%
Total	184	152174	23591.1			100%	100%



Photo: Lockheed Martin



Photo: US Navy

The Qatari Navy's programme for a new LPD similar to the Algerian KALAT BENI ABBES pictured here will significantly increase the country's power projection capabilities.

The Saudi Arabian Multi-Mission Surface Combatant is typical of the frigate/corvette designs being built for Gulf region navies.

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commercial shipping in the Persian Gulf ensures that almost all navies maintain effective mine counter-measures vessels. Kuwait, Qatar, Saudi Arabia and UAE all have active mine countermeasures vessel (MCMV) acquisitions planned, with contract awards expected between 2022-2024. As a ship type, MCMVs represent about 8% of the region's total forecasted acquisition by hull count and almost 6% by value.

Auxiliary/Support: Originating as littoral forces intended for coastal defence, most Gulf navies did not require or acquire significant logistic and support vessels for most of their histories. However, that pattern has changed over the last two decades. Looking ahead, Saudi Arabia, Kuwait and Qatar all have large (2,000-12,000 ton) training and logistics resupply and transport ships in their acquisition plans. Of these, Qatar's two 90 m cadet training ships are building now in the Anadolu (ADIK) Shipyard of Turkey and are expected to be delivered to Qatar by the end of 2022.

Photo: Austal



Amphibious ships and craft serve a wide variety of missions in Gulf navies, most related to transport and logistics. This is the Austal-built AL MUBSHIR, delivered in 2016.

Conclusion and Outlook

Looking at the balance of future regional naval power in the Gulf through the lens of ship types depicted in Charts 6 and 7 shows a split in the region similar to that seen in the country-by-country look. The littoral and constrained geography

of the Gulf, and a mission set focused on near shore maritime security, explains the large numbers of smaller patrol craft and ships in future acquisitions, accounting for 58% of new platforms region-wide. However, since the average per hull acquisition cost of smaller and less robustly equipped patrol ships and craft is US\$20M, the total regional investment represented by patrol designs is less than 9% of the more than US\$23BN in future spending projected for new platforms across the Gulf.

At the other end of the platform spectrum are the destroyer, frigate and corvette programmes underway or projected. Here, some 24 new ships (13% of the regional total) account for 57% of the region's new construction market. This reflects the large size and more expensive sensor, weapon, command and control and hull, mechanical and electrical systems that equip these types of ships. The same concentration is also seen when measured by tonnage, with the 67,060 tons of new destroyers, frigates and corvettes representing 44% of all new ships and craft to be acquired by Gulf nations through to 2040.

The issue of new submarine acquisitions by Gulf countries also raises questions. AMI assesses that both Iran and the UAE (but not Saudi Arabia) plan to acquire new submarines in the next two decades. The scope of these future acquisitions is substantial: 10 new hulls representing US\$3.8BN in acquisition expenditure (over 16% of the Gulf total and ranking second to the destroyer/frigate type). However, as indicated in Table 5, only three of these 10 new boats (the 1,000 ton Iranian FATEH class) have advanced to contract award and construction. This suggests some skepticism is in order regarding the prospects for new submarines upsetting the balance of naval power in the Gulf over the coming two decades.

CHART 6

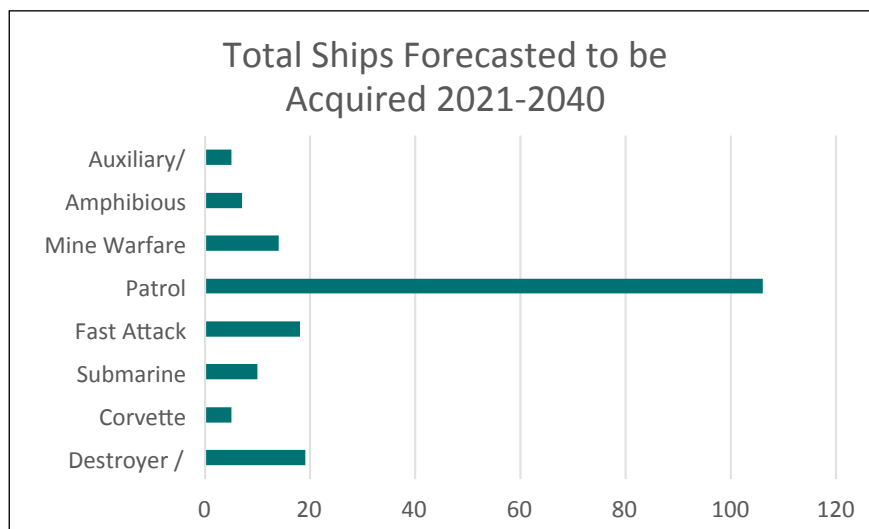
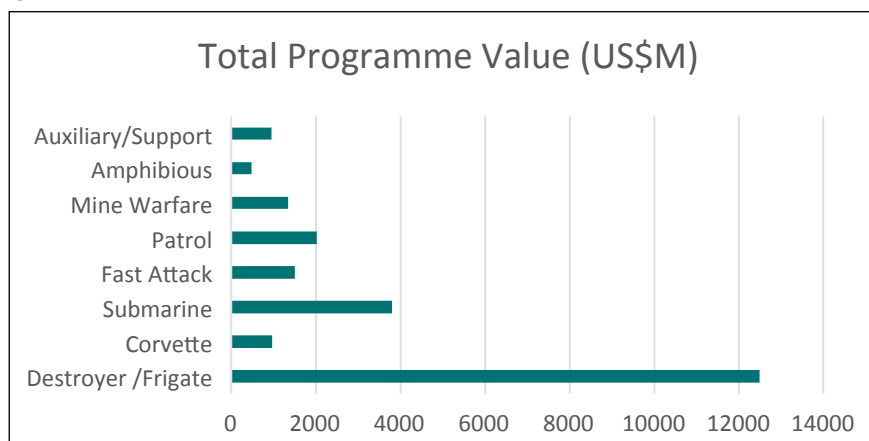


CHART 7



“Maritime security must be streamlined into all strategic policy areas.”

Photo: European Union Military Staff, Public Information Office



Admiral Bléjean addressing land forces in Africa

With his experience as Deputy Commander of NATO's Maritime Command Northwood, Admiral Bléjean has a thorough view on Europe's maritime capabilities. For MSD he provides an honest and in-depth assessment of EU's military endeavours. Eying the bloc's military operations, he considers, that member states are to take the force generation process more seriously. In terms of capability shortfalls for the EU, Admiral Bléjean stresses the need for Maritime C2, maritime interdiction operations assets, harbour protection modules and specialised diver teams. Beyond 2032, his focus is on strategic sea transport, but also on Ballistic Missile Defence, amphibious capabilities, and aircraft carriers.

He assesses the withdrawal of the UK from the EU exacerbated existing shortfalls but did not create no ones. However, EU will have to work on high readiness capabilities after Brexit.

MSD: In a recent interview, you emphasise that the EU is a maritime organisation. Which basic considerations are behind this conclusion?

Adm Bléjean: The EU has a number of strategic maritime interests related to the military aspect, which include the overall security and peace, the rule of law and freedom of navigation, the external border control and the protection of maritime infrastructures: ports and harbours, coastal protection, commercial facilities, underwater pipes and cables, offshore platforms and scientific equipment. The EU's identity is also greatly defined by its connection

Interview with Admiral Hervé Bléjean, Director General EU Military Staff and Director Military Planning and Conduct Capability

to the sea. Twenty out of the 27 member states are coastal states and they rely heavily on the maritime sector both economic prosperity and for their national security.

- 22 out of 27 EU MS are coastal countries
- 50% of EU population and GDP are in maritime regions
- 400 million passengers pass through EU ports and harbours
- 66.000 Km coast line versus 14.000 Km land borders (Wikipedia)
- 20M km² EEZs (world largest)
- 90% of goods for and from the EU in different stages of finish (from raw materials over semi-finished to finished products) are transported over sea
- EU (Europe) is a peninsula on the Eurasian landmass, bordered on three of its majorxes (N, W and S) by the sea

The facts underline that (the) EU has both a very open and a very maritime economy and society. Maritime security is a shared need for the welfare and prosperity of the EU. The seas nurture growth and render key environmental services. Their security is part of the foundation on which our society is built. Maritime security links internal security matters to external ones. Threats are transnational and interconnected by nature and require smart solutions: no single actor can guarantee maritime security on their own. Maritime security must be streamlined into all strategic policy areas. An integrated approach and joint response are ideal: they generate a better environment for stability and development, improving both effectiveness and efficiency.

It is then apparent to everybody that it is realistic to call EU a “maritime union”.

MSD: How can you as DGEUMS and Director MPCC contribute to strengthen this role?

Adm Bléjean: The EUMS contributes to secure the maritime security interests of the



Operation IRINI: inspection crew preparing to board a ship as part of a routine patrol

Photo: Operation EUNAVFOR MED IRINI, Public Information Office

Photo: Office of DGEUMS



DGEUMS at headquarters in an operational planning meeting

EU and its Member States against the risks and threats presented in the global maritime domain. It cooperates with civilian authorities and actors active in the domain in a cross-sectoral way; it also acts to allow for joint security contingency planning, risk management, conflict prevention and crisis response and management.

There are two active maritime operations (IRINI and ATALANTA) that bring tangible results and there are also other initiatives to which EUMS participates, as the Coordinated Maritime Presences Concept (CMP), which project the EU's interests in important regions.

We see the need for EU's Common Security and Defence Policy (CSDP) to evolve from initial mandates that centred on a specific and exclusive maritime security issue (such as piracy, arms embargo or human trafficking) to a wider inclusive 'Maritime Security Operations' approach. With this regards, also both IRINI and ATALANTA tasks has being adapted, to reflect the EU engagement in making the maritime environment safer.

Just recently two executive secondary tasks and four non-executive tasks have been added to Operation ATALANTA, in particular respectively counter weapons and narcotics trafficking and monitoring of illegal fishing, charcoal smuggling, weapons and narcotics trafficking, making the operation widen its scope (without diverting from the primary one, which remains still counter-piracy).

Similarly, IRINI is developing instruments to increase its cooperation with the merchant shipping community in the Central Mediterranean Sea, starting with replicating the

already implemented and well-functioning Maritime Security Centre Horn of Africa (MSCHOA), which helps protecting merchant shipping in the region by sharing information with registered vessels through a web based application.

EUMS is also reinforcing its technical capabilities in relation to the maritime domain and maritime information sharing. We are closely monitoring the development of Common Information Sharing Environment (CISE) and Maritime Surveillance (MARSUR).

During last year, MARSUR – a technical solution that allows dialog between European maritime information systems that aims to improve a common "Recognised Maritime Picture" by facilitating exchange of maritime information and services such as ship positions, tracks, identification data, chat or images – has been installed in EUMS, initially on lease but soon permanently. This will allow our team to have a clearer picture of the strategic maritime environment and be sure that EU policy adapt promptly and adequately to answer the stakeholders' (our maritime communities') needs.

Lastly, under the Coordinated Maritime Presences (CMP) implementation plan, Council can establish a 'Maritime Area of Interest' (MAI) in which the EU wants to protect its maritime interests and partner with regional states as well as coordinate individual Member States' maritime activities. To this effect, a "Maritime Area of Interest Coordination Center" (MAICC) is established within EUMS. It is centred on an EUMS Experts Cell and includes the MARSUR community active for this plan and directed by the Director of Operations

in the EUMS. It has strategic oversight by a multidisciplinary 'CMP Task Force' with participation of different EU entities. At this moment the MAICC is conducting a pilot case, focused on coordinating the activities of EU- Member States' military ships deployed under national flag in the Gulf of Guinea, in order to pursue EU strategic interests in the area.

Regarding MPCC's contribution, the Council in its conclusions of 6 March 2017, agreed to establish, as a short term objective, a Military Planning and Conduct Capability (MPCC), which would be responsible at the strategic level for the operational planning and conduct of non-executive military missions, working under the political control and strategic direction of the Political and Security Committee (PSC). In the same Council Conclusions, it was decided that the Director General of the EUMS will be the Director of the MPCC and, in that capacity, will assume the functions of missions' commander for non-executive military missions, including the three EU training missions (EUTMs) deployed in Somalia, Mali and the Central African Republic, in line with the Terms of Reference for the Director of the MPCC. The current capability within the MPCC to contribute to planning and conducting maritime operations is limited due to insufficiency of expert personnel, connectivity and infrastructure. Based on the future MPCC' review, the maritime dimension could be more efficiently included.

MSD: In your eyes, what is to be done in order to promote Europe's maritime responsibilities?

Adm Bléjean: There are a number of issues that have to be addressed to achieve a desirable end state.

Dialogue with the stakeholders is of utmost importance as is the sharing of information. One of the latest initiatives that we promote I can mention is the "Shared Awareness and Deconfliction Mediterranean" (SHADE MED) conference, an event organised by IRINI Operational Headquarters (OHQ). It took place just few weeks ago and collected more than 250 experts and representatives from an incredibly wide spectrum of maritime domain stakeholder, from the armed forces to the coast guards of the States bordering the Mediterranean, from international institutions such as United Nations and NATO, passing through NGOs and representatives of the governments that are most interested in the Mediterranean questions. SHADE MED is a 'spinoff' of the SHADE series of meetings held in the Indo-Pacific, coordinating between all partners present in different maritime se-

curity operations (counter piracy, counter terrorism, counter drugs trafficking, etc...) in which Operation ATALANTA plays an important leading role.

But to be perceived as a credible security provider, the strengthening of capabilities in planning and conducting operations is fundamental.

Expand CMP across other areas of interest. In due time, after a review of the Pilot Case in the Gulf of Guinea, the CMP Concept could be implemented in other areas with EU interest (i.e. Eastern Mediterranean, Baltic, Indo-Pacific, Arctic). Prerequisite for this is the declaration of Maritime Areas of Interest, by the Council, which is anticipated to be a potentially complicated issue at the political level.

The deepening of the collaboration with the civilian missions and other actors in an integrated approach is also a need.

Another move that can be made is the development of an EU Command and Control system oriented to the maritime domain that will incorporate all the levels of command, from the tactical to the military strategic.

Lastly, member states are to put more effort in the force generation process of the naval and maritime missions and opera-

tions and commit the necessary assets for the achievement of their mandate.

MSD: Given that NATO is also a maritime organization, how do you see the work-share once the EU would engage more in its maritime responsibilities?

Adm Bléjean: When it comes to collaboration with NATO, we have to take into account the availability of member states capabilities. Any action will be undertaken having in mind that member states have finite resources to contribute; often this is referred to as 'a single set of forces' for serving both organizations. Moreover, the tasks of the two organizations are different in their nature and we have to keep in mind that not all EU member states are NATO allies, and vice versa.

In any case, cooperation with NATO is fundamental, and it is covered by the EU Maritime Security Strategy principle of maritime multilateralism.

We already have frequent meetings, discussions and exchanges at staff level with our NATO counterparts (between the two Military Committees as well as from the two Directors General down to Action Officers in both Military Staffs), but there is still the need to enhance the information sharing mechanism especially in Op-

erations. To this end, we need to find ways to overcome the obstacles which exclude specific MS from NATO intelligence. Establishing a new administrative arrangement between EU operation IRINI and NATO operation Sea Guardian in order to share information would also be for the benefit of both parts.

MSD: What kind of operations could one envisage for the EU?

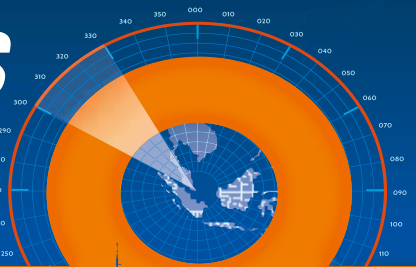
Adm Bléjean: First, to continue, according to their mandate, with the current CSDP missions and operations in three continents, which are aiming at a more stable world and contributing to a safer Europe.

Second, to utilise the experience gained so far to establish new executive or non-executive CSDP operations and missions in other areas of EU interest. The transition from Operation SOPHIA to Operation IRINI was successful due to the lessons learned drawn from previous naval operations.

Third, to promote MS initiatives, under EU overarching coordination, like the recent Pilot Case of the Coordinated Maritime Presences Concept in the Gulf of Guinea. In the same spirit, in January 2020, eight EU Member States decided to give their political support to the creation of a na-

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val mission in the Strait of Hormuz called European Maritime Surveillance Mission in the Strait of Hormuz (EMASOH). The objective is to ensure a safe navigational environment through this strategic strait by providing maritime situational awareness, coordination, and information sharing among all stakeholders. Another objective is to serve as a de-confliction mechanism to help defuse tensions in the area.

MSD: Brexit leaves the EU with a lack of maritime capabilities. How would you see the link to the United Kingdom in order to compensate raising warfighting deficits? Adm Bléjean: It is safe to say that the void left by the United Kingdom particularly vis-à-vis the OHQ Northwood was grand, however the operation was efficiently and smoothly taken over by other contributing

economies as well as our maritime safety and security are intertwined to the point where they depend on each other. A comprehensive trade agreement between both the Union and the UK is of course of utmost importance.

MSD: Coming back to the envisaged operations for the EU, do you think, the EU could cope with these challenges?

Adm Bléjean: Yes, because...

Each EU mission works in the framework of an Integrated Approach across all relevant EU institutions, with a coherent use of all available EU instruments to enable an effective EU response. The operations and missions work in agreement and coordination with the EU Delegations in the same area and in the framework of EU regional policies, in close cooperation with EEAS

needs and the degree of involvement of the supported local institution/agency.

MSD: Given PESCO and CARD, what are your expectations to enhance the EU's maritime capabilities?

Adm Bléjean: PESCO and CARD are flip sides of the coin. They are expected to provide further understanding of the situation while identifying cooperation opportunities, with PESCO specifically aiming at the creation of a Full Spectrum Force Package.

CARD is both, an information exchange and effective decision-making platform. When it comes to Capability development, CARD identified six focus areas for which member states plans could benefit from increased cooperation. Two of them are linked, directly or indirectly, to maritime capabilities. First, European Patrol Class Surface Ship that aims at providing modular naval platforms. Enhanced Military mobility also addresses the strategic sea transport issue which is essential for future CSDP missions and operations. We know that in these fields Member states already have plans to develop their capabilities but increased cooperation in these efforts would facilitate future cooperation on the field.

On the other hand, our capability planning process, the Headline Goal Process, provided us with clear indications regarding the needs and the shortfalls faced by the EU CSDP. This is how EUMS identifies the main shortfall areas; we call them High Impact Capability Goals (HICGs). CARD allowed us to assess which of these HICGs were not sufficiently addressed by member states. CARD identified three priority areas in which there are not enough plans to acquire capabilities Power Projection, Non-kinetic Capabilities and Force Protection. Two of these are linked to maritime capabilities. Regarding Force Protection, Ballistic Missile defence and its maritime platforms will be needed to fulfil the EU CSDP Military level of Ambition. The field of Power projection includes amphibious capabilities which need further cooperation among member states but also aircraft carriers for which EU has very limited capabilities.

Then, considering PESCO, it is aiming at increasing operational involvement and capability development. The last PESCO Strategic Review repeated the need to increase contributions to current operations and to address the HICGs paving the path to a Full Spectrum Force Package.

PESCO will also bring more and more attention to contributions to current operations. When it comes to the enhancement of maritime capabilities, we must consider the current PESCO projects. These projects may

Photo: EUNAVFORMED



A boarding team from ITS SAN GIORGIO in support of Operation IRINI

nations such as Spain and France with the OHQ and "Maritime Security Center Horn of Africa" (MSCHOA) respectively, and quite a while back.

With regards to assets, Spanish, Italian and French naval assets and Spanish and German maritime patrol reconnaissance aircrafts (MPRAs) were ever-present. In addition, all the participating member states and partners have kept up their commitment to keep the high and successful nature of the operation.

The above does not mean that the operation continued and will continue to operate successfully, by mitigating any lack of resources with negotiation, coordination and cooperation with the key stakeholders operating in and around the HOA.

This is a decidedly political issue in which we follow our political leadership. But we see it as essential for Europe's (maritime) security that a close working relationship between EU's and UK's maritime communities continues to exist. Our Maritime

and the EU Special Representative (EUSR) for that particular region.

And last but not least, we address these challenges in close cooperation with our regional and international partners. For the CMP Gulf of Guinea, for example, this is done in cooperation with the coastal states of the Gulf, within the 'Yaoundé Code of Conduct' Maritime Security Architecture and in close cooperation with regional organisations such as the "Economic Community of Central African States" (ECCAS) and the "Economic Community of West African States" (ECOWAS), while linking up with the US as well as the international maritime community and industry.

Over the years we have proven our capability to provide flexible instruments supporting partners in addressing security challenges, adapting to the specificities of each country/case.

We use top-down (advising, mentoring, monitoring) and bottom-up (capacity building) approaches, depending on the

facilitate training such as the EU Network of diving centres or provide new platforms like the European Patrol Corvette or new capabilities like the Maritime Unmanned Anti-submarine System which will bring new C3 systems to underwater systems.

A number of other projects are addressing maritime capabilities we could also mention the maritime semi-autonomous Systems for Mine Counter Measures, Harbour & Maritime Surveillance and Protection, the upgrade of maritime surveillance, or the Deployable Modular Underwater Intervention Capability. Other projects will support or increase the maritime domain by providing joint intelligence or bringing new C2 systems like the EU collaborative warfare project.

Many of these projects will bring new capabilities before the end of the next PESCO phase in 2025.

But in the end, examining our opportunities and challenges together through CARD developing new capabilities thanks to PESCO projects will not only facilitate cooperation in the future but also contributes to further EU own strategic and military culture.

Lastly, PESCO is an increased cooperation on Operations. In particular, the German led project "Crisis Response Operations Core" (CROC) aiming to better align our approach to and standards in Crisis Management Operations, could develop a maritime focused pillar as well.

MSD: Where would you put the priorities - in terms of operational capabilities and in terms of armament or procurement?

Adm Bléjean: Within the EUMS, we focus on operational capabilities. Armament or procurement only makes sense if they are creating operational capabilities. When we are trying to fulfil the EU Military Level of Ambition, there is no value in equipment if it is not supported by a strong organisation, served by trained personnel and ready to be deployed overseas.

When considering the military point of view, the priorities among operational capabilities are one of the main outcomes of the Headline Goal Process.

EUMS has reshaped the military capability planning process (the Head Line Goal Process) and coherently adapting it to the new EU defence initiatives as well as the corresponding NATO process (the NATO Defence Planning Process - NDPP).

As a result of these efforts, the EU is able to plan now its military capabilities with a perfectly aligned with NATO cycle in terms of time and taxonomy and has a new powerful instrument to ensure the fulfilment of its military level of ambition: The High Impact Capability Goals.

These goals define a precise path to address, in the short and medium term, the strategic gaps that the EU still has in terms of military capabilities, they inform the Capability Development Plan, their implementation is timely assessed and discussed with MS through CARD and they serve as a main benchmark for EU cooperation under the PESCO umbrella. The 2020 Progress Catalogue (PC) provided some new insights on the most pressing capability shortfalls, the High Impact Capability Goals.

EUMS provides, through the PC, an analysis on the potential implementation of the HICG, connecting them with three main capability development courses of action "Commitment", "Procurement" and "R&D", being considered as a key guidance for short and medium term future MS' capability development efforts. In the short term, focusing on the maritime capabilities addressing the goals set by the Council for 2026, we could stress the need for maritime C2, maritime interdiction operations assets, harbour protection modules and some specialised diver teams.

In the longer term, 2032, the focus would be on strategic sea transport, naval ISR, maritime patrol but, specifically, on Ballistic missile defence, amphibious capabilities and aircraft carriers. Those last three capabilities are included in the priority areas defined by CARD evoked before: Force Protection and Power Projection.

Aircraft carriers are ambitious capabilities as they rely not only on very large and expensive ships but this capability also require large fleet of specialised airplanes, pilots, sailors and other escorting ships. Speaking of which, the last Progress Catalogue also demonstrated that the withdrawal of the UK from the EU did not create new shortfalls but exacerbated existing ones. UK withdrew before their new aircraft carriers were commissioned, thus, not changing the number of available assets. Nonetheless, the high level of readiness shown by British Forces also increased our needs for high readiness capabilities after Brexit.

MSD: Please share with us some insights into the assessment on the document which was issued in October 2020: EU Maritime Security Strategy Action Plan?

Adm Bléjean: The main remark that I like to note is the significance the member states that contributed to the report and EU institutions, put on maritime security. Moreover, the efforts to promote linkages between maritime security and development policy are noted as also the

activities to prevent and disrupt maritime illicit activities, where military naval operations had a key role.

Interoperability was promoted by cooperating with non-EU countries and with NATO entities.

Naval operations in place took advantage of developments as the "Geospatial Information to Support decision-Making in Operations" project ("GISMO GeoHub"), implemented by EDA.

I also have to note that the implementation of the action plan has started to benefit from several EU defence initiatives, notably the coordinated annual review on defence (CARD); the permanent structured cooperation (PESCO); the European Defence Fund (and its precursor programs).

The current report gives a more complete picture of the efforts made across the EU to consolidate maritime security.

The international cooperation chapter of the action plan benefited from the sustained and complementary commitments of EU institutions, EU agencies, and MS on global maritime security. CSDP naval missions and operations have continued to play an essential role in the EU's external action on maritime security.

In the area of maritime awareness, the report reflected efforts made by MS authorities to complement their maritime-surveillance picture by accessing information already existing in other national and European surveillance systems. Among the ongoing activities aiming to improve maritime awareness, the CISE transitional phase is considered as having a suitable approach to guarantee complementarity of information exchange between different EU and MS maritime-surveillance systems.

The report shows that competent EU and MS maritime authorities are determined to increase their risk assessment and management capacity, seeking to ensure the resilience of critical maritime infrastructure, the security of the supply chain and the protection of external maritime borders. To this end, efforts have focused on consolidating the capacity to address cyber/hybrid threats, climate challenges and maritime environmental disasters.

Finally, this report contains also a new dedicated section that details substantive achievements in civil-military cooperation across sectors and borders.

**Amiral, merci beaucoup.
The Interview was conducted by
Hans Uwe Mergener**

Russia's Baltic Fleet

Counterbalancing NATO's Regional Build-Up

Dr. Nikolai Novichkov

Some ten or fifteen years ago, Russia's Baltic Fleet was the 'neglected offspring' of the Soviet Baltic Fleet. A depleted formation made up of its predecessor's remnants, it did not represent a modern force. Moreover, the formation's structure, warships and naval component were not supported by a combat concept, let alone a clearly defined military doctrine. By early 2021 this situation had dramatically changed. The Baltic Fleet is in the course of being shored up against the background of NATO's expanding presence in the region.

The Regional Context

The Baltic Fleet is primarily based in the Kaliningrad Region. This has a distinct place in the Russian Federation, having no land borders with any other part of the country and being surrounded by states which take an anti-Russian stance. Both Poland and the Baltic States form established parts of NATO's military infrastructure and are modernising their armed forces with the acquisition of new weapons. NATO has intensified its exercises along Russia's land borders, whilst the reconnaissance aircraft of the NATO member states and of Sweden patrol the shores of the Kaliningrad enclave almost round the clock.

Facing this situation, Russia's military command has established the country's first combined arms task force in the region. This comprises naval, land and air components, including coastal units and an air defence network, and brings all forces under the remit of a single commander. The Kaliningrad Region is also home to Russia's first integrated anti-access/area denial (A2/AD) network, encompassing air defence, electronic warfare and strike weapons systems. The A2/AD system's main task is to inflict unacceptable damage on any aggressor, using air and missile capabilities to neutralise its offensive potential.

Author

Following an earlier career in engineering, **Dr. Nikolai Novichkov** is an international defence journalist writing about topics that include aircraft, missiles and naval technologies.

Photo: Author



Previously a neglected legacy of the Soviet era, Russia's Baltic Fleet is being augmented with new equipment in the face of NATO's regional build-up. This is the Project 20380 corvette SOOBRAZITELNIY.

Baltic Fleet Responsibilities

The Baltic Fleet has its headquarters in Kaliningrad, with its main base at Baltiysk. The formation also encompasses the Leningrad Naval Base, with an operational focus on Kronstadt. Its main responsibilities are to:

- Maintain Russia's interests in the Baltic region
- Protect the economic zone, as well as industrial infrastructure.
- Interrupt illegal activities.
- Provide safe navigation
- Act in collaboration with the Russian Navy's other forces (primarily the Northern Fleet's North Atlantic task force)
- Support Russia's foreign policy goals across the world's oceans.

Given the Kaliningrad Region's potential vulnerability, its protection inevitably forms a core part of the fleet's responsibilities. Along with other elements of the integrated defence structure, it is tasked with preventing attacks on key military targets and infrastructure across the region, particularly in the vital first two or three days of any conflict. However, the Baltic Fleet has much wider geographical horizons. According to the Russian Navy's Commander-in-Chief (VFM) Nikolay Yevmenov, the fleet is the leading formation in Russia's western combined arms force, "The Baltic Fleet is a developing fleet which is capable of providing protection against sea threats in its operational area far away from its main bases. Today the formation's servicemen are successfully accomplishing the most challenging goals in interaction



Photo: Crown Copyright 2017

BOIKIY and SOOBRAZITELNIY transiting the English Channel in 2017. The Baltic Fleet is widening its horizons in support of Russia's foreign policy objectives.

with the forces of the Russian Navy's other fleets, including the military service's task force in the Mediterranean Sea."

Baltic Fleet Structure

Administratively part of Russia's Western Military District, the Baltic Fleet can be considered as a balanced combined arms formation. It encompasses naval forces, naval aviation, an air defence network, coastal and territorial defence troops and logistical support assets. All the formation's component units are maintained at a high state of readiness. The Baltic Fleet also maintains significant facilities to support its important role as a major training base for the wider Russian Navy. Most military scenarios in the Baltic region do not favour the use of large surface ships. Instead, the Baltic Sea is a theatre, where light warships can successfully accomplish a wide range of tasks without relying on the support of large naval platforms and nuclear-powered submarines. However, air support is still an essential issue. The Baltic Fleet currently has the following major ships within its structure:

Surface Combatants:

- 1 Project 956 Destroyer (NATO: SOVREMENNY class): NASTOYCHIVIY
- 2 Project 11540 Frigates (NEUTRASHIMYY class): NEUTRASHIMYY and YAROSLAV MUDRIY
- 4 Project 20380 Corvettes (STREGUSHCHIIY class): STREGUSHCHIIY, SOOBRAZITELNIY, BOIKIY and STOKIY
- 3 Project 22800 Corvettes (Karakurt class): MYTISHCHI, SOVETSK and ODINTSOVO
- 2 Project 21631 Corvettes (Buyan-M class): ZELENIIY DOL and SERPUKHOV
- 4 Project 1234.1 Small Missile Ships (Nanuchka III class): ZYB, GEISER, PASSAT and LIVEN
- 6 Project 1331M Small ASW Ships (Parchim class): URENGOY, ZELENODOLSK, KAZANETS, ALEKSIN, KABARDINO-BALKARIA and KALMYKIA

DOLSK, KAZANETS, ALEKSIN, KABARDINO-BALKARIA and KALMYKIA

Major Amphibious Ships:

- 6 Project 1241 Missile Boats (Tarantul class)
- 4 Project 775 Large landing Ships (Ropucha class): MINSK, KALININGRAD, ALEKSANDR SHABALIN and KOROLYOV
- 2 Project 12322 air cushion landing craft (Pomornik class): EVGENIY KOCHESHKOV and MORDOVIA

Other important units include the lead Project 12700 (Alexandrite class) mine countermeasures vessel (MCMV) ALEXANDER OBUKHOV, ten coastal and inshore minesweepers, various landing craft and fast patrol craft, as well as the usual array of logistic support vessels and tugboats. In 2020, the Baltic Fleet received its first Project 02510 (BK-16) fast landing craft with several more of the type planned for delivery during 2021. One potential area of weakness is a lack of underwater combatants, as the fleet currently only operates the two Project 877 (Kilo class) submarines DMITROV and ALROSA. However, industrial sources suggest the fleet may receive the two Project 677 (Lada class) boats KRONSTADT and

VELIKIYE LUKI that are now being built at the United Shipbuilding Corporation's Admiralty Shipyards subsidiary in Saint Petersburg. It is also understood that the Russian Navy is discussing the construction of additional Project 636.3 (Improved Kilo class) submarines armed with the KALIBR (SS-N-27 Sizzler) missile system – already operated by the Black Sea and Pacific Fleets – for Baltic Fleet service.

Modernisation

According to Commander-in-Chief Yevmenov, the Baltic Fleet will continue to be bolstered by new warships as Russia attempts to tip the balance of regional power in its favour. Important arrivals are likely to include further KALIBR missile-armed Project 22800 corvettes, the most recent of which also carry the new PANTSIR-M combined missile and gun close-in weapons system.

Modernisation is not limited to warships, with particular attention being paid to improving the long-neglected Baltiysk Naval Base. The base's berthing facilities have been repaired and extended to a total length of around 3 km, whilst new power cables and waterlines have been laid and communication networks improved.



Photo: Author

Growing numbers of Project 22800 corvettes are entering service with Russia's Baltic Fleet. Shown here is SOVETSK, 2nd of class.



The Baltic Fleet still relies on a number of Soviet-era designs that will require replacement. This is the Project 1131M small ASW ship KAZANETS.



The Project 636.3 Improved Kilo class submarine KRASNODAR was transferred to Russia's Black Sea Fleet after completion but more boats of the type could be built for Baltic Sea service.



Project 20380 corvettes – this is BOIKIY – are one element of a number of Black Sea warships integrated into Russian reconnaissance-and-strike networks to improve interoperability with land-based forces.

Other improvements extend to the enhancement of repair and maintenance workshops as well as upgraded logistical support facilities. The first stage of the upgrades is believed to have been completed by the end of 2020 and further work is underway. The modernisation programme will reduce the base's exposure to adverse meteorological conditions and improve overall operational safety. The expanded facilities also improve Moscow's ability to base naval strike forces close to NATO's borders in a strategically important region, supporting the capabilities of the new assets that are being acquired.

Another important aspect of force modernisation is the introduction of new weapons systems that have particular relevance to the Baltic region. These include a new generation of 'smart' sea mines that are capable of recognising various ship classes. These have already been deployed in the Project 21631 (Buyan-M) class corvettes during exercises, improving their A2/AD capabilities. The new mines are associated with an enhanced concept of 'intelligent' sea minefields that will effectively change shape dependent on the type of threat faced. Operating under the umbrella of a networked system of sensors governed by

a command and control unit, the system allows priority to be placed on countering the most valuable enemy combatants. For example, a minefield can be commanded to destroy only loaded landing ships whilst ignoring empty ones or to disregard MC-MVs but engage large surface combatants. The system is believed to work on the basis of a software library of acoustic signatures that is accessed during the target recognition process, distinguishing between different ships with a high probability of success. The mines can be placed in groups or individually and be deployed by a wide range of assets.

The Project 20380, 22800 and 21631 corvettes have also been integrated into the Russian military's reconnaissance-and-strike networks to enhance the Baltic Fleet's ability to provide close fire support to ground forces. Target information can, for example, be acquired by land-based FORPOST unmanned aerial vehicles (UAVs) and then transmitted onwards via digital communications channels. By using the STRELETS (Shooter) command and control and communications system a serviceman can simply mark a target on his or her personal tablet and call in an artillery or missile strike. Achieving cohesion between warship crews and FORPOST UAVs to monitor, detect, track and destroy potential targets has been a feature of Baltic Fleet exercises.

Land and Aviation Assets

The Baltic Fleet's own coastal troops and aviation forces are also being modernised. According to the Baltic Fleet's Commander, Admiral Alexander Nosatov, "Over the past three years we have adopted BAL (SSC-6 Sen-night) and BASTION (SSC-5 Stooge) mobile coastal defence missile systems, ISKANDER-M (SS-26 Stone) tactical ballistic missiles, S-400 TRIUMF (SA-21 Growler) air defence missiles, PANTSIR-S (SA-22 Greyhound) self-propelled CIWSs, FORPOST UAVs, Sukhoi Su-30SM (Flanker-H) multi-role combat aircraft, and Kamov Ka-27M (Helix-A) and KA-29 (Helix-B) rotorcraft amongst other cutting-edge weapons systems".

The Baltic Fleet's tank units form an important part of its land forces. They have begun receiving upgraded T-72B3M main battle tanks, with both the 7th Motor Rifle Regiment and the 79th Independent Brigade set to be re-equipped. 2020 saw 30 T-72B3Ms delivered to the Kaliningrad Region and the process is expected to be completed before the end of 2021.

In addition to its missile-armed surface warships, the Baltic Fleet has two ground-based missile units: the 152nd Guards Missile Brigade equipped with the ISKANDER-

M and the 25th Coastal Missile Brigade with the BAL and BASTION systems. These weapons are capable of engaging enemy ships at distances of up to 500 km. The Baltic Fleet's artillery units have also been reinforced with battlefield weapons that include URAGAN multiple rocket launch systems, MSTA and PION artillery and the KHIRSANTEMA (AT-15 Springer) self-propelled anti-tank guided missile.

The Kaliningrad enclave is home to a multi-layered air defence network focused on the 44th Air Defence Division. This comprises a regiment of S-300 and S-400 systems and a regiment with S-300V4 missiles. According to open source information, some eight batteries of S-300 and S-400 missiles and two S-300V4 batteries are deployed in the Kaliningrad Region, providing a level of air defences comparable only with the air defence areas of Moscow and Saint Petersburg. Tactical air defences fall under the auspices of the 22nd Air Defence Regiment that is equipped with the TOR-M2 (SA-15 Gauntlet) short-range air defence system. It is understood the ship-based REDUT air defence system of the series-built Project 20380 corvettes have also been integrated into the region's air defence network.

The Baltic Fleet's naval aviation component is provided by the 132nd Aviation Division, that includes fighter, air assault and helicopter regiments. Helicopter types include the Ka-27 (Helix), Mil Mi-24 (Hind) and Mi-8 (Hip) series rotorcraft. Upgraded Ka-27M helicopters were delivered in the course of 2020 and the newest Ka-52 (Hokum-B) and Mi-28N (Havoc-B) types are also expected to be inaugurated soon. The detection of submarines in the Baltic Sea can be difficult due to significant variations in water depths; however, the Ka-27M's dipping sonar allows detection in almost all topographical conditions.



Photo: Author

The ISKANDER-M (SS-26 Stone) tactical ballistic missile system is just one of a range of new weapons that are bolstering the Baltic Fleet's land-based forces.

The region's defences also benefit from one of Russia's most powerful electronic warfare (EW) units in the form of the 841st Independent Electronic Warfare Centre. In late 2018, the MURMANSK-BN jamming system was deployed to the region. Contained in seven heavy trucks, it is believed to be capable of suppressing enemy systems at distances of up to 5,000 km, extending perhaps as far as 8,000 km in favourable environments. The coastal troops also use a range of their own EW assets. According to the Russian Ministry of Defence, the Baltic Fleet's EW equipment provides a full range of capabilities extending from jamming through to the collection and analysis of data received from surveillance of HF and VHF transmissions.

The Kaliningrad Region's westerly geographical location makes it a prime location for surveillance radar systems, including the VO-RONEZH-DM missile defence radar. A new KONTAINER long range over-the-horizon radar system, which can detect aircraft and missile launches as far as the United Kingdom, is also being constructed in the enclave.

Training & Exercises

The concentration of significant United Shipbuilding Corporation shipbuilding facilities in the Saint Petersburg and Kaliningrad areas mean that many of the Russian Navy's surface warships and submarines run their trials in the Baltic. According to Commander-in-Chief Yevmenov, providing assistance with the testing and work-up of these vessels is amongst the Baltic Fleet's most important duties.

An important part of the revitalisation of Baltic Fleet capabilities is the expansion of basic and operational training after the neglect of the immediate post-Soviet years. The most important training exercise is probably the annual Ocean Shield serial, which takes place after the Navy Day celebrations in July. Typically involving some 30 naval vessels as well as aviation, coastal and air defence assets the exercise involves artillery and missile live firing in manoeuvres that include air defence, surface and underwater combat and amphibious operations.

Conclusion

It can be seen from this brief overview that much has been achieved in recent years to rebuild Russia's Baltic Fleet capabilities as a counterbalance to the strength of NATO and allied forces in the region. As a result, the security of the Kaliningrad Region is on a much firmer footing than previously. However, this increase in capabilities remains work in progress. According to Commander-in-Chief Yevmenov, the modernisation and rearmament of the fleet with cutting-edge weapons and equipment will continue in the years ahead. ■



Photo: Author

The Project 12322 air cushion landing craft EVGENIY KOCHESHKOV. Amphibious operations form a major part of the annual OCEAN SHIELD exercises.

European Patrol Corvette: A True European Programme?

Giulia Tilenni

Although a part of the Permanent Structured Cooperation (PESCO) project and a candidate to receive EU funds, the European Patrol Corvette programme might result in the creation of a European combat vessel. Or maybe not...

The development of a European Patrol Class Surface Ship (EPC2S) is among the collaborative opportunities identified in the first European Union Coordinated Annual Review on Defence (CARD). As this report highlights, 20 member states currently operate 45 Offshore Patrol Vessels (OPV) and, more broadly, are expected to invest €17 billion in surface combatants in the short term.

more cost-effective, interoperable, and standardised. Based on these considerations, CARD recommends member states include their national approaches to EU-wide concepts first, with pan-EU cooperative projects to follow. The European Patrol Corvette (EPC) programme fits perfectly within these recommendations. As part of the programmes within the framework of Per-

quently happens joint EU defence sector programmes.

Based on declarations made during the virtual 2020 edition of Euronaval, operational requirements from participants were expected to be defined before the end of 2020, facilitating completion of the first prototypes in 2027. On the same occasion, representatives from Naviris (the Fincantieri and Naval

Image: Fincantieri



EPC design as presented by Italian shipbuilder Fincantieri

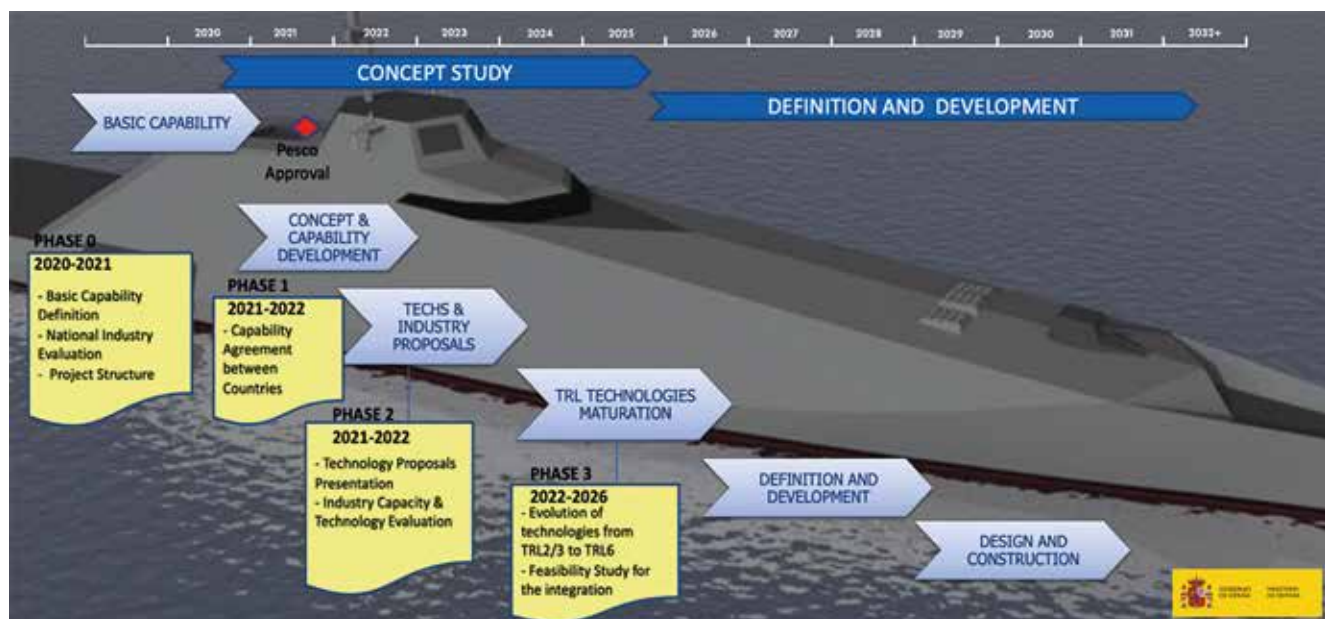
Moreover, purchasing new OPVs is an urgent priority for nine member states and a medium-term need for six of them, with seven already seeking some form of cooperation in one of these programmes. A shared approach would maximise R&D efforts and make maritime patrolling

manent Structured Cooperation (PESCO) approved in November 2019, Italy is coordinating with France, Greece and Spain as participants. As outlined on the official website, all approved projects and collaborations are aimed at designing and developing a prototype for a new class of military ship that allows several systems and payloads to be hosted. The aim is to accomplish a large number of tasks and missions through a modular and flexible approach. However, results could fail to meet expectations, as fre-

Group 50/50 joint venture) and Navantia (the top-ranked partner for the project) speculated about how the EPC might appear. The requirements should have been presented in November as part of the bid for European Defence Fund (EDF) assistance earmarked to cover up to 10% of the total programme costs to help sustain early common activities. However, a bid has yet to be submitted. Companies are expected to bid for additional funding once EDF rules are fully explained.

Author

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EPC milestones according to the Spanish MoD. The timetable appears more relaxed than information from some other sources.

Technical Requirements

Fincantieri and Naval Group had already launched a joint concept study in 2018 for a common corvette aimed at complementing the Italian Pattugliatori Polivalenti d'Altura

(PPA), the French Frégate de Défense et d'Intervention (FTI), formerly known as Frégate de Taille Intermédiaire (FTI), and the FREMM multi-purpose frigates operated by France and Italy. Italy might want eight EPCs to replace its COMANDANTI

and CASSIOPEA class OPVs, while France could buy nine to 11 EPCs. The companies submitted their proposals to Navantia at the end of 2019, as Spain was considering replacing five to six of its DESCUBIERTA class corvettes. Spain subsequently joined



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Configurations thus far presented are mainly derived from existing products, such as the GOWIND class corvettes built by Naval Group.

the EPC programme in April 2020. The Greek Navy will also rely on European cooperation to buy new vessels that are unlike any present in its fleet – possibly replacing some of its fast attack craft.

According to NATO classification, the EPC should be categorised as a “Limited Warship Unit” type with a fully-laden displacement of approximately 3,500 tonnes. The hull would be approximately 110 meters long, with a draft of up to 5.5 metres. Each navy has specific technical requirements for its patrol vessels; however, not all have been made public. Some common features reflect a general trend in corvette design, which is highlighted in the CARD. Nowadays, ensuring surface presence at sea is based on key and highly-interoperable capabilities: long-endurance at sea enabled by high-end unmanned platforms, modularity, and adaptability to different maritime environments.

The capability to carry out long-lasting patrol missions in areas of interest is the most cost-efficient way to ensure constant situational awareness. France and Italy are said to be interested in having a persistent presence in the Eastern Mediterranean. The latest evolutions in Combat Management System (CMS) technology for the Italian, Spanish and French Navies allow them to fulfil this requirement. Consequently, the three countries could prefer to pick an existing system for integration on board their EPCs rather than developing a new one – an option still on the table. However, it is also possible that one or more of the countries might prefer a

national solution, resulting in the selection of three different CMS. Participating countries will face a similar predicament concerning on-board sensors.

As an OPV operates at low speeds over time, choosing the best propulsion solution is another area in which European cooperation might prove effective. EU funds could further boost technological advances in electric propulsion, resulting in EPCs becoming the first defence vehicle to be fully-electric.

The general configuration of the vessel seems to escape cooperation discussions for now. Available images show standardised layouts, mainly derived from existing products.

UAV and USV requirements could be combined with modularity to improve the integration of these systems on the new vessels. A logical choice to maximise cooperation could be to undertake a dedicated study in the wake of the ongoing EU-funded OCEAN 2020 programme that was launched in 2018 to demonstrate enhanced situational awareness by integrating legacy and new technologies. This programme encompasses unmanned systems, ISTAR payloads, and effectors, pulling together technical specialists in the maritime domain covering the “observing, orienting, deciding and acting” of operational tasks. Recent Mediterranean trials demonstrated the need to modify vessel configurations to serve the growing number and variety of unmanned vehicles, in particular requirements with regard to on-board antennas.

Design Details

The concept of a patrol corvette suggests a classic design in line with current trends such as increased OPV size and a focus on defensive main weapons. However, the PPA and FDI programmes demonstrate that today’s designs might soon be obsolete. For example, existing EPC concepts are intended mainly for surface operations. However, the navies interested in these vessels have expressed a desire to provide each ship with ASW capabilities, regardless of size. This will likely transform the EPC’s weapons systems and underwater monitoring capabilities. Taking a prompt decision on providing EPCs with such capabilities is crucial. The FREMM experience has demonstrated that putting modularity at the core of the design phase is central to achieving this flexibility. Even though not been officially confirmed yet, it would also be logical to choose electric propulsion, as this perfectly fits the EPC’s defined missions and integration of unmanned vehicles.

Weapons are not a problem, for the French, Italian and Spanish navies have many available options. In October 2020, the French defence procurement agency designated the Thales-Nexter RAPIDFire close-in weapon system as a reference for future French vessels. This incorporates the new medium calibre 40 mm gun developed by CTAI, the international subsidiary of Nexter Systems and BAE Systems. This choice could be combined

with MBDA MISTRAL 3 missiles in the EPC. Both weapon systems provide excellent flexibility with a combination of short-range, air-to-air and surface-to-surface capabilities. Meanwhile, Spain will probably follow Italy in choosing a solution based on the Leonardo 76mm gun used by both navies, equipped with the DART/STRALES smart ammunition kit. Italy might also specify the MBDA MARTE ER anti-ship missile, while France could offer a solution based on Thales' MARTLET or MBDA's SEA VENOM and/or MMP.

No convergence is expected concerning close-range defence, as France, Italy and Spain each produce turrets of many calibres and shapes. However, participants might agree on integrating the same ASW suite on all vessels, probably from the CAPTAS family (Combined Active Passive Towed Array Sonar). CAPTAS 2 would certainly meet the requirement due to its size and its logistical compatibility with CAPTAS 4, already in service with the French, Italian and Spanish navies.

What Is Ahead?

This year, 2021, will be crucial for the programme, as a decision is expected on the submission for EU funds. Obtaining this support will boost the EPC programme, giving it a first push into the development phase. However, the level of similarity achieved with the final units will provide the real measure of the programme's success. During the Euronaval 2020 virtual edition, representatives of the three main companies working on the programme could not confirm if the different operational requirements expressed by each country would result in different versions. On this basis, the EPC might ultimately mirror what happened with the FREMM programme with a common design achieved in the development phase but the final product turning out to be pan-European only in name. There is also speculation the EPC could be available in three different versions: one optimised for anti-aircraft and anti-surface warfare (ASuW), equipped with self-defence capabilities; another with an oceanic range of 10,000 nautical

miles and optimised for ASuW; and yet another optimised for patrol missions in blue water environments. Again, this is unlikely to drive pan-European commonalities.

To date, it is, however, possible to identify some segments for meaningful European cooperation. Propulsion, modularity and unmanned vehicles are all areas in which participants are particularly open to cooperation, making them ideal candidates for EU funding. More broadly, much will depend on the success of the Naviris joint venture. Fincantieri's takeover of Chantiers de l'Atlantique has been a major driver for collaboration with Naval Group; if it fails then relationships between the two companies could be negatively impacted. This, in turn, would affect the EPC programme given it involves the first vessel planned to be completed under the Naviris joint venture. Collaboration with respect to the CMS would be particularly vulnerable, as Leonardo and Thales could become (again) competitors in this segment, in turn forcing Greece and Spain to make their own combat management system choices. ■

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European Logistic Support Ship Programmes

Conrad Waters

The European naval construction sector is currently experiencing significant demand for new logistic support ships. Previous delays in replacing existing vessels have reached the point where further deferral is no longer an option, particularly given many do not comply with present-day environmental standards.

Most leading European navies either have placed or are planning orders for new replenishment ships. Additional units have been ordered or designed for service abroad. The new ships represent a generational change over the 'legacy' vessels they are intended to supersede.

Market Background

The availability of logistic support – particularly replenishment at sea – is a prerequisite for the effective performance of oceanic naval operations. In spite of this truth, procurement of new support vessels was a low priority for European navies in the immediate post-Cold War era. Many fleets experienced substantial reductions both in size and in resources. Remaining funding was typically focused towards the replacement of frontline warships.

This situation is now changing. The previous deferrals of logistic support ship replacement have meant that the age of existing vessels has crept steadily upwards. Many ships have now been in service for 40 years or more, meaning that further life extensions are no longer an economic prospect. Equally as

importantly, more stringent environmental regulations in the commercial sector – notably the phasing out of single-hulled tankers – have left many naval auxiliaries out of line with the new requirements. It has generally been possible for navies to seek exemption from the new rules but this produces significant practical and moral hazards. For example, a single-hulled naval tanker might not be allowed access to a foreign port. Equally, the political ramifications of any accidental oil spill it might be responsible for would be significant.

The result is that procurement of new logistic support shipping now forms an important part of naval construction programmes across Europe. A variety of projects are at various stages of implementation. This activity has also attracted the interest of overseas fleets in a broadly similar position, driving additional export sales. This article looks at the major programmes currently underway.

United Kingdom

The United Kingdom has the largest and the most advanced plans for new logistic sup-

port shipping. These are driven largely by the need to sustain operations by the QUEEN ELIZABETH class aircraft carriers. Plans have evolved since they were first devised around the turn of the millennium and are currently based on the operation of new classes of fleet tankers and fleet solid support ships. This division between bulk (i.e. liquid) non-bulk (food, ammunition and general stores) support shipping is unusual in Europe but has similarities with US Navy practice. As for all British seagoing replenishment vessels, the new ships are allocated to Royal Fleet Auxiliary (RFA) service.

The overall programme for the renewal of British replenishment and floating logistical support shipping was initially known as the Military Afloat Reach and Sustainability (MARS) project. By 2007, it had been decided to proceed with the tanker element of this programme as a discrete competition. However, it was only in 2012 that a contract was awarded. This saw South Korea's Daewoo Shipbuilding & Marine Engineering (DSME) win out over competing bids from rival Korean builder Hyundai Heavy Industries and Italy's Fincantieri to build four so-called MARS fleet tankers.



British logistic support ship requirements have been heavily influenced by the need to support the new QUEEN ELIZABETH class aircraft carriers. This is the lead TIDE class fleet tanker TIDESPRING conducting a replenishment at sea exercise with QUEEN ELIZABETH.

Photo: Crown Copyright 2018



Photo: Theodor Obrestad Schei/Norwegian Armed Forces

The Norwegian logistic support vessel MAUD is derived from the same BMT AEGIR design family as the British TIDE class fleet tankers but is intended to undertake a wider variety of roles.

A key element of DSME's bid was the use of a design from British consultancy BMT Defence Services as the basis for the new ships. BMT had developed a series of support vessel concepts under the generic AEGIR brand. All used features contained in the Norwegian Skipskonsulent's Baltic type product tankers. The thinking was that the pause in orders for support ships after the Cold War had resulted in naval design practices for such vessels falling behind developments in the commercial shipping market. The evolution of a mercantile design into a ship for military use was therefore seen as providing significant competitive advantages. The DSME proposal was

class carriers. A noteworthy feature of the ships is their hybrid combined diesel-electric or diesel propulsion arrangement. This includes the use of hybrid machines that can either be used as electrical motors for economical, low speed operation or as generators to supplement overall electrical capacity as required. The design requirement was based on achieving a sustained speed of 15 knots in adverse weather and good endurance. A top speed approaching 20 knots was achieved on trials.

Work on the lead ship, TIDESPRING, started in 2014. She commenced sea trials in early 2016 but a number of snags meant that it was nearly a year before her acceptance. On subsequent arrival in the United Kingdom, she

With the fleet tanker project now satisfactorily concluded, attention has turned to acquisition of the fleet solid support ships. As their name implies, these are intended to deliver non-liquid cargo. Up to three ships are planned. Tender documents suggest they will be required to carry up to 7,000m³ of stores at sustained speeds of up to 18 knots and to be able to transfer single loads of up to five tonnes whilst on the move. A shortlisting process concluded in November 2018 saw a British 'Team UK' consortium competing with DSME, Fincantieri, Japan Marine United Corporation and Navantia for a contract said to be valued at £1Bn (US\$1.4Bn). However, the competition was halted a year later after a number of potential bidders had dropped out on the basis that none of the proposals were able to meet the budget. A new tender is expected to be launched in the course of 2021. The new process will

require the successful manufacturing team to be headed by a UK-based company following heavy criticism of the possibility of another contract being allocated overseas. This has already been seen Navantia team with BMT and Northern Ireland shipyard Harland & Wolff (part of InfraStrata

plc) in the hope of keeping its place in the competition alive.

In the meantime, the AEGIR concept has also been adopted by another European country in the form of the Royal Norwegian Navy's logistic support vessel MAUD. An evolution of the AEGIR 18/18R design, she was also ordered from DSME under a US\$140M contract announced in mid-2013. In contrast to the single-role focused TIDEs, the 27,500 tonne vessel is designed as a flexible, multi-role ship. She can supply liquid and solid consumables and also perform alternative support roles such as medical and humanitarian assistance, sea basing



Image: OCCAR

The Franco-Italian replacement logistic support ship programmes are being carried out under the auspices of the OCCAR defence procurement agency. This graphic is an early representation of the Italian VULCANO. Some of her armament will be subject to 'fitted for but not with' arrangements.

derived from the 26,000-ton deadweight AEGIR 26 concept but adapted to achieve higher levels of survivability.

The resulting ships have a full load displacement of 39,000 tonnes. They can ship 20,300 tonnes of liquid stores as well as a limited amount of solid cargo in eight TEU containers. Three replenishment at sea (RAS) stations are provided as well as a stern reel. Facilities for a single medium-sized helicopter also permit vertical replenishment. The layout of the RAS stations was driven by the corresponding arrangement in the QUEEN ELIZABETH

was docked for 'customisation', including the fitting of sensitive communications and other military equipment, finally entering service with the RFA in November 2017. The remaining TIDE class ships followed at roughly regular intervals. TIDEFORCE completed the programme when she became operational in July 2019. Although the construction programme took longer to implement than originally anticipated, the total cost for all four ships of £550M (US\$720M) was below budget and significantly cheaper than could have been achieved by a European-based build strategy.



Photo: Navantia

Navantia has steadily evolved its logistic support ship designs. This image shows (from left to right) the double-hulled CANTABRIA, the earlier single-hulled PATIÑO and the Australian SUPPLY and STALWART, which are slightly modified from the CANTABRIA design.

and the provision of repair and maintenance facilities. A major feature is the incorporation of reconfigurable accommodation spaces. These can, for example, be adapted to expand the core medical facility to a large, 48-bed hospital. Delivered in November 2018, she was formally christened in May 2019 after arriving in Norway in March of that year.

Italy and France

Italy and France share similar at-sea replenishment requirements to the British Royal Navy in as far as they are Europe's other

major aircraft carrier operators. However, they have taken a different approach to renewing their logistic support vessel fleets, opting to acquire auxiliary replenishment oiler (AOR) type ships combining liquid and solid stores capabilities. The resultant ships are more flexible than their British equivalents at the expense of lower overall stowage capabilities and a somewhat higher procurement cost.

What is now essentially a joint Franco-Italian replenishment ship programme traces its origins to the approval of a new Italian logistic support ship under the wider

programme of fleet renewal put forward in the 2014 Naval Law. The acquisition is being managed under the auspices of the European collaborative armaments procurement agency OCCAR. It ordered the ship from a Fincantieri-led consortium in May 2015. Named VULCANO, the new support vessel has been fabricated in two sections at Fincantieri's yards at Castellammare di Stabia near Naples and Mugliano near Genoa. Final integration has taken place at Riva Trigoso in the Gulf of La Spezia. Delivery was initially scheduled in 2019. However, a serious fire during outfitting in July 2018 pushed back the start of sea trials until December 2019. Although the current COVID-19 pandemic has inflicted further delay, it seems likely the Italian Navy will still take possession of the ship shortly.

Displacing a little over 27,000 tonnes at full load, VULCANO is designed in full compliance with the latest international maritime standards. She is able to stow up to 15,500 tonnes of cargo. This includes over 11,500 tonnes of fuel and potable water as well as ammunition, solid stores and eight TEU containers. She has two RAS stations to both port and starboard, two abeam-handling cranes and an additional refuelling position at her stern. In similar fashion to most other logistic support ships, a combined diesel-electric and diesel (CODLAD) propulsion system is optimised for endurance. However, the twin shaft arrangement produces a respectable maximum speed of around 20 knots.

In common with other recent multi-role support ship designs, VULCANO is able to perform limited repair and maintenance work for other vessels. She is equipped with medical facilities that extend to accommodation sufficient for 13 patients. A relatively sophisticated Leonardo-supplied combat management system is scaled down from that used in the PPA type multi-role patrol vessels. This provides tactical level command and control against a wide range of threats. A panoramic bridge arrangement providing 360° views also assists situational awareness. Although the suite of sensors and defensive systems is seemingly largely configured to handle lower threat scenarios, capacity can be expanded by provision for much 'fitted for but not with' equipment. In any event, it seems unlikely that the ship would operate in higher threat areas without considerable escort. VULCANO also has hangar space for two medium-sized helicopters.

Replacements for Italy's two other existing logistic support ships are envisaged in the Italian Navy's latest strategic plan. It therefore seems likely that further members of



Photo: Bundeswehr

The German Navy operates three sophisticated Type 702 BERLIN class combat support ships that make significant use of containerised equipment for operational flexibility. The Royal Canadian Navy has ordered two modified versions of the class.

Integrated Multi-Level Communication Solution – TactiCall ICS

Multinational force operations are increasing, and with them the complexity of the chain of command. Sometimes it is a matter of optimising internal procedures in the area of communication in such a way that external as well as internal and red as well as black networks can be integrated into an easy-to-use and technically secure communication platform. This supports vessels in their complex management tasks. Missions today require efficient coordination and cooperation between the individual actors, a wide range of communication channels and the interaction of different classification levels.

The fully software-based TactiCall ICS is an integrated communication solution inter-connecting all communication technologies regardless of radio band, frequencies or hardware. It gives a fast access and control of all internal and external communications from a single user interface. An intuitive user interface provides access to a variety of communication channels at different classification levels, increasing operators' efficiency in managing operational duties. Designed to be a COTS/MOTS-based building block system, it is possible to tailor content to match the communication needs of every vessel type – from small boat operations to frigates and logistic vessels, submarines or even larger vessel such as destroyers.

Fully Software-Based

The TactiCall ICS is fully software-based and is designed to provide seamless voice and data communications, incorporating all the latest technologies. Modular and scalable system approach ensures seamless integration to 3rd party and legacy systems allowing for a tailored solution to meet specific operational and technical requirements as well as protecting prior investments.

Certified for Multi-Level Security

The TactiCall ICS offers certified multi-level secure communication for up to

NATO Secret level, is based on COTS/MOTS hardware and certified for multi-level security EAL5+. The TactiCall ICS facilitates the chain of command, by giving naval teams access to a variety of communication channels of different security levels from the same user terminal. With TactiCall users can listen to a mix of both secure and unclassified communications and simultaneously be able to talk either secure or unclassified. This communication setup can even be expanded to handle multiple security domains with a mix of unclassified, restricted, NATO secret and national secret communication channels, all accessed from the same communication device.

Centralised Management System

The TactiCall Management system is a modular user and roles-based interface allowing users to easily maintain and control all communication equipment. Furthermore, the TactiCall Management system provides Emission Control Management, in order to invoke different silence levels, and provides optional frequency and antenna management as well as military SATCOM. The TactiCall Management system provides communication plans with the overview of the equipment included in each chain. It also provides an overall overview status for the communication and allows an operator



Photo: Saab

to test the setup prior to use, thus ensuring an effective mission configuration.

Operational on More than 40 Classes of Ships

To date, more than 40 classes of ships worldwide are equipped with TactiCall ICS. In September 2020, the French Naval Group and Kership, part of Naval Group, also selected Saab's TactiCall as part of the Belgian-Dutch MCMV programme. The partnership between Saab and Kership underlines the comprehensive cooperation with the French naval industry, and will strengthen Saab's TactiCall position for the French's MCM programme called SLAM-F. Furthermore the Bulgarian Navy's new MMPV multi-purpose patrol vessels will be equipped with Saab's communication system in the future. Finland also decided to install TactiCall ICS on a total of four new corvettes in the context of the Squadron 2020 programme.

Close Collaboration with Customers

Close collaboration with customers supports a spiral development process, in the scope of which the system is improved through small and continuous evolutionary steps to meet the equally evolving needs and requirement of customers. The navies need to conduct an increased variety of missions – using multi-role ships. But at the same time, the number of crew members are actually reduced in some navies. This emphasises the importance of a system that can be integrated and operated in a wide range of vessels, with positive implications for the training of the relevant staff and also for costs.

Read more: saab.com/tactical



Photo: Saab

the class will be ordered for Italian service in due course. However, in the meantime the basic design has also been selected to meet France's requirement for four new vessels to replace its existing, elderly DURANCE class vessels. This programme was originally intended to be a purely national project under the leadership of local champion Naval Group. However, France decided to adopt the Italian design following Fincantieri's acquisition of control of the Saint Nazaire-based Chantiers de l'Atlantique yard and in the context of growing Franco-Italian naval collaboration.

A €1.7BN (US\$2BN) order for four ships was placed with a consortium of Chantiers de l'Atlantique and Naval Group through OCCAR in January 2019. Naval Group's responsibilities are for the provision of combat management and other systems. Construction work will be split between Castellammare di Stabia and Saint Nazaire. Final assembly will be at the latter site. Limited technical details published to date suggest the French ships will be broadly similar to their Italian sister. Important differences include specification of the Naval Group POLARIS combat management system and an alternative armament arrangement. Work on the first unit – JACQUES CHEVALLIER – commenced in May 2020 to meet a planned late 2022 delivery date. Three sister ships will follow by 2029.

Spain

Spain is the other European country whose logistic support ship capabilities are influenced by the need to carry significant volumes of liquid consumables

to support fixed-wing aviation operations. However, with current requirements met by the existing PATIÑO and CANTABRIA, there is no immediate need for further support vessel construction. The two ships have essentially followed an evolutionary path. The single-hulled, 1990s-era PATIÑO – acquired under a joint project with the Netherlands – was subsequently developed into the double-hulled CANTABRIA, which was launched in 2010. Although the latter vessel is somewhat heavier than her predecessor, the penalties inherent in environmental compliance are reflected in a reportedly lower liquid cargo capacity.

CANTABRIA also has somewhat lower overall capacity than the more recent Franco-Italian logistic supply ship class. She is otherwise similarly versatile. However, the evolutionary approach adopted in her design is reflected in characteristics – such as direct drive diesel propulsion and a single shaft – that have fallen out of favour in recent ships. Nevertheless, a modified variant of the vessel was selected over the arguably more modern AEGIR concept to gain a US\$470M contract for two Australian AORs in May 2016. Both ships have been built at Ferrol in northwest Spain. Lead ship SUPPLY commenced sea trials in August 2020 and subsequently arrived in Australia in October for final outfitting and testing. With sister STALWART also close to physical completion, fears of a gap in production at Ferrol pending commencement of work on the new F-110 class frigates has led to calls for a second CANTABRIA to be ordered for Spanish service. This seems unlikely in the current budgetary environment.

Germany

The German Navy's expanding international presence means that it has experienced growing logistical support demands in the post-Cold War era. These have been met by the three multirole Type 702 BERLIN class combat support ships, which were delivered between 2001 and 2013. Sophisticated and correspondingly expensive vessels, they benefit from significant operational flexibility through use of a large modularised container capacity. Further production for German service is unlikely. However, the design has been sold to Canada to meet a requirement for the licensed construction of two joint support ships. After considerable delay, a ceremonial keel-laying ceremony for the lead vessel – PROTECTOR – was held at Seaspan Shipyards in Vancouver in January 2020. Estimated programme costs for the two ships are a massive CAD\$4.1Bn (US\$3BN). This partly reflects the expense of rebuilding skills in the previously neglected Canadian shipbuilding sector.

Meanwhile, Germany launched a new programme to replace its two existing Type 704 RÖHN class replenishment oilers in mid-2019. In common with other current projects, the new Type 707 fleet tankers will be of double-hulled construction (see: Periscope). In similar fashion to the British TIDES, they will be focused on liquid stores replenishment. Preliminary design requirements suggest a large fluid stowage capacity of 15,000 tonnes as well as the ability to handle 20 TEU containers. Core complement will be limited to the 42 crew members of the existing ships but maximum speed will increase

European Logistic Support Ship Programmes

Specimen Logistic Support Ship Data

Class	TIDESPRIING	MAUD	VULCANO	CANTABRIA	BERLIN	DEN HELDER
Country (Design)	UK	UK	Italy	Spain	Germany	Netherlands
Country (Navy)	UK	Norway	Italy/France	Spain/Australia	Germany/Canada	Netherlands
Number	4	1	1/4	1/2	3/2	1
First Commissioned	2017	2019	[2021]	2010	2001	[2024]
Role: [1]	AO	LSS	AOR	AOR	AOR	AOR
Full Load Displacement	39,000 tonnes	27,500 tonnes	27,200 tonnes	19,500 tonnes	21,000 tonnes	20,000+ tonnes
Dimensions	201m x 29m x 10m	183m x 26m x 9m	193m x 24m x 8m	174m x 23m x 8m	174m x 24m x 7m	Not known
Propulsion	Hybrid CODLOD	Hybrid CODLOD	CODLAD	Diesel	Diesel	IEP
Speed	15 knots sustained	18 knots sustained	c. 20 knots	c. 21 knots	c. 20 knots	Not known
Endurance	8,000+ nautical miles	10,000 nautical miles	7,000 nautical miles	6,000 nautical miles	Not known	Not known

Notes : 1. AO = auxiliary oiler (liquid fuel supply); AOR = auxiliary replenishment oiler (liquid fuel & solid stores supply); LSS = logistic support ship with full multi-mission performance.

from 16 to 20 knots. Although a contract has yet to be awarded, it is anticipated that both new vessels will be delivered/enter into service before the end of 2024.

The Netherlands

The Royal Netherlands Navy took something of an idiosyncratic approach to logistic support ship procurement during the Cold War era, taking the delivery of the joint support ship KAREL DOORMAN in

Only sketchy details of the new ship have been released to date. However, it appears that DEN HELDER will be a relatively large, almost 200 metre-long vessel with a displacement in excess of 20,000 tonnes. Stowage capacity is likely to be similar to that provided by KAREL DOORMAN. It will include the ability to carry 20 containers. There will be two abeam RAS positions and the ability to operate several helicopters. Much defensive equipment will be subject to 'fitted for

ship will be powered by a combined diesel and gas turbine arrangement. GE is providing two of its ubiquitous LM-2500 gas turbines for the ship. The choice is an unusual one, suggesting a desire for speed found only in a handful of high end US Navy and Chinese combat support ships. Turkish industry is also active in the international technology transfer market for logistic support shipping, providing licensed designs for construction in both India and Pakistan.



Graphic: Damen

A graphic of the new Dutch combat support ship DEN HELDER, which is scheduled for delivery in 2024.

2014. She originated from the Naval Study of 2005, which reoriented the fleet towards lower intensity stabilisation missions. The ship combines replenishment, logistical transportation and sea-basing capabilities in a large, 28,000-tonne hull. With the addition of significant surveillance capacity provided by a Thales integrated mast, she is undoubtedly a capable and flexible ship. The major downside of the concept is the higher cost – both capital and operational – of performing any one of the roles she is equipped to undertake.

The Netherlands appear to have taken note of this drawback in the new combat support ship DEN HELDER. This vessel was contracted with Damen early in 2020 and is effectively a replacement for the single-hulled AMSTERDAM – a sister of the Spanish PATIÑO – that was sold to Peru in 2014. She is a more traditional AOR type design focused on the underway replenishment of fuel, water, ammunition and other solid cargo. Following a similar approach to that adopted for the construction of other recent large Dutch naval vessels, the new ship's hull will be built by Damen's Galati yard in Romania. Final outfitting will then take place in the Netherlands prior to delivery in 2024. The total budget for the programme amounts to €375M (US\$450M).

but not with' arrangements due to budgetary constraints. The ship's basic layout owes much to Damen's series of logistic support vessel concepts. However, many of the more detailed design elements – including the selection of an integrated electrical propulsion system – are derived from KAREL DOORMAN.

Other Programmes

Elsewhere in Europe, Portugal's 2019 Military Programming Law makes provision for a new replenishment tanker at an estimated cost of €150M (US\$180M). The vessel will replace the veteran ROVER class tanker BÉRRIO. This was first commissioned into the British RFA as BLUE ROVER in 1970. However, actual commencement of the project is likely to be several years away given the priority allocated to offshore patrol vessel procurement. It is likely construction will be allocated to the domestic West Sea Viana Shipyard at Viana do Castelo once the acquisition is implemented.

At Europe's other extremity, Turkey has its own 'DIMDEĞ' project for an AOR-like combat support ship. This is being implemented by the Sefine Shipyard south-east of Istanbul under a contract awarded in July 2018. The 190 metre, 22,000-tonne

Future Trends

It can be seen from this brief overview that European logistic support ship construction programmes are currently enjoying a healthy level of activity. The supply of both ships and designs to overseas navies is also providing a further boost to the market. With new projects for the United Kingdom and Germany in their early stages and further requirements identified in both Italy and Portugal, it seems likely that the sector will be sustained for some time to come.

Looking further ahead, however, the outlook is somewhat less positive. The high level of current activity has been driven by the lengthy pause in acquisitions after the Cold War. It will inevitably subside to more normal levels once replacement of life expired, non-environmentally compliant vessels has been completed. Moreover, the growing strength of Asian competition – evidenced, for example, by the allocation of TIDE class construction to DSME and Hyundai's recent completion of the AOR AOTEAROA for New Zealand – will inevitably impact future export opportunities. Europe's shipyards and naval architects might therefore be well-advised to make the most of current conditions whilst they still last. ■

FREMM Design: A Success in Modern Naval Development

Luca Peruzzi

The joint French-Italian FREMM (Frégate Européenne Multi-Missions or Frigate Europee Multi-Missione) programme, managed by OCCAR (Organisation Conjointe de Coopération en matière d'Armement) on behalf of the two nations' Ministries of Defence (MoD), remains the most important multi-national initiative to date between European industries in the field of naval defence. The navies of both Italy and France signed the initial programme collaboration agreement in October 2002. Almost two decades later, the design and the technological solutions applied to the programme continue to demonstrate their soundness and still offer potential for growth. This has recently been demonstrated by FREMM's selection as parent design by the US Navy for the Guided Missile Frigate programme, also known as the FFG-62 or CONSTELLATION Class.

OCCAR awarded the development and initial production contract for FREMM to Armaris and Orizzonte Sistemi Navali (OSN) in November 2005. Armaris was the joint venture between DCNS (today Naval Group) and Thales whereas Orizzonte Sistemi Navali was the joint venture between Fincantieri and Finmeccanica (today Leonardo). The selected solution was based on different platform configurations for each service. Common development was limited to specific design and combat system solutions, anti-submarine warfare (ASW) and electronic warfare (EW) suites, and also propulsion. OCCAR successfully managed the development, production and in-service support (ISS) phases. The agency will continue these activities beyond the time schedule initially foreseen for the FREMM programme, potentially managing in-service support for both navies. Moreover, it will also support the Italian MoD's decision to build two new frigates to replace the two units transferred to Egypt in an export deal signed by Fincantieri shipbuilding group in 2020.

Italian FREMM Design and Combat Capabilities

Designed and developed by Italian MoD's Directorate of Naval Armaments (NAV-ARM) together with Orizzonte Sistemi Na-

Photo: Italian Navy



The joint French/Italian OCCAR-managed FREMM programme encompasses the delivery of ten frigates for Italy including four in the Anti-Submarine Warfare (ASW) and six in the General Purpose (GP) or ASuW-oriented configurations. This is the first-of-class CARLO BERGAMINI (GP-configured).

Photo: Italian Navy



The Italian Navy's ASW configured FREMMs, including VIRGINIO FASAN depicted here, are equipped with a comprehensive ASW sonar suite including the Thales Underwater US 4249 low-frequency variable depth sonar and passive towed array, TUS UMS 4110 bow mounted sonar with Leonardo mine-avoidance sonar and underwater telephone, and a panoramic echo sounder.

vali, Italy's FREMM multirole frigate design programme initially foresaw 10 platforms - six for general purpose operations and four in an Anti-Submarine Warfare (ASW) configuration. In 2020, the Italian MoD

decided to replace the two (general purpose) frigates SCHERGAT and BIANCHI, previously planned to be delivered to Italian Navy in 2020 and in 2021 respectively, that had been sold to Egypt. Thus, the

production programme is to be extended by two platforms in an updated configuration.

According to the latest updates by OCCAR, the Italian programme cost amounts to about €5,500M. This includes development, production, combat system configuration updates and initial in-service support, as well as obsolescence care and Engineering Change Proposals (ECP). For in-service support, the agency calculates a requirement of about €100M per year for all the 10 FREMM platforms. The two additional platforms come without additional costs, including changes to mitigate obsolescence issues, as explained later.

Built to RINA MIL specifications, both configurations of Italy's FREMM share a common platform with reduced radar, infrared and acoustic cross signatures. The Italian design differs from its French counterpart in several aspects. It has a higher full load displacement of circa 6,700 tonnes influenced by a longer hull (145 metres) and a more developed superstructure, a CODLAG propulsion system with conventional exhaust (instead of the French hull-mounted type), increased endurance and a higher accommodation capacity (201 instead of 145). With the exception of the French variant's land strike capability offered by MBDA's Missile de Croisière Naval (McCN), it also offers expanded combat and weapons systems capabilities.

The ship's combined diesel-electric and gas (CODLAG) propulsion configuration is based on a single Avio/General Electric 32 MW LM2500+G4 gas turbine cross-connected to the shaft lines through Fincantieri/Renk gearing and two shaft-mounted Jeumont 2.15 MW electric motors for propulsion in the loiter mode. Four 2.1 MW Fincantieri subsidiary Isotta Fraschini VL1716C2 ME common rail gensets provide power for both the main, auxiliary propulsion, and shipboard electrical systems. The Italian FREMMs are equipped with twin shaft lines driving featherable controllable pitch propellers (FCPP).

In service, this configuration has demonstrated enhanced flexibility, redundancy, economy and acoustic stealth, through the provision of three alternative propulsion modes. In electric mode, which is particularly suitable for ASW operations, the ship can reach up to 15.6 knots whilst benefitting from reduced fuel consumption and noise emissions (as the reduction gear is disconnected). Maximum speed of 27 knots can be reached with the gas turbine. In a combination of the gas turbine with the electric motors, high speeds can be maintained in rough seas. Moreover,



Photo: Italian Navy

The FEDERICO MARTINENGO GP-configured FREMM features a stern launch and recovery station for an 11 metre RHIB, which together with the embarked NFH-90 helicopters are key for anti-piracy, special forces and traffic control support.

this mode also provides a degree of margin in the event of displacement increasing due to system modifications at a later stage of a ship's life span.

Autonomy amounts to 6,000 NM at 15 knots. With use of the FCPP, the frigates have demonstrated crash-stop distances well within required distances at top speeds. The forward propulsion and auxiliary compartment hosts a 1 MW azimuthal retractable thruster (ART) to provide emergency propulsion for a speed of up to 7 kn. More generally, the ART is used for platform manoeuvring and positioning at low speed, especially

in restricted waters and during berthing. The BERGAMINI class frigates are the first units of the Italian Navy with a rudder roll stabilisation system. Using larger rudders not only for steering but also simultaneously for roll reduction (removing the need for stabilising fins), the ship has improved manoeuvrability and handling. Both of Fincantieri's configurations adopt an internal layout based on two lateral passageways with technical galleries beneath the weather deck. Twin trunks under the main foremast facilitate vertical movement of crewmembers. Applying the concept of a 'logistic island' permits food storage, gal-



Photo: Italian Navy

The Italian Navy's FREMMs share MBDA Italy's SAAM-ESD air defence missile suite for consort ships and local area defence based on MBDA's ASTER 15/30 missile family, two 8-cell Naval Group SYLVER A50 vertical launchers and C2 module together with Leonardo KRONOS GRAND NAVAL 3D multifunction radar with active phased array antenna (MFRA).

Photo: Italian Navy



The GP-configured FREMMs feature a Leonardo 127/64 mm LW (Light-Weight) main gun with a completely automated magazine and handling system capable to manage both conventional and the VULCANO family of long-range guided ammunitions. The ASW-configured platforms have two 76/62 mm SUPER RAPIDO STRALES guns with DART guided ammunitions to enforce the protection against latest generation anti-ship missile and asymmetric threats.

ley and messing areas to be provided for all the crew on a single deck.

The BERGAMINI class frigates are characterised by a high level of automation. Fincantieri subsidiary Seastema's ship management system (SMS) supports platform control, ship handling and navigation and damage control. With 16,000 independent channels, it monitors almost every system onboard with the exception of the combat system. Two independent and well-spaced ship control centres (SCCs) provide for the management of propulsion, the electrical system and

damage control, the latter assisted by an advanced firefighting system. In addition to its extensive damage control capabilities, the survivability of the Italian FREMM design is ensured by the forward auxiliary propulsion system and a design architecture that permits electric power generation even in case of three adjacent flooded compartments.

Living areas are clustered beneath the aviation facilities and amidships on the lower decks. The accommodation is arranged in single, twin, four and plus-berth cabins each outfitted with internal services, tel-

evision, and computer/email connectivity. The crew is also provided with recreation areas and equipped gym. Beyond the standard crew of 165, additional space permits embarkation of a task group staff, personnel for Special Forces operations as well as other support detachments required for long-duration out-of-area missions – a requirement the Italian Navy has drawn from the EU's counter-piracy operation Atalanta off the Horn of Africa and from deployments to the Gulf of Guinea – to accomplish all requested missions. Finally, accommodation include provision for a helicopter detachment of between 12 (one helicopter embarked) and 23 personnel (two helicopters). Utilising space which is used in the French FREMM for vertical missile launchers (16), the Italian FREMM can provide accommodation for a total of 201/203.

The general purpose frigates differ from their ASW sisters as they feature a stern launch and recovery station for an 11 metre Cabi Cattaneo RHIB for maritime interdiction and special operations. This area is used for housing dedicated anti-submarine material on the ASW platforms.

Two additional RHIBs are housed in lateral launch and recovery stations. While the ASW-type uses two 7 metre RHIBs, the general purpose-type has one 11 metre and one 7 metre RHIB. The flight deck is equipped with a Curtiss-Wright/Calzoni TC-ASSIST helicopter securing and traverse system. The hangar design (double but separated) offers the possibility of accommodating and operating two helicopters. These can be either one Leonardo AW-101 and one NH Industries NFH90 ASuW/ASW helicopter or two of the latter. It is worth noting that both AW-101 and NFH-90 are available in both ASuW/ASW and amphibious configurations.

Combat System

The combat system is centred on the federated ATHENA-family 3rd generation CMS provided by Leonardo, an evolution of the systems in use onboard the carrier CAVOUR and the Horizon class destroyers. The CMS features 17 (plus two as back up) colour triple-screen, multi-function consoles. It interacts with the Italian Navy's Maritime Command and Control Information System (MCCIS) and manages all combat sub-systems. The Leonardo external/internal communications suite includes HF, VHF military/civil, UHF and SICRAL (SHF/UHF), NATO and INMARSAT SATCOMs, in addition to the Multi-Data Link Processor (MDLP) with data Link 11, 16 and 22, JSAT together

Photo: NATO/FRAN S Dzioba



The Italian Navy's FREMM combat system is based on the federated ATHENA 3rd generation CMS provided by Leonardo together with most sensors, communication suite, decoy launchers and gun weapons.



Photo: Italian Navy

The Italian Navy's FREMMs are playing a key role in out-of-area or task group operations thanks to their ability to accommodate up to circa 200 personnel and the dedicated space and C2 equipment for the embarkation of a command task group staff.

with an IP message handling system and Tetra wireless radios.

Both configurations share the MBDA Italy SAAM-ESD (Extended Self-Defence) air defence missile suite based on two eight-cell Naval Group SYLVER A50 vertical launcher modules, MBDA ASTER 15/30 missiles and a C2 module together with Leonardo KRONOS GRAND NAVAL 3D multifunction radar with active phased array antenna (MFRA). The air surveillance radar is complemented by a phased array IFF-system SIR-M5 PA.

For surface-air search, tracking and weapon employment, Leonardo's SASS 360° bi-spectral IRST, RAN30X/I RASS, and two NA-25 gun fire-control systems are used. The radar navigation suite also includes Leonardo LPI (Low Probability of Intercept) for navigation and GEM Elettronica helicopter control radars.

The SIGEN (Elettronica/Thales) consortium integrates a Radar Electronic Support Measures (RESM) with a Radar Electronic Countermeasures (RECM) suite supplied

by a Thales ALTESSE CESM system (also installed on French frigates) and Leonardo SCLAR-H decoy launchers (for the first six vessels) and an Oto Launching Decoy System 20 (OLDS 20) for the remaining four.

A Leonardo 127/64 mm LW (LightWeight) main gun with a completely automated magazine and handling system capable of managing both conventional and the VULCANO family of long-range guided munitions is unique to the general pur-



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Photo: NATO/CPO FRAN Christian Valverde

Together with the French ASW FREMMs, the Italian platform-configured counterparts are equipped with a comprehensive anti-submarine suite (sonar plus helicopters).

pose configuration. This is supplemented by a 76/62 mm SUPER RAPIDO STRALES ILDS (inner layer defence system) with DART guided ammunitions, further expanding protection against the latest generation anti-ship missile and asymmetric threats. There are also two manually-operated 25 mm guns.

Long range anti-surface capability is provided by eight MBDA TESEO Mk2/A missile launchers (and in the future the TESEO Mk2/E). Both types offer storage and handling facilities for airborne weapon systems, MBDA MARTE Mk2/S missiles and MU90 torpedoes deployed from the NFH90 helicopter.

The ASW configured frigates differ from the GP platforms in embarking two Leonardo 76/62 mm STRALES ILDS (one replacing the 127/64 gun) and a comprehensive ASW suite. In addition to a Thales Underwater Systems UMS 4110 bow mounted sonar, a Leonardo mine-avoidance sonar and an underwater telephone common with the GP configured platforms, the ASW frigates feature a TUS 4249 low-frequency variable depth sonar with a passive towed array sonar/anti-torpedo suite, and a panoramic echo sounder.

In addition to the two triple MU-90 torpedo launchers common with GP frigates, the ASW version features two ASW DLS (Decoy Launching System) anti-torpedo decoy launchers and four MBDA MILAS ASW weapon systems (reducing the TESEO Mk2/A missile capability to four). The ASW suite will be further developed through incremental integration of the NFH90 helicopter mission package.

Obsolescence Management and Future Capabilities

Launched by the Naval Armaments Directorate and derived from technological developments funded through the "Legge Navale" programme for the new generation of service platforms, a roadmap to address obsolescence has been established. Beginning with the seventh frigate (FEDERICO MARTINENGO), Leonardo's full solid-state 2D SPS-732 air-and-surface surveillance radar was replaced by the RAN30X/I RASS. A new generation SIRM-CA IFF interrogator system with conformal array (instead of phased arrays) compliant with STANAG 4193 Edition 3 was also implemented. Furthermore, damage control display was digitalised from ninth frigate (SPARTACO SCHERGAT), while The SCLAR-H and SLAT launchers were replaced by Leonardo's latest generation decoy launching system OLDS 20 capable of launching both anti-air warfare and anti-torpedo decoys, to be retrofitted to previous two platforms.

Both Italian Navy frigate configurations have also acted as testbeds for the development of two capabilities key to present and future maritime operations. First, to support the development of Ballistic Missile Defence (BMD) capabilities with de-risking activities and under the supervision of the Italian MoD's Directorate of National Armaments with support from Leonardo, the Italian Navy participated in two US Navy-led Integrated Air and Missile Defence (IAMD) multinational exercises with a FREMM frigate (LUIGI RIZZO and

CARLO BERGAMINI) in 2017 and 2019. Through upgraded processing and a specific software release, the MFRA radar was modified to both detect (autonomously or through external designation) and to track ballistic missiles. The CMS could not only manage these tracks but also integrate them into the Link 16 Joint Range Extension Applications Protocol JREAP network with other assets and ashore stations. During the 2019 edition, BERGAMINI's MFRA radar demonstrated its ability to detect and track ballistic missile surrogate targets in a mixed scenario of conventional supersonic and ballistic threats and share the data with other participating nations via a NATO-classified network. By acting as an early-warning system and supporting the engagement and neutralisation of ballistic missiles, the MFR can therefore contribute to the international defence system.

In November 2019, two Italian Navy FREMMs participated in the international OCEAN 2020 maritime demonstration, led by Leonardo on behalf of European Defence Agency. Its main objective was to integrate unmanned systems into fleet operations. This required not only temporary modifications and enhancements to both units, but also electromagnetic compatibility studies and testing after the installation of the respective systems. Leonardo AWHero rotary-wing unmanned system conducted operations from the frigate VIRGINIO FASAN's flight deck, sending footage and real time data to the vessel. She transferred the information through her CMS to the demonstration station in Brussels. In another scenario FEDERICO MARTINENGO received information and controlled Leonardo SW-4 SOLO rotary-wing unmanned system which operated from ashore. The lessons learned will allow the Italian Navy to speed up future integration of unmanned systems, once procurement funding becomes available.

Cooperation

Representing the backbone of the Italian Navy fleet, the FREMM component has demonstrated its capabilities in almost all national and international operations in and out of the Mediterranean Sea, with the longest missions taking ships to the Indian, Pacific and Atlantic Oceans. To ensure platforms' availability after the initial in-service support package concluded, a Through Life Sustainment Management (TLSM) contract has been operating since July 2019 and it is expected to be renewed annually until June 2024. There is a possibility of extending it for the following

years (until 2034), due to the excellent results achieved from the collaboration with OSN, as stated by OCCAR. The contract is not limited to a simple service of repair and checks to the ships, but is structured to guarantee the coordination of maintenance periods, the development of an informatics tool for all aspects concerning configuration management, analysis of failures and costs, the studies for the updates necessary to 'contain' the impacts of obsolescence and the supply of the stocks. In this sense the contract can be considered as really innovational for the Italian ships, the agency added.

Due to commonality with the French Navy in terms of various systems installed on board both the FREMM Class Units and the Orizzonte Class destroyers, the Italian Navy Logistics Command and their French equivalent are preparing a study for an In-Service Support requirement for the ships' common equipment. Exploiting the existing cooperation between Italy and France, which is already in place for the FREMM programme, OCCAR could potentially manage the possible contract for common In-Service Support.

Export Design and Industrial Success

With the sale of the last two units of the FREMM programme to Egypt, the Italian MoD requested and obtained proposals from industry for their replacement with two new platforms and a sustainment in-service package for the remaining MAESTRALE class frigates until the delivery of the new built platforms.

The Italian Government has given the mandate to OCCAR to proceed with contract modifications to replace the last two frigates (general purpose number 5 and general purpose number 6) by 2 new platforms (general purpose number 7 and general purpose number 8). As OCCAR revealed to MSD, the new ships are scheduled to be delivered by end 2025 without additional costs whilst including changes to mitigate obsolescence impacts and maintain a minimum operational lifespan of 25 years.

A process for a design review has started in early 2021 in order to solve the obsolescence of both platform and combat systems and define the new ships' configuration. The "first steel cutting" of the follow-on-ship, GP 7, is foreseen in February 2021. This is to be followed in June by the Critical Design Review (CDR) in order to evaluate the most important changes, OCCAR added. The main items of equipment subject to upgrades are the ship management and platform systems, the diesel generators and electrical power system, and the combat systems. The latter will encompass the Surface-Air-Missile Extended

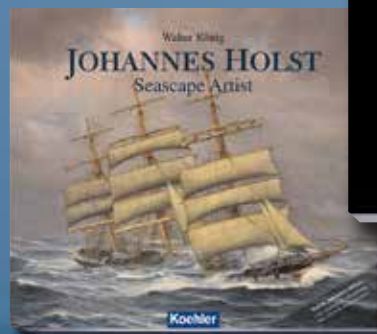
Self Defence missile system and the communication suite. OCCAR has not released further details as the design review is in process. To maintain communality and take advantage of the technical developments funded by the 'Legge Navale' programme that gave birth to the new generation platform, combat and weapon systems equipping the Italian Navy's PPA, LHD and LSS classes, the new FREMMs are also expected to benefit from these available technologies.

According to current plans, GP7 is foreseen to be delivered in February 2025 to be followed by the GP8 in August 2025. ■

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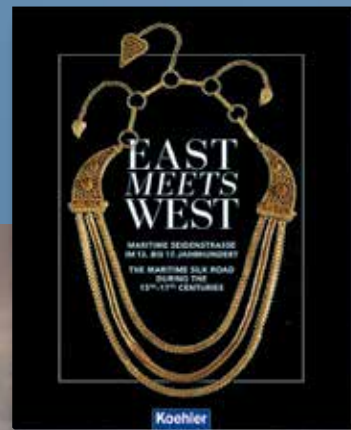
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See but Remain Unseen: the Role of Naval Electro-Optics

Doug Richardson

Electro-optical and infrared (EO/IR) systems can fulfil several main roles aboard a warship.

Optronic systems can provide surveillance, warn of incoming anti-ship missiles, acquire and track targets, handle the fire-control functions for individual weapons, and serve as navigation aids. They can be used either on their own, or as part of an integrated solution that combines them with radar and other sensors. In many cases, an EO/IR system may be used for a combination of roles, for example serving as part of the vessel's fire-control system, but also providing surveillance coverage.

While they lack the all-weather performance available from radar, EO/IR systems are passive, giving the target no warning that it is under surveillance. But it is important to note that the maritime environment can degrade their performance. Rain, fog, and haze can all have undesirable effects.

Performance Increases

Increases in performance along with reductions in weight, size, and power consumption allow modern EO/IR systems to provide all-weather situational awareness for vessels ranging from aircraft carriers to small surface craft. The simplest method of providing all-round EO/IR coverage is to rotate the sensor. This is the solution used for HGH Infrared Systems' SPYNEL-C panoramic infrared surveillance system. Originally known as VIGISCAN, this was installed on five LA FAYETTE class frigates to meet an urgent operational requirement (UOR) to equip these vessels for the anti-piracy and maritime security roles. SPYNEL-C uses a cooled LWIR mercury cadmium telluride linear detector, which is rotated at 60 rpm to provide real-time 360 degree surveillance. Imagery is displayed in low-resolution, but areas of interest within the

Photo: Lukasz Golowanow



Rafael's TOPLITE EO turret can be fitted with up to four sensors.

image can be displayed instantaneously in full resolution.

When a similar UOR was drawn up two years later to cover the D'ESTIENNE D'ORVES class light frigates and the DURANCE class under-way replenishment tankers/command ships, the French Navy procured nine Chess Dynamics SEA COBRA EO/IR surveillance and tracking systems. Subsequently rebranded as the SEA EAGLE EOSS, this uses a sensor head that combines a Selex GALILEO HAWK 640x480 pixel 3 to 5 micron mid-wave infrared (MWIR) thermal imager with continuous zoom, a PIRANHA 36 colour CCD (Charge-Coupled Device) TV camera with an x36 zoom lens, a Cassidian Optronics LP17D eye-safe laser rangefinder and an HPLT V.7 laser designator.

At the 2018 Euronaval Exhibition in Paris Chess Dynamics promoted the most recent members of its SEA EAGLE family of fire-control systems. SEA EAGLE FCRO combines the company's stabilised long-range EO tracking and ballistics system with a marinised Weibel doppler radar capable of tracking targets at ranges greater than 35 km in all weather conditions, day or night, while the SEA EAGLE FCEO-MK4 Electro-Optical Fire Control Director Stabilised System combines thermal and TV sensors with a laser rangefinder.

VAMPIR-MB (Modular Bispectral) from Sagem (now Safran Electronics & Defence) was adopted for the French Navy's aircraft carrier CHARLES DE GAULLE, and for some of its air-defence and anti-submarine frig-

Author

Following an earlier career in engineering, **Doug Richardson** is a defence journalist specialising in topics such as aircraft, missiles, and military electronics.

ates, while Italy uses it on its HORIZON class destroyers, and South Korea has it on its KDX-III AEGIS destroyers and LPX class amphibious assault ships (LHD). Australia selected the follow-on VAMPIR-NG (Veille Air-Mer Panoramique InfraRouge - Nouvelle Generation) infrared search and track (IRST) system for its ANZAC class frigates, LHDs, and HOBART class destroyers. Designed to meet the needs of ocean and littoral operations, VAMPIR-NG uses third-generation MWIR thermal imaging technology to provide high-definition long-range and panoramic coverage. It is designed to automatically detect and track threats such as incoming anti-ship missiles.

EO systems can also play a role in coastal surveillance. For example, the Controp Precision Technologies TORNADO-ER panoramic infrared scanning system uses two cooled MWIR thermal imaging channels fitted with 100 mm and 400 mm focal length lenses respectively to automatically detect targets ranging from large vessels to small floating objects or even swimmers at ranges of 400 m to 12 km.

EO/IR Fixed Arrays

In the same way that advanced naval radars are using fixed-array antennas rather than the more traditional rotating array, EO/IR systems are starting to use multiple fixed arrays. Thales' GATEKEEPER EO/IR surveillance and alerter system uses an array of four fixed sensor heads - each houses uncooled long-wave infrared (LWIR) thermal imagers operating in the 8-12 micron region of the spectrum, and high-definition (HD) colour TV cameras. The latter can be used in daylight to help identify and classify targets detected by the LWIR sensors. Since each sensor head covers 120 degrees in azimuth, they provide a useful degree of overlap. The system's video processing unit uses advanced algorithms to provide automatic detection and tracking of targets. GATEKEEPER is teamed with the SEASTAR active phased-array radar in the integrated mast, which first entered service on the upgraded Dutch KAREL DOORMAN class frigate, VAN SPEIJK.

As part of its recently-completed refit programme, the French aircraft carrier CHARLES DE GAULLE has been equipped with the Thales Optronique ARTEMIS (Advanced Reliable Third-generation Electro-optical Multiplexing Infrared Search-and-track) system. Already operational on board FREMM multi-mission frigates in service with the French, Moroccan and Egyptian navies, this uses an array of three fixed MWIR sensors to perform surface surveillance out to the horizon during the day and night. These

sensors incorporate electronic image stabilisation, and provide 360 degree panoramic surveillance of the surface and any nearby coast line. Being fixed, they have data refresh rates 10 times higher than those of a scanning IRST system, so can detect and classify a broad array of airborne, maritime and land-based threats faster than was possible with earlier-generation sensors.

Thales is currently working with DRT Technologies to develop an ARTEMIS derivative known as OMNISTARE. It is being proposed for use on the planned class of fifteen new Lockheed Martin Canada/BAE Systems Type 26 frigates that is expected to replace Canada's IROQUOIS and HALIFAX class warships. ARTEMIS is designed to automatically detect, track and classify both air and surface targets simultaneously, detecting and tracking manoeuvring and stealthy threats as well as surface asymmetric threats.

EO Fire Control

One of the most basic tasks assigned to naval EO systems is to act as part of the fire-control system for gun and missile systems. Subsystems such as thermal imager, image intensifying camera, or a laser range-finder can be used singly or in combination to point the weapon system towards its target.

Work on Ball Aerospace & Technologies Corporation's STALKER Long-Range Electro-Optic/infrared/laser Sensor System (SLREOSS) started in 2008 to meet an urgent USN requirement for a system to combat fast attack craft/fast inshore attack craft. Three prototype systems deployed and cross-decked across a variety of



Photo: Safran Electronics and Defense

The VAMPIR NG infrared search and track (IRST) system onboard Australia's ANZAC class frigates

US Navy warships were followed by eight developmental models, and in 2014 the company received a US\$23.9M contract from the NATO SEASPARROW Project Office covering the manufacture, test, and deployment of production hardware. SLREOSS combines long-range visible-band and IR sensors with a laser rangefinder. Intended to be a form/fit replacement for the Mk 16 low-light-level TV camera mounted on the Mk 9 Tracking Illuminator System of the Mk 57 NATO SEASPARROW Surface Missile System (NSSMS), it was designed to provide multispectral target imagery and accurate range data.



Photo: U.S. Navy

Two electro-optic/infrared sensors placed forward and aft of USS DWIGHT D. EISENHOWER's island provide 360 degree surveillance capability

Masthead

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Naval Group has selected Safran Electronics & Defense's PASEO XLR (eXtra Long Range) optronic fire control system for integration on the French Navy's new medium-size Frégates de Défense et d'Intervention (FDI). Each vessel will be fitted with a pair of two-axis stabilised turrets. Derived from the DALAS (Dispositif d'aide à l'Appontage au Laser) NG deck approach and landing laser system developed for the aircraft carrier CHARLES DE GAULLE, these will house a high-definition television (HDTV) camera, a SATIS XLR infrared imager, and an eye-safe laser rangefinder. An optional short-wave infrared (SWIR) channel operating in the 0.9-1.7 micron region of the spectrum could be provided to enhance performance under foggy conditions.

Safran Electronics & Defense Australasia is to supply the latest version of its VIGY ENGAGE electro-optical surveillance and fire control multisensor system for installation on the 12 new ARAFURA class offshore patrol vessels (OPVs) due to enter service with the Royal Australian Navy. VIGY ENGAGE is a full panoramic stabilised long-range sighting system that can act as the primary optronic system aboard small naval craft such as fast patrol boats, or can supplement the other sensors on larger vessels. The stabilised head weighs less than 20 kg, but houses a 1,024x768 pixel colour video camera with 40, 12 and 2.4 degree fields of view, a cooled thermal imager based on a MWIR focal plane array, and an eye-safe laser rangefinder.

The functionality of the VIGY 105 EOD and VAMPIR MB are combined in the company's EOMS and EOMS NG systems. These use a panoramic sensor head housing a SWIR or MWIR thermal imager, TV camera, and laser rangefinder. The main user is the French Navy, which has installed the EOMS NG on its FORBIN class destroyers, FLORÉAL class and CASSARD class frigates, and MISTRAL class amphibious ships. The UAE's BAYNUNA class FAC also have the EOMS NG, while Finland and Bulgarian have the older EOMS.

Rheinmetall Defence Electronics' MSP 600 is on service on German Navy frigates, including the F124 SACHSEN class and new F125 BADEN-WÜRTTEMBERG class, and is also used by the Malaysian and Finnish Navies. A development of the earlier MSP 500, it combines a high-resolution LWIR thermal imager, a daylight TV camera with a zoom lens, and a laser rangefinder.

The BADEN-WÜRTTEMBERG class frigates are also fitted with a Diehl Defence Ship's Infrared Monitoring Observation and Navigation Equipment (SIMONE)IRST system. This relies on a combination of single-sensor and multi-sensor modules based on LWIR sensors whose output is electronically combined to provide 360 degree coverage of the sea surface out to ranges of up to several kilometres. It is intended to automatically detect asymmetric threats approaching the ship by air or on the surface.

Rafael's TOPLITE EO turret is based on technology from the same company's aircraft-mounted LITENING EO pod. Designed for use on land, naval and air platforms, TOPLITE can be fitted with up to four sensors. The system typically weighs 60-65 kg, and has four-axis stabilisation. As TOPLITE evolved, later models introduced higher-performance sensors. For example, while TOPLITE III featured a third-generation 640x480 pixel MWIR sensor, TOPLITE MHD was fitted with a third-generation 1,289x1,024 MWIR sensor, while the colour TV camera gave way to an HDTV version with visual and IR (VIR) and near-IR (NIR) capability. Both versions included a laser rangefinder and a laser marker.

Leonardo Land & Naval Defence Electronics offers the MEDUSA Mk4, the latest in a series of EO fire-control systems that included the NA-18, PEGASO, and earlier members of the MEDUSA series. Its sensors are the classic combination of thermal imager, daylight TV, and laser rangefinder, and the company promotes it as suitable for use as a surveillance system, as one component of a more complex naval fire-control system, or as a stand-alone fire-control system. EO or EO/IR sensors can also be mounted on a weapon such as a gun or missile launcher. The Type B version of the OTO Mel-

ara FORTY LIGHT 40mm naval gun system incorporates a high-resolution daylight TV camera that gives the weapon a reversionary autonomous mode to supplement the normal remote-control operation via the ship's combat management system. The Type C has a stand-alone fire control system based three EO sensors – daylight TV, a cooled thermal camera, and an eye-safe laser rangefinder. Even a light weapon such as FN Herstal's SEA DEFENDER remote weapon station armed with a machine gun of 12.7mm or even 5.56mm calibre can incorporate a sight module that can be fitted with a CCD camera and cooled or uncooled IR sensor as required by the customer.

Submarine Periscopes

During 1970s the evolution of EO technology such as lowlight TV image intensifiers and thermal cameras reached the point where these could be integrated into the traditional submarine periscope. However their imagery was still displayed in the instrument's eyepiece. The traditional periscope requires a deep penetration into the pressure hull, a deep well into which its tube can be retracted, and heavy hoist mechanism located within the structure of



Photo: Leonardo

Leonardo's MEDUSA Mk4 is the latest in a series of EO fire-control systems.

the fin or sail. Elimination of the direct-view optics and total reliance on the electronic imagery allowed the creation of the optronic mast - a multi-sensor system whose output is passed to the control room or other locations within the pressure hull via an electronic cable.

EO Masts

Work on the Kollmorgen (later L-3 KEO, and now L3 Technologies) AN/BVS-1 Photon-

ics Mast Programme (PMP) began in 1995, and the resulting system had an EO IR suite made up of an MWIR staring-array thermal imager, a low light level TV camera, a colour HDTV camera; and an eye-safe laser rangefinder. It also incorporated an extensive radio-frequency (RF) suite that included ESM, radar, GPS, and communications antennas. As a result, its sensor head was 18 inches (c.46 cm) in diameter, so had a distinctive appearance which - if sighted by an opponent - betrayed the presence of a US submarine.

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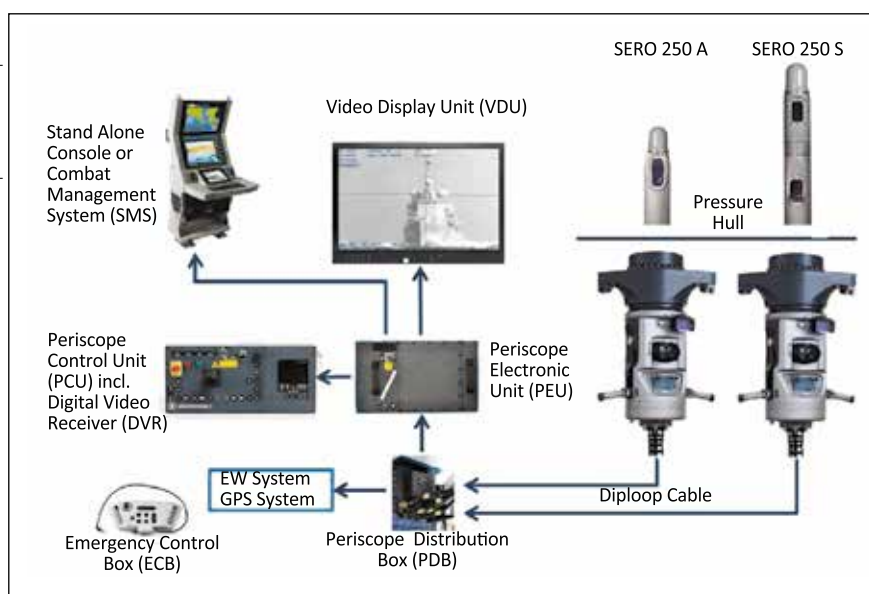
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Hensoldt Optronics' range of masts and periscopes



Typical system configuration of Hensoldt Optronics' SERO periscopes

It also had a significant radar cross-section that increased the probability of detection by enemy surface ships and aircraft.

In 2012 contracts were awarded for the development of a Low-Profile Photonics Mast (LPPM) that was intended to provide as much of the PMP capability as could be installed in a sensor head whose diameter of approximately 7.5 inches (19 cm) was similar to that of a traditional periscope. Developed by what was then L-3 KEO, the LPPM entered service in 2015 on Virginia-class submarines.

Like a traditional periscope, the PMP and LPPM had to be rotated in order to provide full 360 degree coverage. A follow-on concept called the Task-Oriented Technical Insertion Mast (TOTIM) is intended to produce a mast incorporating staring sensors covering a full 360 degrees, and able to house interchangeable subsystem modules that would allow the mast to be

reconfigured as required to suit changed conditions or even individual missions, or even modernised by the installation of improved subsystems. The maximum diameter of 8.5 inches (21.6 cm) is expected to including any treatments required to meet RCS reduction requirements, but when seeking potential contractors in 2016 the USN accepted that this target may not be achievable, so asked responders to indicate how the outside diameter could be minimised while still meeting the performance requirements.

In the early 1990s what was then Barr & Stroud (now Thales UK) began development of what would become the CM010 family of optronic masts. Following a successful test and evaluation installation on board the TRAFALGAR class submarine TRENCHANT, masts from the CM010 family were selected for service on the UK's new ASTUTE class SSNs. The CM010 has

a three-axis stabilisation system which operates at sub-pixel accuracy, countering the effects of submarine movement in rough sea conditions. A range of thermal imaging, image intensification, and colour HDTV sensors can be selected by a customer, and the mast can also house antennas for ESM, communications, and GPS. The CM010 has also been adopted by Japan, where it is manufactured by Mitsubishi Electric Corporation (MELCO) for installation on SORYU class submarines. The Japanese Navy was not prepared to rely totally on an optronic mast, but fitted the SORYU class with both a conventional periscope and a CM010 mast.

In France, Safran Electronics & Defense (formerly Sagem) developed the Series 30 search optronics mast system (SOM). This is dual-axis stabilised, and can accommodate a high-definition MWIR thermal imager, colour HDTV camera, a low-light camera, and an eye-safe laser rangefinder, as well as EW and GPS antennas. Adopted for the French Navy's SUFFREN class SSNs, the Series 30 SOM has attracted export orders from Brazil, Chile, India, South Korea, Malaysia, and Sweden. It also formed the basis for Safran Electronics & Defense's low-signature Series 30 Attack Optronic Mast (AOM).

While still Sagem, the company was also responsible for the Optradar Mast System (OMS) fitted to the French Navy's LE TRIOMPHANT class ballistic-missile submarines. This carries a dual-field of-view infrared charge-coupled device [IRCCD] thermal imaging system, an HDTV system with two magnifications, and antennas for an X-band navigation radar, ESM, and GPS.

Series production of the Hensoldt Optronics OMS 100 optronic mast system started in 1999, and the system has been adopted by Germany, Greece, India, Indonesia, Italy, South Korea, Portugal, and Turkey. It can be installed alongside the same company's SERO 400 direct-view periscope. 2012 saw the introduction of the OMS 110 optronic mast, which features a dual-axis stabilised sensor package that includes a high-resolution TV camera and MWIR thermal camera (both fitted with zoom lenses), and an eye-safe laser rangefinder. The follow-on OMS 200 teams a high-resolution TV camera with an SWIR thermal camera, but an additional MWIR thermal camera can also be housed in order to provide imagery under conditions that the SWIR camera would find difficult.

This article has been able to describe only a representative range of the many EO/IR systems currently on offer. But it shows the important role that these have as part of the equipment fit of a modern warship. ■

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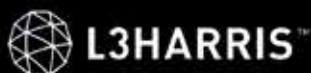
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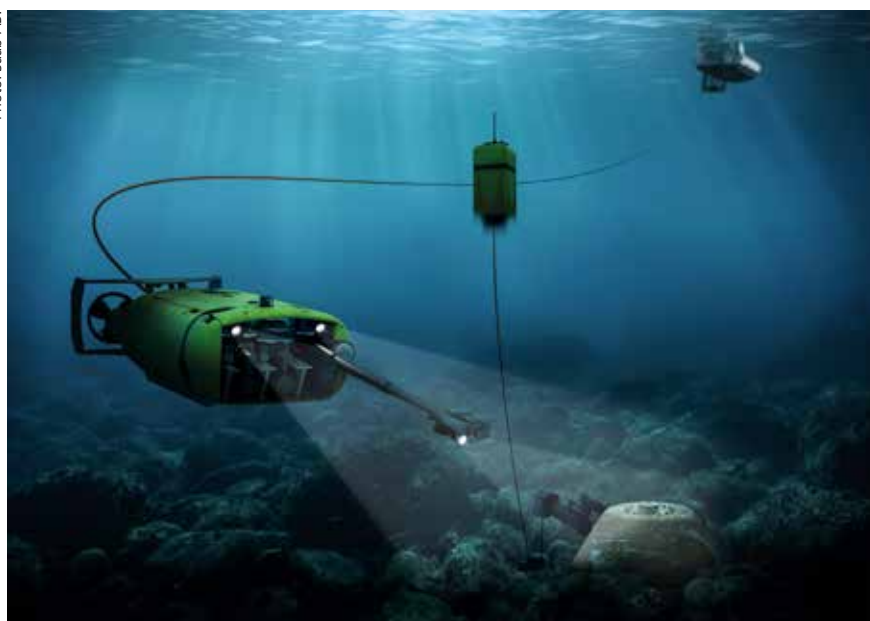
Primer: Cables for Unmanned, Subsea Applications

Tim Guest

Navies are increasingly using Underwater Unmanned Vehicles (UUVs) and related systems in harsh, subsea applications. This places new, stringent demands on the cable industry for ruggedised, reliable, high-performance data transmission solutions.

Navies are using UUVs for deeper, more protracted undersea military tasks that expose equipment to the harshest conditions, anywhere. While some UUVs operate autonomously, as Autonomous Underwater Vehicles (AUVs), others are Remotely Operated Vehicles (ROVs). Today's UUVs are controlled, receive power and remain connected for data transfer by an umbilical tether cable as seen used for underwater de-mining and a number of different missions. To understand the importance of this particular type of cabling, it is important to understand the challenges of the subsea UUV in its environment. The unique type of cables required and offered to meet those challenges come from a handful of manufacturers.

Photo: Saab AB.



The proliferation of unmanned underwater vehicles in increasingly demanding roles is placing greater importance on rugged, reliable underwater cables. This image shows the Saab Multi-Shot Mine Neutralisation System (MuMNS).

Cables as Enablers

Despite physical limitations, the requirement for umbilical cables that tether UUVs is increasing. Their applications range from shallow-depth hull inspections to deep water explosive ordnance (EOD) and mine removal. Similarly, civilian sector use of tethered ROVs/UUVs is on the rise for a growing number of roles in scenarios every bit as demanding as military operations; such as the inspection and maintenance of vital oil & gas infrastructure. An irreversible environmental disaster could occur without the ability to view these structures closely and in detail to determine need for repair or replacement.

Commercial Sector Learnings

In deep water oil & gas exploration, ROVs are connected to a mothership by either a

neutrally buoyant tether, or by a load-carrying umbilical cable together with a tether management system (TMS) under rough conditions and in deeper water. A key role for the TMS is to lengthen and shorten the tether to minimise the effect of cable drag from underwater currents. Umbilical cables are armoured and contain a group of electrical conductors and fibre optics that carry electrical power, video and data signals between the operator and the TMS; the TMS relays those signals and power down the tether cable to the ROV.

Applications for tethered ROV use increase in proportion to demands for higher levels of performance from the cables. Cables and associated connectors are expected to handle progressively larger data loads faster, delivering RF transmissions and real-time video at the same time. This means UUV users need the latest fibre-optic technologies to increase bandwidth without sacrificing the

flexibility that is often lost when a cable contains a high amount of fibre optic strands. The civilian undersea sector benefits in terms of cost and ready availability because they can easily purchase commercial off-the-shelf systems (COTS) cables used in sectors such as offshore, oil & gas and other undersea activities. Because there is a higher level of price-cost sensitivity in the commercial sector than in the military sector, cables available to private enterprises must be cost effective as well as rugged, durable and infinitely capable of meeting user requirements.

Undertaking missions at any depth in the marine environment is a challenge. The depths beyond 50 metres regularly encountered in the oil & gas sector place require that attributes such as waterproofing, saltwater-corrosion protection and high pressure compensation must meet the highest standards. It is reasonable to

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expect that cabling and connector solutions used in civilian scenarios should also be suitable for military/naval purposes.

Challenges

MSD asked experts about the challenges facing UUV operators and the capabilities expected of their cable datalinks. In the case of de-mining, is it possible to address all requirements with one umbilical solution?

WireMasters' Business Development Manager (EMEA) Nick Aubrey clarified: "It's a bit of a trade-off and a matter of the end-user deciding what's important to their application requirements. It's then a case of striking a balance between size, weight, speed, power and materials that will reliably perform, over extended periods of time, in the harshest conditions." He explained that the materials used in the cable can make a significant difference.

For example, engineered polymers offer enhanced performance levels for the materials employed in the manufacture of wire and cable, making it possible to use thin-wall technology (the material separating the various wires and fibres bundled within the cable), without compromising the cable's mechanical or fluid performance.

Safety First

Kraken Robotic Systems is a supplier of UUVs for de-mining, minesweeping and similar tasks. Its KATFISH is a high-speed, actively-stabilised, towed synthetic aperture sonar vehicle. It is deployable from manned or unmanned vessels to survey a seafloor in ultra-high-definition at larger area coverage rates than ever before, enabling operators to survey for seabed and tethered mines from a safe distance in real-time. Launch and recovery (L&R) is one of the highest risk operations undertaken in



Photo: Kraken Robotics

KATFISH is a high-speed, actively-stabilised, towed synthetic aperture sonar vehicle, deployable from manned or unmanned surface vehicles/vessels. The vehicle relies on an armoured cable supplied in either galvanised or stainless steel versions for reliable, high speed data transmission.

the application of towed UUVs. A mission is successful when the needed data is collected and the UUV and its payload are deployed and brought aboard safely, without damage. To ensure this, Kraken's recovery system is an intelligent tentacle winch with advanced control features that ensure optimum performance of the tether cable, especially in rough seas. When coupled with KATFISH, the winch's active terrain following functionality allows the mission control computer to adjust cable scope to assist the tow vehicle in active terrain following and obstacle avoidance. Its auto-tension function also keeps a constant specified tension level on the tow cable, allowing the tentacle winch to hold the vehicle in the docking head during the L&R phase without an additional capture mechanism or danger to cable or UUV. Finally, the winch's auto-render function automatically pays out cable if the cable load exceeds a pre-set threshold.

Kraken's Senior VP of Engineering David Shea specified that the KATFISH operates at speeds up to 10 knots and has high-speed data capability that reduces operating time and cost. This means their system must have an armoured, fibre-optic tow cable to transmit live seabed imagery and bathymetry to the tow vessel. The data is then transmitted from the tow vessel to the command and control vessel via a wireless data radio link in real-time. The tow cable itself consists of two fibre-optic and two copper conductors; this provides a fully redundant "hot spare" fibre that is automatically used in the case of a failure in the primary fibre. The armoured cable is available in either a standard galvanised steel version, or a low-magnetic stainless-steel version, depending on customer requirements. Their KATFISH comes with a 1,000 metre tow cable with partial ribbon fairing as standard equipment.



Photo: Fischer Connectors

Examples of Fischer Connectors' ULTIMATE (pictured left) and CORE series (pictured right) connectors with applications in naval communication, weapon systems and sensors, sonar, and radar systems



An Atlas Elektronik SeaFox ROV pictured in the course of deployment from a Royal Navy MCMV. Communication with the SeaFox's sensors is implemented by a thin fibre optic cable.

A recent Royal Navy announcement illustrated how much growth in the demand and use of towed unmanned systems for minesweeping/de-mining applications is on the uptake. In November 2020, the Royal Navy made a substantial US\$252m (GBP184m) investment in its Maritime Mine Counter Measures programme. This funds the production of an autonomous mine-hunting system designed to replace conventional crewed mine-hunting vessels. The first equipment delivery is due in late 2022, comprising three sets of mine-hunting equipment: 1) an autonomous vessel; 2) towed sonar with umbilical cable; and, 3) a mine neutralisation system.

The Specialists

With the complexities of and considerations surrounding UUV cables, it is worth examining the expertise and benefits offered by the handful of specialists in this field. This includes understanding how the cables enable UUVs and other offshore sector products with potential for naval applications.

TE Connectivity

At the heart of US-based TE Connectivity's tether and umbilical products are its Raychem and Rochester technologies, highlighted by irradiated, cross-linked SPEC

44 wire technology and TE's STEEL-LIGHT fibre-optic elements and pre-formed, corrosion-resistant steel armour. The company's ROV product line comprises heavy lift umbilical cables, neutrally buoyant tether cables and heavy tether cables for a range of applications in offshore and marine environments. The cables have reduced weight and diameter, providing longer lengths on current handling equipment. All three types feature characteristics such as high voltage ratings, high temperature, and reduced diameter power conductors with flexible conductors, as well as screened twisted pairs for instrumentation, and coaxial, or data-bus for data and video transmission. The umbilical cables feature multimode or single-mode "Fibre in Steel Tube" (FIST) and their armour comprises two or three layers of torque-balanced steel wire armour packages; typical depth ratings are to 4,000 metres and tin-plated copper braid provides the cables with EMC protection.

TE's neutrally buoyant tether cables, flexible, yet mechanically robust, are available in custom designs with aramid armour packages. Excursion lengths are up to 1,000 metres and the tether cables' buoyancy can also be tailored in order to maximize the product's excursion length or to provide a positively buoyant material. Heavy tether cables, on the other hand, use the smallest diameter product giving the operator the longest excursion length possible, but with a mechanically resistant sheath. These TE cables can be customised with aramid armour packages.

DeRegt Cables

The Netherlands' DeRegt Cables has developed strengthened, lightweight ROV umbilical and tether cables providing reliable connection for all extreme subsea



In November 2020 France and the UK signed a joint contract for Thales to launch the production of the MMCM (Maritime Mine Counter Measures) programme, Phase 2. The programme places significant reliance on unmanned vehicles, demonstrating the increasing importance of reliable cable technology.

military activities, as well as equally demanding ROV operations in the oil & gas sector. Their cables, aimed at ROV makers and operators, are designed for most standard ROVs, though custom systems for new applications can be developed to client specifications. The company's sub-sea cable solutions for work-class ROV's are designed to deliver reliability and performance under the most extreme conditions. Its middle-weight, ROV-class cable, for example, is a fibre-optic communications cable protected with two layers of armoured, high-temperature-resistant materials and can operate at depths to 4,000 metres.

The company combines several types of high-strength components in a single group, resulting in maximum drag reduction and tow strength. These systems are ideal for operations that require swift deployment and reliability. Its flexible and small diameter ROV tether cable for MCM operations is neutrally buoyant and includes electrical and optical components.

BIRNS, Inc.

A new subsea cable assembly capable of handling data rates of more than 9Gbits/Sec was recently introduced by BIRNS of Oxnard California, USA. The deep submergence cable constructed for Cat 8.2 use, and deep submergence cable assemblies with data transfer rates of 9.4+/- 0.1 Gigabits per second proved, in performance testing, that data consistently transmitted at this rate over the entire range of pressures from 0 to 8,700 PSI/600 bar (6,000m equivalent depth). The initial pin configuration in the 6km-rated BIRNS Millennium connector series tested for the capability is the BIRNS 3M-16, a configuration with twelve 22-AWG data contacts and four 16 AWG contacts for power. Additional high data-rate configurations in the series are planned using BIRNS 52A-278 cable. The company developed the new ultra-high-speed cable assembly capability in answer to industry demands for true Gigabit data transfer for advanced subsea vehicles and this advance should be of interest not only to the civil maritime sector but also for naval applications.

Leoni

Southern Germany-based Leoni is active in civil and military maritime waters. It supplies cabling for both naval shipbuilding (NavalLine range), and also for oceanography, where its cables offer interference-free telemetry of seismic activities at the seabed from undersea vehicles and operations, providing the kinds of performance and capabilities that naval de-mining and

MCM systems would find appropriate. Its cables support the data transmission and energy requirements for underwater robots in oceanographic applications, both in fixed as well as in moving installations. Its subsea solutions are seawater-resistant, tensile-strength cables with steel or aramid core for full loads of up to several tons. As well as standard design cables, its subsea ROV offerings are either neutrally buoyant or floating cables, armoured as appropriate.

A variety of cabling elements can be integrated into any of Leoni's towing or underwater cables depending on the specific application. These elements include: selected power cores up to 6 kV; control cores, pairs, triples and quads; data elements up to CAT 7; bus cable elements; fibre-optic elements; air, gas and fluid hoses; various screening elements; strength members – steel and aramid – up to a load of 100 kN; and cross-linked and non-cross-linked sheathing materials.

Azov Cable Company

The Ukraine's Azov Cable Company in offers a range of certified cable products for maritime use suited to subsea data transmission applications with a variety of cable and wire products of different types and for different applications; relevant here are its signal cables, power cables and wires, oil-filled, and fibre-optic cables, suitably armoured for the subsea environment.

Prysmian Group

The Military and Defence unit of the Italian Prysmian Group makes towed sonar system cables, towed minesweeper tether array cables, magnetic influence minesweeping cables incorporating control and instrumentation cables, data transmission and communication cables (including optical fibre) or combinations of all of these, as required for different applications. The company's products meet various specifications, including national military standards such as IEC, British Def Stan, German VG and US MILSPEC. The company designs, compounds and builds cables according to specific customer needs enabling an exhaustive product range covering all operational functionalities, from the simplest to the most sophisticated multi-functional cables. Cable types employed to meet a user requirement, include: standard commercial-grade cables; LSZH (low smoke zero Halogen cables); fire resistant cables; hydrophone and sonar rubber cables; communication cables; towed, minesweeper, tether, array cables; magnetic-influence, minesweeping cable; torpedo-decoy, and towed cable.



Picture: Leoni

Leoni's NavalLine product range includes inboard and outboard cables for all vessel types, laterally and longitudinally waterproof cables for outboard applications on submarines, self-extinguishing submarine cables, and trailing and underwater cables with integrated strain relief.

Meeting a Growing Undersea Need

The use of UUVs by navies in a range of operations, including in MCM applications, is growing fast. Military exercises are already focusing on the application and inter-operation of unmanned surface and subsurface systems at sea.

Unmanned Warrior in 2016 brought together over 40 military and civil sector defence and maritime industry organisations, along with 50 unmanned systems at that time. Developments since then have given rise to additional, new military systems and applications for which they are suited. However, the civil sector has a headstart over the military sector in UUV/ UAV/ ROV developments and deployments – this certainly includes cabling systems suited to such vehicle data transmission and C4 needs.

Those UUV users working in Offshore, oil & gas, and underwater exploration all employ tethered underwater vehicles for significantly more years than military users. It is possible and necessary to learn and benefit from their expertise in maritime security and naval activities. Certainly, this means adopting and adapting any of the many potentially 'military-subsea-suitable' COTS cabling and unmanned products, ready and waiting for naval users to consider and purchase. ■

Counter-UAS Applications for Naval Platforms

Tamir Eshel

The fast evolution of aerial, surface, and underwater drones attracts naval offensive and defensive planners' attention with its spherical threat potential. Loitering weapons, explosive boats, and miniature submarines pose as much of a multi-dimensional threat as missiles, guns, and torpedoes. The new unmanned menace is small, but but the combined effect of its elements can disable a powerful destroyer as each of a swarm's drones can hit a specific weak spot, degrading a ship's defensive capabilities against more potent killers.

centre via satellite links and allowing ships to remain silent.

Maritime forces might also operate UAS at sea, which include vertical takeoff and landing platforms (VTOL). These are more restricted in mission endurance and payload capacity but become an extension of the vessel's sensor mast, and extend situational awareness.

Small Drones

When ships are in port, inland waterways, or littorals, they could encounter small

Some of these drones cannot be detected by existing air defence systems. With commercial systems becoming rugged, even militarised, they have rapidly evolved at the open-source pace, creating asymmetric adversaries requiring newer, lower cost, and more adaptable defences.

Smaller aerial drones and loitering weapons deployable from submarines to conduct stealthy surveillance and reconnaissance missions, collect target information and extend the submarine's reach far beyond the distance covered by its sensors.



USMC photo by Cpl Aaron Henson/Released

L-MADIS - U.S. Marine Corps staff provide security to their Light Marine Air Defense Integrated System aboard the WASP-class amphibious assault ship USS KEARSARGE (LHD 3) as it passes the Mubarak Peace Bridge in the Suez Canal.

Unmanned Systems in the Naval Domain

Unmanned Aerial Systems (UAS)

UAS are becoming a standard tool for maritime surveillance for their long endurance and comprehensive mission payload. While UAS are operated on land, their missions support maritime domain awareness for task forces at sea, extending coverage beyond the range covered from a surface ship. UAS carry large payloads integrating radar, electronic support measures (ESM), and electro-optical (EO) sensors monitoring vast areas of open sea. UAS can operate far from the task force they support, communicating with the ships and operations

drones or multirotors (e.g. "fancopters") launched from shore or other vessels. Using commercial off the shelf (COTS) platforms, multirotors are commonly used by terrorists and non-state actors as aerial improvised explosive devices flying autonomously or remotely controlled to attack targets. Being small targets that are often regarded as a nuisance, they pose a significant threat. Petite surveillance drones can obtain close-in images of classified systems, monitor electromagnetic signals, disrupt EO or electronics. These tiny drones prove to be resilient to most types of countermeasures, particularly when flown in small groups or swarms, requiring specific means to defeat them.

Autonomous Surface Vessels (ASV)

ASV are becoming common, operated by navies for security, mine countermeasures, anti-submarine, and electronic warfare. Irregular forces also use fast boats loaded with high explosives, rigged with makeshift automation or remote control to attack slow-moving or anchored vessels. Unlike the small drone that requires precision guidance to achieve an effect with a small explosive, a boat loaded with tens - maybe hundreds - of kilogrammes of explosives can cause significant damage anywhere it hits.

Underwater Unmanned Vehicles (UUV)

There is a growing concern for UUVs for reconnaissance, surveillance, underwater



Photo: Weibel Scientific

Weibel's XENTA system provides coastal or at sea surveillance, identifying and classifying unmanned threats.

surveying and mapping roles with the potential to conduct kinetic attacks. These stealthy UUVs are extremely hard to detect and track. Autonomously moving underwater and loitering for days, sometimes operating in groups and conducting unexpected attacks upon an operator's command, they are even harder to defeat.

Threat Analysis

Like cannons, torpedoes, mines, or missiles, unmanned systems with loitering weapon derivatives are a respected threat in the maritime domain. Drones - particularly small drones - should be a priority target for their part in target acquisition and communication and sensor denial. Smaller drones are expected to be close to the shore and port while surveillance drones are often seen at sea. Engaging these drones often relies on electronic or EO countermeasures to prevent them from success. Improvised explosive drones and loitering weapons pose a direct and immediate threat reflected by their offensive behaviour. Due to the limited endurance and range, their threats are often in areas where vessels have limited manoeuvrability - docked in port, passing through narrow straits or canals, and during port entrance. Future vectors of unmanned platform attacks could rely on hybrid systems, either sensors or weapons, comprised of an aerial platform combined with an underwater vehicle launched from boats or aircraft, conducting reconnaissance or attacking targets above and on the surface. Modern unmanned systems combine autonomy with "a human in the loop" and rely on an array of sensors to conduct their mission. A defender could exploit the electromagnetic, photonic, and acoustic emissions of drones to detect, track, and disrupt the drones' operation.

Multi-Domain Sensors

Radar is most useful for detecting aerial and surface targets at sea - day or night, and under all weather conditions. However, drones are difficult to detect as they move slower than aircraft or missiles and have a small radar signature (radar cross-section). Effective radar detection requires specific filtering and signal processing to distinguish drones from other slow-moving objects, such as birds or waves. The primary radars on ships are not optimised for such operation as they focus on other tasks - surface search, missile detection, and air defence. Furthermore, the primary radar is not activated in ports, where ships are vulnerable to terror attacks.

Smaller radars optimised to detect low, slow and small (LSS) targets are optimised for C-UAS. In 2019, when US Amphibious Assault Ship USS KEARSARGE deployed to the Arabian Gulf, it relied on an ad-hoc C-UAS solution provided by a Light Marine Air Defense Integrated System (LMADIS) system to defeat an Iranian drone that approached the ship. The system integrates multiple sensors on a single vehicle, providing mobile, expeditionary C-UAS protection for the US Marine Corps. L-MADIS packs four RPS-42 radars from RADA, a SkyView RF detection package and Modi RF jammer from Sierra Nevada, and an EO payload provided by Ascent Vision.

Other electronic sensors operated onboard are Electronic Support Measures (ESM). This passive Radio Frequency (RF) sensor continuously analyses the electromagnetic spectrum over a wide bandwidth, searching for anomalies indicating that a suspicious activity might relate to a hostile activity. Since unmanned systems have a distinct electronic signature, ESM provides the first alert of a threat to the ship. With its ability to determine the signal's direction arrival, ESM

also provides verification, identification, and localisation of targets detected by radar.

Mobility Challenge

Operating on the move poses a significant challenge for the radar, especially with LLS targets that are masked by sea clutter. MCTECH developed a system to overcome motion challenges in a unique way. The MC HORIZON points the radar at a specific area where the passive ESM sensor suspects the drones to be. MCTECH delivered this system to the Royal Thai Navy. Controlled from the bridge, the system is able to bounce or defeat hostile drones from anchored or moving ships.

EO systems are often used for surveillance means, target acquisition, and as fire control systems onboard ships. Different types of EO/IR systems are available for naval vessels and ashore include the SPYNEL from HGH and the iSea Family of Maritime Surveillance System and SPEED ER from Controp. Panoramic thermal cameras, using fast rotating cameras, provide 360-degree coverage and detect multiple targets simultaneously, on the surface and in the air. Modern computer vision detects and tracks multiple targets concurrently by differentiating non-combatant objects by their profile and behaviour. A radar or ESM use EO/IR sensors to spot, track, and identify targets of interest. Provided with a high level of stabilisation and accuracy, sensor payloads can spot small flying objects and target them for other weapon systems.

Facing growing underwater challenges, navies turn to acoustic sensors to detect activity. While bow-mounted and towed sonars can detect large objects (submarines, fast and noisy torpedoes, etc.) they cannot handle slow, stationary or small objects like UUVs or mines, particularly on a moving ship. Sonar specialist DSIT Solutions developed the MonkFish torpedo detection and alert sonar (TDAS) for this purpose. Installed as a secondary bow-mounted sonar, MonkFish operates alongside the primary sonar and is designed to detect UUVs, divers, and advanced torpedoes on stationary or moving ships.

Monitoring large coastal areas and port entrances help protect vessels and offshore facilities from all underwater threats. Such monitoring is achieved by a network of active-passive SeaShield sensors that build a virtual anti-submarine barrier, guarding against underwater threats. Linked by fibre-optical cables, the centrally monitored sensors provide automatic detection, tracking, and classification of targets of interest. DSIT offers a standalone



TYPHOON C-UAS – computer vision enhances the TYPHOON MK-30C performance by detecting and tracking multiple targets simultaneously.



TYPHOON 30mm - to RAFAEL's TYPHOON MK-30C 30mm Naval Remote Weapon Station (NRWS)

solution for offshore platforms and port surveillance - the AquaShield. This diver detection sonar system was demonstrated in 2018 for the US Navy's STILETTO Maritime Technology Demonstration Program, performing automatic detection, tracking, and classification of UUVs and divers. Integrating multiple sensors and data feeds is essential for situational awareness and effective responses. Counter-unmanned missions require an integrated approach to establish situational awareness over a 360° perimeter around an asset. NiDAR, from Monaco-based MARSS Group, is such a system. The intention was to initially to secure superyachts. NiDAR employs smart software algorithms to autonomously and intelligently detect, classify, and respond to aerial, surface, and underwater objects to determine potential threat levels and trigger alerts.

Tracking Challenge

Weibel Scientific conducted extensive in-house development resulting in the novel XENTA product family, a new generation of counter-drone and short-range air defence radars. This ground-breaking radar system is designed to detect, track and classify LSS targets, such as UAVs - and conventional

air threats like fighters and helicopters. The XENTA family meets the strictest requirements for drone detection and air surveillance – including critical infrastructure and border, perimeter control, and air defence applications. It provides high-performance 3D detection, tracking and classification by combining FMCW and CW digital-array beam forms with advanced dynamic clutter-mapping and MTI-D processing. These radars increase the distance at which even the smallest micro-Doppler signals can be detected. The radars can track a DJI SPARK micro-drone beyond 2.5 kilometres, with micro-Doppler signature classification of the propellers beyond 1.5 kilometres. The DJI PHANTOM IV drone can be tracked up to 6 km with classification up to 4.5 km.

Countermeasures, Soft and Hard Kill

When an unmanned vehicle is detected and determined as a threat, soft and hard-kill countermeasures are used to repel or destroy it. Electronic jamming is the most common countermeasure. They produce jamming protocols to disrupt the drone's control channel or deny GPS location to distract its navigation. However, this can

cause havoc on a ship, the mission of which and self-defence depends on electronic systems that jammers can disrupt.

When commercial drones are deployed, defenders can hijack the drone by means of a cyber attack, which might not always work against military drones. Nevertheless, solutions such as ECLIPSE from NSO Group allows defenders to take over and safely land an invading UAV, allowing the captors to analyse its nature and assess its threat level.

Citadel Defense Company offers TITAN, a C-UAS system for safe use on board ships. The system went through extensive ship-board evaluations and deployments with US Navy destroyers and an aircraft carrier to demonstrate effective onboard operation. TITAN detects drones from a range of about 2.5 miles and delivers an escalated RF countermeasure effect to match the detected threat without interfering with nearby communications. The system employs machine learning and artificial intelligence to identify targets and update its threat library with a new adversary immediately upon detection. According to Citadel, TITAN detects controller, video, telemetry, and Wi-Fi communication links from 400MHz to 6GHz to identify air, land, and sea drone threats. The system has proven success in defeating individual drone threats, and swarm attacks with surgical precision at standoff distances beyond line-of-sight.

Drone swarms are becoming of greater concern due to their "group immunity". The French Icarus Swarms company and associated CERTIFENCE began to operate drone swarms as a RED TEAM testing C-UAS systems' resilience to evaluate risks. Such evaluations are conducted through a protocol of 15 tests employed with groups of real drones. Challenging defence systems of different types, CERTIFENCE showed most current systems cannot cope with even small drone groups. Tiny drones cannot destroy a ship, but when targeted at ship sensors, defensive systems, and the close-in weapon system (CIWS) itself, they degrade the vessel's defensive capability and open the way for a lethal attack by much heavier weapons.

A somewhat more aggressive measure is a physical interception. XTEND's SKY-LORD uses a small UAV interceptor that engages uninvited drones by colliding the drone with an airborne arresting net towed by the interceptor drone. SKY-LORD combines augmented reality (AR) guidance and control technology to enable an operator to perform the complex intercept with ease and precision.



Photo: Orbital ATK/Northrop Grumman

DRONEKILL – In 2018, the **BUSHMASTER** chain gun demonstrated effective hard kill of drones using the **Programmable Air Bursting Munition (PABM)**.

Different types of arresting nets are also in use against unmanned platforms. The STINGRAY UUV interceptor net from Maritime Arresting Technologies is deployed along the target's course of movement, at the path of a suspected UUV. STINGRAY protects the entire water column, extending from the water surface to the seabed.

Kinetic Hard Kill

Used as part of existing naval defensive measures, guns and lasers can generate effect against drones. But these weapons also need some adaptation. Existing radars associated with CIWS are not geared to track slow targets. Furthermore, destroying a group of drones or loitering weapons a few hundred yards from the vessel may be challenging, mainly when a drone swarm performs coordinated manoeuvres that distract the defender from their main threat. Such adaptations were recently made to RAFAEL's TYPHOON MK-30C 30mm naval remote weapon station (NRWS), adapting it to the C-UAS role. Improvements include

higher elevation and depression angles for the gun and improved stabilisation of the system's EO/IR targeting system to enable tracking and engaging these small targets. To engage targets at the maximum range, the NRWS employs active target detection that searches the entire field of view for known target profiles and highlights them for instant evaluation by the shooter. Using programmable airburst ammunition, NRWS has demonstrated neutralising drones at ranges of 2-3 km.

Software upgrades enable real-time computer vision processing for target detection, identification, and tracking. These improvements boost accuracy by introducing an automatic targeting capability that incorporates a diverse mix of synchronised multi-spectral sensors, weapons, and intelligent effectors that result in high hit accuracy. Automatic target recognition, classification, and tracking (ATR), automatic target acquisition (ATA) technologies improve detection, recognition, classification, and tracking of elusive, small targets.

Engaging targets below the waterline also requires special ammunition. A concept developed for the US Navy combines an armour-piercing effect with the ability to shoot straight through the water using the super-cavitation effect. As it pierces through the water, the projectile is engulfed by a low-pressure air bubble, reducing drag drastically. This dual effect means the same ammunition can be fired against surface and submersible targets.

Defence at the Speed of Light

Future C-UAS effectors could further laser weapon developments. Several navies are already testing laser weapons, including those of the US, UK and Germany. Lasers are considered effective against soft targets such as drones and fast boats and operated autonomously or to enhance other defensive systems onboard to defeat simultaneous missile attacks.

The US Navy is moving quickly to include laser weapons to boost the protection of its combat ships. In 2020 the US Navy tested the Laser Weapon System Demonstrator (LWSD) built by Northrop Grumman on the PORTLAND amphibious transport dock (LPD-27) ship. For destroyers and frigates, the Optical Dazzling Interdictor – Navy (ODIN) is developed. The prototype was integrated in 2020 on USS DEWEY (DDG-105), an ARLEIGH BURKE-class guided-missile destroyer. Built by Lockheed Martin, ODIN is less potent than LWSD but achieves an effect at a more extended range since it is designed to distract and blind electro-optical sensors rather than destroy incoming threats.

The German Navy plans to test its laser this year. The first project will use a 20 kW fibre laser made by Rheinmetall, mounted on the class F124 SACHSEN frigate. This laser effector consists of 12 nearly identical 2kW fibre laser modules with close to diffraction-limited beam quality. A beam combiner couples the 12 fibre-laser beams to form a single, weapons-grade laser beam. The modular assembly has growth potential in the 100kW performance class.

New Understanding

But the rush to add C-UAS capabilities on board should not be hasty. Sensors and countermeasures must be carefully tested and integrated with the ship's systems, and concepts of operation have to be developed to cover the looming threat of small and slow drones while avoiding disruption to the ships' systems. ■



Photo: US Navy

The US Navy tested the first SEQ-3 Laser Weapon System in the Arabian Gulf on board USS PONCE in 2014.

Assurance – Key to Autonomy

Christian von Oldershausen

This op-ed article focusses on one element in the use of autonomous vehicles: building trust. The author explains how to overcome the biggest barrier in the use of new technologies. As a safe autonomous vessel needs to have situational awareness in all relevant conditions, whatever the weather, lighting, sound, and ship motions that it might encounter, assurance is key for its operation.

With this article, Maritime Security and Defence is opening a regular feature in which we intend to illuminate upcoming changes in the world of shipping. Driven by the idea that changing the way a ship is operated will have an impact on multiple aspects of maritime security, it will most certainly have significant consequences for the naval sector.

Unmanned autonomous and remotely operated transport for automated supply chains and improved safety and environmental performance were once the stuff of science fiction. They are moving closer to becoming reality thanks to advances in information and communications technologies (ICT).

The modern ship bristles with software-driven systems already sold by many equipment and system manufacturers. These systems include firmware, operating systems, application software, and network and Internet of Things devices. With software determining what they do, they are usually very flexible.

at the end of the day the general public, be sure that the vessels are just as safe, efficient, and environmentally sound as if they were manned?

Well-conceived regulation opens the window to the ecosystem of vessel owners, builders, equipment makers, operators, charterers, insurers, and finance, gaining



Image: Rolls-Royce

Modern ships already bristle with software-driven systems and there are few if any technical obstacles to autonomous and remotely operated vessels; the biggest barrier is trust. These Rolls-Royce Marine (now part of Kongsberg Maritime) autonomous ship concepts date from 2016.

Author

As a Vice-President and former navy officer, **Freiherr Christian von Oldershausen** is the Segment Director Navy at DNV GL in Hamburg, Germany.

In short, there are few if any technical obstacles to autonomous and remotely operated vessels. As with other new technologies, or novel uses of them, the biggest barrier is trust. In other words, would an autonomous or remotely operated ship also be a safe ship? Can a port authority, vessel owner, operator, governments, and

clear sight of what it takes for autonomous ships to operate safely, efficiently, and sustainably.

We believe that the International Maritime Organization (IMO) should set overarching regulation in very high-level terms. For example, it could simply call for IMO member states to require autonomous and remotely

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Photo: US Navy



The US unmanned surface drone SEA HUNTER has been used to provide information to help the future integration of autonomous systems into the US Navy; the service awarded a contract for the development of a prototype Medium Unmanned Surface Vehicle in 2020.

assurance procedure for safety compliance in these cases as it is to make the technology itself.

The question of risk is central. If a vessel is to operate solely across the Pacific Ocean – where it may encounter another ship once a week, for argument's sake – the safety consequences of remote-control or autonomy failing may be limited enough to accept the risk of a ship not being completely safe in all operational situations. The risk profile would be very different for

a vessel operating some or all of the time in congested waters with complex navigational challenges.

Building on this thought, a safe autonomous vessel needs to have situational awareness in all feasible conditions, whatever the weather, lighting, sound, and ship motions that it might encounter during operations.

For all these reasons, I think it likely that we will first see the first implementations of autonomy and remote operation being for various types of machinery parts on

vessels operating in open water, perhaps within five years.

What I am already seeing is that development of industrial clusters that can support the development and deployment of these technologies is most advanced in flag states where regulation encourages innovation while laying down requirements. They include, China, Finland, Japan, South Korea, Norway, Singapore, UK, and the US. There is perhaps a lesson there for other flag states that would like their maritime industries to have a piece of the autonomy pie." ■

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WATERCAT Boats for Demanding Requirements

Marine Alutech is a leading manufacturer of state-of-the-art maritime vessels for military, law enforcement and other maritime applications. 2021 is a milestone for the 30 years anniversary celebration. Company is based in the greater Helsinki area (Finland). Marine Alutech's product portfolio includes:

- Combat and fast patrol boats in lengths between 5 and 25 metres;
- Typical marine diesel & waterjet propulsion systems;
- Modular weapon & self-protection systems.

The company's core capabilities cover prime contractor services, project management, design and manufacture of aluminium and composite vessels including lifecycle management. Besides, it can provide dedicated expertise in unmanned vessels, Electromagnetic Interference and Compatibility (EMI/EMC), electrical systems and for the integration of weapon and CBRN systems.

Vessels of the company are in service and successfully operated in Asia, Africa, the Middle East and Europe.

The company is proud of Finland, as Marine Alutech's home market, constituting the largest customer reference; Marine Alutech sees itself as a partner of the Finnish Defence Forces and the Border Guard – rather than just a supplier.

As an SME, the company takes advantage of such a relationship based on partnership, particularly during periods of military conflicts, global financial crises, and health pandemics, as they have been experienced since 1991.

So what has been the key success factor for this innovative company?

"Our ability to recognise customer requirements" says Niko Haro, the CEO. "This helps us understand exact requirements of our customers' needs and means that we can provide vessels in response to these requirements". When finding an answer to the question, Mr Haro appreciates the dynamic development of related benchmarks. "30 years ago, the benchmark was a speed of 40 knots with very simple manual weapon systems. Today, we are discussing customer requirements for vessels with fully integrated weapon systems that achieve top speeds over 50 knots. Everyone wants to go faster and be more heavily armed".

Recognising this, Marine Alutech's focus is the "M" product range of the WATERCAT type vessels. M stands for Military, thus applying significantly more rigorous internal design features and construction processes.

The M range includes of the M12 vessel that is primarily designed for troop transport, but also for amphibious support. It can be fitted with the Patria NEMO 120mm mortar system.

The M18 can be designed for troop transport but can also be configured as a weapons platform. More than 30 of 12M and twelve M18 vessels (with a wheelhouse roof mounted RWS) are in service with the Finnish Defence Forces.

The flagship of the M range is the M22. Using the same design concepts as implemented with the M18, it is a physically larger vessel. Haro is quick to point out that a slightly larger vessel size adds significant capability. "We can engineer a weapons suite on board to include a main gun of up to a 40mm calibre, 2 x 12.7mm side guns,



Photos: Marine Alutech

Watercat M18 AMC

and a medium range missile system. With a proven hull shape and a propulsion system able to achieve speeds in excess of 50 knots we believe this vessel offers multiple roles and tactics needed for today's military organisations".

Haro is reluctant if asked about demand. He does not disclose any details about parties interested in the M range except that the company is in various stages of negotiations with many organisations for the supply of these heavily armed multi-role vessels.

Whilst the focus is on meeting customer expectations with the current M range of WATERCAT vessels, Haro points out that the company is still very active in law enforcement and commercial markets. "We have served these markets for our complete 30-year history, and this sector has been very loyal to us and we are happy to reciprocate that kind of loyalty". Recent achievements include a fleet of 14 vessels to a Middle Eastern coast guard authority and seven vessels for a port authority in Singapore.

Combined with the support of 60 dedicated personnel, full ISO 9000 and AQAP management recognition, prime waterfront facilities, newly built state-of-the-art outfitting halls, the future looks promising. Haro: "Here's to the next 30 years".

Marine Alutech invites you to its digital meeting point at NAVDEX, Abu Dhabi, stand C-016.



Watercat M22

The New Normality for Shipbuilding

MSD Editorial Team

It cannot be ignored, COVID19 presence and its impact on our lives is everywhere - gnawing at the edges of our existence more aggressively daily. New variants threaten the easing of lockdown measures, activities are forbidden and dear lives succumb to the virus, leaving gaping holes in our families. Nevertheless, human ambition to survive and thrive once again continue on a pathway of "normalcy" that endures. While requirements for defence materiel and naval assets remain a constant as national defence and industrial strategies struggle to maintain a pre-COVID existence, new ways of fulfilling obligations to defence organisations become available as shipbuilders adapt

and find new ways of meeting their demanding build schedules and realise new efficiencies.

Maritime Security and Defence (MSD) spoke with several international shipbuilders, posing the same question to them: "What measures did your company take (or have in place), allowing it to thrive despite COVID-19?" Shipbuilders are finding novel practices and a "new normal". The following are some overviews about measures the leadership of these shipyards took to meet customer demand and overcome COVID challenges. This editorial focus provides MSD readers with an opportunity to benefit from these shipyards' new best practices and processes.

Hein van Ameijden, CEO, Damen Naval, The Netherlands



Photo: Damen

David Massey, CEO, ADSB, United Arab Emirates



Photo: ADSB

from outside while the administrative staff worked remotely.

Measures to contain the virus involved: designating multiple buildings as isolation facilities for those who tested positive; quarantine for those exposed; and, separate facilities for those tested negative or recovered. Staff members were moved sometimes every few days where necessary. With a healthy workforce largely in their 20s to 40s, only a very small number of those who were tested positive required hospital treatment. Surely there was an impact on workforce availability; however, ADSB never closed down and (rather) maintained support to its customers throughout the pandemic, working with staff members who were all regularly tested negative.

As commercial customers tried to mitigate the effect of vessels being off-charter or not being used in oil service operations, they brought the vessels forward for maintenance activities. We benefitted from this unexpected outcome; driving the ADSB commercial repair and maintenance revenues in 2020 are significantly ahead.

Although international movement restrictions impacted on business development, we used this time to strengthen our design team and develop new projects. At the forthcoming IDEX exhibition in February we will be able to show prototypes for several new vessels, which – for the first time – are completely designed and built by ADSB.

I believe that the COVID19 outbreak has the potential to transform how business is done globally in our industry and across many sectors. Damen responded decisively to the pandemic with new safety measures supporting new efficiencies, i.e. remote working. The restrictions caused international supply chain disruptions, travel reductions and presented other challenges,



Photo: Damen

Damen shipyard view in Visslingen, during the delivery ceremony of the KAREL DOORMAN Joint Support Ship for the Royal Netherlands Navy

such as preventing our customers and strategic suppliers from attending/performing testing and commissioning activities at our sites abroad. However, the solid relations between our teams, customers and suppliers led to new ways of progressing work within strict safety measures to continue serving our customers.

COVID19 demands maximum flexibility and solution creativity with respect to working from our offices and from home. From secure IT connections to organisation and project agreements, all solutions must be well considered and balanced. Many people still work remotely, as the Netherlands finds itself in a second lockdown, so we lean more on digital communication for our daily work, with clients and each other. I think these changes were coming anyway, but the virus outbreak certainly accelerated them.

The pandemic will also accelerate developments in sustainability in this increasingly environmentally conscious and health and safety-minded world. The sustainability performance of our products is becoming ever more important, especially with Western countries. It is something we anticipated and is a main theme in our R&D initiatives we undertake with industry partners, research institutes and universities.

We are quite confident in our post-COVID business prospects as our market position grows in Europe: Combat Support Ship contract for the Royal Netherlands Navy (RNLN), our selection as main contractor for the new Anti-Submarine Warfare Frigates (ASWF) for both the RNLN and the Belgian Navy, the F126

frigates contract for the German Navy, the pre-selection of SAAB/Damen for the replacement programme of the RNLN Walrus-class submarines, and the role of Damen as coordinator of Sea Defence, the first naval European Defence Industrial Development Programme project. We will continue to focus on launching customer programmes in the European and home markets.

As for the rest of the world, we expect government budget cuts, as a result of COVID19, meaning more demand for compact, cheaper vessels. This is a promising opportunity for our flexible and future-proof portfolio for navies and coast guards, especially our SIGMA range of combat and ENFORCER range of logistic and amphibious ships.

Julia Maris, EVP for Defence and National Security, ENGIE Solutions, France



Photo: ENGIE Solutions

When the pandemic started to affect us, our first actions were to protect our employees because we put their safety above all other considerations. We therefore adapted and put in place appropriate procedures to avoid infection in places where we operate, providing the means to protect ourselves and imposing strict compliance with barrier and physical distancing measures.

Furthermore, we are very active in the field of Maintenance in Operational Condition. For our clients, this involves strategic issues related to the national sovereignty of the countries concerned. They must be able to use their equipment at all times. We, therefore, remain in action, whatever the circumstances, to carry out our maintenance plans and guarantee a high level of availability for the equipment in our charge.

We have continued to grow in the naval industry, winning several major contracts. These include, for example, the contract to install the entire HVAC system for 12 new-generation mine hunters for the Belgian and Dutch navies. We will also be providing maintenance in operational condition for the icebreaker Astrolabe, operated by the French navy in Antarctica and the Indian Ocean.

Finally, this global pandemic has led us to innovate and we are now able to incorporate bio-decontamination solutions to guarantee a healthy environment on board ships and combat the spread of viruses. Completely modular, these solutions can be adapted to the concrete needs of vessel operators to include, if necessary, new equipment to combat viruses (including UV lamps, HEPA filters, etc.) as well as automation programs specific to the circumstances.

Eitan Zucker, CEO, Israel Shipyards, Israel



Photo: Israel Shipyards

Israel Shipyards, has thrived despite COVID-19. We entered this new phase in a strong position, and were able to meet the challenges through flexibility and an agile response to required changes, even without any significant government assistance. First, regarding operational and manufacturing activities, we established a Corona-focused routine to protect the health and safety of our employees – implementing strict social distancing, limiting the number of workers in close proximity at any given time, requiring masks to be worn at all times, imposing personal hygiene procedures, and continually monitoring the health of each individual. In addition, we maintained ongoing communications with all personnel, ensured a strong managerial





Israel Shipyard's OPV62 and SHALDAG MK II

presence, and made emotional and other support readily available.

Next, we significantly expanded our digital customer engagements – providing virtual tours of our premises, holding dozens of online meetings, and delivering webinars for clients around the world. Our main takeaway from this crisis was the need to prepare plans in advance that ensure maximum support of our customers and attention to their needs. Recognising that they were also experiencing

this crisis, we expanded our budgetary assistance, offering exceptionally convenient financing terms, long-term credit, and trade-in options. These flexible payment plans enabled the acquisition and leasing of our vessels, even by those facing the most extreme budgetary restrictions, and allowed them to meet their critical need to upgrade their maritime security.

Our post-COVID plans cover the development of an array of customisable new solutions that expand our current offerings, ensure the continuous high performance of our vessels, and create new health safeguards – including advanced means of identifying and isolating those exposed to contagious diseases. In addition, we plan to enter new markets, which are tangential to military markets, such as humanitarian aid, disaster relief, and routine policing and security.

Lena Ströbele, Managing Director, Fr Lürssen Werft, Germany



Due to the current situation regarding the Corona crisis, we have implemented numerous preventive measures at all our shipyard locations. In addition to the various standard hygiene measures, we have also introduced, for example, shift working in production so less employees are working at the same time, introduced zoning areas to keep unnecessary

contact to a minimum and also work-from-home opportunities for various office functions. These measures follow the current recommendations that come from the Robert Koch Institute, as well as the specifications of the German health authorities. In addition, we are in close contact with the regulatory bodies on a daily basis so that we can reassess the situation on site each day and ensure we adjust our operating procedures at short notice if necessary.

So far, we have continued regular operation at our shipyards, taking the current circumstances into account. We are confident that we will be able to continue to lead our shipyard group through the current crisis without any substantial disruptions, subject to the given restrictions and precautions. However, we are already noticing that internal operating expenses have increased significantly and that the global shipbuilding market has clouded over, with strong effects on the German shipyard landscape.



MAGDEBURG, second-of-class of the German Navy's K130 corvettes, was built at Lürssen shipyard's facilities on the river Weser.

Reducing Risk in Cargo Shipping

David Fairnie

Worldwide, cargo shipping faces a myriad of threats whether in transit, when stored in warehouses, and even when it reaches its final location. This risk of theft applies for cargo regardless of the modality used for transportation, whether via air, sea, land, or all three, and threatens Organisational Resilience if the threats are not recognised and appropriate loss prevention mitigation techniques applied.

Identifying the Threat of Cargo Theft

Cargo crime continues to rise as strategies employed by thieves diversify and evolve, challenging organisations that must also be agile and adapt to these new threats. Thieves use a multitude of tactics to steal cargo. Often, the particular theft modus operandi is regionally specific. For example, in Latin America and South Africa, cargo hijacking while trucks are in-transit to seaports is a popular tactic. In Europe, thieves predominantly use a "slash-and-grab" tactic, slashing through a soft-sided trailer to steal cargo. Additionally, thieves may steal cargo by breaking into warehouses and facilities, posing as a legitimate carrier to fictitiously pick up cargo or trucks, or outright steal entire trailers or trucks from port facilities. One of the more prominent examples of this type of theft occurred in Canada in 2015 when thieves stole a shipping container loaded with \$10 million of silver from Montreal's port.

Looking at the highest areas of concern for cargo theft globally, Brazil, Mexico, India, the United States, and Germany are the top-ranking countries. Tactics used by thieves in these countries can vary, but in general cargo thefts tend to involve a higher proportion of truck

shipments over any other transportation modality. This is not to say that freight carried or intended to be taken by ship is excluded from the risk of cargo theft, as the incident in Canada demonstrates that the threat extends to these points in the supply chain, albeit at a lower rate. Often, cargo thefts that occur at port facilities, involve some element of corruption, with supply chain actors either participating directly or providing critical inside information to thieves.

warehouse facilities where these items are stockpiled may continue to face an increased risk of theft.

The Bigger Picture

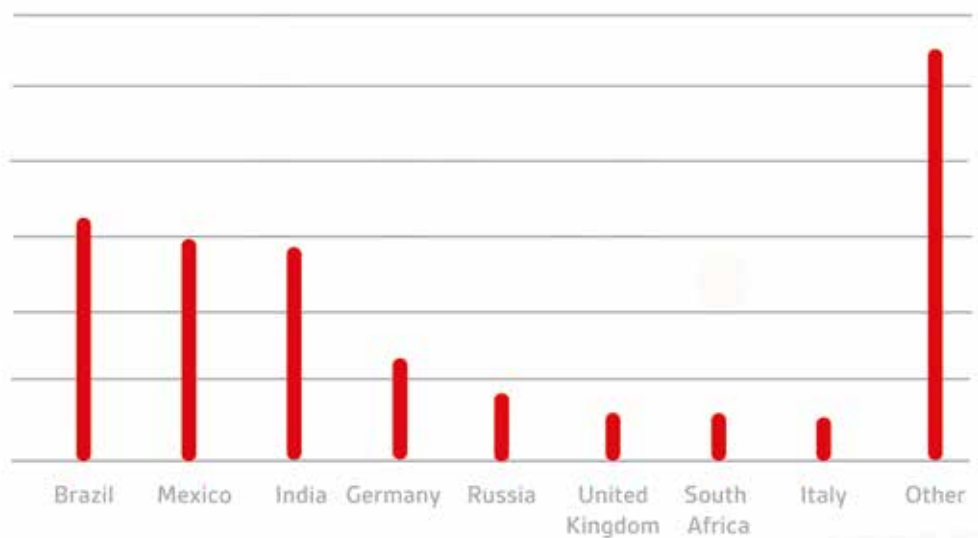
A resilient supply chain, effective in mitigating loss is often measured in loss ratios, compliance scores, on-time deliveries, and bottom-line cost savings. However, a truly resilient supply chain arguably means that an organisation's logistics infrastructure

Graphic: BSI 2021

Cargo Theft Trends Global 2020

Based on recent incident data via collaboration and partnerships with law enforcement, government, non-government, commercial partners, trade associations, open source media reports, and input from BSI advisors and expert consultants

Top Theft Locations 2020



BSI data shows that the top commodities stolen by criminals in 2020 were food and beverage and consumer projects. Criminals targeted new products due to their increased value during the pandemic, creating new vulnerabilities for organisations transporting these commodities and increasing the importance of securing their supply chain.

This past year, as a result of COVID-19 lockdowns and consumer demand for certain products, we witnessed strategies employed by thieves shifting. Specifically, BSI intelligence data identified increased targeting of food and beverage commodities and alcohol and tobacco, likely due to the increased value resulting from panic-buying, stockpiling, and shortages. Consumer products, such as hand sanitizer and cleaning supplies, and medical devices and supplies, including PPE, were targeted at elevated rates in many regions due to their high demand and subsequent shortages. As lockdowns continue into 2021,

and operations are not used as a conduit for criminal and corrupt activity and that shipping is done in a responsible manner, minimising risk to the business, operations, and employees.

The issue of cargo crime is just one challenge an organisation must face in any typical year. 2020 was far from a typical year. Due to COVID-19, supply chain resilience was pulled into the public eye to an unprecedented degree. Supply chain disruptions, including large cargo theft rates and added exposure for goods stockpiled in warehouses, were a chief concern for companies and consumers

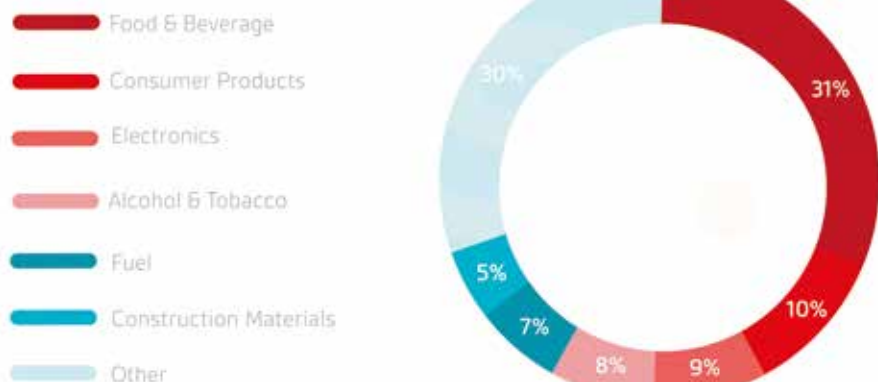
Author

David Fairnie is a senior security and risk management expert with extensive operational and commercial experience worldwide whose solutions positioned organisations as international leaders in supply chain security initiatives, including the US Megaports and Secure Freight Initiative non-proliferation programmes.

Cargo Theft Trends Global 2020

Based on recent incident data via collaboration and partnerships with law enforcement, government, non-government, commercial partners, trade associations, open-source media reports, and input from BSI advisors and expert consultants

Top Commodities Stolen



In 2020, the countries with the largest amount of cargo theft incidents were Brazil, Mexico, India, and Germany. While the types of cargo theft in these countries might vary, organisations should guard their supply chains in these countries against the risk of theft.

alike. With massive supply chain shortages around the globe for items critical to combatting the early spread of the virus, including medical masks, hand sanitizer and other essentials, the threat of cargo theft was at the forefront of concerns for organisations even more. Particularly those not used to experiencing as high of a risk - in comparison to industries like electronics, which due to the inherently high value, tend to be stolen frequently.

Early in 2020, the BSI SCREEN Intelligence team began noting cargo thefts of daily necessities in locations, like China and Hong Kong, where these types of crimes occur at a relatively lower rate compared to other cargo theft hotspots around the world. Organisations that moved swiftly to track the situation beginning to unfold

were at a much more significant advantage to mitigate losses. While the events of 2020 were unprecedented in the way that they impacted supply chains on a global level, the vital take-away is that the changing tactics, trends, and wilfulness of cargo thieves can have a significant rippling effect on supply chain resilience. Not only can there be a sizeable financial downside to theft, but the security of personnel, product, and reputation are all at risk when supply chains are exposed to vulnerabilities.

Mitigating the Risk

Organisations looking to reduce the risk of cargo crime in their supply chain need to primarily understand the varying type of

risk common to each country of operation. To build a supply chain that is ahead of the criminal tactics and trends, organisations should secure their supply chain by implementing specific security procedures dependent on the identified level of risk exposure, while concurrently providing appropriate awareness and training for staff. Organisations must also remain current on the primary trends in cargo theft risk and be aware of their evolving nature these take over time.

Looking at prevention, organisations needed to consider risk mitigation to cargo as it moved through the supply chain. Protecting cargo in transit can involve adding locks and seals to trailers, route risk analysis and training drivers to be aware of problematic routes. While at rest stops and parking locations, drivers should maintain strict protocols with monitoring their vehicles. To prevent occurrences of theft, organisations should invest in and deploy a combination of driver training and technology for monitoring cargo status. Warehouses and facilities storing and distributing high-value products should be more vigilant than ever with security protocols, as criminals are increasingly targeting these locations due to the lull in the flow of goods during the COVID-19 outbreak and lockdown cycles.

Overall, with cargo theft on the rise and a rapidly changing market for criminals, securing an organisation's supply chain against cargo theft is of the utmost importance. Identifying the threat of cargo theft globally and for an individual organisation, understanding the overall impact and significance of the risk, and taking appropriate and proactive measures to decrease these risks is the best way to ensure Organisational Resilience and combat cargo crime. ■

Graphic: BSI 2021

Photo: BSI/Getty Images



BSI's risk assessment mapping

Adapting Aircraft Carriers to F-35B Operations – A Progress Report

Peter Donaldson

Preceded only by the HARRIER and the Soviet era Yakovlev Yak-69, the Lockheed Martin F-35B LIGHTNING II is a member of a very exclusive club of jets to operate from carriers without catapults and arresting gear.

This it achieves with the aid of a thrust vectoring nozzle for the engine exhaust, a lift fan behind the cockpit that blows through a box containing movable vanes and a pair of variable area thrusters (known as roll posts) under the wings that provide roll control using compressor bleed air.

That vectored exhaust can damage any surface on which it impinges; even without the use of afterburner it can buckle deck plating and the structure underneath if it is not adequately protected. On the British Royal Navy's new carriers, QUEEN ELIZABETH and PRINCE OF WALES, for example, a coating protects the flight deck surface from exhaust gases at temperatures of up to 1,500 °C to which it is exposed when a jet is in the hover and making a vertical landing. Monitor Coatings, which developed the material, says that it is a compound of aluminium and titanium that is sprayed onto the deck in molten form and is intended to last for the vessels' 50-year design life.

In spite of this need to protect against heat damage, the F-35B arguably makes fewer and smaller physical demands on an aircraft carrier than a conventional jet of the same size and weight because it needs neither catapults nor arresting gear (although the ski-jump that enables short take-offs at greater weights is far from a trivial feature of a ship's deck). The F-35B's power-plant and flight control systems provide it with several alternative ways of launching from and recovering aboard an aircraft carrier. Short Take-Off and Vertical Landing, proven over many years of HARRIER operations, works particularly well aboard ski-jump-equipped vessels, allowing greater take-off weights. A standard vertical landing involves bringing the aircraft to a hover next to the deck and then translating sideways before briefly hovering once more and touching down. However, weight limits on vertical landings mean that aircraft might have to dump fuel and weapons.

Author

Peter Donaldson is a freelance writer focusing on aerospace, defence and technology.

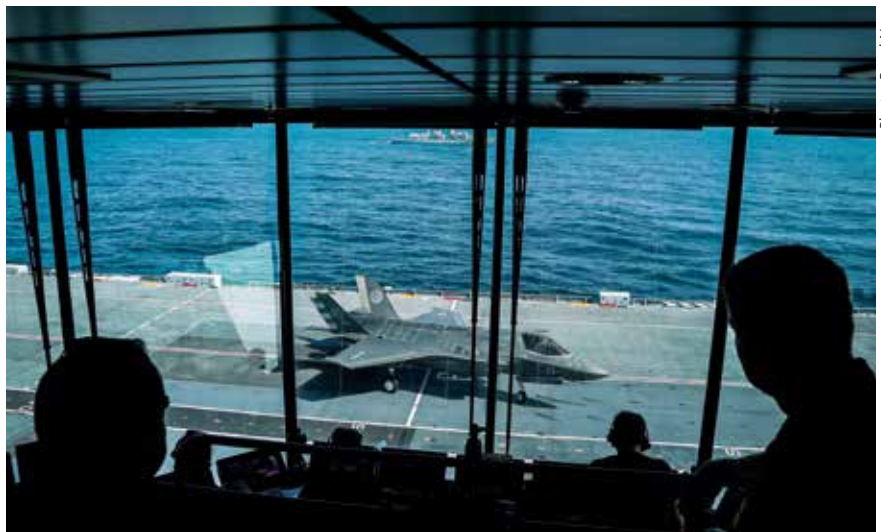


Photo: Royal Navy

Seen from the "flyco" aboard HMS QUEEN ELIZABETH, this USMC F-35B was pictured just after it made the first vertical landing of the type on the carrier.

This is why the British F-35B test team devised the Shipborne Rolling Vertical Landing (SRVL) technique, which was carried out for real for the first time in October 2018 by British pilot Peter Wilson after more than 2,000 practice landings in the simulator. The technique requires the pilot to make a conventional looking approach to the carrier at speed from astern while using a combination of wing lift and vectored thrust to bring it to a touchdown at a speed low enough to roll safely to a halt.

Make Room for ALIS, then ODIN

A major element of the total F-35 system that is not trivial to accommodate is the Autonomic Logistics Information System (ALIS). Every F-35 unit has an ALIS, which consists of a computer server system and terminals that form a Standard Operating Unit (SOU). A deployable version fits into

a standard shipping container. Integrating operations, maintenance, prognostics, supply chain, customer support services, training and technical data, ALIS is designed to be a single, secure information environment that provides users with up-to-date information through web-enabled applications on a distributed network. It is a complex and bulky system that has exhibited problems and is set to be replaced around the middle of the decade with the Operational Data Integrated Network (ODIN).

The US Marine Corps (USMC) has been exploring shipboard LIGHTNING II operations since 2015 and has tested the new Lightning Carrier concept under which up to 13 of these jets have flown from its WASP (LHD-1) class and AMERICA (LHA-6) class amphibious assault ships. These vessels reportedly lack the command and control capabilities needed to exploit the data the LIGHTNING II's sensor suite can generate. Accordingly, the USMC is considering oper-



Photo: Royal Navy

Final approach during the first ever Shipborne Rolling Vertical Landing (SRVL) in October 2018. SRVL allows the F-35B to land on-board carriers at higher weights.

ating SAN ANTONIO (LPD-17) class amphibious transport docks in cooperation with the Lightning Carriers because they have much more sophisticated C2 systems. F-35s are fifth generation jets that principally communicate over the stealthy Multifunction Advanced Data Link (MADL). However, most US allies use Link-16 that is not designed to handle certain 5th generation information. Solutions to most of this problem include gateway translation systems aboard airborne warning and control aircraft or the GLOBAL HAWK high-altitude long-endurance UAV. However, direct translation of messages into Link-16 format within MADL systems has been demonstrated.

Preparing the Queen

A number of other firsts for the British carrier programme preceded the October 2018 SRVL trial. During a deployment off the US

eastern freeboard in the autumn of that year by QUEEN ELIZABETH, the first F-35B deck landings on the Royal Navy carrier were completed on 25 September followed by the first night landings a few days later. Shortly afterwards, the first weapon launches from an F-35 operated from the carrier took place using inert PAVEWAY II laser guided bombs assembled from kits aboard the ship. QUEEN ELIZABETH returned to the US east coast in the autumn of 2019 to work up with RN/RAF and USMC F-35Bs, testing aircraft, aircrew and shipboard support crew in realistic war fighting scenarios as a cohesive carrier strike group that also included a Type 45 air defence destroyer, a Type 23 frigate, a tanker, MERLIN and WILDCAT helicopters. The group was also joined by other US Navy, Air Force and Marine Corps units.

One milestone was the attachment of a full 22,000 lb weapon load to the jet aboard the carrier for the first time, which included inert PAVEWAY bombs and Advanced Short Range Air-to-Air Missiles on external pylons and in the internal bay. This allowed "bomb-head" air engineer technicians to exercise the carrier's Highly Mechanised Weapon Handling System. Remotely controlled "moles" carry weapons on pallets along tracks and via lifts to preparation areas or the hangar. Prepared weapons are then moved on another set of lifts to the flight deck and wheeled to the aircraft. The aircraft launched from the carrier to practice dropping weapons.

The exercise culminated in the launch of four F-35Bs from QUEEN ELIZABETH's deck within seconds of each other.

Early 2020 saw the carrier in the North Sea, with four F-35Bs completing night landings as part of joint RN/RAF operational conversion unit 207 Squadron's qualification of

aircrew and landing signals officers. Despite postponement of operational sea training for COVID-19 testing, ship and crew were ready by 18 July, enabling 617 Squadron, the first operational UK LIGHTNING-II unit, to take part in Exercise Crimson Ocean 2020. Here, the F-35Bs mounted combat air patrols involving simulated combat against RAF TY-PHOONS, practice strikes against simulated targets ashore and aerial refuelling.

This paved the way for participation in the overlapping GroupEx 2020 and Joint Warrior/Griffin Strike 2020 from September into October. With F-35Bs from USMC squadron VMFA-211 in addition to those from 617 Squadron, 15 jets operated from QUEEN ELIZABETH and dropped live weapons for the first time on Scotland's Cape Wrath Weapons Range.

Initial Operational Capability (IOC) was expected to be declared around the end of 2020 and was formally announced on 4 January 2021.

International Observers

Other navies are watching these developments with close interest. These include Italy, whose carrier CAVOUR came out of a 16-month overhaul and refit in early May 2020 to equip the vessel to operate and support the aircraft. The refit notably included a thermal coating to protect the deck. Cavour can accommodate a maximum of 16 F-35Bs, with 10 in the hangar and six on deck. The Italian Navy plans to acquire 15 of the type (another 15 will be operated by the Italian Air Force) with an IOC scheduled for 2024.

Japan is to upgrade its two IZUMO class helicopter carriers to operate the type, having announced its decision in late 2018. Initial work on the IZUMO was reported to be in progress by July 2020. Elsewhere in the Asia-Pacific region, South Korea reportedly plans to acquire 20 F-35Bs for its future LPX-II light aircraft carrier, which is expected to displace between 30,000 and 35,000 tonnes. However, suggestions that Singapore's future Joint Multi-Mission Ship could embark the 12 or so F-35Bs that the nation is acquiring are thought to be largely speculative.

Australia's amphibious assault ships CANBERRA and ADELAIDE are other speculative contenders for F-35B operation, although a more likely possibility is the Spanish JUAN CARLOS I, which was the model for the Australian ships and already operates HARRIERs. With an eye to interoperability with the RN and other F-35B operators, a French parliamentary report published in October said that studies are underway to analyse the implications of including a dedicated landing spot on its future aircraft carrier. ■

Photo: Italian Navy



The Italian Navy aircraft carrier CAVOUR completed a refit to allow the ship to operate the F-35B in the course of 2020.

AGÉNOR's View: from a Danish Frigate's Bridge in the Strait of Hormuz

Hans Uwe Mergener

The Danish frigate HDMS IVER HUITFELDT returned to her base on 10 December 2020 after a four-month deployment to Arab peninsular waters. From late August to late November 2020, it joined Operation AGÉNOR the military pillar of the European Maritime Surveillance Mission in the Strait of Hormuz (EMASOH).

This European-led mission's goals include: assessing situations independently; monitoring maritime activities; and, guaranteeing freedom of navigation in the Persian Gulf and the Strait of Hormuz, which connects the Persian Gulf to the Gulf of Oman and onto the Arabian Sea and the Indian Ocean. The Strait became a potential choke point for shipping in circa June 2019 when a multilateral "denuclearisation" agreement with Iran collapsed with the US withdrawal from the treaty. The Strait is close to Iran's territorial waters and has a width of only 21 nautical miles (39 km) separating the United Arab Emirates and Oman from Iran. Extra-regional ships (European) were in particular danger of being detained indefinitely by Iranian maritime patrols as these ships passed through this narrow, strategic seaway that eventually leads to many vital commercial and industrial destinations.

Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Portugal are taking part in Operation AGÉNOR as a maritime security initiative to ensure safe transit and freedom of navigation for merchant shipping. While force generation seems to be an issue for EMASOH, there are three nations contributing sea-going assets: Denmark, France and the Netherlands - also France contributed maritime patrol aircraft for intermittent missions. EMASOH is headquartered in the French military base in Abu Dhabi.

During the three months of Operation AGÉNOR, IVER HUITFELDT patrolled in designated waters and conducted numerous tasks in and around the Strait of Hormuz. An essential aspect of this mission is to establish a surface situational picture and recognise traffic patterns in order to identify anomalies that could indicate illegal activities or hostilities. IVER HUITFELDT logged long patrol periods weighed against comparatively short port periods for rest and replenishment. The ship's company was complemented by three



Photo - EMASOH

A view of the Danish frigate IVER HUITFELDT escorting the tanker TORM RAGNHILD as seen from a helicopter gunship

organic helicopter plus a detachment of the Frømand-Korps, a special forces unit. Beginning in early 2021, Denmark takes command of the Force Headquarters in Abu Dhabi. Commodore Carsten Fjord-Larsen, Deputy Commander Royal Danish Navy,

was assigned to this task. When coupled with the appointment of a Senior Civilian Representative - Ambassador Julie Pruzan-Jørgensen - to the mission, the strength of Denmark's commitment to maritime security is clear.



Photo: Danish Defence/Emma Kjærside

Commander s.g. Kim Nybo Skjødt became the Commanding Officer of HDMS IVER HUITFELDT and Division Commander in 2020. To his credit he was decorated as Knight of the Dannebrog Order and awarded both a Medal of Honor, serving the Navy for 25 years (2010) and a Medal for participation in Operation AGENOR (2020).

Maritime Security & Defence (MSD) magazine recently spoke with Cmdr (s.g.) Kim Nybo Skjødt, the Commanding Officer of HDMS IVER HUITFELDT.

MSD: What is the background for Denmark's participation in Operation Agénor?

Skjødt: Denmark's participation with the frigate HDMS IVER HUITFELDT was based on a parliamentary resolution with a strong mandate in the spring of 2020. As the world's fifth largest maritime nation, the right to free navigation is of crucial importance to Denmark. Danish merchant ships sails through the Strait of Hormuz on a daily basis and therefore constitute an important source of employment and prosperity for Denmark.

In light of the security incidents in the Strait of Hormuz in 2019, France took the initiative to establish a maritime surveillance mission in the Strait of Hormuz. The mission aims to

protect freedom of navigation, ensure coordination between partners in the area and contribute to de-escalation through presence on both sides in the strait. Through increased international presence and monitoring, the mission is intended to reduce the risk of more of the type of incidents that took place in the summer of 2019.



Dane-by-Dane, IVER HUITFELDT escorts the merchant ship ESTELLE MAERSK.

EMASOH Participation (%)



It was thus an obvious task for the Danish Navy, and IVER HUITFELDT sailed from Denmark on 10 August 2020 with a view to join this classic naval task.

MSD: How did you and your crew prepare for the operation?

Skjødt: IVER HUITFELDT was on high alert in 2020, and the general training level was equivalent. There was therefore a primary need to focus the mission preparation training by integrating the external sub-contributions (helicopter crew, special forces, etc.). In addition, it was obvious to train strait crossing. For that purpose, we used the inland Danish waters and straits. This gave a very realistic scenario, where also various input from other units and role players provided good training in the legal considerations that could be foreseen in the Strait of Hormuz. After intense mission preparation weeks at sea in the summer of 2020, IVER HUITFELDT was ready to begin the transit to the area of operations.

MSD: How do you assess Operation AGÉNOR'S success from the IVER HUITFELDT perspective?

Skjødt: The operation seems to live a "quiet" life, there is not much publicity on a larger scale. It can also be categorised as a "success", as there have been no significant security incidents since the operation started in 2020.

AGÉNOR is a mission at the 'soft' end of the conflict scale. The task itself and the geography are somewhat reminiscent of the coastal environment in Danish waters. The task is thus an uncomplicated task for a highly certified frigate.

The operation can generally be categorised as a simple task in a very complex environment. I was very aware that a possible mistake on my tactical level or other misinterpretations among the actors at sea and in the air could ultimately have military consequences and strategic implications.

This mentioned, we did not actually see any activities we had not been prepared for. And

after about a month in the area, we had a very clear picture of the pattern of life and could gradually begin to anticipate movements and activities.

I foresee that this successful European mission – and I say this even though some of the member nations still have not participated with ships or aircraft – could lead to other case-by-case European missions in the future. In this context it will be important that one or more members of a mission already have a kind of a footprint in the specific region. This will make all the infrastructure setup smoother – just like the French facilities in Abu Dhabi for the EMASOH mission.

MSD: What are the lessons learned?

Skjødt: Due to the complexity of the area and the fact that an actual military confrontation cannot be ruled out, it should be maintained to deploy actual combat units with a high degree of self-defence for operations in the Strait of Hormuz or the Persian Gulf in general.

The countries around the Strait of Hormuz clearly demonstrated that they distinguished between EMASOH units and units from other missions in the area. They appeared polite and professional.

The cooperation within our task force was uncomplicated. It was a kind of 'plug and play' since we used to operate together in other contexts. Using a French naval base in Abu Dhabi was also an important pre-condition for both the staff and the ship's logistics. Other lessons learned – besides the challenge with the force flow – I could have wished for even more strategic communication, both to the entire world in general, but also specific to the merchant shipping units operating in the area. Also, more interaction and cooperation with other local actors could be prioritised, but I know that these topics are well-known by the force headquarters.

My overall conclusion from the tactical level is clear: it has been an easy and successful mission with very good cooperation within the task force.

MSD: Cmdr Skjødt, thank you. Fair winds and following seas.

The questions were asked by Hans Uwe Mergener



IVER HUITFELDT alongside her French counterpart LANGUEDOC (a French FREMM type frigate)

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