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War in Europe

On 24 February 2022 at 0330hrs CET, the Russian air force attacked airfields in Ukraine. In the early hours of the morning, ground troops also invaded eastern Ukraine "to prevent a genocide of the Russian population in the Donbas", as Putin stressed in a press statement.

Quote from German Chancellor Olaf Scholz's speech to the German Bundestag on 27 February: "We will set up a 'Special Fund of the Bundeswehr' for this purpose. The 2022 federal budget will provide this special fund with a one-off sum of €100Bn. We will use the funds for necessary investments and armament projects. From now on, we will invest more than two percent of the gross domestic product annually in our defence."

"We must not be naïve" was a phrase uttered by German Chancellor Olaf Scholz several times during the 2022 Munich Security Conference. He had had to endure a history lecture during his visit with Russia's President Putin. From this Putinian view of history it was probably clear that the President in Moscow is bitterly serious about his threats against Ukraine.
We must not be naïve: Putin's negotiation scenario was so infamously constructed that the only possible outcome was that which was announced on 21 February: recognition of the two micro-states on the territory of Ukraine, which led to the marching orders for his troops in the morning of 24 February. The demands he made of the Western world were not supposed to be achievable. That is why he formulated them in such a way that the West could not accept them. And the offers to negotiate arms control and confidence-building measures could only produce a weary smile in Moscow: All agreements of this kind that exist or existed have been violated by Russia in recent years. The only unfortunate thing is that Donald Trump's USA in particular terminated agreements because Russia did not comply with them. That was understandable, but now it is good for Russia in terms of propaganda.
And another thing is striking: Putin's tone has become increasingly strident since a democratic movement brought the Lukashenko regime to the brink of losing power in Belarus after the rigged presidential elections of 2020.
Putin's decision brings a question into the focus of political discussion: What is international law actually worth? What is the value of treaties that have been agreed? The events of Monday, 21 February 2022, have finally turned international law into fair-weather law. An unscrupulous, brutal acting Russian President, dreaming of old glories, makes the creation of new frontiers the defining characteristic of his regime, dismissing the norms of international cooperation and rejecting the international rule of law.
21 February 2022 is the day when rules-based foreign and security policy came to an abrupt end, at least for the time being. Russia, a permanent member of the UN Security Council, which has thus far benefitted from these rules, recognises two mini-states that are not independently viable. Putin created the two entities through his "insurgents". They belong to Ukraine "under international law".
Russia snatched the Soviet Union's nuclear weapons from Ukraine with the promise that Russia would ensure Ukraine's territorial integrity in the long term. Where would we be today if Ukraine had not signed this treaty, and had kept its nuclear weapons?
And then, after recognising these two small states, he sends troops into them to address a threat that does not even exist. Ukraine has declared that - as agreed in Minsk at the time - it will grant the two provinces special status, that is, it will not station its own troops there. Special status in the state of Ukraine, of course, not in the state of Russia. There was no military threat to Ukraine – according to Russian narrative. Those who ask for help but are not in need of it have other things on their mind.
We can easily imagine how the scenario will continue. The two separatist leaders, who are now heads of state by Russian grace, will soon realise that their "states" are not viable. They will then apply to be allowed to join the Russian Federation. But perhaps by then they will have already been "integrated" by way of conquest.
The West reacts with sanctions. At the time this issue went to press, it was not yet clear which ones. A catalogue had long been agreed upon, they said in Munich. Nevertheless, consultations have begun. It is right and important to take action against Russia with massive sanctions.
But we must not be naive: Putin is not interested in these sanctions. He goes his own way, regardless of how his people are doing. He has a a self-image that puts him on a par with Lenin and Stalin. Are his methods so different?
We are witnessing a phase in history in which a determined politician goes his own way – without regard for the international community, without regard for international law, without regard for all the treaties and agreements the country has signed. The law of the strongest prevails.

Rolf Clement
Rolf Clement is the Editor-in-Chief of our German sister journal Europäische Sicherheit & Technik

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Tesat Expands Production in the USA

(gwh) Tesat-Spacecom, a provider of optical communications technologies for space, is expanding its manufacturing facility in the US to support its US Government and commercial customers, the company has announced.

Photo: Tesat

Tesat's Optical Communication Terminals (OCT) have achieved more than 500,000 hours of operation in space, the company said.

OCT are miniaturised systems for high data rate transmission between satellites and from satellites to ground stations. 100 Gbps terminals are under development. In the USA, a production rate of 160 OCT per month is to be achieved on 25,000 m² from 2023.

Russia's Rubin Establishes a Marine Robotics Centre

(yl) Russia's Rubin has established Marine Robotics Centre. The Centre, which commenced work in Kronstadt, is intended to design, manufacture and test autonomous unmanned underwater vehicles. The facility is capable of simultaneous assembly of underwater vehicles of various sizes: extra-large, large, medium and small underwater vehicles.

Photo: CDB ME Rubin

Rubin has purchased several facilities from Kronstadt Marine Plant. The plan to develop a marine robotics centre was approved by the United Shipbuilding Corporation as well as St. Petersburg Administration and a new production cycle was organised in 2017. Housing of the production and test facilities on the same premises is expected to considerably reduce time and resource expenditures. The project is funded by Rubin from internal resources.

The Marine Robotics Centre comprises three manufacturing areas including two assembly jigs, as well as testing facilities and quality control units. The Centre will employ about 100 designers and production workers. It will also serve the interests of other industrial partners of United Shipbuilding Corporation - robot prototypes can be manufactured in accordance with ship designs.

Rubin develops robot-based underwater systems in a fully digital environment, which speeds up the computational analysis, reduces concept-to-delivery time and makes it possible to have nearly zero rejects during manufacture and assembly of a vehicle.

Rubin has been working in the field of underwater robotics for 10 years and has designed and constructed, among others, the VITYAZ-D deep-water vehicle (for the Advanced Research Foundation) - the world's first UUV that worked in the Mariana Trench -, small UUVs and the AMULET and TALISMAN families of small robots. Rubin has also designed unmanned underwater gliders and a system for under-ice seismic surveys.

Patria and Pratt & Whitney to Deepen Cooperation

(jh) Patria and Pratt & Whitney have signed a Letter of Intent to deepen their ongoing cooperation related to the F100-PW-220/220E and F100-PW-229 military jet engines operational in the F-16 and F-15 combat aircraft, Patria writes in a press release. The aim is to maintain and develop the existing relationship in support of maintenance, repair and overhaul logistics for worldwide F100 customers.

In addition, there is a joint intention to further work toward Patria becoming a part of Pratt & Whitney's F100 global sustainment network and become a logistic support supplier including F100 maintenance, repair and overhaul. The Parties have established a working group targeting a long-term co-operation strategy and agreement within 2022.

Naval Group and PT PAL Strengthen Cooperation

(jh) Pierre Eric Pommellet, Naval Group's Chief Executive Officer and Kaharuddin Djenod, PT PAL's Chief Executive Officer have signed a Memorandum of Understanding in presence of General Prabowo Subianto, Indonesian Minister of Defence and Florence Parly, French Minister of the Armed Forces, Naval Group writes in a press release. The intention is to leverage the capabilities of both partners to meet the growing requirements of the Indonesian Navy against the background of Indonesia's intention to acquire two SCORPENE type submarines. The submarines would be built in Indonesia based on transfer of technology by Naval Group. Both companies also intend to open a joint R&D centre involving other Indonesian companies.

Photo: Naval Group

Hanwha and IAI Ready to Collaborate

(jh) Israel Aerospace Industries (IAI) and Hanwha Systems have signed a Memorandum of Understanding (MoU) to market combat suites for naval platforms to customers around the world and specifically across Asia, IAI writes in a press release. In the context of the MoU, IAI and Hanwha Systems C will establish a steering committee to direct and monitor the progress of the collaboration.

Photo: IAI

First Sea Trials of FREMM DA LORRAINE

(jh) On 22 February 2022, Naval Group started the first sea trials of the FREMM DA LORRAINE, the company writes in a press release. LORRAINE is the eighth FREMM to be delivered to the French Navy and second with enhanced air defence capabilities (FREMM DA) and has been built on order to the Organisation for Joint Armament Co-operation (OCCAR), on behalf of the French Procurement Agency (DGA) and the French Navy. The initial sea trials are expected to enable the performance of the ship's propulsion

Photo: Naval Group

and navigation systems to be tested. Several campaigns will then be carried out to test all the systems. FREMM DA LORRAINE will then be delivered by the end of the year.

Bell Begins Production on Czech Republic Ah-1Z

(jh) Bell Textron has started production of the first AH-1Z VIPER for the Czech Republic at Bell's Amarillo Assembly Center, the company writes in a press release. The production of the VIPER joins UH-1Y production as part of the Czech Republic Foreign Military Sale (FMS) of mixed fleet aircraft.

Bell's work beyond aircraft manufacturing includes building a flight training device for the Czech Republic. Bell began production on the Czech Republic UH-1Y in 2021, marking the first production for an international operator of this type of aircraft. The Czech Republic's purchase of both the AH-1Z and UH-1Y takes advantage of the 85 percent commonality between parts and enabling mission capabilities between both aircraft.

In addition to the Czech Republic, Bell is actively producing AH-1Zs for the US Marines Corps and the Kingdom of Bahrain. In total, the H-1 programme is on track to produce 217 AH-1Zs and 168 UH-1Ys, with more than 100 consecutive H-1s delivered on time for the USMC and FMS customers.

Photo: Bell

Airbus and OCCAR Sign EURODRONE Contract

Airbus and the Organisation for Joint Armament Co-operation (OCCAR) have signed the EURODRONE global contract, which

Photo: Airbus

includes the development and manufacturing of 20 systems and 5 years of initial in-service support, Airbus writes in a press release. Industry prime Airbus Defence and Space GmbH signed in representation of the three Major Sub-Contractors (MSC) Airbus Defence and Space S.A.U in Spain, Dassault Aviation in France and Leonardo S.p.A. in Italy, while OCCAR has signed on behalf of the four launch nations Germany, France, Italy and Spain.

British-French Development of Missiles against Land and Sea Threats

(gwh) With an intergovernmental agreement and development contracts, the procurement agencies Direction générale de l'armement (DGA) from France and the UK's Defence Equipment & Support (DE&S) have settled the preparatory work for the Future Cruise / Anti-Ship Weapon (FC/ASW) programme.

Photo: MBDA

As MBDA has announced, the preparatory work will focus on the coordinated development of a programme of next-generation deep-strike and heavy anti-ship weapons. Two complementary missile concepts are being examined for possible deployment from the end of the decade: a subsonic concept with low observation capability and a supersonic concept with high manoeuvrability. This would be based on French and UK requirements leading to new capabilities to combat land-based and maritime threats, hardened targets and air defence systems at very long ranges and in increasingly contested battlefields.

MBDA sees itself as particularly suited to this development mission. Firstly, because the company is a joint venture with French and British shareholders. Secondly, MBDA has development and production capacities in both countries.

Airborne Launch of a UAV from an A400M

(gwh) A drone was successfully launched from the rear of an A400M transport aircraft during a flight test conducted by a joint flight test team of members of the German armed forces and Airbus, Airbus has announced. During the test over a training area in northern Germany, the Airbus Do-DT25 drone was landed safely with a parachute.

In the development of the Future Combat Air System (FCAS), support for combat aircraft by unmanned drones is a core capability. Transport aircraft such as the A400M can bring the unmanned aerial systems to

Photo: Airbus

the area of operations and - as the test has shown - make them available there from the air. These so-called remote carriers, in cooperation with manned combat aircraft (Manned-Unmanned Teaming, MUM-T), are to open up new tactical possibilities to surprise, deceive, deter, saturate and attack opponents.

Acting as a stand-in for a long-range guided missile during the test flight, the Do-DT25 was connected to the A400M mother aircraft via Modular Airborne Combat Cloud Services (MACCS) delivered by Airbus for data exchange throughout the flight, Airbus writes. This is said to be an illustration of the Combat Cloud Network, in which both information and control commands are to be distributed centrally in the combat aera for use by FCAS.

The A400M is expected to be able to carry 40 or more remote carriers in its cargo bay. This would allow the transport aircraft to carry enough remote carriers to the battlefield to enable FCAS to perform multiple missions. The A400M is to be validated as an airborne launch platform for remotely piloted aircraft carriers to deploy this large

number of drones. The next flight test is planned for later this year.
Airbus said it had already demonstrated the first successful application of MUM-T with operational military aircraft in Europe in June 2021 during the TIMBER EXPRESS exercise with the German Air Force. In this exercise, a Eurofighter TYPHOON networked with two Do-DT25 drones and controlled them in real time,
Previously, Airbus also demonstrated the control of five Do-DT25 drones by a mission group commander who was airborne in a manned command and control aircraft. Validating such elements, as connectivity, human-machine interface, and the concept of teaming intelligence through mission group management, also constitute key steps towards using Remote Carriers as force multipliers within the Future Combat Air System.

Rafael's C-DOME Completes 1st Interceptions from SA'AR 6 Corvettes

(jh) Rafael Advanced Defense Systems, the Israel Missile Defense Organization (IMDO), in the Directorate for Defense R&D of the Israel Ministry of Defense, and the IDF have

Photo: Rafael

completed a successful series of live-fire tests of the C-DOME system - a naval configuration of the IRON DOME air defence system, Rafael writes in a press release. The C-DOME was operated for the first time aboard the Israeli Naval Ship (INS) SA'Ar 6 MAGEN corvette against multiple threats. Crew members of the INS MAGEN led the C-DOME tests.
The test campaign consisted of a number of scenarios simulating advanced threats, including rockets, cruise missiles and UAVs. According to Rafael, C-DOME is capable of successfully intercepting such threats.

DIMDEX 2022 Official Diplomat Briefing

(jh) As the countdown begins for the seventh edition of the Doha International Maritime Defence Exhibition and Conference (DIMDEX), the organising committee provided an update on the preparations and an overview of the event at a diplomat briefing session at Sharq Village and Spa on 21February.

Photo: DIMDEX

According to the organisers, DIMDEX 2022 is shaping up to be the biggest and most diverse edition ever, with more than 200 companies from nearly 20 countries set to showcase their products and capabilities. The biennial event, held under the patronage of HH Sheikh Tamim bin Hamad Al-Thani, the Amir of the State of Qatar, and hosted and organised by Qatar Armed Forces, will take place from 21 to 23 March 2022 at the Qatar National Convention Centre (QNCC) under the theme 'Connecting the World's Maritime Defence and Security Community.'
An overview of the progress DIMDEX has achieved over the past editions was presented to the diplomats and other high-level delegates in attendance at the briefing session. The DIMDEX Organising Committee also shared details on various aspects and attractions of the upcoming edition: the main exhibition, the Middle East Naval Commanders Conference (MENC), the Visiting Warships Display at Hamad Port, as well as the opportunity to network with VIPs and senior defence decision-makers comprising Ministers of Defence, Chiefs of Staff, Chiefs of Navies, Coastguard Commanders, and heads of defence industries who will be attending DIMDEX 2022.
Ministry of Public Health officials and Qatar Armed Forces Medical Services representatives provided details of the medical preparedness plan in place for the event, including COVID-19 health and safety protocols. Details on the hospitality and services for Official VIP delegations were also shared with the Diplomats, along with insights on the logistics and security for visiting warships that will be hosted at Hamad Port. DIMDEX 2022 visitors will get a chance to get up close with an array of warships from navies around the world. While DIMDEX 2018 featured nine warships from seven countries, the organising committee expects to have 15-20 warships in the upcoming edition.

AeroVironment Awarded PUMA LE FMS Contract

(jh) AeroVironment has announced it received a US$10,534,348 firm-fixed-price US Department of Defense Foreign Military Sales (FMS) contract award on 21 January 2022. The contract includes the delivery of PUMA LE small Unmanned Aircraft Systems (UAS) over a six-year period to an allied nation, as well as add-on

Photo: AeroVironment

air vehicle kits, initial spares packages, training and support.

Weighing only 23.5 pounds (10.7 kg), the ultra-lightweight PUMA LE is hand or bungee launchable. The aircraft comes equipped with the MANTIS i45 gimbaled EO/IR sensor suite and secondary payload bay with dedicated power supply and Ethernet for a total payload capacity of 5.5 pounds (2.5 kg). According to the company, on-board batteries provide up to 6.5 hours of flight endurance with an operational range of 37.2 miles (60 km) when used with AeroVironment's Long-Range Tracking Antenna (LRTA) and PUMA SMART 2500 battery.

Netherlands to Procure Smart Shooter SMASH AD

(Kristóf Nagy) The Dutch Armed Forces are procuring the SMASH AD fire control system from Israeli company Smart Shooter after successful trials, the company has announced. Reportedly, the systems are designed to increase the ability to defend small drones at the lower tactical level.

The SMASH fire control system has been developed for handguns of different calibres. The system uses a combination of electro-optical hardware, integrated image recognition software and a ballistic computer. According to the manufacturer, SMASH AD - the AD stands for Anti-Drone - offers different target acquisition and tracking modes, optimised for targets such as UAVs. With integrated position stabilisation, the targeting device can be successfully used against both static and dynamic targets. In addition, the shooter is supported in target detection as well as tracking even with limited visibility. This is especially true for very small drones.

Photo: Technische Bureau H.A. Muller via Smart Shooter

Back in October 2020, the Dutch Ministry of Defence announced that the Dutch Armed Forces had conducted successful tests with the SMASH system, mounted on the Colt C7 assault rifle in 5.56 x 45 mm calibre, as a means of drone defence. Representatives of both the Army and the Dutch Air Force took part in the tests. Further tests followed in the Austrian high mountains in January 2021. The aim was to have individual gunners engage various small unmanned aerial vehicles (UAVs) under conditions that were as realistic as possible. This two-day test was also extremely successful.

Sale of ABRAMS MBTs for Poland Approved

(gwh) The US State Department has approved the possible sale of M1A2 SEPv3 main battle tanks and associated equipment to the Polish Government for an estimated price of US$6 Bn, according to the Defense Security Cooperation Agency (DSCA). The Polish Government had announced its request in July 2021.

Photo: GDLS

According to the DSCA, the Polish Government's application under the Foreign Military Sales (FMS) procedure includes 250 ABRAMS main battle tanks in the latest M1A2 SEPv3 version, 26 M88A2 HERCULES armoured recovery vehicles, 17 M1110 armoured bridge layers on M1A1 chassis and 15 spare engines. In addition, there are IED defence systems, machine guns as secondary armament and remotely controllable weapon stations, almost 30,000 rounds of tank ammunition of various types, workshop and spare parts equipment, simulators for crews and logisticians as well as support in training and logistics.

Poland wants the first battle tanks to be delivered this year. The Polish Army currently uses LEOPARD 2 A4 and A5 main battle tanks, which are undergoing performance upgrades, and T-72 and PT-91 from the Soviet era that are to be replaced.

Continued Development of the French CAESAR 6x6 Artillery System

(gwh) The Direction Générale de l'Armement (DGA) has selected Nexter as prime contractor for the development of the CAESAR 6X6 Mark II new generation (NG) artillery system. According to a Nexter statement, the new system is expected to enter production at the end of a four-year development and qualification phase. In 2024, the company expects a decision whether 109 CAESAR 6x6 Mark II systems will be produced or whether 33 new systems will be produced and 76 existing CAESAR systems will be retrofitted. In any case, the artillery regiments of the French Army are to have 109 systems with the new scope of performance from 2031 onwards and will be subject to logistic support for a period of two years.

Image: Nexter

The basis is the CAESAR 6x6 system on a Renault Sherpa chassis introduced into the French armed forces in 2000. The export version has a Unimog U 2450 6x6 chassis. Weighing less than 18 tonnes, the system can be deployed in transport aircraft such as the C-130 and A400M. According to Nexter, CAESAR 6x6 systems have been used in operations since 2009 and have collectively fired more than 100,000 rounds.

While the weapon system with the 155mm gun with 52 calibre lengths is to remain unchanged in configuration, crew protection and mobility are to be brought to a new level, Nexter describes the objective of the development. Accordingly, Arquus delivers a new chassis with an engine that, at 340 kW, has more than twice as much power as its predecessor. The vehicle will have a new automatic transmission. Nexter will provide a cabin protected against mines, improvised explosive devices and small-calibre ammunition. The cabin is prepared to accommodate the new CONTACT radios as well as BARAGE jammers.

Switzerland Orders Rheinmetall's MASKE 76mm Smoke/Obscurant Cartridges

(jh) The Swiss procurement authority armasuisse has awarded a contract to Rheinmetall

Image: Rheinmetall

to supply a new generation of the MASKE 76 rapid smoke/obscurant cartridge, known in Switzerland as the "7,6cm Nebelpatrone 21 mit elektrischer Zündung", or "7.6cm Smoke/ Obscurant Cartridge with Electric Fuse", Rgeinmetzall writes in a press release.. The order is worth a figure in the mid-two-digit million-euro range. A pilot lot is due to undergo acceptance testing starting in November 2022. Delivery of the final lot is expected to take place in August 2027. The contract was awarded following a competitive bidding process. According to Rheinmetall, the order will keep the MASKE production unit at Rheinmetall's plant in Neuenburg am Rhein in Baden-Württemberg working at high capacity for years to come.

Issued at the end of 2021, the order heralds the Swiss Army's replacement of the MASKE-C predecessor generation after a roughly 25-year service life with a new product. An additional contract was concluded for conducting periodic test firing during the entire lifespan of the smoke/obscurant shells.

MASKE 76 is designed to be fired from tactical vehicles as a force protection measure. The MASKE family is based on a bimodular, bispectral ammunition concept. It consists of two rapid reaction decoy modules that generate an intensive blooming effect using proven deception technologies. Moreover, a long-lasting decoy module employs visible and infrared smoke/obscurant to interrupt the enemy line of sight in the visual and infrared spectrum.

LYNX Family Expanded by LYNX 120 Fire Support Variant

(gwh) Following the infantry combat and combat support vehicle, Rheinmetall has now introduced a mechanised fire support variant of the LYNX infantry fighting vehicle. The variant is called LYNX 120 with the 120mm smoothbore gun derived from the LEOPARD 2 as main armament.

The vehicle combines a scalable large-calibre turret concept and the 120mm armament with the modular chassis of the LYNX KF 41, writes Rheinmetall.

Rheinmetall sees the LYNX 120 as an suitable complement for users of the LYNX platform with a balanced mix of firepower, mobility and protection. The modular design of the family concept allows the use of standard components, thus offering weight reduction. The vehicle architecture has been simplified and provides an open 'plug-and-play' capability for future upgrades, including protection, while remaining compliant with and potentially compliant with NATO standards, the company emphasises.

PHOTO: Rheinmetall

The 120mm smoothbore gun is capable of firing the new DM11 programmable multipurpose ammunition. It is complemented by a coaxial machine gun and an independent weapon station for the commander with .50 calibre machine gun. A 360° camera system with automatic target detection and tracking isa part of the vehicle's sensor fit

Protection modules are available for protection against ballistic threats, Improvised Explosive Devices (IED), Explosively Formed Penetrators (EFP) and artillery fire. The LYNX 120 will be the first armoured vehicle to feature Rheinmetall's Active Defence System (ADS) as a standard equipment item.

Hensoldt to Deliver IFF Technology to South Korea

(jh) Hensoldt has been awarded two contracts worth approximately €10M by the Korean defence company LIG Nex1 to deliver 20 MSSR 2000 ID secondary radars including test equipment and related services. The IFF systems will be integrated with a number of coastal surveillance and air surveillance radars to improve their ability to distinguish hostile from friendly forces (identification-friend- or-foe, IFF), Hensoldt writes in a press release.

Image: Hensoldt

IFF systems, so-called secondary surveillance radars (SSR), identify aircraft by automatically sending interrogation signals which are answered by so-called transponders on-board friendly aircraft. Thus, IFF enables field commanders to quickly distinguish friendly from hostile forces and helps avoiding friendly fire incidents. Unlike Mode 4 used hitherto, Mode 5 employs sophisticated encryption techniques to avoid hostile signal manipulation, thus ensuring that the identification process is reliable and secure. "Mode 5"

is in the process of being introduced in all western armies as a precondition of joint operations of US/NATO and allied forces.

Xtend Launches XTENDER tactical sUAS

(jh) Xtend, a company specialising in human-guided drone operating systems, has announced the launch of the second generation of the XTENDER indoor tactical sUAS system.

Photo: Xtend

The micro-tactical ISR platform is to enable the remote completion of missions. Powered by SKYLORD, Xtend's operating system, XTENDER uses Virtual and Augmented Reality (VR/AR) technologies coupled with AI and machine learning flight algorithms.
Using patented drone-teaming and mark & fly technologies, the new generation XTENDER enables multiple drones to enter a remote target site carrying various payloads, perform the required tasks with extreme precision, and seamlessly exit, regardless of any indoor-outdoor transition limitations or GNSS-denied locations, the company writes in a press release.
According to Xtend, the second-generation XZENDER allows any operator - even with zero flight experience - to perform accurate recon and data collection tasks – such as close-quarters combat (CQB) clearance, IED and tripwire identification, and enemy detection – in complex urban environments, without any physical contact with hostile forces.

TKMS Bidding for the Polish MIECZNIK Programme

(gwh) In the scope of the the Polish MIECZNIK procurement effort for three frigates, the designs of ThyssenKrupp Marine Systems (TKMS) and Babcock International have been selected by the Polish Ministry of Defence for contract negotiations following the completion of the study phase.

Image: TKMS

TKMS had participated in the concept design study with a MEKO-A300 multi-purpose frigate design adapted to Polish requirements. Babcock entered the race with the ARROWHEAD 140. The Spanish shipbuilder Navantia is no longer among the contenders.
Poland has founded a consortium for the MIECZNIK project under the leadership of the holding Polska Grupa Zbrojeniowa (PGZ), which is to build the frigate. This consortium with two shipyards will provide the shipbuilding capacity. The technology is to be supplied by the selected foreign company. Contract negotiations will involve fine-tuning the design according to military requirements, determining the framework for technology transfer and negotiating the funding for the project.
At the beginning of the study phase, TKMS had stated that the construction of warships in cooperation with the industry of other countries was a matter of course. More than half of the ships exported were built by shipyards in the country of the respective customer, TKMS said.
Initially, Poland wants to build only one frigate from 2023. After commissioning in 2028, the design is to be tested in an operational environment. The test results are to be considered for the construction of the second and third frigate. The entire MIECZNIK project is to be completed by 2034. According to a PGZ statement, the contract value for the three frigates, including armament and a logistical package, is €1.8Bn.

Bell to Advance High-Speed VTOL Capabilities

(jh) Bell Textron has announced its advancement to the next phase of the AFWERX High-Speed Vertical Take-Off and Landing (HSVTOL) Concept Challenge, a crowdsourcing effort for the United States Air Force (USAF) and United States Special Operations Command (USSOCOM). Bell is one of eleven companies selected to receive market research investments aimed at advancing solutions that enable optimal agility in austere environments.
According to the company, Bell's HSVTOL vehicles blend the hover capability of a helicopter with the speed, range and survivability features of fighter aircraft. This family of scalable aircraft concepts is designed to support a range of missions, including personnel recovery, autonomous ISR/strike,

Photo: Bell

and tactical mobility, with low downwash hover capability and jet-like speeds of more than 400 kts.
Bell's concepts are envisioned as part of a broader HSVTOL mission system framework that provides the next generation of speed, range, and survivability. These concepts are to provide the flexibility to carry out USAF and USSOCOM missions across the full spectrum of conflict and political scenarios.

MK 41 VLS Contracted for German F126 Class Frigates

(jh) Damen Naval has contracted Lockheed Martin for the MK 41 Vertical Launching System (VLS) in the scope of the German Navy's F126 project, Damen writes in a press release. The direct commercial sale contract was signed on 31 January 2021. The Lock-

Photo: Damen

heed Martin scope of supply and services includes the production and delivery of two 8-cell strike length MK 41 VLS EVOLVED SEA SPARROW Missile Block 2 capable modules for each of the four ships plus associated engineering efforts and ancillary hardware.
Both the German and Royal Netherlands Navy operate this system. Damen is familiar with the MK 41 VLS system operating on the Netherlands' Air Defence and Command Frigates (ADCF) and various other surface combatant designs on the export market. Moreover, the system has a rich 25+ year history with the German Navy, including projects such as the F123 BRANDENBURG class and F124 SACHSEN class frigates.

Hungary to Procure 120 mm Mortars from Hirtenberger Defence

(Kristóf Nagy) At the end of 2021, the head of the Planning Group of the Hungarian Armed Forces Command, General László Sticz, announced a procurement effort for 120 mm mortar systems. Reportedly, these weapon systems will be supplied by Hirten-

berger Defence and will include not only the mortars but also other system components. The decision comes as no surprise for industry insiders. After all, the Hungarian armed forces have not had this key infantry fire support capability since the M1943 mortar was decommissioned some time ago. However, internal publications of the Hungarian armed forces and studies have been calling for the reestablishment of the capability by means of modern systems for more than a decade.

Photo: Hirtenberger

According to well-informed sources, a low double-digit number of 120 mm M12 mortars will be delivered to the armed forces by 2023. The intention is the integration of the weapon systems as an element of the armed forces and to increase the number of specialised personnel through training. In a further step, additional systems could be procured which, according to some sources, have already been budgeted for.

The incoming mortar systems will be fitted on a trailer to enable towed deployment. Besides, the Hungarian mortar forces are to receive modern fire control solutions and a corresponding ammunition package from the Hirtenberger.

Hirtenberger's M12 mortar is produced in two versions, which differ mainly in the barrel length and the resulting total weight, as well as in the range. According to the manufacturer, both versions have a rate of fire of up to 15 rounds per minute. It has not been disclosed whether Hungary will receive the version with a ballistic barrel length of 1385 mm or 1535 mm.

The decision in favour of a Hirtenberger product does not come as a surprise for observers. Effective 29 October 2019, the Hungarian state-owned company "HDT Védelmi Ipari Kft" has had a share of 100% in the Austrian Hirtenberger Defence Group, which also includes companies in the UK and New Zealand. Before this acquisition, Hirtenberger Holding GmbH had decided to divest the its defence division and to look for a buyer for the mortar business.

Thailand to Test the THeMIS UGV

(gwh) Late last year, Milrem Robotics delivered the THeMIS (Tracked Hybrid Modular Infantry System) unmanned ground vehicle to Thailand's Defence Technology Institute (DTI), Milrem has announced recently. Thailand wants to test the Robotic Combat Vehicle (RCV) in a cooperation between the Army and the DTI and evaluate its possible applications.

According to Milrem, the RCV consists of the THeMIS unmanned tracked vehicle equipped with the R400S-Mk2HD remotely operated weapon station from EOS (Electro Optic Systems), Australia. The weapon integrated is the Northrop Grumman M230-Mk2HD externally powered 30 mm machine gun, known as a helicopter gun. THeMIS combat UGVs can be equipped with light or heavy machine guns, 40-mm grenade launchers and anti-tank missile systems.

Milrem pitches the THeMIS combat UGVs with direct fire support capability for ma-

Photo: Milrem Robotics

noeuvre forces as a force multiplier. With an integrated, self-stabilising, remote-controlled weapon system, they offer high precision at wide ranges, day and night, increasing the distance, protection and survivability of troops, the company stresses.

Russian Air Force Armament

(yl) According to Russian national media, the Russian Aerospace Forces (VKS) received 21 new combat aircraft during 2021. With six aircraft, the Su-34 type fighter bombers take the largest share of these. Four were manufactured according to the latest version of the Su-34 NVO. This has provision, among other things, for reconnaissance systems in underwing containers.

These aircraft were manufactured under a three-year contract for 24 new Su-34s. Therefore, in order to comply with the terms of the contract, the Novosibirsk Aviation Plant (manufacturer of the Su-34) is obliged to deliver nine aircraft per year in the next two years. By the end of 2021, the Russian industry had produced a total of 145 Su-34s, including seven pre-production aircraft. Of

Photo: UAC

the Su-35S fighters, five new aircraft were delivered in 2021.

At the moment, the VKS operates up to 103 Su-35S fighters. In 2022, the Gagarin Aviation Plant in Komsomolsk-on-Amur (Su-35S manufacturer) will deliver seven new fighters of this type to VKS.

Of the Su-30SM2 multirole fighters, four aircraft for the naval aviation wing of the Baltic Fleet were delivered in 2021. This was the first delivery of Su-30SM to the Russian Armed Forces since 2018. According to current data, the Russian Federation has 120 Su-30SM aircraft with 26 in service in the naval aviation of the Russian Navy.

Also last year the Russian Aerospace Forces received the last two of the six ordered MiG-35 fighters ordered under a contract 2018. Finally, the VKS received the first two new YAK-130 combat training aircraft under a contract covering the delivery of 25 such vehicles.

A separate story is the supply of new Il-76MD-90A aircraft for the VKS military transport aviation. Formally, in 2021, the Russian military received five new aircraft of this type. However, three of them are the "tail" of the unfulfilled delivery plan for 2020. These aircraft were produced under the 2012 contract for 13 new Il-76MD-90A with deliveries to be concluded by 2023.

In 2021 a new contract between the Russian MoD and the Aviastar-SP plant in Ulyanovsk was concluded for 14 more Il-76MD-90As to be delivered by 2028.

Russian media released unofficial statistics on the export of the Russian military aircraft. The statistics include:

- Six to 12 YAK-130 combat trainers to Vietnam
- 10Mig-29M/M2s and two Su-30MKAs for Algeria
- Two Su-30SME fighters for Myanmar

KUB-E Loitering Ammunition Approved for Export

(yl) The Russian KUB-E guided munition has been approved for export. According to the Kalashnikov group of companies' press-service, the manufacturer and the Rosoboronexport national defence trader intend to promote the system at international exhibitions and through presentations for the ex-

Photo. Zala Aero

port market. According to Kalashnikov, the weapon has already been successfully tested in real combat environments. KUB (pictured) made its international debut at the Russian national pavilion during IDEX-2019 in Abu Dhabi, UAE. What distinguishes the export version called KUB-E from the version to enter service with the Russian armed forces has not been disclosed.

The KUB loitering ammunition was developed by Zala Aero (Kalashnikov subsidiary) and passed state tests in November 2021. The system's delivery to the Russian armed forces is scheduled for later this year. KUBs can be used to engage infrastructure facilities, individual soldiers, as well as lightly armoured targets. KUB has a top speed of 130 km/h and can spend up to 30 minutes in flight.

French Army Receives First JAGUAR

(gwh) In December 2021, the Groupement Momentané d'Entreprises (GME) consortium handed over a first lot of 20 JAGUAR armoured reconnaissance and combat vehicles (Engin blindé de reconnaissance et de combat, EBRC) to the French Army. After the GRIFFON, this marked the start of deliveries of the second protected wheeled vehicle in the scope of the SCORPION programme. Another 18 vehicles are scheduled for deliveries in 2022, according to the French MoD, and the first tranche of 150 JAGUARs is to be delivered by 2025, completing the programme with a total of 300 vehicles by 2030.

Following the delivery of the first 20 vehicles, there will be a six-week training of the crews concluding with the handover of the vehicles to the regiment to be equipped. The first course is scheduled to last until May 2022.

Photo: French Army

In 2017, an initial supply contract had been signed with the GME, which consists of Arquus, Nexter and Thales. In the consortium, Arquus is responsible for the propulsion system, Nexter for the superstructure and turret, and Thales for optronics and communications.

The 6×6 JAGUAR weighs about 25 tonnes and reaches a top speed of 80 km/h with a 370-kW diesel engine from Volvo. It offers space for a three-man crew of commander, gunner and driver. The two-man turret is armed with:

- A 40 mm CTAS gun
- Four Missile Moyenne Porté anti-tank missiles
- A remote-controlled weapon station for 7.62 mm machine guns.

The CTAS gun is fully stabilised and fires a wide range of new telescopic ammunition with an elevation of up to 75 degrees. The Belgian Army is to be equipped with 60 JAGUARs from 2025 as part of the Capacité Motorisée programme.

IFAD Awarded Portuguese Air Force Contract

(jh) The Portuguese Visa Court has approved the purchase of a new F-16 tactical training centre for the Portuguese Air Force. IFAD TS A/S (IFAD), together with subcontractor ArenalogicApS (AL), has

Photo: Royal Danish Air Force

been selected as supplier of the Deployable Affordable Readiness Trainer (DART) the company writes in a press release. DART is a combined F-16 and JTAC/GCI tactical training centre, which will support the Portuguese armed forces in educating and training their F-16 pilots in tactical Air-to-Air and Air-to-Ground operations, their Joint Terminal Attack Controllers (JTAC) in Close Air Support (CAS) operations, and Ground Controlled Intercept (GCI) personnel.

According to IFAD, DART has been jointly developed by IFAD and AL and has been in operationwith the Royal Danish Air Force for several years.

Senop to Provide Night Vision Equipment for CAVS

(jh) Senop Oy has signed a framework agreement with Patria to supply the driver's night vision systems, which will be installed on the 6×6 Common Armoured Vehicle System (CAVS) Armoured Personnel Carriers (APC), the company writes in a press release. The agreement includes a purchase order which secures the continuation of already ongoing deliveries of Senop driver's night vision systems to all Latvian APCs and Finnish pre-series vehicles. In addition to this, it also enables deliveries to other potential countries participating in the programme, according to Senop.

Photo: Senop

Senop's Defence & Security portfolio consists of:

- Image intensifiers
- Night sights
- Thermal sights
- Handheld target acquisition and observation systems
- Vehicle camera systems
- Hyperspectral cameras
- Multipurpose container-based platform solutions.

Plasan to Provide Armour for DRAGÓN 8×8

(jh) Plasan has announced the signature of a contract with Tess Defence to provide the armour package for the Spanish Army's VCR DRAGÓN 8×8 wheeled combat vehicle. The contract, which was signed in November 2021, covers the first 348 vehicles. Within the contract scope, Plasan will supply its lightweight and modular RPG protection, branded as Hybrid Slat Fence (HSF). This is in addition to its mine protection solution for under belly and IED side blast with its corresponding energy absorbing mine seats. Deliveries under this contract will continue until 2026.

Photo: Plasan

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India's New Approach to the Defence Budget

Suman Sharma

For the first time, there is a separate allocation for private industry, R&D, and start-ups in India's defence budget.

India's US$80Bn defence budget allocation for the 2022-23 fiscal year ushers in a ray of optimism. There is a 10 per cent increase with 68 per cent of the US$20.5Bn capital procurement budget earmarked for domestic industry aimed at promoting self-reliance, making this a first. The share in GDP still remains at 2 per cent.

Regarding the big push for self-reliance through research and development by the private sector, start-ups and academia, Indian Defence Minister Rajnath Singh has said, "It is in line with the 'Vocal for Local' and will certainly boost the domestic defence industries."

In a bid to boost indigenisation, the Government's thrust to honour its commitment of 'AtmaNirbhar Bharat' (Self-Reliant India) and decrease imports, defence research and development (R&D) will be opened for industry, academia and start-ups with 25 per cent of the defence R&D budget. The private manufacturers will be assisted in design and development of military platforms in collaboration with the Government-owned Defence Research and Development Organisation (DRDO).

Through enhanced budgetary support over the years, the Government has placed modernisation and infrastructure development of the armed forces at the centre of national security. An enhancement of 76 per cent over a period of nine years can be seen in the capital expenditure from US$11.7Bn in 2013-14 to US$20.54Bn in 2022-23. Furthermore, defence pensions have increased from US$43Bn in 2013-14 to US$80Bn in 2022-23.

Author

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Indian Army Sikh Light Infantry Regiment on the Day of the Republic Parade in New Delhi in 2004

Revenue expenditure, which comprises salaries and maintenance of forces, has been assigned US$31Bn, while pensions for retired veterans are at US$16Bn, in the present budget.

DRDO

This year's budget brings hope and optimism for the private defence industry and start-ups which have been assigned US$11.5Bn, whereas DRDO, which has largely dominated India's defence industry, receives US$1.619Bn.

Indian Air Force (IAF)

The IAF received the lion's share in this year's capital allocation compared to its two sister services, with US$7.5Bn, which is 10 per cent more than last year. The IAF's spending from its allocation last year has been around 70 per cent.

The IAF's mega modernisation projects explain the Government's move. Besides payments for the 36 RAFALE aircraft, other programmes demanding immediate attention are the upgrade of the JAGUAR and MIRAGE 2000 fleets, indigenous Light Combat Aircraft (LCA) TEJAS and Sukhoi-30MKI fighter jet production. The upcoming 114 multi-role fighter aircraft deal worth US$18Bn, to replace the ageing Soviet-era fighters through a global tender, is a purchase worth watching.

The Indian Navy

Underlining the importance of overall maritime security, the capital budget allocation for the Indian Navy has been enhanced by 44.53 per cent, with a total allocation of US$6.2Bn for 2022-23; the Navy is the only service which has been able to spend its maximum share of last year's capital allocation, at 90 per cent.

This year's increase is aimed at acquiring new platforms, the creation of operational and strategic infrastructure, bridging critical capability gaps and building a credible maritime force for the future.

The Indian Army

Despite the size of the Indian Army in terms of manpower- with 1.3 million personnel - it received the smallest share this year in capital outlay, at US$4.32Bn, down by 12.2 per cent. Last year, the Indian Army was able to spend only 40 per cent from its share of US$5Bn and surrendered the rest.
The Indian Army's Lt. Gen (retd.) Vinod Bhatia says, "The challenge lies in optimal expenditure of the capital budget. The policy changes are good, but the processes and procedures still remain lengthy and laborious adding to avoidable costs."
Border tensions with China, emerging challenges in the Indian Ocean Region (IOR) and Indo-Pacific, have forced the Indian Armed Forces to go for emergency procurements in the past couple of years. A 40 per cent increase in Border Roads Organisation (BRO) allocation by way of US$490M is aimed at expediting progress of the border infrastructure, including the strategic tunnels like Sela and Naechiphu.
To bolster coastal security, the capital budget of the Indian Coast Guard has been enhanced by 60.24 per cent to US$574M with a view to building up assets, augmenting infrastructure and establishing the coastal security network.

Photo: GODL India

The Indian Navy aircraft carrier INS VIKRAMADITYA with a SEA HARRIER

Hailing the budget as progressive, Jayant Patil, Director, Larsen & Toubro (L&T), says, "It is satisfying to note a large increase in the allocation for indigenous acquisition from 58 per cent to 68 per cent which augurs well for the growing private sector in defence."
It may be noted that as per the Indian Parliament's Defence Standing Committee's 2018 recommendation, the defence budget allocation should be raised to 3 per cent of the nation's GDP. ■

Marketing Report: Aeronautics Ltd.

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Photo: Aeronautics Ltd.

Matan Perry, Vice President for Marketing & Sales at Aeronautics, elaborates on the important role of diverse offerings. "Aeronautics' systems are at the forefront of the most advanced technologies in the world and provide some of the highest capabilities available on the market with greater endurance, serviceability, operational flexibility, and cost-effectiveness." He adds, "This diversity enables us to penetrate new countries."
As the industry leader, Aeronautics identifies its customers' diverse needs and responds with innovative technological solutions. Backed by continuous research and development, and proven in combat, these systems are built on three decades of technological and operational experience.

Fighting for the Caliphate? Not Really.

Dr. Gayane Novikova

This article intends to analyse the combined influence of internal and external factors that promoted and contributed to the direct involvement of Islamists in the Nagorniy Karabakh conflict in 1993-1994 and 2020 and, in a broader context, the danger posed by this precedent. The Azerbaijani authorities have denied any participation of Islamists in both Karabakh wars.

The withdrawal of Soviet troops from Afghanistan (1989), the dissolution of Yugoslavia and the war in Bosnia (1992-1995), the collapse of the Soviet Union, the proclamation of the Republic of Ichkeria (Chechnya; 1991) and the first Russian-Chechen war (1994-96) – all triggered the spread of Islamic radicalism.
The establishment of the Islamic State of Iraq and Syria (ISIS) greatly contributed to Islamists' global jihad against the rest of the world. The ISIS branches in Afghanistan, the Northern Caucasus, Central Asia, and several African states, Islamists mobility and ability to mobilize the most vulnerable segments in the different societies, the increasing numbers of terrorist attacks against civilians, and the involvement of Islamist militants in the international conflicts and civil wars – all are sources of concern for governments and societies dealing with unconventional threats. The Nagorniy Karabakh (NK) conflict provides a unique example of how the internal utilization of the Islamic factor by the Azerbaijani leadership has intertwined with a long history of involvement and participation of Islamist mercenaries on the side of Azerbaijan.

Photo: Diana Ananyan

The village Shoshin in Nagornyi Karabakh on 15 November 2020

The Utilisation of the Islamic Factor

A revival of the religious self-identification in Azerbaijan was marked by the strong influence of geopolitical factors. Azerbaijan, as the second – after Iran – Shia-majority country belongs to the Turkic world through its ethnic, linguistic, and cultural identities. After independence, it adopted a secular model of governance, following Turkey's state structure as a model. However, a politicization of the religion has gradually become an important factor in Azerbaijan's domestic and foreign policies.
Among the internal factors that have contributed to a radicalization of Islam in Azerbaijan have been:

- the unresolved NK conflict and flow of refugees from Armenia and an internal displacement of people as a result of the Armenian-Azerbaijani hostilities that began in 1988 and ended with the defeat of Azerbaijan in the first Karabakh war (1991-1994);
- a disillusionment in the West, which was incapable of settling the conflict;
- a growing totalitarianism and authoritarianism along with regular violations of human rights;
- a drastically increased level of corruption and a decreased level of social security.

Among the external factors should be mentioned the multidimensional activity – from philanthropy and humanitarian aid to a training of militants – of Islamic and Islamist organisations supported by the Iranian, Turkish, and some Arab governments. Applying for their diplomatic and military support for the resolution of the NK conflict, as well as for substantial humanitarian aid, Azerbaijan welcomed – to a different degree – their presence. A differentiated approach to these organisations was strongly defined by Azerbaijan's strategic interests.

Iranian Influence

Initially, Iran was welcomed in Azerbaijan as a first provider of humanitarian aid in the areas of the refugee and IDP resettlement. Its influence and presence was increasing in Nakhichevan, in the southern regions mainly populated by Talishes and Tatas, and on the Apsheron peninsula. Some radical Shia clergy were criticizing Azerbaijani authorities as corrupt and even calling for a jihad –against them and against Armenians. Simultaneously, owing to a series of sensitive security issues, Iran kept its border with Armenia open, thereby on the one hand diminishing the

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consequences of the Azerbaijani-Turkish blockade of Armenia and on the other hand stimulating anger and mistrust among the Azerbaijani political leadership and the population.

Turkish Activities

Turkey's activity in the religion sphere was significantly less than that of Iran. It was concentrated in the cities of Baku, Gyandja, and Sumgayit, as well as along the borders with the Russian Northern Caucasus (in the areas dominated by Lezgins and Avars, traditionally practicing Sunnism), and in the central regions. It was carried out by state and non-governmental channels in full accordance with Azerbaijani legislation and with support from the Azerbaijani government. Turkey's absolute political, diplomatic, and economic support of Azerbaijan, including the closure of the border with Armenia in April 1993, provided to Turkey the opportunity to drastically increase its presence and role in Azerbaijan.

The Salafi Movement

In parallel with official Islam, the Salafi movement in the early 1990s was also finding its place in Azerbaijan: in 1993-94, 15 Arab philanthropic foundations – mainly from Kuwait and Saudi Arabia – were operating in the north of the country, as well in Baku and Sumgayit. They were providing humanitarian aid, building and renovating mosques (63 in total by 2003), and in the meantime intensively introducing a radical religious education and recruiting militants (many of whom later fought in Afghanistan and Chechnya). Salafi imams sharply criticized the authorities and called for jihad against the Karabakhi Armenians and Armenia.

At various international fora, especially at the Organisation of Islamic Conference, Azerbaijan has been introducing itself as a Muslim country victimized by Christian Armenia's aggression. Through an artificial identification of Azerbaijan with the 'dar al-harb' (the "territory of the war"), thereby including a religious component into the ethno-political conflict, the Azerbaijani elite attempted to acquire maximum external support. In particular, in 1993-1994 a desperate need for help on the battlefield led to the recruitment of several hundred fighters from Chechnya and several thousand mercenaries from Afghanistan to fight in the Karabakh war. The reasons for participation of (mainly Arab) mercenaries in the 2020 Karabakh war were slightly different.

Photo: president.az

Azerbaijani President Ilham Aliyev speaking to the military leadership of Azerbaijan on the Armed Forces Day

Islamist Foreign Fighters in the First Karabakh War

Contacts between the Azerbaijani and Chechen leaderships were established in late 1991 when both Azerbaijan and Chechnya proclaimed their independence. Azerbaijan was already a party to the NK conflict, and the unrecognized Republic of Ichkeria (Chechnya) was enjoying its short, relatively peaceful period of existence. A visit by A. Elchibey, the leader of the "Popular Front of Azerbaijan" (the President of Azerbaijan from May 1992 to September 1993) aimed to establish close – including military – relations with a brotherly Muslim state entity. By July 1992, according to some sources, around 300 Chechens were fighting alongside Azerbaijanis in Nagorniy Karabakh. They were paid approximately 600-1000 Russian Rubles (1000-1700 USD). It is worth mentioning that the Chechen leadership and field commanders viewed the war in NK as an ethnic-based rather than a religious war. After the eruption of war in Abkhazia (1992-93), Chechens and other fighters from the Northern Caucasus jointed the Abkhazians in their war for independence from Georgia. From 1994 until 2000, the majority of them returned to Chechnya to fight against Russia. Some of these mercenaries later fought in Bosnia and Afghanistan. Many then joined the ranks of ISIS.

In mid-1993, the Azerbaijani government directly initiated the recruitment of Afghan Mujahedin after unsuccessful attempts to acquire direct military support from any of the foreign actors interested in the South Caucasus and, in particular, in Azerbaijan's oil reserves. After a trip by the Azerbaijani Interior Deputy Minister R. Jivadov to Afghanistan, and after his negotiations with Islamist warlord Gulbuddin Hekmatyar (then Afghanistan's Prime Minister), in August 1993 the Mujahedin (who were associated with Hekmatyar's Hezb-i-Islami fraction) began to arrive in Baku on charter flights from Peshawar and Kabul. The financial aspect of this deal is unknown; one source mentioned Saudi Arabia as a sponsor. The most probable promised payment was $500 per month (some sources provided an estimated payment as high as $700 and even $1,000).

The number of Afghan Mujahedin fighting in Nagorniy Karabakh varied between 1,500 and 3,000. In an article, "The future is for the professional army," published in Baku's newspaper "Zerkalo" (August 10, 2002), a spokesperson for the Azerbaijani Ministry of Defence in 1992-1993 stated that "about 2,500 Afghan mercenaries fought for Azerbaijan." The most significant participation of Afghan Mujahedin in the battle was their attack on Armenian forces on October 21, 1993, in the outskirts of the city of Zangelan on the border with Iran. According to T. Goltz, a war correspondent who was in Azerbaijan during the entire period of warfare, "a group of Afghan mujahedeen brought into the sector decided to launch a jihad against Armenians. The Azeri command …did not back them up, and the Armenians hit back hard…"

After signing a ceasefire agreement with the Armenian armed forces on May 9, 1994, the Azerbaijani government tried

to reach another deal with Hekmatyar. However, owing to the special mission of G. Libaridian (then the Senior Advisor to the first President of Armenia, L. Ter-Petrosyan) to Jalalabad in late May 1994, deployment of a new group of the Mujahedin in Azerbaijan was prevented. In his letter to the Armenian President in June 1994, the President of Afghanistan B. Rabbani wrote: "Regretfully I must indeed say that certain adventurous groups, endangering the socio-political stability of Afghanistan and in the meantime pursuing personal financial gain, are worsening the relationship between Armenia and Azerbaijan. Afghanistan is making every effort to prevent the inhumane activity of the extremists."

Contacts between the Azerbaijani leadership and Islamic philanthropic and Islamist radical organisations continued and deepened after the end of the first

Photo: Azerbaijani Historic Photography / CC BY-SA 4.0

Azerbaijani soldiers during the first Nagorno Karabakh war in 1992

Karabakh war and especially with the beginning of the Chechen war. Azerbaijan provided a shelter to Chechen refugees (by the beginning of 2001 their number exceeded ten thousand). It factually became a transit country for weapons supplies mainly from Afghanistan and Pakistan for Chechen militants (a significant number of whom were trained in camps in these countries) and for humanitarian aid for the population of Chechnya and Chechen refugees inside Azerbaijan. Y. Bodansky (Director of the Congressional Task Force on Terrorism and Unconventional Warfare of the US House of Representatives from 1988 to 2004) mentioned that, according to an agreement reached in 1997 between then President of Azerbaijan H. Aliyev and the Chechen Islamist leadership, the Chechens gained a right of free movement of mercenaries and weapons through Azerbaijan's territory in exchange for a promise not to undertake any coup d'état attempts or armed uprisings against the Azerbaijani authorities. It should be emphasized that Chechens and supportive Arab organisations brought the Wahhabi ideology to Azerbaijan.

In general, the activity in Azerbaijan of Islamist terrorist organisations, including al-Qaida, since 1995 has been well-documented and lies beyond the scope of this analysis. However, manipulating the Islamic factor at home, the Azerbaijani authorities could not ignore that further radicalization of their society would constitute a threat to their power. A law banning the activity of foreign missionaries was adopted in 1996 and the status as "traditional confessions" was granted to Shiites, Sunnis, the Russian Orthodox Church, and Jews. It was followed by the demolition and closure of several radical mosques, the arrest of their imams, and repression against their followers. These actions contributed to a further radicalization of certain segments of the population, especially youth. Furthermore, they did not prevent Islamist terrorist organisations either from operating inside Azerbaijan or coordinating their activity from there.

Islamist Foreign Fighters in the Second Karabakh War

The Arab Spring generated a systemic crisis in the Middle East. ISIS has become a home for different terrorist and jihadist organisations. Among thousands of Islamist radicals there are citizens of Russia (mainly from Chechnya and Dagestan) and Azerbaijan (who converted into Sunnism) already experienced in fighting global jihad. According to the October 2017 report of the US-based global intelligence and security consultancy Soufan Group, "Beyond the Caliphate: Foreign Fighters and the Threat of Returnees," the number of foreign fighters from the republics of the former Soviet Union in ISIS was 8,717; among them were 3,417 from the Northern Caucasus. On March 7, 2017, Azerbaijan's State Security Service Lieutenant General M. Guliyev reported at a conference in Baku that up to 900 Azerbaijani citizens had joined the ranks of ISIS.

The Syrian civil war enabled a huge flow of refugees primarily into the neighboring countries. Turkey hosts approximately 1,5 million Syrian refugees, including jihadist fighters and their families. President Erdogan has chosen two options aimed to reduce this burden: He blackmails Europe by releasing refugees and utilizes thousands in proxy wars in Libya, Afghanistan, and, most recently, Azerbaijan.

Rumours that 50-70 Islamist fighters of Azerbaijani descent left Syria in April 2016 to fight in Nagorniy Karabakh were actively circulating in the Russian and Iranian mass media. However, evidence for their participation was lacking. Four years later, in 2020, the situation changed. Information about the presence of Islamist fighters in Azerbaijan and their participation in the battles of the 2020 Karabakh war (September 27 – November 9) was confirmed by French, Russian, American, Iranian, and Armenian intelligence services, as well as by war journalists on the frontlines, by independent human rights organisations, and by multiple selfies and videos posted by mercenaries online.

If available sources are compared, the most reliable number of Islamists in the area of the NK conflict appears to have been between 2,700 and 3,000. They were primarily members of the Sultan Murad Division, the Hamza Division, and the Suleiman Shah Brigade. With diverse ideological allegiances all are associated with the Syrian National Army (SNA) established by Turkey in 2017 with the aim to support military factions opposed to the regime in Damascus. Although their primary motivations for fighting in NK were different, all endorsed and maintained a religious language.

The recruitment of Islamists began in July-August 2020 in the refugee camps. Four-month contracts (for guarding borders or oil and gas pipelines, or serving peacekeeping mission) included a monthly salary up to $2,000 and $7,800 in life insurance, both paid in Turkish lira. One source reported that Turkish citizenship was guaranteed for fighters and immediate members of their families. One of the SNA commanders, Ziyad Haci Ubeyd speaking on the Rûdaw TV News Bulletin from Antep on September 28, stated that Turkey provides economic support to more than 70,000 fighters. They therefore "have to pay [their] debts for the support Turkey has given" and "are ready to fight everywhere for Turkey's national interests and security." He added, "The fighters have to go to war in Azerbaijan to provide [support] for their families due to bad economic conditions."

Only a thin line separates the mercenaries and jihadists in the Karabakh war is thin. In accordance with the morale of devout jihadists rooted in religious fanaticism, Shias are heretics. Therefore, according to one of the most influential jihadist ideologues, Abu Muhammad al-

Maqdisi, fighting alongside Azerbaijanis is a sin and dying in the Karabakh war will not guarantee martyrdom. However, some Sunni clerics directly involved in recruiting have introduced a war against "infidels" – Armenians – as an "enforced sufficiency" of global jihad. To avoid confusion among the "devout" regarding the Sunni – Shia rivalry, and to justify this war, one of the sheiks stated on October 9, 2020: "Our nation is being tested in the East and the Maghreb. Our battle is in Azerbaijan now as it is our battle in the Levant. They became Shiites in Azerbaijan under the weight of the sword, otherwise the country of Azerbaijan was a Sunni country par excellence."

The logistics were handled, among other private and security companies, by Sadat International Defence Consultancy (SADAT), a private Turkish company owned by President Erdogan's former chief military consultant, A. Tanriverdi. Fighters were flown into Azerbaijan in Turkish cargo airplanes and deployed in the five camps proximal to the Iranian border in the Horadiz and Hadrut areas.

The issue of mercenaries in NK was addressed on November 11, 2020 in the UN Working Group on the Use of Mercenaries Report: "The alleged role of Turkey is all the more concerning given the similar allegations …in relation its role in recruiting, deploying and financing such fighters to take part in the conflict in Libya. In this context, it is even more worrisome that the Syrian fighters deployed to Azerbaijan are allegedly affiliated with armed groups and individuals that, in some cases, have been accused of war crimes and serious human rights abuses during the conflict in Syria, thus seemingly perpetuating a cycle of impunity and risking further abuses of international law."

Quo Vadis?

Unresolved conflicts and small wars have become the fertile ground for radicalization of some strata of the directly involved population. Meantime, they have been attracting diverse groups of foreign Islamist militants.

The participation of Afghani Mujahidin and the Chechen fighters on the battleground in NK in 1993-94 did not change the military balance in favour of Azerbaijan. However, a large flow of Chechen refugees significantly contributed to the strengthening of Sunni Islam.

A manipulation of the Islamic factor by Azerbaijani authorities brought into the spotlight its dual utilization. On the one hand, they welcomed the presence and activity of different Islamic and Islamist organisations. The jihadist network has begun spreading across Azerbaijan since the mid-1990s. On the other hand, Azerbaijan introduced itself after 9/11/2001 simultaneously as a potential target of jihadists and terrorists and as a barrier on their pathway to Russia and Europe.

Cultivating its image as a victim of the Armenian aggression, Azerbaijan gradually infused a religious component into the NK conflict. Bellicose rhetoric became intertwined with an appeal to Islam as a source of strength, especially during – and immediately after – the 2020 Karabakh war.

Turkey skilfully uses the Middle Eastern mercenaries in its long-term proxy wars in Syria, Libya, and Afghanistan. Azerbaijan has also used Islamist foreign fighters. By bringing them into the 2020 war in NK, Azerbaijan and Turkey mainly intended to reduce casualties in the Azerbaijani army. It should be noted that Azerbaijani ethnic minorities (both Shia and Sunni), for different reasons, were reluctant to fight against Armenians.

There is no information that mercenaries from Syria left en masse the conflict zone; only a few reports refer to a transfer of bodies (in total around 300-500) back to Syria. However, taking into consideration Erdogan's attempts to change the demographic configuration of Turkey (through granting to Syrian Sunni Arabs Turkish citizenship and settling them in areas populated by Alevites and Kurds), it is possible to assume that the same scenario can be implemented by Azerbaijan in the territories which were under the Armenian control from 1993 to 2020.

Photo: Diana Ananyan

Shahumyan Region in Nagornyi Karabakh

In this case, the Armenian population of Nagorniy Karabakh will be under a permanent threat of physical elimination.

In the mid-term perspective Islamists can challenge the authorities of Azerbaijan with the prospect of becoming a serious security threat in the long run. Presumably, Azerbaijanis and Chechens, who fought in Syria and had problems with both ISIS and another militant Islamist organisation, Tahrir al-Sham, could use the war in NK as an opportunity to return to Azerbaijan and the Northern Caucasus.

Russia and Iran have articulated their serious concerns regarding the presence of Islamists in the South Caucasus. In the short-term perspective the territories of Russia and Iran, as well as that of Georgia, can be used by Islamists as transit zones to move out of the Caucasus – into the Middle East and/or Europe, or somewhere else – to continue to fight jihad.

Turkey's full-scale support of Azerbaijan in the 2020 Karabakh war has enhanced its role in the South Caucasus, its influence in the Middle East, as well as in the Turkic world. It will continue to utilize mercenaries and jihadists in its far-reaching plans. ■

This article is based upon the testimonies of several war correspondents, the memoires of Western diplomats deployed in Baku and Yerevan, reports from the independent human rights organisations, resolutions of the international organisations, as well as different printed and social media resources, documents, and photographs captured in the battlefields.

EU's Security and Defence in 2022

Andreea Stoian Karadeli

As we witness the complex international events rapidly developing in the first months of 2022, we all must come to one realisation: the post-Cold War order in Europe has now officially ended. In a fast-changing geopolitical context, the European Union has been forced to adapt and act at this very moment, redefining its own identity and reconstructing its security and defence paradigm from scratch. It is either now, or never.

In response to the threat at Ukraine's borders and Russia's aggression in recent weeks, the US deployed troops to Poland, Romania, and Germany to demonstrate to both allies and foes America's commitment to NATO's eastern flank. In the first week of February, 1,700 American military personnel arrived in Poland, led by Major General Christopher Donahue, who was the last US soldier to leave Afghanistan in the summer.

At time of writing, while US officials still believed there are few chances for Putin to invade Ukraine again, he certainly possesses the capabilities needed to do so, according to the US press secretary: "The current situation demands that we reinforce the deterrent and defensive posture on NATO's eastern flank," Kirby said. "President [Joe] Biden has been clear that the United States will respond to the growing threat to Europe's security and stability. Our commitment to NATO Article Five and collective defence remains ironclad." Kirby stressed these deployments are prudent and temporary and done in consultation with European allies. He stressed that the forces were not going to fight in Ukraine. "They're going to ensure the robust defence of our NATO allies," he said. The movements are separate from the 8,500 troops that were placed on alert last week to prepare to deploy to Europe for a potential Ukraine contingency within five days. Those forces are intended to be part of the NATO Response Force, which requires consensus within the Alliance to activate — which has not been reached yet.

Photo: via author

The current crisis, dramatically unfolding in Ukraine's eastern region, the Donbass, is indeed a test for the West, but it also reflects the perfect storm that has already formed within the EU, making it harder to manage or respond to the complex threats of today's geopolitical context.

Diving to the Bottom of the Iceberg

The EU was never created to become a military alliance, but it is now forced to use all strategic tools available to create a united security and defence strategy that will allow it to face the complex threats beyond the Ukraine-Russia context. In fact, the current demonstration of power at Ukraine's borders can be seen as just the tip of an iceberg that has a dangerous and unseen bottom: a mixture of internal and external threats that are continuously changing and adapting to exploit the EU's greatest weaknesses, all coming from the same pit – the disunity among its own members. The Ukraine crisis and the EU's response has reiterated the lack of clear policy toward its eastern neighbours and Moscow, proving once again that the Union is not prepared to face today's geopolitical challenges. The question is: will the EU ever be prepared?

To begin with, in case forgotten, the EU is an economic and political entity with vast resources to make a difference to its own members and to its neighbours, while NATO is a military, defensive organisation. The EU and NATO can, if willing to do so, complement each other, and develop common strategies accordingly. However, there is now a growing, muted rivalry between the two that not only threatens their strategic actions, but also weakens them.

Author

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As we dive into the ice-cold depths, we discover multiple threats out there, including: the slowdown of globalisation, growing economic rivalry between global powers, climate change and competition for resources, migratory pressures, and threats to the multilateral system, regional instability, conflict, state fragility, inter-state tensions, external influences, destabilising impact of non-state actors, state and non-state actors targeting the EU with hybrid tools, including disruptive technologies, disinformation, and other non-military sources of influence; and, not to forget, the terrorist threat. All these elements have been identified within the EU Threat Analysis: a comprehensive analysis on key threats and challenges to the Union, its Member States, and citizens, including global and regional threats, conflicts in our neighbourhood by state and non-state actors.

But the most dangerous threat to the EU's security is hidden in plain sight: the lack of a unified understanding of threat among all 27 Member States and the widening gap between their separate expectations and results. The way in which the EU has managed the Ukraine-Russia border crisis so far is a perfect reflection of this gap.

Today, soft power has given way to resilience and the enemy no longer fits within the profile of the Cold War. The opposing side is now somebody with whom you trade, from whom you get gas and to whom you export high-tech goods, making it harder to fight. Not to mention the internal individual perspective that each of the EU Member States have towards the opponents and changes based on their own national context. So far, Russia's success at its own game is fostered by the EU's lack of preparedness and unity towards the threat, while the pressure of high energy prices, disinformation and political instability over a prolonged period come only as an extra card on the table. The crisis in the EU's eastern neighbourhood is exacerbated by a deepening energy crisis at home. Both point towards a common cause: Russia, the main supplier of crude oil, natural gas, and solid fossil fuels to the bloc. The EU's energy dependence on Russia has soared in recent times and the Kremlin has attempted to exploit Brussels' energy insecurity to its advantage. This geoeconomics of energy trade, largely in favour of Russia, makes Brussels' position frail in dealing with the Kremlin.

The fall of the Berlin Wall, the end of the armed stand-off between East and West in Europe, and the collapse of the Soviet Union marked the beginning of a new post-Cold War political and security order that envisioned a Euro-Atlantic community whole and free, from Vancouver to Vladivostok. However, this vision of an undivided Europe was never fully realised. Competing views of the architecture of the post-Cold War European security order were never reconciled. The changing geopolitical context and the evolution of threat not only creates a new set of challenges for the EU, but it also amplifies the unsolved issues of the post-Cold War political and security order. The perfect storm encompasses not only the current economic and energy crisis, the pandemic, organised crime, and terrorism, but also the lack of common perspective within the post-Cold War European political architecture.

Graphic: via author

The EU's Strategic Compass

In March 2022, the 27 EU Member States are expected to adopt a "Strategic Compass" (SC) that is intended to make the Union a provider of international security by 2030 and strengthen its strategic sovereignty. On 15 November 2021, the High Representative of the European Union for Foreign Affairs and Security Policy (HR/VP), Josep Borrell, presented the first

Photo: US Army

US Army soldiers assigned to the 2nd Cavalry Regiment during exercise "Dragoon Ready 21" at the Hohenfels training area in April 2021

draft document to the EU's foreign and defence ministers: the "Strategic Compass for Security and Defence – For a EU that protects its citizens, values and interests and contributes to international peace and security." At its core, the compass aims to answer three key questions: What challenges and threats does the EU face today and in the near future? How can it better pool its resources to meet them? And how can it assert Europe's influence as a regional and global player more strongly than before?

The Security Compass' drafting progress was divided into three phases. To begin with, in the summer of 2020, the High Representative of the European Union for Foreign Affairs and Security Policy had the task to prepare a joint threat analysis.

A Last Chance to Find the Right Path?

The results of this first step served as the basis for the second phase – a dialogue process of the EU Member States starting in January 2021 on the four areas of crisis management, resilience, capabilities, and partnerships. The 28-page document, presented in November 2021, bundles the discussions into five chapters, entitled "The World We Face," "Act," "Secure," "Invest," and "Partners." While "The World We Face" develops an assessment of the current threats, the second chapter, "Act", aims at improving the readiness of EU armed forces and civilian experts to reinforce CSDP missions and operations and developing a European Union Rapid Deployment Capacity of up to 5,000 troops supported by strategic enablers. The third chapter, "Secure", focuses on strengthening the EU's capacity to prevent, deter and respond to hybrid threats, including external cyber-attacks and foreign information manipulation and interference, while safeguarding EU security interests in the maritime and space domains. "Invest" promotes jointly investing in key military capabilities to operate on land, at sea, in the air, in the cyber domain and in outer space and boosting research and innovation to fill strategic gaps and reduce technological and industrial dependencies. The last chapter, "Partners", promotes strengthening cooperation with NATO and the UN, as well as with the OSCE, AU and ASEAN and boosting cooperation with individual partners such as the US, Canada and Norway and other countries.

The current third phase provides the Member States with the opportunity to submit requests for changes until March 2022. The process is also an expression of Franco-German cooperation in that Berlin has persuaded President Macron to complete the process during the French EU Presidency in the first half of 2022, and the joint action of Berlin and Paris thus represents the umbrella of the Security Compass process. In fact, the result of the Security Compass process represents the EU's first White Paper on defence, and it has the potential to become a key deliverable of the French presidency, known for its determination to translate intent into actions and make European defence more operational.

So far, based on the current operational conclusions of the Security Compass, further emphasis should be given to the geographical focus of the EU in terms of security policy, in order not to raise false expectations among its members. In this regard, the immediate European neighbourhood should be underlined as the priority for the future security strategy. Still, consensus among Member States is also needed in order to set the geographical limits of interest, as much as it is needed in order to define and assess current threats.

While the context has never been better, the EU should first develop a common understanding of the threats and challenges facing the EU as a single entity. Once the bottom of the iceberg melts, then all the other strategies that will be developed might have the chance for success. This unprecedented exercise can pave the way for a stronger Europe. Failing to successfully fulfil the Strategic Compass and its ambitions means the EU will not only remain behind the curtains of the international scene, but it will also realise that it does not fit into the changing geopolitical order.

Either Now, or Never

The French EU Presidency's calls for a Europe to build up its own strategic and defence capabilities are not about making the bloc independent of NATO or the United States. In fact, the Security Compass itself reiterates the fact that NATO remains at the heart of European territorial defence. The current debate is focused on preparing Europe to deal with the changing geopolitical landscape and power shifts, dominated by China and Russia. Their policies can undermine Western democracies and the stability of the EU if the Europeans do not recognise the nature of the threats posed by Beijing and Moscow. Ukraine should be forcing a major rethink not only in Brussels, but in all European capitals. ■

"Serbia is determined to enhance its involvement in international partnerships."

Photo: via Yugoimport

The Serbian defence industry has now firmly re-established itself as one of the key players in Europe with the capability to design, develop and manufacture a wide range of weapon systems, especially in the key land sector. ESD had the opportunity to talk to Nenad Miloradovic, PhD, Assistant Minister of Defence of Serbia for Materiel Resources.

ESD: Is your organisation the only one in charge of responding to the materiel needs of the Serbian military? Are there other organisations involved in defence procurement in Serbia?

Miloradovic: The Materiel Resources Sector (MRS) is one of the pillars of the Ministry of Defence of the Republic of Serbia (SrbMoD), responsible for equipping the Serbian Armed Forces (SAF) with armament and military equipment (AME), as well as other warfare supplies and consumables.

The main tasks of the MRS include the following: research, development and production of AME, as well as development of industrial technologies required for its production, equipping of the SAF; planning, supervision and construction of military infrastructure; organisation and supervision of military equipment, together with the maintenance and planning of standardisation, metrology and quality control systems. The MRS comprises the Department for Defence Technologies (with the subordinate Military Technical Institute-MTI), Procurement and Sales Department, Infrastructure Department and General Logistics Department.

The Procurement and Sales Department is in charge of all major acquisition projects, satisfying overall materiel needs of the SrbMoD and SAF.

Nevertheless, in order to provide more effective and flexible support in the area of general logistics and repair, certain acquisitions are conducted by specialised branches of the SAF General Staff, as well as individual units within the SrbMoD and SAF hierarchy themselves. However, all subject procurements require prior approval and monitoring by the Procurement and Sales Department of the MRS.

ESD: To what extent is your organisation involved in Research & Development (R&D) programmes? In terms of budget allocations, what is the share assigned to R&D? Can you provide a brief survey of your current R&D activities?

Miloradovic: The Serbian defence management and maintenance strategy has traditionally focused on equipping the SAF predominantly with domestically produced weapons and military equipment. In order to meet the requirements defined in the National Long-term Capability Build-Up Plan (previous release was 2011-2020), the subject strategy was significantly increased, resulting in 104 new weapon systems being introduced into the SAF's inventory in just the last three years, including numerous complex combat systems, contributing to the improvement of the operational capabilities of the Serbian military. Prior to fielding, all those weapons have been rigorously tested and evaluated by the Technical Test Centre (under SAF HQ).

For the purpose of equipping the SAF, the Materiel Resources Sector (MRS) designs, guides and oversees the complete spectrum of defence-related R&D, as well as the implementation of new defence industry technologies.

Photos: MoD Serbia

LASTA TP - turboprop trainer aircraft

Combat multi-copter "OBAD"

The MALI MILOSV2 robotic vehicle

This function is conducted in close coordination with relevant authorities within the SAF's General Staff, through the Defence Technologies Department, which is in charge of both weapon systems development, as well as defence technology development. This is carried out by coordinating corresponding activities across the SAF's structure and the Serbian Defence Industrial technological base.

The majority of the defence R&D workload within the Defence Technologies Department is conducted by the Military Technical Institute (MTI).

The MTI is one of the most prestigious defence-related R&D institutions in south-eastern Europe and is the main research and development institution of the Serbian MoD, spearheading all Serbian Defence Industry R&D. Throughout its 74 years of existence, the MTI has developed more than 1,300 different types of weapons. This eminent institution also provides higher education and training services, as well as research and development services collaboratively with foreign partners.

The MTI consists of the following specialised branches – aircraft design and experimental aerodynamics sector, sector for electronics, missile systems sector, ground forces weapons and vehicles sector, energy and other materials sector – comprising 24 modern laboratories, some of which (e.g. several wind tunnels, including three sonic) are unique in south-eastern Europe.

In addition, the majority of 17 Government-owned factories, members of the Serbian Defence Industry Group, together with more than 50 private companies, registered producers of armament and military equipment, universities and specialised laboratories, all contribute with their own R&D outputs. They work in synergy with MTI in order to achieve the desired end-state and deliver future weapons solutions.

Budget wise, the MoD typically spends on R&D an amount equivalent to approximately 7 per cent of its allocated investment budget, which is planned to be substantially increased in the near future. In addition, companies belonging to the Defence Industrial Group are tasked with allocating significant funds for R&D.

The main Serbian MoD research and development efforts are focused on the following areas:

- Ground and aerial combat robotic vehicles
- Guided/smart munitions, AD and anti-tank missiles, artillery projectiles and rockets with course correction, air burst medium calibre ammunition, non-line of sight air launched guided missiles, as well as a new generation of energetic materials (rocket fuel, gunpowder, explosives, etc.)
- New generation of small arms, medium calibre weapons, mortars, artillery pieces and multiple rocket launchers
- Combat vehicle systems such as propulsion (classical, electrical and hybrid), suspension, situational awareness, protective subsystems including active and reactive armour solutions, modern camouflage, turrets and weapon stations
- Fire control, battle management, ISR, communications and EW systems
- Future soldiers' systems

ESD: What is the total annual budget available for defence procurement in Serbia? What is the share of the procurement budget if compared to the entire defence budget or even the Serbian GNP?

Miloradovic: Due to a stabilisation of macroeconomic factors of the national

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economy, as well as defence oriented strategic decisions, in recent years, the Ministry of Defence's budget allocations have been increasing progressively.
Namely, over the last five years, it has increased from 1.71 per cent to slightly more than 2 per cent of GDP this year, out of which the procurement budget is over EUR 500M in 2022.

It is worth mentioning that ten years ago, the share of investment cost in the overall defence budget was significantly less than 20 per cent, and the share of personnel expenditures was dominant.
However, as part of a comprehensive programme to improve the SAF's capabilities in accordance with long-term and medium-term operational capability development plans, the "magic limit" of 20 per cent of investments in the military budget has been reached and exceeded over the past five years. For this year, it is at the rate of over 40 per cent.
Such a percentage confirms that a modern defence resource management strategy has been adopted properly, and will provide much-needed rapid modernisation of the armed forces in order to bridge the technological gap caused by an almost 30-year absence in complex weapons systems procurement.
We anticipate that the share of investment cost in the overall military budget, after the completion of ongoing equipment programmes, will be reduced and stabilised at the desired level of 30 per cent, meaning it will allow for further development at an advisable pace.

The H-145M helicopters are equipped with guided and unguided weapons, as well as optoelectronic and self-protection systems.

ESD: What are the most important defence modernisation programmes currently implemented by your organisation?
Miloradovic: The most important (and the most expensive) ongoing programmes are related to improvements in the Air Force and air defence capability, such as:

- MiG-29 Fighter squadron upgrade programme through which this legacy platform enhances its capability to a level of a multirole aircraft with improved air-air and significantly improved air-ground capability, with a primary mission to control and protect the sovereignty of the national airspace
- Helicopter procurement (H-145M, Mi-17, Mi-35M) has significantly increased the Air Force capabilities for ground attack missions. All newly procured helicopters are armed with guided and unguided weapons, and equipped with optoelectronic and self-protection systems, and are therefore capable of engaging ground targets both during the day and night, and of transporting troops/cargo
- ORAO J-22 ground attack aircraft modernisation programme providing for the integration of the new attack navigation system and non-line of sight stand-of guided weapons and EW suite
- Serbian built light reconnaissance UAVs and tactical armed UAVs, as well as imported tactical armed UAVs
- Short/medium-range hybrid air defence systems (PANTSIR S-1) for territorial air defence
- Short-range self-propelled hybrid artillery/missile air defence system (PASARS M16) with 40 mm gun and IR guided AD missiles, such as MISTRAL-3 which, together with the upgraded KUB AD missile system, will provide manoeu-

vring forces with adequate protection against modern aerial threats such as armed tactical UAVs, loitering munitions and drones
- Air surveillance and air defence long/medium/short range radars

The most important ongoing programmes related to land forces capabilities are:

- Modernisation of MBT M-84 and IFV M-80, which will remain the backbone of the SAF's mechanised units, but with upgraded protection, firepower and situational awareness, in order to meet the requirements of the 21st century battlefield
- Procurement of LAZAR-3 8x8, M20 MRAP 6x6, MILOS 4x4 and BOV OT 4x4 wheeled armoured combat vehicles to increase the level of protected mobility to the SAF's infantry, special forces and military police battalions
- 155 mm NORA B52 M15 self-propelled howitzer, OGANJ M-18 and TAMNAVA modular long-range MLRS, and upgraded 2S1M self-propelled 122 mm howitzer with accompanying day and night fire control and artillery BMS integrated on the BOV KIV recce vehicles, together with a new generation long-range/smart/increased lethality ammunition to provide required fire power to SAF ground forces
- Robotic combat vehicles (RCV) family MALI MILOS
- New generation of small arms and increased lethality ammunition with opto-electronic day and night sights/devices and new tactical gear with increased protective and camouflage characteristics in both visible and IR spectrum
- Communications, ISR, C4I systems

ESD: Which of your current programmes are carried out in international partnership with other national or multinational procurement organisations? Are there defence procurement efforts executed in the scope of public-private partnerships?

Miloradovic: Serbia is determined to enhance its involvement in international partnership-based projects. However, there are currently only a limited number of programmes carried out in international partnerships with other national or multinational procurement organisations.

The capacity development programme for conventional ammo stockpile management that Serbia has established with the support of the NATO Support and Procurement Agency (NSPA) is the best example of this determination.

Within this project, a specific mechanism has been put in place to enable safe and

ORAO 2.0 J-22M modernised ground attack fighter

The PEGASUS tactical armed UAS

The PASARS M16 hybrid gun/missile air defence system

The modernised M-80AB1/2 infantry fighting vehicle

The LAZAR III multirole armoured vehicle 8×8 with 30 mm RCWS

The 155 mm NORA B52 M15 self-propelled howitzer

Miloradovic: The Serbian defence industry is one of the main pillars of national industrial technological growth. In addition, it is historically recognised as a crucial mechanism to maintain Serbian political/military neutrality. It is therefore afforded high priority in terms of national investment and support. Notwithstanding the fact that the Serbian defence industry has traditionally contributed significantly to the national GNP.

Having developed the Serbian defence industry to such a broad scale and scope, a reliable and effective basis is established to respond to the materiel needs of the Serbian military. In most domains, the defence industry's production capability exceeds the actual needs of the Serbian Armed Forces, thus production is export-orientated, delivering the majority of its output abroad.

However, there are several areas where the national industry cannot meet the defence requirements, namely in the production of helicopters, fighter jets, mid-long range ground based air-defence and short-mid-long range radars, meaning that solutions are therefore sought worldwide.

The interview was conducted by Jürgen Hensel.

environmentally friendly demilitarisation of surplus and obsolete ammunition.

Moreover, Serbia is considering joining partnership-based projects with the European Defence Agency in the standardisation domain and sustainable energy domain, as well as in the NATO programme regarding Land Battle Decisive Munitions.

Defence procurement in Serbia is conducted in accordance with national legislation related to public procurement, as well as with the relevant law on production and trade in weapons and military equipment. Therefore, defence public-private partnerships are recognised as a legal method of acquiring those needed goods and services.

Even though defence procurement efforts are not frequently executed in the scope of public-private partnerships, partnering between the MoD and private sector is very much present within the R&D domain.

ESD: To what extent is the Serbian defence industrial base capable of responding to the materiel needs of the Serbian military? In which areas do you have to rely on foreign suppliers?

The robotic combat vehicle family "MALI MILOS"

Infantry squad equipped with T-19 tactical gear set with 6.5 mm modular rifles with optronic sights

The Serbian Defence Industrial Base

Colonel Slavko Rakic, PhD

The production of Armaments and Defence Equipment (ADE) in the Republic of Serbia is an activity of strategic interest for the country; it covers all efforts and operations related to R&D, manufacture, testing, overhauling and upgrading, demilitarisation and utilisation of ADE, including the development and mastering of defence technologies.

Historically, the term 'defence industry' has been identified as a key mechanism to secure political neutrality, and its development has therefore been supported by significant investment. Specific to the Republic of Serbia, which is derived from the historical and geopolitical circumstances of the last century, is that the Ministry of Defence, in cooperation with other departmental agencies, is the authority in charge of the planning and execution of these activities.

In the Republic of Serbia, the production of ADE is not differentiated as a separate industrial sector. The Serbian defence industry business ecosystem in the narrow sense consists of various sized companies (small, medium-sized and large enterprises) and different ownership structures (state-owned and private companies with domestic and/or foreign ownership) that have been granted a licence for the production of ADE by the Ministry of Defence, in compliance with legal regulations. These companies, together with military-technical institutions (dealing in research, development, overhaul and test activities) within the Ministry of Defence and the Serbian Armed Forces (SAF), constitute the country's defence technological and industrial base.

The core of this complex is composed of 17 companies with majority state ownership that have formally joined forces into the Group of Serbian Defence Industry (SDI) as of January 2020 with their products covering about 85 per cent of armaments production in the country, both in terms of quantity and turnover. The remaining 15 per cent of ADE production is covered by as many as approximately fifty small and medium-sized (SMEs) enterprises, mainly with private ownership, which partly provide cooperation services to SDI companies, but also deal in the development and production of their own products.

Author

Colonel Slavko Rakic, PhD is the Head of the Defence Technologies Department of the Serbian MoD.

Photos: Yugoimport

Airbus helicopter H-145 with integrated Serbian weapon systems

SDI Group

Although they have been constituted as companies with majority state ownership whose direct purpose is to equip domestic armed forces, the SDI Group enterprises, which are solely controlled and supervised by the Republic of Serbia, conduct business according to market rules and regulations and are mostly export-oriented (more than 90 per cent of their trade is export).

In recent years, a series of modern arms development projects have been initiated and implemented by SDI Group companies in the role of manufacturer and integrator. These arms will largely contribute to the growth of the Serbian Armed Forces' capability in the forthcoming period. The SDI Group production is predominantly based on land forces combat systems and armaments (non-combat and armoured fighting vehicles, unmanned ground platforms), artillery and hybrid troop counter UAV system, a new family of infantry weapons and equipment) and Air Force equipment (aircraft for basic training and unmanned aerial platforms). There is a long and successful tradition in the production of all types of ammunition and guided missiles and unguided projectiles and rockets of increased range, precision and effectiveness, of energetic and pyrotechnic materials, the quality and competitiveness of which have been recognised globally.

A new wheeled self-propelled gun-howitzer 155 (NORA B-52 M21), with a range of 40+ km, introduced into the Serbian Armed Forces, should be specifically mentioned. Some of the technical

GAZELLE helicopter with integrated Serbian weapon systems

solutions of this gun-howitzer make it a unique weapon worldwide. Serbia participated in a tender invited by the US Army for the procurement of this type of weapon in competition with leading manufacturers from countries such as France, Sweden, and Israel. From the technological point of view, NORA B-52 M21 is the most complex army system (weapon-ammunition-fire control system) manufactured today by the country and it is a precursor of new accomplishments of the Serbian Defence Industry. The sale of this weapon has already been initiated with some foreign partners from the EU, Africa and Asia.

The SDI Group has rounded off the production of the entire conventional artillery and missile programme. Besides the aforementioned NORA B52, this programme encompasses Multitube Modular Rocket Launchers SVLR with a 50+km range, mobile acquisition and command and information systems and fire control systems. Furthermore, aware of modern trends in small arms ammunition unification and in search of a "universal round" at the tactical level, the SDI Group has developed a whole range of new small arms ammunition in calibre 6.5x39 mm Grendel (modular automatic rifle 7.62/6.5x39 mm, submachine gun and light machine gun). The idea is to support the Ministry of Defence in their intention of being among the first in the world to introduce this concept in the armed forces on a large scale. Following development trends in the 21st century, the SDI has manufactured, together with their subcontractors, a complete system for a modern infantry soldier covering the following subsystems: arms; bullets; optical and optoelectronic sights and sensors; ballistic and camouflage protection; communications and command systems; and auxiliary remotely controlled vehicles for various purposes. These efforts have resulted in high-level protection, high precision, environmental awareness and effectiveness, coupled with improved ergonomics and resilience in all modern warfare conditions.

Analysing the policy of the country's armed neutrality, and the commitment to the optimum use of available resources, the SDI Group has gradually developed a substantial capability and solutions for the improvement, modernisation, upgrading and integration of some weapon systems used in the Serbian Armed Forces. This applies to both western and former Soviet Union origin weapon systems, which date back to the cold war era. In the field of modernisation, the most important projects are: upgrading existing tanks (M-84); modernisation of armoured fighting vehicles (M-80) with an emphasis on their increased protection, fire power and situational awareness; modernisation of artillery, AD and radar systems and aircraft of domestic make. It would be appropriate to mention here the hybrid counter UAVs troop self-propelled air defence and missile system PASARS M16. With the integration of proven solutions (such as the Swedish 40 mm Bofors air defence gun), combined with new systems and sub-systems (French short-range air defence missile MISTRAL), the Serbian target identification system, fire control and command system mounted on a modern wheeled armoured platform and equipped with

Modernised and integrated systems: the Military Technical Institute, overhaul facilities, defence industry and foreign partners work together on armaments with integrated Serbian weapon systems such as the MBT M-84 depicted above.

new electronically programmable ammunition, the PASARS has become a universal solution for action against a wide range of targets.

Further development trends of state-owned companies within the SDI Group are determined by the needs of the Serbian defence system in the first place. But they are also influenced by market requirements of the manufacturing plants themselves which are oriented towards investments into new production technologies and into the development of new products with an imperative to make maximum use of their own industrial scientific and technological base, while promoting their cooperation with regional and international partners at the same time.

The intention is that such cooperation, in addition to the exchange of experience, knowledge and products on a commercial base existing so far, be extended to joint investments, establishing joint venture enterprises, and other forms of partnership in the country and abroad. This is now possible thanks to the Law on the Manufacture and Trade of ADE of the Republic of Serbia, adopted in 2018. The said law established in an affirmative and encouraging manner the conditions for extending and promoting the Serbian technological and industrial base and authorised foreign investments in this sector.

The Military Technical Institutions of the Ministry of Defence and the SAF are a separate entity within the defence sector which closely cooperates with industry, and incorporates state-owned military technical institutions of the Ministry and the SAF:

- The Military Technical Institute as a main R&D institution in the field of defence technologies serves as a specific hub for all subjects dealing in these matters in Serbia. The Institute also cooperates with similar institutions in the region and globally
- Overhaul Depot of Land Forces and Air Force Overhaul Depot which perform all maintenance operations of materiel and directly participate in all programmes of modernisation and integration of Land and Air Force platforms respectively
- Ammunition Overhaul Depot which performs all activities involving follow-up, maintenance, overhaul (refurbishing) and modernisation of ammunition. This establishment has been included in the programme for development of the capacities for conventional ammunition stacks management instituted with the NATO Support and Procurement Agency (NSPA)

PASARS M16 40mm self-propelled hybrid AD system with integrated SHORAD missiles, MISTRAL and Modular MLRS OGANJ M21, produced by PPT-namenska Trstenik

The M-80 infantry fighting vehicle constitutes one of the backbones of the mechanised units.

The LAZAR-3 8x8 multirole armoured vehicle

The MALI MILOS robotic combat vehicle

The PASARS M16 AD system has become a universal solution to engage a broad spectrum of targets.

- Technical-Test Centre which is end user-oriented and takes an active part in tests and trials of ADE being developed and manufactured for the needs of the SAF and for export needs, using modern standards and methods

Other Manufacturers

As previously stated, as many as approximately fifty SMSEs producing ADE are based on majority private ownership (domestic or foreign) which complements the state-owned manufacturing plants whose sub-suppliers they are to a large extent. However, these SMEs also appear on the market on their own. They deal in the production of various ADE, some of them being highly specialised in the field of optics and optoelectronics, precision mechanics and electronics, telecommunications, radar techniques, modern energetic and protective materials, software and IT solutions. Similar to the European Union, Serbia has recognised the importance of these enterprises as an agile initiator of innovative activities and the acquisition of new defence and civilian technologies, whose work is closely followed. The focus is placed on the identification of innovative and "Copernican" solutions that will change the method of operating and reasoning in the defence sector, such as AI, self-contained weapon platforms, and nanotechnologies. These enterprises also achieve an important scope for cooperation with foreign partners from the region and the European Union, thereby promoting the entire Serbian Defence Industry.

For the time being, there are no models of institutional support by the Serbian Defence System to SMSEs in the defence sector or defence technologies; instead, cooperation between the user and service supplier is based on commercial principles. With regard to investments, the Republic of Serbia represents a fertile ground for foreign investments that have been increasing in recent years in the civilian sector, with important potential in the defence industry. This potential is obvious given the quality and competitiveness of the defence technological and personnel base, geographical location and connection to the most profitable markets, as well as the country's policy of armed neutrality, which confers the position of some sort of node and allows a large spectrum of cooperation activities worldwide.

The intention is to create in Serbia a favourable environment for the enhancement of partnership with EU countries and beyond in terms of securing their support to the establishment of SMEs and centres of excellence that would specialise in the development of specific technologies and products. That would result in furthering the capabilities of the SAF and defence system overall and in greater competitiveness of its commercial representation on the world market.

Serbia has no ambition to establish technological and manufacturing lines in areas reserved for the most developed countries. Nevertheless, the country is proud of the fact that, in addition to its traditionally high quality products in the field of small arms and artillery weapons and their accompanying ammunition, a significant breakthrough was achieved in recent years in areas of the most up-to-date optoelectronics, automation, robotics and software. In this regard, there are programmes underway for supplying the SAF with modern and complex combat systems from renowned global manufacturers. These include German H-145 helicopters, Spanish C-295 transport aircraft, Chinese BPL CH-92 UAVs, and the Russian PANCIR S-2air defence system. These are directly related to the improvement of technological capabilities of Serbia's industry through transfer of technology and know-how to its companies, overhaul depots and the Military Technical Institute.

Finally, it may be concluded that the Serbian defence industry, ever since its

establishment,has evolved and subsisted in various circumstances. The country itself has gone through different forms of its development but its strategy towards the defence industry has never changed and has always been focused on building its capacity to supply the country's armed forces with state-of-the-art armaments and defence equipment. Besides, the quality of its products has long been recognised and the products have been in demand globally. The defence industry has always been related to the country's industry through its cooperation arrangements, thus providing impetus to the entire Serbian industrial base. Its capacity to adapt to modern trends and cope with the ever-greater influence of the new "civilian" technologies and dual use technologies, along with the extension of the SMEs' cooperation base, sustain the expectations that in the years to come, it will represent a solid base for military neutrality. In addition, its high degree of production will enable the country to achieve an overall economic equilibrium. In short, the defence industry is a significant factor of the defence and security policy of the Republic of Serbia, where the development of its capabilities is achieved by a synergetic approach of large state-owned companies, institutions and small private companies, as well as through cooperation with foreign partners.

The M19 modular combat system manufactured by Zastava Arms Kragujevac which is the oldest factory within Grupacija OIS.

New GBAD Developments Counter Evolving Threats

Doug Richardson

Over the second half of last century and the first two decades of the 21st, the nature of the air threat has continued to evolve, but improvements to ground-based air defence (GBAD) systems has generally kept pace with these changes, with radar and other target detection/tracking sensors of improved performance being introduced alongside improved surface-to-air missiles and more effective point-defence gun systems. However, recent and pending developments in air-to-surface weaponry will pose formidable problems for the defender.

A total of 18 countries now operate the PATRIOT air-defence system. The most recent customer was Switzerland which announced last year that it had selected the US system rather than the Eurosam SAMP/T to meet its BODLUV 2020 requirement, During 2022, Romania will become the first customer to receive PATRIOT Post-Deployment Build 8.1, the first incremental enhancement to the eighth major upgrade introduced since PATRIOT was first fielded. This version includes a new digital exciter that will be easier to maintain than the current analogue unit, and be easier to update to cope with future threats. The new Warfighter Machine Interface (WMI) is more intuitive for operators familiar with video games and modern personal computers, so should result in greater operator proficiency.

Photo: Raytheon

Designed to defeat advanced and next-generation threats, including hypersonic weapons, Raytheon Missiles & Defense's Lower Tier Air and Missile Defense Sensor (LTAMDS) is the first member of the company's family of GhostEye radars.

PATRIOT

PATRIOT currently uses the AN/MPQ-53 radar, but this will give way to the new Raytheon Technologies Lower Tier Air and Missile Defense Sensor (LTAMDS), which will form part of the US Army's Integrated Air and Missile Defense network. This uses gallium nitride (GaN) technology to provide enhance range, as well as increased detection and discrimination performance. While the AN/MPQ-53 uses a single antenna array, LTAMDS has a main array and two smaller secondary arrays, an arrangement that will provide full 360-degree coverage. A LTAMDS mock-up first shown at the 2019 Association of the United States Army (AUSA) showed side-mounted arrays of 12 cooling fans, evidence of the high level of power being used.

The first combat launch of the Rafael/Raytheon DAVID'S SLING, Israel's middle-tier air defence system, took place on 23 July 2018 when a two-round salvo was fired against a pair of OTR-21 TOCHKA (SS-21 SCARAB) tactical ballistic missiles that had been launched in Syria, and whose targets are reported to have been close to that country's border with Israel. The decision to engage them with DAVID'S SLING was probably a precautionary measure before the trajectory and likely impact point of the Syrian missiles had been fully analysed. Both of the Israeli interceptors were ordered to self-destruct, but early reports suggesting that one may have crashed intact on Syrian territory were never confirmed.

In February 2021, Rafael completed the development firings of the ground-based Air Defense version of its I-DERBY ER (Extended Range) air-to-air missile. Identical in size and configuration to the standard

Author

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

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Photo: LIG

South Korea's CHEONGUNG programme combines locally-developed technology with that obtained from Russia.

DERBY missile, I-DERBY ER teams a dual-pulse rocket motor with an active radar seeker. It is compatible with Rafael's SPYDER air-defence system, and has a range of 40 km, rising to 80 km with a booster. Turkey is currently developing a long-range SAM system designated SIPER. Begun in 2016, this project by Aselsan, Roketsan and Tübitak Sage uses a vertically-launched missile fitted with a short tandem booster, and reported to use a K-Band radio-frequency seeker for terminal guidance. Maximum range is more than 150 km, and the target set includes air-breathing threats and ballistic missiles.

Deliveries of the LIG Nex1 CHEONGUNG Block 1 (also known as the KM-SAM or M-SAM) to the South Korean Air Force (RoKAF) ended in 2020. Developed under programme that involved the South Korean Agency for Defense Development (ADD) and technical support from Russia's Almaz-Antey and Fakel, it uses technology from the 9M96 missile used by Russia's S-350E and S-400 air-defence systems. Cold-launched from vertical launch tubes carried by a wheeled transporter-erector-launcher vehicle (TEL), the missile has a top speed of Mach 4.5, a maximum range of 40 km, and can engage targets at altitudes of up to 20 km. CHEONGUNG Block 1 entered service in 2015 to replace the obsolete MIM-23 HAWK.

The follow-on CHEONGUNG Block 2 was designed to engage incoming ballistic missiles at altitudes of up to 20 km. The first Block II battery entered service with the South Korean air force in November 2020. A year later, the United Arab Emirates (UAE) became the first export customer for the CHEONGUNG Block 2 when it announced that it intends to acquire the system under a contract worth up to US$3.5Bn.

SKY SABRE

A good example of how a modern SAM system can outperform its earlier counterpart is the British Army's new MBDA SKY SABRE, the first examples of which were delivered to the British Army in late 2021. SKY SABRE combines a Saab GIRAFFE Agile Multi-Beam (GAMB) 3D radar, a Rafael Surface-To-Air Missile Centre (SAMOC) used for command-and-control, and a LAND CEPTOR missile vehicle. Intended to replace the MDBA RAPIER point-defence SAM, this has a maximum range of more than 25 km, around three times that of the older weapon. RAPIER was a semi-automatic command to line-of-sight weapon, so could engage only one target at a time, but SKY SABRE uses MBDA's Common Anti-Air Modular Missile (CAMM), which combines strapdown inertial guidance and active-radar homing, so can be fired in salvoes in order to counter multiple attackers. Under a 2021 agreement between Poland and UK, CAMM will form part of NAREW, Poland's future Ground-Based Air Defence System.

Photo: Roketsan

Test firings of Turkey's new SIPER high-altitude and long-range SAM system are currently under way.

A CAMM-ER extended-range variant of the missile incorporates low aspect-ratio wings mounted on the centre-to-rear section of the missile, which has a greater diameter in order to accommodate a new AVIO rocket motor that increases the maximum range to 45 km. Developed for the Italian MoD under a programme launched in 2013, CAMM-ER will replace Italy's existing ASPIDE/SPADA missiles.

Sweden's FMV procurement agency handed over the first Diehl Defence IRIS-T SLS firing units to the Air Defence Regiment in Halmstad in August 2019. Designated as the RBS 98, and intended to replace the existing RBS 70, the system uses an open system architecture and combines a vertical-launch version of the IRIS-T missile with system elements such

as sensors/radars, command and control systems, and communications systems from various manufacturers. A dedicated variant of the BV 410 tracked AFV carries four ready-to-fire missiles.
The Norwegian Army has also adopted IRIS-T as part of its Mobile Ground Based Air Defence System. This reuses the NASAMS command and control and network facilities, linking these to six modified M113 vehicles armed with IRIS-T missiles.

Russian SAM Systems

The long range of some Russian SAM systems such as the S-300 (SA-10 GRUMBLE) and S-400 TRIUMF (SA-21 GROWLER) can create problems for the air forces of nearby countries. In November 2015, Russia deployed an S-400 system to Hmeymim air base near the port city of Latakia in Syria, and this was not withdrawn when Russia removed much of its Syrian-based hardware in the following year (2016). From Hmeymim, the coverage of the system extends deep into Turkey and Israel, and over Cyprus. S-400s deployed in Russia's Kaliningrad enclave have a range that extends as far as Warsaw and over the southern Baltic.
In 2019, Turkey took it first delivery of S-400 hardware to meet a reported requirement for four batteries. By mid-2021, Turkish personnel were reported to be sufficiently trained that Turkey no longer needed support from Russian technicians. At the MAKS-2021 air show, Alexander Mikheyev, CEO of Rosoboronexport stated that a proposal was being drawn up covering the supply of an additional batch of S-400 systems to Turkey.
In order to protect such long-range assets, the Russian practice is to deploy shorter-range SAM or combined SAM/gun systems. In addition to countering low-flying aircraft and helicopters, their primary role is to incoming cruise, direct-attack, and anti-radiation missiles, engaging multiple targets in quick succession. Obvious tactics for countering this sort of rapid-fire SAM system are to swamp their capability by mounting a rapid series of attacks by from different directions in short order, or by presenting enough targets to exhaust the missile capacity and ammunition magazines.
Until recently, aircraft and missiles represent unitary targets for defensive systems, but the fielding of lightweight but autonomously-homing missiles such as the Raytheon Missiles & Defense STORM-BREAKER and Rafael SPICE 250 allow a heavy fighter such as the F-15E STRIKE EAGLE to release more than 20 mini-missiles from a launch location outside the coverage of the defences. The growing availability of small UAVs and mini-UAVs also allows the conduct of 'swarming' attacks that threaten to swamp the capability of GBAD defences.

Photo: Swedish MoD

A Swedish RBS 98 SAM system is deployed ready for action. It uses a vertically-launched version of the IRIS-T missile.

PANTSIR

Following a US, British and French cruise missile attack mounted against Syrian chemical-warfare sites on the night of 13-14 April 2018, Russian Defence Ministry spokesman Igor Konashenkov had claimed that Syria's PANTSIR-S1 (SA-22 GREYHOUND) systems had showed "almost 100% effectiveness" in countering the West's missile strike. This situation was about to change.
During a large-scale air attack mounted on the night of 10 May 2018 against Iranian forces operating in Syria, Israel destroyed a number of Russian-supplied surface-to-air missile systems operated by the Syrian military, including at least one example of the BUK-M2E (SA-17 Grizzly'), and the PANTSIR S-1 combined gun and missile system. A video released by the Israeli Ministry of Defence showed the destruction of a PANTSIR. This vehicle had been deployed in the open - its radar system was not fully deployed – its stabilising jacks were not in the lowered

Photo: Russian MoD

In 2015, this Russian S-400 system was deployed to Hmeymim air base near the port city of Latakia in Syria.

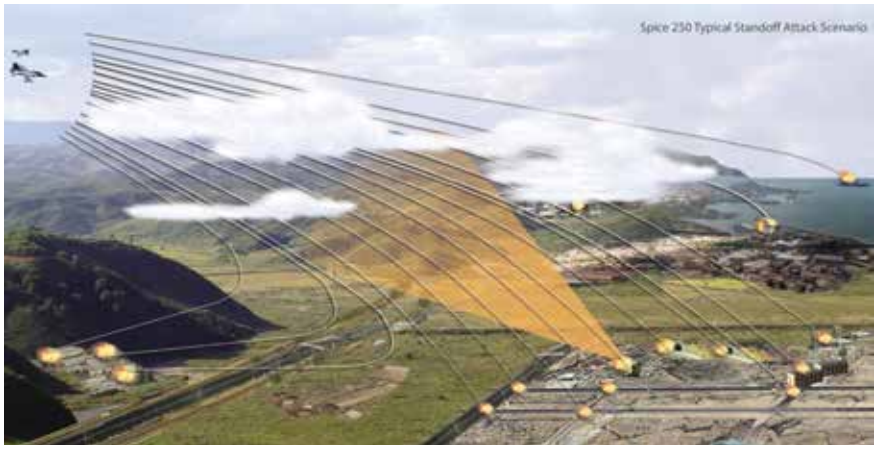
position, and its missile tubes were pointing to the rear. IR imagery was obtained from the seeker of the weapon used in the attack showed that at least two missile tubes were hot at their front end, an indication that missiles had recently been fired. During a press briefing after the attack, the Israel Defense Force (IDF) stated that the PANTSIR been attacked after it had fired at Israeli aircraft. PANTSIR was developed in the 1990s and entered Russian service following final trials conducted in 2007, so the publicised destruction of the Syrian example of this relatively modern weapon must have been an embarrassment for the Russian military.

PANTSIR has been upgraded to detect and destroy all types of enemy drones, and can use hypersonic missiles with a range of up to 30 km, an official at the Rostec state tech corporation told TASS News Agency in late 2021. The upgrade has also reportedly improved the PANTSIR's stealth and jamming resistance capabilities, as well as its rate of fire and maximum engagement altitude. Improvements have been made to the system's multifunctional fire control radar and search radar, allowing up to 40 targets to be monitored simultaneously. The EO target tracking subsystem has also been upgraded.

In early 2020, Valery Slugin, the chief air-defence designer at KBP revealed a proposal to provide the 24-round Transporting and Loading Vehicle (TLV) of the PANTSIR system with the ability to fire missiles against targets assigned to it by the system's main unit. This would involve fitting the TLV with a simplified control system. Reliance on external cueing could prevent incidents such as the downing of Malaysia Airlines Flight MH17 in 2014 by a BUK fire unit with limited autonomous capability.

Using a guided missile to destroy a drone is hardly cost-effective. High-energy laser weapons are a potential low-cost solution to this problem. Another potential solution is a high-power microwave system, or a jammer able to disrupt the drone's control system. High-energy lasers and high-energy microwave weapons they may also play a role in defeating UAV swarms.

Photo: Rafael



After releasing a salvo of individually-targeted Rafael Advanced Defense Systems SPICE 250 'smart' bombs, an F-16 turns away to avoid entering the coverage of enemy air-defence systems. Weapons such as this and the Raytheon STORMBREAKER will pose a formidable challenge to GBAD systems.

DE M-SHORAD

Efforts are under way in several counties to package a laser weapon into a vehicle. The US Army's Directed Energy Maneuver-Short Range Air Defense (DE M-SHORAD) has integrated a 50 kW-class high-energy laser, a Ku720 multi-mission radar (both provided by Raytheon), and the associated power and thermal-management systems onto a General Dynamics STRYKER A1 8x8 armoured vehicle. Conducted under the MMHEL (Multi-Mission High Energy Laser) programme, this combination is intended to protect ground units from threats such as rotary and fixed-wing aircraft, UAVs, as well as incoming rocket, artillery, and mortar rounds. Several DE M-SHORAD vehicles are due to be delivered to Fort Sill, Oklahoma, late this year.

The UK MoD is spending the equivalent of US$100M on capability demonstrators for land and maritime directed-energy weapons (DEWs). An industrial team lead by Raytheon UK is to create a laser-based DEW installed on a WOLFHOUND wheeled AFV, while a team led by Thales UK is to provide a high-powered RF system mounted on a MAN SV truck.

Hypersonic Missiles

Hypersonic missiles will pose the greatest emerging challenge to air-defence systems. While some SAM systems can cope with high-speed threats such as ballistic missiles, this class of threat flies a fairly predictable trajectory. Hypersonic weapons typically fly within the upper atmosphere at speeds greater than Mach 5. This minimises the time available to the defence for threat-detection and engagement, and their manoeuvrability makes their trajectory hard to predict.

The characteristics of hypersonic flight do not always favour the attacker. Extended flight through the atmosphere poses the need for effective thermal management. The missile may well face aerothermal

conditions that severely stress its control systems and structure, and even a small amount of damage imposed by a defensive missile could rapidly result in the vehicle's destruction. Inevitably, a hypersonic vehicle will have a high IR signature, while it will be difficult to deploy decoys or other countermeasures

As hypersonic missiles rise above the local horizon and become detectable by ground-based sensors, their sheer speed gives the defender little time to react. High-altitude or even space-based sensors may be needed to provide early detection. Current SAMs lack the performance needed to counter a manoeuvring hypersonic threat. Engaging these weapons will require improved SAMs, and it is possible that future versions of existing weapons such as ASTER 30, PAC-3 MSE, and THAAD could also be given some degree of anti-hypersonic capability. The MDA already plans to test an SM-6 against what it terms an "advanced manoeuvring threat".

In November 2021, the MDA announced that Lockheed Martin, Northrop Grumman and Raytheon Missiles and Defense had been selected to design a GLIDE PHASE INTERCEPTOR (GPI) intended to counter hypersonic weapons that rely on a boost stage to bring them up to their operational speed. Although currently envisaged as a naval weapon, it could find a land-based role.

Directed-energy weapons are a possible alternative defensive solution, but given that a hypersonic missile will have been designed to cope with severe aerothermal conditions, the additional stress caused a high-powered laser weapon may not be enough to cause destruction, given that the threat is likely to be illuminated for only a few seconds. High-powered microwave beams could prove a more viable solution, with their radiation leaking into the target to disturb or even damage the internal electronics used for flight-control and navigation.

In whatever form they are deployed, GBAD systems will always be high-priority targets for an attacker. This was demonstrated recently by the border crisis between Armenia and Azerbaijan. Armenia has claimed some success in attacking Azerbaijan's air-defence assets by means of lethal drones. The victims of these unconventional attacks are reported to have included TOR (SA-15 GAUNTLET), OSA (SA-8 GECKO), PANTSIR, KUB (SA-6 GAINFUL), and S-300. As these incidents demonstrate, the long struggle between the attacker and the air defender seems set to continue. ■

Photo: IDF

This seeker image was transmitted just before an air-to-surface missile struck a PANTSIR-S1 during an Israeli attack on 10 May 2018 against Iranian forces operating in Syria.

Photo: US Army

To date, the US Army has ordered a total of 12 laser-armed STRYKER vehicles – an initial batch for four due for delivery this year, followed by a further eight to be delivered in FY2023-24.

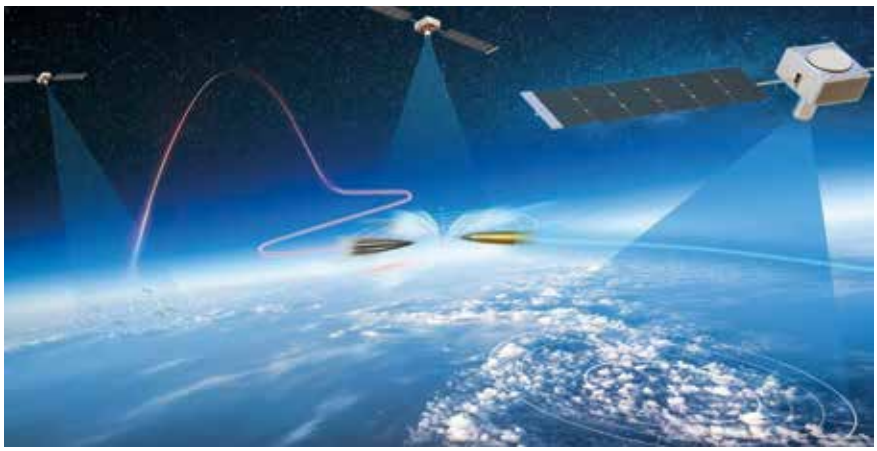


Photo: Northrop Grumman

This Northrop Grumman artwork shows how space-based sensors could be used during the interception of a hypersonic threat.

OCCAR Seeks NATO Standardisation of ESSOR Waveforms

Lars Hoffmann

Six European countries are currently working on the development of standardised digital waveforms for the transmission of voice and data for military use. Designated European Secure Software Defined Radio (ESSOR) and involving Italy, France, Spain, Germany, Finland and Poland, the programme is managed by the European Organisation for Joint Armament Co-operation (OCCAR). The wideband waveform called ESSOR High Data-Rate Waveform (EHDRWF) for use by ground forces has already been developed. OCCAR is now aiming to have this waveform certified within the framework of NATO's STANAG standardisation plan. A proposal has been made to the relevant NATO working group, says Eric Langlois, OCCAR's ESSOR Business Development Officer. He expects the proposal (STANAG 5651) to be approved in the coming months, following which the certification process can begin. "We want ESSOR products to be standardised by NATO as well," says Langlois, describing OCCAR's strategy.

The background to the ESSOR effort is the objective of enabling the armed forces of several nations to communicate better on the battlefield. At present, the problem is that, as a rule, an army's digital radio technology only works with a certain software, the digital waveforms. Often the waveforms are developed by the radio manufacturers specifically for their technology. Since the major armies of Europe each use different radios and waveforms, this means that a French battalion commander cannot communicate via radio with his Italian or German counterpart. The ESSOR project now aims to develop uniform waveforms that work with the different radios of all partner countries - just as in the civilian sector a Samsung mobile phone can communicate with an iPhone from as well as with a device from Motorola.

A major contribution to harmonisation within the OCCAR project is made by industry. For example, each ESSOR country has nominated a national industrial champion - usually a radio manufacturer - to participate in the development of the waveforms. For Finland, this is Bittium, for France Thales, for Germany Rohde & Schwarz, for Italy Leonardo, for Poland Radmor, and for Spain Indra. The six national industry champions have joined together to form the a4ESSOR industry consortium.

Photo: OCCAR

The programme has been running for several years and waveform development is already advanced. In the coming months, further compatibility tests for the wideband waveform will take place with radio technology from several manufacturers, as Langlois explains. This will take place in a special facility in Poland.

Waveform Variants

In addition to the wideband waveform, which is primarily intended for army applications, OCCAR and industry are working on other variants. For example, the narrowband waveform ENBWF, which is also to be standardised by NATO, a waveform for UHF satellite communication and a 3D waveform.

In addition, France, Germany, Italy and Spain agreed last year to develop new waveforms within the framework of the ESSOR Multi-functional Information Distribution System (EMIDS), which are specifically tailored to the needs of air combat with fast-flying aircraft. In the process, transmission hardware is also to be designed for the first time in the ESSOR programme. Should there be a desire for further developments in the customer countries, OCCAR would be happy to fulfil it, Langlois emphasises.

Interest in More Partners

The more nations participate in ESSOR, the better the interoperability of the armed forces. For this reason, OCCAR is very interested in involving further partners. It is also possible to join the programme at a later stage, as the example of Germany has shown. After all, the German Ministry of Defence only decided to join ESSOR after some time for reflection, after the other countries had already committed and started the project. "We also see interest from other European states," says Langlois. Several of the companies involved in ESSOR have asked whether they can also export technology. Apparently, there are potential customers interested in the technology outside the countries of the ESSOR consortium.

Companies that participate in ESSOR are also likely to benefit from projects within the circle of the six users. For example, according to well-informed circles, in the tender for its command and control radios in the context of the Digitisation of Land-Based Operations (D-LBO) effort, Germany has stipulated that the radios to be procured must also be ESSOR-compatible. This limits the group of bidders to the six ESSOR companies. Other bidders would then possibly have to cooperate with one of these companies in order to gain access to the tender at all.

Since the harmonisation sought within the framework of ESSOR is in line with the EU Commission's aim of harmonising the defence sector and expanding European sovereignty, it is not surprising that the project is also being promoted by the EU. The European Defence Industrial Development Programme (EDIDP), which was launched as a precursor to the European Defence Fund, has already provided €37 M for the ESSOR projects. ■

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Conrad Waters

The ongoing importance attached to securing valuable maritime resources means that international demand for Offshore Patrol Vessels (OPVs) remains buoyant. The market spans a wide range of requirements, ranging from basic constabulary patrol ships to sophisticated, corvette-like combatants.

In spite of growing competition from Asian yards, European shipbuilders retain a firm presence in this market. However, the approach that has been adopted to securing vital export sales varies from country-to-country.

Photo: Navantia

Venezuela's GUAICAMACUTO is an example of Navantia's AVANTE 1400 littoral patrol vessel.

Spain

One of the most long-established European players in the international OPV market is Spain's Navantia. Its current product line up is focused on its AVANTE family of patrol vessels. This encompasses designs ranging from 300 to 3,000 tonnes that can be adapted for research, support, patrol and combat missions. Navantia states that the AVANTE series utilises a common design philosophy and shares common standards. A "fitted for but not with" approach is intended to allow ready expansion of capabilities without major reconstruction.

Early export success for what is now the AVANTE line up was achieved in 2006 with the award of contracts for four 99-metre POVZEE (AVANTE 2200 PATROL) oceanic and four 80-metre BVL (AVANTE 1400) littoral patrol vessels from Venezuela. Seven of these ships were delivered from Navantia's shipyards in the Bay of Cadiz between 2010 and 2011. However, assembly of the final BVL – COMANDANTE ETERNO HUGO CHÁVEZ – was allocated to state-owned shipyard DIANCA in Puerto Cabello and not completed until 2020. All these ships were essentially designed for constabulary missions, although the AVANTE 2200 hull incorporates military design standards and has sufficient growth margin to be adapted to a combatant role.

The flexibility inherent in this design approach is reflected in the five AL-JUBAIL class corvettes ordered by Saudi Arabia under a €1.8Bn (US$2.1Bn) contract announced in July 2018. Examples of the AVANTE 2200 COMBAT configuration, these 104-metre vessels are slightly larger than Venezuela's POVZEE type but differ most markedly in being outfitted for high-intensity warfare. This includes specification of Navantia's CATIZ combat management system and installation of a Mk 41 Vertical Launch System (VLS) for quad-packed Evolved Sea Sparrow Missiles (ESSMs). Sea trials of the lead ship commenced in September 2021 and launch of the final unit, UNAYZAH, took place on 4 December.

In January 2021, Navantia marked a further success for the AVANTE family with an announcement that a new OPV would be built for the Royal Moroccan Navy. Although only limited details of the project were provided, it is believed that the new vessel will be based on the AVANTE 1400 hull. In line with most other OPV construction, fabrication has been allocated to Navantia's Cadiz facilities, reflecting a business model that has seemingly focused heavily on supporting domestic employment. However, recent press reports suggest that diplomatic tensions between Spain and Morocco might threaten implantation of the contract, with alternative sources of supply being explored to meet the navy's requirements.

France

In common with Spain, France's shipbuilding industry has focused heavily on using in its own, domestic yards to meet international export requirements for OPVs. However leading shipbuilder Naval Group has adopted a policy of drawing a much clearer distinction between constabulary and combatant vessels. This is most clearly reflected in the establishment of the Kership joint venture with Brittany-based shipbuilder Piriou in 2013. The enterprise focuses on building vessels intended for coast guard, law enforcement, customs and scientific missions up to 95 metres in length. The arrangement allows Naval Group to devote its own facilities to building "higher end" naval combatants, such as its popular series of GOWIND corvettes and light frigates.

The most prominent OPV programme implemented by Kership to date has been the

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Photo: Navantia

Saudi Arabia's AL-JUBAIL, an AVANTE 2200 COMBAT corvette, demonstrates the blurred distinction between the constabulary OPV and warfighting corvette categories.

Photo: Naval Group

Seen here under French Navy colours as L'ADROIT, BOUCHARD is one of four new OPVS being acquired by the Argentine Navy.

Argentine Navy's circa €300M (US$350M) contract for a quartet of 87-metre L'ADROIT (BOUCHARD) class vessels that was signed with Naval Group in 2018. The agreement encompassed the refit of the speculatively-built L'ADROIT to meet Argentinian requirements following the ship's period on loan to the French Navy and the completion of three new-build vessels by Kership. Three of the class have been delivered to date. The final unit is scheduled to be handed-over in the spring of 2022.

Naval Group's division of its activities between bespoke combatant and constabulary vessels arguably means that each type can be best optimised to master its intended role. In the case of L'ADROIT, key design features include a 360° panoramic bridge that encompasses combat information centre functions to maximise crew efficiency and situational awareness. The POLARIS Combat Management System (CMS) installed is specifically designed to support constabulary operations. The twin stern ramps and associated handling system facilitate deployment and recovery of the ship's boats – arguably its most important "weapon" – in conditions up to Sea State 4.

Another recent success for Kership's portfolio of designs has been Senegal's selection of its OPV 58S type for three 62-metre patrol ships contracted with Piriou in November 2019. Published images suggest that these will share the panoramic bridge and stern ramps found in the Argentinian ships and the POLARIS CMS is also likely to be an important design feature. However, it has also been reported that the trio will be capable of embarking a missile-based armament, suggesting the distinction between constabulary and combatant vessels may be difficult to maintain in practice.

Away from Kership, a number of other French builders offer OPV designs. Constructions Mécaniques de Normandie (CMN), Ocea, Radico Marine and Socarenam have all achieved success in the sector. Of these companies, Ocea's portfolio of lightweight, aluminium-hulled patrol vessels has gained most sales in the market for fast, coastal craft. However, the deliveries of the 58-metre OPV 190 Mk II FOULADOU to Senegal in 2016 and the larger 84-metre OPV 270 GABRIELA SILANG to the Philippine Coast Guard at the end of 2019 demonstrate the potential of the company's larger designs. Meanwhile, Socarenam's role in the Patrouilleurs Antilles Guyane (PAG) and subsequent Patrouilleurs Outre-Mer (POM) programmes for the French Navy will provide optimism that it can leverage these projects to achieve overseas sales. It delivered the smaller patrol vessels CASTOR and POLLUX to the Belgian Naval Component in 2014-15 and received an order for what might be the first of a series of 70-metre OPVs for the Polish Coast Guard in October 2020.

Italy

Italy's Fincantieri has a wide variety of patrol vessels within its portfolio and is currently designing a new class of multi-role OPV for the Italian Coast Guard. The Turkish Coast Guard's 88-metre DOST class search and rescue vessels – delivered between 2013 and 2014 – were based on the group's SIRIO class OPV design for the Italian Navy.

Photo: Fincantieri

Whilst officially described as an OPV, the heavily-armed Fincantieri-built MUSHERIB has much in common with a traditional fast attack craft.

Photo: Conrad Waters

The Batch 2 RIVER class OPV ARAGUARI was ordered for the Trinidad & Tobago Coast Guard but subsequently sold to the Brazilian Navy.

However, the majority of its export business in this market segment has been focused on heavily-armed combatants that – although sometimes referred to as OPVs – fall more readily into the fast attack craft and light frigate categories.

A good example of this type of vessel is the Qatar Emiri Naval Forces' MUSHERIB class, the first of which was delivered at the end of January 2022. Displacing some 725 tonnes and capable of speeds of circa 30 knots, this pair of 64-metre warships are heavily armed with equipment that includes EXOCET surface-to-surface and MICA surface-to-air missiles in addition to a main 76mm OTO gun. This focus on combat capabilities probably reflects the company's success in Middle Eastern markets, where the lightly-armed constabulary role has less relevance.

It should also be noted that Fincantieri's Vard Marine subsidiary has its own portfolio of OPV designs that have gained important international contracts. These include the VARD 7 080 and VARD 7 0 90 OPVs built in the United Kingdom for the Irish Naval service and the US Coast Guard's ARGUS (WMSM-915) class offshore patrol cutter, which is based on the VARD 7 110 concept.

United Kingdom

The United Kingdom's presence in the international OPV market is largely based on BAE Systems' Batch 2 RIVER class OPV design. In a reversal of usual trends, this design was initially developed for an export contract and subsequently adopted by the British Royal Navy to meet its own requirements.

The 91-metre Batch II RIVER class is based on the hull form of a series of the former Vosper Thornycroft-designed light frigates originating from as long ago as the 1960s but also incorporates design practices from the Royal Navy's first batch RIVER class OPVs. The first three were ordered by the Trinidad & Tobago Coast Guard in 2007 but subsequently acquired by Brazil as the AMAZONAS class when the original contract collapsed. Five more have been recently delivered for Royal Navy service. Whilst all these ships were built in British yards, the design has also been licensed for construction in Thailand for the Royal Thai Navy. Here two KRABI class vessels have been completed to date, being delivered in 2013 and 2019. It is reported that

further units are planned. These vessels are more heavily armed than their earlier sisters, with the latest unit to complete being armed with surface-to-surface missiles. More broadly, the Thai contract reflects a trend towards the increased importance of facilitating transfers of shipbuilding technology in many international programmes for OPVs.

Photo: US Navy

DARUTTAQWA is one of four NVL OPV 80 type vessels acquired by Brunei.

Germany

The transfer of technology model has certainly been apparent in Germany, where recent contract awards for OPV have been heavily weighted towards overseas build in the acquiring country. The most prominent group operating in this market is the newly restructured NVL (formerly Lürssen). The company offers a range of OPVs in the 80-90 metre segment based on a modular design philosophy that allows easy configuration to meet specific mission requirements. In line with this approach, outfitting can be either to constabulary or combatant standard.

An early success for NVL's OPV product line was the sale of four OPV 80 type vessels to Brunei in 2007 as part of a broader contract that also encompassed four smaller fast patrol vessels. The four resulting DARUSSALAM class OPVs that were delivered between 2011 and 2014 were outfitted to a military configuration that includes canisters for EXOCET surface-to-surface missiles. Unlike following contracts, this deal was notable in that all construction was performed in Germany.

Subsequently, in November 2017, it was announced that the OPV 80 design had been selected to meet Australia's requirement for twelve OPVs that were to be acquired under the AU$3.6Bn (US$2.6Bn) Project SEA 1180 Phase 1 as replacements for the existing ARMIDALE class patrol vessels. The resulting ARAFURA class has been reconfigured in line with Australian specifications, including installation of the Saab 9LV command and control system used aboard other Royal Australian Navy warships. The ships have a primary constabulary mission-focus and will be only lightly armed.

All twelve ships are being constructed in Australia in a partnership between NVL's local subsidiary and Australian industry. Whilst an initial pair are being completed at Adelaide in South Australia, the majority will be built in Henderson in Western Australia by a joint venture between the German group and local Australian group company Cimvec. The first two vessels were allocated to the Osborne facility in Adelaide to ensure continuity of production prior to commencement of work on the new HUNTER class frigates.

In addition to the ten vessels currently allocated to this venture, it has also been decided to explore a variant of the design for up to eight new mine countermeasures "mother ships" and hydrographic survey vessels set to be acquired under Project SEA 1905 Phase 1. This holds out the prospect of an extended production run. The lead ship was launched in December 2021 and is scheduled for delivery before the end of the current year.

In November 2020, NVL gained a further export award for its OPV line with an order from Bulgaria for two Multi-Purpose Modular Patrol Vessels (MPPVs), which are widely reported to be based on the group's 90-metre, OPV 90 hull. In similar fashion to the ARAFURA class, they will utilise a Saab combat management system. They are likely to be configured for a combatant role. Actual construction has been allocated to Bulgaria's MGT Dolphin shipyard in Varna, which commenced fabrication of the first vessel at the end of 2021.

Fellow German shipbuilder Fassmer is also active in the OPV market, having carved out a particular niche for licensed construction of its designs in Latin America. Its portfolio encompasses a range of standard designs for OPVs and multi-role patrol vessels from 50 metres to over 120 metres in length, largely with a primary constabulary focus. However, it also mar-

Photo: Fassmer

Fassmer's MPV70 MKII design is being license-built in Ecuador by ASTINAVE.

Photo: US Navy

The Pakistan Navy's TABUK is one of two OPVs built by Damen in Romania to the group's OPV 1900 design.

kets a "Deterrence" line of littoral mission vessels and patrol corvettes, highlighting its ability to develop new products tailored to a navy's specific requirements.

Fassmer's OPV80 design has gained most traction in the international OPV market, being first selected to meet a Chilean requirement in 2005. Four units of the resulting PILOTO PARDO class were delivered between 2008 and 2017, with physical construction being allocated to Chile's ASMAR. The last two were of a modified, more heavily-armed variant and incorporated a degree of ice-strengthening. The design was subsequently selected by Columbia for its PZM project requirement for OPVs, with three out of a provisional six-ship programme being commissioned between 2012 and 2017. Assembly was carried out by the COTECMAR shipyard in Cartagena.

In December 2019, Fassmer achieved a further overseas sale with the selection of its MPV70 MKII design for the Ecuadorian Navy. Part of a family of vessels designed to combine OPV and logistical support roles, the innovative vessel combines a large flight deck with a stern ramp for RHIB deployment and incorporates an integrated mast. The vessel is being completed by ASTINAVE in Guayaquil, Ecuador with the help of material packages and technical support from the German shipbuilder.

Netherlands

No overview of the international OPV market would be complete without reference to Dutch Damen group's broad portfolio of patrol vessel designs. The company's best known products are, perhaps, its standardised StanPatrol series. The largest of these – the StanPatrol 6211 selected for the South African Navy's multi-role inshore patrol vessel programme – arguably approach the OPV category in overall dimensions. However, Damen also markets a range of distinct OPVs ranging from 1,000 to 2,500 tonnes in displacement. They effectively bridge the gap between the StanPatrol series and the combat-focused SIGMA corvettes.

Damen's export model balances construction in its large international network of shipbuilding facilities with licensed assembly arrangements. A current example of the latter is the 2017 agreement with Malaysia's THHE-Destini joint venture that encompasses the construction of three vessels for the Malaysian Maritime Enforcement Agency to the 83-metre Damen OPV 1800 design. The first of these vessels – to be named TUN FATIMAH – was reportedly ready for launch at the end of 2020. However, its delivery has been delayed by a restructuring of the initial joint venture and the impact of the COVID-19 pandemic. The delay could be regarded as indicative of one of the potential pitfalls of third-party assembly despite the arrangement's growing popularity.

2017 also saw Damen sign an agreement with the Pakistan Ministry of Defence for construction of two of its slightly larger, 91-metre OPV 1900 type. In contrast to the Malaysian order, implementation of the contract was allocated to Damen's own shipyard at Galati and Romania. The lead ship, YARMOOK, was commissioned in February 2020. Her sister, TABUK, followed in November the same year. Although often referred to as corvettes, with the exception of a prominent CIWS, the pair's current armament is largely configured to perform a primary patrol role. Like many of the vessels discussed in this article, the class is able to deploy mission-specific equipment through the embarkation of a range of containers.

Damen's SIGMA design series also has relevance to the international OPV market, essentially fulfilling similar "higher end" roles to ships such as the AVANTE 2200 COMBAT and NVL MMPV. SIGMA corvettes and light frigates have been delivered to the Moroccan, Indonesian and Mexican navies, with construction again being split between Damen's own facilities and yards in the acquiring country. The most recent ship to complete was Mexico's "POLA" long-range oceanic patrol vessel. This was delivered by the ASTIMAR 20 shipyard early in 2020 following assembly from modules fabricated by both ASTIMAR and in the Netherlands. She is emblematic both of the wide range of OPVs encompassed by current international procurement as well as the range of options available to support their construction. ■

Anti-Ship Missiles – A European Perspective

Tim Guest

Longer-range anti-ship cruise missiles, capable of evading defences and seeking out individual vessels, will call into question the existence and effectiveness, or not, of naval forces in any future conflict.

The world's seas and oceans are crucial for any nation projecting power through its naval might, sailing through international waters, perhaps into regional maritime domains from where effective land operations can be launched. Moreover, with the absolute importance of the maritime domain recognised by all and sundry, recent years have seen a greater emphasis placed on the use and further development of an array of new ship-killing missile threats, including longer-range systems. Such longer-range anti-ship missiles are more often termed anti-ship cruise missiles, and are designed to deliver a large warhead over long distances. The term anti-ship missile is typically abbreviated as AShM or ASHM, (as below), to avoid confusion with other types of missile system.
This article looks at a couple of longer-range ASHM developments, with focus on latest developments of the Indian/Russian BraHmos system, the thinking behind it, as well as a recent change of plans by the Royal Navy.

Photo: Kongsberg archive

Recent years have seen a greater emphasis placed on the use and further development of an array of new anti-ship missile systems. Pictured: A Norwegian Navy NSM of the early tranche which will be upgraded under a new service contract.

Troubled Waters, Troubled Times

If recent and ongoing activities in maritime hotspots like the Black Sea, the South China Sea and the Arabian Gulf are anything to go by, the crucial nature of the world's oceans to naval force power projection, by any nation, means the seas and oceans of the world will see major flotillas and carrier strike forces plying the waves in order to support overseas operations, should hostilities ever break out in far flung, and not so far flung, regions of the globe. And while advances in naval architecture and ship-building capabilities mean some of the most sophisticated vessels are now at sea and will be in any future conflict, whether carrier, destroyer, corvette, submarine, cruiser, littoral craft, stealth vessel or other, even the most advanced vessels with latest defence systems such as Aegis will be hard pressed to defeat the looming and perilous threat of the new breed of longer-range, supersonic and hypersonic ASHMs.

Brahmos' Latest

Currently in service with the Indian military is the Indian-Russian joint venture, the BRAHMOS supersonic cruise missile, built by Brahmos Aerospace. BRAHMOS is a portmanteau derivation of the names of the Brahmaputra and Moscow Rivers. The basic BRAHMOS ASHM, which has been deployed by the Indian military in several locations and is under ongoing development and improvement, is already one of the fastest sea-skimming missiles in the world. The two-stage missile relies on a first-stage, solid-fuel rocket booster to accelerate it to supersonic speeds after which its second-stage ramjet takes the missile to at least Mach 2.8. Though the kinetic energy of a direct, Mach 2.8 hit without a warhead would be sufficient to cause massive damage on any ship, BRAHMOS carries a 200-kg conventional warhead, and can fly as low as 10 metres above the water's surface out to ranges close to 300 km when launched by surface vessels or land-based ASHM batteries. Launched from aircraft, however, such as the Su-30MK1 of the In-

Photo: Brahmos

The two-stage missile relies on a first-stage, solid-fuel rocket booster to accelerate it to supersonic speeds after which its second-stage ramjet takes the missile to at least Mach 2.8.

Photo: Indian MoD/Brahmos

BRAHMOS with enhanced capability test fired off Odisha coast, Jan 2022.

dian Air Force, BRAHMOS carries a 300-kg warhead as far as 500 km. In each configuration, the ASHM's stealth, high speed and surface-skimming properties enable it to evade detection until the very late stages of its flight, potentially leaving only seconds for a ship's defences to detect, track, illuminate and attempt to shoot the missile down. Successful defence depends largely on the target vessel's detection and defensive capabilities, such as radar position and height. If missile detection can be made at a range to target of around 30 km, for example, this would leave around half a minute for the target vessel to shoot it down.

In January this year, the missile was put through two latest tests by India's Defence Research and Development Organisation (DRDO) in cooperation with the Indian Navy and other parties. One of the January test firings was from the stealth guided-missile destroyer, INS VISAKHAPATNAM. This was an extended-range, sea-to-sea variant of BRAHMOS off the coast of Odisha in Balasore, India. The DRDO said at the time that the missile was equipped with new technological developments which were successfully proven. A direct hit on target was reported. INS VISAKHAPATNAM, the lead ship of Project 15B stealth guided missile destroyers being built at Mazgaon Docks, was delivered to the Indian Navy on 28 October 2021. This project is a follow-on of the KOLKATA class (Project 15A) destroyers commissioned in the last decade and comprises an eventual four ships christened after major cities from all four corners of the country: VISAKHAPATNAM, MORMUGAO, IMPHAL and SURAT, each of which will be equipped with the BRAHMOS missile.

According to the Indian Navy, the majority of its frontline ships, like the KOLKATA, RANVIR and TEG classes, are capable of firing the missile. Its three stealth frigates, including INS TARKASH, are all equipped with the standard BRAHMOS missile, and while a submarine-based version is understood to have been under consideration, it has not been developed due to lack of interest.

Part India's Missile Strategy

At an Indian Navy Missile Seminar during 2021, it was stated that BRAHMOS had proved itself to be 'a potent weapon and amongst the world's best SSMs, enabling it to strike from various types of land, sea and air-based platform'. The missile is seen as an important part of India's missile programme, whose strategy overall is to deliver sovereignty and self-reliance and an enhanced, national defence capability. India's defence strategists see a rapid and robust upgrade of its arsenal of missiles, their use, where possible, of indigenous technology, as a way of strengthening peace and stability from the Himalayas to the Indo-Pacific.

India is exploring emerging trends in missile technology through its missile programme as militaries around the world increase the adoption of precision missile systems for strike operations. And with demands for, and improvements in, accuracy, range, firepower, manoeuvrabil-

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Photo: Kongsberg

A Joint Strike Missile (JSM) version of the NSM is under development for use with Norway's F-35 Joint Strike Fighters.

Photo: UK MoD

The Anglo-French FCASW project may deliver something akin to the LRASM system, but not for another 8-10 years.

ity and lethality, all enabled through latest science and technological advances, these are all aspects of general missile technology development that India's missile programme wants to take full advantage of. Indeed, the nation's military is looking at a handful of emerging technological trends, globally, that their manufacturers need to focus on in the development of their advanced missile systems, like Brahmos, in order to best achieve increased accuracy, range and speed. These include adaptive missile guidance for better accuracy through the incorporation of GPS and other advanced guidance systems, leading to improvements in navigational and surveillance abilities. Then, a reduction in missile size and weight is seen as crucial for increased range; miniaturisation and the development and use of microelectronic components, which significantly reduces the weight of the entire missile system while maintaining original lethality, are seen as crucial to achieving greater ranges. As for speed, the rapidly increasing development and appearance of hypersonic missiles by certain nation states is a key factor behind India setting out and becoming one of the few nations with this ability to develop hypersonic missiles. The DRDO has now successfully demonstrated air-breathing, scramjet technology, and has flight tested a Hypersonic Technology Demonstration Vehicle. Brahmos-II is such a hypersonic cruise missile and is currently under joint development as a significant force multiplier for the Indian military.

Photo: Royal Norwegian Navy

HNoMS FRIDTJOF NANSEN; armed with Kongsberg's NSM ASHM, the FRIDTJOF NANSEN class frigates are a class of frigates that are the main surface combatant units of the Royal Norwegian Navy.

Naval Strike Missile Latest

Towards the end of 2021, Norway's Kongsberg signed two contracts with the Norwegian Navy via the Norwegian Defence Materiel Agency (FMA) valued at MNOK 1,426 for delivery of a latest batch of its Naval Strike Missiles (NSM) for use by its frigates and corvettes, as well as a life-extension package for the existing inventory of the navy's NSMs; this latter signing will see systems go through a series of maintenance actions to extend their operational timeline and continue providing advanced capabilities for the navy. What Kongsberg described as 'The triangular collaboration' between the company, the Norwegian Armed Forces and the Norwegian Defence Research Establishment (FFI), they see as key to Norway's ability to develop such advanced and complex systems. Øyvind Kolset, Executive Vice President of Kongsberg Defence & Aerospace, said, "We cannot produce, nor deliver, such advanced and state-of-the-art products alone."

The company calls the NSM a fifth-generation missile with a low radar signature for use in sea-to-sea or sea-to-land operations, capable of achieving ranges around 185 nm carrying a 125-kg warhead. It can evade enemy radar and detection systems by performing evasive manoeuvres and flying at sea-skimming altitudes of around 10 m. It also has excellent penetration capabilities against enemy defences, with its superior performance profile able to go up against well-defended targets with the ability to penetrate the most advanced air defence systems. The missile has integrated sensors to locate exact targets, but, with a built-in safety mechanism to avoid collateral damage, the NSM will self-destruct if it is unable to find an intended target.

Now the primary weapon on Norwegian frigates and corvettes, the NSM is a suc-

cessor to the Penguin ASHM. A Joint Strike Missile (JSM) version of the NSM is under development for use with the F-35 Joint Strike Fighter, and will be capable in both air-to-ground and anti-ship missions. It is slated for operational duty sometime next year and it is reported that it will also be suitable for launch from a 533 mm submarine torpedo tube.

Royal Navy Conundrum

In the UK, the Royal Navy's Interim Surface-to-Surface Guided Weapon (I-SSGW) competition was intended to replace the semi-obsolete HARPOON Block 1C (GWS 60) anti-ship missiles carried aboard Type 23 frigates and Type 45 destroyers. Due to be taken out of service in 2023, continuing service support for HARPOON is now likely until the spring of 2024 leading to the missile remaining in service until at least 2027. The available budget for I-SSGW had been up to £200M for a small, stop-gap stockpile of missiles and support until the more formidable Future Cruise and Anti-Ship Weapon (FCASW) becomes available after 2028. Contenders for I-SSGW cover a number of European developments including the Kongsberg NSM, already mentioned, Saab with the latest version of its RBS15 Mk 4 GUNGNIR (ODIN'S SPEAR), Israel Aerospace Industries and Thales UK offering the SEA SERPENT missile based on the latest Gabriel Mk 5 variant also known as the Advanced Naval Attack Missile (ANAM) and, lastly, Lockheed Martin's Long Range Anti-Ship Missile (LRASM) AGM-158C, based on

Photo: RNoAF

With 31 of 52 aircraft so far delivered, full operating capability for the F-35A in RoNAF service is scheduled for 2025. A Joint Strike Missile (JSM) version of the NSM is under development for the F-35.

Photo: Royal Norwegian Navy

Armed with Kongsberg's NSM ASHM, the HNoMS FRIDTJOF NANSEN and USS HARRY S. TRUMAN Carrier Strike Group passing through the Strait of Gibraltar in December 2021.

Photo: Saab/Diehl

The long-range RBS15 Mk4 GUNGNIR is the latest system in the joint Saab/Diehl Defence RBS 15 family of ASHMs.

Photo: Diehl

The RBS15 Mk3

the Joint Air-to-Surface Stand-off Missile (JASSM-ER).

However, without going into further detail on these options that may no longer be relevant to the Royal Navy's intentions, at the start of November 2021, the situation changed at a defence Select Committee session in the House of Commons, when it became apparent that the decision had been made not to proceed with I-SSGW, with the navy more interested in holding out for longer-ranged hypersonic missiles instead of the 'unnecessary expense' of a 'stop-gap' solution. So, focus now is on what the Anglo-French FCASW project can deliver, hopefully something akin to the LR-ASM system, particularly as it is unlikely to produce operational results until the end of the decade or later. And whether FCASW will result in a hypersonic solution has yet to be seen. Until then, the Royal Navy's Achilles heal may well be an inability to kill enemy ships outright, if called on to do so.

A GUNGNIR Footnote

The long-range RBS15 Mk4 GUNGNIR, mentioned above, is the latest system in the joint Saab/Diehl Defence RBS 15 family of ASHMs, designed to dominate the littoral environment, but also suited for blue water ops and with effective land-attack capabilities. Like the Mk3 system, it is subsonic with a Mach 0.9 speed, though its range exceeds 300 km versus 200 km for the Mk3. Both carry 200 kg warheads. Showcased for the first time in 2018, the GUNGNIR has an expected service life of 30 years. Both systems use multiple 3D waypoint technology to guide them along their trajectory coupled with INS and GPS guidance, the Mk4's GPS also jam resistant. Deployment of RBS 15 Mk2 missiles with the Swedish forces are aboard the Royal Swedish Navy's VISBY-class corvettes (each carries eight missiles) and Swedish Air Force Saab JAS GRIPEN fighters. Deliveries of the RBS15 Mk3 missile to the German Navy are also slated for the 2022-2026 timeframe. Diehl Defence is responsible for deliveries of the missile as the primary armament for the German Navy's new corvettes of the Braunschweig-class (K130), giving them a long-range, all-weather capable, fire-and-forget missile that's highly manoeuvrable and extremely resistant to electronic countermeasures.

In January 2021, Sweden's Defence Materiel Administration (FMV) signed two agreements with Saab for a mid-life upgrade of the current VISBY-class vessels, as well as the product definition phase for the VISBY Generation 2 corvettes, which will be equipped with latest versions of the RBS 15 ASHM family, as well as other upgrades making the ships relevant beyond 2040. ■

Long-Range Anti-Ship Missile Programmes – A US Perspective

Sidney E. Dean

The United States and its allies and partners face multiple challenges at sea. Adversary naval weapons – whether conventional or hypersonic – are acquiring greater range and accuracy. To counter these developments, the United States, NATO allies and other partner nations are acquiring a number of new anti-ship missile systems (ASMs) with longer range, greater accuracy and more flexibility than legacy systems.

Some potential adversaries are significantly enlarging and/or modernising their fleets. Some adversaries, such as China, are augmenting their fleets with networks of fixed anti-air and anti-ship installations in an effort to establish anti-access/area denial (AA/AD) zones.

Launching anti-ship missiles is no longer a strictly navy Surface Warfare (SuW) mission. New long-range anti-ship missiles – or legacy missiles, which have been adapted for this new application – are being deployed by land-based aircraft as well as by ground forces. By holding enemy warships at risk from multiple directions, US and allied/partner forces hope to establish AA/AD zones of their own choosing, even in the vicinity of an adversary's own territorial waters.

Photo: US Navy

An AGM-158C LRASM cruise missile prior to mounting on a US Navy F/A-18F fighter

North America

LRASM

While many weapon systems are in fact long-range anti-ship missiles, only one actually bears that name. The AGM 158C LRASM produced by Lockheed Martin is a derivative of the Joint Air to Surface Standoff Missile - Extended Range (JASSM-ER). While the JASSM is strictly air-launched, the LRASM can be configured for aircraft-carriage or for deployment in Mk 41 vertical launch system (VLS) silos. The US Navy officially defines LRASM as a near-term solution for the Offensive Anti-Surface Warfare (OASuW) capability gap that will provide flexible, long-range, advanced, anti-surface capability against high-threat maritime targets.

Mission range is classified, but is officially stated to exceed 370 kilometres at high-subsonic speeds; some estimates place the range closer to 500 km, especially when air-launched. This permits launch from well beyond most AA/AD weapon systems. Advanced signature control, electronic support systems and a radar warning receiver help the missile penetrate enemy defences. The missile features semi-autonomous guidance systems which will bring it to the designated target zone even if enemy electronic countermeasures (ECM) block GPS and data feeds from reconnaissance aircraft. Once in the zone, the missile's sensors can use gross target cuing and an onboard ship profile database to identify and

Photo: Lockheed Martin

An AGM-158C LRASM cruise missile (black) on a US Navy F/A-18F fighter

Photo: Lockheed Martin

Artist concept of an LRASM firing from a VLS tube

Photo: Lockheed Martin

Test firing an LRASM from the Navy's Self Defense Test Ship, the former USS PAUL FOSTER

destroy the proper vessel with its 454 kg penetrating blast fragmentation warhead. The missile is capable of target discrimination even in cluttered environments, autonomously selecting the pre-programmed target and ignoring other surrounding ships. This capability will enable selective engagement of high-value targets such as aircraft carriers, guided missile cruisers and destroyers, or amphibious vessels.

The LRASM cruise missile is currently operational on the B-1B bomber (which can carry 24 missiles) and the F/A-18E/F, and has been selected for deployment by the P-8A maritime patrol aircraft by 2026. VLS-compatibility was demonstrated during an at-sea test firing in 2016; Lockheed Martin is currently pursuing full development of operational VLS capability.

SM-6

Raytheon has configured the Standard Missile 6 (SM-6) to engage surface targets in addition to its previous anti-air/anti-missile profile. The first surface target was destroyed during at-sea testing in 2016. The weapon, officially designated the RIM-174 Standard ERAM (Extended Range Active Missile) has an official range of circa 370 kilometres at Mach 3.5 speeds. The multi-capability of the VLS-carried SM-6 adds to its value. As it can be fired from any surface vessel (manned or unmanned) equipped to carry the Standard Missile family, it supports the US Navy's concept of distributed lethality. The integrated data link enables a shipborne missile to receive targeting coordinates from an external platform such as a reconnaissance UAV or a strike aircraft which has already expended its own ordnance. The SM-6 is considered one of the most precise ASMs. The on-board dual-mode seeker is independent of external target cuing, and can receive new target information in flight to either update target location or redirect to a different target.

Maritime Strike TOMAHAWK

The longest-range ASM in the current US arsenal is Raytheon's new Maritime Strike TOMAHAWK (MST) missile, also known as the TOMAHAWK Block Va variant. The MST can strike moving targets at sea at up to 1,600 km distance. Targeting is independent of external cuing. The US Navy intends to procure newly built MST cruise missiles, and to upgrade additional Block IV missiles in the current inventory to Block Va status. The maritime strike capability rests within the MST seeker suite which can be installed on Block IV TOMAHAWKs.

Midcourse and terminal guidance is managed through the MST seeker suite which includes upgrades to the cruise missile's previous navigation and communications systems, improved anti-jamming capability, reduced radar signature and a new advanced multi-mode seeker. The 454 kg warhead has enhanced penetration capability. The MST retains aspects of the Block IV variant, including GPS, a two-way datalink which can transmit video from the missile's camera to a control centre, and in-flight retargeting.

MST is the first TOMAHAWK cruise missile capable of striking maritime targets since retirement of the RGM/UGM 109B in 1994. The subsonic weapon is carried in VLS silos and is launched from surface and submarine platforms. The US Navy awarded Raytheon the first MST Low-Rate Initial Production (LRIP) contract in October 2021. The work is to be completed by October 2024.

Land-Based Anti-Ship Missile

The US Army and US Marine Corps (USMC) are also actively developing a Land-Based Anti-Ship Missile (LBASM) capability. This option constitutes a force multiplier in both the Pacific and Euro-Atlantic theatres of operations. By placing small, air- and sea-deployable missile units on islands or remote coastal strips in the Asia-Pacific region, US forces hope to attack and destroy enemy ships from multiple directions, or deny them access to certain waterways. In European waters, the capability can hold enemy forces at risk from a distance and from unexpected, constantly changing locations.

The US Army has demonstrated the ability to hit maritime targets using the truck-mounted High Mobility Artillery Rocket System (HIMARS) firing the Army TACtical Missile System (ATACMS) rocket. This is made possible through a new seeker head enabling the engagement of moving targets, whether on land or at sea. The ATACMS original warheads have also been replaced by Lockheed Martin with the same 227 kg class blast fragmentation warhead used on the Harpoon ASM. The GPS and INS guided upgraded projectile

has approximately 350 km range and a speed in excess of Mach 3.

The USMC has experimented with the ATACMS as well, but the Marine Corps' primary focus is currently the Navy-Marine Expeditionary Ship Interdiction System (NMESIS). That system consists of the Kongsberg Naval Strike Missile (which will be discussed in more detail below) mounted on an unmanned, remote-control joint light tactical vehicle known as a ROGUE (Remotely Operated Ground Unit Expeditionary) vehicle. During a tactical exercise on Hawaii in August 2021 two NMESIS systems were transported to a landing zone by C-130 and LCAC, respectively. Receiving targeting data from external platforms, both NMESIS successfully struck a decommissioned ship some 160 km over the horizon. Elements of the 11th Marine Regiment will continue testing the 185+ km ranged NMESIS through late 2023.

The Army, and perhaps the USMC, will ultimately gravitate to the Precision Strike Missile (PrSM) currently being developed by Lockheed Martin. The highly manoeuvrable and stealthy PrSM will have a minimum of 500 km range, and be capable of striking both land and sea targets. Further development is expected to increase range to at least 650 km. Initial Operating Capability (IOC) of the base version of the weapon, which will be restricted to ground targets, is expected in 2023. Planned incremental upgrades including a multimode seeker which will enable engagement of moving targets including surface ships; this upgrade is expected by 2025. PrSM can be deployed on the HIMARS system, which can accommodate two missiles simultaneously (by comparison, HIMARS can only carry a single ATACMS).

Photo: US Navy

Launch of an SM-6 missile from a US Navy ARLEIGH BURKE class destroyer

Photo: Raytheon

SM-6 launch

Photo:s US Navy

A synthetically guided TOMAHAWK Block IV cruise missile hits a moving maritime target during concept validation testing in 2005.

Photo: USMC

The NMESIS

NATO EUROPE

NSM/JSM

European NATO states are pursuing multiple long-range ASM programmes. Norway's Kongsberg has developed the Naval Strike Missile (NSM), which has garnered significant international interest. Among others, the US Navy has chosen the NSM as an SuW element for its small surface combatants; for the US market Kongsberg has partnered with Raytheon to produce and market the NSM and its derivatives. Several other NATO forces have opted for the NSM, as has Malaysia. The majority chose the missile as a shipboard weapon for corvettes and frigates, although Poland and Romania have opted for the mobile land-based coastal defence system. The sea-skimming, highly manoeuvrable missile has a low radar signature and moderate weight due to the use of composite missiles. Using a passive infra-red imaging sensor and autonomous ship class identification/target recognition instead of a radar seeker also permits the projectile to approach its target undetected. The missile is programmed to execute additional random manoeuvres in the terminal flight phase to evade enemy targeting. The missile flies at high subsonic speeds and impacts the target near the waterline. The 125 kg titanium alloy blast-fragmentation warhead features a void-sensing Programmable Intelligent Multi-Purpose Fuze to enhance effectiveness against hard targets.

Kongsberg is augmenting the ship- and ground-launched NSM with an air-launched variant dubbed the Joint Strike Missile (JSM). The JSM will have similar performance parameters to the NSM, albeit with a larger 227 kg warhead and a longer effective range of circa 280 km (low-altitude flight). A data-link allows in-flight target redirection. Originally developed for the Royal Norwegian Air Force, the JSM is also being acquired by Japan and Finland and is under consideration by the United States. The JSM is the only long-range ASM, which can be carried internally on the F-35, preserving the aircraft's stealth profile. The missile can also be carried externally on various fighter models including the F-15 and F/A-18E/F.

EXOCET

MBDA continues to produce the venerable EXOCET family of high-subsonic ASMs, including the 200 km ranged MM40 Block 3 shipborne missile. The newest variant, the upgraded MM40 Block 3C now being delivered to the French Navy, adds a digital radio-frequency (RF) target seeker and an onboard ship profile database, which will enable the missile to attack specific vessels within a task force. The new seeker will also steer the missile to impact at specific points of the ship, exploiting weaknesses of various ship classes. The Block 3C variant will also feature improved anti-jamming technology. In addition to acquiring newly built missiles, the French Navy is also backfitting older MM40 missiles to the Block 3C capability.

The MM40 Block 3 also forms the core of the truck mounted EXOCET Mobile Coastal Defence System. Each unit consists of a mobile sensor unit, a mobile control unit, and two mobile firing units, each with four sea-skimming missiles. Units can operate autonomously or integrate into a greater command and control network. The system permits control of the littorals out to 200 km distance, regularly changing location to prevent counter-targeting.

TESEO

MBDA also produces the OTOMAT anti-ship missiles, which retain a secondary land-attack capability. In the Italian navy, this shipborne weapon system is designated as TESEO. In 2020 the Italian Navy signed a contract for delivery of the next-generation TESEO Mk2/E variant. The "E" stands for "Evolved," reflecting the significant performance enhancement of the new system. Range has been doubled to more than 350 km. A low radar signature and the state of the art Electronic Counter-Countermeasures (ECCM) suite enable the weapon to overcome enemy defences. The dual-mode targeting system integrates a new RF seeker and an electro-optical (EO) sensor to ensure precision target identification and engagement. A two-way data link provides the operator with an up-to-date tactical picture and enables target reassignment or mission abort at any time. The sea-skimming missile travels in the high-subsonic range, and executes high-g manoeuvres during the terminal flight stage. Effects of the semi-piercing, high explosive warhead are scalable, enabling operators to fine-tune the level of damage and to minimize collateral. Detonation is possible

Photo: US Army

The ATACMS GPS guided rocket has a unitary warhead with a proximity sensor.

via impact or proximity fuse. The mission management system includes a salvo capability with Simultaneous Time on Target to overwhelm enemy defences and maximize damage to larger targets. While TESEO Mk2/E is primarily a shipborne system, it can be configured for coastal defence.

ATMACA

The Turkish Navy is acquiring the ATMACA (Hawk) ASM developed by Roketsan. The weapon features a 250 kg high-explosive warhead and a range of over 220 km, at speeds reaching 0.95 Mach. Future upgrades are expected to increase range to 360 km. The weapon's ASELSAN control suite includes an advanced mission planning system with 3D route maps and the ability to set waypoints; in-flight target redirection or abort; GPS and INS (Inertial Navigation System) navigation; and barometric and radar altimeters. An ECCM suite protects the missile from interference. The missile flies below 15 metres above the waves for the approach phase, and then descends to only 1 to 5 metres elevation for the terminal attack phase. This enables the missile to blend in with waves to mask the approach.

At-sea qualifications were completed with the sinking of a decommissioned ship in June 2021, clearing the way for serial production. Deliveries to the Turkish Navy began in mid-2021. The missile will be deployed on frigates, corvettes, patrol boats, and on the planned TF-2000 destroyers. As European Security & Defence reported in June 2021, Turkish defence circles have made clear that in the future, the weapon will also be carried by the P-72 Maritime Patrol Aircraft, the S-70 SEAHAWK helicopter, and by UAVs.

GLOBAL

Nations around the world are developing long-range ASMs.

GABRIEL V

Israel Aerospace Industries (IAI) introduced the GABRIEL missile family in the 1960s. The newest iteration, the GABRIEL V Advanced Naval Strike, entered service with the Israeli Navy in the late 2010s. Finland selected the weapon in 2018 to replace its MT085M anti-ship missiles, with deliveries continuing from 2019-2025. Both nations deploy the missiles on small surface combatants (corvettes and missile boats). Finland also plans to deploy the missiles in the vehicle mounted coastal defence role. While primarily a SuW asset, the missile retains a secondary capability to

Photo: US Army

Lockheed's prototype Precision Strike Missile (PrSM) fires from an Army HIMARS launcher truck in its first flight test, December 2019.

Photo: US Navy

HIMARS-based ordnance such as ATACMS and PrSM can be fired from the deck of amphibious warships, adding an ad hoc surface warfare (SuW) capability to that category of ship and enhancing an amphibious groups self-defence options.

Photo: USMC

Andoya, Norway. Exercise Formidable Shield. The 24th Marine Expeditionary Unit (MEU) conducted its first High Mobility Artillery Rocket System (HIMARS) launch in Europe, further integrating the Marines in a joint environment and capitalising on its strategic lift capabilities.

Photo: Kongsberg

The NSM Coastal Defence System acquired by Poland mounts four Naval Strike Missiles on a Jelcz P662D truck.

Photo: Kongsberg

Firing a Naval Strike Missile from a FRIDTJOF NANSEN class frigate

Photo: Kongsberg

Concept image, deployment of a Joint Strike Missile from an F-35A

attack land targets. The expected service life is 30 years.

The official range is given as 200+ km, although some sources postulate up to 400 km. Designed to meet the needs of the Israeli armed forces, the new missile – while blue water capable – is optimized for littoral waters. This makes it attractive to other navies with a primary coastal defence mission. Navigation utilises both GPS and INS, but is not impaired by GPS signal disruption. The mission control system permits pre-programming multiple in-flight waypoints to evade obstacles or detection. The missile's powerful ECCM suite is configured to overcome not only active electronic countermeasures but also chaff and sophisticated decoys. The advanced active-radar seeker is capable of discerning targets within a cluttered environment and is impervious to jamming, enabling precision strikes with the penetrating warhead.

BLUE SPEAR / SEA SERPENT

In 2020 IAI and Singapore's ST Engineering formed a joint venture company called Proteus Advanced Systems. The firm's primary purpose is development and marketing the BLUE SPEAR ASM, a derivative of the GABRIEL V. ST Engineering contributes several major components including the booster motor and warhead, with IAI responsible for the remaining systems. The cruise missile has 290 km range. In October 2021 Estonia issued a procurement order for the BLUE SPEAR, which it intends to deploy as a land-based coastal defence asset. There remains considerable speculation that Proteus will attempt to market the BLUE SPEAR to Singapore's navy as a replacement for the fleet's current shipborne Harpoon ASM arsenal.

IAI has developed a second Gabriel V derivative in partnership with Thales. The SEA SERPENT ASM was introduced at the DSEI trade show in London in September 2021. The partners are openly offering the SEA SERPENT as an option for the British Royal Navy's Type 23 frigates, which needs to replace its aging HARPOON ASMs in 2023. An IAI representative at DSEI emphasized that the missile's footprint is very similar to that of the HARPOON, which would ease the transition for any service currently using the American missile. The new cruise missile is suitable for both the SuW and the land-attack role. The IAI representative confirmed an effective range in excess of 290 km while maintaining a low-profile flight mode. The new missile is both blue-water and littoral capable. In the latter environment, it is designed to cope with congested sea-lanes as well as clutter from

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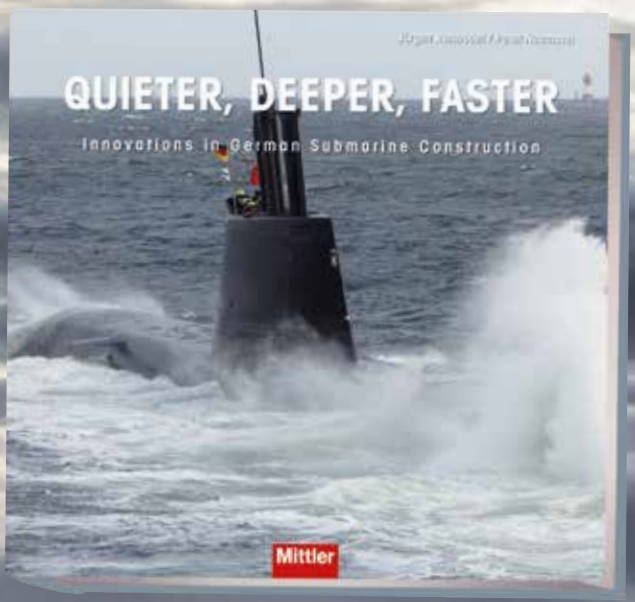

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Photo: Norwegian MoD

Preparing to release a JSM from an F-35A test aircraft. The first test release was conducted in March 2021 by the Norwegian Forsvarsmateriell (defence material agency) at Edwards AFB using a US Air Force test aircraft.

Photo: MBDA

Launch of an EXOCET MM40 Block 3 ASM

Photo: MBDA

The EXOCET mobile coastal defence system

Photo: MBDA

The TESEO MK2E concept

land. The flight control and targeting systems are designed to overcome ECM, decoys, and kinetic countermeasures. In-flight updates from external platforms allow course corrections as well as redirection of the weapon to a different target.

SEA BREAKER

Rafael Defence Land Systems unveiled the SEA BREAKER ASM in June 2021. The cruise missile has 300 km range and can be deployed aboard fast attack boats and warships or as a truck-mounted coastal defence battery utilizing Rafael's SPYDER launchers. Shipborne SEA BREAKER missiles have a secondary land attack capability. Artificial intelligence and decision making algorithms permit autonomous operations of what Rafael designates as a 5th generation weapon system. The missile is ECM-immune and can operate under GPS-denied conditions and in advanced Anti-Access/Area-Denial zones. An advanced infra-red imaging seeker offers surgical targeting precision in cluttered environments including littoral and brown waters and archipelagos. The on board database and sophisticated mission computer enable Automatic Target Acquisition (ATA) and Automatic Target Recognition (ATR), although real-time intervention by a human operator via datalink is always possible. Calculated impact angles and aimpoint selection maximize the effects of the 114 blast/fragmentation penetrating warhead. According to Rafael, a single impact is sufficient to neutralise a frigate-sized ship.

BrahMos

The BrahMos supersonic cruise missile developed by BrahMos Aerospace is a two-stage system. A solid-fuel booster motor forms the first stage. The booster separates after the missile reaches supersonic speed. The liquid-fuel ramjet engine of the second or main stage accelerates the weapon to Mach 2.8, making it one of the fastest supersonic cruise missiles in service today. The original operational range was set at 290 km. This distance provides for circa five minutes of supersonic flight time between launch and target impact. This short flight duration, as well as the low radar signature, reduce the enemy's window of opportunity for countermeasures.
Efforts to considerably increase range and speed are underway. An extended range variant tested in 2020 reached 400 km. In January 2022 an enhanced version of the missile was fired from the destroyer INS VISAKHAPATNAM, verifying a capability

Photo: Roketsan

Launching the ATMACA ASM from the Turkish corvette TCG KINALIADA (F-514)

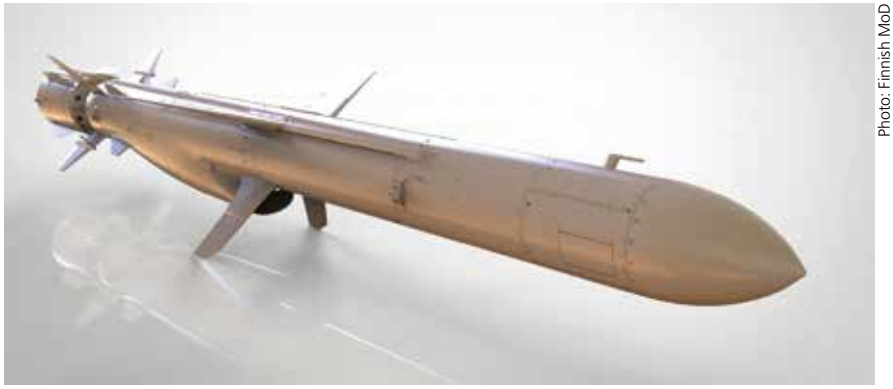


Photo: Finnish MoD

The GABRIEL V ASM

in excess of 500 km. Aspired ranges of 800-1,500 km are being discussed.

The BrahMos missile operates as a "fire and forget" weapon with no operator involvement after release. The weapon, which first entered service in 2005 with the Indian Navy, can be launched by submarines, surface ships, aircraft, or ground vehicles. Aboard ships the missile containers can be installed in either an inclined or vertical configuration; the latter mode utilises the Universal Vertical Launcher Module developed by BrahMos which will be used for future shipboard installations of the missile. Salvoes of up to eight missiles can be fired from one vessel, with firing intervals of 2.5 seconds between missiles. The salvoes can be directed against a single target to maximize destruction, or against several targets. The latter tactic permits a single BrahMos-armed platform to simultaneously engage engagement of an entire enemy battle group.

According to the manufacturer's website, flight altitude can vary from 15,000 metres during the approach phase to as low as ten metres during the terminal attack phase, with the missile performing high-G manoeuvres to execute altitude and trajectory changes quickly and evade enemy countermeasures. The conventional semi-armour-piercing warhead can be configured between 200 kg (sea-launched missile) and 300 kg (air-launched missile). The warhead's destructive power is augmented by the high kinetic energy released upon the supersonic missile's impact.

In January 2022, the Philippines announced it will be purchasing the BrahMos coastal defence variant, with plans to equip three batteries. BrahMos Aerospace has revealed ongoing discussions with Indonesia and Thailand as well.

Future Concepts

Current long-range ASMs fly either in the high-subsonic range or in the supersonic spectrum up to Mach 3+. Armed forces now aspire to acquiring hypersonic ASMs with speeds of Mach 5 or more. A hypersonic variant of the BrahMos is under development.

Interest exists in Europe as well. As early as 2011, MBDA conducted a six-months concept study for a Future Cruise/Anti-Ship Weapon (FC/ASW) as a potential replacement for legacy ASMs on British and French warships. The resulting CV401 Perseus concept featured Mach 5 flight speed, 300 km range, and the capability to carry submunitions. Paris suspended the continued Anglo-French collaboration on a FC/ASW system in September 2021, but the British First Sea Lord, Admiral Tony Radakin, stated in November that hypersonic weapons were still being considered as options for a future ASM programme.

The US Navy seems ready to proceed much sooner. In August 2021, the Office of Naval Research issued a solicitation asking industry to develop and test an hypersonic scramjet powered concept aircraft. The goal behind this Screaming Arrow project is to enable carrier-based strike aircraft to attack high-value surface targets – including but not limited to surface combatants and capital ships – on very short notice. A previous solicitation, which was issued in March 2021 but abruptly cancelled, stated: "The need for Screaming Arrow technologies arises from a capability gap in propulsion solutions for servicing adversary targets at range within a compressed time of flight, which is not achievable with today's sub-hypersonic weapon approaches." Officially the US Navy views this project as stage two of the Offensive Anti-Surface Warfare (OASuW) programme, making the hypersonic ASM the direct follow-on to the AGM-158C LRASM discussed at the beginning of this article. ■

Photo: Rafael

Concept of the Rafael SEA BREAKER ASM with 300 km range

Defence Acquisition Programmes and Requirements in Malaysia

Dzirhan Mahadzir

Despite the Malaysian Armed Forces (MAF) having long term capability development plans for not only the overall armed forces but also each service having its individual capability development plan, the progress for the Malaysian Armed Forces has been slow.

Photos: via author

Malaysia wants to replace its outdated S-62 helicopter.

Slow progress is owing to a number of factors ranging from the country's political situation, the impact of Covid-19, limited funding and the continued depreciation of the national currency and in the case of the MAHARAJA LELA class Littoral Combat Ship for the Royal Malaysian Navy (RMN), the failure of the assigned local shipbuilder, Boustead Heavy Industries Corporation, to complete the ships on schedule. The result is that while the MAF has a number of acquisition programmes and requirements, whether these get funded and carried out anytime soon is another question, particularly with a General Election having to be held by May 2023 though there is also the possibility that the present governing Barisan Nasional coalition may either call or be forced to call an election due to its slim estimated parliamentary majority of 3 or so MPs.

The unstable political situation also means that there is no certainty as to whether a defence programme approved under one government will be continued or upheld by the next government, particularly where no contracts or agreements have been signed. At the same time, the current Malaysian government is unlikely to proceed with large scale defence procurement given the proximity of a general election and the fact that an electorate badly battered by the economic impact of COVID-19 is unlikely to view favourably on spending on military equipment.

The Malaysian government has currently been forced to devote significant finances to bring relief to the population and the economy due to the impact of the Covid-19 pandemic which in turn has resulted in significantly less funding available for government spending at all levels including defence. Along with that, the relatively weak position of the national currency, the ringgit, has resulted in defence funding in real terms, actually being less despite small increases in the defence budget over the years. Despite the majority of Maintenance, Repair and Overhaul (MRO) work being carried out in Malaysia by local companies, the costs are still substantial given the parts have to be sourced from overseas. Even indigenously produced equipment such as the AV8 GEMPITA 8x8 AFV consists largely of parts and components overseas rather than locally produced.

Malaysia has been fortunate though that some of its requirements have been met by assistance from partner nations such as the supply of F/A-18 HORNETs spare parts from Australia following Australia's phasing out of its legacy HORNET fleet and the United States funding the conversion of three of the Royal Malaysian Air Force's (RMAF) CN-235 transport into Maritime Surveillance Aircraft (MSA) and providing the Royal Malaysian Navy (RMN) with 18 ScanEagle Unmanned Air Systems (UAS). However this assistance, while significant, does not cover the overwhelming requirements of the MAF, particularly in regard to aging and obsolete assets. The funding issues and the uncertain political situation makes it unlikely that that acquisition programs and the meeting of defence requirements will be carried out in the near term and more likely to be carried out after the general election, assuming of course the next government has a comfortable parliamentary majority to ensure its continuance.

Author

Dzirhan Mahadzir is a freelance defence journalist and analyst based in Kuala Lumpur, Malaysia. He has written a number of international publications in regard to defence and security developments in Southeast Asia.

The Malaysian Army

The Malaysian Army has been over the past ten years working to improve its firepower and mobility. The Army this year is taking in the final 31 of 257 AV8 GEMPITA AFVs contracted for in 2011, though the total ordered has only been enough to replace the SIBMAS 6x6 AFVs used by the Royal Armoured Regiment and some of the CONDOR 4x4 APCs used by the mechanized infantry. Around 200 CONDORs out of the original 400 plus procured in the 1980s remained in service. In 2016, a refurbishment programme was proposed by Malaysian compant Deftech, manufacturer of the AV8 GEMPITA, which involved not only modernisation of the in-service vehicles but conversion of a portion of them into cargo carriers. However, the programme was still in the assessment and evaluation phase of the trial models when the Pakatan Harapan government, which came into power in May 2018, cancelled the programme and, though not formalised, the Malaysian Army gave indications that it wanted to pursue a 6x6 AFV programme rather than additional AV8s owing to the cost of the AV8. The rational was that new 6x6 vehicle without the electronics and weapons systems of the AV8 would be a cheaper solution particularly with the numbers required to be around an estimated 200 or less vehicles. The Pakatan government's ouster and replacement by the Perikatan Nasional government in February 2020 and the Perikatan Nasional's government's replacement by the Barisan Nasional government in August 2021 has not appeared to have changed things though the requirement has still yet to be formalized or announced officially. The Malaysian Army tendered for 30 4x4 wheeled armoured vehicles for its

A Littoral Mission Ship (LMS) of the Royal Malaysian Navy

The 15 To 5 Plan calls for the transformation of the RMN's fleet of 15 different ship classes to just 5 classes of ships.

United Nations Interim Force in Lebanon (UNIFIL) contingent in October 2020 but no announcement has been made in regard to the status of that tender.

Artillery is another pending requirement for the Army, particularly with the Army planning for the establishment of three new field artillery regiments to round out the newly established 5th Infantry Division stationed in Sabah, East Malaysia. One regiment, 8th Royal Artillery Regiment is in the process of being established and equipped with the 105mm Model 56 Pack Howitzer though their guns are guns that were available due to the 1st Royal Artillery (Para) Regiment converted from the Model 56 to the 105mm LG1 howitzer. Malaysia signed a contract for 18 such guns in 2018, enough to equip one regiment with spares for training. There is a need for the Model 56 to be replaced with more modern guns along with the purchase of additional guns to fill out the remaining two planned artillery regiments though it is likely that any procurement, if carried out will be done incrementally. So far, Malaysia has not put out a formal procurement program for such and again likely this will only get done with the next government. Similarly a 155mm Self-Propelled Howitzer requirement is also in existence, originally these were to be filled by 29 Excess Defence Articles M109A5 155mm SPHs but the Pakatan Harapan government cancelled the purchase in 2019 which was initiated under the preceding Barisan Nasional government in 2018. The 155mm SPH requirement is again like other Malaysian Army requirements not formalised into a formal funded program though informal trials and evaluations have been carried out in-country over the past years on wheeled 155mm SPHs.

A medium lift tactical transport helicopter squadron has long been a requirement for the Army Air Corps with an initial step taken by the Army towards such a capability in 2015 with an agreement to take 12 RMAF S-61 Nuri helicopters into their service until the army received funding to procure modern tactical transport helicopters. The rate of transfer had been slow and only an estimated half a dozen were with the Army Air Corps when it was decided in 2020 to phase out the S-61s in service with the Army and RMAF. So far the government has not given any go-head for the purchase of new helicopters for the Army to meet the gap left by the phasing out of the S-61s.

Royal Malaysian Navy

The RMN officially issued its 15 To 5 strategy document in 2018 though the 15 to 5 Transformation Plan had already been initiated earlier by 2016. The 15 To 5 Plan calls for the transformation of the RMN's fleet of 15 different ship classes to just 5 classes of ships, namely the Littoral Combat Ship, Next Generation Patrol Vessel (NGPV), Littoral Mission Ship (LMS), Multi Role Support Ship (MRSS) and Submarine. The 15 To 5 Plan called for the present six Maharaja Lela Class Littoral Combat Ships (LCS) under construction to be joined by another six ships, 18 Littoral Mission Ships (LMS), the six KEDAH class Next Generation Patrol Vessels in service to be joined by another 12 ships of the same design but more heavily armed with better electronics and sensors, 3 new Multirole Support Ships and the in-service SCORPENE submarines to be joined by another two submarines.

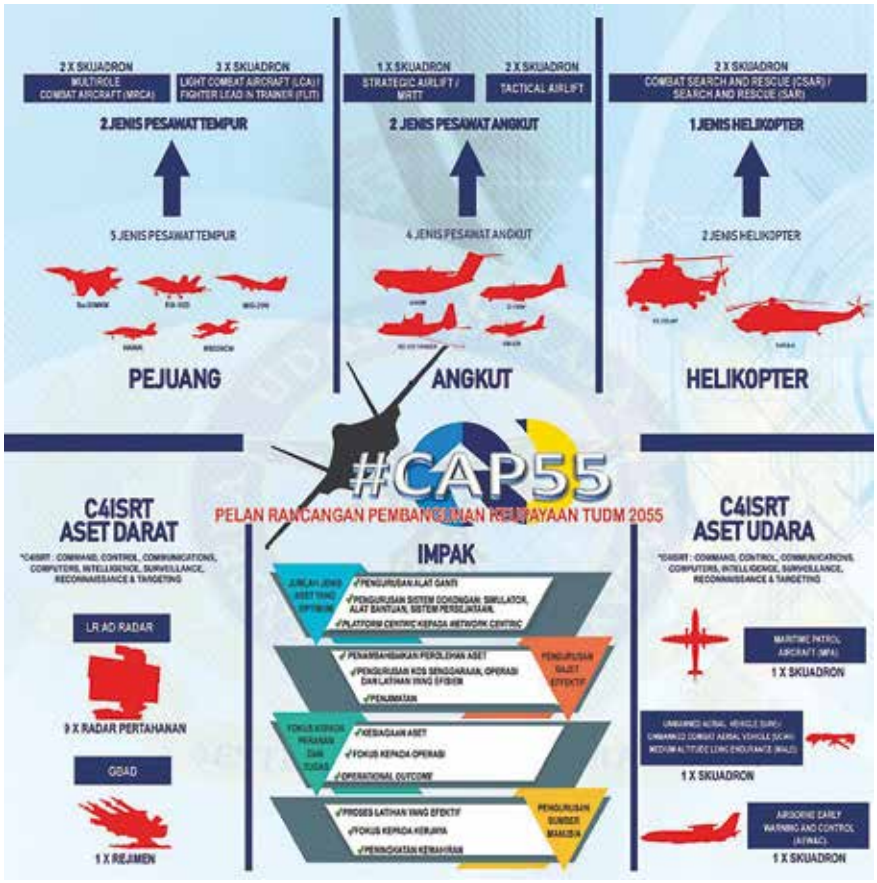
The 15 To 5 Plan originally envisage the ship classes with the exception of the submarines to be of the same design but the RMN has since deemed the LMS to be generic class of different designs rather than a single design origin. This though defeats the original concept of the 15 To 5 Plan as having the same design for the ship class would streamline and simplify logistics, support and training for the LMS. However, due to the limited utility in the 4 KERIS class LMS built in China by China Shipbuilding & Offshore International Company, the last of which was commissioned into service this year, has led to the RMN opting for a different design with a planned tender for an initial three ships to be issued at the end of the year and subsequently five more ships to be tendered for. The issues with the KERIS class stemmed from the fact that the ships were to have included ISO standard container mission modules allowing the ships to carry out various missions such as mine detection and clearance, UAV operations and hydrography among others. However, the ship's Chinese origins basically precluded any Western equipment on the modules as Western companies were not willing or able to have their systems integrated with a Chinese built ship as it would require them to share technical information with

the Chinese manufacturer of the LMS. Additionally, as the mission modules would have to be developed from the ground up, Malaysia would have to pay the development costs for such if these were to be built though in the end, the lack of any non-China companies willing to put their systems on the modules resulted in the concept being stillborn.

The other parts of the 15 To 5 Plan is also facing major challenges that makes it seem likely that the plan will not be achieved, the Maharaja Lela class LCS programme has now become a long running saga that spans 3 different political governments in regard to its delays and cost costs overruns to the RM9.1Bn (€1.9Bn) programme. The LCS is a Naval Group GOWIND design corvette with the name chosen at the programme's initiation to downplay any regional concerns on the ships mission and purpose, with construction of first ship beginning in 2014 with a scheduled entry of service in 2019. However, the programme has fallen behind schedule with the six ships under construction in various stages of completion. At the time of writing, the Malaysian government has yet to decide on the fate of the programme though all three governments had indicated that no additional funds would be allocated for the ships' completion and that BHIC would have to work with the contracted amount and raise any additional funds themselves. Complicating the matter is the fact that BHIC is a subsidiary of Boustead Holdings, a corporation whose majority owner is the Armed Forces Fund Board which manages the pension funds of MAF personnel and along with the fact that several hundred local subcontractors are involved in the LCS programme and a general election on the horizon, the cancellation of the LCS programme is politically unviable to the present government though the option to do so has been spoken of by all three Malaysian governments dealing with the issue. The compromise solution is to finish at least two ships with the current allocated funding though this in turn goes against the 15 To 5 Plan though even if the six ships were to be completed and entered into service, it would seem unlikely that funding would be made for an additional six ships nor would the government want to turn to BHIC to construct the ships though it could ask Naval Group, the design owner to do so but the costs of overseas construction would also make that an unlikely option.

The problems with BHIC has also meant that the additional 12 KEDAH class NGPVs called for in the 15 To 5 plan are now unlikely since BHIC was the constructor of the KEDAH class and holds the IP of the KEDAH's MEKO 100 design in regard to construction in Malaysia. Again the Malaysian government could bypass BHIC by construction overseas by the original manufacturer, now part of NVL Group. So far the RMN has not indicated officially where it plans to head on this aspect, with the priority now on resolving the LCS issue and acquiring the second batch of LMS. Meantime the MRSS has also yet to be formed into a formal procurement programme, despite the RMN actually having a requirement for such since 2006 while the additional two submarines are becoming even more unlikely given Malaysia's fiscal position.

The RMN has received 12 of 18 SCAN EAGLE Unmanned Air Systems UASs provided by the United States under a capacity building program with the remaining six to be delivered this year. These are all consolidated into No. 601 Squadron UAS based at RMN Kota Kinabalu,



In 2018, the RMAF announced its Capability 55 programme, in which it postulated a desired force structure for the year 2055.

Sabah, East Malaysia with the squadron beginning initial UAS flying operations in 2021. The RMN also will received three AW139 Maritime Operations Helicopters this year which will be utilised for transport and utility roles and armed only with door-mounted weapons. The RMN has a long-standing requirement for six anti-submarine warfare helicopters to replace its six SUPER LYNX helicopters but this has not materialised into a formal funded programme.

The Royal Malaysian Air Force

In 2018, the RMAF announced its Capability 55 which postulated a targeted end state force structure by 2055. Among the main priorities of the Capability 55 Plan is the open timeframe acquisition of two squadrons of Multi-Role Combat Aircraft, 3 squadrons of Light Combat Aircraft, and the establishment of squadron each of Maritime Patrol Aircraft, Unmanned Air Vehicles and Airborne Early Warning and Control Aircraft (these would individual squadrons but the number operated is expected to be below the actual strength found in a full squadron) along with consolidating the transport fleet into a single strategic airlift squadron and two tactical airlift squadrons and the helicopter fleet consisting of a single type forming two combat Search and Rescue Squadrons while on the ground, the RMAF would be supported by 9 Long Range Air Defence Radars and a ground based air defence regiment.

In 2020 and 2021, Malaysia issued tenders in line with the aims of the Capability 55 Plan tenders for the supply of two Maritime Patrol Aircraft (MPA) and three Medium Altitude Long Endurance (MALE) Unmanned Air Systems in 2020 and tenders for the supply of a single long range 3D air defence radar and 18 Fighter Lead In Trainer (FLIT)/ Light Combat Aircraft in 2021. However, none of these tenders have yet to be awarded as of the time of writing with finances said to be the key issues in regard to the MPA and MALE UAV tenders with the allocated funding for the programmes being less than the price cited by tenderers. Evaluations and assessments of the aircraft and systems though offered for the tenders are ongoing according to sources familiar with the programs. The likelihood though is that these tenders will only be awarded once the general election has been concluded and the next government firmly in control.

Since 2017, Malaysia has been mulling the possibility of acquiring Kuwait F/A-18s to bring up its current fleet of 8 F/A-18s to a full strength squadron of 16-18 aircraft but no formal talks have begun with Kuwait on it so far. The Multi-Role Combat Aircraft requirement continues in its pattern of going nowhere irrespective of whoever the Malaysian government it with the primary issue being of cost and successive governments unwilling to commit to a costly procurement. On the positive side for the RMAF, some of its capability requirements are being addressed via US funded programmes. The United States has funded the conversion of three RMAF CN-235 transports into Maritime Surveillance Aircraft, the first of which is expected to be completed by the first quarter of this year and the operation of the aircraft will enable the RMAF expand its maritime surveillance capabilities. Malaysia currently operates three Beechcraft 200T aircraft in the Maritime Patrol role but both the CN-235 and C-130 fleet have been used for maritime patrols though these aircraft are limited to visual sightings when doing so. The converted CN-235s though will not have an armament capability as per US policies on such assistance programmes. The United States is also providing a single TPS-77 mobile radar system to Malaysia with the programme to be concluded by 2025 at the latest.

As a stop-gap measure following the phasing out of the S-61 fleet, the RMAF is leasing 4 AW-139s under the Malaysian government's 'Government Operate, Company Own and Maintain' (GOCOM), with the RMAF already using a similar arrangement since 2015 for the 5 Airbus EC-120s it uses for training. Two helicopters were delivered in December 2021 with the remaining two will be delivered in February and April this year. The RMAF hopes to secure funding for procurement of replacements for the S-61s, particularly now with the RMAF's 12 H225Ms being its sole operational missions helicopters in service.

Meantime, the future status of the RMAF's C-130 fleet, of which around 14 aircraft are in service, remain unclear, originally it was planned in 2014 to have the fleet undergo a modernisation and service life extension programme but the programme has since been in limbo with successive governments since then not approving the go-ahead for the programme. There has been consideration of replacing the fleet with new model C-130 Js though the fiscal issues for Malaysia always comes up. Some of the C-130's task, particularly in regard to air transport to East Malaysia from Peninsular Malaysia is now being taken over by the RMAF's four A400M transports. ■

Viewpoint from New Delhi

Photo: Suman Sharma

Ukraine, Russia Crisis, Which Side is India on and What Does it Mean Globally?

Suman Sharma

The amassing of 100,000 Russian troops on Ukraine's borders has seen world leaders zipping around in hectic diplomatic parleys, coupled with the militaries of American and European nations readying for a conflict, while the world watches events unfolding.

Reminiscent of Cold War brinkmanship seen during the Cuban missile crisis of the early 1960s, when Moscow and Washington clashed amidst a divided world, the present Ukraine-Russia crisis is again forcing the world to pick sides, as seen at the recent UN Security Council (UNSC) vote.

UNSC Vote

Proposed in January 2022 by the US, the UNSC procedural vote was to decide whether a discussion should be held over the Russia-Ukraine crisis, which saw India abstain, much like it did in 2014 when Russia annexed Crimea.

India's abstention, coupled with India's Permanent Representative at the UN, TS Tirumurti's statement calling for "Immediate de-escalation of tensions taking into account the legitimate security interests of all countries" were seen by Moscow as a show of Indian support to Russia, thanked accordingly in a tweet by Russia's First Deputy Permanent Representative to the UN, Dmitry Polyanskiy. Former Indian Ambassador to Russia, PS Raghavan says, "The Indian position was quite balanced. Of course, an escalation resulting in war or sanctions would damage every economy, including India's."

India's Stand

Accused of being a fence-sitter, India's non-aligned position has been compared to neutrality. Being non-aligned during the Cold War years, which necessarily does not mean non-interference, India always reached out to both warring sides as a peacemaker, illustrated during the Korean War of the early 1950s, where New Delhi mediated for reunification and for reducing casualties. Ukraine and the US apparently want India to play a similar role.

Politically speaking, India enjoys balanced relations with both Washington and Moscow, through the Quad and BRICS. Indian concerns include the 20,000 students and cooking oil imports from Ukraine, while with Russia it is about natural gas imports and weapons.

Russia makes up for 20 per cent of global natural gas requirements and about 40 per cent of European Union gas imports and 26 per cent of oil imports. The energy crisis, skyrocketing prices and disrupted supply chains, can be envisaged in the eventuality of a conflict, not just for India, but also for Europe and the wider world. Russia also makes up for half of India's weapons imports. Openly siding with Russia would mean inviting US Countering America's Adversaries Through Sanctions Act (CAATSA) for deliveries of the Russian S-400, a waiver granted to India by both the past and present White House.

As India finds itself at centre stage of the Indo-Pacific strategy, amidst China's continuing land grab, it is time for New Delhi to dust off its Cold War playbook.

Ukraine, NATO & Failed Agreements

Historically, Ukraine has never had it easy with Russia, as evident when Stalin tried to quell the Ukrainian quest for self-determination, by starving approximately four million Ukrainians to death in the early 1930s.

Russian President Vladimir Putin has demanded security guarantees from the West, especially assurances of Ukraine not being admitted into the North Atlantic Treaty Organization (NATO),

Signed in 1994 at the Organization for Security and Co-operation in Europe (OSCE) conference, the Budapest Memorandum on Security Assurances with Ukraine was about denuclearising Ukraine in return for guarantees for Ukraine's sovereignty and independence. But the Budapest Memorandum was later breached with the annexation of Crimea. In May 1997, the NATO-Russia Founding Act, to limit NATO's expansion in eastern Europe, also failed as three new members joined NATO in 1999 and the Baltics joined in 2004, becoming the first ex-Soviet states to do so, followed by NordStream-2 and Crimea. George Friedman writes in 'Geopolitical Futures' that "Ukraine's Orange Revolution in 2004 was the breaking point, along with the admission of the Baltic States into NATO. The Russians saw the latter as a violation of the West's pledge not to expand NATO into the former Soviet Union, and the former as a desire to build anti-Russian regimes in areas of vital interest to the Russians."

The Minsk Protocol signed in 2014 was aimed at bringing about peace in Donbas following the ouster of the pro-Russia Ukrainian President after the famous 'Maidan 'protests' or the 'Çoloured Revolution' Kyiv then feared Russian expansion as Crimea fell. The Minsk II agreement, which was brokered by France and Germany under the so-called Normandy format, was billed as a blueprint by Europe to find a breakthrough to the present crisis, along with shuttle diplomacy by world leaders don't seem to be working.

India's Indirect Firing Requirements

Debalina Ghoshal

India's indirect fire unit and artillery modernisation plans have been neglected for years. Only after the 1999 Kargil War and the success of artillery systems such as the FH77 Bofors gun, was serious consideration given to the modernisation of the artillery regiment.

The Indian Army's doctrine 2018 highlights the revolution in military affairs (RMA) on the battlefield. Indirect fire has become an integral component of RMA with countries possessing sophisticated artillery systems designed to neutralise and suppress, and in some cases even destroy enemy targets.

Focus 1: Field Artillery

The Indian Army's Field Artillery Rationalisation Programme (FARP), conceived in the 1990s, still has a long way to go. The Army has not only acquired the BAE's 155mm/39-calibre M777 ultra-light howitzers (ULH) from the US under Foreign Military Sales to replace the obsolete Bofors guns, but also deployed the ULH system in Ladakh in the recent past. Given their light weight due to the use of titanium and aluminium alloys, these ULHs can be easily transported to rough terrain, including mountains, by helicopters like the CH-47 Chinook and are also capable of easy road mobility.

The induction of the M777 ULH was a part of the 'mediumisation' process of the artillery in which guns of low calibre like the 105 mm would be phased out and replaced with guns of a high calibre. Under 'Make in India', Mahindra Defence has partnered with BAE Systems, and is assembling, integrating and testing these gun systems which would enable the Indian Army to access maintenance, spares and support for the guns at home. In fact, it is Mahindra Defence that would cater to the

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Photo: BAE Systems

The Indian Army has acquired BAE's 155 mm/39-calibre M777 ultra-light howitzers (ULH).

Army's need for more ULHs along the LAC. Under the current government, India has aimed to focus on 'Make in India' systems. The Defence Research and Development Organisation (DRDO) indigenously developed the Swathi weapons locating radar (WLR), built by Bharat Electronics Limited. These WLRs are reported to be capable of providing fast, automatic and accurate location of enemy weapon systems within a range of 50 km, as well as detect multiple projectiles fired from different weapons at different locations. The 'Make in India' move to make India self-reliant has provided a boost to many Micro Small Medium Enterprises (MSMEs) to venture into developing weapon systems and allied systems. Not only has India deployed the towed M777 ULH along the LAC, but it has also deployed K-9 VAJRA self-propelled howitzers along the LAC, thereby keeping a balanced mix of indirect fire power along the LAC. These 155 mm/52-calibre howitzers have been developed by the Larsen and Toubro (L&T) after importing the gun systems in semi-knocked down state from Hanwha Techwin in South Korea to be assembled in India by L&T.

In January 2022, there were reports that the Indian Government had placed orders for more VAJRA gun systems to be developed with upgraded systems for fighting in cold and rough terrain conditions. These guns are able to function independently and proved as such by deploying to eastern Ladakh under their own power, rather than being transported by tank trailers. After the guns were successfully tested in the Ladakh region, there is also a plan to deploy them to other sectors of the LAC including in Uttarakhand state and in those North East Indian states which share a border with China.

In 2020, the Ordnance Factory Board (OFB) upgraded the 130 mm SHARANG (M-46) guns to 155 mm and handed them over to the Indian Army with more explosive capability and damage potential. The OFB is responsible for upgrading more of these guns to 155 mm calibre by 2024.

Hiccups

The Indian Army has also realised the need for an Advanced Towed Artillery Gun System (ATAGS), currently under development by DRDO in collaboration with Bharat

Forge and Tata Power SED. However, as identified by the Director General Artillery, Lt. Gen. T.K. Chawla, the ATAGS failed some parameters in summer test trials in Rajasthan and would need a few modifications to become more robust and reliable. Its heavy weight has become an impediment for its deployment in high altitude and rough terrain.

A 155 mm/52-calibre towed howitzer, representing one of the best weapon systems for mountain warfare, is urgently needed for the Indian Army's artillery regiment. However, there is a delay in the development of a robust ATAGS by the DRDO while the decision to go ahead with Israel's Elbit Systems' Autonomous Towed Howitzer Ordnance System (ATHOS), that would have facilitated a full 'Transfer of Technology' mechanism to India's OFB, is still pending. Moreover, DRDO has claimed that the ATAGS it is developing is superior to ATHOS, though reports suggest that the ATHOS is lighter than the ATAGS.

The ATHOS is reported to be a joint venture of Elbit and Bharat Forge in which the technology and design would be fully transferred to Bharat Forge and OFB if a decision was taken. In June 2021, citing "urgent operational necessity" due to the Indo-China stand-off, the Army revived the gun import proposal. The L&T has also offered to supply towed guns to the Army jointly developed with French gun maker Nexter. However, it is only a matter of time to see which of these systems are credible on the battlefield and proves to be an as-

Photo: Bandanschik / CC BY-SA 3.0

In 2020, the Ordnance Factory Board (OFB) upgraded the 130 mm SHARANG (M-46) guns to 155 mm and handed them over to the Indian Army with more explosive capability.

Photo: Elbit Systems

A decision to go ahead with Israel's Elbit Systems' Autonomous Towed Howitzer Ordnance System (ATHOS) that would facilitate a full 'Transfer of Technology' to India's OFB is still pending.

set for the Indian Army's artillery regiment. While the first batch of 155 mm/45-calibre DHANUSH indigenous guns, which would replace the Bofors was delivered to the Army in 2019, its reliability tests are still awaited. Hence, the gun has not yet been deployed as the Army awaits the modifications to the system it had suggested. The gun under development by Gun Carriage Factory (GCF) is now under Advanced Weapons and Equipment India Limited in Kanpur after its corporatisation.

The gun has recently faced a number of muzzle brake hits during user trials, which has delayed their deployment. Again, according to reports, cheap Chinese parts were used in the gun, which passed off as "Made in Germany" parts. Presently, the OFB is undertaking the modification process. The gun is reported to receive high strength steel for the gun barrel from a defence public sector enterprise, Midhani, supplied to OFB.

Again, OFB-developed ammunition for the gun systems do not meet the qualitative parameters and lead to frequent accidents. In fact, the Army even noted that the money used to purchase this faulty ammunition could have allowed them to purchase 100 155 mm medium artillery guns. However, the OFB has denied such allegations, claiming that accidents have occurred due to other failed parameters and not just because of the ammunition.

However, the Army's indirect firepower modernisation process still has a long way to go. Under the Indian Army's FARP, there was a plan to acquire 2,800-3,000 155 mm/52-calibre guns of all kinds and 155 mm/39-calibre lightweight howitzers by 2027. These included 814 truck mounted guns, 145 ULHs to name a few. These parameters would still need to be achieved. Not only has the failure to meet technological and combat related parameters been the reason for the delay in acquiring and inducting gun systems (note: induction is a peacetime process), but the recent pandemic has affected supply chain of defence systems across the globe. Hence, the Indian Army's artillery regiment had also to face the brunt of this limitation.

Focus 2: Extended Range EXCALIBUR

In June 2021, the US Army issued a Foreign Military Sales (FMS) contract modification for Raytheon Missiles and Defense to provide India with US$9.17M worth of EXCALIBUR INCREMENT 1b projectiles for close support situations. This is a fin-stabilised projectile with GPS guidance and hence, more lethal against enemy armoured formations. The EXCALIBUR will enable the Indian artillery to engage targets with more precision given its fin stabilised projectile over longer ranges. These projectiles are compatible with 155 mm howitzers and therefore, will be critical for India's indirect firing capability.

Focus 3: Multiple Launch Rocket System/ Multi Barrel Rocket Launcher (MBRL)

In December 2021, the extended range version of the PINAKA MBRL was successfully tested, along with its two ancillary systems, the Area Denial Munitions (ADMs) and indigenously developed fuzes. The PINAKA MBRL system was developed by the DRDO and at present, the artillery possesses the Mk.1 version of the PINAKA. Due to transfer of technology, the extended range system is now being developed by Armament Research and Development Establishment (ARDE) and High Energy Materials Research Laboratory (HEMRL). Indian private sector companies, such as Ashok Leyland and L&T have upgraded the Soviet-era BM-21 GRAD MBRL. However, considering that India possesses sophisticated PINAKA with longer ranges, they could replace the GRAD systems in the future.

In October 2021, India reportedly deployed the PINAKA MBRL and the SMERCH Multiple Rocket Launcher (MRL) in Assam.

Miniaturised fuzes have also been designed by ARDE for the ADMs, which include Direct Action Self Destruction (DASD) and Anti-Tank Munition fuses with their flight trials reported as satisfactory.

Missiles

The regiment of artillery will also possess the short-range PRALAY missile developed and successfully tested in 2021 by the DRDO. The missile has a low trajectory and can manoeuvre in flight with a range of 150-500 km. This conventional missile system will add to the artillery's firepower considerably. The supersonic cruise missile BrahMos, with a range of 290 km, now increased to 450 km, has been a mainstay for the artillery with three Blocks; Block I with manoeuvrability and precision-striking capability; Block II with target discrimination capability; and Block III with mountain warfare capability.

The Indian Army's artillery regiment is in dire need of indirect firing options. However, technology related impediments, combat related limitations and the pandemic are the reasons for the slowing down of the induction of sophisticated gun systems. However, the Indo-China stand-off has also ensured that India does not become lackadaisical with its field artillery modernisation process.

Any effort to develop credible indirect fire support on the battlefield would leave India with little need to develop tactical nuclear weapons (TNWs) despite its capability to do so. Pakistan's NASR MLRS, which is nuclear capable at tactical level, has raised concerns if India followed suit. However, a credible conventional firepower capability would reduce India's need for a TNW, strengthening the nuclear threshold and increasing nuclear stability.

Naval Indirect Firing and Indian Navy

Traditionally, the Indian Navy has operated heavy guns of 57 mm calibre and above, along with 35 mm auxiliary guns and smaller calibre guns. However, India's indirect naval firepower was in dire need of a 127 mm calibre gun along with ammunition (extended range guided munition type of ammunition for high calibre guns) to be fitted on its frigates and destroyers for both anti-surface and anti-air roles.

Though the MK 45 guns from the United States could have been an option, in 2021, there were reports that the Indian Navy has decided to focus on a 'Make in India' gun system. Bharat Heavy Electricals Limited (BHEL) was nominated by the Defence Min-

istry for the development of 127 mm guns already after it has successfully supplied 76 mm guns to the Navy and the successful production of the 80 mm gun for the Navy since 2011.

Currently, the Indian Navy operates the 100 mm and the 76 mm guns. In September 2021, the Indian Navy gave orders to BHEL for an upgraded Super Rapid Gun Mount (SRGM) for the TRIPUT class frigate. These upgraded guns are reported to be capable of engaging fast, manoeuvring, as well as non-manoeuvring and radio controlled targets. They can fire advanced ammunition with a higher range and programmable ammunition.

The upgrading of the SRGM and a higher calibre gun (127 mm) would enable the Indian Navy to possess a strong indirect firing capability. However, possessing sophisticated warships and frigates alone are not enough to provide the Navy with a blue water capability. These warships would need to be armed with credible weapon systems for credible conventional deterrence. An indirect firing capability would also ensure that the Navy's nuclear deterrence was reinforced by strengthening India's conventional strike capability that would bolster its 'no-first use' pledge. ■

Photo: MoD India / GODL

India's Defence Research and Development Organisation (DRDO) successfully conducted a maiden flight test of indigenously developed surface-to-surface missile PRALAY from Abdul Kalam Island off the Odisha coast on 22 December 2021.

India's IAFV and IMBT Programmes

Suman Sharma

The power of armoured vehicles in warfare has been proven time and again. German General Heinz Guderian once said, "If the tanks succeed, then victory follows."

India's military credits its victory in the 1965 and 1971 wars primarily ton its armoured firepower. To reinforce this opinion and provide India's youth with a historic sense of pride, vintage CENTURION, PT-76 and OT-62 TOPAZ tanks were on parade this year on 26 January at the 73rdRepublic Day celebrations. The CENTURION tank provided India with its youngest Param Vir Chakra holder (India's highest wartime gallantry award), posthumously awarded to 21-year old Second Lieutenant Arun Khetarpal.

The Indian Army's newest combat arm-Mechanised Infantry Regiment, was raised in the 1980s and was turned into a potent fighting force through the sustained efforts of former Army Chief General K. Sundarji. Focusing on technology, speed, and mobility, General Sundarji proposed several initiatives, both operationally and technically, thereby raising mechanised forces which eventually became the mainstay of the Indian Army's Strike Corps.

The Indian Army, which has largely operated British and Russian tanks in the past, has embarked on an armoured modernisation drive more intensively in the last couple of years, with multiple programmes, which include both imports and home-grown platforms.

Photo: DRDO

AERV - India's indigenous Armoured Engineer Reconnaissance Vehicle (AERV) made by DRDO, OFB & BEL

India's indigenous ARJUN Main Battle Tank

India's quest for a homemade tank began after the 1971 Indo-Pak war with the ARJUN Main Battle Tank (MBT) project launched in 1972. The indigenous ARJUN, developed by the Government-owned defence research agency-Defence Research and Development Organisation (DRDO), has the involvement of 15 academic institutions, eight laboratories and various medium, small and micro enterprises (MSME). Manufactured by Combat Vehicles Research and Development Establishment (CVRDE)'s Heavy Vehicles Factory (HVF), the first lot of 16 ARJUN MBTs entered service in 2004, with an additional order for 124 coming in 2010. The legacy ARJUN MBT underwent many changes in the ensuing years, as the original was not considered up to the mark, with new variants like ARJUN Mk-1 and ARJUN Mk-1A.

Under the present Government's 'Atmanirbhar Bharat' pitch (Self-Reliant India), a deal for 118 improvised ARJUNs called the ARJUN Mk-1As, worth approximately US$1.3Bn, was cleared in August 2014, and signed in September 2021, for two regiments.

The ARJUN Mk-1A differs from its earlier version as it incorporates 71 improvements including 14 major upgrades. Poised to be one of the world's heaviest battle tanks, the ARJUN-Mk-1A will largely be confined to the western theatre's desert region, as it has issues with transportation by rail. Indian Army former Additional Director General Mechanised Forces Maj Gen (retd.) Rohit Gupta, says, "[the] ARJUN is a very good tank. The old issues of quality control have largely been resolved. It has a handicap with its weight, restricting its use in particular areas only."

The 68.5-tonne Mk-1A with a length of 10.19 metres promises to be a dependable and a state-of-the-art war fighting machine. To bolster the ARJUN Mk-1A's potency as a weapon's platform, DRDO has proposed the integration of indigenous anti-tank weaponry like the NAG anti-tank guided missile, HELINA – airborne NAG, an MPATGM (man-portable version), and the ARJUN gun barrel. The ARJUN Mk-1A is also capable of firing the Israeli LAHAT anti-tank missile fitted to the 120 mm main gun. There have been reports of LAHAT running into issues with its accuracy, forcing its exit from the programme with DRDO pushing for the indigenous Canon Launched Guided Missile (CLGM), as LAHAT's replacement.

After the limited series production, each of the two regiments will get its full batch of 59 tanks by 2025-26. The first five tanks will be delivered by 2023, followed by 30 tanks each year thereafter. Each regiment will get five tanks by the middle of 2023, 30 tanks by mid-2024 and then remaining 24 tanks by 2025-26.

Time and cost overruns in the ARJUN MBT programme have been attributed to the DRDO and Government-owned Ordnance Factory Board (OFB) inability to plan life cycle support and their inability to build indigenous supply chains for spares and

support needed over a lifetime of almost 40 years in active service.

Future Projects

Infantry Armoured Fighting Vehicle (IAFV) is a generic term and in the Indian context the specific programme named Futuristic Infantry Combat Vehicle (FICV).

FICV

The Request for Information (RFI) for the approximately US$5Bn deal for 1,750 FICVs was issued in 2021. This armoured vehicle comes in both tracked and wheeled versions and can cross water obstacles while afloat. Depending on RFI responses, the decision will be made at the Acceptance of Necessity (AoN) stage.

The FICV programme was launched under 'Make' category (which later became Make-1 category), following consultations with the industry which began in 2008. An Expression of Interest (EoI) was issued in 2010 for 2,600 FICVs valued at about US$6.7Bn for which three private manufacturers and OFB responded. The private manufacturers who responded were Larsen & Toubro (L&T) with its in-house design facility, Tata Motors and Mahindra Defence with foreign OEMs as design partners. The OFB proposal was considered sketchy and was thus rejected by the Integrated Programme Management Committee (IPMT).

Due to anomalies and non-compliance issues, the EoI was retracted and re-issued in 2015.This time, ten companies received the EoI, of which those who responded were – Larsen & Toubro (L&T), Mahindra Defence, Tata Motors and Bharat Forge, OFB, Pipavav (Reliance) Defence, Tata Power & Titagarh Wagons.

Due to long delays, sensing elimination, Reliance Defence and Titagarh wrote to the Ministry of Defence (MoD) about their readiness to develop FICV under the newly introduced Make-2 category with nil funding from the Ministry. The MoD convinced others too, to participate in Make-2. All three competent bidders which responded to the first EoI, withdrew from this programme under Make-2, as there is no funding from the Government.

Difference between Make-1 and Make-2

Under Make-1, the development and production for mega platform programmes are jointly funded by the MoD and industry, as per Defence Procurement Procedure (DPP) 2006 (pure cost and no profits) with the order for the complete platform in its entirety.

Photo: Press Information Bureau, Govt. of India

The ARJUN Mk-1A

Photo: Rosoboronexport

The SPRUT SDM1

Make-2, introduced in DPP-2016, entails the entire programme to be funded by industry alone, and sanctions the development of just the major sub-systems and building blocks, not the entire platform.

The development costs for FICV have ranged in the millions with no commitment by MoD to fund the project. The programme lingered on and died a natural death, resulting in the withdrawal of the second FICV EoI. The latest RFI in 2021 which invites Indian, as well as global players, has provided fresh impetus to the FICV programme, which came full circle in 13 years, with no decision taken.

Meanwhile, the Indian Army's mechanised forces were forced to continue with vintage and obsolete, under-powered and under-protected BMPs.

Photo: Rosoboronexport

The SPRUT SDM1 has been criticised after it was called out by the Indian Army as not being a tank.

FRCV

The Future Main Battle Tank (FMBT) was DRDO's proposal, targeted to replace the ageing Russian mainstay of the Indian Army - the T72 and T90, with a 50-tonne weight class. The T-90, licence-produced locally by HVF, also face challenges of denial of technology from Russia for critical systems like the gun (barrel included) and turret armour plates.

The deal for 1,770 Future Ready Combat Vehicles (FRCVs) valued at approximately US$11Bn invited RFI responses in 2021 from potential customers. The FRCV is India's FMBT, as it is the 50-tonne class category aimed at replacing the T-72 and T-90. The new name for this programme is Next Generation Main Battle Tank (NGMBT) and its induction is expected by 2030.

The foreign OEMs participating in this deal include the South Korean K-2 from Hyundai Rotem, Russian T-14 ARMATA, and French LECLERC. The RFI is expected to follow the Strategic Partnership (SP) route, in which an Indian defence manufacturer (either private or government-owned) teams up with a foreign OEM.

The FRCV RFI mandates training and maintenance as essential requirements, along with Transfer of Technology (ToT), performance-based logistics and engineering support packages.

During the Indo-Russian annual Inter-Governmental Commission on Military and Military-Technical Cooperation held in December 2021 in New Delhi, the Indian side specified its requirements for this programme. Press Secretary of Russia's Military-Technical Cooperation (FSMTC), Valeria Reshetnikova, stated that, "The Indian partners were offered new areas of work, including the creation of armoured vehicles based on the customer's specifications on the ARMATA platform." Russia's T-14 ARMATA battle tank armed with a digital fire control system and a 125 mm new generation gun, possesses a high degree of active and passive armour protection.

The French LECLERC, which is lighter than most of its western counterparts, is seen as France's attempt to salvage its image globally following the AUKUS snub. According to reports, the French Parliament was informed about Paris backing the Indian Army bid through a separate production line for India. According to some reports, the German LEOPARD and American M1 ABRAMs are unsuitable as per the RFI requirements owing to their heavy weight. Jayant Patil, Director L&T says, "I am a firm believer that India does not need foreign OEMs for designing and developing FICV or FMBT. The technologies in both are the same. What changes is the protection (survivability) levels and main armament. Mobility remaining similar at different weight class."

Difference between FRCV and FICV

FRCV is a heavily armoured 45–50 tonne class MBT, intended to replace the ageing Russian T-72s and T-90s. Equipped with a 120 mm main gun with anti-tank missiles, the FRCV has many futuristic features capable of fighting multi-theatre digital domain wars.

The FRCVs are likely to perform multiple roles such as artillery observation post vehicle, air-defence gun missile system, tracked light tank, wheeled version, armoured ambulance, bridge laying tank, engineer reconnaissance vehicle, armoured recovery vehicle, tracked MBT, trawl tank, mine ploughs, and self-propelled artillery howitzer. The FICVs are set to replace the vintage BMP II (acquired in mid-1980s). The FICV is a 16–18-tonne class armoured vehicle with 30-40 mm gun as its primary weapon, with an anti-tank missile and a 7.62 mm gun as secondary weapon systems.

Light Tanks

After the Indo-China border stand-off in eastern Ladakh began in 2020, the Indian MoD floated a RFI in 2021, for a deal worth more than US$2Bn for 350 light tanks. These lightweight tanks, designed for both mountainous terrain and plains, focus on mobility and speed, and are basically full-fledged tanks with lower armour.

Foreign participants in this deal are South Korea's Hanwha Defence which proposed its K21-105 light tank, equipped with a 105 mm Belgian gun and Russian SPRUT SDM1. The K21-105 became operational in the South Korean Army a few years ago. The Russian SPRUT SDM1 was first offered to India during Defence Minister Rajnath Singh's visit to Moscow amidst the Indo-China border stand-off in June 2020, when New Delhi started scouting for lightweight tanks. Hanwha Defence has assured modifications in K21-105 as per the Indian Army's requirements.

Russia's state-owned Rostec announced last year that the 18-tonne SPRUT-SDM1, a modernised version of the SPRUT-SD amphibious light tank, was ready for serial production, following successful trials. The SPRUT-SDM1 boasts an ability to fire guided missiles and cannons while afloat. The advantage that SPRUT has proposed is its 125 mm gun, which shares a similar munition to T-72 and T-90 tank guns, making it cost effective for the Indian user. The SPRUT SDM1, however, came under criticism after it was called out by the Indian Army as not being a tank. According to some insiders, apparently SPRUT has also been rejected by the Russian military itself.

Other tanks in the lightweight category operated globally include the Chinese Type-15, the Turkish-Indonesian joint venture KAPLAN MT and the Israeli SABRAH. China had deployed its lightweight Type-15 along the Indo-China Line of Actual Control (LAC). Contrastingly, India pitted its 45-tonne T-90s and T-72s, which were

found heavy enough for transportation and deployment in forward areas.
Since the Indian military has largely been focused on its western flank with its plain, semi-desert and desert topography, the heavy armoured T-90s and T-72s have been positioned in these locations while the high-altitude Indo-China LAC has been largely ignored. Maj Gen (retd.) Gupta adds, "Our Pakistan centric approach has cost us when it comes to the more important adversary of China."
Besides L&T, other private companies that are likely to compete in all three tank projects - FRCV, FICV and light tanks - are Tatas (TASL) and Mahindra Defence. Others like Bharat Forge have joined the Consortium led by Tatas. Lt-Gen (retd.) Praveen Bakshi, who was in charge of the Indian Army's Eastern Command during the Indo-China Doklam stand-off in 2017, says, "The private-public partnership in defence manufacturing has come of age and should be leveraged for the nation's security."

The Present Scenario

While the MBT project has been put on the backburner, according to Ministry sources, the light tank programme is gaining momentum. It is interesting to note that the light tank deal proposed by the Indian Army more than a decade ago, never really took off, owing to bureaucratic hurdles and intra-service rivalry as most Indian Army brass come from the Infantry and not the Mechanised branch. This not only pushed the programme back, but also resulted in interested vendors like the Swedish S-tank being knocked out due to lack of response. The project took off again after the late General Bipin Rawat, who died in an unfortunate helicopter crash in December 2021, assumed charge as India's first Chief of Defence Staff (CDS) in January 2020. General Rawat expedited the light tank deal.
Interestingly, the vintage PT-76, which won Dhaka for India in the 1971 Indo-Pak war was a former Soviet amphibious light tank. Other instances, as with the AMX-13 tanks of 20th Lancers used in Chushul during Indo-China war of 1962 and the light tanks of 7th Light Cavalry in Jammu and Kashmir's mountainous terrain of Zojii La in 1948, only reinforce the Indian Army's experience with light tanks and strengthen the case for their acquisition. However, one might find it surprising that despite these success stories, a case for a similar platform could never be built convincingly, regardless of skirmishes in Sikkim and eastern Ladakh bordering China.

In a joint venture with South Korea's Hanwha Defence, L&T was awarded the Army's artillery gun deal a couple of years ago and is hopeful for the light tank deal as well. L&T is riding high on its successful delivery of the K-9 VAJRA gun in record time and without any defects.
DRDO and L&T are believed to have an understanding about this project, which is called the High Altitude Tank System (HATS). Expected to incorporate technology from Hanwha Defence, L&T's HATS

Photo: hanwha-defense.co.kr

The K21-105

is likely to be a highly modified K-9, with DRDO's ARJUN MBT and light tank technologies merged in. This is emerging as a perfect private-public partnership, something that is long overdue. Reinforcing this sentiment is Maj. Gen. (retd.) VK Singh of the Indian Army's Armoured Corps, "Self-reliance in defence production is critical to reducing India's dependence on other countries for urgent procurement in times of exigency. A robust domestic defence manufacturing sector can transform India's military capabilities."
Challenges cited by the user and the vendor are often the prolonged procedure timeline, whereby the time taken from the issuance of the RFI to the contract award could take anywhere between four-five years. Prior to the issuance of the RFP, preparation of the General Service Qualitative Requirement (GSQR) by the user service takes two years and after the order is contracted it takes a minimum of two more years to receive the first consignment. The entire process takes a total of eight years, which some fear might affect operational preparedness and bring in obsolete technology.

Armoured Vehicles

To bolster the infantry soldiers' protection and mobility, the Indian MoD has embarked on numerous programmes.

KALYANI M4

Aimed at Self-Reliance, Indian private defence manufacturer Bharat Forge (Kalyani Group) won an order worth US$24M in April 2021 to deliver 27 multi-role, quick-mobility armoured vehicles for rough terrain, jointly signed with South African aerospace company, Paramount Group. These vehicles, called KALYANI M4, will be equipped to withstand mines and threats from improvised explosive device (IED).

AERV

In December 2021, the first set of indigenously developed next-generation Armoured Engineer Reconnaissance Vehicle (AERV) was inducted into the Army's Corps of Engineers. The deal for 53 vehicles, worth US$64M is hailed as a major game changer in support of mechanised operations in future conflicts. Designed by DRDO and manufactured jointly by OFB and Bharat Electronics Limited (BEL) the AERV comprises 90 per cent indigenous content and functions like a versatile BMP-IIK ICV.

Mahindra LSV

Last year, the MoD signed a deal worth US$143M for 1,300 light specialist vehicles (LSV) for the Army, with private manufacturer Mahindra Defence Systems Ltd (MDSL). These LSVs, earmarked for the Special Forces, were initially envisaged in 2002 as part of a modernisation study.

Tata WhAP

The Tata Group, another major private defence contractor in India, is at the forefront of receiving an Indian Army order for heavy armoured protection vehicles for troops in forward areas. Tata WhAP, co-developed with DRDO, has reportedly cleared critical high-altitude trials. The Tata WhAP will expedite induction and de-induction of troops at the frontline. ■

European/Indian Defence Industrial Cooperation

European arms producers are working hard to establish new toeholds in the Indian arms market.

J C Menon

As France takes over the Presidency of the European Union (EU), defence industrial co-operation between India and EU is expected to intensify. With defence budgets shrinking in most European countries, India, with its rising military expenditure, offers many opportu-nities for European defence companies, who are pursuing more innovative ways to get business in India. European arms producers, particularly France and Sweden, have worked hard to establish new toeholds in the Indian arms market, mostly through joint ven-tures and other industrial partnerships.

When Defence Minister of France Florence Parly and her Indian counterpart Rajnath Singh met last December in New Delhi, both leaders vowed to increase defence coopera-tion across all domains. During their bilateral talks defence industrial co-operation was a key theme. Parly said that France was ready to provide additional RAFALE aircraft to In-dia, besides the 36 fighters bought off the shelf in 2016 for €7.8Bn. The Indian defence minister made a strong pitch for greater industrial cooperation, highlighting that French companies can either collaborate with Indian companies or simply produce in India for both Indian requirements and for global customers.

Already companies such as Airbus is offering to establish a final assembly line in India in partnership with Tata to produce C295 military transporter as a replacement for the Indian Air Force's Avro aircraft fleet.

Airbus is also offering its A330 Multi-Role Tanker Transport (MRTT) aircraft, a proven mul-tiplier, to the Indian Air Force to meet its long-term strategic requirements.

Airbus, which is also Europe's leading space company, has extensive experience working with Indian Space Research Organisation (ISRO) and its commercial arm, Antrix. Togeth-er, they have designed and built two communication satellites – Eutelsat W2M in 2008, and HYLAS-1 in 2010 – for European customers. In addition, ISRO has successfully launched Airbus' Earth observation satellites – SPOT-6 in 2012, and SPOT-7 in 2014 – aboard its Polar Satellite Launch Vehicle (PSLV). In 2015, Surrey Satellite Technology Ltd (SSTL), a UK-based satellite manufacturer and Airbus subsidiary, launched DMC-3 satel-lites via the PSLV.

Airbus products were also a part of several important ISRO missions, including the Mars Orbiter Mission (MOM) and the Indian Regional Navigation Satellite System (IRNSS).

Launch services supported by Airbus have orbited more than 20 satellites for ISRO, with these spacecraft lofted from the Guiana Space Centre (CSG) – Europe's Spaceport in French Guiana, South America.

Author

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Photos: Press Information Bureau PIB

Defence Minister Rajnath Singh and French Minister for Armed Forces Florence Parly in New Delhi on 17 December 2021.

France Eyes More Deals

The French is also pursuing a larger order for more fighter aircraft from the Indian Air Force, and the Indian Navy. Expressing her country's willingness to offer India more RA-FALE fighter aircraft, Parly said, "there is a room for new developments. We are ready to answer any additional needs or requests that can be made by India. We know that aircraft carrier (IAC VIKRANT) will soon be delivered and aircraft are needed. So we are open and ready to provide any other RAFALE if this is India's decision."

France has already delivered 33 out of 36 RAFALE fighter jets, manufactured by Dassault Aviation as part of a deal signed in September 2016 through a government-to-government deal.

The Navy had floated a tender for 57 twin-engine carrier-based jets, the responses for which are being evaluated. Boeing F-18 SUPER HORNET and Dassault RAFALE are competing in this. However, the Navy is expected to reduce the number to 24, given a new indigenous Twin Engine Deck Based Fighter programme taken up by India's Defence Re-search and Development Organisation.

French companies are also eyeing the Indian Navy's multi-billion-dollar Project 75 India (P75I), under which six conventional submarines are to be built. India and

France are al-ready building six SCORPÈNE class submarines in Mumbai, four of which have been commissioned by the Indian Navy. 'Make in India' has been a reality for French companies for several years, particularly for defence equipment such as submarines," Parly said.
At the last DefExpo in 2020, a strong French representation of France's seven biggest de-fence companies (Airbus, Dassault, MBDA, Naval Group, Nexter, Safran and Thalès) were present and around 15 SMEs showcased their know-how of naval, land and air defence technologies, either at the French stand or with their Indian partners.
Apart from the expertise of the French arms industry, this presence also marked France's full commitment to supporting the Indian government's Make in India programme in the defence sector.
Among EU member states, France is by far the closest defence partner for India. This is not just because of the deal over the RAFALE, or the 2005 sale of the SCORPENE sub-marines equipped with EXOCET anti-ship missiles or even the cooperation in the Mirage fighters and their upgrade– all of which are of vital importance to the Indian Navy and Air Force. It is also because France is the only European country, which has around one mil-lion citizens in the Indian Ocean, and is therefore considered as the most natural Europe-an partner in military and security issues.

United Approach Lacking

Defence cooperation between India and European countries is highly fragmented, and New Delhi engages with each country separately on a bilateral and case-by-case basis. Efforts are on to have a collective and strategic approach towards multiple projects.
India has bilateral cooperation with several EU nations. For example, the India-Germany Defence Cooperation Agreement, signed in 2006, provides a framework for bilateral de-fence cooperation. The then German Defence Minister Ursula von der Leyen visited India in May 2015 and India's defence minister visited Berlin in February 2019. To further en-hance the defence industry and defence cooperation between Germany and India, an Ar-rangement on Implementation of the Agreement of 6 October 2006 concerning Bilateral Defence Cooperation was signed on 12 February 2019 during the minister's visit to Berlin. Under the agreement, India wants to increase the defence investments from Germany to India.

Defence Minister Rajnath Singh says the strong cooperation between India and France will continue to grow and contribute to global peace, prosperity and environmental sustainability.

German defence manufacturers including Rheinmetall have been exploring options to en-ter the Indian defence market in collaboration with state-run engineering major BHEL. The company has shown keen interest in investing in the country. However, Germany's thyssenkrupp Marine Systems (tkMS) recently expressed its inability to be fully compliant with the existing technical and commercial terms of the Indian Navy's Request for Pro-posal (RFP), which seeks deep transfer of technology (ToT) to create submarine design capability in India. TKMS was one of the key bidders for India's US$5.7Bn programme to acquire a new line of six attack submarines under Project 75 (I). This is the world's largest tender for diesel-electric submarines and the first procurement programme under India's ambitious Strategic Partnership model intended to push the Make in India agenda.
Two other European ship builders— Naval Group, present in India through its 100 per cent subsidiary Naval Group India, and Navantia of Spain are also in the race. Naval Group has also been part of first of its kind P75 KALVARI programme to deliver entirely "Made in In-dia" submarines to the Indian Navy. The P75 programme is a major element of the strategic Indo-French partnership developed over the last decades.
In November 2020, India launched the VAGIR, the fifth Indian KALVARI class submarine with SCORPENE design, entirely made in Indian shipyard Mazagon Dock Shipbuilders Limited (MDL), based on years of technology transfer and partnership with Naval Group.
The SCORPENE is a conventional-propulsion submarine designed and developed by Na-val Group for all types of mission, such as surface warfare, anti-submarine warfare, long-range strikes, special operations or intelligence gathering. Extremely stealthy and fast, its level of operating automation allows for a limited crew which reduces its operating costs significantly. Its combat edge is highlighted by the fact that it has six weapon launching tubes and 18 weapons (torpedoes, missiles, mines).
Naval Group has also collaborated with India's leading shipbuilder GRSE to offer surface ships for India and export markets based on the adaptable and sea proven GOWIND de-sign. GRSE will work closely with French and Indian industry.
The MoU seeks to leverage the capabilities of both partners to meet the growing require-ments of international navies and offer a robust world-class product. This blend of technol-ogy, innovation and management of state of art Indian and French naval expertise will be a real value proposition for modern navies.
Alain Guillou, SEVP international development at Naval Group said: "This extension of cooperation with GRSE, with whom we had worked for the propulsion system of KAMOR-TA class ASW corvettes, clearly highlights our long-term investment in India and empha-sises the potential of strategic relations shared between France and India in the Indo-Pacific region".

Swedish-Indian Defence Ties on a High

Last June, India's Defence Minister Rajnath Singh and his Swedish counterpart Peter Hultqvist reaffirmed their countries' close and long-standing bilateral relations and their growing partnership, especially in the field of defence where "there is a great scope for industrial cooperation". Singh invited leading Swedish defence majors to set up manufac-turing bases in India as he showcased the country as an attractive destination for invest-ment to produce military equipment and platforms.

The SCORPENE class of submarines can undertake multifarious tasks typically undertaken by any modern submarine which include anti-surface as well as anti-submarine war-fare.

Swedish firms such as Saab already have a major presence in India with several technical collaborations with the Indian industry. Saab has already expressed its interest in the Indi-an Air Force tender to acquire 114 multi-role fighter aircraft worth over US$15Bn. A spokesman of Saab said the GRIPEN fighter jets will be largely developed locally as part of the Make-in-India drive to build a global defence manufacturing hub in India. Saab is completely aligned with the 'Make in India' policy of the Indian government and plans to build a production line in India to meet all requirements of the Indian Air Force.

"The Make in India concept provides excellent opportunities for cooperation that would serve both our countries' interests. The ongoing multi-role fighter aircraft procurement where the GRIPEN fighter concept offered by Saab is a good example of transfer of tech-nologies and is supported 100 per cent by the Swedish government," Minister Hultqvist said.

Slovenia Too Gets its Pie

In one of the world's largest single contract for the delivery of light aircraft to date, Sloveni-an company Pipistrel was awarded a contract to produce 194 highly capable trainer air-craft for the IAF, the navy and the National Cadet Corps (NCC) for various purposes.

With its successful implementation, Slovenia, which held the EU Presidency between July-Dec 2021, and India secured a firm foundation for future bilateral cooperation in the field of defence.

Opportunities Galore

At present, India is in the midst of a massive modernisation drive of its armed forces, given its persistent border disputes with Pakistan and China, and the Chinese Navy's growing
profile in the Indian Ocean region. Estimates of India's military expenditure over the next decade, range from approximately US$130Bn (€116Bn) to approximately US$223Bn (€199Bn). Most of these defence requirements (60 per cent) have been met through the imported equipment.

This has made India one of the world's largest arms importer during the preceding five years, accounting for 14 per cent of global arms imports. More European equipment is proposed to be inducted into the Indian military as part of this modernisation.

With the opening of a research window under the the Preparatory Action on Defence Re-search (PADR), a precursor programme of the European Defence Fund (EDF), and a ca-pability window under the European Defence Industrial Development Programme (EDIDP), it is clear that the EU has entered a rapid phase of progress on European defence re-search and industrial matters. In this respect, the two test programmes, the PADR and the EDIDP, paved the way for the EDF under the 2021–2027 MFF, framed as a timely catalyst for cutting-edge defence research and innovation.

"In Europe, security and defence cooperation have long been the realm of member states and other security organisations like NATO. But recent efforts at the EU level have begun to create a European defence sector—which presents unique challenges and opportuni-ties," noted Raluca Csernatoni, a visiting scholar at Carnegie Europe.

Of late, there seems to be a growing acknowledgement by a number of European indus-tries in the defence sector to work together and harness each other`s potential. The role of EDTIB is becoming very important mainly in augmenting the cooperation. "The defence sector cooperation with India from EU's perspective is yet to be harnessed to the fullest potential. The defence sector cooperation can only get enhanced when the political di-mension in EU-India relations is on the right track. India always prefers to purchase de-fence equipment through Government-to-Government negotiations. European defence industry got evolved in addressing to the needs at the land, air and sea based levels. The emphasis on aeronautics and aerospace feature very prominently in all the developments witnessed in defence sector. European market in these sectors are flourishing," said Mal-gorzata Bonikowska, President, Centre for International Relations, Warsaw. ■

Electronic Coast Guardians

Luca Peruzzi

The safety of maritime traffic and the protection of national waters and coastal borders require an integrated surveillance network which involves a range of systems managed by national and international agencies alongside coast guards and navies.

The backbone of the worldwide coastal surveillance systems (CSSs) and vessel traffic services (VTS) is the coastal radar network of manned, but mostly unmanned sites, coupled with electro-optical systems for identification of radar contacts where available. Illegal traffic, piracy and terrorism threats, together with the increasing need to protect national waters and beyond, requires a continuous exploiting of developments in the radar sector by manufacturers. They are confronted by one of the most congested and cluttered environments in which to operate, as well as adhering to the standards and guidelines set by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) for maritime traffic safety and data distribution.

Photo: GEM Elettronica

Italy's GEM Elettronica proposes the OLYMPUS product family, which has been designed to fully meet the latest IALA V-128 guidelines for coastal surveillance and VTS applications. The OLYMPUS is an X-band, fully coherent, fully solid-state, pulse compression radar with an innovative transceiver characterised by high dynamic range and software define functionality.

Photo: Blighter

The Blighter Surveillance Systems Ku-band C400 series radar's electronic-scanning (e-scan) system uses a low-power passive electronically scanned array (PESA) and FMCW technologies.

Aselsan

Aselsan provides the SERDAR family of fully solid-state X-band low probability of intercept (LPI) coastal surveillance radars for the detection of sea surface and low-flying airborne targets. The Frequency Modulated Constant Waveform (FMCW) transmission technique employed by the SERDAR radar allows for its superior performance and enables substantially reduced output power, according to Aselsan. LPI is a vital characteristic for coastal surveillance radars as it enables detection of approaching targets without being detected itself, the Turkish company states. SERDAR is available in two different antenna configurations offering superior close-range performance and enhanced target resolution, with both configurations compliant with the latest IALA V-128 recommendations. The SERDAR system can detect and track targets up to 48 NM range and can simultaneously track up to 250 targets.

Blighter Surveillance Systems

Building upon the heritage of its B400 series of ground surveillance radars, the UK company Blighter Surveillance Systems proposes the C400 series of coastal security systems. Characterised by a modular, non-rotating, entirely solid-state design, the Ku-band radar's electronic-scanning (e-scan) system is implemented using low-power passive electronically scanned array (PESA) and FMCW technologies. The Blighter C400 series radars use advanced Doppler signal processing to provide the ability to precisely examine the motion of waterborne objects with respect to waves or ripples on the water surface. This allows for the detection of very small targets, such as RHIBs and kayaks even in cluttered environments. Each C400 radar unit, with a 25 kg antenna and dimensions of 666x503x128 mm, has a 90° field of scanning, requiring two radar units to provide a 180° coverage. With 1 Watt of nominal transmitter power, the system has a maximum detection range against small wooden boats and RHIBs of 11 and

Photo: Hensoldt UK

Hensoldt UK, the manufacture of Kelvin Hughes SHARPEYE radars, proposes the fully coherent SBS-800 and SBS-900 Doppler radar solutions to meet the stringent requirements of both coastal surveillance and VTS.

Photo: BATS

Last February, the Bahrain Defence Forces (BDF) selected the IAI's Belgium subsidiary BATS for the supply of an Integrated Coastal Surveillance System to protect the shores of a military base in the country.

Photo: Leonardo

Leonardo is currently promoting the TPS-732 V5 coast surveillance version of its compact 2D SPS-732 air/surface surveillance naval radar. The TPS-732 V5 features programmable transmitting powers and proprietary complex waveform/frequency combined with true Low Probability of Intercept (LPI) capabilities.

16 km respectively, while maximum instrumented range reaches 32 km. During DSEI 2021, Blighter unveiled the new A800 3D multi-mode radar capable of detecting small drones, as well as search-for-surface targets over land and water.

GEM Elettronica

With its long know-how and experience in surveillance and navigation radars, and having provided coastal surveillance systems worldwide, Italy's GEM Elettronica has developed the OLYMPUS product family. This has been designed to fully meet the latest IALA V-128 guidelines for coastal surveillance and VTS applications. An evolution of the SENTINEL family, the OLYMPUS is an X-band, fully coherent, fully solid-state, pulse compression radar. It is fitted with an innovative transceiver characterised by high dynamic range and software define functionality, including video processing techniques, such as time and frequency diversity with automatic adaption to the real scenario, CFAR and Doppler Filtering, alongside 31 programmable sectors. With an instrumented maximum range of 96 NM, the family comes with 12', 19' and 21' antenna lengths, up-mast configuration with embedded transceiver up to 400 W, depending on the chosen solution, also including down-mast, dual redundant or frequency diversity configurations. GEM Elettronica is providing the X-band SENTINEL family capabilities to the Italian MoD and Ministry of Interior for upgrading the Italian Navy's radar coastal surveillance network. It involves both fixed and mobile sheltered applications, as well as offering the dual X/Ka band capabilities of the GEMINI family in service with Italian Navy vessels, to ensure full surveillance of critical infrastructures thanks to its precise shorter-range detection of small targets.

Hensoldt

Hensoldt UK, the manufacture of Kelvin Hughes SHARPEYE radars, proposes two fully coherent Doppler radar solutions to meet the stringent requirements of both coastal surveillance and VTS. The SBS-800 family's four variants are configured as a single up-mast transceiver with the SHARPEYE sensor integrated into the antenna tuning unit thereby removing any need for a down-mast housing. The SBS-900 systems SHARPEYE transceivers are housed in a separate dedicated outdoors enclosure, close to the antenna turning unit and do not require an air-conditioned enclosure. The two families' SHARPEYE solid-state transceivers are fully coherent, providing greater capability and situational awareness through digital pulse

compression and pulse Doppler processing. The SBS-800 family includes the 800-1 and 800-2 models with 300W peak power and 48 NM maximum instrumented range, with 3.7 and 5.5 m antenna size respectively, alongside the frequency diversity 800-3 model and the S-band 800-51 solution. The SBS-900-2 and -900-3 both have 300 W peak power, 48 NM maximum instrumented range, 3.7-to-6.4 m antenna size, and higher antenna gain. They differ as the 900-3 model has a dual single-band transceiver configuration for redundancy. The 900-4 model has X & S-band transceivers. In 2020, the SBS-900 long-range radar was chosen by the Lithuanian State Border Guard Service for monitoring vessels in the coastal waters of the country.

The new generation SPEXER 2000 DA belongs to the land-based sea, ground and low air space surveillance AESA (Active Electronically Scanned Array)-based SPEXER radar family. Exploiting the latter technology, it provides a quad beam capability, which offers an advanced target detection in harsh sea clutter situations. In addition to ensuring simultaneous use of target tracking and sector surveillance on the ground, over water surfaces and in the air, with the non-mechanical movement during processing, the SPEXER 2000 DA produces better operational performance and results for the detection of slowly moving targets such as swimmers. The X-band Pulse Doppler, based on AESA technology, has a very low average radiated power (16 W).It can detect a swimmer at 1 km, small boat, rubber dinghy, and jet ski, all at 20 km, in addition to drones at 9 km and light vehicles at 22 km. Capable of detecting targets over the horizon with an instrumented maximum range of 247 km, the SPEXER 2000 DA and SPEXER 2000 coastal radar versions have found success mainly in the Middle East and Asia.

IAI

In February 2021, the Bahrain Defence Forces (BDF) selected IAI's Belgium subsidiary BATS for the supply of an Integrated Coastal Surveillance System to protect the shores of a military base in the country. The solution features multiple installations of state-of-the-art-radars and electro-optics, integrated in a Command and Control centre. According to the same company, GR12 ground and coastal surveillance radar technology will be the core of the solution. IAI's X-band solid-state high resolution FMCW radar ensures simultaneous and continuous multi-beam coverage of the entire region of interest, both on ground and sea surfaces, allowing for continuous surveillance and instantaneous target tracking over a wide area. The system ensures automatic and continuous detection and tracking with high accuracy of both land and sea targets. Weighing 47 kg, the radar features a non-rotating planar array covering a 90° sector with a detection range of 22 km for rubber boats or a moving person, and 44 km for a small sailboat or moving vehicle, and up to 3 km for a swimmer. IAI also offers the ELM-2226 ACSR (Advanced Coast Surveillance Radar) family, also identified as CR20 by BATS, which is an X-band solid-state LFMCW (Linear FMCW) radar, capable of automatic detection and tracking of more than 500 targets, with a detection range (sea state 3) of over 20 km for rubber boats and over 60 km for patrol craft. It is offered in three versions: short-, medium- and long-range.

Leonardo

A prime contractor for integrated coastal surveillance, as well as VTS solutions worldwide, Leonardo is currently promoting the TPS-732 V5 dedicated version of its compact 2D SPS-732 air/surface surveillance naval radar. Based on a modern X-band, fully coherent, solid-state architecture, the lightweight, compact and modular TPS-732 V5 features programmable transmitting powers (down to hundred

Masthead

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Cover: Seen here under French Navy colours as L'ADROIT, BOUCHARD is one of four new OPVS being acquired by the Argentine Navy
Photo: Naval Group

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Photo: Terma

With more than 360 units delivered, the SCANTER 2000 series is an X-band, 2D, fully coherent pulse compression radar family, based on solid-state transmitter technology with digital software-defined functionality.

mWs) and proprietary complex waveform/frequency combined with true Low Probability of Intercept (LPI) capabilities, with surveillance and tracking requirements against both surface and air targets. With very high gain, double beam antenna group and powerful up-mast solid-state transmitter, according to Leonardo, the TPS-732 V5 offers super-resolution modes, zoom, range profile imaging with scan and over-the-horizon surveillance modes. With < 600 kg heavy antenna (with optional integrated IFF), the new radar has three operating modes: the standard surveillance (mode 1) with an over 98 NM instrumented range, mode 2 for surveillance (54 km max) in strong clutter of fast moving targets, alongside detection of drones up to more than 25 km, and mode 3 with OTH performances up to 150 NM. The previous generation RASS C solution, together with the same company's T200C GABBIANO radar with ISAR (Inverse Synthetic Aperture Radar) capabilities, represents the longer-range backbone of the Italian Navy's coastal radar network. This is especially the case for coverage of the southern peninsula and water borders around Sicily, which the Italian authorities plan to enhance with a dedicated programme.

Terma

With over 3,000 SCANTER radar systems installed worldwide, the Danish Terma group provides sensors for VTS, coastal surveillance and surface-movement radar segments. With more than 360 units delivered, the SCANTER 2000 series is an X-band, 2D, fully coherent pulse compression radar family, based on solid-state transmitter technology with digital software-defined functionality. Capable of detecting targets at a range exceeding IALA advanced requirements, the SCANTER 2000 can provide fully automatic volume surveillance and early detection, and tracking of separate multiple (non-cooperative) surface and air targets in close proximity, in all weather conditions. The system is characterised by a 26 kg outdoor transceiver unit, which can be placed up-mast close to the antenna to minimise installation requirements, costs and waveguide loss, alongside a standard IP network capability for easy integration. With an over 80 W peak power, an automatic environmental adaption and a power sector transmission capability, equipped with a Terma 18' compact antenna, the SCANTER 2000 meets the IALA standard recommendations up to 36 NM. Among the declared customers, Estonia, Bahrain, India, Saudi Arabia, Pakistan, Singapore, Taiwan, and Colombia are using the system for coastal surveillance and critical infrastructure protection. Specifically designed for CCS and VTS applications, with a 96 NM detection range and a 50-to-350 W peak power, together with a 77 kg transceiver, the SCANTER 5000, has also found international success for the same applications with Norway, Spain and Colombia. Both radar models can be equipped with an ET2 tracker for fast, agile and small targets tracking in severe weather conditions alongside slow-moving targets.

Photo: Thales

The Thales COAST WATCHER 100 radar answers the need for round-the-clock, long-range surface and low-altitude target detection. The solid-state X-band offers an instrumented range of up to 100 NM and a range resolution down to 4 m, in addition to all-weather detection capability.

Thales

The Thales COAST WATCHER 100 radar answers the need for round-the-clock, long-range surface and low-altitude target detection. The solid-state X-band offers an instrumented range of up to 100 NM and a range resolution down to 4 m, all-weather detection capability thanks to frequency agility, circular polarisation, high resolution and Doppler processing, together with the capability to be installed at high altitude (up to 1,000 m), and to be remotely operated with an unmanned radar site. Capable of medium-range detection of very small threats, and long-range detection (line of sight) of medium and large targets, alongside low-flying threats, the COAST WATCHER 100 saw recent sales to the Jamaica Defence Force as part of a national coastal surveillance system. It has also been sold to the French defence procurement agency (DGA) for surveillance of its coastal waters near to the two missile test sites of the Mediterranean Sea and the Landes. ■

US Army Integrated Tactical Network

Thomas Withington

The US Army's Integrated Tactical Network promises a step change in how the manoeuvre force handles and shares non-classified data.

In a nutshell, the US Army's Integrated Tactical Network (ITN) provides voice and data communications at the tactical level to the manoeuvre force. It does this using an ensemble of communications and networking hardware and software. US Army documents say that the ITN provides a tactical network to aid expeditionary missions. This network will be capable of working in a resilient and reliable fashion in electromagnetically contested and congested environments. Given the investment into electronic warfare that near-peer adversaries like the People's Republic of China and Russia are making, this will be imperative.

Photo: US Army

The US Army's enhanced Expeditionary Signals Battalions are receiving the ITN architecture. These units provide signals support to deployed US Army formations.

Components

The ITN's hardware and software includes legacy radios, systems entering service and commercial off-the-shelf equipment like and tablets. The great strength is that all these radios, systems and devices will be able to share non-classified data on a single network.

The ITN is distinct from other US Army networks equipping the manoeuvre force as it carries secure, rather than classified, traffic with significant built-in redundancy. As Jeff Simpson, vice president of business development for communications systems at L3Harris notes that the "ITN is designed so that you can operate both in a secure but unclassified environment and within a classified environment" at the same time.

One of the clever elements of the ITN interesting is that it does not rely on one type of radio or radio waveform to handle its voice and data traffic. "The ITN is not a separate network," says Paul Mehney, director of public communications for the US Army's Programme Executive Office for Tactical Command, Control and Communications. It "incorporates the army's current tactical network environment." This includes software applications, radios, communications devices, gateways, nodes and network transport.

Specific equipment is being procured to facilitate the ITN. This is being rolled out at the brigade, company and battalion command levels. Platoons and squads also receive specific kit. Klas Telecom provides its Battalion and Company Tactical Radio Integration Kit. The former provides a voice and data gateway at brigade and battalion levels. Similar services are provided by Klas' Company Tactical Radio Integration Kit at the same level. Sierra Nevada Corporation's TRAX software is a common operating system used by the disparate communications devices on the ITN. This processes the data that will be moved around the ITN. Allied to this is PAR Government's TAK Tactical Assault Kit server software. 4K Solutions and Verizon are providing a mobile broadband WiFi system. A plethora of Variable Height Antennas (VHAs) and portable satellite communications terminals are furnished by Hoverfly, GATR and Tampa Technologies. TrellisWare and Silvus Technologies are providing transceivers. Specifically, these include TrellisWare's TW-950 and TW-875 radios, and Silvus-4200/4800 transceivers. The latter are discussed in more detail below. Finally, Samsung Galaxy-S7 tablets running PAR Government's WINTAK software will equip dismounted troops. The tablets will let the troops to send and receive ITN data.

All this equipment is designed to work alongside the manoeuvre force's existing Very/Ultra High Frequency (V/UHF - 30 megahertz to 512MHz) tactical radios. For example, the Silvus-4200/4000 StreamCaster radios use wavebands of between 400MHz to 5.875 gigahertz/GHz depending on the chosen frequency band option. Colonel (retired) Mike Kell, Silvus' director of army strategic programmes, says these radios will be used for at-the-halt and on-the-move line-of-sight communications between brigade and battalion command posts. This is in addition to "other critical nodes requiring terrestrial line-of-sight connections." The VHAs are tethered UAVs.

Author

Thomas Withington is an independent electronic warfare, radar and military communications specialist based in France.

Photo: US Army

The ITN is an important step forward for the US Army's ability to share information across echelons right down to units deployed at the forward edge of the battle area.

These will provide a Brigade Combat Team (BCT) area of operations with network data rates of up to 100 megabits-per-second. Mr. Kell says that the StreamCaster radios were chosen "to connect key command and control nodes due to their self-organising network designed to operate in multiple spectrum bands at high data rates, and their interference mitigation capabilities." He adds that Silvus is now working with the army on integrating these radios into their vehicles. Units lacking specific ITN equipment will still be able to share secure data with other units equipped with ITN. This can be done using their existing tactical communications.

An array of different radios and waveforms can handle ITN traffic. It is noteworthy that the US Army is receiving TrellisWare's TSM waveform. This UHF waveform will be used for intra- and inter-platoon, company, battalion and brigade communications. It is carried by the army's Thales AN/PRC-148D V/UHF and L3Harris AN/PRC-163 handheld, plus L3Harris AN/PRC-158 and Collins AN/PRC-162 backpack radios. A soldier could connect their Galaxy-S7 tablet to their handheld radio and send and receive unclassified voice and data traffic across the ITN. Alternatively, they could use the mobile broadband WiFi system for the same task if this is more practical or convenient.

Conventional US DOD Satellite Communications (SATCOM) networks like the Mobile User Objective System (MUOS) will also carry ITN traffic within and between deployed units. The MUOS constellation carries UHF SATCOM traffic using the WCDMA (Wide Code Division Multiple Access) waveform. Avantgarde technologies like Low Earth Orbit (LEO) cubesat constellations could also be used for similar tasks in the future. These constellations could include commercial LEO efforts like Amazon's Project Kuiper, SpaceX's Starlink and OneWeb. All these efforts focus on fielding large constellations of LEO satellites to provide global broadband internet connectivity.

This ability to use different forms of communication gives the ITN its all-important redundancy. It also offloads unclassified data from classified networks using Type-1 encryption. Type-1 is a rigorous US National Security Agency (NSA) encryption standard used for handling classified material. As ITN does not use Type-1 encryption non-classified traffic can be shared with ease. This helps avoid overloading Type-1 certified networks with non-classified traffic.

As Mr. Simpson notes, the US Army has a mix of radios, some of which will have Type-1 encryption and some of which will not. The handheld and backpack systems like the AN/PRC-148D, AN/PRC-163, AN/PRC-158 and AN/PRC-162 are all Type-1 certified. Other radios "that will be below echelon at squad level" will be Type-3 certified. According to NSA definitions, Type-3 encryption covers sensitive, but unclassified, information. Mr. Simpson explains that the type of information moving between dismounted troops at the Forward Edge of the Battle Area (FEBA) would be of marginal benefit to the red force if obtained. This cannot be said of the information moving between command levels at platoon and above. Hence radios carrying such information have Type-1 certification. The ITN will greatly ease the movement of Type-3 standard information around the FEBA as well as up and down levels of command.

Given that unclassified traffic is being handled via the ITN, non-US allies and partners can use the network to send and receive voice traffic. These nations may not always be cleared for Type-1 certified radios, particularly if they are non-traditional US allies. At the same time, the exigencies of coalition warfare stress that US and allied forces working together must be able to easily share information. The advent of the ITN is an important step forward in this regard. The ability of allied land forces to 'plug into' the ITN with Type-3 level devices will help improve the synergy and coordination between US army and allied manoeuvre forces. Above all, "the ITN provides mobile network availability down to the small unit dismounted leader to facilitate mis-

Photo: Silvus Technologies

Several technologies are being acquired to support the ITN architecture. This includes Silvus Technologies' StreamCaster radios.

sion command, situational awareness and air-to-ground integration," says Mr. Mehney.

The advent of the ITN is accompanying a wider overhaul of US Army manoeuvre force command and control architectures. For example, the army's Command Post Computing Environment (CPCE) is an IP-based system consolidating existing, yet disparate, command post tools. These include the Tactical Ground Reporting System, Global Command and Control System – Army, Command Web and Command Post of the Future. CPCE will be available from command post down to vehicles and dismounts. The Artillery's Advanced Field Artillery Data System will also be integrated into the CPCE.

One hypothetical scenario illustrates how the ITN may be used tactically. A soldier may spot a potential target like a building with red force troops. This information is not necessarily classified in itself. The soldier determines that target's position using the map application on their tablet. They then upload this information onto the ITN. From there, it goes to the command post and is fed into the CPCE. A decision is taken on what action will be taken against the target, and this then flows out to the units responsible for executing this.

Photo: Samsung

Troops are receiving Samsung tablets which will form an integral part of the Integrated Tactical Network. This will allow them to send and receive information using these devices.

Implementation

The ITN is being rolled out in a series of Capability Sets (CSs). Mr. Mehney says that during the 2021 fiscal year, the CS-21 ITN iteration was fielded to four units. These are the 1st and 3rd BCTs of the 82nd Airborne Division, the 173rd Airborne Brigade and the 3rd Brigade Combat Team of the 25th Infantry Division. CS-21 was also fielded with three of the army's Enhanced Expeditionary Signal Battalions (ESB-Es). The US Army says that the ESB-Es provide signals support to US Army expeditionary units. This ensures that the latter have full and secure intra- and inter-theatre network connectivity. The 2021 fiscal year will also see ITN being rolled out across the 1st Multi-Domain Task Force (MDTF). Essentially, a combat support element, the MDTF is a "theatre-level manoeuvre (element) designed to synchronise precision effects and precision fires in all domains against adversary anti-access/area-denial networks in all domains," according to the army. Mr. Mehney says that three additional Infantry BCTs and a Stryker BCT will receive the ITN under CS-21 this year. "The army will also continue ESB-E and MDTF fielding of ITN elements."

Mr. Mehney says there is no set 'end date' for ITN fielding "because ITN is part of the army's two-year network capability set delivery process. The process is continuous in order to enable iterative improvements and technology insertion" to keep pace with technological change and emerging threats. He says that while CS-21 is being fielded, CS-23 is in "near-term development and experimentation, CS-25 is in technology maturation and prototyping, and CS-27 design goals are being developed." While CS-21 has prioritised Infantry BCTs, CS-23, CS-25 and beyond target network modernisation for Stryker and armour formations.

Challenges

The ITN is not without risks. Perhaps the most glaring is information saturation. Will troops simply be overwhelmed by the information that they can send and receive? How will information be managed to avoid this deluge? Similarly, will the impressive levels of connectivity between all echelons that the ITN will facilitate risk micromanagement? Will higher echelons be tempted to exercise too much control over subordinate units rather than just letting them get on with the task? Could communications/transmission security and cyber security also become a vulnerability? Although the ITN is not carrying classified data, there are inherent dangers that a deployed network could be hacked. Red force cyberwarriors could then destroy, degrade, damage or deceive the information flowing around the network. This could have an adverse effect on the blue force's scheme of manoeuvre.

Mr. Mehney is quick to allay concerns regarding security. He says that "under the umbrella of the (NSA) the army provides all network users with secure organic cryptographic key management." The army is also modernising its legacy waveforms like SINCGARS. This will ensure they are resilient against near, mid and long-term threat, he continues. "Future evolutions of the capability sets and the ITN will continue to increase resiliency through use of low probability of interception/detection technology."

The Integrated Tactical Network seems like the right tool at the right time. The reality is that the US Army will have to fight alongside coalition and allied land forces during future operations. Sharing data between them will be paramount if they are all to fight in a smooth, coordinated manner. Zeros and ones are becoming as important on the battlefield as shells and bullets. Whoever gathers, manages and distributes data most efficiently is most likely to make quick, informed decisions which transform rapidly into actions. Manoeuvre warfare focuses on the OODA (Observe, Orient, Decide, Act) maxim of its prophet John Boyd. If one navigates the OODA Loop quicker than one's adversary, victory is more likely. The advent of the ITN is an important conduit for this to happen. ■

Passive Radar – Passive Aggressive

Thomas Withington

A debate has emerged over the extent to which approaches detailed in a recent academic paper claiming passive radars can be detected are feasible.

Passive radars have been around since the dawn of radar itself. The first ever demonstration of radar in the United Kingdom involved a passive radar. On 26 February 1935, the engineer and 'father of radar' Robert Watson-Watt and his assistant Arnold 'Skip' Wilkins were in a field in Weedon, central England. They assembled on this cold winter morning with an oscilloscope and radio detection equipment. Just over 3.3 miles (5.3 kilometres) northwest from Weedon was Daventry Transmitting Station.

The Birth of Radar

This transmitted British Broadcasting Corporation (BBC) radio around the United Kingdom. Transmissions included short wave programmes on frequencies of between three and 30 megahertz/MHz. Messrs. Watson-Watt and Wilkins performed an experiment that changed the world. That morning, the transmitting station was broadcasting BBC programmes as normal. The two gentlemen had arranged for a Royal Air Force Handley Page Heyford bomber to fly in the vicinity of the station. They noted that the bomber disturbed the BBC transmissions. By using their radio receivers and triangulation they could compute the range of the bomber. During the experiment, the aircraft was detected at a range of seven nautical miles (13 kilometres) from their location. They had conclusively demonstrated that radio waves could detect and track an aircraft. Radar was born and the rest, as they say, was history.

This first experiment used the principles of passive radar. A conventional radar transmits a pulse or wave of Radio Frequency (RF) energy. This moves at the speed of light, 161,595 knots-per-second (299,274 kilometres per second). The energy hits a target and is bounced back to the radar as an echo.

Author

Thomas Withington is an independent electronic warfare, radar and military communications specialist based in France.

Photo: Roy Huxley

Roy Huxley's painting depicting the Daventry Experiment of 1935. This proved the feasibility of using radar to detect and track aircraft. Messrs. Watson-Watt and Wilkins' experiment used passive radar principles.

The distance between the radar and target can be calculated by halving the time taken for the energy to hit the target and bounce back. If the target is moving away from the radar, the echo's frequency will be slightly lower than the transmitted pulse. The echo's frequency will be slightly higher if the target is moving towards the radar. This is phenomena is known as the Doppler effect. Thus, radar can determine in which direction and at what speed a target is moving.

Useful as they are, radars have one major weakness. As they transmit RF energy, they can be detected. Radars have several tricks up their sleeves to make their transmissions as difficult to detect as possible. Nonetheless, as they have to transmit there is always a risk, no matter how small, they might be detected. Once a radar is detected, its position can be determined. Once its position can be determined, it can be attacked - either electronically or kinetically.

Passive radars aim to be undetectable because they do not generate and transmit their own RF energy. Instead, they rely on detecting disturbances to existing RF energy. Such disturbances might be caused by aircraft like the Heyford bomber flying through the BBC transmissions. Alternatively, they will listen out for an aircraft's RF emissions and use these to determine its location.

The ether is thick with electromagnetic radiation. Cellphone traffic, television and radio broadcasting ensure there is a steady stream of RF energy covering the Earth's surface. For example, estimates from the cellphone industry state that circa 40 percent of the Earth's total land area enjoys cellular coverage. Passive radars work like conventional radars by sensing disturbances caused by aircraft moving through this electromagnetic soup. Likewise, a passive radar can simply listen for an aircraft's own RF emissions. Aircraft produce a lot of RF. They have radios and use radio navigation. They may have meteorological radars to keep tabs on the weather. Satellite communications carry voice and data traffic. Military aircraft may also have powerful fire control or airborne surveillance radars, alongside tactical datalinks to send and receive mission data across radio links. Some passive radars listen out for these transmissions and use them to locate and track an aircraft.

Adoption

There is a growing interest in passive radar. Advancements in computing and software have honed the efficiency and accuracy of passive radars to detect targets. Several systems are now available from several manufacturers. These include ERA (VERA), Hensoldt (Twinvis), Patria (MUSCL), Leonardo (AULOS), Israel Aerospace Industries (PCL) and Lockheed Martin (Silent Sentry), to name just six. Several academic institutions are also involved in passive radar research and development.

The maturity of the technology has prompted the North Atlantic Treaty Organisation (NATO) to invest in passive radar. In 2018, NATO's Communications and Information Agency acquired two of ERA's VERA-NG passive radars. The Armáda České Republiky (Czech Army) also uses the VERA-NG. Further east, the Russian armed forces are passive radar aficionados. Independent electronic warfare brigades equipping each of Russia's military districts deploy KRET Moskva-1 passive radars to supplement ground-based air surveillance coverage. Open sources say that these can detect and track RF emissions in frequencies of 30MHz up to 18 gigahertz. This encompasses most aircraft Very/Ultra High Frequency (V/UHF - 30MHz to three gigahertz) radio emissions. Airborne early warning radar emissions in L-band (1.215GHz to 1.4GHz), airborne surveillance, fire control and aircraft meteorological radars transmitting in X-band (8.5GHz to 10.68GHz) are also covered.

Photo: Thomas Withington

Several companies are producing passive radars. These include Hensoldt which has developed Twinvis. This passive radar has been used in NATO trials.

Photo: ERA

ERA's Vera-NG passive radar is one of the most famous such systems in use today. It is deployed with the Czech armed forces and several other operators.

Compromised?

Has the low observability of passive radar, arguably its greatest strength, now been compromised? In July 2021 a team of academics from Poland's Military University of Technology published a paper in Electronics. This is an online, peer-reviewed journal. Their paper was entitled A Method of Remote Detection of Passive Radars for Electronic Warfare Systems. The paper's authors, Michal Kniola, Tomasz Rogala and Zenon Szczepaniak proposed a method for detecting and locating passive radars.

As the authors note, some passive radars exploit 'transmitters of opportunity'. These are nearby transmitters emitting RF energy be that radio or TV broadcasting, or handling cellular traffic. The radar will detect the signal from the transmitter of opportunity which is received by the radar's reference antenna. Meanwhile the radar's main antenna is listening for the same signal. However, the radar uses this signal to determine whether this latter signal is in any way different from that received by the reference antenna. If it is, this could betray the presence of an aircraft. The difference between the main antenna's signal and that of reference antenna is then exploited to track the aircraft.

Detection

The paper describes an approach which could be used to detect a passive radar. The authors state that the only way into a passive radar is via the antennas it uses to sense the surrounding electromagnetic environment. These antennas will be matched to detect changes in local frequencies such as V/UHF transmissions. This could include local cell phone coverage, TV or radio broadcasts. For the their experiment, the authors assumed the passive radar was sensing disturbances in local Digital Video Broadcasting-Terrestrial (DVT-B) frequencies. DVT-B uses a waveband of 170MHz and 860MHz for digital television broadcasting.

The receiving antennas are part of the radar's receiver. This includes the antenna itself, a Low Noise Amplifier (LNA), and an Analogue-to-Digital Converter (ADC). The DVT-B signals enter the radar through the antenna and reach the LNA. The DVT-B signals will be at a very low power level when they enter the radar. As such, they need to be amplified so they can be used by the radar. A normal amplifier will increase the power of the signal and the electromagnetic noise surrounding it. This noise is always present. You simply cannot receive a signal without receiving some noise. The problem with a normal amplifier as that it will amplify the signal and the noise. An LNA works to amplify the signal without amplifying the noise. This artificially makes the signal clearer and easier to exploit. It is the LNA that this passive radar detection and location technique seeks to exploit.

To detect the passive radar, the authors say it is necessary to generate a sounding sig-

Photo: Vitaly Kuzmin

NATO nations must concern themselves with passive radars deployed by near-peer adversaries like Russia. KRET's Moskva-1 system pictured here provides additional air surveillance coverage to Russia's military districts.

nal within the bandwidth the passive radar detects. In this case, it would be a signal of between 170MHz to 860MHz. The problem is that this signal will be received by the passive radar, but no signal will come back out of the passive radar. During amplification in the LNA, the incoming signal will experience distortion. Some of this distortion leaks back out of the antenna into the environment. This distortion is the tell-tale fingerprint of a passive radar. In theory, by detecting and locating this distortion, you can detect and locate the passive radar. Prof. Szczepaniak says that detecting this distortion from the LNA via the passive radar's antenna "is like detecting a black panther in perfect darkness by noticing a reflex of your flashlight in its eyes."

Next Steps

So far, the work of Prof. Szczepaniak and his colleagues has been confined to the laboratory testing of an architecture which could detect passive radars. There is still work to do before a working counter-passive radar system could be realised. Prof. Szczepaniak added that the most important parts of this counter-passive radar locator technology are currently at Technology Readiness Level-6 (TRL-6). According to European Union definitions, TRL-6 means these technologies have been demonstrated in a relevant environment. The next step is TRL-7. This would see a system prototype demonstrated in an operational environment. He says there are several hurdles still to jump before the technology could be ready for operational use. These include the production of software for mission planning and passive radar detection. Prof. Szczepaniak says the development of a "complete hardware system, including transmitter, receiver and signal processing" could take up to one year. Additional work taking development further will depend on "cooperation with interested partners," he adds.

For such a system to be effective, the authors emphasise that the correct siting of any counter-passive radar equipment is imperative if it is to be effective. Where possible, the location of known ground-based air surveillance radar, including air traffic control radar, must be ascertained. This will betray areas where conventional radar coverage is weak and where passive radars maybe sited to act as surveillance gap fillers. Importantly, the location of transmitters for television and radio broadcasting, and cellular coverage, and their power levels, should be ascertained. This will help suggest the potential position of red force passive radars. Passive radars will ideally be sited relatively close to these transmitters to ensure they benefit from high power levels. Prof. Szczepaniak and his colleagues say that these criteria will also help develop computer simulations which could determine potential passive radar locations.

The authors foresee a counter passive radar system being mounted on an Uninhabited Aerial Vehicle (UAV) which search over the suggested areas where passive radars may be operating. This concept could be further adapted with several UAVs. For example, two aircraft may transmit the sounding signals to excite the LNA with one or more additional UAVs detecting the resulting LNA distortion. Likewise, a counter-passive radar system could be installed in an anti-radar missile. This could be used by the missile to identify the passive radar and its location. Once determined, the missile will attack the radar.

The Riposte

The work of Prof. Szczepaniak and his colleagues could be disruptive, potentially nullifying passive radar's great advantage in being difficult to detect. What is the reaction of passive radar manufacturers to the research? A Hensoldt source told the author that "the technology described is physically possible ... On the other hand, we think that this approach will be very challenging to transform into a real countermeasures product." One of the challenges they flagged is the potentially limited range of the passive radar detection system. They argue that "the countermeasure must be much closer to a passive radar than the (radar's) typical operating range." "Furthermore, passive radars can be equipped with elements that suppress the radiation which is needed by this countermeasure."

Vojtěch Stejskal, head of strategy development at ERA, struck a similarly cautious note. "We know the weaknesses of passive radars and we know how to work with them," he said. "Once someone tries to interfere with your radar, you will know that." Mr. Stejskal said that as passive radars are continually monitoring the spectrum, "you will see a signal which is uncommon or abnormal." In-built electromagnetic support measures continually monitor the spectrum mapping spectrum clutter. "Any deviation is like an earlier warning for us. You can detect spoofing, intentional and unintentional interference. It is hard to hide a signal in a way that cannot be recognised by the passive radar operator."

One concern of spectrum monitoring and geolocation specialists CRFS is that the sounding signal transmitted to excite the passive radar's LNA would need to be quite powerful. This could have the paradoxical effect of making the RF sensor tasked with locating the passive radar "very visible," the firm said in a statement. Once visible a transmitter can become a "definite target". Moreover, the sounding signal could be absorbed by other radio receivers in the radar's vicinity, generating a similar response. As a result, CRFS believes that the RF sensor "would need to be looking for sensors in barren areas ... devoid of (other) devices."

One could argue that 'the passive radar manufacturers would say that wouldn't they', faced with the prospect that their products could be detectable. Nonetheless, Prof. Szczepaniak and his colleagues clearly believe that they have pioneered a technology which can counter one of passive radar's greatest strengths. Time and resources will tell if the approaches outlined in their paper can become a real threat to passive radar technology. ■

Naval Minehunters and Mine Disposal

European Navies begin to embrace the "MCM Toolbox".

Guy Toremans

In light of the ever-increasing number of stealthy smart mines and maritime improvised explosive devices, as well as the changing strategic landscape caused by Russia's increasing belligerence, European navies are facing a wider range of challenges in naval mine warfare (NMW). They are cognizant that a recapitalisation of their mine countermeasures (MCM) capabilities is imperative, either by upgrading their legacy assets and/or by introducing new equipment.

There is broad consensus 'to take the man out of the minefield', meaning the transition from the 'traditional' platform-centric minehunting and minesweeping to a 'stand-off' approach that embraces the employment of motherships that embark on a so-called MCM Toolbox. This approach comprises a variety of off-board unmanned and autonomous MCM systems capable of executing all three MCM-techniques, e.g. minehunting, minesweeping and mine clearance. In general, today's MCM toolboxes are made up of unmanned surface vehicles (USV), unmanned underwater vehicles/ autonomous underwater vehicles (UUV/AUV) and unmanned aerial vehicles (UAV). When containerised, such MCM Toolboxes can be deployed out-of-area, either 'piggy-shipped' on board surface combatants, commercial vessels and Craft-of-Opportunity (COOP) or airlifted, and can also operate independently from ashore to clear inland waterways and rivers.

Belgium and the Netherlands

The navies of Belgium, France, Italy, the Netherlands and the United Kingdom are adopting this new stand-off MCM approach for the renewal of their MCM capabilities.
The Belgian Navy's and Royal Netherlands Navy's bi-national Replacement Mine Countermeasures Capability Programme (rMCM CRP) got underway in 2021. Belgium Naval & Robotics, a consortium of Naval Group and ECA Group, will supply twelve 2,830-tonne motherships (six for each navy), plus a pool of about 100 drones, to be shared by both navies. The toolbox, based on the ECA Group's Unmanned MCM Integrated System (UMIS), can master the complete 'detect to engage' cycle, from identification and classification to neutralisation. The Belgian-Dutch MCM toolbox will consist of two INSPECTOR 125 USVs, two TI8-M towed sonars, three A18-M AUVs, three SeaScan ROVs, 40 K-Ster C drones, a mine sweeping module, two REMUS AUVs, and two SKELDAR V200 UAVs. The keel of the lead ship - the Belgian Navy's BNS OOSTENDE - was laid on 30 November 2021 and her commissioning is set for September 2024. All twelve units are anticipated to be operational by 2030.
Under the joint French/UK Maritime Mine Countermeasures (MMCM) programme, both navies' future mine countermeasures capability will be delivered by off-board systems operating remotely from a command centre deployed either on ships or ashore. The French Navy is developing the Système de Lutte Anti-Mines Futur (SLAMF) that adopts a combination of a dedicated 'mothership' and MCM toolboxes, whereas the Royal Navy is working on the Mine Countermeasures and Hydrographic Capability (MHC) Project.

Photo: Belgian Navy

The BE/NL rMCM CRP motherships will have a length of 82.6 m, a width of 17 m, a draft of 3.8 m and a displacement of some 2,830 tonnes.

France

The SLAMF Project will replace the French Navy's ten ÈRIDAN class minehunters, the four VULCAIN class diving tenders and the three ANTARÈS route survey vessels. The project involves the construction of six motherships (Bâtiments de Guerre Des Mines), five EOD diver support vessels (Bâtiments Base Plongeurs Démineurs), and a Mine Warfare Operating System. Additionally there are up to eight toolbox modules, each made up of a Saab Multi-Shot Mine Neutralisation System (MuMNS) ROV, an ECA Group A27 AUV, a L3Harris ASV C-Sweep USV with a Thales' Synthetic Aperture and Mine Detection Imagery Sonar (SAMDIS) and a

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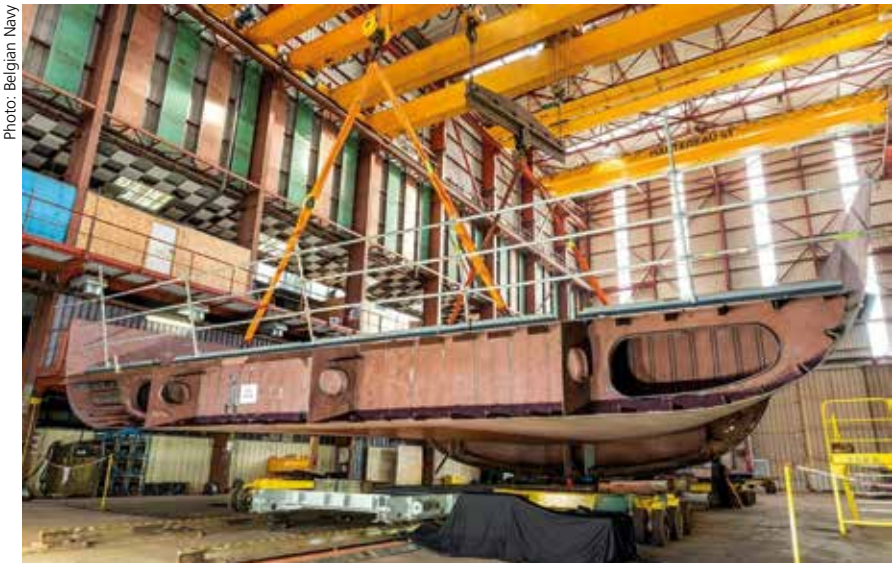
Photo: Belgian Navy



The keel for the first of 12 new MCMVs, the Belgian BNS OOSTENDE, was laid at Piriou Shipyard in Concarneau (France) on 30 November 2021

containerised operations centre housing a Thales M-Cube MCM command system and a Kongsberg communications suite. The naval service received its first SLAMF module on 25 November 2021. The delivery of another three systems is anticipated by 2024 and the complete SLAMF project should be operational by 2030.

The UK

The Royal Navy's MHC Project will replace the HUNT and SANDOWN class minehunters, as well as the two ECHO class survey ships. The initial key components are the Atlas Elektronik UK (AEUK), Atlas Remote Combined Influence Minesweeping System (ARCIMS), RNMB HUSSAR, RNMB HALCYON, RNMB HARRIER, RNMB HAZARD and RNMB HYDRA, fitted with advanced 'sense and avoid autonomy' combining UXV Autonomy software with SeeByte's planning and analysis software and towed side scan sonar. The USV can tow a variety of effectors including three Coil Auxiliary Boats (CAB), a magnetic electrode sweep, and a hydro-sounder wideband sound source. The Navy will also receive four sets of a Thales Portable Operations Centre (POC), including the Mission Management System and Mi-MAP software, two Thales / L3Harris 12-metre USVs, and a Towed Synthetic Aperture Multiviews (T-SAM) with a Synthetic Aperture & Mine Detection Imaging Sonar (SAMDIS) and a Saab MuMNS. In the first phase, the Royal Navy will operate the systems from onshore or on board non-dedicated platforms. But the Navy is also considering operating the MHC from a dual-purpose platform, such as BMT's VENARI-85 hybrid OPV/minehunter, or on its future Type 26 and Type 31 frigates. In the meantime, the five remaining SANDOWN and five HUNT class minehunters are being upgraded with the ORCA command information system (a variant of the Thales M- Cube) in order to keep them operational until 2025-2030.

Italy

The Italian Navy is also set to adopt a 'stand-off'' MCM approach to replace its LERICI and GAETA class units. Intermarine has been awarded a contract for the development of the next-generation platforms - the "Caccamine di Nuova Generazione". The programme calls for the construction of up to twelve motherships in two versions: the 60m-long New Generation Coastal MCMV (Cacciamine di Nuova Generazione Costiero (CNG-C)), and an 80m-long New Generation Offshore MCMV (Caccamine di Nuova Generazione d'Altura (CNG-A)). The CNG-C will incorporate a 'toolbox' of offboard unmanned surface and underwater systems similar to the BE/NL toolbox systems, while the CNG-A will have a superior performance in terms of range, a small flight deck for operating a UAV, and embark a more comprehensive MCM Toolbox, including new autonomous vehicles, such as the CALZONI Mini-Ranger USV and the Kongsberg HUGIN deep-water AUV.

Elsewhere in Europe

The German Navy seems to favour a combination of both a "stand-off" and "non-stand-off" MCM approach for its next-generation MCM capability. Initial plans call for up to ten motherships (non-stand-off) to be used mainly in home waters while containerised MCM modules ("stand-off") will be embarked on board other ships, such as the MKS-180 Multi-Purpose Surface Combatant. In the meantime, five FRANKENTHAL class minehunters: FGS DILLINGEN, FGS HOMBURG, FGS SULZBACH-ROSENBERG, FGS FULDA and FGS WEILHEIM are being upgraded with the latest version of the At-

Photo: Bulgarian Navy

The two ex-Dutch ALKMAAR class minesweepers HMNS MAASSLUIS and ex-HMNS HELLEVOETSLUIS arrive in Varna, on board the semi-submersible heavy lift vessel SUPER SERVANT

las Elektronik IMCMS (Integrated Mine Countermeasures System) between 2022 and 2025.

The four Scandinavian navies maintain relatively strong MCMV capabilities. The Danish Navy, the first to abandon dedicated mine countermeasure vessels in favour of a remote minehunting capability - the MCM DKN concept - continues to upgrade this system. The four Minor Standard Vessels (MSFs) with the Kraken Robotics' SeaScout® system made up of Kraken Autonomous Launch/Recovery System and the KATFISH™ 180 towed Synthetic Aperture Sonar. Delivery of the SeaScout systems is scheduled for end-2022. The Navy was also awarded a contract with Portuguese OceanScan for the delivery of six Light Autonomous Underwater Vehicles (LAUV) that will be operated from the HOLM class MSDs. Five of the LAUVs will feature a side scan sonar, replacing the Thales STS 2054 side scan active sonar. The sixth is to be equipped with an Identification (ID) functionality using high resolution photos and laser scans. The first three LAUVs will be received in the first quarter of 2022, and the other three by 2023. With its three KATANPÄÄ class minehunters, commissioned between 2012 and 2016, the Finnish Navy currently has the most modern MCM-fleet of the Scandinavian navies. These platforms can embark several state-of-the-art MCM systems that are fully interoperable with EU and NATO navies. Key to the Royal Norwegian Navy's (RNoN) MCM-renewal is the "Future Norwegian Maritime Mine Countermeasure Capability Project 6359". This project calls for the procurement of two motherships and three modular transportable MCM-toolboxes made up of USVs, AUVs, MDS and, optionally, UAVs. One of the possible systems could be Kongsberg's ODIN USV that can embark a AUV, such as the HUGIN 1000MR. The Navy is also looking into combined influence sweep systems such as the PATRIA AK-20 and the Thales Cable Powered Advanced Acoustic Generator (CP-AAG) lightweight influence minesweeping system.

The toolbox will be deployable on board non-specialised vessels, offshore and shore-based installations, or transportable by trucks or airplanes. Likely candidates to win the contract are Umoe Mandal A.S. and Vard Shipbuilding. The RNoN plans to have the project fully operational in 2028, by which time the two OKSØY and two ALTA class vessels, he only remaining units from the nine-ship strong class, will be retired. The Royal Swedish Navy is planning to replace its five

Photo: Guy Toremans

F.l.t.r. the Danish MCM DNK Minor Standard Vessel (MSFs) and a HOLM class MSD

Photo: Guy Toremans

The Danish Navy's four Minor Standard Vessels (MSFs) will be equipped with the Kraken Robotics' SeaScout® system

KOSTER class vessels with new platforms based on Saab Kockums' MCMV 80 design. The MCMV 80 is a versatile vessel, tailored to embark containerised mission modules that allow operations both in the minefield as a dedicated MCM platform, as well as outside the minefield (as a mothership for remotely operated or autonomous minewarfare systems). The construction contract will be in place as early as 2023 and the first unit to join the fleet will be by 2025. Meanwhile the VISBY class corvettes are coming online with an MCM capability.

In the Baltic Sea, the Polish Navy retains a sizeable MCMV fleet. The core of the Navy's MCM capability for the next 30 years are three indigenously developed KORMORAN II (Project 258) class units, designed by Remontowa Shipbuilding in co-operation with Centrum Techniki Morskiej (CTM). ORP KORMORAN joined the fleet in November 2017, ORP ALBATROS in 2021 and the commissioning of the third unit, ORP MEWA is scheduled for this year. These platforms feature an extensive selection of unmanned vehicles. Some of the Navy's other MCM assets - twelve GOPLO and four MAMRY class minehunters - might be subject to modernisation. Between 2000 and 2010, the Estonian, Latvian, and Lithuanian Navies acquired relatively modern second-hand minehunters from the Royal Netherlands Navy and the Royal Navy. The Estonian Navy's three SANDOWN minehunters have been upgraded with a Thales M-Cube MCM combat management system (CMS) and a Type 2193 hull-mounted sonar. Three of the five Latvian Navy's IMANTA class (ex-ALKMAAR class) minehunters will be upgraded by 2024 with ECA A18-M drones with an UMISAS 120 sonar,

Photo: Kraken Robotics

The Kraken Robotics' SeaScout® system made up of Kraken Autonomous Launch/Recovery System and the Katfish™ 180 towed Synthetic Aperture Sonar.

and Seascan Mk2 and K-Ster C expendable mine disposal systems (EMDS). The Lithuanian Navy's LVNS SKALVIS and LVNS KURŠIS (ex-HUNT class) have also been fitted with a Thales' M-Cube CMS, a Type 2193 sonar, as well as the ECA K-Ster C EMDS. A third HUNT class, (ex-HMS QUORN), is expected to be transferred in 2023, after completing an extensive modernisation and overhaul. All three Navies continue to further enhance their MCM inventories, possibly with additional second-hand minehunters which will be phased out by the Belgian, the Netherlands and the Royal Navy from 2025 onwards.

In southern Europe, the Hellenic Navy is in the midst of an ambitious modernisation programme that includes the upgrade of its MCM capabilities. The Greek Defence Procurement Agency signed a Letter of Intent (LoI) with the Dutch Defence Materiel Organisation (DMO) for the possible procurement of up to six ALKMAAR class minehunters to replace its ageing two EVNIKI (ex-USN OSPREY class) and one EVROPI (ex-RN HUNT class). On 27 October 2020, HS KALLISTO was severely damaged after a collision with a Portuguese containership off Piraeus.The Spanish Navy has no intention to substitute its six SEGURA class minehunters before 2030. However, the naval service plans to equip the minehunters, as well as some of the Navy's smaller warships, such as the METEORO class multirole offshore patrol vessels. These come with a remote multi-influence minesweeping capability - the Minas Tracking System Influence for Remote Control SIRAMICOR that is being developed by Navantia, assisted by SAES, the Complutense University of Madrid and the Spanish shipbuilding research institute Canal de Experiencias Hidrodinámicas de El Pardo (CEHIPAR). Underway since 2017, ongoing defence cuts keep delaying the finalisation of the SIRAMICOR though. In January 2018, the Turkish Navy released a Request for Information (RfI) to replace the five ENGIN, four SEYDI and two FELENK class units with a follow-on class to the six AYDIN class minehunters. However, this project continues to be postponed because the Navy's priorities favour the procurement of larger platforms and the upgrade of its existing vessels. A Request for Proposal (RfP) for the new MCMV project is likely to be issued in 2025. And since 2018, the ENGIN class minehunter TCG EDINCIK is the trials platform for the indigenously developed Aselsan MATESS hull mounted mine detection/mine avoidance sonar.

Elsewhere in Europe, the Bulgarian, Croatian, Romanian and Ukrainian navies also seek to enhance their MCM capabilities. The Bulgarian Navy's MCM

Photos: Guy Toremans

The KATANPÄÄ, lead ship of the Finnish Navy's three KATANPÄÄ class minehunters. With a length of 52.4 m, a beam of 9.9 m and a draught of 3.1 m, they displace some 697 tonnes.

Photo: Chantiers de l'Atlantique

Artist's impression of one of the possible designs for the French Navy's new MCM motherships (Bâtiments de Guerre Des Mines).

Russia

The Russian Navy is in the midst of renovating its ageing MCM flotilla with the new 800-tonne ALEXANDRIT class (Project 12700) ocean minesweepers. These MCMVs are equipped with the GNPP Region Integrated System for Search and Destruction of Mines (IPSUM-E). IPSUM-E consists of a UUV, a towed vehicle, and a shipboard retractable hull sonar. The lead ship, ALEXANDER UBUKHOV was commissioned in December 2016 and, as of today (February 2022), four additional units have joined the fleet. An initial batch of ten ALEXANDRIT class vessels is on order, but this could be extended up to 30 units.

Conclusion

Unmanned and autonomous systems are increasingly integrated and are able to considerably improve the operational tempo and the area coverage rate. In

inventory was boosted by the transfer of two former Netherlands ALKMAAR class minehunters in September 2020. These two additional vessels BNS MESTA, 'ex- MAASSLUIS) and BNS STRUMA (ex-HELLEVOETSLUIS) supplement the BNS BRIZ, BNS TSIBAR (ex-Belgian MYOSOTIS transferred in 2007) and six OLYA (Project 1259) inshore minesweepers. Under the Long-Term Development Plans 2015–2024, the Croatian Navy stated its requirement for four new MCMVs. However, a lack of funding has delayed this programme until at least 2028. Negotiations seem to be underway though with the German Navy for a transfer of two KULMBACH class units as an interim solution. The Romanian Navy also needs modern MCMVs to replace its 1980-vintage MUSEA class minesweepers. Due to a limited budget, second-hand hulls, updated with modem minehunting systems may prove an attractive option as an interim solution. The Ukrainian Navy is expecting a transfer of the two Royal Navy SANDOWN class minehunters HMS BLYTH and HMS RAMSEY. Both minehunters are currently undergoing an extensive modernisation and overhaul in Rosyth. This transfer is part of a new memorandum between Ukraine and the United Kingdom. Following dockyard works, the ships will be transferred to the Ukrainian Navy.

Although Hungary and Serbia are not maritime nations, they do operate three and four NESTIN class river minesweepers respectively.

Photo: Guy Toremans

The German minehunter FGS DILLINGEN is one of the five FRANKENTHAL class minehunters to be upgraded with the Atlas Elektronik IMCMS

Photo: Guy Toremans

The Hellenic Navy's HS EVNIKI (ex-USN OSPREY class) minehunter

Photo: Guy Toremans

The Italian Navy's LERICI and GAETA class units alongside in the home-port of La Spezia.

Photo: INTERMARINE

Artist's impression of the Italian Navy's next-generation MCM mothership - the "Caccamine di Nuova Generazione"

Photo: Guy Toremans

The Lithuanian minehunter LVNS SKALVIS (ex-HMS COTTESMORE) has been fitted with a Thales' M-Cube CMS, a Type 2193 sonar, as well as the ECA K-Ster C EMDS.

this regard, European navies are acutely aware that there are technological and operational challenges ahead, such as formulating new operational concepts (CONOPS), bringing autonomy up to a level that ensures reliable operations on the frontline, reliability of 'over-the-horizon concepts' at ranges out to 30 NM and 'over the air' data connectivity network capacity (to name but a few). Adding to the complexity is the need to keep abreast of the rapid advances and developments of new technologies. Fields like autonomy, digitalisation, cybersecurity, Augmented Reality (AR), Artificial Intelligence (AI), Big Data Analytics (BDA), increasing connectedness, and anti-collision support are just some of these technologies.

USVs are fitted with collision detection and avoidance systems that enables them to navigate through busy waters, integrating navigation charts and Maritime Automatic Identification Systems.

QinetiQ, together with BAE Systems, Thales and Secbyre, are developing an open information architecture, known as the Maritime Autonomous Platform Exploitation (MAPLE). This is a programme that seeks to demonstrate and de-risk the integration of multiple unmanned systems into a combat system. Additionally, Thales developed the AI-assisted Mine Intelligence Mapping system (Mi-Map), for sonar data analysis that reduces operator workload, improves Man-Machine performance, and speeds up post-mission analysis. Naval Group Belgium is leading the MIne RIsk CLearance for Europe (MIRICLE) project sponsored by the European Commission and eight EU Member States under the umbrella of the European Defence Industrial Development Programme (EDIDP). MIRICLE is a roadmap for the next generation "Made in Europe" MCM solutions, addressing topics such as navigation, communications and autonomy and the development of a scalable intelligent multi-unmanned vehicle (UxV) mission management system. Some of these technologies may even allow the systems of 'thinking for themselves'.

Although a majority of MCM operations can be entrusted to unmanned assets, when navies have to deal with mine clearance in very shallow water (VSW) or surf zones, the 'old school approach', e.g. relying on specialist Explosive Ordnance Disposal (EOD) divers still remains, for the time being, the preferred choice. It is obvious that today's 'state-of-the-art' technology, automation and technological advances cannot completely replace the crew required to operate a ship, nor the expert EOD personnel. ■

New Generation Multi-Function AESA Radars Gain Momentum

Luca Peruzzi

A new generation of scalable and modular shipborne medium- and longer-range surveillance and fire control radars have reached the market with installation on a wide range of platforms.

These radars fully exploit the capabilities and features of active electronically scanned array (AESA) and latest technologies in the front-end and processing. This includes fully-digital and software-defined solutions with latest developments in the Gallium Nitride (GaN) transmitter-receiver modules (TRM) technology. They are capable of dealing with the latest threats in the naval domain, from challenging ballistic and very high-speed missiles, to asymmetric threats in both blue-water and littoral environments.

Photo: thyssenkrupp Marine Systems

Hensoldt group's TRS-4D C-band non-rotating (NR) multifunction radar provided was selected by the German MoD's BAAINBw procurement agency for the F126 multi-purpose frigates.

Hensoldt TRS-4D

In January 2022, the last of the four frigates of the F125 class was delivered to the German Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) by thyssenkrupp Marine Systems, leading the ARGE F125 shipbuilding consortium. The surveillance and targeting acquisition main sensor of these 'expeditionary' frigates for the German Navy is the TRS-4D C-band multifunction radar provided by the Hensoldt group in a four AESA fixed-faces (4FF) configuration. The same radar system has been chosen by the BAAINBw as part of the mission and combat system for the new F126 multipurpose frigates for the Deutsche Marine, whose overall integration and delivery contract was awarded to Thales by Damen Schelde Naval Shipbuilding, as the F126 programme prime contractor in November 2020. Exploiting the most advanced AESA technology based on GaN solid state transmitters, with multiple, digitally formed beams and innovative electronic scanning, the C-band TRS-4D allows unprecedented quick and full 3D surveillance for AAW and AsuW missions, according to Hensoldt. Capable of being installed on one or a two mast ship configuration, the TRS-4D has an instrumented and minimum range of 250 km and <200 m, an elevation search and tracking coverage range of respectively -2/+70 and -2/+90 degrees, a target detection capability in term of RCS equal to < 0.01 m2, and a tracking 3D capacity of over 1,500 targets. The system is quoted as featuring flexible electronic multi-beam scanning, high sophisticated dual-mode operation, 3D air volume surveillance with fast target alert and high range resolution surface surveillance. In addition, it boasts fire control support, surface gun fire control with splash detection, helicopter control, cued search with enhanced detection performance for a dedicated sector, cued track with high-priority target tracking for missile guidance and automatic target classification.

IAI MF-STAR

The first IAI/ELTA ELM-2248 AESA Multi-Function Surveillance, Tracking and Missile Guidance (MF-STAR) radar is operational on board the new Israeli Navy first-of-class SA'AR 6 corvette and is being integrated on the follow-on platforms. In July 2021, IAI announced that, together with the Administration for the Development of Weapons and Technological Infrastructure (part of Israeli MoD) and the Israeli Navy, it completed the first phase of installing the MF-STAR (Magen Adir) radars on the new SA'AR 6 corvettes. It will also continue to integrate the BARAK MX Air Defence System (RA'AM ADIR) on the vessels, of which the radar system is also an important component. Installed initially on board the LAHAV SA'AR 5 class corvette, the digital AESA MF-STAR operates in the S-band and uses a 4FF arrangement based on a modular tile-array architecture and optical networking to allow for 'scalability' in the size of the antenna aperture and weight reduction. Incorporating advanced technology and robust system architecture, the MF-STAR uses pulse Doppler techniques, multiple-beam forming and advanced electronic counter-countermeasures (ECCM) to extract stressing, low radar cross section threats even in conditions of heavy jamming and dense clutter. The MF-STAR's basic transmitting-receiving element digital output enables software only adaptive beamforming and mode variations to form a software defined

Photo: IAI

The IAI/ELTA ELM-2248 AESA Multi-Function Surveillance, Tracking and Missile Guidance (MF-STAR) radar is part of the combat suite of the new Israeli Navy first-of-class SA'AR 6 corvette and is being integrated on the follow-on class platforms.

Photo: US Navy Mass Communication Specialist Seaman Drace Wilson

The IAI/ELTA MF-STAR found export success being installed by the Indian Navy on board the KOLKATA class – here depicted the first-of-class – and VISAKHAPATNAM class destroyers, VIKRANT class aircraft carrier and on new NILGIRI class frigates, together with the IAI BARAK 8 air defence system.

radar, according to IAI. Key functionalities include three-dimensional volume search, missile-horizon search, multi-target tracking, mid-course guidance of active/semi-active anti-air missiles, illuminator enslavement for semi-active missiles, surface surveillance, helicopter detection, automatic splash detection and measurement for gunnery support. The MF-STAR scalable 4FF solution can be installed in various configurations and sizes including single or dual mast arrangement. According to IAI, the MF-STAR in corvette and frigate versions installation have an instrumented range of respectively over 250 and 450 km and a common 360° azimuth and -20°to+85° elevation coverage. The MF-STAR found export success when installed by the Indian Navy on board the KOLKATA class and VISAKHAPATNAM class destroyers, VIKRANT class aircraft carrier and on new NILGIRI class frigates, together with the BARAK 8 air defence system.

Leonardo KRONOS DUAL BAND

Exploiting the long experience gained in multifunctional radars (EMPAR and KRONOS families) and combat system developments by Leonardo, together with Elettronica's latest generation EW and the Fincantieri platform and combat system integration developments, the Italian Navy is equipping its new generation of combatant and amphibious vessels with an integrated radar and EW suite. This will be able to fuse and fully exploit the passive and active capabilities of both Leonardo's new generation of C- and X-band AESA fixed faces radars integrated into a single dual-band (radar) system and the Elettronica-provided EW suite. To satisfy Italian Navy requirements in the Integrated Air and Missile Defence (IAMD) domain, encompassing present and future high-speed threats, including tactical ballistic missile (TBM) acquisition (either autonomously or under cueing) and tracking in the re-entry phase, missile guidance (MBDA ASTER 15/30 uplink) and air-breathing threat (ABT) and surface target search and tracking, the KRONOS DUAL BAND radar features the most powerful and capable versions of both new generation fully-solid state, 4FF each C-band KRONOS QUAD and new X-band STARFIRE AESA radars. The new C-band AESA KRONOS QUAD radar arrays embodies an undisclosed number of 'quad pack' high power four-channel transmit receive modules (TRM) with new generation GaN-based high-power amplifier. The X-band AESA KRONOS STARFIRE radar arrays features an undisclosed number of 'otto

(eight) pack' high-power eight-channels TRMs with GaAs (Gallium Arsenide)-based high-power amplifiers. The KRONOS DUAL BAND AESA radar system features a system manager capable of controlling in real-time both the two different band radars and the ship's EW suite to fully exploit the passive long-range, high-threat alert EWS capabilities and both the EW's jamming and radar (X-band) future electronic attack modes, while ensuring the efficient use (digital blanking) of both systems. The integrated KRONOS DUAL BAND radar and full EW suite is being installed on only two of the seven combatant high-sea patrol ships (PPA, Pattugliatore Polivalente d'Altura) belonging to the THAON DI REVEL class, while the single X-band KRONOS STARFIRE radar is installed on the two Light-configured PPAs. This includes the first-of-class platform and the single C-band AESA KRONOS QUAD radar which is being installed on the three remaining Light Plus-configured PPAs. The latter ships are equipped with the MBDA SAAM ESD air defence missile system centred on ASTER 15 and 30 munitions. Both the PPA Light and PPA Light Plus are fitted to receive the full KRONOS DUAL BAND suite, budget permitting. The single X-band KRONOS STARFIRE radar is also being installed on board the Italian Navy's new LHD, while the KRONOS DUAL BAND will form the basis to develop the radar suite for new generation destroyers (DDX) for the same service. Both band 4FF KRONOS radar systems are available in three different configurations depending on the number of AESA TRMs, allowing Leonardo to offer them and satisfy different naval applications and missions.

Photo: Luca Peruzzi

The first Fincantieri PPA (Pattugliatore Polivalente d'Altura) multirole patrol combatant vessel in the Full (combat system) configuration is being equipped with the Leonardo KRONOS DUAL BAND radar suite, including the new generation fully-solid state, 4FF each C-band AESA KRONOS QUAD and X-band STARFIRE AESA radars.

Lockheed Martin SPY-7(V) and International Cooperation

Lockheed Martin successfully demonstrated the integration of the new generation S-band AN/SPY-7(V)1 radar into the AEGIS Weapon System last January. The company executed the processing required to detect, track and discriminate ballistic missile threats, and successfully guide interceptors to those threats. The successful demonstration of the complete ballistic missile defence fire control loop is a critical milestone in the development of the SPY-7 equipped AEGIS Combat System Baseline J7.B for the Japanese MoD. The SPY-7(V)1 radar shares the same core technology, scaled equipment and software, derived from the Long Range Discrimination Radar (LRDR). Under a contract awarded in 2015, it commemorated initial fielding on December 2021, serving as the backbone of the Missile Defense Agency's (MDA) layered defence strategy to protect the US homeland from ballistic missiles. The modular and scalable software-defined digital solid state radar provides several times the performance of current SPY-1 radars, according to Lockheed Martin. It is able to detect, track and engage sophisticated ballistic missile threats, including multiple threats simultaneously. Lockheed Martin is modifying its production test centre facility to prepare for the live SPY-7(V)1 radar integration and test with AEGIS Baseline J7.B hardware and software for Japanese sea-based AEGIS System Equipped Vessel (ASEV) platform to provide national homeland ballistic missile defence. In addition to the Japanese MoD, which acquired the SPY-7 in two radars with four antenna-each for the ASEV programme, Lockheed Martin's radar was also selected and contracted by the Canadian and Spanish MoDs to equip the 15 Canadian Surface Combatant (CSC) programme frigates and the five F110 multi-mission frigates built by the Spanish Navantia shipyard. In the latter

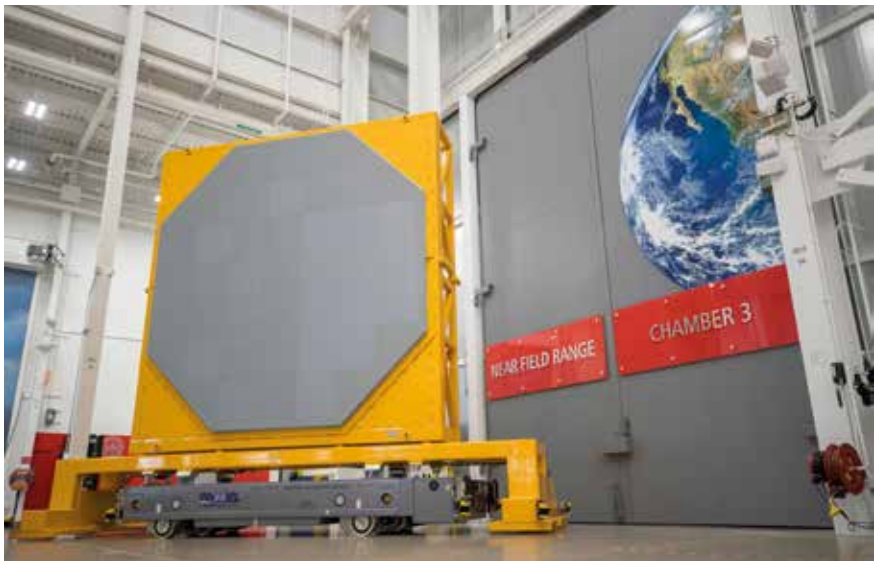
Photo: Fincantieri

The Leonardo KRONOS DUAL BAND AESA 4 FF radar suite installed on board the PPA in the full (combat system) configuration features a system manager capable of controlling in real-time both the two different band radars and the ship's EW suite to fully exploit all system capabilities.

Photo: Navantia

In addition to the Japanese MoD, which will use the sea-based AEGIS System Equipped Vessel (ASEV) platform to provide national homeland ballistic missile defence, the SPY-7 radar will be installed on board the new generation frigates for the Royal Canadian and Spanish Navies. Depicted here is the Navantia F110 frigate design for the Spanish Navy.

Photo: Raytheon Missiles & Defence



The Raytheon Missiles & Defence's AN/SPY-6(V)1 Air and Missile Defence Radar (AMDR) is being installed on ARLEIGH BURKE class Flight III destroyers, while the SPY-6(V)2 variant will protect amphibious assault ships and Nimitz class aircraft carriers.

Photo: Finnish MoD/Navy

The SEA GIRAFFE 4A Fixed Face (FF) S-Band multifunction radar system has been selected to be part of the combat system provided and integrated by Saab for the Finnish Navy's new POHJANMAA class corvettes, in the so-called SEA GIRAFFE Multi Sensor Solution, together with the X-band SEA GIRAFFE 1X and integrated into the Saab Lightweight Integrated Mast (SLIM).

programme, Lockheed Martin is working with Indra group, which is supplying the building block to achieve a fully digital antenna, including the digital TRM modules containing the state-of-the-art solid-state GaN high power amplifiers.

Raytheon SPY-6(V) AMDR

In December 2021, the Raytheon Missiles & Defence's AN/SPY-6(V) Air and Missile Defence Radar (AMDR) attained another milestone when the future USS JACK H. LUCAS ARLEIGH BURKE class Flight III first destroyer achieved 'light off' on its AEGIS Combat System marking the beginning of combat system testing. The AN/SPY-6(V) is the family of newest modular and scalable S-band AESA radar with digital beamforming architecture for the US Navy. It is based on building blocks known as radar module assemblies or RMA, each of which is a 'self-contained radar', employing the GaN technology and measuring 60.9x60.9x60.9 cm with a single software-hardware baseline. This allows for more streamlined maintenance, training and sustainability across ships. Capable of defending against ballistic missile, cruise missiles, hostile aircraft and surface ships simultaneously, the SPY-6(V) comes in three version depending on the number of RMAs. The SPY-6(V)1 to equip the new ARLEIGH BURKE class Flight III destroyers has four array faces. Each has 37 RMAs, offering full-time, 360 degree situational awareness, greater detection ranges and increased discrimination accuracy, providing more than twice the range, 30 times more sensitivity and increased raid handling, alongside advanced electronic protection, compared to current radar installed on the ARLEIGH BURKE class platforms. The SPY-6(V)2 and (V)3, also known as EASR (Enterprise Air Surveillance Radar) features a single-face rotating array (9 RMAs) with an equivalent sensitivity of the current SPY-1D(V) radar. This allows it to protect amphibious assault ships and NIMITZ class aircraft carriers, and three-face fixed array (9 RMAs). The latter is being installed on FORD class aircraft carriers and the future CONSTELLATION class (FFG 62) frigates.

Saab SEA GIRAFFE 4A FF

Saab defence and security offers the SEA GIRAFFE 4A Fixed Face (FF) S-Band multifunction radar, which provides long-range air surveillance and defence with full horizon coverage on surface targets. The system has so far been selected to be part of the combat system provided and integrated by Saab for the Finnish Navy's new

POHJANMAA class corvettes in the so-called SEA GIRAFFE Multi Sensor Solution, together with the X-band SEA GIRAFFE 1X and integrated into the Saab Lightweight Integrated Mast (SLIM). The SEA GIRAFFE 4A FF combines the battle-proven designs from the SEA GIRAFFE AMB and ARTHUR product families, with an all-new radar fixed face sensor, based on AESA digital beam-forming antenna introducing GaN technology, and providing an instrumented range of 350 km to meet medium- to long-distance air surveillance and target indication requirements. The SEA GIRAFFE 4A FF scans the total 360 degree search volume more than up to 70 degrees with very high and flexible update rate and provides an unparalleled 3D target update rate, along with high altitude coverage and monopulse accuracy, says Saab. The radar provides simultaneous all-weather coverage against air and surface targets, from low, slow and small targets (ELSS), to fast-moving fighters and missiles, RAM (Rocket Artillery and Mortar) target and jammer strobes, at all altitudes and in severe clutter. The surface channel gives a high probability of detecting very small targets, such as RHIBs in close proximity to the surface. The surface channel is also equipped with a high resolution surface surveillance capability specifically designed to detect gun fire splashes in order to provide data for gun fire corrections. Based on Saab's next generation 'track while scan' technology, the Swedish group has developed and introduced the Hypersonic Detection Mode (HDM), which is optimised for the SEA GIRAFFE 4A FF configuration. The HDM enables track start within a fraction of a second. Its quick track formation time and high update rate means it will be able to track any number of targets, including stealthy ones, in all types of conditions, Saab claims.

Photo: Thales

In October 2021, the French defence procurement agency announced it had formally qualified the Thales SEA FIRE S-band multifunction AESA 4FF radar ahead of integration into the combat system of the new AMIRAL RONARC'H class Frégate de défense et d'intervention (FDI) frigates being built by Naval Group.

Photo: Naval Group

The Thales SEA FIRE is a software controlled 3D multifunction S-band radar using 4FF fully digital AESA panels, based on GaN high-power amplifier technology to provide full 360 degree coverage in azimuth and 90 degrees in elevation.

Thales SEA FIRE

In October 2021, the French defence procurement agency (DGA) announced they had formally qualified the Thales SEA FIRE S-band multifunction AESA radar ahead of integration into the combat system of the new AMIRAL RONARC'H class Frégate de défense et d'intervention (FDI) frigates being built by Naval Group. In the meantime, in April 2021, Thales announced it had delivered the first radar for integration on the first naval platform to Naval Group, a key milestone in the FDI programme, following a seven-year development and in line with the French defence procurement agency's initial schedule. Manufactured by Thales France, the SEA FIRE is a software controlled 3D multifunction radar using 4FF fully digital AESA panels, based on GaN high-power amplifier technology - where every element output is processed - to provide full 360 degree coverage in azimuth and 90 degrees in elevation. Providing an update rate of up to 10 Hz and a surveillance coverage of 300 km, the system is designed to perform a range of duties, including simultaneous long-range 3D Surveillance, Horizon Search, Surface Surveillance and Defence, Fire Control for the ASTER missile family and surface gun fire support in complex environments. Thanks

Photo: Damen Schelde Naval Shipbuilding

The Thales Nederland-developed second-generation APAR (Active Phased Array Radar) Block 2 X-band 4FF multifunction radar will be installed on board the new Germany Navy F126 multi-purpose frigates.

to its modular architecture, the SEA FIRE can be installed on light frigates up to destroyers, transforming a multipurpose frigate into an AAW frigate. Thanks to its fully digital and software defined architecture, the SEA FIRE has a tracking capacity of over 800 air and surface targets, with enhanced surveillance capabilities in littoral environment and against all targets, from slow moving and very low radar-cross section to supersonic and highly manoeuvring stealth targets, while supporting ASTER missile family up to their full performance with fire control and autonomous surveillance coverage (no cueing required), says Thales. In addition to the five FDI frigates for the French Navy being built by Naval Group, the French and Greek Ministries of Defence announced in January 2022 that a contract for the procurement of three Defence and Intervention Frigates (FDI HN) and equipment (plus one frigate option), including the Thales SEA FIRE and MBDA weapon systems, is expected to be signed within the first quarter of the year.

Thales APAR Block 2

Based on the successful and proven in-service X-band APAR (Active Phased Array Radar) 4FF architecture and capabilities, exploiting the latest generation AESA, GaN and radar processing technologies, Thales Nederland is proposing applications of the second-generation APAR (Active Phased Array Radar) Block 2 same-band 4FF multifunction radar. According to customer needs, this can be integrated with the company's SEA MASTER 400 Block 2 4FF S-band volume search air- and surface-surveillance radar under the same group XS-suite or with other radar manufacturer solutions. In November 2020, Thales received a €1.8Bn contract from Damen Schelde Naval Shipbuilding for the full integration and delivery of the mission and combat system for the German Navy's four F126 multi-purpose frigates. In addition to being responsible for the combat system integration and subsystems procurement, the company will also supply its TACTICOS combat management system and a new Above Water Warfare System (AWWS) fire-control cluster incorporating the APAR Block 2 X-band multifunction radar. This contract marks the first production order for both systems. Already in funded development by Thales Nederland for the Netherlands/Belgium Vervanging M-fregatten (M-frigate replacement) programme, the AWWS will combine an advanced fire-control suite with the APAR Block 2 radar to provide guidance support for the Raytheon Evolved SeaSparrow Missile (ESSM) Block 2 local area anti-air missile. The new APAR Block 2 X-band radar builds on the existing APAR reference platform in service with the Royal Netherlands, German and Royal Danish navies, based on the same 4FF architecture with a scalable number of solid-state TRMs, but with enhanced performances through selected technology insertions centred on high-power GaN technology-applied TRMs for the antenna 'front end' and highly rationalised below-decks cabinets by moving to all COTS based processing. Leveraging on the X-band propagation characteristics for early detection of small incoming low elevation targets in littoral scenarios, the APAR Block 2 performs against saturation attacks with simultaneous AAW and ASuW engagements. It does so with both active and semi-active guidance using interrupted continuous wave illumination (ICWI). It also supports Raytheon ESSM, Standard Missile 2 (SM-2) and RAM missile families including the ESSM Block 2 and the future Standard family using the JUWL (Joint Universal Weapon Link) datalink. With true digital beam forming enabling multi-beam volume search and 'track while scan' for non-engaged targets, the APAR Block 2 has an instrumented air range of 150 km, in addition to more than 1,000 targets tracking coverage and over 70 degrees elevation above horizon coverage, providing surface gunfire support up to the radar horizon. ■

Photo: Koninklijke Marine

The APAR Block 2 X-band multifunction radar is already in funded development by Thales Nederland for the Netherlands/Belgium Vervanging M-fregatten (M-frigate replacement) programme. The APAR round antennas are visible on the upper part of the integrated ship mast.

European Combat Aircraft for Asian Programmes

Andreea Stoian Karadeli

In 2020, Europe accounted for 19 per cent of the US$1,981Bn global military expenditure (SIPRI, 2021), becoming the third largest spending region, after the Americas (43 per cent) and Asia and Oceania (27 per cent). While European countries are working towards developing their defence capabilities, both through internal and external sources, the current international context represents an opportunity for further cooperation and progress in every sector of the defence industry.

Photo and Text: Panavia

The Panavia TORNADO weapon system combines in one airframe a full deterrent capability, representing the most effective aircraft of its class today. The TORNADO was designed and produced by the aircraft industries of three nations.

One of the main technological challenges faced today by the air forces and aerospace industries in European countries is the development of the next generation of combat aircraft, to be part of a system of systems with satellites, drones and other military tools developed to face the changing threats to our security. Nevertheless, developing the industry to collaborate and export beyond European borders, such as in the context of Asian Programmes, is an equally difficult challenge that requires better planning and cooperation between the European countries, most of whom have already developed bilateral agreements with key States in the Asia-Pacific region.

Europe's Military Investments

According to SIPRI researchers, the total military spending in Europe in 2020 amounted to US$378Bn. This marked a rise of 4.0 per cent in comparison to 2019 and 16 per cent higher than the military spending figure in 2011. Military spending rose in all three subregions in 2020 and over the decade 2011–20. In Western Europe, military spending in 2020 totalled US$273Bn, up by 3.9 per cent on 2019 and by 8.5 per cent on 2011. Spending in Eastern Europe reached US$71.7Bn in 2020 — 3.4 per cent higher than in 2019 and 31 per cent higher than in 2011. At US$33.6Bn in 2020, military spending by countries in Central Europe increased by 6.0 per cent on 2019 and by 74 per cent on 2011. With a total of US$59.2Bn in 2020, the UK was the largest military spender in Western Europe and the fifth largest in the world. In central Europe, 39 per cent of the total military investment is attributed to Poland's US$13.0Bn military spending in 2020. Poland's spending was 8.7 per cent higher than in 2019 and 60 per cent higher than in 2011. According to its 2020 National Security Strategy, Poland has committed to increase its military burden from the 2020 level of 2.2 per cent of GDP to 2.5 per cent by 2024. Hungary's military expenditure grew for the sixth consecutive year, to US$2.4Bn in 2020. Hungary's military spending has increased by 133 per cent since 2014 to cover the costs of the expansion of its military capabilities and the replacement of ageing Soviet-era equipment. The growth in spending in 2020 was partly a result of a financial stimulus package implemented in response to the COVID-19 pandemic. Azerbaijan's 17 per cent increase in military spending was the largest relative increase among countries in Eastern Europe in 2020. The rise in spending was largely driven by the conflict with Armenia over the Nagorno-Karabakh region. In contrast, Armenia's military spending fell by 2.6 per cent in 2020.

Although the progress made in terms of military spending is visible across Europe, the European Defence Agency (EDA) reported a slump in collaborative spending despite an EU defence pact signed in late 2017 to try to pool resources and end the competition between national industries that has weakened past defence efforts. "The downward trend on European collaborative spending is particularly concerning," EDA Chief Executive Jiri Sedivy said in EDA's report, which found a 13 per cent decrease in joint equipment procurement compared to 2019, to €4.1Bn, the third-lowest value recorded by the agency. While visible investment is made for the European defence capabilities, there is still

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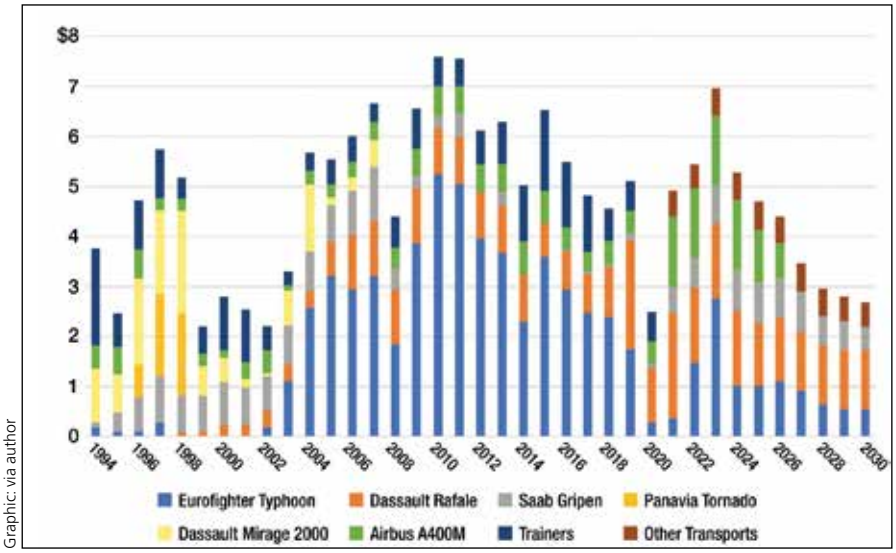

Graphic: via author

limited cooperation between European States towards the development of a fully collaborative defence industry packet. This is also reflected in the current state of the European combat aircraft projects.

European Combat Aircraft Overview

During the 1970s, Messerschmitt-Bölkow-Blohm (MBB), the predecessor of Airbus, shared forces with companies in the UK and Italy for the development of the Panavia TORNADO – a twin-engine, variable-sweep-wing multirole fighter. This represented the moment when Europe became a player in jet-age combat aircraft, and the beginning of a difficult journey. While combat air systems are one of the most symbolic defence capabilities, especially for countries that assume an active role within the development of the industry, the costs for the acquisition of these capabilities leave space for cooperation, instead of purely one-nation-based projects. In fact, since the 1970s, the defence capability needs of European countries have been ensured through cooperatively preserving a domestic technological and industrial base. Throughout the journey so far, several issues have been recurrent, such as higher R&D and procurement costs than expected, delays, unsatisfactory compromises on requirements, and limited industrial consolidation or specialisation between participating countries.

Most recently, motivated to regain European autonomy in a strategic technology cluster, two European consortia, FCAS and TEMPEST, have set out to develop and manufacture 6th-generation fighter jets. Germany, France, and Spain constitute the Future Combat Air System (FCAS) project; Britain and Italy, likely supplemented by Sweden, also join forces within the TEMPEST framework. Although the two actors, FCAS and TEMPEST, do not share a truly common vision, differing both in military and politico-industrial parameters within their approaches and ambitions, the current technological and manufacturing ecosystem provides opportunities to combine national strategic autonomy and European defence cooperation. And there are other important factors favouring further cooperation: the tense security environment amplified by Russian aggression in eastern Europe, the so-called 'energy game', the unclear future of the transatlantic alliance and its American dominance, and also the ongoing pandemic. For now, the expected result is to introduce 6th-generation platforms characterised by advanced network-embedded avionics, the potential for unmanned deployment, and a degree of stealth capabilities as part of the European fleets of combat aircraft by 2040. But disagreements have already appeared on both sides of the deal, leaving space for other cooperation opportunities, beyond Europe's borders.

Disregarding internal and external obstacles, European collaboration towards the development of combat aircraft is backed by the current technological evolution and by the opportunities brought through Industry 4.0, the fourth industrial revolution, providing new ways for cooperation that have the capacity to combine national strategic autonomy and European unity. This possible new configuration constitutes a chance for a faster move towards a truly European defence technological and industrial base, in which each country can define a niche position, without requiring a constraining "big programme" frame or industrial consolidation detrimental to its domestic industrial interests. Such a configuration could represent a game-changer in the field of cooperative programmes, but most of the European countries are rather reserved in their openness to cooperate.

The Asia-Pacific Region

Military expenditure in Asia and Oceania totalled US$528Bn in 2020. Military spending in the region was 2.5 per cent higher in 2020 than in 2019 and 47 per cent higher than in 2011, continuing an uninterrupted upward trend since at least 1989. The rise was due primarily to increases in spending by China and India, which together accounted for 62 per cent of total military expenditure in the region in 2020.

The Asia-Pacific Region and Europe

The strategic importance of the Asia-Pacific region for EU States has been emphasised by the first EU Indo-Pacific strategy, published in September 2021. But the interest shown by the Europe-

Photo: MBDA

Artist's impression of an FCAS in Luftwaffe colours

ans in the region has gone a long way to understand why the security, economic, and political centre of gravity seems to be moving towards the Indo-Pacific, and that the EU should become a more active security actor in the region, building on its own CSDP missions in the western Indian Ocean, and deepening links with several partners across the Indo-Pacific. The 'Council decision on an EU strategy for cooperation in the Indo-Pacific' adopted by the EU Council on 19 April 2021 set out the EU's intention to reinforce its strategic focus, presence, and actions in the region. Later on, the 'Joint Communication on the EU strategy for cooperation in the Indo-Pacific', published on 16 September 2021, has given the EU a template to transform its interests in the region, and put its own assets into a substantial strategy to enhance its security role across the Indo-Pacific and defend EU security interests in relation to it.

Cooperation with states and partners in the Indo-Pacific is now more crucial than ever before. Polarising geopolitical US-China competition within the region complicates the security challenges there and their consequences for the EU and its Member States. So does the current context between Russia and Ukraine, in parallel. This is because the US plays an essential role in European security and has been actively encouraging its European allies to focus more on China as a threat to national and international security. As such, how the EU frames the security challenges in the Indo-Pacific, as well as how it implements its Indo-Pacific Strategy, is likely to have significant repercussions for transatlantic relations and, ultimately, European security.

Photo and Text: Team Tempest

TEMPEST is the RAF's next generation combat aircraft, coming into service from 2035 to replace the TYPHOON.

Photo and Text: Dassault Aviation

The mission system of the RAFALE has the potential to integrate a variety of current and future armaments.

European Combat Aircraft for Asian Programmes

In recent years, there has been a growing interest of European defence contractors in the Indo-Pacific arena, seen as a promising export destination for their warplanes. As this market has been dominated by US manufacturers, an industrial competition between European and American actors for the sale of military aircraft is taking shape in the most strategic and dynamic form. Requests for advanced military systems are on the rise across South, Southeast and East Asia, where China's military advancement, especially in the China Seas and the Indian Ocean, has prompted other regional actors to reinforce their defence capabilities. As there is space for a unified platform for cooperation that would encompass the collaborative efforts of all European States, the current European combat aircraft for Asian Programmes is visible through limited actors' agreements.

For instance, the Asia-Pacific region is a core market for Airbus and its divisions, with the company enjoying success in every area of its business. Today, the region accounts for a third of the European manufacturer's total order book and a third of its revenues. In the defence sector, over 150 Airbus light and medium tactical aircraft (C212, CN235 and C295) are in service in the region. These are operated by military services, as well as government and civilian agencies, in Bangladesh, Brunei, Indonesia, Malaysia, Pakistan, Papua New Guinea, the Philippines, South Korea, Thailand, and Vietnam. These aircraft are deployed on transport operations, and missions such as search and rescue, maritime patrol, and rainmaking.

Malaysia is the first export customer for the game-changing A400M airlifter, and the country took delivery of its fourth aircraft in 2017 to become the first operator with a full squadron. These have been successfully deployed on transport and humanitarian missions. Moreover, Airbus has signed a letter of intent (LOI) with Indonesia's Pelita Air Services, which represents a consortium of state-owned companies, on the potential purchase of the A400M.

Australia ordered the A330 Multi-Role Tanker Transport (MRTT) in 2004 to meet its air-to-air refuelling and transport requirements. The Royal Australian Air Force (RAAF), which became the platform's launch operator in June 2011, received all five aircraft by November 2012. A follow-on order for two more platforms was placed in 2015.

Singapore confirmed an order for the Airbus A330 MRTT in March 2014, receiving its first next-generation tanker aircraft in September 2018. South Korea picked the A330 MRTT in a landmark June 2015 decision, with all four delivered to the Republic of Korea Air Force in 2019.

Most recently, the United Kingdom and Japan have announced plans to jointly develop a prototype fighter jet engine as they both pursue programmes focused on fielding new-generation fighter jets, under the TEMPEST and F-X programmes. The latest agreement is part of an expanding military relationship between the two countries, which also includes sharing air-to-air missile technologies. In the first weeks of 2022, the UK's Ministry of Defence (MOD) announced details of the agreement, a Memorandum of Cooperation, within which the Anglo-Japanese fighter jet engine is the flagship item. Work on the joint engine demonstrator will begin early next year with the United Kingdom investing an initial £30M in "planning, digital designs, and innovative manufacturing developments" (UK MOD). Also related to the bilateral cooperation on future air combat technologies is the UK MOD's support to Japan's Joint New Air-to-Air Missile programme, or JNAAM. This weapon is expected to combine British expertise relating to the MBDA METEOR beyond-visual-range air-to-air missile (BVRAAM) with a Japanese-developed advanced radio frequency (RF) seeker.

Within European borders, the UK Ministry of Defence committed to invest £2Bn (approximately US$2.8Bn) over the next four years into the concept phase of its Future Combat Air System with Sweden and Italy, which includes the TEMPEST "sixth-generation" fighter programme first unveiled in 2018. In 2017, France and Germany (joined by Spain in 2020) launched their own Future Combat Air System programme, which includes a common next-generation manned fighter to be fielded by 2040. This European programme is projected to cost over €100Bn (US$119Bn). The collaboration between the two European consortia, FCAS and TEMPEST, to manufacture 6th-generation fighter jets, is currently under question, due to internal disagreements on both sides.

While there is indeed space and opportunity for collaboration within the European borders, so is beyond them. The defence industry cooperation between European States and Asian partners do not only have technological and military implications, but they also bring political and diplomatic results. Countries like France, UK and Germany are using defence-related exports to deepen their relations with several Indo-Pacific nations. Most recipients of European and US arms supplies in the Asia-Pacific region are either allies and partners of the US and EU such as Japan, South Korea, Australia, New Zealand and Taiwan, or potential friends in a confrontation with China like Indonesia, Singapore, Malaysia, Thailand, the Philippines, and India. Just like all other branches of the defence industry, European combat aircraft cooperation in the Asian Programmes is also a tool towards ensuring the power balance in the Asia-Pacific region. ■

"We are on track for yet another epoch-making edition."

Photos: DIMDEX

Staff Brigadier (Sea) Abdulbaqi Al-Ansari, the Chairman of the Doha International Maritime Defence Exhibition and Conference (DIMDEX).

Despite COVID restrictions, the seventh edition of the Doha International Maritime Defence Exhibition and Conference (DIMDEX) is scheduled to take place in the capital of Qatar from 21 to 23 March 2022. In mid-February, ESD had the opportunity to speak with Staff Brigadier (Sea) Abdulbaqi Al-Ansari, the Chairman of DIMDEX

ESD: With just weeks to go until the start of DIMDEX 2022, what is the current status of preparations for the event?
Al-Ansari: The organising committee of DIMDEX is working hard to put the finishing touches on preparations for the much awaited seventh edition of the event that will be held from March 21-23 at the Qatar National Convention Centre (QNCC). The unbridled enthusiasm shown by exhibitors and sponsors, both domestic and international, prove that we are on track for yet another epoch-making edition.
Even though we are still a few weeks away from the event, over 95% of the space has already been taken. More than 200 international companies from nearly 70 countries as well as members of Qatar's growing domestic defence industry will showcase their unique products and capabilities at DIMDEX 2022, thus providing a window into the latest innovations in the field of maritime defence and security. 10 countries- China, Italy, France, Germany, Turkey, USA, Canada, UK, Australia, and Pakistan– will have their own pavilions at the event. Three countries – Pakistan, Croatia, and South Korea – will be participating for the first time in the exhibition. In addition to the impressive line-up of countries that will have exhibitors at the event, more than 80 VIP delegations will attend DIMDEX 2022 to represent their respective countries.
With the complexity of modern day defence challenges increasing exponentially and defence interoperability becoming a norm, various branches of Qatar Armed Forces – Qatari Emiri Naval Forces, Qatar Emiri Airforce, Qatar Emiri Air Defence Forces, as well as the Qatar General Directorate of Coasts and Borders Security will showcase their capabilities at DIMDEX 2022, thereby gaining access to new and emerging defence technologies. Precautionary measures in compliance with Qatar's COVID-19 policies and regulations will be strictly enforced to ensure the smooth and safe conduct of the event.

ESD: You have been associated with the event for a significant period. How satisfied are you with the way DIMDEX has grown over the years?
Al-Ansari: We have indeed come a long way since the inaugural edition. In 2008, we had 85 exhibitors. That number has grown in every edition; in 2018, we had over 180 exhibitors. For DIMDEX 2022, we expect more than 200 companies. The increase in the number of exhibitors has much to do with the fact that the event offers greater scope for commercial success than most other similar shows. We measure progress not only in terms of the increase in the number of exhibitors but also by gauging the impact the event has had on the country's indigenous defence industry. The impressive strides that the country's domestic defence companies have made in recent years prove that DIMDEX has been a resounding success on both counts. We will strive to sustain the momentum generated by previous editions through DIMDEX 2022 and future editions.

ESD: What, in your opinion, has been the impact of DIMDEX on Qatar's domestic defence and security sector? Do you think local companies will benefit from the upcoming edition?
Al-Ansari: I believe that DIMDEX is one of the primary catalysts for the speedy growth of Qatar's indigenous defence and security sector. Although one of the world's top importers of arms – according to the Stockholm International Peace Research Institute (SIPRI), Qatar's arms imports increased by 361% from 2016-2020 compared to the previous five-year period - the country is firmly committed to localisation of defence equipment production. Previous editions of the biennial event have resulted in numerous collaborative partnerships between domestic companies and their international counterparts. There have been intangible benefits as well. The exposure and experience domestic companies have gained from being a part of such a prestigious event have helped to raise their profile on the international stage. Local companies have also benefitted from the unlimited opportunities for knowledge sharing that the event provides. With Barzan Holdings, the commercial gateway of the country's defence and security industry, playing a major role at DIMDEX 2022 as strategic partner and gold sponsor, I expect local companies to experience major success, during the event and in the future.

ESD: What are some of the new features of DIMDEX 2022?
Al-Ansari: To start with, the exhibition area has remarkably grown over the years

The guided missile destroyer INS KOLKATA was among the visiting warships at previous editions of DIMDEX.

and will be landscaped over 35,000 sqm in the upcoming edition. The vast show floor will host the latest technological innovations and solutions in addition to being a comprehensive networking platform for exhibitors, top military officials and other key decision makers from Qatar and other countries.

Judging by the variety of exhibitors that have signed up for DIMDEX 2022, the event will be the most diverse in terms of the variety of products and capabilities that will be on display. A wide range of product showcases, including anti-piracy systems, C5iSR systems, AI software, electronic warfare and intelligence, autonomous systems, as well as advanced weaponry such as precision-guided munitions for naval, land and air forces will be among the highlights of the upcoming edition.

Participants can also expect to learn more about defence interoperability solutions, the buzzword in modern military circles. Another key feature of the upcoming edition is the Delegation Management System (DMS), a comprehensive online portal by which they can request face to face meetings with VIP delegations. I expect DMS to substantially increase exhibitors' chances of commercial success.

ESD: What can visitors expect from the Middle East Naval Commanders' Conference (MENC)?

Al-Ansari: The Middle East Naval Commanders' Conference (MENC) is a not-to-be-missed component of DIMDEX as it plays a major role in shaping the future course of action against the innumerable threats that confront the maritime domain. The conference assumes additional significance in the present scenario as the threats that the domain has had to face have multiplied in recent years, thus endangering global trade and peace.

Experts are unanimous in their view that of all the challenges that the maritime sector faces, none is of greater concern than asymmetric threats. At the conference, which has "Resilience in the Maritime Domain – Confronting Asymmetric Threats" as its theme, a stellar panel comprising global security experts, doyens from academia, and leading industry figures will attempt to come up with globally acceptable solutions to asymmetric threats. Top-level officials and key decision makers from around the world, including ministers, chiefs of navies, fleet commanders, as well as other senior navy and maritime defence officials are expected to attend the conference.

ESD: The visiting warships display is one of the most popular segments of DIMDEX. What is in store for visitors at the upcoming edition?

Al-Ansari: The previous edition of DIMDEX featured eight warships from seven countries - the U.S., Pakistan, India, U.K., Bangladesh, Italy, and Oman. This time, we expect to have 15-20 warships at Hamad Port, the most at any one edition. I am confident that visitors will welcome the opportunity to explore warships and learn from the leaders and crew about their capabilities and technological features. DIMDEX has hosted more than 80 warships across editions; we are keen to grow this segment even more in future editions.

ESD: Has the response from sponsors matched your expectations?

Al-Ansari: Most definitely. Fittingly for an event of such major international stature, DIMDEX 2022 has attracted a glittering array of sponsors. Barzan Holdings, which promotes the growth of the Qatar's indigenous defence industry by facilitating international collaborations, is strategic partner of DIMDEX 2022 and also gold sponsor. Leading shipbuilder Fincantieri and missile systems developer MBDA are returning as diamond sponsor and gold sponsor respectively. Dukhan Bank is silver sponsor while Mwani Qatar, which manages the nation's seaports and shipping terminals, has signed up as silver sponsor. It is exciting to see that the organising committee is still getting queries from the industry about potential sponsorship opportunities.

ESD: Finally, do you have any special message for international exhibitors at DIMDEX 2022?

Al-Ansari: With the country's military modernisation programme being accorded top priority, there will be plenty of opportunities for established and new companies to partner with Qatar on various projects. I therefore expect exhibitors to showcase their full array of new products and capabilities at the upcoming edition. I am also optimistic that the event will further speed up the development of Qatar's domestic defence industry; I expect DIMDEX 2022 to help lay the framework for growth by facilitating defence technology transfer through joint ventures and other collaborative partnerships.

The interview was conducted by Stephen Barnard.

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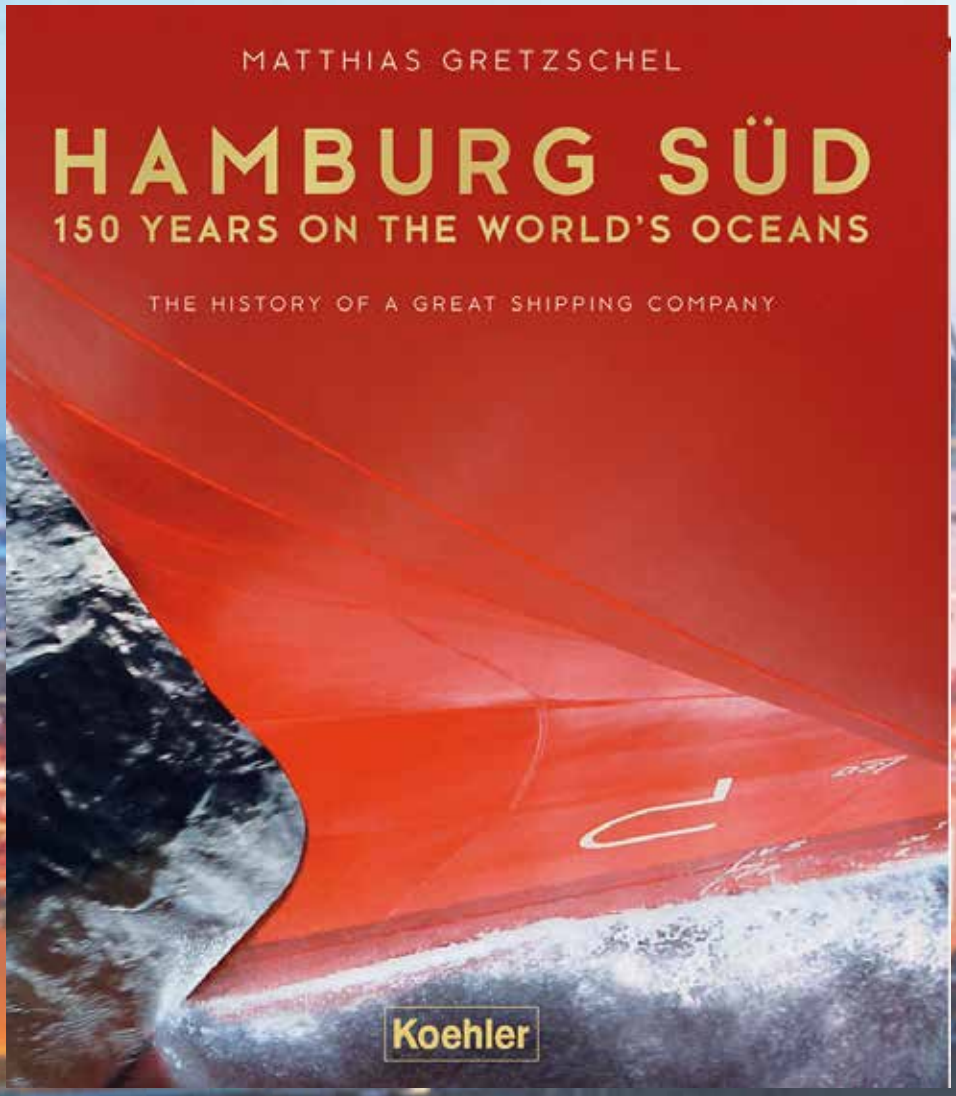

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Defence Industrial Initiatives in Saudi Arabia

J C Menon

International investors are eyeing the enormous opportunities that Saudi Arabia's military sector offers.

When the General Authority for Military Industries (GAMI), founder of Saudi Arabia's World Defence Show, announced a venue expansion amid unprecedented exhibitor demand for space at the inaugural event this year, it showed how the modern Kingdom continues to stand as one of the most exciting investment opportunities for global defence and technology companies.

Saudi Arabia has traditionally looked abroad when sourcing military technologies. However, a substantial shift in the country's agenda – and that of the wider Gulf region – is unlocking major opportunities for defence producers of all sizes to do business in the largest economy in the Arab region. Supported by its strategic partner, Saudi Arabian Military Industries (SAMI), the Gulf state has set the platform to serve as the global stage for interoperability across five domains: land, air, sea, space and security, through the World Defense Show.

In line with Vision 2030, Saudi Arabia's ambitious plan to diversify its economy and move away from hydrocarbons, the Gulf state has committed to localising 50 per cent of military expenditure – with experts predicting a subsequent boom in the domestic defence sector over the next decade. Significant interest has been recorded from leading global manufacturers, multinationals and SMEs across the defence industry, which considers Saudi Arabia – located at the crossroads of three continents – to be a critical market given its welcoming investment environment, ease of doing business and government support to foreign investments. The Vision 2030 presents unprecedented opportunities for defence contractors to invest in Saudi Arabia, which has already opened partnership with the aim of incubating an indigenous defence-manufacturing sector.

Photo: MoD Saudi Arabia

Saudi Arabia's inaugural World Defence Show is set to have a major impact on the Kingdom's local economy.

A Top Military Spender

In line with the new local production strategy, Saudi Arabia has already decided to spend less on imports this year. The country has allocated only US$46Bn to its military in 2022, about a 10 per cent decrease from the 2021 defence budget. According to GAMI, the number of defence firms licensed to operate in the country increased by 41 per cent as of June 2021. Local companies received 85 per cent of these licenses, demonstrating the significant progress in the Kingdom's drive to boost its home-grown defence capabilities.

The Saudi Arabian defence market was valued at US$13.58Bn in 2020, and it is anticipated to register a CAGR of 4.34 per cent, to reach a market value of US$17.39Bn by 2026. The country is one of the top military spenders globally and the primary importer of arms from the United States. The high defence spending of the country, due to its robust economy and high GDP, made the market lucrative for several local and foreign players. Saudi Arabia will invest more than US$20Bn in its domestic military industry over the next decade as part of aggressive plans to boost local military spending, the head of the Kingdom's military industry regulator said. "The government has put a plan that we will be investing in excess of US$10Bn in the military industry in Saudi Arabia over the next decade and equal amounts on research and development," Governor of the General Authority for Military Industries (GAMI) Ahmed bin Abdulaziz Al-Ohali told a defence conference in Abu Dhabi recently.

The Gulf state wants to develop and manufacture more weapons and military systems domestically, aiming to spend 50 per cent of the military budget locally by 2030. "We want to reduce reliance on imported military hardware as well as add higher value jobs in the Kingdom," the governor added.

This strategy has been led by Crown Prince Mohammed bin Salman, who has pledged to make Saudi Arabia a global leader in the defence industry. SAMI alone aims to be among the world's top 25 defence firms by 2030 and generate annual revenue of US$5Bn by the next decade. "We want global arms manufacturers to move production and maintenance to the Kingdom, and work with

Sami, or other local partners here, to win contracts," Walid Abukhaled, Sami's chief executive, said.
By connecting key defence contacts, primes, SMEs, and buyers, World Defence Show has laid the foundations to advance the defence industry and launch an industry-wide front against the challenges presented by ever-deeper defence systems integration.

Vision 2030

Under the Vision 2030, leading global military exporters would be able to establish joint ventures with local companies, transfer technology, and also enable SAMI and other potential partners to proceed with joint-venture agreements on the basis of the transfer of intellectual property.
SAMI, which was established in 2017, act as a vehicle to deliver upon the most strategic localisation targets. SAMI established joint ventures between national Saudi companies and international military production companies. They are mainly responsible for consolidating local companies and assets and aims to develop new and existing local industries and new technologies. "International investors are realising the enormous opportunities that the Kingdom's military sector offers, and opportunities will abound for foreign companies willing to become involved through joint ventures aimed at technology transfer, job creation and training opportunities," a GAMI official informed.
The recent launch of the HS132 fast interceptor boat is a good example of how these policies are bearing fruit; the HS132 was locally manufactured under a Transfer of Technology agreement in conjunction with French shipyard CMN for the Royal Saudi Naval Forces.
To establish a base for technological innovation GAMI and SAMI signed a contract to develop and manufacture the unmanned aerial vehicle, 'SkyGuard'. "The agreement is expected to add significant value by increasing military readiness, enhancing field responsiveness and technical support within the Kingdom's defence ecosystem," Governor of GAMI said.
The Vision 2030 will also grant foreign defence firms opportunities to procure contracts not only with the Ministry of Defence and its branches (the Royal Saudi Arabian Land Forces, the Royal Saudi Navy and the Royal Saudi Air Force), but also with the Ministry of the National Guard, the Ministry of Interior, and state-owned enterprises such as the Military Industries Corporation, which will oversee major facets of the development of the local defence industry.
By launching the Military Industry Marketplace (MIM), GAMI has unveiled even greater opportunities throughout the local supply chain, enabling investors to gain access to and connect with registered companies – from maintenance, repair, and overhaul to defence electronics, platforms and structural components, he said.

Photo: Qurmoo3 / CC BY-SA 4.0

A Saudi PATRIOT system. Saudi Arabia is dangerously close to running short of the weapon system following the heavy use over the past several months to thwart ballistic missile and drone attacks launched by Houthi rebels.

Go Local is New Mantra

Local companies have already struck joint venture deals with France's Naval Group and Thales and Belgium based firm CMI Defence, and memorandums of understanding have been signed with US's Lockheed Martin and Boeing. Last February, SAMI signed a joint venture agreement with Lockheed Martin, which is involved in installing a US$15 billion missile defence system in Saudi Arabia. The joint venture, in which SAMI will have a 51-per cent shareholding and Lockheed Martin will hold the remaining stakes, is aimed at developing localisation capabilities through the ToT and ToK and training of Saudi nationals to manufacture products and provide services to the Kingdom's armed forces. "SAMI has been exploring avenues to help build a sustainable, self-sufficient military industries sector in the Kingdom, and our strong and enduring partnership with Lockheed Martin underpins our commitment. Such joint ventures will support our efforts in localising cutting-edge technology and knowledge, as well as building strategic economic partnerships," Abukhaled said.
SAMI is also advancing an agreement with Sikorsky, a Lockheed Martin company, for the development of a local rotorcraft manufacturing capability as outlined in Vision 2030 enabling the production of up to 150 BLACK HAWK helicopters in the Kingdom.
The US had already sanctioned the sale of 25 'modified' UH-60M helicopters at an estimated cost of US$99.8M for the Saudi Arabian National Guard (SANG). Work is set to be complete by 31 October 2024.
SAMI also had signed a Memorandum of Understanding with Boeing to develop a new joint venture aiming to localise more than 55 per cent of the MRO services for fixed and rotary-wing military aircraft in Saudi Arabia. The agreement enables transfer technology to install weaponry on these aircraft as well as localise the supply chain for spare parts in the Kingdom.

Planned Acquisitions

However, Saudi Arabia continues to import the vast majority of its military hardware, munitions, and spare parts. Political tensions in the Middle East over the past decade have resulted in the country investing more in the defence acquisition. With several nations indulging in armed conflicts in the region, there is a growing push among the countries to obtain military assets, comparable in roles and capabilities to the adversaries. Moreover, the indulgence of global superpowers with advanced military capabilities, like the United States and Russia into the scenario, has further boosted these requirements.

Saudi Arabian government has plans to procure new fighter jets, surface combatants, and armoured vehicles. In recent years, it has also increased its focus on C4ISR and cybersecurity solutions.

A significant portion of the Kingdom's defence budget is being diverted for enhancing the air defence capability. After months of uncertainty, decks are now cleared for the sale of 280 Advanced Medium Range Air-to-Air Missiles and associated launchers by the United States to Saudi Arabia for US$650M.

Amid intense debate about the sale, the US administration made clear that it believed the deal was consistent with President Joe Biden's Feb. 4 pledge to end support for "offensive operations" in the war in Yemen, where a Saudi-led coalition has been fighting with the Houthi rebels since 2015. The administration also had claimed in a Dec. 7 policy statement that the missiles could not be used against ground targets and that "Saudi Arabia uses these munitions to defend against aerial cross-border attacks, such as Houthi explosive-laden drones." The United States also could soon sell Saudi Arabia 31 MIDS-LVT data link systems to upgrade Riyadh's THAAD air defence platforms, supplementing similar systems already installed on its PATRIOT missile defence array. "The proposed sale will provide the Saudi armed forces with the equipment, training, and follow-on support necessary to protect Saudi Arabia, and the region, from the destabilising effects of terrorism, countering Iranian influence, and other threats," the Pentagon said in a notice to Congress. The upgrades to the missile defence systems will cost Saudi Arabia US$23.7M.

Riyadh has also reportedly requested Washington to replenish its stock of PATRIOT surface-to-air missile system as it is dangerously close to running short of the weapon systems following the heavy use over the past several months to thwart ballistic missile and drone attacks launched by Houthi rebels.

Boeing also has recently bagged a contract worth up to US$9.8Bn towards modernisation and support work for Saudi Arabia's F-15 fleet. The modernisation processes include hardware, software, and interface design, development, integration, test, subsystem and structural component production. It also includes installation of future modifications and enhancements to the F-15 Saudi weapon system as well as product support, and is expected to be completed by November 2025.

Reports are also doing the rounds that Saudi Arabia is manufacturing ballistic missiles with China's help. According to a U.S. intelligence assessment report late last year, this is believed to be the first time Riyadh is producing them domestically. Saudi Arabia already possesses ballistic missiles purchased from China, including the 3,000-kilometer-range DONG FENG-3, which the kingdom displayed in 2014, and other Dong Feng-class missiles transferred from Beijing in batches since 2018.

Photo: US Army

Soldiers from U.S. Army Central, the South Carolina Army National Guard and the Kingdom of Saudi Arabia Royal Saudi Land Forces (RSLF) lower their country's respective flags Feb. 28 to commemorate the success of Exercise Friendship 2.

Corruption Risk

However, Saudi Arabia faces critical corruption risk across its defence institutions, with almost no transparency or oversight in operations, finances and procurement, according to research by Transparency International – Defence & Security. Steve Francis OBE, Director of Transparency International – Defence & Security, said: "The Middle East and North Africa remains one of the most conflict-riven regions in the world and this instability has a major impact on international security. While some states have made some improvements in their anti-corruption safeguards, the overall picture is one of stagnation and in some cases regression. The countries with defence sectors at a 'critical' risk of corruption are Algeria, Egypt, Jordan, Morocco, Oman, Qatar and Saudi Arabia, as there is virtually no accountability or transparency of defence and security institutions. Many of these countries are either major arms importers or benefit from significant international military aid."

That said, Saudi Arabia's inaugural World Defence Show is set to have a major impact on the Kingdom's local economy, according to a report by consultancy Ernst & Young. The event – taking place in Riyadh from March 6-9 is set to unlock opportunities for international exhibitors and visitors. According to EY, which considered factors ranging from daily visitor spend to imports and exports, World Defence Show will create SR700 million of economic activity by 2030. ■

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