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European Defence Review

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A USMC Amphibious Combat Vehicle operated by Marines with the ACV Transition Training Unit exits the surf at Marine Corps Base Camp Pendleton, California. Compared to the AAV7 the ACV has a much better capacity when ashore both in terms of mobility and protection.
© USMC Capt. Matthew Wolf

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SHIP-TO-SHORE **AMPHIBIOUS VEHICLES**

BY MARC CHASSILLAN



A US Marine Corps ACV pictured during the testing phase while splashing from an amphibious ship. The 8x8 developed by BAE Systems and IDV is now in service with the Corps. © USMC/LCpl. Drake Nickels

The projection of force from the sea to the land is a major concern of a growing number of global or regional powers. China, Algeria, Egypt, Qatar, Türkiye, Singapore, South Korea, Australia and soon Malaysia are purchasing amphibious assault ships of significant tonnage, far from the simple landing crafts they used for limited missions along their own coasts. They join the select club of countries that have long had significant amphibious assault capabilities such as the United States, the United Kingdom, Japan, France, Italy, Spain and Russia. The scenarios in the Mediterranean, in the Indo-Pacific, on the African coasts or in the Arctic, already written by strategic planners, implement powerful means of landing in which specialized armoured vehicles play a major role in seizing the beaches so that larger forces can eventually be deployed. These amphibious armoured vehicles use technologies and architectures different from those of combat vehicles simply capable of crossing small and calm waterlines such as rivers or small lakes.

After the Vietnam War during which the US Marine Corps (USMC) used the bulky and slow LVTP-5 (Landing Vehicle Tracked Personnel), the United States put the LVTP-7 into service (later be named AAV7, for Amphibious Assault Vehicle). Manufactured by FMC, now BAE Systems, the AAV7 has been subject of successive modernization programmes intended to improve mobility by changing the suspension and improving the transmission, protection with added ballistic solutions such as the enhanced applique armour kits (EAAK) easily identifiable with their "V" tiles, armament by integration of all-weather observation means or communication equipment. In addition to its three-man crew, it can carry a full Marines squad of 13 and a support team of 4. The AAV-7 is in service in Europe (Spain, Greece, Italy), South America (Brazil, Argentina, Venezuela) and Asia (Philippines, Taiwan, Japan). It is available in three versions, the AAVP7A1 APC, the AAVC7A1 command post and the AAVR7A1 recovery.

The P7 can accommodate the Mk 154 Mine Clearance Line Charge kit to clear beaches while the machine is still swimming at sea. The AAV7 was to be replaced from 2015 by the very ambitious Expeditionary Fighting Vehicle, or EFV, from General Dynamics Land Systems (GDLS). The EFV, associated with the V22 Osprey tilt rotor aircraft and the Landing Craft Air Cushion, was to revolutionize the USMC's amphibious assault doctrine by allowing the invasion fleet to stand beyond the horizon, out of range of the batteries of surface-to-sea missiles. Thanks to its very high speed on the water, more than 45 km/h, it could very quickly reach the beaches or inland, streaming up the rivers. Its 12-cylinder MTU 883 Ka-524 engine could run under two different thermodynamic regimes. Thanks to seawater cooling, it delivered 2,700 hp to power two enormous pump jets required for high-speed nautical transition. On land, its air-cooling regime reduced its power to 1,300 horsepower.

The EFV was a "transformer" with its dual-cycle engine, retractable hydropneumatics suspension, foldable bow plates and hull shaped like a jet ski board. Its technical complexity, its poor ballistic protection, its low reliability, and its price higher than that of the most sophisticated version of the M1 Abrams tank condemned the program in 2011. The USMC relaunched a new program, the Amphibious Combat Vehicle, won by BAE Systems with an original Italian IVE-



A USMC AAV7 belonging to the Assault Amphibian Schools Battalion. This vehicle has been for decades the backbone of the USMC landing capacity, but should be soon replaced by new vehicles.
© USMC/LCpl. Drake Nickels



An Italian Army AAV7 pictured close to Venice. Italy's Joint Amphibious Force is made of Navy and Army elements, both assault battalions being equipped with the amphibious vehicle of US origin. © P. Valpolini

CO (now IDV) design, the Super AV. The ACV is the only wheeled machine described in this article. Started in 2013, the development of the ACV went through two increments, 1.1 and 1.2, intended to evaluate the sensitivity of certain parameters (buoyancy, speed, protection, volume of the combat group) of the future production vehicle. The USMC plans to acquire 632 vehicles. The question of speed on water remains critical because ACV does not improve the performance of the AAV-7, which is around 12 km/h. The ACV retains from the Super AV the "H" driveline which reduces the silhouette while providing good protection against mines thanks to a "V" shaped floor. It can carry 13 Marines in addition to the three-man crew. The basic version is armed with a 12.7 mm Kongsberg Protector RWS but the Norwegian firm has also been selected for the 30 mm MCT-30 turret.

In late 2022 the Italian MoD signed a contract for the acquisition of 36 VBA (Veicolo Blindato Anfibio), the Italian version of the ACV. These vehicles will be delivered to the "San Marco" Brigade, the Navy component of the Italian joint amphibious force.

While the ACV gradually comes into service, the USMC is preparing another amphibious vehicle programme, the Advanced Reconnaissance Vehicle, which will integrate robotic air and land platforms and BLOS precision weapons. Textron and GDLS are the main contenders for this wheeled armoured vehicle program.



An Amphibious Combat Vehicle assigned to the 3d Assault Amphibian Battalion, 1st Marine Division, enters the water to reach the amphibious transport dock ship USS *Anchorage* (LPD 23), visible in the background. © USMC/ LCpl Willow Marshall



An ACV platoon belonging to the 3rd Assault Amphibian Battalion, 1st Marine Division, pictured during training. The USMC plans to acquire 632 such vehicles. © USMC/Capt. Matthew Wolf

The AAV7 gave birth to the KAAV-7 manufactured under license in South Korea and which equips the national Marine Corps. One hundred and seventy KAAV-7s will soon receive a Hanwha Defense stabilized remotely operated turret armed with a 40 mm K4 automatic grenade launcher and a 12.7 mm K6 machine gun. This cupola integrates daylight and thermal cameras as well as a laser rangefinder. It will also equip the K808 wheeled armoured vehicles. The successor to the KAAV-7 is in preparation at Hanwha. This is the KAAV-II, 12 tons heavier, and better armed thanks to a remotely operated turret armed with an indigenous 40 mm cased-telescope ammunition cannon currently under development. It will carry a crew of three men and an assault group of 21 Marines. Its speed on water should reach 20 km/h and will be fitted with rubber tracks. Its commissioning is not expected before 2030.

The Chinese People's Liberation Army Marine Corps fields six brigades, making it the second largest in the world after the USMC. It relies on an amphibious fleet which grows every year, and which includes three Type 075 Yushen Landing Helicopters Docks class and eight Type 071 Yuzhao class Landing Platform Docks in addition to 32 Landing Ship Tanks type units. The landward assault force comprises approximately 1,200 ZBD-05 amphibious armoured vehicles which, from a technical point of view, is a hybrid between the AAV7 and the stillborn EFV from which it borrows the two-cycle engine (550/1,450 hp) and the foldable bow plates to form a surfboard. The ZBD-05 weighs 25 tonnes and can cruise at nearly 30 km/h on the



The prototype of the ACV-30, the ACV version fitted with the Kongsberg MCT-30 turret that should soon start replacing USMC LAVs. © BAE Systems

Manufactured under license in South Korea, the KAAV-7 The AAV7 gave birth to the KAAV P7A1 which is fitted with a Hanwha RCWS armed with a 40 mm K4 automatic grenade launcher and a 12.7 mm K6 machine gun. © P. Valpolini





The “naval front” of the APVT shown at Eurosatory 2018 by then KMW is clearly aimed at optimising the marine performances of this hybrid amphibious vehicle. © P. Valpolini

sea, a speed triple that of the AAV7. Like the EFV, the ZBD-05 planes to ride waves, which reduces hydrodynamic drag and increases speed. Its under-armour armament includes a 30 mm ZPT-99 automatic cannon and HJ-73B antitank guided missile (ATGM). It carries eight fully equipped infantrymen in addition to the three-man crew. Three other versions are in service, a command post, a fire support vehicle with a 105 mm ZPL-98A cannon and a 122 mm self-propelled artillery. The armour consists of an aluminium hull to which high-hardness steel plates are attached, providing protection against heavy machine gun bullets. A Type 071 LPD could carry up to 60 ZBD-05s.

Revealed at the Eurosatory exhibition in June 2018, the KNDS Amphibious Protected Vehicle Tracked or APVT was developed by the KMW design office. The APVT concept is based on a very special technical choice, that of differentiating the direction of movement in the water and that on land. On land the machine moves in a given direction with two front crew stations, including that of the driver, which take place behind a glacis. This makes it possible to design a body front that can better roll over obstacles. In the water, the rear becomes the bow whose hydrodynamic shape allows it to cut through the water better than a conventional armoured vehicle body would have done. The idea is therefore clever to ultimately design two “fronts” of the body optimized for each of the environments, and to reverse the movement whenever it is necessary. From a technical point of view this translates into the installation of the engine in central position, a gearbox in the bow and a pair of hydro jets under the glacis. This powertrain architecture balances the loads. The drawback is a dissociation of the propulsion components which makes impossible the exchange of powerpack in the field. In aquatic mode, the pilot takes place in a tub set up on the roof outside.

A ramp is integrated into the bow which, when the vehicle moves on land, becomes the rear of the vehicle. This allows the combat group of eight infantrymen to disembark as any IFV would do. At the approach of a beach or a bank, the infantrymen can disembark like a barge, towards the front, but the machine can pivot thanks to its tracks and turn its protected side towards the enemy in order to secure the landing. The choice of the track also corresponds to the objective of giving the machine a certain ease on the very soft terrain that are often encountered in coastal and river areas. The APVT is fitted with segmented Diehl rubber tracks. With a weight in combat order of around 30 tonnes, the APVT is powered by an 816 hp MTU en-



The “land front” of the KMW APVT is designed to optimise the movement on land in order to overcome obstacles encountered on its way. © P. Valpolini

gine associated with an automatic transmission. Its payload is 5 tonnes. The APVT is presented with a dual-feed 20x139 mm Rheinmetall turret, an armament that has already be seen on an 8x8 IFV Boxer, but the vehicle can be armed with one of many solutions from KNDS, Nexter ARX- 20/25/30 being preferred. The vehicle is equipped with an CBRN protection system and a 17 kW reversible air conditioning device.

With the possible return of amphibious operations in Europe, particularly in the Baltic and Arctic areas, and in Southeast Asia, KNDS wants to take a market share where it will compete with the Turkish Zaha and the 8x8 ACV from BAE Systems-IDV.



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The personnel transported in the APVT can disembark from a ramp located in the "naval front" of the vehicle, which allows infantrymen to debus from the rear of the vehicle when used on land. © P. Valpolini

The delivery of 27 FNSS Zaha (Zırhlı Amfibi Hücum Araçları for Armoured Amphibious Assault Vehicle) to Turkish Naval Forces is completed this year. They will equip the marine infantry battalion embarked on the new *Anadolu* drone carrier. This unit will include two command post vehicles, two recovery vehicles and 23 troop transports, six of which can be converted into mine clearance vehicles.

The Zaha is heavily inspired by the AAV7 from BAE Systems, one of the parent companies of the Ankara firm. Its massive silhouette gives off a large volume to be able to float by Beaufort 3 sea and to take on board 21 personnel, 18 of whom make up the dismounted group of marine riflemen. The Zaha uses aluminium hull technology on which additional armour plates increase the level of protection. Its armoured floor protects the crew from mines, which is still a weakness of the AAV7. As regards mobility, the Zaha borrows all the components of the Bradley tracked train, just like the Kaplan light tank. The powerpack is made up of a 600 hp Caterpillar C13 engine and an Allison automatic transmission. Two large hydro jets propel the machine in the water at 10 km/h. The armament consists of a FNSS Caka remotely operated station with a 12.7 mm/LG40 combination. Each Zaha APC carries an anti-tank missile firing unit with six Roketsan Omtas ATGMs on board.

The Turkish Navy's assault unit is thus capable of landing 23 missile firing stations and 414 marines, which represents a very significant force for consolidating a small bridgehead on a rough shore. The Turkish government recently declared that it would soon acquire a second Anadolu-type drone carrier, which would potentially double the Zaha fleet.

As said, six APCs are fitted out in a modular manner so that they can be transformed into mine cleaning systems. Two launchers of explosive charges intended to clear landing corridors on the beaches take place in lieu of the combat group. It is a system designed in Turkey quite similar to the British Giant Viper or the American Miclic; a rocket fires a cord of explosive several tens of meters long, which falls to the ground and is ignited. The overpressure generated above the ground is supposed to detonate the mines. Quite logically, the Zaha mine clearing systems precede the landing echelon. The beaches will have to be reconnoitred beforehand by special forces divers and drones. The development



The ZAHA amphibious vehicle developed and manufactured by Turkish FNSS is now in service with the Turkish Naval Forces amphibious unit. It is fitted with the CAKA, an RCWS purposely designed for amphibious vehicle. © FNSS



A ZAHA being launched from L-400 *Anadolu* during the test phase. The ZAHA is available in three versions, personnel, command post and recovery, and is in service with one amphibious battalion. A second batch of 27 vehicles might be acquired if the Turkish Navy will build a second amphibious ship. © FNSS

of the Zaha shows a very offensive doctrine of the Turkish Navy. It is noticeable that in Europe, only the Spanish Armada, the Greek Navy and the Italian Navy and Army operate a few AAV7s. Neither the French Marine Nationale nor the Royal Navy have equivalent capabilities.

Interestingly, the Zaha command post versions carry 10 personnel, enough to constitute a very comprehensive mobile CP with the three operational functions integrated into a single vehicle (combat, fire support and 3D management, logistics).

The Turkish Navy's initiative could open some lucrative markets for the Zaha since there are no real competitors, the AAV7 having not been produced for a long time. Only China has something equivalent and modern, the ZBD-05. Arab countries, such as Algeria, Egypt or Qatar, which have purchased amphibious assault ships are targeted. In Asia, Malaysia has a project to acquire three multi-purpose vessels with amphibious capability and the Zaha could be part of the assault capabilities. Indonesia, which has strong relationships with Türkiye, is a potential future user too. ■



A view of the inside of the ZAHA; it can carry a crew of three plus 18 dismounts that access the vehicle via the rear ramp. © M. Chassillan

GERMANY'S PIVOTAL ROLE **IN EUROPE - AND BEYOND**

BY TIM MAHON



Marders pictured at Rheinnmetall's facility, ready to be upgraded before being delivered to Ukraine. The first 20 such vehicles were delivered in Marh 2023, and since new orders were filed, the last one for 20 more IFVs being issued in late March 2024, deliveries being expected before year end. © Rheinmetall

Germany has risen increasingly to the fore since embarking on what has arguably been one of the world's most far-reaching (and successful) reconstruction and reinvigoration campaigns in the 1940s and 1950s. The nation's economic and political heft – already outstanding by the 1990s – was hugely augmented by the reunification of the 'two Germanies' by the end of the century. Bonn (and now Berlin) did not seek a greater European role post reunification: nonetheless, it got one. But the ensuing period of economic turmoil, coupled with unrest and political uncertainty – partly characterised by global financial crises, epidemics and armed conflict in the Middle East and now Central Europe – have had an unforeseen and certainly undesirable result. Berlin stands accused by various observers of being hypocritical, indecisive and maverick in some of its political posture – particularly with regard to Ukraine.

For the last quarter century, the 'German question' has no longer been about looking backwards and reflecting on the effects of political division and social fragmentation: now, it has been transformed by time and tide and is rather about looking forward, pursuing realistic pan-European ideals and providing leadership and inspiration at both the European and wider levels. Germany's time in the sun has, according to many, arrived. But are there storm clouds brooding on the horizon?

One thing is certain from the events of the last several years, according to critical observers: Olaf Scholz is no Angela Merkel. But who is to say how the former chemist who was Germany's political leader for 16 years would have dealt with the crisis and traumatic changes to industrial, economic and social life brought about in the wake of the COVID pandemic? Certainly, Scholz rose to the challenge of Putin's invasion of Ukraine in 2022 - just two and a half months after he became Chancellor. The speed and apparent conviction with which the Scholz administration announced funding, dramatic defence-related modernisation and political commitment to defending democracy not only shocked Putin - who had counted on more EU- and NATO-wide "business as usual," consisting of plenty of talk but very little substantive action - but also pleasantly surprised a number of Germany's friends and allies. This was a different Germany from the one that had walked a political tightrope regarding 'out-of-area' military operations for decades. Here was some actual leadership and a very positive move towards greater European responsibility in defence.

Two years on and the knight's shining armour is somewhat tarnished. Some of the promises made in early 2022 have been shown to have been founded on erroneous suppositions, inaccurate calculations or blind optimism regarding the scale of the obstacles - internal and external - that would have to be overcome. Promised budget increases have been glacially slow in having actual effect, internal political infighting has distracted attention from what readers of this journal might consider 'the main event', and mutual accusations flash across borders and oceans that German policy is fragmented and self-contradictory. As a recent example, Berlin's decision not to supply Ukraine with Taurus cruise missiles came at exactly the same time that Scholz was berating his international partners for not doing enough to supply Ukraine with what it needs in time for it to have tangible effect.

That apparent incoherence may well mask a carefully crafted strategy, however, according to some political analysts in Brussels, London, Paris and Washington. Looking at Scholz's decision matrix, supplying Taurus missiles to Kyiv, which might then use them to destroy the now infamous Kerch bridge that links Crimea to Russia, may well result in Russian retaliation aimed directly at Germany - with the almost inevitable invoking



The ARGE consortium, consisting of Rheinmetall Waffe Munition and MBDA, is engaged in further development of a high energy laser weapon systems, tested in 2022 on board the German frigate Sachsen at a test range in the Baltic Sea. The system addresses an increasingly sought-after capability by navies seeking to counter the growing threat from unmanned platforms.
© Rheinmetall



Bundeskanzler Olaf Scholz, in power since December 2021, has faced a series of challenges, some of which were inherited and some of which have been entirely new, stemming largely from Vladimir Putin's illegal invasion of Ukraine in February 2022. His robust response and the commitment to a €100 billion modernisation fund for German defence surprised many observers - Putin included. © German parliament

of NATO's Article 5 mutual defence pledge leading to a massive escalation in conflict in Europe. Not supplying them, however, may speak to another goal: to provide Ukraine with what it needs to survive, but not to enable it to conduct overly aggressive offensive operations that may dramatically alter the strategic picture in Europe - and may well push Putin (or his successor?) over the edge. That is what some observers might term 'constructive engagement' and one of Scholz's nineteenth century predecessors might well have termed *realpolitik*.

Moving away from the broader geopolitical picture for a moment - no matter how tempting it is to comment on current iterations of 'The Great Game' - the fact that Germany is engaged in an almost unprecedented period of defence force modernisation is a major consideration in determining the role the nation is playing today and will continue to play in future. Defence Minister Boris Pistorius has, since last year, been pushing the Bundeswehr towards becoming a far more "war-capable" force - a dramatic change indeed for a nation whose military posture has tended towards caution more than deterrence or even overt action for the last several decades.

The expression "war-capable" has attracted widespread criticism in German political circles, but Pistorius recently told a press gaggle in Berlin that he is "convinced it is one of the few words that really describes correctly the imperative here [...] I respect the fact that others struggle with the word - but I also note that most do not have a problem with the substance behind it". That sentiment perhaps embodies the most crucial contribution Germany can currently make: leadership in making courageous and well-founded decisions - and implementing them. Recognising that defence - one of the most fundamental obligations of government - is an insurance policy is one thing - plenty of nations do that. Paying the necessary premiums is quite another - and only a handful of 'the usual suspects' manage that, though some surprising and less obvious nations have shamed their larger neighbours in recent years with their efforts to meet and exceed expected levels of defence spending.

The new vision is of a single, unified operational military command in Germany that will cater for planning and implementation of deployments for both national territorial defence and overseas operations, replacing the twin structures that currently oversee them. An existing cyber and information warfare department will be significantly expanded and will rapidly be reorganised as a fourth combatant service, alongside the army, navy and air force. But the challenges should not be un-



Diehl Defence's IRIS-T SLM/SLS short-range air defence system is one of the several modern systems the Bundeswehr is relying on to modernise its air defence capabilities in the short term. There are multiple longer-term projects also under way. © Diehl Defence



The Taurus cruise missile has become an object of controversy as the German parliament has voted against sending the missile to Ukraine in light of concerns that Russia could retaliate against Germany in the event of Ukraine's use of the system against Russia. There have been suggestions that the very similar MBDA Storm Shadow could be supplied instead from the UK. © MBDA

derestimated. Pistorius recognises the problems inherent in "resetting the Bundeswehr for a new and old challenge - that of defending [both] the country and the alliance".

One of the major criticisms levelled at Germany in the past has been its failure to live up to the commitment of spending 2% of gross domestic product (GDP) on defence and security - a benchmark it has consistently failed to meet. "We have [it] this year and we will reach it in the coming years as well, but also must reach it so that we can do justice to our responsibility and our role in NATO," Pistorius told reporters. Quite how the 2% level - to which Scholz committed two years ago - will be attained and sustained remains unclear, which fuels adversarial commentary from critics and plays into the hands of hostile propaganda machines such as Moscow's. But most observers agree there is a new sentiment abroad in Berlin and there are real prospects of sustaining the requisite levels of investment after the 'special fund' of € 100 billion dedicated to defence modernisation runs out - likely in 2027.

That modernisation programme, however, is not without its own problems and unresolved questions. At the time of writing, the Bundestag parliamentary commissioner for the military had just publicly stated the Bundeswehr "still has too little of everything". The underlying problems seem to be legion - and growing - but, fundamentally, it seems the resources - even given the € 100 billion fund over several years - are simply stretched too thin to support the ambitions. Alternatively,



In 2023, Germany, for the first time, was the framework nation of the Special Operations Component Command of the VJTF Very High Readiness Joint Task Force , the spearhead of NATO's Response Force. © Bundeswehr/KSK



Germany's armed forces remain among the most powerful among NATO's European members - but official statements recently hold that they "are still short of almost everything". Russian equipment in Ukraine has proven to be less effective than some pundits had feared - but quantity exercises a quality all of its own and Germany's major platforms - including Leopard main battle tanks - are limited in number. © Bundeswehr

the ambitions may constitute 'a bridge too far,' perhaps?

Late last year, for the first time since suspending conscription in 2011, Berlin issued a 19-page new defence policy document which sought to define the *Zeitenwende* - the seismic policy shift Chancellor Scholz announced in the wake of the Ukraine invasion. The document marks Germany's emergence as "a grown-up country in terms of security policy," Pistorius said at the time. With armed conflict once more breaking out in Europe, it was time to take positive action. "As the most populous and an economically strong country at the heart of Europe, Germany must be the backbone of deterrence and collective defence in Europe," he said. Deploying a combat brigade to Lithuania - a dramatic 'first' for the Bundeswehr - would signify Germany's readiness to place its armed might at risk in defending allies, just as NATO troops had done in Germany for decades. A new spirit of realism, as well as a palpable level of commitment, was now apparent, within Germany and beyond its borders.

Has this sentiment, along with the commitment, survived the 'slings and arrows' of recent political fisticuffs? To be honest, the jury is still out. The Scholz administration is in a period of flux and uncertainty but, as argued above, this may be smoke and mirrors to distract external observers from penetrating the Chancellor's strategy too deeply. Time will tell - and this writer expects to see increasing signs over the next several



Puma infantry fighting vehicles belonging to the 37 Armoured Infantry Brigade trains at the Army Warfighting Simulation Centre in Wildflecken. In 2023 the Brigade was part of NATO's Very High Readiness Joint Task Force (VJTF). © Bundeswehr/Maximilian Schulz

years that Germany is, indeed, committed to 'walking the walk' in terms of living up to and exceeding its commitments. For example, the development of the *Ringtausch* (or 'circular exchange') concept - a system whereby third-party countries could receive modern German-manufactured weaponry in exchange for sending their (largely Soviet-era) heavy armoured vehicles to Ukraine - was a laudable idea, and one that was developed with commendable speed. Unfortunately, it foundered, largely on the rock of the parties involved having different perceptions of the value of both donated and replacement equipment. Unwarranted expectations aside, the programme changed mindsets at a time that thinking 'outside the box' was a challenge for many militaries trying to support Ukraine's efforts with minimal resources.

Germany's industrial might is another potent weapon in the arsenal it can deploy in support of its increasingly pivotal role on the international stage. At a time when 'defence industry rationalisation' is an increasingly used watchword in Brussels and other EU capitals, there are early signs that German industry is doing its best to step up to the mark - albeit at a pace that, while it should not be described as akin to that of a snail, is scarcely gazelle-like. The merger of Krauss-Maffei Wegmann with France's Nexter to form KNDS had a profound impact at the time of its announcement, but has turned into something of a 'so what' event since. This does not detract from the excellent intentions behind the merger - and it will inevitably prove to be beneficial to both nations and the industry as a whole in the long term. Those last three words, however, highlight one of the problems confronting industrial change - the pace - a problem that, frankly, the general public fail to appreciate and understand. That inevitably means increased cynicism on matters related to defence and security, reducing governmental credibility and undermining efforts to do the right thing and pay the necessary premiums for a comprehensive national insurance policy.

Other companies take an entirely different approach. At a speech in Berlin several years ago Armin Papperger, Chairman of the Board and CEO of Rheinmetall, commented that partnership models pointed the way to a substantial part of the company's growth opportunities in the defence and security sector in the foreseeable future. And his company truly has 'walked the walk' in recent years, putting money, human capital, intel-



German Army Leoaprd 2A6 belonging to 104 Tank Battalion pictured at the army's combat training center in Letzlinger Heide. Following the invasion of Ukraine Germany is beefing up its armed forces, also thanks to the € 100 billion "special fund" for Defence approved by the Bundestag in June 2022. © Bundeswehr/Marco Dorow

lectual property and massive effort into generating effective, efficient and exploitable partnerships - in Austria, in Hungary and in Australia, to name only the most obvious. Of course, it helps that those partnerships are centred on well-designed and competent products - such as the Boxer family of armoured vehicles - and involve significant volumes of technology and knowledge transfer - the Holy Grail of most defence industry systems import plans in the 2020s.

German technology is undoubtedly an arena in which the nation can have a beneficial effect on its own defensive capacity - for both territorial and alliance defence missions - and as a potential export asset, generating further income for the nation and cementing industrial capability. A case in point - in late 2022 the ARGE consortium, combining the expertise and know-how of both MBDA Deutschland and Rheinmetall Waffe Munition, successfully tested a high energy laser on board the German frigate Sachsen in the Baltic Sea. Demonstrating an ability to effectively locate, identify, track and kill hostile drones at short and very short ranges, the capability speaks to one of the most sought-after solutions to the challenges raised by the prospect of the kind of drone



A Tiger belonging to Combat Helicopter Regiment 36 deployed as part of the Very High Readiness Joint Task Force (VJTF). Germany is about to select a successor for the Tiger. © Bundeswehr/Mario Bähr



Eurofighters from the German Air Force Tactical Air Force Squadron 74 from Neuburg an der Donau take off on scramble from the Ämari Air Base, in Estonia, during a Baltic Air Policing deployment in northern Europe. © Luftwaffe

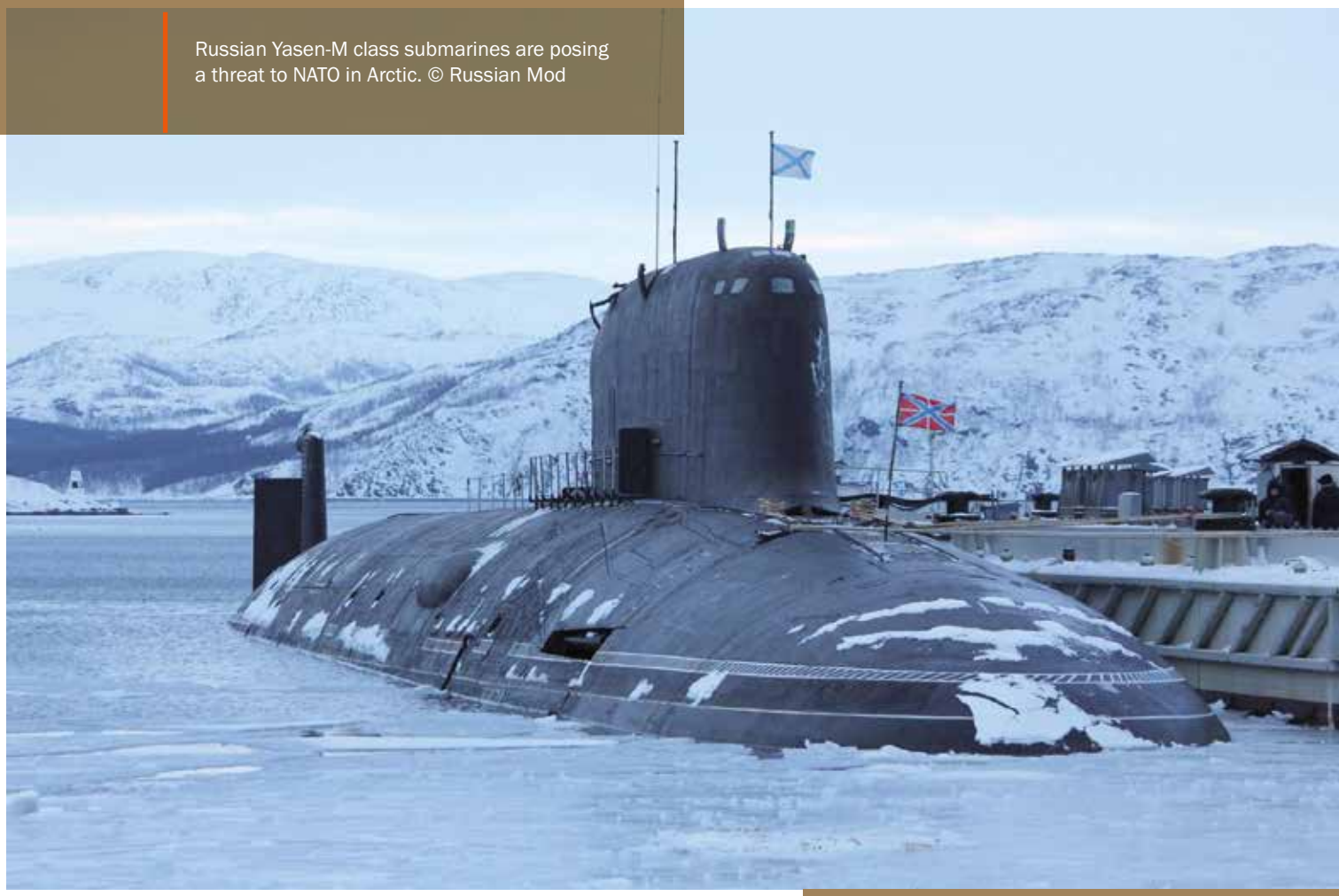


The German Navy has deployed its ships in many multinational EU and NATO contexts; here the Hamburg frigate F220 leaving her *Hamburg* home port to join the EU Irini mission. © Bundeswehr/ Leon Rodewald

warfare we are currently seeing in Ukraine. The additional development and testing programme already under way will almost certainly result in a powerful asset available to German and allied operators faster than might have been assumed when the project was first launched.

Another Rheinmetall product - this one initially developed in Canada - already attracting considerable attention from overseas users is the Mission Master unmanned ground vehicle. Under evaluation in Germany, Canada, the USA, the United Kingdom and Norway, among others, the most recent customer is Japan, which will receive three vehicles to kick off its UGV fleet development.

And that note is perhaps an appropriate one on which to bring this brief assessment of how Germany's role in our defence and security world is developing and is likely to continue so to do. Solid, sound technological solutions to real, identifiable problems; a spirit of partnership and sharing that can potentially exploit synergies more effectively; a commitment to changing doctrine, dogma and development of alternative solutions at pace; and, perhaps above all, the pragmatism to recognise the art of the possible and to pursue it with every political, industrial and economic sinew. Tomorrow is already here, and there is no longer the time available to achieve a 101% ideal solution. Practical, concrete, achievable results are needed - and that is exactly the area in which Germany excels. Couple that to the now evident political will to make things happen and you have - *realpolitik*. Potentially. ■



Russian Yasen-M class submarines are posing a threat to NATO in Arctic. © Russian Mod

NATO'S ARCTIC SURVEILLANCE OF THE RUSSIAN SUBMARINE THREAT WITH FOCUS ON THE BALTIC

BY DAVID OLIVER

The Arctic is increasingly an area of focus for non-Arctic states as well as those with territory within the Arctic Circle. Russia in particularly is wary of the growing international interest in the region as most of its strategic maritime platforms are based in the Murmansk Oblast on the Kola Peninsula, including the bulk of its nuclear ballistic missile submarine fleet. More than half the Arctic coastline is Russian and following its invasion of Ukraine, this has led Russia to revitalise its Cold War-era military infrastructure. The Russian Northern Fleet is located in the Arctic region.



Exercise Nordic Response participants included new NATO members Sweden and Finland. © US Navy

After decades of low tensions, the Arctic is back on the front line of NATO's efforts to combat Russian naval threats to Trans-Atlantic lines of communication. Biggest concern is what moves down deep, the post-Soviet designed fourth generation Yasen-M class submarines which are allegedly capable of diving to a depth of 600 metres. While the Barents Sea is shallow, with an average depth of 230 metres, the Norwegian Sea to the west reaches a depth of 2,300 metres. In recent years, Russia's Northern Fleet has conducted exercises more frequently in the naval choke point between North Cape and the Bear Island. This is where the shallow waters meet the deep.

"Since it became obvious in the early 2010s that there will be nothing like a peaceful co-existence with Russia and that Russia emphasised its subsea assets for strategic signalling against NATO and its partners, Western navies have been struggling hard to regain their anti-submarine warfare (ASW) skills," according to Johannes Peters, who heads up the Center for Maritime Strategy and Security at the Institute for Security Policy at Kiel University, Germany.

In response, NATO has stepped up its activity in Arctic, with Canada, Denmark, Norway, the United States having territory within the Arctic Circle. US and UK submarines, as well as Russia, have demonstrated their ability to operate under ice and the Norwegian military exercise Cold Response has a long history and takes place in Northern Norway every other year. With Finland and Sweden joining NATO, the exercise was expanded to a Nordic Response in 2024 with over 20,000 soldiers from 13 allied nations taking part. The participating nations were Belgium, Canada, Denmark, Finland, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, the United Kingdom, and the USA. The exercise had its focal point in northern Norway, Sweden, and Finland as well as in the corresponding airspace and sea areas. There was particularly high activity at sea with over 50 submarines, frigates, corvettes, aircraft carriers, and various amphibious vessels. In the air, more than 100 aircraft including maritime-patrol aircraft (MPA) took part.

The Baltic states face myriad hybrid and conventional threats from Russia in the maritime domain. NATO as a whole has been unprepared for Russian aggression at sea and given the economic and strategic importance of the Baltic Sea itself to the Baltic states and NATO, this situation has to be remedied. By strategising procurements,



NATO ships taking part in BALTOPS, the largest naval military exercise in the Baltic Sea. © NATO

crisis response, and coastal defence, the long-standing condition of "sea blindness" can be reversed.

In the Baltic Sea Region, the maritime status favours Russia. Although its Baltic Fleet has only one operational conventionally powered attack submarine Russia could use the fleet to harass military and civilian activity at sea and take surprise offensive military action. In the case of the latter, there is very little that Estonia, Latvia, and Lithuania could do to prevent Russia from projecting power into their port facilities, territorial waters, exclusive economic zones (EEZ), or other littoral areas. Also, in the event of hostile activities which generally fall below the threshold of war and/or surprise offensive military action, there is very little that the Baltic states or NATO could do to stop Russia. Combined with Russia's anti-access/area denial (A2/AD) capabilities based in Kaliningrad and the logistical chokepoint of the Suwałki Gap, this could pose a strategic threat for NATO in the Baltic theatre. However, Sweden, now a full NATO member, has had a long and successful experience of monitoring and identifying Russian submarine activity in the Baltic which will considerably strengthen the Alliance in the region. Also, apart from Russian coastlines in the Gulf of Finland and in Kaliningrad, the shores of the Baltic Sea will now be controlled by NATO members.

Air Defender 23, which was held in June 2023 in Germany, was the largest air force exercise in NATO's post-Cold War history, involving some 10,000 troops from 25 countries and 250 military aircraft including MPAs. During this event, a number of international task forces made up of various aircraft were formed to simulate the gaining of air superiority over the North and Baltic Seas and supporting the operations of allied troops in the Baltic states under a collective defence scenario.

The BALTOPS exercises, which the United



A total of eight Boeing P-8A Poseidon multi-role maritime aircraft have been ordered to replace the German Navy's AP-3C Orion maritime patrol aircraft. © Boeing



A Norwegian Air Force crew member's view from a P-8A Poseidon at low level on patrol over near the Arctic Circle. © Norwegian Air Force

States has been organising since 1971, are the largest naval military drills in the Baltic Sea. Also taking place in June 2023, 50 ships, more than 45 aircraft and around 6,000 troops from 20 countries were involved in this exercise. NATO allies and their partners practised protecting convoys, fighting submarines and surface ships, and carrying out landing operations in Lithuania and Latvia.

Apart from NATO's anti-submarine warfare frigates, it principal weapon against Russia's submarine fleet are its MPA and anti-submarine warfare (ASW) aircraft, and in the future this will be almost exclusively the Boeing P-8A Poseidon which will be operated by not only the US Navy, but by the RAF, the Royal Norwegian Air Force, and the German Navy.

Germany is meeting NATO's target of each member spending 2% of GDP on defence. In November 2023, the Bundestag's Budget Committee released necessary funds of € 1.1 billion for the purchase of three additional P-8A Poseidon multi-mission maritime patrol aircraft to bring its eventual fleet to eight. The money will come from the Bundeswehr special fund, a € 100 billion (US$ 109 billion) one-off item created in 2022 for the re-equipment of the German Armed Forces in the wake of the Russian invasion of Ukraine.

The initial five P-8A Poseidon were procured via Foreign Military Sales (FMS) in September 2021, the first of which will be delivered to Germany by the end of 2024, when they will begin to replace the Marinefliegergeschwader 3's aging fleet of six Lockheed AP-3C Orions. In July 2022, Boeing, ESG Elektroniksystem- und Logistik-GmbH and Lufthansa Technik signed a three-party agreement that reinforces joint efforts to support Germany's new P-8A Poseidon fleet.

While the first acquisition of P-8A aircraft was presented as an "interim solution", this

second order may have definitively sealed the fate of the Franco-German co-operation Maritime Airborne Warfare System (MAWS) project. The MAWS programme was launched in 2018 following the signing of a letter of intent between France and Germany aimed at developing a common European manned aircraft for maritime patrol missions, to fly in 2035 to replace the French Atlantique 2 and the German AP-3C Orion. The proposed aircraft were to be based on either the Airbus A320neo or the Falcon 8X and the larger Falcon 10X offered by Dassault.

Though the German P-3 Orion is slowly but surely being replaced by the Boeing P-8A Poseidon for ASW work, the transition is far from complete. The specialised German personnel will undergo training at Naval Air Station Jacksonville in Florida, to work with USN aircrew and mission specialists in the P-8A operating with the USN's Patrol Squadron 30 (VP-30) training establishment. German Navy personnel will comprise pilots, tactical coordinators and weapons-systems operators. However, it will be some years before the German fleet of P-8As have fully trained personnel and it can declare full operational capability.

The Boeing P-8A Poseidon has a total of 11 hardpoints, five in the internal bay and six external ones for various conventional weapons. The aircraft can accommodate Mark 54 or Sting Ray torpedoes, naval mines, depth charges, AGM 84 Harpoon, AGM-88, and the High-Altitude Anti-Submarine Warfare Weapon Capability (HAAWC) system.

The aircraft is equipped with a Raytheon AN/APY-10 multi-mission surface search radar with a range of up to 250 nautical miles, an AN/ALQ-240 Electronic Support Measures Suite, and an AN/APS-154 Advanced Airborne Sensor.

In August 2023 the Portuguese government authorised the Portuguese Air Force (PAF) to acquire the entire inventory of the German AP-3C Orion maritime patrol aircraft fleet for € 45 million. The contract includes six aircraft, Mid-Life Upgrade (MLU) sets, spare parts, support equipment and test benches, as well as flight simulators and tactical procedures. This acquisition aims to enhance Portugal's capabilities in detecting and countering undersea threats, an increasingly vital aspect of current maritime security. In February 2024, the PAF took delivery of the first of the German AP-3C Orion aircraft, and delivery of all the aircraft is scheduled to be completed by early 2025.

On 20 November 2020, the Bundestag also approved the purchase of 31 Airbus Helicopters NH90s for the navy to replace their 22 Sea Lynx Mk.88A helicopter fleet which entered service in 1981 with a contract



The Portuguese Air Force acquired the six German AP-3C Orion MPA fleet; following an upgrade programme, the first was delivered in early 20224, the delivery of all the aircraft being scheduled for early 2025. © German MoD



The Sea Tigers will replace the German Navy's fleet of ageing Sea Lynx Mk.88A helicopters to operate from German frigates. © US Navy

valued at € 2.7 billion, including spares, accessories, and training aids. This version, called the Sea Tiger, is designed for ASW and anti-ship warfare with SAR as a secondary role, and to operate in conjunction with German Navy Frigates. The Sea Tiger variant is similar to the French NFH Caiman version and is planned to enter service starting in 2025. The first flight of the Sea Tiger took place in late November 2023.

The Sea Tiger is the latest version of the proven NH90 Naval Frigate Helicopter (NHF). It has been specifically designed to match the needs of the German Navy for a state-of-the-art ASW helicopter. The shipborne Sea Tigers' missions will include, in addition to reconnaissance and transport, those of engaging targets above and below the surface. Equipment includes a new electro-optical system and improved electronic support measures (ESM) as well as the Folding Light Acoustic System for Helicopters (FLASH) active dipping sonar and BlueTracker sonobuoy processing system supplied by Thales. The Sea Tiger will be equipped with the advanced lightweight third generation MU90/IMPACT anti-submarine torpedoes manufactured by EuroTorp, a consortium of French and Italian companies. The new helicopter is expected to be equipped with the lightweight, long-range MBDA Marte ER ASuW missile, a potential alternative being the Naval Standard Missile (NSM) from Kongsberg. No firm decision has been made to date.

Meanwhile, the Royal Netherlands Air Force (RNLAF) is using its unmanned General Atomics MQ-9A Reaper for an increasing

diverse set of NATO missions, according to Lieutenant-Colonel Jan Ruedisueli, commander of the RNLAF's 306 Squadron. "With these upgrades, we will support NATO's ISR and maritime surveillance missions throughout Europe." In 2023 the RNLAF announced that it will double its MQ-9A Block 5 fleet from four to eight and GA-ASI will integrate the new payloads for the RNLAF, including a Synthetic Aperture Radar with the Maritime Search option, extended range fuel tanks, ESM, weapons, and a communications relay that is purpose-built to connect all services of the Netherlands Ministry of Defence.

In 2008 Germany had made a request to purchase five MQ-9 Reapers and four ground control stations, plus related support material and training valued at US$ 205 million via the US Foreign Military Sales (FMS) process. However, Germany cancelled the request and decided to lease the Israel Aerospace Industries Heron TP offered by IAI and Rheinmetall as a stop-gap measure before a long-term decision on the Eurodrone Medium-Altitude, Long-Endurance (MALE) system being developed by Airbus, Dassault and Leonardo.

The IAI Heron UAS is the main airborne maritime ISR asset used by Israel for the past ten years. Its ability to operate in harsh weather conditions over the sea as well as land, refuel, and take off from remote airfields with minimal logistical support, makes it a versatile and effective tool for the maritime surveillance missions. The integration of IAI's Windward software into the Heron UAS enables a real-time fusion of data from the UAS's sensors with Windward's constant monitoring. This integration allows the Heron UAS to effectively identify and track vessels of interest, enhancing its surveillance capabilities. The Heron UAS also utilizes cross-cueing between real-time sensor data and Windward's risk assessments, further enhancing its situational awareness and target identification capabilities. It is possible that this system could be offered as an optional upgrade for Germany's IAI Heron TP fleet to enhance its maritime capability. ■



The German Air Force leased unmanned IAI Herons could be adapted for maritime surveillance. © US Navy

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A RENAISSANCE OF MIDGETS **AND COMPACT SUBMARINES PLATFORMS?**

BY LUCA PERUZZI



The new DGK compact submarine developed by DRASS can safely operate in blue, green and brown waters, and manage all mission profiles assigned to a conventional submarine. © DRASS

Technological developments in the underwater domain have not only expanded the potentialities of unmanned platforms but also revitalized the segment of smaller underwater manned platforms, especially in the context of littoral warfare, where they have always excelled. Larger shipyards and smaller companies' developers of midgets and compact submarines see a potential market thanks to new technologies that are improving capabilities and performances of on board and offboard systems, maintaining not only the compact dimensions of these platforms, something that is highly appreciated when operating in coastal or shallow waters, but also reducing manning and costs compared to larger conventional submarines. All these are key features for naval forces that cannot afford the procurement and sustainment of large platforms but are also important drivers for coastal operations and deterrence, without forgetting the support to special operations and asymmetrical offensive missions for which midgets are the most effective manned assets. The latest designs of midgets (with displacement of up around 200 tonnes) and smaller compact submarines (which could reach up to around 900 tonnes), take the advantage of their limited size to operate safely in shallow as well as in blue waters. Their compactness and exceptional quietness allow them to avoid detection safely operating submerged in less than 30 meters sea water. In addition to an exceptional low acoustic signature, they have a significantly lower aerial and infrared silhouette at periscope depth compared to larger platforms, and thanks to latest generation camouflage patterns, even surfaced signature.



DRASS is developing its own combat management system with multi-function consoles equipped with state-of-the-art sensors, communication and augmented reality systems integrating AI. © DRASS

The latest developments in power generation and storage significantly impact on the indiscretion rate, which is the percentage of time that a submarine must snort when measured against the total time at sea. New generation combat systems and of underwater and surface sensors, exploiting artificial intelligence (AI), allow these platforms to perform almost all the offensive actions of a conventional submarine in blue waters. These assets can launch heavyweight torpedoes, deploy swimmer delivery vehicles, perform mining operations and covert reconnaissance, the latter thanks also to unmanned underwater, surface and aerial platforms, allowing manned-unmanned teaming activities. All the above makes these platforms not only a deterrent but also an offensive asset, to be well considered by pier and not pier adversaries.

DRASS

With an heritage that goes back to 1927 with Galeazzi's deep diving equipment, and the more recent merging with COSMOS (COStruzioni MOtoscafi Sottomarini) providing an underwater vehicles portfolio ranging from combat swimmer vehicles to midgets and compact submarines sold worldwide for decades, DRASS maintains its headquarters in Leghorn with production facilities in Italy and Romania, alongside commercial offices in Dubai, with a workforce of 200 units operating in 13,000 m^2 of covered facilities. With this vast knowledge, DRASS is addressing the challenges of current and future underwater operational scenarios with its latest DGK compact submarine. The DGK retains approximatively the same length of the DG160 but with a slightly higher displacement, and thanks to new technologies and an innovative design it offers the enhanced capabilities of a compact submarine such as the DG550. With an overall length and height of respectively around 34.5 and 7 metres, a hull diameter (equal to overall width) of approximately 3.5 metres, and a displacement ready to dive of about 220 tonnes, the DGK is able to safely operate in blue, green and brown waters, to navigate submerged in as little as 20 metres sea waters and reach an operational depth of over 200 metres.

Featuring a maximum submerged and on surface speed of respectively over 9 and 15 knots, the DGK remains stealth whilst carrying out operations of covert surveillance, intelligence and deployment of Special Forces in coastal areas, missions which cannot be conducted by conventional submarines.

Characterized by an optimized hull design and high-tech solutions enabling a significantly reduced signature compared to conventional submarines, and a fully redundant power and electric plant with reliable power generating sets and lithium-Ion battery packs, the new compact submarine design has a cruising range (snorkeling/submerged) of over 2,000 nautical miles (NM) and submerged range (on batteries) of almost 200 NM.

It can transport up to six Special Forces operators in addition to nine crew members thanks to the high automation. Fitted with an advanced combat system with a fire power consisting of two bow-mounted torpedo launchers with ready-to-fire wire-guided heavyweight torpedoes, in addition to two (optional) externally mounted launchers for the same weapons, the DGK can manage all mission profiles assigned to a conventional submarine, claims DRASS.

With an "always in water" operational requirement and installation of vital systems such as the batteries inside the main pressure hull, the DGK is externally characterized by stern X-rudders and sail planes providing optimal manoeuvrability, alongside Propeller Boss Vortex diffuser to minimize acoustic signature, a sail structure positioned amidship with exit trunk for the deployment of special forces, and reconfigurable ballast tanks for extended missions. The GRP hydrodynamic hull structure external shape allows the location of dedicated spaces in the top free flooding areas (fore and aft of the sail) for transportation of payloads in addition to two inflatable boats each capable to carry four SF operators. These spaces can host alternatively a DRASS DS8 9 metres SDV, mine racks (6x) or a single ROV behind the sail, and drones and their launch and recovery systems in front of it. The submarine has been designed in a single hull configuration divided in three sections that are bolted together and can be disassembled for maintenance and rapid road transportation allowing discreet relocation. The single deck pressure hull features, from stern to bow, a propulsion and machinery room, main switchboard and electronic equipment and combat centre areas, radio, sanitary, mess and reconfigurable cabins and living quarters for payload accommodation.

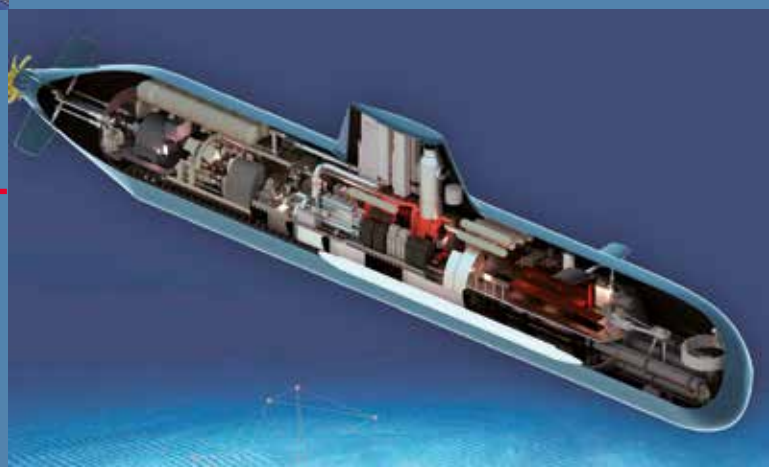
In addition to an integrated platform management system, DRASS is developing its own combat management system with multi-function consoles equipped with state-of-the-art sensors, communication and augmented reality systems integrating artificial intelligence, allowing enhanced situational awareness and connectivity. Besides a baseline passive sonar suite (featuring a forward-looking sensor with 3D scan), the new boat is fitted with a fully electric sail with up to five masts; one of them carries a new optronic solution, while another one is dedicated to signal and intelligence, another one



To enhance the new DGK compact submarine's stealth capabilities across diverse operational conditions, a well-designed camouflage pattern was applied by DRASS to the sail and masts. © DRASS



The S800 LS developed by Fincantieri and unveiled at IDEX/NAVDEX 2023 can conduct all the missions assigned in the brown, green and blue waters, carrying a weapon package of nine (plus one) heavyweight torpedoes and swimmer carrier vehicles. © Luca Peruzzi



With a crew of 18 and the capability to carry eight SF operators, the S800 LS is being promoted by Fincantieri with a combat and platform management system based on four multifunctional consoles. © Fincantieri

carrying navigation systems enabling precise detection, tracking, and evasion of threats in both shallow and deep waters. Based on the development activities and tests already conducted on previous DRASS mini subs such as the DG160 and DG550, the DGK design is ready for production.

FINCANTIERI

The IDEX/NAVDEX 2023 exhibition saw the unveiling by Fincantieri of the S800 Light Submarine (S800 LS), which was developed to meet all main requirements for missions in the littoral environment, and at the same time provides comparable performance of conventional submarines operating in blue waters to more than 250 metres depth. The S800 LS has been conceived based on experiences and technologies developed with the U212A and U212NFS programmes and smaller platform concepts to operate in shallow waters. With an overall length of 51 metres, a pressure hull diameter of 4.80 metres and a total height (including masts) of 10 metres, the S800 LS is characterized by a compact hull design with a very low signature and automated platform control system, featuring 'X' stern rudders and forward hull-positioned hydroplanes, providing the boat high manoeuvrability and sea bottom contours following. With a ready to dive and submerged displacement of respectively 750 and 850 tonnes and an operational depth of 250 metres, the S800 LS is characterized by a diesel-electric propulsion system featuring a 12-cylinder turbocharged diesel engine with synchronous generator and a permanent magnet excitation electric motor driving a 3 meters diameter propeller, alongside two battery banks providing a maximum submerged speed of over 15 knots, and a submerged range at 4.5 knots of respectively over 200 Nautical Miles (NM) on batteries and 4,500 NM with snorkelling cycles and batteries. Indiscretion rate, according to Fincantieri, is indicated at 10% at 4.5 knots without providing further data, while endurance is reported at 30 days. No other details have been provided by the Italian shipbuilder on the electric power generation and storage



The S800 LS is characterized by a compact hull design with a very low signature, featuring 'X' stern rudders and forward hull-positioned hydroplanes, making the boat highly manoeuvrable. © Luca Peruzzi



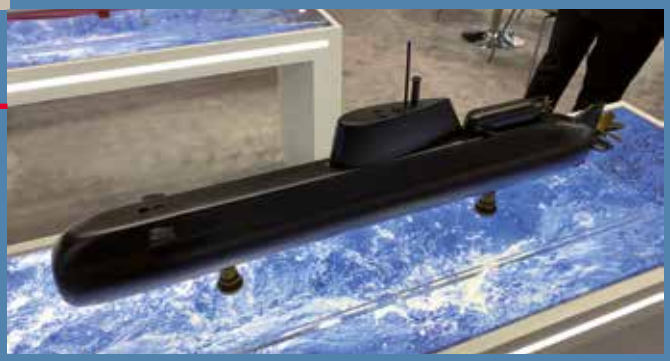
M23, formerly GSE Trieste, is well known for having participated with the Button 5.60 vehicle here depicted, in teaming with General Dynamics/Electric Boat to the US Navy tender for the current generation of a tailored Midget Carrier for the USSOCOM. © M23

but together with other Italian companies, namely Seri Industrial Group's FIB-FAAM, Fincantieri is working on a Lithium-Ion battery-based national solution for the Italian Navy's U212NFS programme.

The S800 LS is also being promoted with an additional air independent propulsion (AIP) solution centred on two Fuel Cell modules with a maximum output power of 70 kWe each. Fincantieri claims the AIP plant will provide a submerged range at 4.5 knots of 4,500 NM, "bringing to zero the indiscretion rate for 7 days of submerged patrol." Thanks to its design, the S800 LS is the most suitable strategic asset for supporting Special Forces (SF) missions, providing the capability to release and recover two swimmer delivery vehicles in fully covert operations. The new submarine has been developed with a high degree of automation thanks mainly to Fincantieri's NexTech participation on U212NFS where the company is responsible for the integrated platform management system. With a crew of 18 among officers (5) and crew (13) and the capability to carry a team of eight SF operators, the S800 LS is being promoted by Fincantieri with a combat and platform management system based on four multifunctional consoles of which three devoted to the combat system and one to the platform control. No further details were provided on the proposed solution, but these should derive from the work done by Fincantieri on the U212NFS programme with Leonardo and Avio, which respectively provide the new combat management system and the enhanced autopilot. The sensors suite includes an attack periscope, an optronic search mast, communications and navigation radar masts, a signal intelligence suite with dedicated mast and electronic warfare/direction finding equipment on periscope. The sonar suite includes a passive flank array sonar, a passive cylindrical array sonar, an active array and an obstacle avoidance



Thanks to the STM500 compact submarine project, developed by STM to accomplish a wide range of missions, Turkey will join the club of countries capable to design, build and outfit a submarine. © Paolo Valpolini



With a length of 42 metres and a submerged displacement of 450 tonnes, the STM500 has a firepower of 4+4 heavyweight torpedoes and can carry a swimmer delivery vehicle behind the sail. © Luca Peruzzi

sonar, alongside an underwater telephone. It also features a torpedo countermeasures system, the latter expected to be based on a Leonardo solution. The S800 LS is equipped with five swim-out pneumatic heavy-weight torpedo (HWT) tubes with a reloading system for a total load of nine (plus one) weapons, possibly Leonardo Black Shark Advanced HWTs. No details have been released so far on the S800 LS programme, except that it is at a development stage compared to a post critical design review (CDR) milestone and its delivery would require four years since contract award.

M23

Based on the experience acquired in over 30 years of activities in the underwater domain by the Italian company's GSE Trieste, the M23 spin-off company established in 2019 has the in-house know-how and capability to design, test, build and deliver manned underwater vehicles. These range from swimmer carrier vehicles to more complex midget submarines, featuring an enhanced Combat Management System capability, with length spanning from 6 to 25 metres. M23, formerly GSE Trieste, is well known for having participated in teaming with General Dynamics/Electric Boat to the US Navy tender for the current generation of a tailored Midget Carrier for the US Special Operations Command (USSOCOM) with the Button 5.60 vehicle capable to transport four special forces operators in addition to two pilots. Also known as UOES3 (User Operational Evaluation System 3), the vehicle was extensively evaluated by the USSOCOM. No further details were released about the current company production except for the fact that an undisclosed Midget Submarine with enhanced capabilities is already in the hands of an unidentified customer and has been sailing for some time, according to the company.

M23 designs its underwater vehicles on customer requirements. These are based on a high percentage of in-house design and solutions, making these assets not only ITAR-free but also not dependent from other countries embargo issues.

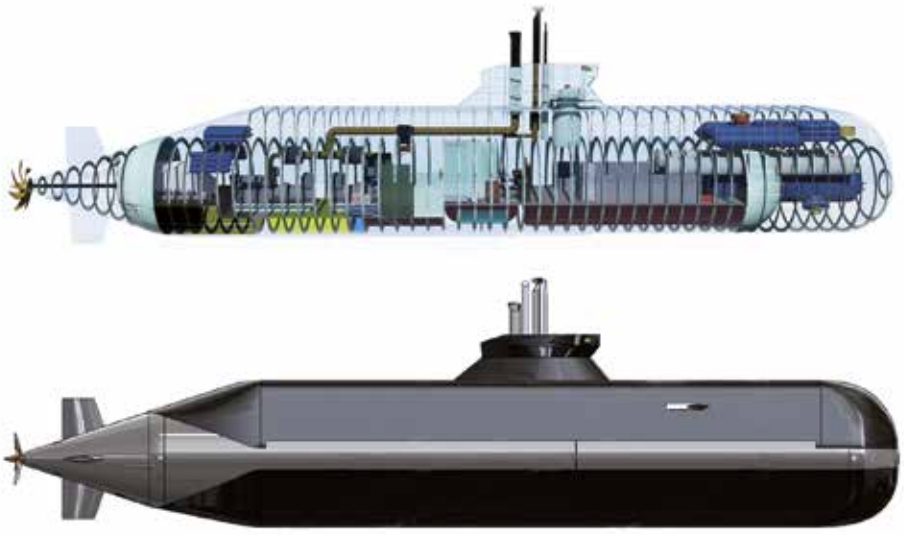
The company has an overall workforce of around 120 personnel distributed in two facilities located near Bergamo, Northern Italy, with an overall surface of around 35,000 m^2 between covered and open areas. Depending on their design, M23 midgets can be built to operate in a wide depth environment from 50 to 400 metres depth and can be equipped with a full combat management system. Although few details were released, in addition to passive underwater and surface surveillance and navigation sensors, including sonar and signal surveillance equipment, the most capable platforms can be equipped with a full range of tailored weapons including heavy and/or lightweight torpedoes, in addition to mine laying capability. They are also able to carry, deliver and recover special forces personnel and equipment.

Propulsion and energy storage solutions can be based on lead-acid or lithium-ion batteries depending on customers' requirements.

According to export documentation released by Italian authorities in 2020 and other open-source documents, M23 has a 190 million Euro programme related to the supply of two midgets to an undisclosed Middle East customer. In addition to the supply of the two underwater vehicles, the programme also includes a comprehensive training, a simulator, additional equipment and services.

STM

At IDEF 2023, the Turkish STM engineering company announced that the first elements of its new shallow water diesel-electric STM500 submarine design have started assembly. The company is expected to start building blocks assembly later on in 2024. Being developed to accomplish a wide range of missions, including anti-submarine warfare (ASW), ISR, special operations support, mine warfare, unmanned operations, especially in shallow water environments, thanks to this project Turkey will join the club of countries capable to design, build and outfit a submarine, anticipating the national submarine (MILDEN, Milli Denizalti) project to equip the Turkish Naval Forces. With a length and diameter of respectively 42 and 4.2 metres, a maximum height of 8,5 metres and a displacement of respectively 485 tonnes on surface and 450 tonnes submerged, based on latest model and videos, the STM500 features an external design with stern cruciform rudders and bow planes to enhance manoeuvrability in coastal waters, a slightly backward sail with exit trunk for deployment of Special Forces operators, and an accommodation area behind the sail for a swimmer delivery vehicle, and other payloads. Two diesel generators allow the charge of Lithium-Ion batteries packs which power the approximately 1.5 MW permanently excited propulsion motor driving the screw. The STM500 has an endurance of 3,500 NM when running on diesel, while on batteries it reaches 75 NM. STM has also proposed an air independent propulsion (AIP) system, without providing details about its nature and capabilities, which brings the endurance to 4,000 NM, according to the company. Information provided by other sources stated that the STM500 pressure hull could be made in the future with high strength steel provided by Turkish industry, alongside an undisclosed number of components of the propulsion system by undisclosed national companies. With a maximum diving depth of over 250 metres and an operational endurance of 30 days, the STM500 has been designed with accommodation for 18 crew members and the capacity to host six Special Forces operators. The living and accommodation areas with galley, dry provisions, freezer room and separated mess rooms are hosted in the



Unveiled at IDEF 2021, the Dearsan L SUB 33 has a crew of 6-8 members and can carry six SF operators. It has two standard HWT launchers and carries an undisclosed number of torpedoes and six bottom mines. © Dearsan

bow area, where we also find the four 533 mm standard torpedo launchers and associated reloading equipment. As anticipated, the stern hull section is devoted to the propulsion and electric power generation while the under-sail section accommodates the platform and command management centre. To accomplish the wide range of missions requested to the STM500, although no details have emerged about the combat system management the latter is expected to be a tailored variant of Advent-Müren first indigenous CMS for underwater platforms developed by Havelsan; STM was responsible for its integration on the in-service submarines of the Turkish naval Forces under their mid-life upgrade programme. The STM500 features a sensors suite installed on dedicated masts, including a navigation radar, optronic search and attack periscope, electronic support measures (ESM) and communications systems expected to be supplied by companies such as Aselsan and Havelsan. The sonar suite includes a cylindrical hydrophone array (CHA) sonar with transducer array positioned in the bow, passive ranging, intercept detection and ranging sonar (IDRS), mine avoidance system, own-noise array and cavitation indication equipment expected to be provided by Tubitak Bilgem and Meteksan. As anticipated, the STM500 is equipped with four standard 533 mm torpedo launchers with reloading capacity of which two tubes are available for guided missiles, with four extra weapons stowed on board in addition to the four in the torpedo tubes. The new submarine is also equipped with anti-torpedo countermeasures such as the Aselsan Zargana.

OTHER DEVELOPMENTS AND CONCEPTS

The Turkish shipbuilder Dearsan unveiled at IDEF 2021 the model of the “Light Submarine L SUB 33” compact submarine, which has been developed so far as a concept design being offered on the international market. The L SUB 33 is 33.6 metres long with a 3.05 metres beam, and features cruciform tail rudders and forward hull-mounted planes, characterized by a unique low-signature sail design. It is designed to conduct ASW, ASuW, ISR, SF operations, mine hunting command and control, asymmetric warfare and underwater search and rescue missions. Equipped with a diesel-electric propulsion package based on two diesel generators and an electric motor, it has a surface and submerged speed of respectively 6+ and 10+ knots, and an endurance

of 1,600 NM at undisclosed patrol speeds. With an operational dive depth of 150 metres, and a crew of 6-8 members plus six SF operators, the LSUB 33 is equipped with two NATO standard HWT launchers and carries and undisclosed number of torpedoes and six bottom mines. The sensors package includes a sonar suite, radar and periscope masts, in addition to communications and navigation equipment.

The UK BMT maritime-oriented high-end design house and technical consulting firm unveiled in 2017 and subsequently introduced novel variants of the Wyvern concept, offering a modern approach to submarine design, leveraging latest technologies for new capabilities or upgrades. Acknowledging global budget constraints, the Wyvern concept presents a cost-effective yet capable solution for a variety of maritime missions, including ASW, ASuW, ISR, Special Forces, training, and emergent tasks. Emphasising a straightforward design philosophy, Wyvern utilises open-source standards and equipment supplier data, tailored to generic operational requirements. This concept put at the forefront of the platform design process its availability, considering the whole life cycle including maintenance activities centred on programmed splice hull cuts. With a surface and submerged displacement of respectively 720 and 860 tonnes, a length and pressure hull diameter of respectively 46 and 4.5 metres and a 20% reserve buoyancy, the Wyvern has a 15 crew and can carry six SF operators. With a propulsion package including a Saab Kockums Stirling AIP, the endurance is 20 days, including on station, four days submerged using the AIP, and average transit distance, speed, and time assessments. The boat is equipped with four swim-out HWT launchers and a forward access route/trunk for SF operators. The combat system is based on a six-console suite managing a sensors package with optronic masts, signal intelligence, communications and sonar suite. The concept explored the potential for a hydrogen AIP system, as well as various platform configurations; these might include unmanned underwater vehicles and/or external batteries, showcasing the Wyvern adaptability. ■

The Wyvern concept by BMT is proposed as a cost-effective yet capable solution for a variety of maritime missions, including ASW, ASuW, ISR, Special Forces and emergent missions. © BTM



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