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Credit: author

Defence is the Best Form of Attack?

Over the past few months, the world has watched as Ukraine has made incremental gains in the Zaporizhzhia front in the South, and Bakhmut front in the East. In many ways this has not been a surprising state of affairs – as stated in ESD 05/2023, "expectations for a rapid victory are probably over-optimistic, and any Ukrainian gains are likely to be hard-won." So far this prediction has been borne out by the available evidence, as hopes of a rapid breakthrough have generally subsided.

Nonetheless, a common narrative is that since Ukraine remains on the offensive, this in of itself demonstrates a lack of capability in the Russian military, which finds itself on the back foot. This is partially true. However, opting to defend its existing gains was also a logical response in Russia's strategic position, and one which appears to be paying dividends. Since moving to a defensive posture, Russia's loss rates have fallen quite sharply. Using figures from the Oryx blog, we can compare confirmed Russian materiel losses incurred in 2022, to those incurred in 2023, the latter of which has been characterised by a largely defensive response to Ukraine's counteroffensive:

Type	Losses from 24/02/2022 to 31/12/2022	Losses from 01/01/2023 to 22/08/2023	Mean Average Losses per Month 2022	Mean Average Losses per Month 2023	Change Losses per Month 2022 to 2023
Tanks	1600	653	160	81.63	-49%
Assorted AFVs	743	206	74.3	25.75	-65%
IFVs	1872	808	187.2	101	-46%
APCs	283	60	28.3	7.5	-73%
MRAPs	43	3	4.3	0.38	-91%
Infantry Mobility Vehicles	176	25	17.6	3.13	-82%
Command Posts	217	30	21.7	3.75	-83%
Engineer Vehicles	261	74	26.1	9.25	-65%
SP Anti-Tank Vehicles	32	9	3.2	1.13	-65%
Artillery Support Vehicles	90	17	9	2.13	-76%
Towed Artillery	151	132	15.1	16.5	+9%
SP Artillery	302	197	30.2	24.63	-18%
MRLs	166	90	16.6	11.25	-32%
AA Guns	16	1	1.6	0.13	-92%
SPAAGs	23	1	2.3	0.13	-95%
SAM Vehicles	84	65	8.4	8.13	-3%
Radars	20	23	2	2.88	+44%
Jammers	22	28	2.2	3.5	+59%
Fixed-Wing Aircraft	67	18	6.7	2.25	-66%
Helicopters	74	28	7.4	3.5	-53%
UCAVs	4	10	0.4	1.25	+213%
Recce UAVs	152	121	15.2	15.13	-0.5%
Ships	12	1	1.2	0.13	-90%
Trucks, Utility Vehicles	2156	619	215.6	77.38	-64%

Of course, this is not an entirely fair comparison, not least since one is a 10-month timespan and the other an 8-month timespan. Nonetheless, the broad trend has been toward a sharp reduction in confirmed Russian average monthly losses in nearly all materiel categories, with only a few notable exceptions such as UCAVs, which have risen, or reconnaissance UAVs, which have stayed roughly the same. At the same time, although reliable figures remain difficult to come by, Ukraine's own losses are estimated to have risen quite considerably as it has pushed into well-entrenched Russian lines. This should be no surprise given the scale of Ukraine's task, or given that attacking is generally much harder than defending.

In light of these difficulties, Ukraine has been promised new capabilities in the form of F-16 fighter aircraft, as well as more cruise missiles and air defence systems. These are likely to alleviate some of the strain, but success will still ultimately hinge upon a major breakthrough on the ground. Looking at the observed fall in losses, it is hard to escape the impression that Russia is gradually starting to get the kind of war it prefers to fight. For Ukraine's allies, reversing this trend is likely to require providing more ambitious assistance.

Mark Cazalet

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AS21 Redback Emerges Victorious in Australia's Land 400 Phase 3 IFV Contest

(pf) South Korea's Hanwha Defense has secured the Australian Defence Force's (ADF's) Land 400 Phase 3 infantry fighting vehicle (IFV) requirement with its AS21 Redback, beating out a rival bid from Rheinmetall with its KF-41 Lynx, local news sources reported on 26 July 2023.

Credit: Hanwha Defense

The prize contract, however, will be much smaller than originally envisaged, as in April this year the Australian government of Prime Minister Anthony Albanese announced that it was slashing the procurement of IFVs under Land 400 Phase 3 from 450 vehicles to 129. The decision was made in response to Australia's Defence Strategic Review (DSR), which the Albanese government received in February 2023.

Land 400 Phase 3 is intended to replace the ADF's fleet of M113AS3/4 armoured personnel carriers, around 400 of which remain in Australian Army service.

According to the Australian Financial Review on 26 July, the Australian Cabinet's national security committee made the IFV decision on 25 July, informing the bidders and the South Korean and German governments the following day. As of 26 July, however, the decision had not been officially announced.

The Australian news website Defence Connect, meanwhile, stated in a report on 26 July, "It is understood that the Redback performed marginally better than its German competitor, the KF-41 Lynx, with [the Australian Department of] Defence deferring the decision ultimately to Government as both vehicles were deemed 'suitable' for Defence's requirements."

Some observers had thought the KF41 was the favourite to win Land 400 Phase 3 because the ADF had already selected Rheinmetall's Boxer 8×8 AFV to replace its wheeled Australian Light Armoured Vehicles (ASLAVs).

The AS21 Redback is an advanced version of the K21 IFV already in service with the Republic of Korea Army. It features an EOS T-2000 turret armed with a Bushmaster MK44S 30 mm cannon, a MAG 58 7.62 mm coaxial machine gun, 76 mm multi-barrel smoke grenade dischargers and two Spike LR2 missile launchers. The vehicle is protected by the Elbit Systems Iron Fist active protection system and powered by an MTU eight-cylinder diesel engine generating 1,000 hp.

The Australian Department of Defence shortlisted the Redback and Lynx for Land 400 Phase 3 in September 2019 and signed risk mitigation activity contracts with Hanwha and Rheinmetall the following month that called for three test vehicles to be delivered from each bidder. These were delivered in early 2021 and an announcement of the winning bidder was originally set to be announced in 2022.

Local subsidiary Hanwha Defense Australia will build the Australian Redbacks at a new factory near Avalon Airport in Geelong, Victoria.

Zelenskyy Footage Shows Ukrainian Air Force is Launching SCALP-EGs

(pf) Video footage of President Volodymyr Zelenskyy visiting a Ukrainian airbase has confirmed that the Ukrainian Air Force is now actively using French-supplied SCALP-EG air-launched cruise missiles: French versions of the Storm Shadow missiles already provided to Ukraine by the United Kingdom.

In the footage, posted on 'X' (formerly Twitter) by the Ukrainian Ministry of Defence (MoD) on 6 August 2023, President Zelenskyy is seen writing 'Glory to Ukraine' on a missile brightly labelled as a SCALP-EG that has been loaded under the wing of an Su-24 'Fencer' strike aircraft.

Credit: Ukrainian MoD

The Ukrainian MoD subsequently posted imagery on X indicating that "Storm Shadow missiles" had recently been used to attack and damage two road bridges to Crimea: one at Chonhar and another connecting Henichesk to the Arabat Spit. Both bridges have previously been targeted; putting them out of action would add significantly to Russia's burden in running resupply routes between occupied Crimea and Russian-held territory to its north.

French President Emmanuel Macron announced on 11 July 2023 that his country would provide SCALP-EG missiles to Ukraine, joining the UK, which first delivered Storm Shadow missiles to Ukraine in May this year.

The Storm Shadow/SCALP-EG, which is made by MBDA, is a turbojet-powered deep-strike missile that is officially quoted by MBDA as having a range "in excess of 250 km". However, its actual range is likely to be much further than that, with its use putting all Russian-occupied Ukrainian territory under threat.

The missile, which is 5.1 m long and weighs 1,300 kg, carries a blast/penetrator warhead and travels to its target using INS, GPS and terrain reference navigation.

UK MoD Awards GBP 870 M ECRS Mk2 Contract

(pf) BAE Systems has received a GBP 870 M (EUR 1.02 Bn) contract from the UK Ministry of Defence (MoD) to continue development and integration work on the European Common Radar System (ECRS) Mk2 for installation on the Eurofighter Typhoon, the company announced on 4 July 2023.

Credit: Leonardo

The majority of this funding will flow on to Leonardo UK as the lead for the aircraft's main sensing and survivability systems, which includes the ECRS Mk2: an advanced active electronically scanned-array (AESA) radar that also features electronic attack (EA) and electronic warfare (EW) capabilities.

Development and integration work on the ECRS Mk2 thus far has been conducted under a GBP 317 M contract awarded to BAE Systems and Leonardo in September 2020. This saw the first ECRS Mk2 delivered by Leonardo to BAE Systems' Warton site in April this year, where it is undergoing integration work and ground-based testing in preparation for its first flight tests next year on board Typhoon BS116, which is a Royal Air Force (RAF) test and evaluation aircraft loaned back to BAE Systems for its work.

The new funding announced on 4 July, a BAE spokesperson confirmed, will see the ECRS Mk2 progressed to the point where it is ready to go into production, with 12 radar sets produced under this latest contract.

ESD has previously been told by a BAE Systems spokesperson that the work required to fit the ECRS Mk2 into a Typhoon "is an incredibly in-

vasive, intrusive modification involving the entire front end of the aircraft, [involving a] new radome, new line-replaceable units, not just the antenna itself, [and] new cooling equipment. It's a very involved, invasive upgrade."
The current planning assumption of the UK MoD is that the ECRS Mk2 will be integrated on all 40 of the RAF's Tranche 3 Typhoons, although the MoD has announced it is retaining the option to also fit the radar onto the RAF's 67 Tranche 2 Typhoons.
The RAF's initial operational capability with the ECRS Mk2 is currently forecast for 2030.

Israel to Acquire a Third Squadron of F-35As

(pf) The Israeli Air Force (IAF) is to acquire a third squadron of Lockheed Martin F-35 Joint Strike Fighters.
The Israeli prime minister's office announced on 2 July 2023 that Defence Minister Yoav Gallant had approved a proposal by the IDF Chief of the General Staff, Lieutenant General Herzi Halevi, the Director General of the Israel Ministry of Defense (IMOD), Major General (Res) Eyal Zamir, and the Commander of the Israeli Air Force, Major General Tomer Bar, to procure a third F-35 squadron for the IAF).
The Israeli MoD is to purchase 25 additional F-35As, which are known as Adirs in Israeli service, to add to the 50 F-35s already procured. The deal, valued at approximately USD 3 Bn (EUR 2.74 Bn), will be financed by US Foreign Military Financing.
Following the defence minister's approval, the IMOD Mission to the USA will issue an official letter of request to the F-35

Credit: IAF

Lightning II Joint Program Office (JPO). This step will facilitate the approval and signing of the transaction in the coming months.
Israel became the first country to select the F-35 through the US government's Foreign Military Sales process when a letter of agreement was signed in October 2010. The IAF received its first F-35A on 22 June 2016 and declared its F-35 fleet operationally capable in December 2017. The IAF's second F-35 squadron was inaugurated in 2020.

Russian Landing Ship Damaged in Ukrainian USV Attack

(pf) The Ukrainian armed forces appear to have significantly damaged the Russian Ropucha-class landing ship Olenegorskiy Gornyak during an unmanned surface vehicle (USV) attack in the Russian Black Sea port of Novorossiysk on the night of 3-4 August 2023.
The Russian Ministry of Defence claimed on the morning of 4 August that an attack carried

Original footage: SBU

out by two Ukrainian USVs in the port of Novorossiysk had failed when both of them were destroyed "by fire from the standard weapons of Russian ships guarding … the naval base".
However, a video post on the Telegram messaging channel from the 'Operational Ukrainian Armed Forces', which various news sources described as being sourced from the Security Service of Ukraine (SBU), featured footage of what appeared to be a USV clearly closing on the port side of a Ropucha-class landing ship at night. Despite the ship's searchlights being on, no gunfire is apparent in the footage, which cuts out as the USV makes contact with the ship and presumably detonates.
Text accompanying the 'Operational Ukrainian Armed Forces' posting of the footage is entitled "SBU conducts special operation in Novorossiysk Bay - large amphibious assault ship Olenegorskiy Gornyak damaged".
The text goes on to state, "The video shows an SBU surface drone loaded with 450 kg of TNT attacking an enemy ship with about 100 crew members.
"According to Security Service sources, the special operation was carried out jointly with the navy. As a result of the attack, the Olenegorskiy Gornyak sustained a serious hole and is currently unable to carry out its combat missions. So all the Russians' claims about the 'repelled attack' are fake."
The text then concludes with, "We remind you that this is not the first successful SBU special operation using surface drones. Earlier, SBU Head Vasyl Malyuk said that the attack on Russian ships in Sevastopol Bay last October and the recent bombing of the Crimean bridge were the work of the Security Service."
Photographs subsequently appearing on social media show a Ropucha-class landing ship presumed to be Olenegorskiy Gornyak listing to port and accompanied by tugs in what looks very much like the bay at Novorossiysk.
Ropucha-class landing ships are 112.5 m long and have a full-load displacement of 4,080 tons. Destroying or heavily damaging one presents Ukraine with its most significant naval 'win' since the sinking of the Russian cruiser Moskva on 14 April 2022.
Moreover, if ever Russia's troops in Crimea are cut off from the rest of the Russian forces and the Kerch Strait Bridge is compromised, ships like Russia's Ropucha-class vessels could be needed to resupply them.
Within hours of the attack on Olenegorskiy Gornyak a Ukrainian USV damaged the Russian oil tanker Sig, while subsequent USV attacks have targeted bridges between Crimea and occupied Ukraine.

US State Department Approves F-35 Sale to Czech Republic

(pf) The US State Department has approved the Foreign Military Sale (FMS) of Lockheed Martin F-35 Joint Strike Fighters to the Czech Republic, the US Defense Security Co-operation Agency announced on 29 June 2023.
The sale, which covers 24 F-35A conventional take-off and landing (CTOL) variants as well as munitions and other related equipment, is valued at up to USD 5.62 Bn (EUR 5.15 Bn) and has been passed to the US Congress for final approval.

Credit: USAF

The Czech Republic selected the F-35 in July last year to replace the 14 leased Saab Gripen C/Ds currently operated by the Czech Air Force, the lease on which expires at the end of 2027. Prague had also considered Gripen Es and Eurofighter Typhoons to replace its leased aircraft.
As well as 24 F-35As and 25 Pratt & Whitney F135-PW-100 engines (ie one spare); the proposed sale to the Czech Republic includes 70 AIM-120C-8 Advanced Medium Range Air-to-Air Missiles; 86 GBU-53/B Small Diameter Bomb - Increment II (SDB-II) StormBreaker all-up-rounds; 12 Mk-84 general purpose 2,000-lb bombs or BLU-109 2,000-lb penetrator bombs for the GBU-31 Joint Direct Attack Munition (JDAM) guidance kit; 12 KMU-556/KMU-557 JDAM tail kits; 50 AIM-9X Block II/II+ Sidewinder short-range air-to-air missiles; plus associ-

ated spares and training systems for the munitions listed.
The wider contract also includes extensive engineering, technical, maintenance, logistics and programme support.
The principal contractors for the deal will be Lockheed Martin as the F-35 manufacturer as well as Boeing and Raytheon Missiles and Defense as the producers of the munitions.

Baykar Signs Major Deal with SAMI for Saudi Akıncı UCAV Production

(pf) Turkish unmanned aerial vehicle (UAV) manufacturer Baykar has signed a comprehensive deal with state-owned Saudi Arabian Military Industries (SAMI) for the production of Bayraktar Akıncı high-altitude long-endurance unmanned combat air vehicles (UCAVs) in Saudi Arabia.

Credit: Baykar

The agreement was announced on X (formerly Twitter) on 6 August 2023 by Baykar CEO Haluk Bayraktar, who stated, "With Bayraktar Akıncı exports, we signed the biggest export agreement in the history of the [Turkish] Republic in defence and aviation with the Saudi Ministry of Defence last week."
Bayraktar added, "Thus, a strong and strategic co-operation takes place between Turkey and Saudi Arabia."
SAMI was founded in 2017 to grow Saudi Arabia's defence-industrial base and reduce its reliance on foreign defence products. While the group has signed memoranda of understanding and established joint ventures with numerous Western defence companies, the relationship with Turkey's Baykar promises not only technology transfer but a significant advance in the country's indigenous unmanned airborne strike capabilities.
The Bayraktar Akıncı can fly at an altitude of 40,000 ft and has an endurance of 24 hours. Equipped with a multi-function active electronically scanned-array radar, it has dual-redundant satellite communications and navivigate with internal sensor fusion without having to depend on GPS. Baykar claims the Akıncı can conduct operations in co-operation with manned fighters and can perform air-to-air as well as air-to-ground missions.
The Akıncı can carry a range of ordnance, including Bozok, MAM-L and MAM-C mini-smart munitions; Cirit and L-UMTAS air-to-ground missiles; SOM-A stand-off air-to-ground missiles; Gokdogan amd Bozdogan air-to-air missiles; and a range of guided bombs.
While Saudi Arabia bought 50 Italian Selex Galileo Falco UAVs in 2012, its subsequent armed UAV purchases have been Chinese; an unspecified number of Chengdu Wing Loong medium-altitude long-endurance armed UAVs were ordered in 2016. Since then the kingdom has increasingly sought to develop its own capability to produce UAVs.

Canada Orders Four New A330 MRTTs, Conversion of Five More

(pf) The Canadian government has contracted Airbus Defence and Space to supply four newly built Airbus A330 Multi Role Tanker Transport (MRTT) aircraft and convert five used A330-200s into MRTT platforms for the Royal Canadian Air Force (RCAF), the company announced on 25 July 2023.
The order is worth approximately CAD 3 Bn or (EUR 2.1 Bn) excluding taxes).
Known as the Strategic Tanker Transport Capability (STTC), this new fleet of aircraft will replace the RCAF's ageing CC-150 Polaris (A310 MRTT) fleet, which is used to perform air-to-air refuelling operations, military and personnel and cargo airlift, medical evacuations, as well as transport Canadian government VIPs.
The newly built A330-200s will be assembled at the A330 final assembly line in Toulouse, France, and are scheduled to enter the conversion process at the A330 MRTT facilities in Getafe, Spain, in mid-2025. The first completed MRTT is to be delivered to the RCAF in 2027.

Image: Airbus

Under the agreement the A330 MRTTs will be equipped with both hose-and-drogue and boom refuelling options, maximising their compatibility with allied aircraft. The aircraft will additionally feature cyber security solutions and countermeasures and could also receive Airbus Medical Evacuation kit solutions, which consist of two intensive care units and additional stretchers.
The contract covers a full suite of training services, including full flight simulators, to prepare and maintain crew readiness as part of the modernisation of the Canadian armed forces' air operational training infrastructure.
Airbus was selected as the only qualified supplier for the RCAF's CC-150 tanker replacement in April 2021 following an open procurement process.
The A330 MRTT now has 76 orders from 15 customers, representing a market share outside the United States of 90%, according to Airbus. The aircraft, which can carry up to 300 troops, has clocked up more than 270,000 flight hours.
As an aerial refuelling platform the A330 MRTT can carry up to 111 tonnes of fuel – the highest capacity of all tanker aircraft, according to Airbus – and can offload 50,000 kg of fuel to a broad range of receivers during a four-hour loitering mission at over 1,000 n miles from its take-off point.

Rheinmetall Announces it Will Produce F-35 Fuselage Sections at Weeze

(pf) Germany's Rheinmetall announced on 4 July 2023 that, in co-operation with US partners Lockheed Martin and Northrop Grumman, it plans to build an "ultra-modern" factory at Weeze in the Kleve district of the German state of North Rhine-Westphalia (NRW) to produce fuselage sections for the F-35A Lightning II Joint Strike Fighter.
The decision on where to place the factory followed a review of possible locations around Germany, Rheinmetall said.
The new plant is due to produce at least 400 F-35A fuselage sections for the air forces of Germany and other friendly nations, with production expected to begin in 2025.
Germany officially joined the F-35 programme on 14 December 2022, when it signed a letter of offer and acceptance to acquire the aircraft.
The German decision to acquire the F-35 came in March 2022, when it was decided that 35 F-35As would be sought to replace the Luftwaffe's fleet of Panavia Tornado strike aircraft.
Featuring state-of-the-art technology, the planned factory will be operated through Rheinmetall Aviation Services GmbH and will feature 60,000 m2 of floorspace, with over 400 highly skilled personnel crewing the assembly line. In addition, the plant will include logistics and warehouse facilities, research and test centres, classrooms and quality control units.
"We're proud that our longstanding partnership with Northrop Grumman and Lockheed Martin and our decades-long relationship with the Bundeswehr is resulting in a genuine transfer of know-how to Germany," Rhein-

Credit: Northrop Grumman

metall chief executive Armin Papperger was quoted as saying in a company press release. "And we're very pleased to be contributing to the future viability of Germany as a technology powerhouse, and especially NRW: our long-standing corporate home. Close to the state capital in Düsseldorf, we're going to build a factory that sets standards Europewide. We're very grateful for the political and administrative support we experienced in Weeze during our search for a location."

"Northrop Grumman will replicate our automated and manufacturing technologies of the Integrated Assembly Line in Weeze," said Glenn Masukawa, vice president for the F-35 programme at Northrop Grumman. "Combined with Rheinmetall's capabilities, our collaboration with Lockheed Martin to manufacture the centre fuselage is critical in bolstering global security. We look forward to the success of this newest F-35 facility."

Romania Cancels Corvette Deal With Naval Group

(pf) The Romania Ministry of Defence (MApN) has cancelled the long-delayed EUR 1.2 Bn deal it had with France's Naval Group to acquire four Gowind 2500 corvettes.

According to the DefenseRomania website the decision was approved on 7 August and covers the whole process, meaning that a runner-up bid by Damen of the Netherlands will not be considered.

The MApN was quoted as stating, "The decision to cancel the specific procedure was taken … since the tenderer declared the winner did not sign the framework agreement within the terms requested by the contracting authority and the funds necessary to declare the economic operator in the next place as the winner were not identified".

Credit: Naval Group

Naval Group, teamed with local company Constanța Naval Shipyard, won the Romanian corvette contest in 2019, which would have seen four Gowind 2500 corvettes built in Romania, but a contract for the ships was never signed. Initially stalled by legal challenges, the deal became increasingly stymied by disagreements over rising costs.

The deal would also have covered the renovation of the Romanian Navy's two existing frigates.

Romania has a 245 km-long coastline on the Black Sea that stretches from the country's eastern border with Ukraine to its southern border with Bulgaria. Already tense in terms of security issues, the Black Sea has seen open conflict on its waters since Russia's invasion of Ukraine in February 2022: giving good reason for Romania to pursue stronger naval capabilities.

IDEF 23: Turkey's FNSS Unveils Kaplan Hybrid Vehicle Prototype

(pf) Turkey's FNSS has unveiled its Kaplan Hybrid Vehicle, exhibiting it for the first time at the IDEF 23 defence exhibition, held in Istanbul from 25 to 28 July.

The project has essentially involved FNSS taking its Kaplan-10 AFV platform and replacing its diesel engine with a unique

Credit: FNSS

hybrid diesel/electric powerpack featuring a 400 hp diesel engine and two PMSM electric motors providing a continuous 397 hp or peak output of 617 hp. This solution can also be integrated into other tracked platforms in the current and future FNSS portfolio, as well as other tracked vehicle families in need of capability enhancement and life extension, the company stated in a press release.

While the Kaplan hybrid propulsion system has been developed for tracked vehicles weighing up to 20 tonnes (the Kaplan Hybrid Vehicle has a combat weight of 17.5 tonnes), the system is intended to be resized for tracked vehicles of different tonnages in the near future.

The hybrid propulsion system of the Kaplan Hybrid Vehicle not only offers silent drive in electric-only mode but also the ability to integrate new-generation weapon systems with high energy needs: capabilities well suited to combat and reconnaissance scenarios. With a lithium ion battery offering 800 V and 56 kWh, the vehicle can operate in silent drive mode for 20 km at a constant speed of 10 km/h and can operate in stationary silent surveillance mode for 48 hours (or 14 hours if the vehicle is using its air conditioning system), according to the specifications detailed on the FNSS website.

FNSS states that its hybrid powerpack "offers remarkable off-road performance for a tracked vehicle with its external transmittable power and increased fuel economy". The company notes that the high torque provided by the new hybrid propulsion system give the vehicle better acceleration than other tracked platforms, providing a critical advantage in the field and the ability to respond quickly to battlefield conditions.

The Kaplan Hybrid Vehicle is stated by FNSS to have a power-to-weight ratio of 22-35 hp/tonne compared to 21 hp/tonne for the conventionally powered Kaplan-10. The vehicle has a maximum road speed in excess of 65 km, a 0-32 km/h acceleration of 6 seconds and a range greater than 525 km.

FNSS added that, while some subsystem components were imported to expediently produce the Kaplan Hybrid Vehicle, development of local alternatives is underway. One of the most important components to be produced locally is the cross-drive gearbox. This has a design unique to FNSS, which claims it has become one of the few companies with the technological competence to develop this type of system.

The project started in the FNSS Research and development centre in 2021. With assembly of the first prototype vehicle now completed, control software development and other improvement activities continue. Critical verification tests are planned to start towards the end of 2023.

Tunisia Receives Eighth and Final T-6C on Order

(pf) The eighth and final Beechcraft T-6C Texan II turboprop trainer on order for Tunisia has been delivered to the Tunisian Air Force's No 13 Squadron at Sfax Air base, the aircraft's manufacturer, Textron Aviation Defense, announced on 10 August 2023.

The US Department of State approved a potential USD 234 M (EUR 212.6 M) Foreign Military Sale to Tunisia of 12 T-6Cs plus related equipment in 2019, after which Tunisia decided in 2021 to buy eight with an option for an additional four.

Credit: Textron

The Beechcraft T-6C Texan II Integrated Training System for the Tunisian Air Force at Sfax Air Base will also include a ground-based training system, an operational flight trainer and a computer-based training lab.

Speaking at a 17 July 2023 event marking the arrival of the first four T-6C aircraft, US Ambassador to Tunisia Joey R Hood stated, "Tunisia plays an important role in ensuring not only its own national security but also that of northern Africa and the continent as a whole." He reiterated the US commitment to supporting Tunisia's efforts to strengthen its air force's capacity to respond both to security and humanitarian needs.

No 13 Squadron currently operates 17 SIAI-Marchetti SF-260 piston-engine-powered basic trainers, while Tunisia's jet trainer fleet consists of nine Aero L-59Ts. The T-6Cs are expected to replace both these types.

The T-6Cs will also serve as lead-in trainers for the four Beechcraft AT-6E Wolverine light attack aircraft Tunisia has on order, the sale of which was approved in February 2020. The T-6C and AT-6 share an 85% commonality in structure, avionics, and other systems.

USMC Trials F-35Bs Operations From Disused Highway

(hum) The Republic of Singapore Navy (RSN) submarine RSS Impeccable was received at Changi in Singapore on 20 July 2023, marking the arrival of the RSN's first boat of the Kiel-built Invincible class, according to the Singaporean Ministry of Defence (MINDEF).

Credit: MINDEF

The boat had left Kiel on board the transport ship *Rolldock Storm* at the beginning of June. A photograph published by MINDEF shows RSS *Impeccable* entering RSS Singapura – Changi Naval base, where a homecoming ceremony was held.

As build number 2 of the four-boat programme, Impeccable is the first submarine of the class to arrive in Singapore. The first boat, Invincible, will remain in Germany to support crew training, but was christened in 2019 and delivered in the meantime. According to MINDEF statements from late February 2023, Invincible is "expected to return to Singapore later this year following completion of sea trials".

Illustrious, boat number 3 in the programme, was named alongside sister ship *Impeccable* in Kiel on 13 December 2022 in the presence of German Chancellor Olaf Scholz. Shipyard thyssenkrupp Marine Systems (tkMS) was able to complete the factory sea trials of Illustrious this spring, but is not yet known when the boat will set sail for the Southeast Asian city state.

Impeccable will now carry out a series of sea trials to reach full operational capability.

The Type 218 SG/Invincible-class submarines are specially designed for deployment in the shallow and heavily trafficked tropical waters around Singapore. They will replace the RSN's Archer- and Challenger-class submarines, which are now more than 60 and 40 years old respectively and were procured by Singapore to gain experience and expertise.

Admiral Gilday Completes Tenure as US Chief of Naval Operations

(pf) Admiral Mike Gilday relinquished his post as the US Navy's Chief of Naval Operations on 14 August 2023 after successfully concluding his four-year tenure as the navy's top military leader.

In a ceremony at the United States Naval Academy in Annapolis, Maryland, Adm Gilday handed over to Vice Chief of Naval Operations Admiral Lisa Franchetti, who has been nominated by US President Joe Biden to be the next CNO and will perform the duties of the CNO until someone is formally appointed to that role in accordance with law.

Adm Gilday became the 32nd CNO in August 2019. As a member of the Joint Chiefs of Staff, the CNO acts as an advisor to the President of the United States, the National Security Council, the Homeland Security Council, and the Secretary of Defense. Under the direction of the Secretary of the Navy, the CNO is responsible for the command, utilisation of resources, and operating efficiency of naval forces and shore activities.

As keynote speaker at the ceremony Secretary of the Navy Carlos Del Toro emphasised Adm Gilday's "transformational leadership" and prioritisation of readiness during an era of strategic competition.

"Admiral Gilday boldly charged forward, leading and inspiring sailors at every level, from the tactical, to the operational, to the strategic… he's also championed our strategic relationships with allies and partners," said Del Toro. "He served as our 32nd Chief of Naval Operations during a pivotal – and perhaps sometimes even a bit chaotic – time for our fleet, for our nation, and for our friends around the world."

Credit: US Navy

For his part, Adm Gilday reflected on the adaptation and change the US Navy has undergone in adjusting to a new and challenging security environment, while also calling for the Department of Defense to "act with urgency and purpose" in order to maintain maritime superiority. He expressed confidence and optimism in the navy's direction, while praising sailors and families around the Fleet for their resilience and service.

"We have the best Navy in the world," said Gilday. "Every day, our people are standing the watch, operating globally and at the tip of the spear, strengthening our alliances and partnerships."

Adm Gilday described Adm Franchetti as exceptionally well qualified to take up his post, stating, "I am proud that she will be my CNO. She is a fleet sailor, an operator, a warfighter. She has already made the navy better as our Vice Chief of Naval Operations; the navy is in good hands with her at the helm."

'Stolty' Sees his Term Extended as NATO Secretary General

(pf) Former Norwegian prime minister Jens Stoltenberg has had his tenure as NATO secretary general extended by a further year, until 1 October 2024, the alliance announced on 4 July 2023.

The decision is to be endorsed by NATO heads of state and government at the alliance's 2023 Vilnius Summit, which takes place on 11-12 July.

Stoltenberg took office as NATO secretary general on 1 October 2014, meaning he will eventually have been in post for a full decade. He is already the second-longest-serving NATO chief after Joseph Luns of the Netherlands, who served for 12 years and 268 days from October 1971 until June 1984.

In response to the announcement, Stoltenberg was quoted by NATO as saying, "I am honoured by the decision of NATO allies to extend my term as Secretary General. The transatlantic bond between Europe and North America has ensured our freedom and security for nearly 75 years, and in a more dangerous world, our great Alliance is more important than ever."

Extending Stoltenberg's tenure gives continuity to the NATO leadership at a time when the allies need to maintain a united front in supporting Ukraine against the Russian invasion that began in February 2022. However, it is also a sign that the allies cannot reach a consensus on who should succeed him.

Candidates mentioned as being in the frame for the job include the prime ministers of Spain and the Netherlands, Pedro

Credit: NATO

Sánchez and Mark Rutte respectively, as well as two female candidates: Ursula von der Leyen, the president of the EU Commission; and Mette Frederiksen, the Danish prime minister. While UK Defence Secretary Ben Wallace had openly aspired to the job, he withdrew his candidacy in June this year after it became clear the United States would not support it ahead of keeping Stoltenberg in position or promoting a candidate from one of the 'new NATO countries' most keenly feeling Russia's belligerence.

The UK, at any rate, has already provided three NATO secretary generals – Hastings Ismay, Peter Carrington and George Robertson – which is surpassed only by Italy, which has provided four (although Alessandro Minuto-Rizzo was an acting head who only served for 15 days), and equalled by the Netherlands, which has also provided three. Stoltenberg was the first Norwegian to take up the post, succeeding the first Dane, Anders Fogh Rasmussen, who served from August 2009 until October 2014.

Fortifying the Eastern Frontier: Poland Modernises its Armed Forces

Sidney E. Dean

As a NATO frontline state neighbouring Russia, Poland has long been concerned with its security. Moscow's invasion of Ukraine has fortified Warsaw's interest in modernising and strengthening its armed forces.

Poland's high-speed acquisition programme is partially driven by the need to replace significant amounts of equipment donated to Ukraine, and partially by the general need to retire outdated Soviet-era gear. The greatest motivation is the recognition – evident since the 2014 annexation of Crimea – that Russia is willing to undertake aggressive action along and across its borders. Poland is planning to double the size of its armed forces to 300,000 by 2035, with a corresponding increase in hardware. Warsaw's modernisation efforts cover all military domains. To ensure a rapid acquisition schedule, the nation is looking to sources in Europe, North America and Asia. This article examines the high-end weapon systems being acquired.

Credit: US Army

US Army M1A2 Abrams tanks fire at targets in a combined arms live-fire exercise during Anakonda23 at Bemowo Piskie, Poland, 9 May 2023. Poland is receiving 250 M1A2 tanks, as well as 118 older M1A1 Abrams.

Army Systems

US-Sourced Ground Systems

In spring 2022, Warsaw signed a USD 4.75 Bn contract for Abrams Main Battle Tanks (MBTs) to replace 240 Soviet-era tanks delivered to Ukraine. This includes 116 M1A1 FEP Abrams MBTs to be delivered through the end of 2023 to fill an urgent requirement for more firepower, and 250 more modern M1A2 SEPv3 tanks to be delivered in 2025-2026. The order also includes an additional 43 armoured tracked support vehicles.

Under a 2019 contract valued at USD 414 M, 20 US-made M142 High Mobility Artillery Rocket System (HIMARS) rocket artillery systems (including two training units) are being delivered through 2023. The first units were delivered by Lockheed Martin Missiles and Fire Control in May 2023, with the rest to follow by the end of 2023. Each launcher unit can carry either six M30/M31 Guided Multiple Launch Rocket System (GMLRS) missiles with a range of about 84 km or a single Army Tactical Missile System (ATACMS) missile with a 300 km range. Both munition types are included in the order. In February 2023, the US State Department approved the sale of an additional 18 HIMARS units.

In May 2023, Lockheed Martin revealed that Poland's armament's agency was expected to invite the firm to negotiate a framework accord for the HIMAR-A programme which aims to integrate the HIMARS rocket launcher on the Polish Jelcz 6 × 6 truck; the negotiations would also encompass Polish production of the relevant munitions. The US State Department has already approved the sale of 468 launcher loader module kits plus munitions which could be fitted onto the Polish trucks.

South Korean Land Systems

In summer 2022, Poland signed procurement contracts with South Korea for various land-based weapon systems as well as combat aircraft. The contract is valued at USD 14.5 Bn and includes approximately 1,700 armoured ground combat vehicles. First deliveries were made in December 2022. Early availability was one of the major advantages of procuring South Korean systems, given the large backlog of orders for many US weapon systems and limited production capacity in some European nations.

Major weapon systems scheduled for early delivery include 180 Black Panther K2 MBTs, 212 Thunder K9-A1 self-propelled (SP) howitzers, and 288 K239 Chunmoo Multiple Launch Rocket Systems (MLRSs). These figures concern the first acquisition tranche, which consists of materiel to be transferred from South Korean army stocks. The first units of the K2 and K9 weapon systems, along with support vehicles, were delivered by ship in December 2022, with the rest of the first tranche to be delivered through 2026. In the long term, Poland plans to acquire an additional 820 K2/K2PL MBTs and 460 K9PL howitzers, some of which will be built in new facilities to be opened in Poland in 2026.

The K2 Black Panther is lighter than the M1 Abrams tank, which can be advantageous for manoeuvring in eastern European terrain. The K2PL MBTs built in Poland are due to be a customised variant optimised for Warsaw's requirements. Under a 'maximalist' proposal for K2PL, the vehicle would be lengthened, with seven roadwheels per side instead of six, and the additional payload capacity

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largely used to improve protection. Under this proposal, the steel/composite armour is augmented by explosive reactive armour (ERA) and bar armour, supplemented by side skirts to improve protection of the vehicle flanks. The three-person crew is augmented by a high-speed automatic loading system. The 120 mm main gun handles a variety of munitions including the KSTAM II gun-launched, sensor-fuzed, explosively-formed penetrator (EFP) top-attack munition, with a maximum range of 8 km, K279 armour-piercing fin stabilised discarding sabot tracer (APFSDS-T) and K280 high explosive anti-tank multi-purpose tracer (HEAT-MP-T) rounds. Another advantage over the Abrams is the use of diesel rather than JP-8 fuel; this is not only cheaper, but significantly reduces the logistical burden in the field.

The K9PL self-propelled howitzer (SPH) is also set to be optimised for Polish requirements. Changes include a chrome-lined barrel with a 50% greater service life compared to the original. Additionally, the Polish Army has ordered a further 48 Krab SPHs, partially to offset Krabs donated to Ukraine, and deliveries of this new batch are due from 2026. The Krab is a hybrid system consisting of a Korean K9 hull with a British AS90M Braveheart turret and gun and the Polish Topaz fire control system. The SPH is manufactured by Polish firm Huta Stalowa Wola 9HSW.

Credit: US Army

Polish K2 tank on static display for a live fire demonstration in Bemowo Piskie, Poland on 31 March 2023

Army Helicopters

Poland is acquiring 32 AW 149 medium utility helicopters from Italy under a July 2022 contract with Leonardo. Production will take place in Poland by PZL Swidnik. Deliveries are expected to take place between 2023-2029. Warsaw has furthermore contracted for purchase a total of 96 Boeing Apache AH-64E attack helicopters, with deliveries slated to begin in 2026 or 2027. In May 2023, it was agreed that eight units would be delivered in advance to expedite training by Polish forces, although the statement did not specify whether the advance aircraft were part of the purchase lot or a loan from US military stocks. Poland is acquiring 800 Lockheed Martin Hellfire II missiles to deploy on both helicopter types. Deliveries of the missiles are expected to take place in 2023-2029.

Credit: US Army

Polish K9 howitzer during a live fire demonstration in Bemowo Piskie, Poland on 31 March 2023.

Air Force Systems

Poland's Air Force currently has 48 F-16C/D Fighting Falcons as its most advanced combat aircraft; the American jets entered service in 2006-2008. Poland would have liked to acquire 48 more Falcons, but Lockheed Martin's long waiting list would have forced Warsaw to wait years for deliveries. South Korea offered an attractive alternative.

The July 2022 procurement contract with Seoul included USD 2.5 Bn for 48 supersonic (Mach 1.5) FA-50 Golden Eagle jets suitable as both trainers and as light combat aircraft. The capabilities profile of the Korean jet, which incorporates F-16 technology, is often compared to the Falcon, with the added benefit of a lower unit cost. The first tranche of 12 Block 10 aircraft, designated the FA-50GP (Gap Filler) could be delivered as early as August 2023 to meet an urgent requirement and to begin pilot orientation. Follow-on deliveries will consist of FA-50PL Block 20 aircraft equipped with Sniper Advanced Targeting Pods, AIM-120 AMRAAM integration, and the Phantom Strike AESA radar. These aircraft will also have a greater onboard fuel capacity as well as the Chobham aerial refuelling kit. The first aircraft with the Chobham refuelling probe will be tested by Korean Aerospace Industries (KAI) in Saechon before serial assembly begins in 2025. Deliveries are expected over the 2026-2028 timeframe.

In future, Warsaw plans to introduce 32 F-35A stealth fighters under a 2020 contract with deliveries expected between 2024-2026. Together, the FA-50, F-16 and F-35 will provide the Polish Air Force with a tiered,

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Polish Procurement Summary – Army			
System	**Source**	**Requirement**	**Schedule**
K2 MBT	Korea/Hyundai Rotem	180	2022-2025
K2PL MBT	Korea/Hyundai Rotem	820	2026+
M1A1 FEP	US Army	118	2023
M1A2 SEP3	USA/GDLS	250	2025-2026
BWP Borzuk IFV	Poland/HSW	1,000	2024+
K9A1 155mm SP Arty	Korea/ADD	212	2022-2026
K9PL 155mm SP Arty	Korea/Poland	460	2026+
Krab 155mm SP Arty	Poland/HSW	48	2026-2027
M142 HIMARS	US Army	20 (+200)	2023
K239 Chunmoo MRLS	Korea/ADD	288	2023+
Narew AD/CAMM-ER	UK/MBDA	23 Batteries	Mid-Late 2020s
PSR-Pilica+ SHORAD	Poland/UK/MBDA	15 Batteries	2024+
AH-64E Attack Helicopter	USA/Boeing	96	Late 2020s+
AW-149 Multi-Mission Helicopter	Italy/Leonardo	32	2023-2029

Polish Procurement Summary – Air Force			
System	**Source**	**Requirement**	**Schedule**
FA-50GF Block 10	Korea/KAI	12	2023
FA-50PL Block 20	Korea/KAI	36	2025-2028
F-35A	USA/Lockheed Martin	32	2024+
MQ-9B Reaper	USA/General Atomics	Undisclosed	2024+
SAAB 340 AEW&C	Sweden/SAAB	2	Mid-2020s
C-130H	US Air Force	5	2021-2024
S950 VHR EO Satellites	Airbus	2	2027

Polish Procurement Summary – Navy			
System	**Source**	**Requirement**	**Schedule**
Miecznik Class Frigates (Arrowhead 140)	UK/Babcock	3	2029-2030
Orka Attack Submarine	Undetermined	3	Pending
Komoran-2 Class Minehunter	Poland/Remontowa	3	Beginning late 2020s
Signals Intelligence Ships (Artemis Class)	Sweden/SAAB (with Remontowa)	2	2027

mutually supportive capability spectrum. The tactical air fleet will be coordinated through two Saab 340 Airborne Early Warning and Control aircraft. Contract negotiations with the firm, which were made public in May 2023 by Polish officials, were ongoing in June 2023. The turboprop AEW&C aircraft are being acquired as an urgent operational requirement (UOR). They will be able to detect incoming cruise missiles and other aerial targets at a range of several hundred km, a considerable improvement over the 50 km range of current ground-based air defence radars (due to radar horizon limitations). The aircraft to be acquired will be pre-owned, but will be upgraded by Saab with new sensors and avionics.

Naval Systems

The Polish Navy's modernisation was previously discussed in detail by Grzegorz Sobczak in ESD 4/2023, allowing for a summary here.

The Polish Navy is acquiring three multi-mission frigates designated as the Miecznik class. The ships are being built by a consortium of Polish firms in partnership with Babcock (ship design), Thales (integrated combat system) and MBDA UK (air defence). The 7,000 tonne vessels will have 16 Saab RBS-15 anti-ship missiles as well as 32 VLS cells, each capable of accommodating four MBDA CAMM short-range air defence missiles. The anti-submarine kit will include the Thales BlueHunter active-passive hull-mounted sonar and a CAPTAS low-frequency towed sonar, as well as 2x2 launchers for EuroTorp MU90 impact torpedoes. The ships are due to be delivered by 2029-2030, with full operational capability by 2034.

In May 2023, Polish Defence Minister Mariusz Blaszczak announced that Warsaw was reviving the Orka attack submarine programme. The formal effort will be launched later in 2023 with the aim of acquiring three vessels capable of deploying heavy torpedoes against surface ships and submarines, as well as long-range land-attack cruise missiles. Several European manufacturers, as well as South Korea's

Daewoo Shipbuilding and Hyundai Heavy Industries, are considered potential bidders for the contract.

Air Defence Systems

In April 2023, Poland ordered MBDA's Common Anti-air Modular Missile (CAMM) short-range air defence (SHORAD) system to form the outer layer of Poland's Pilica+ VSHORAD/SHORAD combined batteries. Launch vehicles and missiles to equip 22 Pilica+ batteries are valued at EUR 2.2 Bn. Poland had previously received its first CAMM battery in 2022 to meet an urgent requirement under the 'Mała NAREW' programme. Additionally, MBDA and the Polish armaments agency PGZ have been working towards contracting the technology transfer and Polish manufacture of the mid-tier NAREW air defence programme, which is armed with the CAMM-ER (extended range) missile. Furthermore, the parties have been exploring cooperation on future missiles for higher air defence tiers (through a contract placed in 2022). In addition to land-based air defence, Poland will employ CAMM interceptors for its future maritime air defence system on the Miecznik class frigates.

On 28 June 2023, the US State Department approved the sale of up to 48 PATRIOT air and missile defence systems to Poland. The authorised transfer could include up to 48 M903 launch stations; 644 PATRIOT Advanced Capability 3 Missile Segment Enhanced (PAC-3 MSE) missiles; and 12 Lower Tier Air and Missile Defense Sensor (LTAMDS) radars. Poland has not yet placed an order, but the US Government approval clears the way for Warsaw to negotiate a procurement contract with the PATRIOT system's primary manufacturers, RTX and Lockheed Martin. Should Poland choose to pursue the procurement option – as is expected – the deal could have a total value of USD 15 Bn.

Credit: PGZ Group

Concept of Babcock's Arrowhead-140PL design for the Miecznik frigate programme.

Going Forward

Warsaw is working to boost its own defence industry as it acquires foreign systems. This includes licencing agreements permitting production components, munitions and complete weapon systems in Poland. This also includes ongoing construction of a facility to build F-16 fuselages (for export to the US) in southern Poland, a KA-50 maintenance facility, as well as a production facility for PATRIOT missile launchers. South Korea has also agreed to support in-country production of the ground combat systems Poland is procuring, with facilities in Poland becoming operational mid-decade. Ultimately, this is a win-win for the defence industry of both nations, as Korea could find it easier to market to additional European armies if production and maintenance sites are local rather than half a world away.

By the time all current procurement orders are fulfiled, Poland will have the strongest land forces in Europe; the planned force of 1,500 MBTs alone will be larger than the combined tank fleets of the other European NATO allies. Given the aggression and the instability signalled by Russia, this will offer reassurance to Poland as a frontline state, but should also provide a strong bulwark for the neighbouring allies as well. Finally, doubling the size of the armed forces will permit Warsaw to play an increased role in international and out-of-area security affairs. ■

Through the Looking Glass

Tamir Eshel

Intelligence gathering, surveillance, and reconnaissance (ISR) are time-honoured cornerstones of military strategy. From the era of horse-mounted scouts to the epoch of globe-circling satellites, the potency of ISR lies in its power to collect, analyse, and leverage information about adversaries in the carrying out of successful military operations.

While the modes of ISR have evolved over the years, the underlying principles have remained rooted in their foundations. Before the dawn of revolutionary technologies such as drones, cameras, balloons, telescopes, and artificial intelligence (AI), ISR was vital in military affairs. Armies relied on human observation and the skills of experienced commanders to understand the terrain and evaluate enemy posture, positions, movements, and capabilities. The information gathered by observers was fundamental for operational planning, shaping the battlefield, executing the right move at the right time, and consequently, often determining the victor.

Fast-forwarding to the modern era, technology has profoundly transformed how ISR is conducted. No longer reliant on field reports by observers and reconnaissance patrols, ISR has embraced high-tech observational tools, delivering real-time, detailed, and accurate information and insight. Yet, for all the technological leaps, the age-old tenets of ISR remain as significant today as they were millennia ago. This article analyses the evolvement of ISR and offers a look ahead.

At the tactical edge, handheld solutions such as the TacFusion binoculars from Photonis are capable of fusing low-light day and thermal channels to enable target detection out to 3 km in low-light conditions.

The domain of intelligence gathering has traditionally been rooted in long-range observation. For many years, holding the highest ground equated to seeing the furthest thereby giving your own forces a critical advantage. However, inventions such as the hot air balloon and aircraft revolutionised this dynamic, facilitating aerial dominance over vast, flat landscapes. However, these advances came at an elevated risk to the observers and platforms.

With the advent of reconnaissance satellites equipped with powerful telescopes or synthetic aperture radar (SAR), the risk was mitigated by providing the world's leading governments the means to monitor any area of interest around the globe, though not in real-time.

The ushering in of unmanned systems has since democratised this realm, empowering every military, paramilitary, insurgent, and terror actor to observe and strike from

Application	Observation Means	Mission Characteristics
Intelligence Gathering	LORROS, MALE/HALE UAS, Observation & SAR Satellites, SIGINT, 2D/3D Mapping	Long-range, high-volume, data collection from a stand-off range, change detection capabilities
Target Acquisition	MALE/Tactical/Mini UAS, Covert Ground Observation, Special Forces, JTAC	Long-range, very high accuracy, fast turnaround, concealment
Counter Terrorism	Mini UAS, WAMI, SAR/GMTI, Mobile Observation Systems, 3D Mapping, Change Detection	Relatively short-range, short-term persistent surveillance over designated areas, high accuracy, forensic investigation capabilities, rapid turnaround, concealment
Terrain Analysis	Multispectral Reconnaissance (materials, composition, ground), Change Detection, Measurement and Signature Intelligence (MASINT), Light Detection and Ranging (LIDAR), FOPEN	Broad area coverage, multispectral measurement, 3D mapping
Force Protection	Elevated Surveillance, Aerostat, Mini-UAS, UGVs, Ground Surveillance Radars, Unattended Sensors, WAMI, SIGINT	Wide-area persistent surveillance, life pattern analysis, anomaly detection, forensic investigation
Border/Coastal Protection	Physical Obstacles, Sensory Fences, Mast-mounted Sensors, Aerostats, UAVs, UGVs, Unattended Sensors, Change Detection, SIGINT, WAMI	Linear persistent surveillance, life pattern analysis, anomaly detection

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Thanks to its expertise, Photonis was the first manufacturer in the world to develop white phosphor image intensifier tubes and is also the only company to offer a 16mm format tube. A new standard which enabled the design of modern, lighter and smaller night vision binoculars. While it is important to maintain the best performance of an image intensifier in all light conditions, it is nearly equally important to make this opto-electronic system as easy and comfortable to use in battlefield conditions allowing effective soldiers to operate safely.

Moreover, with the broader availability of night vision devices, the challenge is to have the best performance image intensifier based equipment that is always more efficient than the one of the opposing forces.

Preferred technology for European Armed Forces

The 4G is perfectly suited to the stringent requirements of night combat operations by providing operators high image quality and long detection ranges in the most challenging light conditions. Following decades of experience with in-service night vision devices using Photonis image intensifiers, the 4G in 16mm format has become the standard in all major European Land Forces programs: Germany, Belgium, United Kingdom, Spain, The Netherlands, Poland notably.

Reducing the load on a soldier is a constant challenge: reduction of SWaP (Size Weight and Power) contributes to enhance the efficiency and effectiveness of armed forces. Night vision devices that are designed around the 16mm offer the tremendous advantage of having the same level of performance as those based upon the 18mm tube, but with significantly reduced weight.

With such advanced technology, Photonis enables soldiers' tactical situational awareness, agility and mobility. And Photonis has not yet said its last word...

Credit: Safran

Safran Vectronix's tripod-mounted GonioLight provides a stable platform for observation and target acquisition equipment. The configuration shown here includes the Vector 23 rangefinder binoculars and JIM LR FLIR.

Credit: Teledyne FLIR

Developed for US defence and federal agencies, the R80D SkyRaider delivers a range of versatile Group 2 and 3 payload capabilities with the agility and single-operator deployment footprint of a proven Group 1 Vertical Take-Off and Landing (VTOL) aircraft.

the sky or sea. Visual Intelligence (VISINT) is often considered the gold standard for state and military entities. VISINT harnesses a plethora of visual information from all sources, processes it, and presents it to decision-makers for comprehensive analysis and subsequent action.

Visual Intelligence

Image acquisition methods for VISINT span a broad spectrum, ranging from spy satellites orbiting hundreds of kilometres above the Earth to high-altitude UAVs surveying vast expanses of land or sea, and even down to small, low-flying drones that capture detailed imagery of specific targets. Although the means to secure the imagery might vary, the techniques and goals remain consistent.

These systems commonly employ multispectral imaging, which includes visible (VIS), near-infrared (NIR), short-wave infrared (SWIR) components to sense direct and reflected light. Going beyond these, medium-wave (MWIR), and long-wave infrared (LWIR) infrared thermal sensors can detect tiny temperature variations, providing imaging of thermal signatures of objects and their surroundings. As such, these latter two can operate in total darkness, identifying objects based on their unique heat signatures rather than reflected light. These sensors are typically designed for long-range performance, extending visibility beyond national borders and facilitating stand-off operations while keeping the reconnaissance systems themselves safely out of range.

Modern VISINT systems frequently combine various sensors, some even operating simultaneously to extract a fused image that conveys more information than each channel could provide. This data is processed to highlight objects of interest. If past images of the same area exist, they are compared with new images to reveal changes indicative of enemy infrastructure build-up, force movements, logistics activities, and other preparations.

Multispectral imaging merges observations across several spectral bands, providing a deeper understanding of the scene. With this technology, analysts can see through camouflage and vegetation, identify earthwork and fortifications—even when covered—and potentially spot land mines and improvised explosive devices (IEDs) based on the subtle disruption they cause to the soil.

Previously, such processing demanded extensive communication and computing resources, available only at national-

level intelligence and imagery processing centres. These centres also served other purposes, such as maintaining a 'target repository' for precision-guided munitions or resources for mapping and analysing potential battlefields. Today, some of these resources are more accessible, with some even available at the operational level, supporting counter-terrorism activities and special operations.

Observation systems fill intelligence and situational awareness gaps at multiple levels of a force, with ground observation posts, UAVs, and satellites are employed. However, at the tactical edge, the general trend leans toward Vertical Take-Off and Landing (VTOL) UAVs, which can deliver high-quality and responsive ISR. Sensor manufacturers are adapting to meet this need, integrating multi-sensor payloads into the low-space, weight, and power (SWaP) form factor of a few kilogrammes. Such payloads require the drone to be equipped with sufficient power to process images and videos, providing tactical users with actionable intelligence and targets. Similar capabilities have also been extended to tactical vehicles.

The intelligence-gathering process becomes more time-sensitive at the lower echelons for activities carried out close to one's own forces. The time to acquire, process, and disseminate information to the user is paramount. This forms part of the 'sensor to shooter' cycle of target acquisition, which gained relevance with the introduction of guided munitions in the 1990s. Today, as both sides of the war in Ukraine demonstrate, target acquisition and fire direction are routinely conducted using unguided artillery, mortar, and rocket fire, with spotter drones flying over the combat zone.

Credit: EVPU Defence

Longer-range vision systems, such as the EVPU Defence Sirius optronic sight pictured above, incorporate day and thermal sensors, and are capable of detecting targets out to ranges of 25 km, depending on the variant.

Target Acquisition

Target Acquisition (TA) and Battle Damage Assessment (BDA) frequently merge observation, range finding, and target

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designation equipment. These systems are mounted on a goniometer to ensure the alignment and precision necessary for the weapon in use. Targeting systems might be integral to the weapon systems – for example, combat aircraft, attack helicopters, or tanks – or utilised by a specialised reconnaissance or fire support vehicle. Vehicular systems, less restricted by space, weight, and power, achieve longer ranges and higher resolution. However, since these assets must maintain a direct line of sight with their targets, they are inherently exposed and vulnerable to enemy fire.

To enhance the survivability and resilience of dedicated TA assets, sensors are affixed to telescopic masts. This setup enables the vehicle to operate from a defilade position or under a tree canopy. Dismounted teams also manage portable equipment. Both methods rely heavily on camouflage systems to conceal their position and favour maintaining a static position as long as they remain undetected. With the advent of smaller, lighter payloads, these missions are increasingly assigned to unmanned systems – autonomous ground vehicles, fixed-wing, and multirotor drones. The latter also excel in BDA as they can maintain continuous coverage of the target throughout the engagement.

Besides improving crew security and safety, these platforms have introduced a new capability: the ability to conduct tactical observation and target acquisition Beyond Line-of-Sight (BLOS). Matching this function with precision-guided weaponry has introduced a new and transformative capability to the modern land battle.

Surveillance Systems

Observation systems are critical in surveillance missions, encompassing border and coastal defence, force protection, and public or infrastructure security. These missions necessitate ongoing surveillance of specific areas, a task often challenging for human operators due to the high concentration and alertness required over extended shifts. The employed equipment blends a myriad of sensors designed for day, night, and adverse weather operations. The fusion of visual intelligence and radar is highly beneficial due to the radar's ability to detect movement and cue the observation system to scrutinise the detected activity.

This integration can also harness unattended sensors placed throughout the area under surveillance. Modern devices capable of wide-area surveillance also provide data for video motion detection and automatic target recognition. This enables systems to undertake much of the routine surveillance tasks, allowing operators to concentrate on analysing suspected targets and high-alert situations.

While most surveillance networks depend on a static sensor network, even the most robust system has some vulnerabilities that seasoned and determined adversaries could exploit. Incorporating mobile segments into such a network enhances the overall system's efficiency. Mobile observation posts may use relocatable unattended sensors, mounted patrols, or drones. These can be deployed pre-emptively based on intelligence information or ad-hoc to strengthen specific lines of access where adversary activity is anticipated.

Summary

Intelligence gathering, surveillance, and reconnaissance have always been pivotal elements of military strategy. Despite the profound transformation of ISR methods through technological advancements, their founding principles remain relevant. This article explored various facets of ISR, from intelligence gathering and target acquisition to border surveillance and security.

Visual intelligence plays a critical role in amassing and processing visual information. With advances in video processing, AI/machine learning, and automatic target recognition, users are now better equipped to exploit this information. Consequently, sensor operators are transitioning into analytical roles, and information processes are being automated into real-time information systems. As technology continues to evolve, the future of ISR holds immense potential to elevate situational awareness and decision-making capabilities within military operations. ■

Preparing Tactical Command Posts for the Next War

John Antal

Nearly every day, the news from the fighting in Ukraine includes the unmasking, targeting, and destruction of a Russian or Ukrainian tactical Command Post (CP). Imagine what it takes to reconstitute a destroyed brigade or division CP. Numerous generals, hundreds of colonels, and senior operators have been killed in these strikes since the start of the war. NATO cannot afford to lose CPs the way the Russians and Ukrainians have in the Russia–Ukraine War. Russian CP configurations at the start of the conflict were not much different from NATO's CPs. Based on these insights, it is vital to rethink how modern military forces prepare their CPs for combat.

As the authors of a March 2023 article, 'The Graveyard of Command Posts,' in the US Army's Military Review stated: "We must rethink command posts for this new era of warfare. In the face of this immediate threat ... command posts will need to adapt to such an extent that they will be unrecognisable to the generation of leaders that fought in Iraq and Afghanistan."

NATO's tactical CPs, as they are currently equipped and operated, are not ready for combat and will not survive the first strike of the next war. Lessons from three recent wars, the Second Nagorno-Karabakh War (2020), the Israel–Hamas War (2021) and the ongoing Russia–Ukraine War (2022-?) demonstrate that CPs are high-value targets and at great risk in the modern battlespace. These recent conflicts are the future of military combat: the Second Nagorno-Karabakh War (2020) was the first war in history won largely through mass employment of robotic systems; the Israel Defence Forces (IDF) declared the 2021 war with Hamas as the first to be won primarily by artificial intelligence; and the Russia–Ukraine War is the largest conflict in Europe since 1945 and employing perhaps the greatest range of military technology in history.

Author

John Antal, US Army (Retired) is a best-selling author and a thought-leader in military affairs.
He writes and speaks extensively about the art of war and the changing methods of warfare.

Credit: USAF

In today's battlespace, Command Posts (CP) are vulnerable. We must reimagine how we prepare CPs for war. In this image, a target explodes after being struck by rounds from an AC-130J Ghostrider Gunship near Hurlburt Field, Florida, 20 June 2023.

The primary takeaway is that destroying command and control is the essence of 21st century warfare. Today, CPs are nearly impossible to hide and extremely difficult to defend. Finding and targeting a CP is at the top of the enemy's to-do list. Preparing survivable CP configurations now, and equipping them to win, must be a priority.

Towards a Transparent Battlespace

In the past, the enemy had to be seen and heard with human eyes and ears, and visualised with the use of analogue maps and terrain models. Seeing at night and in extreme weather was particularly difficult. Winning armies undertook extraordinary means to mask their locations; in addition to taking advantage of low night-time visibility, they have made use of environmental conditions including storms and fog, and terrain obscurants such as forests, mountains, and urban terrain. Knowing what was over the next hill, or around the corner in an urban setting required human reconnaissance.

Today, however, a range of sensors are quickly augmenting or in some areas replacing such forms of reconnaissance. Multidomain sensor capabilities, now possessed by even third-tier military powers, have made it much more dif-

ficult to hide on the battlefield. Multidomain sensor networks employ technology able to scan from space down to the mud at ground level to reveal targets. Creating an unblinking eye that identifies, locates, and tracks targets in a congested battlespace is not simple. It takes sophisticated planning and systems to reveal the enemy, but it offers a battle-winning advantage and is worth the investment. When ubiquitous sensors are coupled with long-range precision fires, capable of hitting and destroying targets at extreme ranges, staying alive on the modern battlefield can be a challenge.

In the Nagorno-Karabakh War in 2020, Gaza in 2021, and Ukraine from 2022, the combined effort of sensors, drones, and long-range precision fires have shaped the conduct of these conflicts. Seeing enemy forces in the battlespace, and being able to strike them nearly anywhere, is a revolutionary disrupter to traditional methods of warfare. The battlespace is becoming more transparent – a layer of sensors can stream real time information to reveal the battlespace and confirm battle damage, putting every CP potentially at risk. General Mark Milley, the US Chairman of the Joint Chiefs of Staff, stated: "The probability of being seen is very high. In a future battlefield, if you stay in one place for longer than two or three hours, you'll be dead." With the rapid accelera-

Credit: US Army

Large command posts in tents, as shown here, provide a tempting target.

Credit: John Antal

An Armoured Brigade Combat Team (ABCT) Tactical Operations Centre operates at the National Training Centre, Fort Irwin, California, in September 2022. ABCTs now have M1087 Expandable Van Shelters, known as 'Expando-Vans', to use for CPs. These vans are easier to set up than tents but offer no significant protection.

tion of sensor technology, even two or three hours may be optimistic. Our CP mindset should embrace the concept that there are no longer any safe areas, and we are likely in range of enemy fire. Anything less is inviting disaster.

Reimagining Tactical Command Posts

Command and Control (C2) of military forces and executing mission command is the most important warfighting function. The purpose of a CP is to assist the commander in the execution of Mission Command (MC). MC contends that human decision-making 'at the point of contact' generates a flexible and winning approach that fosters harmony, initiative, and speed by understanding the commander's intent, carrying out mission-type orders, and empowering lower-level initiative. The CP facilitates the commander's execution of MC by enabling the commander to better understand, visualise, describe, direct, and evaluate combat operations.

For decades, tactical CPs have been set up in tents and vans, some elaborate enough to house scores of operators with banks of computers, large display screens and other ancillary equipment. Today, gathering critical, human-brainpower in one location, within range of enemy sensors and fires is a recipe for catastrophe. Tents offer no protection from drones or artillery strikes. Modern alternatives, including CP trailers, called 'Expando-Vans,' such as the US Army's M1087 Expandable Van Shelter, are not much better. Although these vehicles provide an easier CP set-up, they are not truly mobile CPs, as soldiers cannot operate from inside them when they are on the move. These shelters are relocatable, meaning they take time to set up, break down, and move. During an attack by drones, artillery, or missiles, they provide little protection. To improve survivability in the modern battlespace, CPs should be armoured, mobile, masked and dispersed. This is not the traditional CP thinking, but is the harsh reality of modern combat. We must not hesitate in rapidly defining the major design parameters that will prepare a modern CP to meet these requirements.

Armoured: In the Second Nagorno-Karabakh War, Azerbaijan destroyed Armenian tactical CPs in the first weeks of fighting as they were easily discovered and primarily housed in tents and unhardened facilities. In the Israel–Hamas War, the IDF tracked the locations of Hamas leaders and synchronised their attacks with sophisticated, artificial intelligence. As we are witnessing in the Russia–Ukraine War, many Russian CPs have been destroyed by Ukrainian long-range precision fires.

The logical alternative to 'soft' cover CPs is to maximise available armoured vehicles for protection from enemy fire. Any armoured vehicle furnished with the necessary Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) equipment is far superior to a tent or soft-skinned tactical vehicle. Forming a mesh network of mobile, armoured CPs makes the enemy's reconnaissance and targeting problems more difficult. Each armoured vehicle node must be equipped with the C4ISR systems necessary to independently take over the fight.

In 1982, US Army Gen. Donn A. Starry said, "... experience convinced us that the Corps battle cannot be fought from the Main CP and we believe the evidence is sufficiently compelling for us to field an armour-protected TAC CP [tactical command post] with sufficient equipment and personnel to track the battle and issue timely orders." His insight was true then and is more poignant today in against even a near-peer opponent. Military forces will need to either adopt armoured vehicle CPs, occupy hardened urban facilities, or 'dig in' deep and fast.

Mobile: CPs can no longer stay in any position for extended periods. While most current CP solutions are re-locatable, they require too much time to set-up, breakdown, and reposition, and cannot operate on the move. A mobile CP that is agile and can move in an instant will reduce vulnerabilities to incoming fire. In a transparent battlespace, only mobile and protected CPs will survive and be capable of conducting MC on the move, thus increasing the probability that the CP will survive. MC on the move allows commanders to lead closer to the front, with a smaller tactical footprint, and with a higher chance of survivability. CPs must have the capacity to conduct MC on the move, consistently practice this ability, and never forget that if we do not rise to the level of our expectations, we fall to the level of our training.

Masked: To hide in this transparent battlespace, CPs must mask to survive. Masking calls for full spectrum, multi-domain effort to deceive enemy sensors and disrupt enemy targeting. CPs require the equipment, and the tactics, techniques and procedures (TTP), to mask in the areas of optical (be the best at physical camouflage), thermal (reduce heat signatures), electronic (lower emissions and manage electronic signatures), and acoustic (dampen sounds). CPs can also generate false-positive signals to deceive enemy sensors by using decoys and avoiding obvious concentrations of vehicles. A group of three to four vehicles appears like a platoon to most sensors, and there will be many platoons in the battlespace, making identification and targeting much more complicated. On the other hand, eight or more vehicles presents a much more recognisable, and thus tempting, target. Thus, we must network groups of 2–4 vehicles into MC nodes to form a mesh CP structure.

Dispersed: A survivable CP configuration requires new thinking about how CPs operate, communicate, and share information in the battlespace. We can no longer concentrate equipment and operators in easy-to-find-and-destroy target sets. For example, a mesh battalion-level CP configuration could be comprised of three distributed nodes of two C4ISR equipped armoured vehicles per node, dispersed according to the terrain and threat, and using the same common operational picture (COP) to track and synchronise the battle. This mesh arrangement becomes resilient when each node is ready to assume command as required. An ideal mesh CP configuration is a flexible, self-forming, self-healing, and self-organising tactical network arrangement of command nodes. A mesh CP configuration distributes the CP infrastructure into resilient 'functional nodes' that are spread out, and masked throughout the battlespace, yet remain in effective communication. This 'Distributed Mission Command' employs smaller, dispersed command nodes to execute the functions of the CP without staff co-location. The goal is to enhance continuity and survivability of the command function in the modern battlespace.

Visualising the Future

The only constant in leadership and war is change. Leaders need foresight to visualise and prepare for the next fight. The systematic unmasking and attack of CPs in recent conflicts is a wake-up call. If we change our views about CPs to organise them around Distributed Mission Command, using a military internet cloud and hardware, then we can deliver the function of a CP and provide persistent MC as a service, not a geographical location. Imagine if we established CPs in a mesh network of command nodes, each comprising 2–4 networked armoured vehicles, that allowed any commander, from battalion to corps, to operate from any of the nodes. The commander would traverse from node to node to enhance command presence and leadership. If one node is disrupted, another takes over, and the new acting commander seamlessly takes charge of the unit.

To avoid turning CPs into graveyards, commanders must reimagine how they conduct MC and adopt new TTP for CPs. As Gen. James McConville, Chief of Staff of the US Army, said in October 2022: "In the future, the battlefield will be so lethal, and there'll be the ability to gather [targeting] information on where our command posts are, so we're going to have to move them very, very quickly, and they'll have to be dispersed and smaller." The lesson from the Second Nagorno-Karabakh War, the Israel–Hamas War, and the Russia–Ukraine War is clear: in the modern, transparent, lethal battlespace, the target that sticks out gets hammered. Sir Winston Churchill once said: "Want of foresight, unwillingness to act when action would be simple and effective, lack of clear thinking, confusion of counsel until the emergency comes, until self-preservation strikes its jarring gong—these are the features which constitute the endless repetition of history." Lack of foresight to prepare tactical CPs will result in them being quickly targeted and destroyed, with the resulting, irreplaceable loss of experienced commanders and staff. While there has been much discussion of equipping CPs for modern combat, not enough is being done to field new systems and train command-staff teams. Preparing tactical CPs for the next war is a vital task that demands immediate action, lest we fall victim to ignoring the poignant and deadly lessons learned from recent and ongoing conflicts. ■

Marketing Report: Will-Burt

The Will-Burt Compact Elevation System

The concept for Will-Burt's Compact Elevation System (CES) was driven by the desire to have a highly efficient mobile elevation system that could accommodate large and heavy sensor payloads while being small enough to conceal the entire package. This is no small task when one considers the size and weight of advanced sensor packages that combine a pan and tilt, multiple video sensors and radar.

The requirement is to quickly and covertly deploy sensors for UAV defence, border surveillance, and force protection. Flexibility is critical. The system is based on a pallet design that can be installed on a variety of vehicles, trailers, and shelters. Will-Burt offers multiple integrated solutions for small trucks and military spec trailers and the Compact Elevation System can also be purchased as a standalone product as well, so that a customer may integrate the system onto their own specialised platform.

The low-profile design makes it possible to conceal the stowed elevation system and its payload below 630 mm and conversely allows it to elevate the payload to a height of 8,540 mm. Will-Burt offers two telescopic mast types for the Compact Elevation System that are field proven and MIL-STD 810 tested and certified to perform under the most difficult environmental conditions. The Stiletto AL mechanical mast with a payload capacity of 181 kg and the Super Heavy-Duty Pneumatic mast with a payload capacity of 241 kg can be fully integrated into the system, offering power, precision, and rock-solid stability for the customer-installed sensors. Both telescopic masts have full-length external keys that minimise rotational twist, allowing the sensors and radars to perform at their full potential.

Lastly, the entire system is fully integrated with a single CAN-Bus/Serial user interface that is easy to operate and supplies system status feedback as well. It may also be integrated directly into the customer's control system.

Will-Burt is a global organization founded in 1918 and headquartered in the USA with manufacturing and support locations in the UK, Germany, Turkiye, and Singapore.

Credit: Will-Burt

The Future of Persistent Ground Surveillance

Tamir Eshel

Ground surveillance consistently monitors ground activities and has historically relied on radar and observational data. This integration of multiple pieces of equipment, such as cameras, radars, and other electronic sensors, results in a single-band or multi-spectral surveillance coverage over a specified area. Unlike conventional systems relying on single sensor feeds inspected by human operators, persistent surveillance enables continuous monitoring by automated means, acting as an 'unblinking eye.' Constantly analysing the sensor feeds, these systems may prevent incidents by early threat detection and even pre-empt potential issues, enabling a swift and timely response.

Digital imagery has revolutionised persistent ground surveillance, introducing significant technological advantages. Unlike traditional methods, modern systems mostly automate operations and can perform constant surveillance without fatigue or attention lapses. These systems cover large areas, including harsh or inaccessible terrain, delivering real-time information to their operators. They automatically detect and track suspicious objects within predefined areas or by analysing the object's activity. Video processing can be done on the camera or at the command centre. Depending on the activity of a detected target, these systems trigger an alert through rule-based or behaviour analysis that can be learned automatically over time.

The early 2000s saw the development of persistent ground surveillance technology. They played a major role in the US-led 'Global War on Terror,' operating as part of force protection packages on aircraft, aerostats, and unmanned aerial vehicles (UAVs) used by coalition forces in Afghanistan and Iraq. The Israel Defense Forces (IDF) also have utilised these capabilities to secure Israeli borders. Today, persistent surveillance capabilities are already introduced in some 'safe city' programmes despite public concern about the privacy issues they create. This article addresses the technological aspect of persistent surveillance but does not delve into the public debate about the legality of the civilian use of those systems.

Credit: USAF/Tech. Sgt. Robert Cloys

US Air Force MQ-9 UAV equipped with Gorgon Stare were operated by the 455th Air Expeditionary Wing in Afghanistan for persistent surveillance and force protection.

A crucial feature of these systems is their ability to integrate live and archived data from various sources. Collecting and analysing data from multiple sources, such as thermal cameras, radar systems, acoustic sensors, and satellite imagery, provides a holistic picture of the surveillance area and deep insight into perpetrators' potential hostile activities and preparations. This allows for more accurate detection and response. These capabilities are further enhanced by advanced video motion analysis algorithms, artificial intelligence (AI), and machine learning (ML). They allow the system to identify patterns, detect anomalies, and predict potential threats.

Persistent ground surveillance utilises various sensors and software tools to gather information and continually monitor vast areas of interest. Each tool offers unique capabilities, from the optronic sensors' passive surveillance and high-resolution imagery to the all-seeing Gorgon Stare Systems' real-time wide-area motion imagery (WAMI) and Multi-INT payloads.

Wide-Area Motion Imagery

Optronic sensors operating in visible (VIS) and near-infrared (NIR) wavebands, are extensively employed by military and security forces for intelligence, surveillance, and reconnaissance (ISR). These sensors act passively, though some utilise infrared light to actively illuminate the scene. Certain active systems deploy pairs of infrared (IR) sources and sensors, functioning as 'optical tripwires' that prompt action when their line of sight is disrupted. There is also the and short-wave infrared (SWIR) band, which is particularly good at highlighting muzzle flashes and is thus employed in hostile fire indicator applications.

Traditional cameras demanded constant human monitoring, however, newer automated systems now leverage real-time image processing technologies, such as video motion detection and object recognition algorithms that can automatically trigger alerts, transforming the operator's role from monitor to analyst. Modern wide-area optronic payloads are explicitly designed to blanket extensive areas with high-resolu-

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tion imagery, facilitating the identification of individuals, vehicles, and other objects without human monitoring.

The US-based company Logos offers a compact wide-area motion imagery (WAMI) payload called Redkite-1, designed explicitly for the Insitu RQ-21 Integrator Group III Tactical UAV. The company also developed the Blackkite-1 pod to accompany the Redkite-1 missions at night. The company extends similar capabilities with its Redkite pod system, which is adaptable for light aircraft or helicopters. This compact system can conduct surveillance of an area equivalent to a small city in near real-time. Its coverage, defined by a circular footprint with a 4 km radius, allows for detecting and tracking multiple targets simultaneously, recording events for subsequent analysis. The system's resolution is tuned to track vehicles and spot moving dismounts within user-designated 'watch boxes' thus enabling automated detection alerts. Redkite-1 employs the Multi-Modal Edge Processor (MMEP), a high-performance processor that transforms gigabytes of data into geotagged imagery, storing up to eight hours of mission data on the platform. This data can be shared with friendly forces while the sensor is airborne over the scene. Ground operators can also use the WAMI system's live and previously-recorded geotagged imagery for intelligence collection and analysis.

Credit: Logos

Logos tested the Redkite-1 WAMI sensor on the RQ-21 UAV in 2017.

3D Mapping Cameras

High-resolution geotagged imagery can be transformed into 3D models, delivering near-real-time information to users and enhancing situational awareness and operational planning. Earlier this year, the Israeli firm BlueBird Aero Systems unveiled the MagiCam, a high-resolution 3D wide-area mapping camera. When deployed on a small drone flying 500 m above ground, it can cover up to 40 km2/hour in 2D or up to 12 km2/hour in 3D. This 1.5 kg camera payload incorporates a 103 MP sensor and an onboard processing computer processing the imagery. With a Ground Sample Distance (GSD) of 3.2cm/pixel, the system generates crisp and detailed images, which can be transformed into actionable intelligence in 3D models, maps, or orthophotos within hours of landing. To compile the data necessary for mapping, MagiCam scans the area, capturing many geotagged, high-resolution images in all directions to ensure precise 3D mapping. The system also processes IR thermal mapping to enrich the model by spotlighting changes in the object's heat signatures indicative of recent human activity.

Through scanning, MagiCam can detect and mark disparities between current and previous sorties, enabling users to track changes in ground surfaces, object dimensions, textures, and more. This information can be vital in identifying potential threats, such as Improvised Explosive Devices (IEDs) or mines, as well as pre-prepared ambush sites.

Credit: Elbit Systems

SupervisIR is a passive, staring IR sensor for covert missions requiring persistent surveillance.

Harnessing Thermal Vision

Optronic thermal imagers are passive devices that transform the infrared radiation emitted by objects into discernible images. Operating in two distinct bands — mid-wave (MWIR), and long-wave IR (LWIR) — these sensors prove especially effective in low-light or night-time scenarios. They excel in detecting heat signatures such as those emitted from a human body or vehicle movement, even without visible light. Both excel at penetrating environmental obscurants such as haze, fog, and rain, with MWIR slightly more suited to warm climates, and LWIR more conducive to colder climates.

Most thermal imagers are engineered to detect and identify targets at extended ranges, but they need to encompass a broad area for persistent surveillance. Elbit Systems' SupervisIR is specifically designed for this application. It furnishes automatic target detection and tracking with a panoramic field of view spanning 12.5° in elevation by 90° in azimuth. The system automatically detects and tracks multiple targets and displays them in multiple windows specified by the operator to show specific areas of interest. This sensor can function independently or as part of an integrated system, guiding other sensors to observe, identify, and engage targets.

Elbit Systems has also developed an airborne surveillance payload for tactical UAVs, such

as the SkyLark 3. Known as MiniSkEye, the system provides day and night persistent surveillance over a wide area. Data and video obtained by the WAMI optronic IR sensor are stored onboard, offering user access via standard interfaces and communication channels in real-time. The system executes WAMI for persistent surveillance or sweeps through a 'push-broom' style aerial survey to cover larger areas, leveraging historical data to detect changes in the currently surveyed scene. With WAMI, the system offers an overview of the entire area, automatically detecting activity and movement in multiple user-defined zones. Images are captured at high resolution, enabling the system to perform target recognition automatically. At the same time, analysts or users can further analyse the target behaviour using one of the system's many high-resolution windows. Although the system primarily uses thermal imagery, it can cross-cue with other cameras onboard the host platform to automatically track operator-specified targets with full-motion video when necessary.

Credit: US DoD

Indiana ANG 181st Intelligence Surveillance Reconnaissance Group (ISRG) employed Gorgon Stare WAMI systems during the aftermath of Hurricane Florence in North Carolina on 19 September 2018.

The Unblinking Eye

In response to a pressing US DOD demand for real-time, wide-area surveillance capabilities during the early 2000s, US-based Sierra Nevada Corporation (SNC) conceived the Gorgon Stare (GS). This transformative technology has drastically expedited intelligence preparation for combat operations from days to hours and minutes on a single mission. GS has been extensively used, so far accumulating over 100,000 flight hours. The system uses an array of 12 cameras to provide uninterrupted surveillance over a city-sized area, round-the-clock. It leverages day and thermal channels, which can be streamed to users in near real-time to offer overwatch footage while simultaneously being archived for further use. An essential feature of the system is this post-mission review of the recorded motion imagery, which allows for forensic analysis following an incident or another significant activity.

Over two decades of operations have seen the Gorgon Stare system evolve significantly. The latest iteration, Gorgon Stare Increment 2, provides more versatile area coverage, improved resolution sensors, and the addition of a broadband Beyond Line-Of-Sight (BLOS) communications data link capable of supporting up to 40 Mbps data backhaul over SATCOM, LINK 16, and MESH networking. The size and weight reduction have enabled SNC to incorporate both sensors into a single pod, allowing the MQ-9 to carry weapons alongside the Gorgon Stare ISR package. Further enhancements include adding day colour imagery, dynamic camera aiming, and adaptable flight pattern manipulation, enabling operators to contract or expand the data collection area while keeping the aircraft's flight path within permissive airspace. In addition to increasing the frame rate and sensor resolution for enhanced image clarity and object characterisation, Gorgon Stare has introduced artificial intelligence (AI) capabilities. This allows for automated target detection, classification, and tracking based on various parameters such as geography and behaviour.

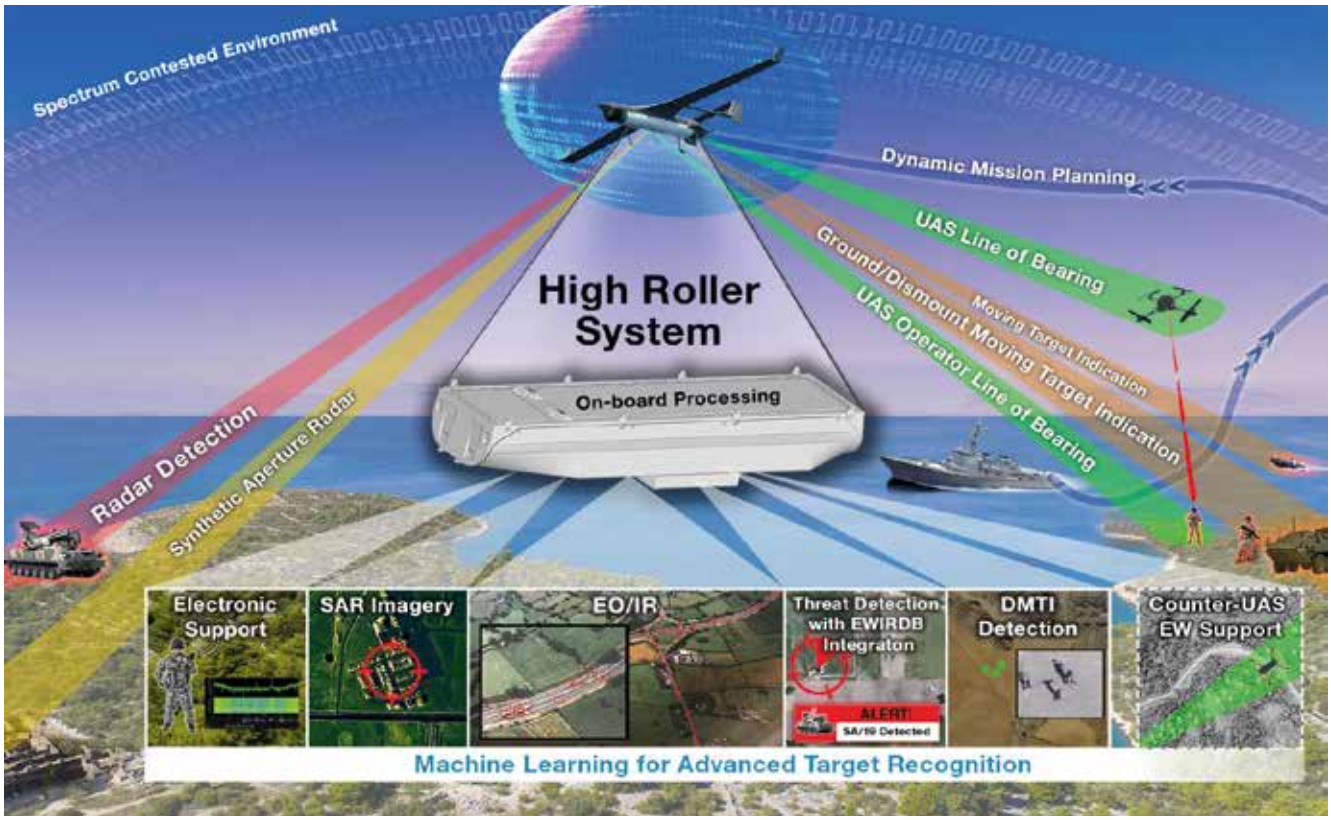
Ground Surveillance Radars

Surveillance radars are crucial in monitoring expansive areas for moving objects on the ground and in the air. Unlike their counterparts employed for airspace surveillance, which often provide 360° coverage, ground surveillance radars are typically static and focus on specific sectors. These systems offer insights into tracked targets' position, velocity, and direction. Modern radars, leveraging electronic scanning, are more compact and lightweight than their predecessors.

For instance, the ELM-2112 V8 radar by IAI Elta is a compelling example. It can detect a person walking at a distance of up to 6.5 km or a vehicle up to 13 km away, ascertaining their range with an accuracy of 3 m. Weighing just 9 kg and equipped with batteries supporting up to 36 hours of operation, this portable unit can be carried in a backpack, mounted on a vehicle's telescopic mast, or deployed on an aerostat. Additionally, the system can be integrated with other sensors, such as observation equipment, launch detection systems, or communication systems, empowering users to monitor areas even without a line of sight.

Another type of airborne radar is the Synthetic Aperture Radar (SAR) and Ground Moving Target Indicator (GMTI),

Credit: SRC Inc.



Applications of the High Roller multi-INT payload.

which provides WAMI-like imagery in all weather conditions. Such radars are often mounted on UAVs, and in this vein High Roller was conceived as a multi-intelligence payload for the RQ-21 Integrator. The payload reconciles signals of interest (SOI), synthetic aperture radar (SAR), electro-optical/infrared (EO/IR) imagery, and moving target indicators (MTI). Besides delivering independent streams of ISR data, High Roller enables the host platform's onboard systems to collaborate autonomously, offering multiple-look, geo-registered multi-INT data to friendly forces on the ground.

Surveillance by Signals Intelligence (SIGINT)

Monitoring signals of interest across the radio frequency (RF) spectrum yields real-time intelligence from radio emissions of various sources, including mobile phones, radios, radars, and drones. Comprehensive solutions such as the RFEye from the US-based CRFS company are combined with radar and electro-optical systems, integrating seamlessly into the persistent surveillance mechanisms of aerostats for tasks such as border protection or safeguarding strategic locations.

The unique advantage of these SIGINT systems is the localisation of each signal, which enriches the situational picture by adding more layers of intelligence. These systems meticulously exploit the signals, classifying

Credit: Halo Solutions

Halo Solutions' Drone and Stream technology feed and the Incident Threat Management dashboard.

and geolocating their sources. This information can guide other sensors toward these locations for a more detailed investigation. An in-depth examination of operations, interactions, and shifts in behaviour patterns of these signals could hint at the activity and intentions of the targets. Thus, SIGINT systems are instrumental in detecting and understanding potential threats.

Unlocking the Power of AI

While individual sensors are responsible for collecting video feeds and data, the potent digital processing capabilities using cutting-edge pattern recognition and motion analysis algorithms deliver the analytic processing power. This power enables activities such as triggering rule-based alerts for analysts to study, performing target recognition, tracking targets, and providing comprehensive situational awareness, adding recommended actionable courses for operators, commanders, and forces. These systems are also invaluable for security organisations overseeing large public events, maritime surveillance operations, and military forces. Tapping endless information sources and data points, analytic AI-driven systems can expand the area under surveillance far beyond the visible area covered by the sensors.

One such example of technology deployment is the Halo Drone and Stream technology, used at recent major sporting and cultural events to monitor protester activity, persons of interest, ticket reselling, and crowd safety. The live streaming capability of the Halo (v5) incident and threat management system significantly enhances its utility and provides an important link for building intelligence.

IAI's Elta StarLight system is another significant player in this space, primarily used for military and maritime security. This cloud-based multi-INT analysis system transforms massive amounts of unstructured data from distributed ISR sensors into actionable intelligence. The sensor-agnostic system interfaces with SAR/GMTI radars, SIGINT, EO/IR, Video, WAMI, and Launch Detection Systems. Its innovative AI-based smart operational applications include a situational awareness engine, data mining tools, a threat generator, and more, all interacting to interpret and understand the tactical situation picture and implement responses most efficiently.

Palantir's AIP is another solution leveraging AI to process intelligence data used by all US DOD branches. Currently supporting the Ukrainian Army in its conflict with Russia, this multi-INT system taps thousands of intelligence sources of all modalities, providing alerts on enemy movements, preparations, or potential opportunities on the battlefield. Using AI to analyse the sensor data, analysts can swiftly answer crucial questions such as the enemy's location and intentions. NATO analysts use these procedures to locate Russian troop concentrations, air defence systems, command posts, and supply depots across the war zone. Following the detection and designation of targets for attack, they are transferred directly to the Ukrainian forces over commercial broadband satellite links.

In summary, integrating AI technology is evolving surveillance and reconnaissance operations in both civilian and military contexts. Collecting, processing, and analysing vast amounts of data in real-time enhances situational awareness and enables proactive responses to potential threats. The increasingly sophisticated use of AI, particularly in predictive analytics, signifies a new era in intelligence and security operations. ■

Marketing Report: EVPÚ

LAWAREC – Quality Passive Protection System for Modern Military Vehicles

Let's start with a question: What do the tracked Lynx IFV (a recent Hungarian acquisition) and the wheeled Patria 8x8 AFV (a current Slovak acquisition) have in common? The answer: Both of these sophisticated vehicles are equipped with an advanced passive protection system made in the Czech Republic by optoelectronics specialist EVPÚ Defence.

The LAWAREC laser and radar irradiation detection system is designed to increase the defensive capabilities of military vehicles and vessels. It consists of two types of detection modules, which contain either a laser detector or a combination of laser and microwave detectors. These modules are connected by a daisy-chain with a central unit using a LONWORKS control network, which guarantees the system's reliable operation even in the event of partial damage. LAWAREC detects, analyses and locates radio emissions from radar systems and laser beam sources such as rangefinders, designators and beam riders. Upon detecting a threat, it alerts the crew, indicates the direction of the source and automatically suggests a suitable countermeasure, such as deploying smoke grenades to prevent the enemy from further targeting the vehicle.

"Using LAWAREC brings important benefits to the vehicle crew," says R&D engineer and LAWAREC specialist Jakub Mikel. "With a number of modules proportionate to the size of vehicle, the system provides a threat detection coverage that spans the entire vehicle perimeter. It can be fitted to a broad range of wheeled and tracked vehicles, where it offers effective passive protection against laser aimed and guided weapon systems. Moreover, it can be integrated with various other defence systems. We are delighted that leading European producers are choosing LAWAREC to be part of their solutions in key projects such as the armoured vehicle acquisition in Hungary and Slovakia, and see this as the start of further successful large-scale collaborations in the future."

Credit: EVPÚ Defence

Members of the professional and general public will next be able to see a complete LAWAREC set along with other defence systems produced by EVPÚ Defence at the IDEB exhibition in Bratislava, Slovakia, which takes place from 3-5 October 2023.

Offshore Patrol Vessels: The Swiss Army Knife of Modern Navies

Jean Auran

Hundreds of Offshore Patrol Vessels (OPVs) are already widely operated worldwide, and more than 200 will be launched in the coming years. These small vessels now form the backbone of many countries' coastal maritime operations, protecting against various threats, including terrorism, smuggling, drug and human trafficking, illegal fishing, and illegal immigration.

The roles taken up by OPVs are highly varied – alongside the aforementioned tasks, they also play a key role in search and rescue, environmental protection and securing critical maritime infrastructure such as offshore oil rigs. They patrol from the Arctic regions to the vastness of the Pacific Ocean, particularly in exclusive economic zones (EEZs). Shipyards compete to improve the capabilities of their ships, concentrating a maximum amount of equipment on platforms with limited space available. This article looks at OPVs ranging from the smaller end at 500 tonnes to significantly larger vessels over 2,500 tonnes.

OPV Characteristics in 2023

Current patrol vessels have evolved to increase their capabilities and scope of missions. Offshore service (supply) vessels, renowned for their robustness and endurance, have inspired modern designs; some hulls have been designed to obtain better performance at low speeds, which reduces the wake, eddies, and vertical acceleration on the rear. French shipyard Kership adopted C-SHARP (Combined-Speeds Hull with All-Round Performances), an innovative hull design developed with the Nantes Research Laboratory in Hydrodynamics, Energetics and Atmospheric Environment (LHEEA); C-SHARP offers high performance at both high and low speeds.

In terms of weaponry, this varies depending on the OPV's intended use. While some patrol vessels have only light armaments, others have a 76 mm gun. The lightest vessels are equipped with 20 mm and 30 mm remote weapon stations (RWSs). In this category, we can mention Leonardo's Lionfish 20 mm RWS with 250 ready to fire rounds and the Oerlikon KAE cannon, which has a cyclic rate of fire of 1,000 rds/min and an effective range of up to 2,000 m. Nexter/KNDS markets the NARWHAL (NAval Remote Weapon, Highly Accurate, Lightweight) incorporating the Nexter M621 chambered in 20 × 102 mm, or the more powerful M693

Credit: Spanish Navy

OPVs can be heavily armed like the Egyptian Navy's ENS S. Ezzat.

Credit: Spanish Navy

Most ships carry remote weapon stations, which are useful against sea targets, but also against air or missile threats.

Author

Jean François Auran is a retired French Armed Forces officer and a Defence and Security Analyst.

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Credit: Liteye System Inc.

Most patrol vessels have sophisticated sensors for identifying threats.

Credit: Spanish Navy

Seahawk aboard the Spanish Navy patrol boat Relampago.

which is chambered in 20 × 139 mm and has an effective range of approximately 1,500 m. The US uses the Mk44 Bushmaster II 30 mm automatic cannon,, and is now offered on various stabilised RWSs, including the Aselsan SMASH. The lighter units suit 12.7 mm solutions such as the Belgian Sea Defender, Swedish Trackfire and Israeli Wave 350 from Elbit Systems. This type of weapon is appropriate for most operations.

OPVs can also carry anti-ship missiles such as the MM40 Block 3 Exocet or the RGM-84L Harpoon. Philippine Navy ships receive the Korean-built SSM-700K C-Star missile with a maximum range of 180 km. The Senegalese Navy's three Walo class (OPV 58 S) vessels will receive the MARTE Mk2/N missile from MBDA, a light missile weighing 310 kg with a range greater than 30 km. Another possibility is to mount the Brimstone maritime missile, which weighs only 50 kg, and range is understood to be approximately 12 km for the Brimstone 3B variant when surface-launched. All OPVs have one or more Rigid Hulled Inflatable Boat (RHIB), allowing for onboard inspection teams, thereby accelerating their action when necessary. Most have a rear ramp for quick boat deployment while another RHIB is commonly positioned under the davit on the deck.

Most OPVs implement aerial and maritime surveillance drones. Here we can mention the SMDM mini-drone capable of operating within a limited range of 50 km, in service with the French Navy. On its River class, the Royal Navy deploys the Puma 3 AE drone, which is 1.4 m long, has a wingspan of 2.8 m, and can fly for two hours. Some OPVs accommodate helicopters such as the AS.365 Dauphin, Seahawk and NH90. The majority can perform a vertical replenishment, or VERTREP, to bring supplies or conduct medical evacuations.

Some OPVs have surface-to-air defences, such as the VL Mica missiles, installed on the OPV Al Shamikh of the Royal Navy of Oman. Pakistan is willing to acquire the RIM-116 surface-to-air missile for its new OPV from Damen shipyard. Vessels are fitted with navigation radars, marine and air surveillance. Multiple models, such as the Kelvin Hughes Mk11 SharpEye air and surface surveillance radar, are available on the market. Thales offers the NS50 with associated air/surface surveillance and fire control functionalities. The Dutch Navy's OPV Holland was the first to receive the Thales integrated mast IM 400, incorporating the Thales Sea Watcher 100, and Sea Master 400 radars, as well as observation and communication systems.

Terma's Scanter 6000 radar is also widely deployed for new-generation OPVs, which are all equipped with optronic turrets. We can also mention the installation of a three-sensor gyroscopically stabilised optronic system Argos-15HD on certain units or the Sea Eagle optronic system from US company Liteye or Gatekeeper from Thales. Most are equipped with an information management system and Link-11 and Link-22 data link systems for NATO countries. The 12 Australian Arafura class vessels will receive an iXblue Inertial Navigation System (INS), providing them with highly accurate and reliable navigation capabilities in all environments, including within Global Navigation Satellite System (GNSS)-denied operational areas.

Current Acquisition Programmes

Demand is strong for OPVs and there is an increasingly diversified offer. If Western navies lightly arm their OPVs because they have frigates and destroyers, emerging countries' navies tend to equip them more robustly because they constitute their main naval assets. Nevertheless, the broad trend is toward increasing the size of patrol vessels to take on a wider range of missions.

Strong Demand in the Gulf of Guinea

African countries have long neglected the protection of their maritime access and their EEZ. That lack of investment has enabled the development of maritime piracy and illegal, unreported, and unregulated (IUU) fishing. Recently, countries in the Gulf of Guinea have been acquiring new units. Even if the units remain modest because of ownership costs, there is an increase in their size and their capacities. In North Africa, the Royal Moroccan Navy ordered the Avante 1800 Patrol from Navantia. The vessel is 89 m long, 13.3 m wide, with a

Credit: French Navy

The OPV Auguste Bénébig (P779) has reached her base at New Caledonia.

complement of 46. The ship will receive a 76 mm gun, a missile launcher, modern sensors, and radars and can accommodate a helicopter. The country already operates five OPV 64 vessels and one OPV 70 built by STX and Raidco Marine.

The Piriou shipyard in Concarneau delivered the Walo to the Senegalese Navy on 2 June 2023. This is the first of three missile patrol vessels ordered in 2019 from the French manufacturer. This 62.2-m-long ship with a draft of about 3 m will be the most heavily armed of the Senegalese vessels with a 76 mm OTO-Melara turret and two remotely operated guns. The Polaris mission system from Naval Group will manage all armament and sensors. The OPV 58S will be able to implement aerial or underwater drones suitable for deploying commandos, including combat swimmers. The country also has the OPV Fouladou made by manufacturer OCEA. It is the largest aluminium OPV in Europe, 58 m long and 9.4 m wide. The platform's stability and noise levels are excellent, even without including its pair of Naiad Dynamics fin stabilisers. No less than 27 shapes of hulls have been evaluated to find the best design. In addition to its navigation and surveillance radars, the Fouladou is equipped with a Vigy observer optronic system in its mast. It has a RWS from MSI Defence Systems armed with a 30 mm cannon installed on the foredeck. The ship has FRSQ 700-type aluminium-hulled RHIBs, which can exceed 35 kn and carry about 15 people.

The Ivory Coast has also significantly strengthened its fleet by acquiring the RPB 33-type OPV. Ufast shipyard in Quimper built the Ivorian units based on a design provided by Camarc Design, a small British company. With a composite hull 33 m in length, these OPVs have a 6 m RHIB, and can be armed with a 20 mm cannon and two 12.7 mm machine guns. In March 2023, Ivory Coast received the high seas OPV 45 type patrol vessel Espérance (46.7 m long and 8 m wide), manufactured in Israel. This ship is armed with a Rafael Typhoon weapon station, which is understood to be equipped with a 30 mm automatic cannon, and two 12.7 mm machine guns. The vessel has a crew of 32 and range of 3,500 NM at 12 kn (22 km/h).

On 17 June, the Ghana Navy took delivery of two ex-US Coast Guard Marine Protector patrol boats supplied by the US. The Marine Protector class is 27 m long, with a displacement of over 90 tonnes. Two MTU diesel engines provide a top speed of 25 kn (46 km/h), providing a range of 1,700 km (and the capability to remain operational for up to three days). Nigeria, long decried for its maritime inaction, has strengthened its intervention capacities. We can mention the acquisition of several 32 m Ocea FPB 98 MKI vessels. On 6 June 2023 in Abuja, a contract signing ceremony was held between the Nigerian Navy and Turkey's Dearsan Shipyard to construct a new 57-m Tuzla class patrol ship. South Africa is building four units of the Damen-6211 type, which constitutes the Warrior class, to improve control of its maritime borders.

A Dynamic European Market

Several European countries have plans to equip or renew their patrol ships, including France, Portugal, and Denmark. The French Navy participates in two OPV programmes; these are for six Patrouilleurs Outremer (POM) of which two will be based in New Caledonia, two in French Polynesia and two in the island of Reunion. The last of these six POM ships should be delivered at the end of 2025. French company Mauric designed the ship and Socarenam ensured the construction in Saint-Malo and then in Boulogne-sur-Mer.

The vessels have a steel hull and aluminium superstructure measuring 79.9 m in length and 11.8 m wide, with a draft of 3.5 m. The new patrol vessels, which can move with a full load of 1,298 tonnes, are equipped with a passive stabilisation system comprising two water tanks on the deck, just in front of the gangway. They have a maximum speed of 24 kn and can operate without refuelling for 30 days. From 0 to 12 kn, they use only electric propulsion, after which the two main diesel engines are employed from speeds of 12 to 22 kn, with diesel and electric propulsion combined to reach 24 kn. The armament consists of a Nexter's NARWHAL and an optronic solution supplied by Exavision. The POM can operate the Navy's Mini Aerial Drone System (SMDM) to expand its surveillance and identification capabilities. The Aliaca is a

Credit: OMT

First impression of the future Danish OPV.

Credit: Royal Navy

The River Class is in service with the UK, Bahrain, Thailand, and Brazil.

light fixed-wing tactical drone developed by French company SURVEY Copter, a subsidiary of Airbus. The drone is 2.2 m long with a 3.6 m wingspan, and weighs only 16 kg. The Aliaca fields a TV/IR camera (with ×30 zoom) and an Automatic Identification System (AIS) receiver.

The 2024-2030 military programming law foresees the construction of ten patrouilleurs hauturiers (PH) to replace the D'Estienne d'Orves class (Type A69 Aviso) and three OPVs. Seven will be delivered between 2024 and 2030 and three more between 2030 and 20357. The DGA notified Naval Group in October 2021 of the contract relating to the preliminary and detailed design of the ships. Piriou, CMN and Socarenam will secure the construction together in a consortium. The main armament will consist of the RapidFire RWS, developed by Nexter and Thales, and armed with a 40 mm CTAS cannon. The vessels will be equipped with up to three RHIBs, should be able to reach 22 kn (41 km/h), with a 40-day autonomy, while being able to navigate 5,500 NM at an economical pace. An NS54 radar and a BlueWatcher hull sonar will equip the PH, and Naval Group will provide the combat system.

Portuguese shipyards are building a second series of six Viana do Castelo OPVs, while four are already in service. The new units will join the Portuguese Navy between 2026 and 2030. The ship has a 30 mm cannon, two RHIBs and can operate a Super Lynx MK95 helicopter. The ships operate unmanned systems, a single Sagem SA Vigy 10 MKIII naval surveillance and observation platform, three water cannons, and two rigid inflatable boats. The United Kingdom is also a manufacturer of military vessels including OPVs. BAE systems was involved in the River or the Khareef class for Oman. HMS Spey is the fifth in the series and entered service in June 2019. BAE Systems in Glasgow built all the vessels belonging to Batch 2 (the ships Forth, Medway, Trent, Tamar, and Spey). Babcock International has a portfolio of class-leading inshore patrol vessels (50 m long) and OPVs (90 m long). A few years ago, the company delivered four patrol vessels for the Irish Naval Service, based on a Vard Marine Inc. (formerly STX Marine) design.

Denmark has just launched a programme to acquire new patrol vessels with the configuration still needing to be finalised. Danske Patruljeskibe K/S – a consortium founded by Terma, Odense Maritime Technology and PensionDanmark – leads the project. Seven European states, along with two observers are involved in the European Patrol Corvette (EPC) programme, which aims to develop new missile corvettes and OPVs. It is possible that the change in strategic context will have an impact on the development of this programme. Turkey will soon launch the TCG Akhisar (P-1220), which is the first of ten Hisar class OPVs. These vessels are derived from the MILGEN corvette, but are streamlined to be made faster and cheaper.

Credit: Cotecmar

Several South American countries have modern patrol boats, some of which are locally built.

Bright Prospects in Asia-Oceania

Demand is high in the Indo-Pacific region. Dutch shipyard Damen supplied the Pakistan Navy with the PNS Yarmook, built in Galati (Romania) and commissioned in February 2020. The vessel is based on the Damen OPV 1900 design and features an overall length of 91.3 m, a beam of 14.4 m, and a hull draft of 4 m. The patrol ship will be equipped with the CM-302 supersonic anti-ship cruise missile (ASCM).

The Philippine Navy (PN) is strengthening its capabilities to face China and in this regard, the Philippines Department of National Defence (DND) has signed a contract with Hyundai Heavy Industries (HHI) to construct and deliver six new OPVs. The ship has a length of 81 m, a beam of 13.1 m, a draft of 3.5 m, and a maximum speed of 21 kn. It also is armed with a 76 mm main gun, a remote-controlled weapon station carrying a 30 mm secondary gun, and two MBDA Simbad-RC launchers for the Mistral missile family.

Australia has launched an extensive procurement programme to replace existing Armidale class and Cape class patrol ships. German shipyard Lürssen's OPV 80 gained the contract after a lengthy process to form the Arafura class, which is 80 m long and has a maximum speed of 20 kn. The first two vessels are already

under construction by Lürssen Australia and ASC in Adelaide. Lürssen Australia and Civmec will build the remaining ten vessels in Henderson, Western Australia. The Royal Australian Navy (RAN) is in talks to procure a containerised variant of Rafael's C-Dome to increase the firepower of its future OPV.
China produces different models of OPVs which are mainly operated by the Chinese Coast Guard. The country sold this type of patrol boat for military use in African countries – for instance Nigeria operates two P18N type OPVs.

Sustained Demand in South America
Countries in South America are also keen on patrol ships, which are often heavily armed. The Mexican Navy has many patrol vessels and in 2020, it commissioned the long-range OPV, ARM Reformador. Renamed Benito Juárez, the ship is based on the Damen shipyard's SIGMA 10514 design, displacing 2,570 tonnes, with a length of 105.1 m, a beam of 14 m, and a draft of 3.7 m. Reformador has Thales' Tacticos combat management system, SMART-S air/surface surveillance radar, and Stir EO fire-control radar. Armament includes RGM-84L Harpoon Block II surface-to-surface missile launchers, RIM-116 RAM Block II surface-to-air missiles, Raytheon MK 54 Mod 0 torpedoes, a 57 mm BAE Systems Bofors Mk 3 gun, and four mounts for 12.7 mm machine guns.
The Colombian shipyard Cotecmar has just completed the first block of the Colombian OPV 93 hull, ordered at the end of 2022. The vessel is a 100% Colombian design adapted to the Colombian Navy's operational needs and the region's navies since it should also be exportable. The vessel travels at a maximum speed of 18 kn (33 km/h) and has a range of 10,000 NM (18,520 km) at 12 kn (22 km/h). Chile was the first country to order two OPV 80 ships from Fassmer; these large OPVs have exceptional sea-keeping characteristics. Their hull design makes them fully seaworthy and suited for naval and coastguard missions with a range of over 10,000 NM.

The Middle East
The various navies of countries in the Gulf have received countless OPVs, several of which are from Italian and Spanish shipyards. On 28 December 2022, Edge Group's ADSB (Abu Dhabi Ship Building) PJSC announced the steel-cutting ceremony for the first Falaj 3 for the United Arab Emirates Navy. These vessels have a length of 60 m, move 641 tonnes at a speed of 26 kn, with a range of 2,000 NM and are based on the Italian Diciotti class. Qatar also has Italian-built ships as Fincantieri has developed the Musherib class for the Qatari Emiri Navy with a displacement of 745 tonnes, and 21 days of endurance. The armament comprises an OTO Melara 76 mm gun, eight VL-MICA surface-to-air missiles, four MM40 Block3 missiles, and two 20 mm cannons.

Wrapping Up

To conclude, OPVs perform a growing number of missions, with capabilities now including the launching of anti-ship missiles or engaging land targets. Despite the dominance of European countries in the market, new local players can build good-quality ships. While new producers have emerged in Latin America and the Middle East, Turkey could also become a dynamic player in this sector.

Type 31/Arrowhead 140 Frigate Programmes: Status Report

Conrad Waters

Four years ago, at the time of DSEI 2019, Babcock International announced that its 'Arrowhead 140' design proposal had been selected as the preferred bid for the United Kingdom's Type 31 frigate programme. Since then, production of the new class has commenced at a new building hall at Babcock's Rosyth facility, from where the first ship of the class will be launched in the months ahead. Arrowhead 140 has also achieved early export success, with both Indonesia and Poland selecting the design for indigenous frigate construction. This article provides a status report on the progress that has been achieved with both the British and export contracts.

Project Origins

Arrowhead 140 traces its origins to a requirement to replace the ageing Type 23 frigates that currently form the core of the British Royal Navy's (RN's) surface fleet. The United Kingdom's 2015 Strategic Defence & Security Review determined that previous plans to replace all 13 ships of this design that were then in RN service with a single class of Type 26 frigate, also known as the Global Combat Ship, would be revised. Eight of the highly sophisticated and costly Type 26s would still be built to meet the requirements of 'high end' anti-submarine tasking. However, a new class of five less expensive, general purpose light frigates would also be acquired to maintain fleet numbers. These new light frigates quickly received the Type 31 designation.

Credit: Babcock International

A graphic of the British Royal Navy's Type 31 frigate, which is based on the Arrowhead 140 design, showing the basic configuration as of 2021. In addition to meeting the Royal Navy's frigate requirement, Arrowhead 140 has also gained early export success.

Author

Conrad Waters is Editor of Seaforth World Naval Review, Joint Editor of Maritime Defence Monitor and a regular contributor to other Mittler Report publications.

The programme to acquire the Type 31 was formally launched on 7 September 2017. The project was heavily influenced by the conclusions of a new British National Shipbuilding Strategy (NSS), which had been published the previous day. The NSS aimed to revitalise Britain's naval sector through, amongst other measures, a more cohesive approach to warship procurement and an increased focus on exports. The Type 31 acquisition was viewed as a priority programme within the NSS and the inter-related factors of affordability and exportability were to be an emphasis of its core design. It was intended to be an adaptable, modular frigate focused on less intensive maritime security roles, thereby releasing the RN's complex warships for 'high end tasks'. The focus on affordability was reflected in an average target cost of just GBP 250 M (EUR 290M) per unit for the five frigates, which were to be delivered from 2023 onwards. Yards would also be required to agree a fixed-price contract to build the ships. Whilst both a UK-owned design and a British build strategy were mandatory features


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of the programme, the involvement of international suppliers willing to meet these requirements was encouraged.

Although initial interest in the Type 31 programme was encouraging, the demanding programme requirements soon reduced the number of potential participants. It also became clear during discussions with industry that there was reluctance to accept the level of risk associated with the programme given the challenges involved. This even resulted in the temporary suspension of the programme during mid-2018 whilst the way forward was evaluated. Finally, in December 2018, three groups were each awarded GBP 5 M (EUR 6 M) contracts to refine their design proposals. One of these was the Babcock-led Team 31, which also included Thales as a principal partner. The other finalists were consortia comprising BAE Systems and Cammell Laird, as well as Atlas Elektronik UK and thyssenkrupp Marine Systems. On 12 September 2019, it was announced that Babcock Team 31's Arrowhead 140 design had been chosen as the preferred bid to meet the programme requirement.

As a brief note on nomenclature, the Type 31 programme was initially designated Type 31e; the 'e' referring to export. Subsequently, the designation Type 31 has been used for the RN variant of the Arrowhead 140 design, with the Arrowhead 140 terminology being used for export campaigns. The national Indonesian and Polish frigates both use Arrowhead 140 as their baseline.

Credit: Conrad Waters

The development of the Arrowhead 140 design traces its origins to the need to replace the Royal Navy's ageing Type 23 frigates. This photograph shows HMS Kent, which was delivered in the year 2000.

Type 31 Design Description

The Arrowhead 140 design developed by Babcock as the basis for its Type 31 bid was derived from the Danish Absalon and Iver Huitfeldt class series of frigates built for Denmark in the early 2000s. They are directly based on the latter class's hull. Odense Maritime Technology (OMT), designers of the original ships, provided important technical assistance as part of Babcock Team 31. In particular, their expertise in adopting commercial practices to warship construction provided invaluable in meeting the affordability required in the new ships. Although the ships have not adopted the well-known Danish containerised 'StanFlex' system, OMT's heritage of involvement in modular designs was also a major factor in achieving the adaptability that was aimed for in the Type 31. British maritime and defence consultancy BMT also provided significant input into the Team 31 design effort.

With a length of 138.7 m, a maximum beam of 19.8 m and a displacement of around 6,000 tonnes, Arrowhead 140 is a larger vessel than the Type 31's original 'light' frigate designation would imply. This approach helps to ease ongoing maintenance and provides greater scope for through-life upgrades. Importantly, it also provides considerable flexibility with respect to meeting the varying equipment requirements of export customers. The design is sufficiently large to be equipped with a flight deck that can support a heavy helicopter and the hangar can house a rotorcraft of Leonardo AW101 Merlin size. Another nod to affordability is the use of a cost-effective and efficient combined diesel and diesel (CODAD) propulsion arrangement using four Rolls-Royce MTU 20V 8000 M71 engines. Given that the RN ships are not primarily intended for the anti-submarine warfare role, the noise penalties associated with this arrangement can be accepted.

Credit: US Navy

The Babcock Arrowhead 140 design is based on the hull of the Royal Danish Navy's Iver Huitfeldt class air defence frigates. This photograph shows HDMS Niels Juel, the third and final member of the class.

The 'digital heart' of the Type 31 Arrowhead 140 variant is provided by Thales' well-established 'Tacticos' combat management system (CMS). Its selection represented an important break-through into the UK CMS market, which had previously been dominated by BAE Systems. Thales is also responsible for the supply of other important electronic equipment used in the Type 31. This includes the class's integrated communications system and NS110 surveillance radar. Actual weaponry is reflective of the new ships' proposed maritime security role. In addition to the MBDA Sea Ceptor surface-to-air missile system, each frigate will be equipped with one 57 mm BAE Systems/Bofors 57 Mk3 (US Navy Mk 110) and two 40 mm BAE Systems/Bofors 40 Mk 4 naval guns.

Credit: Babcock International

A generic graphic of the Arrowhead 140 design that was released at the time Babcock Team 31 became preferred bidder for the Type 31 contract. The family resemblance with the Iver Huitfeldt class is obvious.

UK Progress

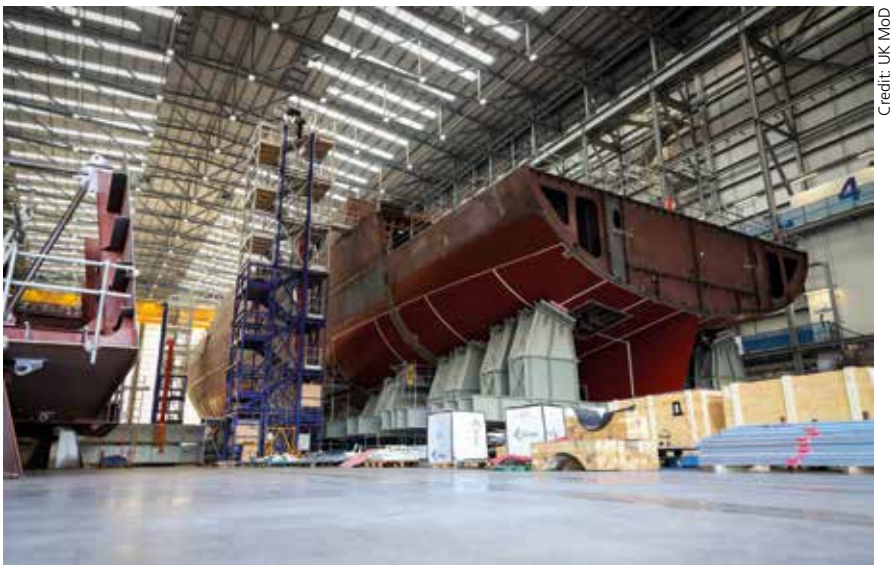
The selection of Babcock Team 31 as preferred bidder for the Type 31 programme was followed by the award of a formal construction contract on 15 November 2019. Announcement of the agreement confirmed that the average production cost of GBP 250 M per ship targeted at the time of programme launch had been achieved. However, it seems that this ambition was only met by excluding additional expense in areas such as government furnished equipment from the headline figure. By this stage, initial hopes that the first ship in the class would be delivered by 2023 had also been adjusted. Instead, the aim was to have the lead frigate launched by 2023, with manufacturing of all five ships completed by 2027/2028. It was also intended that May 2027 would see the first Type 31 complete crew training and validation to enter full operational service.

Despite these revisions, implementation of the Type 31 programme has subsequently proceeded at pace. A key element of Babcock's plan for delivering the new frigates is their assembly in a new covered construction hall at their site in Rosyth, near Edinburgh. Named the 'Venturer Building', this assembly hall provides a state-of-the-art ship building and integration facility utilising the latest manufacturing and information management processes. Measuring 147×62×42 m, it is equipped with two, 125 tonne gantry cranes and can support the simultaneous assembly of two frigates. Babcock believes that the assembly hall will benefit not only Type 31 delivery but also participation in subsequent British and international shipbuilding projects.

Ground-breaking for the facility took place in April 2020 and it was completed in November the following year. By that time, work on the lead frigate, the future HMS Venturer, was already underway following an official first steel cutting ceremony by then British Defence Secretary Ben Wallace on 23 September 2021. The five ships of the class – Venturer, Active, Bulldog, Campbeltown and Formidable – will collectively be known as the 'Inspiration' class under a decision announced in May 2021.

The start of construction of HMS Venturer has been followed by the successful achievement of a number of other project milestones. The keel-laying ceremony for the lead frigate was held on 26 April 2022 and was followed by first steel cutting for the second Type 31, HMS Active, in January 2023. Subsequently, in July 2023, the British Ministry of Defence (MoD) reported that the initial crew members had been assigned to the first-of-class to help prepare for launch and subsequent delivery. At this stage, it was stated that, "Venturer is due to emerge from the construction hall at Babcock's Rosyth facility within a year". As of mid-2023, the official keel-laying of HMS Active was also imminent, thereby marking the start of simultaneous multi-ship assembly. All-in-all, the programme currently remains on track to meet a demanding production plan.

Despite the very real progress that has been achieved in the face of the COVID-19 pandemic, implementation of Type 31 construction has not been without its complications. In April 2023, Babcock announced that macroeconomic changes that had taken place since the contract was first agreed – likely the impact of high inflation – had resulted in an increase in actual and projected costs to deliver the programme as planned. They stated that they had entered a dispute resolution process with the MoD to establish who was responsible for this additional expense. In the event they cannot recover the costs, a loss of between GBP 60M and GBP 100M (EUR 70 M to EUR 115M) would need to be recorded. Babcock's 2022-23 accounts, released on 20



Credit: UK MoD

The lead Type 31 frigate HMS Venturer under construction in the namesake Venturer Building in July 2023. She is due to be launched by mid-2024.

Credit: Babcock International

A computer generated graphic of the Polish Arrowhead 140-based Miecnik frigate. The design, which has evolved since this image was released in 2022, has similarities with the British Type 31 frigate but is equipped with a more comprehensive outfit of weapons and sensors in line with the Polish Navy's requirements.

July 2023, recorded a GBP 100.1 M provision against the Type 31 frigate contract. Another potential challenge relates to a decision revealed in May 2023 to increase the Type 31's warfighting potential by equipping the 'Inspiration' class with the Mk 41 vertical launch system (VLS). The basic Arrowhead 140 design is already configured to accept this weapon, but it is not yet known whether the work will be undertaken during build or at some later stage of the class's life. Answering a question asked by ESD via Babcock in June 2023, the MoD said, "Working closely with the US Department of Defence and US Navy, the UK Ministry of Defence have commenced an assessment phase to explore the options, installation opportunities, and costs associated with fitting T31 with Mk 41. At this time, it is too early to speculate on the timing of fitting this capability."

Export Success

As previously mentioned, a key driver of the initial Type 31 programme was to increase the exportability of British warship designs. Recognising the highly competitive nature of the global frigate market, Babcock sought to market Arrowhead 140 as a warship that could be readily customised to meet a wide range of national requirements whilst doing so in an affordable way. One of Babcock's leading advantages in developing this proposition was the extensive experience that it had already gained in providing maintenance and other support services throughout the world. This has enabled it to position Arrowhead 140 to deliver value for money not only in terms of initial capacity/cost considerations but also in subsequent through-life support. This can extend to the wholesale revitalisation or, even, creation of an indigenous shipbuilding sector. In September 2021, Babcock took the opportunity presented by DSEI 2021 to launch its Arrowyard product in support of this approach. Arrowyard brings together transfer of knowledge and technology options to enable the construction, final assembly and outfitting of Arrowhead 140 frigates, whilst supporting implementation of a sovereign in-service support capability.

It also seems likely that having the RN as Arrowhead 140's lead customer has proved to be another important advantage in export campaigns. This factor has been conspicuously absent from many other recent British warships that have been designed for export, robbing them of association with one of the world's most respected navies. To give just one example of the new approach, all Arrowhead 140 customers are able to join a RN-chaired Babcock AH140 user group. Here they can assimilate lessons learned during the design, build and acceptance stages, participate in concept of operations development and – eventually – share 'real world' operational experience. In any event, Arrowhead 140 looks set to be one of the most important British naval exports of recent times, already gaining two early sales successes.

Indonesia: Arrowhead 140 achieved its first export sale in September 2021 when Babcock signed a design licence contract with Indonesia's state-owned shipbuilder, PT PAL. The Indonesian Navy's requirement encompasses two frigates and is known locally as the 'Merah Putih' ('Red White') programme, after the colours of Indonesia's national flag. Babcock's responsibilities under this programme are to provide a comprehensive package of baseline Arrowhead 140 design materials, undertake technical liaison with counterparts in PT PAL during the build process, and provide whatever additional engineering support may be required. PT PAL meanwhile, as lead contractor for the programme with the Indonesian MoD, has responsibility for adapting the design to meet the Indonesian Navy's requirements, and will construct the frigates at their shipyard in Surabaya.

Physical implementation of Indonesia's Arrowhead 140-based construction began with a first steel cutting ceremony for the lead ship at Surabaya on 9 December 2022. The programme's delivery schedule has been determined between PT PAL and the Indonesian MoD. It is believed to involve delivery of this lead unit around the end of 2026. The equipment fit determined by the Indonesian Navy is reportedly optimised for the air defence role and, consequently, is different from that adopted by their RN 'half-sisters'. Another significant variation is the selection of Turkish company Havelsan's 'Advent' CMS to provide the Indonesian frigates' command and control (C2) functions.

Poland: Arrowhead 140's second export success was announced in March 2022 when Babcock was selected as the platform design provider and technology partner for Poland's 'Miecznik' ('Swordfish') frigate programme. Arrowhead 140 had previously been one of three designs initially shortlisted for the Polish require-

Credit: UK MoD

The first crew members assigned to the lead Type 31 frigate HMS Venturer line up in front of the ship's hull at Rosyth. The progress achieved with the Arrowhead 140-based Type 31 frigate and export contracts has helped to put the British naval sector back on the map.

ment alongside German tkMS MEKO A-300 and Spanish Navantia F-100 based proposals. The British and German designs had subsequently been down-selected for detailed consideration, with Babcock's offer winning out in this final phase.

Babcock has subsequently been awarded a number of contracts related to class design and transfer of technology activities pending conclusion of a design licence agreement that, as of mid-2023, was close to being finalised. This envisages the construction of three frigates based on the Arrowhead 140 design by the PGZ-MIECZNIK Consortium for delivery towards the end of the decade onwards. On 17 June 2023, an event was held at the PGZ Naval Shipyard in Gdynia to mark the start of work on construction of a ship hall and other facilities that will support the Polish ships' build. It is currently planned that a ceremony will take place at Gdynia on 16 August 2023 to mark the first steel-cutting for the lead ship.

Details that have emerged of the Miecznik frigate's configuration suggest a number of similarities with their British Type 31 counterparts. Notably, they will likely also incorporate a Thales Tacticos CMS and be equipped with the MBDA Common Anti-Air Modular Missile (CAMM) that forms the core of Sea Ceptor. However, the Polish ships will be outfitted as 'high end' general purpose frigates. Poland's specification of additional anti-surface and anti-submarine weaponry supported by suitably advanced sensors demonstrates the ease with which the baseline design can be flexed to accommodate various user requirements.

In addition to these initial contracts, Arrowhead 140 has formed the basis of a number of proposals to other countries incorporating construction options ranging from licensed build to full assembly at Rosyth. These include ultimately unsuccessful discussions to meet the Hellenic Navy's recapitalisation requirements. It has also been reported that the supply of an Arrowhead 140-based frigate to Ukraine was considered within the broad ranging Ukrainian Naval Capabilities Enhancement Programme (UNCEP) signed in June 2021, before the current war with Russia disrupted the country's naval modernisation plans.

Speaking to ESD in July 2023, Babcock stressed that the location of Arrowhead 140 construction for any future programmes would be entirely based on customer preference. They stated that, "Babcock's offer allows customers to take advantage of our Arrowyard concept and decide upon a range of services from the provision of export design licenses, through the additional provision of product design and build support services where the customer seeks to build the ships, or parts of their ships, in their own shipyards. Delivery of the entire programme of full design and build services at our Rosyth shipyard facilities in Scotland is also an option."

Current Arrowhead 140 Frigate Programmes

Programme	Country	No. of Ships	Shipyard
Type 31 Frigate	UK	5	Babcock, Rosyth, UK
Merah Putih	Indonesia	2	PT PAL, Surabaya, Indonesia
Miecznik	Poland	3	PGZ Naval Shipyard, Gdynia, Poland

The Way Ahead

The British RN's Arrowhead 140-based Type 31 frigate programme has clearly made considerable progress since Babcock Team 31 was selected as the project's preferred bidder some four years ago. Despite the significant disruption caused by the COVID-19 pandemic, construction to date has progressed largely in line with a timetable that was always considered aggressive compared with other British warship procurement. Moreover, Babcock's early achievement of overseas sales of the Arrowhead 140 design suggests that the focus on exportability engendered by the NSS has already started to achieve tangible results.

It has not all been plain sailing. The current dispute over the impact of unexpectedly high inflation on Type 31 programme costs is certainly an unwelcome distraction for a project that has otherwise served as something of a 'poster boy' for British shipbuilding's revitalisation. It should also be noted that Type 31 construction has yet to progress to the most complex, outfitting stage. This suggests that challenges to timely project delivery remain. In this regard, it is worth noting that the licensed-construction projects are at an even earlier stage in their implementation.

Nevertheless, both the RN Type 31 programme and Babcock's Arrowhead 140-based export sales are currently meeting the expectations set for them. Moreover, Babcock continues to leverage the adaptability of the Arrowhead 140 hull-form to incorporate a range of customer capability choices for ongoing export campaigns, as well as the requirements of the proposed British Type 32 frigate programme. The group's concept design team continue to develop other concepts and innovations in response to rapid technological advances and evolving customer expectations. Most importantly, Arrowhead 140 has proved the ability of its mix of capacity, flexibility and cost-effectiveness to disrupt the global shipbuilding market. In doing this, it is helping put the British naval sector back on the map. ■

Future Soldier Systems: Current Programmes

Sidney E. Dean

Current Future Soldier programmes aim to upgrade infantry capabilities through technology, but display more realistic goals than some previous initiatives.

From Afghanistan to Ukraine, modern conflicts have proven that dismounted infantry remain the decisive military force. Airpower, artillery and armoured vehicles are of course indispensable, but ultimately serve to enable the infantry to conquer the proverbial 'last 100 yards' of the battlefield. Dismounted soldiers' role is even more prominent in post-conflict, peacekeeping or counterinsurgency operations.

Armed forces regularly upgrade infantry gear, with an eye to enhancing both survival and lethality. The first decade of the current century was marked – especially in the United States – by some highly ambitious projects which aimed to leverage conceptual technology to create 'super soldiers' equipped with strength-multiplying exoskeletons and 'Iron Man' suits offering ballistic protection and integrating non-traditional weapons options. After years of research it became evident that such concepts still belonged, at least for the time being, to the realm of science fiction.

Credit: French Army

The French Army's new F3 Ballistic Helmet is evolved from the original FELIN helmet. Function rails, hook-and-loop brackets, and new side parts enhance the ability to mount accessories.

French Army

Programmes with more moderate parameters, such as the French Army's FELIN (Fantassin à Équipement et Liaisons Intégrés; ENG: 'Infantryman with Integrated Equipment and Communications'), were more readily implemented. The industry team led by Safran Electronics and Defense delivered circa 23,000 FELIN sets to the French Army between 2010 and 2015. The system is operational with airborne, mountain and mechanised infantry units, and was successfully deployed in Afghanistan, and Africa. The modular system includes improved communications gear and sensors, infantry weapons and advanced aiming aids, ballistic protection and ergonomically optimised uniforms and harnesses. The kit can be configured to meet mission parameters and the role of the individual soldier within the unit or echelon.

Immediately after completing procurement of the original FELIN kits, the DGA (Direction générale de l'armement; ENG: General Armaments Directorate) in 2016 awarded Safran the contract to upgrade the system to the FELIN V1.3 standard. Improvements include software upgrades for targeting sensors and fire support, more modular protective gear, and enhanced combat vests optimised for the SitComdé tactical terminal and battle management system. V1.3 promised to reduce system weight by 40% without compromising protection. Then in 2019 the DGA launched the Centurion initiative. The programme runs through 2026 and aims to accelerate innovation by French industry and integrate new technologies into existing programmes including future increments of FELIN. The goal is to enhance "individual, collective and collaborative capabilities of the fighter" through technologies such as connectivity and communication, positioning and navigation, innovative interfaces, protective and stealth equipment, mobility aids, observation and identification means, innovative energy sources, soldier health monitoring, and functionalised textiles.

Other countries' ongoing Future Soldier System programmes are following the same approach of systematically adopting incrementally-improved equipment and new materials, and fielding them as holistically balanced packages to improve soldier performance. Wearable electronics and advanced networking capabilities are considered vital elements in all of these programmes. The US Army and the German Army present two typical approaches.

US Army

The US Army's current infantry modernisation effort is focussed in several compartmentalised, parallel but independent projects to develop new infantry weapons, wearable sensors and situational

awareness tools, and personal protective equipment (PPE). The Next Generation Squad Weapon (NGSW) programme, the Integrated Visual Augmentation System (IVAS) and the Enhanced Night Vision Goggles – Binoculars (ENVG-B) are among the Army's highest priority or 'signature' development efforts. Their development is being guided by the Army Futures Command's Soldier Lethality cross-functional team.

NGSW

The NGSW system consists of four elements. The XM7 rifle will replace the M4 carbine. The belt-fed XM250 automatic rifle will replace the M249 light machine gun. Both gas-operated weapons are being developed by Sig-Sauer under a 2022 contract. They will be equipped with the optional 'smuzzle', a combined sound suppressor and muzzle brake developed by Army engineers. Army testing shows the smuzzle provides a 33% reduction in felt recoil, 25% reduction of flash signature downrange, and 50% reduction in acoustic signature.

The NGSW-Fire Control (NGSW-FC) is an integrated optic system designed to provide enhanced target acquisition and aim correction for both weapons. The design contract was awarded to Vortex Optics in 2022. The FC's main components include a variable-power scope, a laser rangefinder, a ballistics computer, a disturbed reticle (referring to two aim-points observed when looking through the sight, with one aim point aligned with boresight, and the second tracking the electronically 'tagged' target), and a wireless link to soldier devices. It autonomously calculates range, wind and elevation and adjusts the aim point accordingly, while projecting target location, distance, and status to the soldier's display.

The final component of the NGSW is the new 6.8 × 51 mm (.277 Fury) cartridge designed for its greater projectile weight and muzzle velocity over the M4's 5.56 × 45 mm ammunition. Overall, NGSW is expected to significantly increase range, accuracy, and target penetration over current infantry weapons; the Army's stated goal is "achieving overmatch against global adversaries and threats that emerge on the battlefield of today and tomorrow." The system recently complet-

ed production qualification testing, and the first operational unit is scheduled to be equipped with NGSW during the second quarter of FY 2024. The Army plans to procure 250,000 XM7s and 150,000 XM250s over a ten-year period.

IVAS

IVAS is derived from Microsoft's Hololens 2 headset, which uses holographic technology to overlay digital imagery over real-world imagery. According to Microsoft, the system combines the HoloLens' mixed-reality technology with thermal imagery, sensors, GPS technology and night vision capabilities in order to improve soldiers' situational awareness and impart tactically-relevant information. Holographic images, three-dimensional terrain maps and a compass are superimposed onto the heads-up-display (HUD) of the otherwise transparent lens. This includes reconnaissance and targeting data from the squad's unmanned aerial vehicles (UAVs). Major components are the helmet-mounted visor, a computer (called the 'puck') worn on the body, a networked data radio and three conformal batteries. A wireless interface connects the goggles to a family of weapon sights, projecting the weapon reticle and a thermal image of the target onto the goggle display; this enables soldiers to remain under cover while extending their weapons – even around corners – in order to aim and fire at enemies.

Initial IVAS 1.0 demonstrators were tested by troops in 2022, followed in short order by improved IVAS 1.1 prototypes. Soldier feedback has exposed numerous issues such as disorientation and neck strain which are to be alleviated with iteration 1.2. The first IVAS 1.2 prototypes were delivered in July 2023, with operational fielding expected in 2025.

Credit: French Army

In 2017 the French Army introduced the new generation Structure Modulaire Balistique (SMB) or 'modular ballistic structure'. Inspired by soldier feedback, the SMB is a fusion of the ballistic protection vest and the combat equipment transport system. It improves mobility and comfort through lower weight and improved ergonomics over its predecessors.

ENGB-V

The helmet-mounted Enhanced Night Vision Goggle-Binocular (ENVG-B) developed by L3Harris combines white phosphor image intensification and long-wave infrared (LWIR) thermal imaging to create an enhanced view of the battlefield under low-light and degraded visual conditions. By integrating with the NETT Warrior system (described below), the goggles can also display maps, navigation, and blue force tracking. Like IVAS, the ENVG-B is intended to enhance mobility, survivability, and lethality in complex environments by significantly expanding situational awareness and improving soldiers' ability to identify and engage targets. The Army plans to acquire 40,000 units through 2028.

NETT Warrior

NETT Warrior (NW) is an integrated situational awareness system for dismounted infantry leaders (team level and above). The cross-platform system uses the handheld military radio as an interface to link a commercial off-the-shelf (COTS) smartphone into the brigade-level command and control network. Via the smartphone, the soldier can access apps to track friendly forces, coordinate movements with other units, request fire support, send messages and share data; the system can also network with sensors of small unmanned ground vehicles (UGVs) and UAVs. NW employs the map-based Tactical Assault Kit (TAK) situational awareness software suite along with custom applications. The system was introduced in 2010, but has undergone several iterations to date, both to enhance performance and to reduce weight. The third increment is currently undergoing testing, and could be delivered to selected units in 2024. A major goal of the newest design is enhanced artificial intelligence to optimise the interface with other new Future Warrior equipment.

Credit: US Army

The Sig Sauer XM7 Rifle will replace the M4 carbine as part of the US Army's Next Generation Squad Weapon (NGSW) programme.

Soldier Protection System (SPS)
The SPS body armour system entered production (depending on the component) between 2016 and 2019, and consists of: Torso and Extremity Protection (TEP), which includes the Modular Scalable Vest (MSV), the lightly armoured, flame-resistant Ballistic Combat Shirt and the Blast Pelvic Protector to reduce the risk of groin injury; the Vital Torso Protection (VTP) set of front, back and side armour plates for insertion into the MSV; and the Integrated Head Protection System (IHPS) consisting of a base helmet which can be augmented with mandible armour and goggles. The SPS is intended to provide equal or greater degrees of protection than legacy body armour against small arms fire and fragmentation, but at reduced weight. The modular system's individual components can be configured for various tiers of protection to meet mission parameters and soldier needs. Three elements of the SPS are currently being upgraded. The new components are the Second Generation Modular Scalable Vest (MSV Gen II), the Third Generation Vital Torso Protection (VTP Gen III), and the Next Generation Integrated Head Protection System (NG-IHPS). MSV Gen II and VTP Gen III began early fielding in 2021. Ballistic testing is ongoing, and failure rates so far remain below 5%. The Army plans to acquire 150,000 of each system subset.

German Army

Germany's Infanterist der Zukunft (IdZ) (ENG: Infantryman of the Future) programme was initiated in 2004 as an urgent operational requirement to equip personnel deployed to Afghanistan. The initial IdZ – BS (Basissystem; ENG: Base System) phase was based on COTS components in order to speed up implementation. The currently fielded iteration is designated IdZ – ES (Erweitertes System; ENG: Expanded System) Gladius. Development began in 2006 by prime contractor Rheinmetall Defence Electronics, with deliveries beginning in 2013. The 'ES' suite was conceived as a clean-sheet development because, as the German army stated, "the essential capabilities required by the infantryman can only be fulfilled via a closed and coordinated system approach." In addition to performance enhancement, the new equipment is also optimised for ergonomic comfort and weight reduction, improving soldier mobility, and reducing fatigue or risk of injury.
The German armed forces currently have circa 165 platoon-equivalent kits, sufficient to equip 6,600 servicemembers (mostly Army, although other services have been provided a limited number of kits as well). IdZ

Credit: US Army

A soldier tests an IVAS headset during a training exercise at Fort Bragg, North Carolina.

Credit: German Army

German soldier with the 'Future Infantryman' (IdZ) kit.

Credit: Rheinmetall

The System Panzergrenadier forges the Puma IFV and its infantry dismounts into a fully digital team sharing situational awareness and enhancing lethality.

consists of three subsystems: BST (Bekleidung, Schutz- und Trageausstattung; ENG: Clothing, Protective and Load-Carrying Equipment), WOO (Weapons, Optics and Optronics), and C4I (Command, Control, Computers, Communications and Information). The entire system is modular, permitting elements from each subsystem-group to be put together to meet the needs of either light or mechanised infantry or reflect an individual soldier's function within the unit. The common core is formed mostly of vest-mounted communications and networking equipment including a USB hub (into which electronic communications, data and sensor devices are plugged), tactical radios, a visual display unit, digital navigation devices, multiple conformal batteries, and a communications headset. This core is augmented by selecting from nearly 80 options organised into various categories including helmet- and weapon-mounted vision modules and fire control units, multi-mode binoculars, augmented reality devices, numerous customisable firearms and grenade launchers, and personal protective equipment (PPE).

The IdZ family continues to be upgraded regularly, and is considered one of the most advanced infantry systems in the world. Regarding the BST and WOO subsystems, recent improvements have largely focussed on reducing weight and improving user-friendliness. Individual sensors and sights have incrementally improved performance, and the greatest effort is now being placed on C4I systems as the key to tying all elements together into a force multiplier package. Deliveries of the newest IdZ iteration, designated 'IdZ-ES VJTF 2023', began in 2021, with additional orders placed in January 2023. This variant is optimised for the German contingent leading the NATO Very-high-readiness Joint Task Force (VJTF) in 2023. New aspects include upgraded software-defined radios as well as enhanced situational awareness and target acquisition features; these include the chest-mounted CeoTronics CT-MultiPTT 3C central operation and control unit which displays blue-force locations on a tactical map. The IdZ-ES VJTF 2023is compatible with the German military's new Digitised Land-Based Operations (D-LBO) programme, which is designed to provide a framework for mobile command and control (C2) networks.

Together with upgraded electronics and communications equipment on the Puma infantry fighting vehicle (IFV) and other armoured combat vehicle classes, the IdZ-ES VJTF 2023 also forms the basis for the System Panzergrenadier which will deploy for the first time with the NATO VJTF. The System Panzergrenadier fully networks vehicle sensors and weapons with those of the mounted and dismounted mechanised infantry, creating a seamless common operating environment. This amalgamation of dismounted infantry and IFVs into a true fighting unit enables opposing forces to be detected, identified, and effectively engaged at greater range and with improved precision. With this, the German Army has set a new baseline for integrating dismounted infantry with their IFVs.

In 2021 the German Army tasked Rheinmetall with initiating a study for the next generation Future Soldier System, to be designated IdZ 3.0. It will build on the digital backbone of the current variants, while incorporating new hardware. Full details have not yet been decided, although a few new components are known. These will include the new G95A1 and G95KA1 assault rifles (more widely known as the HK416 A8) which will begin replacing the current G36 as of 2024. New sensors and weapon sights are also expected. One is the FCS 12 fire control system which combines several functions including day or night weapon sight, laser rangefinder, ballistic computer, and video recorder. As Jan Gesau, First Director of the Bundesamt für Ausrüstung, Informationstechnik und Nutzung der Bundeswehr (BAAINBw) or Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support, stated in an interview in the August 2023 edition of this publication, findings of the relevant studies "will be continuously incorporated into the design of the next steps towards the realisation of the third generation" of the IdZ system.

An Unending Road

Ultimately, 'the future' is always one step ahead of any ongoing programme. Once a particular suite of equipment enters service, the military must begin planning the next system of upgrades in order to keep pace with technology and with potential adversaries. In this, the German, French and US land forces – and all of their counterparts – face the truth that the only constant is change.

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The Future of Poland's K2/K2PL Tank Programme

Robert Czulda

The order for nearly 1,000 South Korean K2 tanks is arguably the largest contract of its kind in the world. Poland is hoping not only to strengthen its armoured units, but also its defence industry.

In mid-June 2023, Poland received its last batch of six K2 Black Panther main battle tanks (MBTs) scheduled for delivery in 2023, and these were assigned to the 20th Mechanised Brigade of the 16th Mechanised Division. Poland now has 28 K2s, part of an order for a total of 180 tanks. Deliveries are planned to run from 2022-2025, and the value of the contract, including training and logistics packages, amounts to EUR 3 Bn. The overall framework agreement covers an acquisition of 1,000 MBTs in total. While the first batch (comprising 180 tanks) is to come from South Korea, subsequent vehicles will be co-produced, with the last batch set to be entirely manufactured in Poland.

The purchase of K2s is just one part of an ambitious project to modernise the Polish Armed Forces, including its armoured units, which have seen an order for a total of 1,366 tanks. It is worth noting that Poland is also purchasing 366 Abrams tanks (116 ex-USMC M1A1FEP and 250 new M1A2 SEPv3 MBTs). Both the Abrams and K2s are intended to become the main MBTs in the near future, as all ex-Soviet era tanks are to be retired as soon as possible (most of them, about 300, have already been donated to Ukraine). Poland's Leopard 2 tanks (2A4, 2A5, 2PL variants – a total of 247 vehicles by 2026) are expected to meet the same fate, though some will likely be assigned to reserve units. The total of 1,366 tanks is still below the limits set by the Conventional Forces in Europe (CFE) Treaty under which Poland is allowed to have no more than 1,730 tanks however, the CFE de facto no longer exists, as Russia withdrew in 2023.

However, there are still many unanswered questions in the programme, the most important of which concerns the development of a 'K2PL' variant. At least 500 K2PLs are planned to be produced at the Military Automotive Works in Poznań (WZM). Other companies, including original partner Hyundai Rotem in Poland, namely H. Cegielski-Poznań (HCP), will be involved in the process. HCP is expected to be acquired by Polska Grupa Zbrojeniowa (PGZ), a major Polish state-owned industrial holding company.

Credit: Polish MoD/ kpr. Piotr Szafarski

K2 MBT firing during a demonstration.

The K2 baseline variant has been criticised within Poland for inadequate crew protection for Polish operational requirements, along with ammunition being insufficiently isolated from the crew compartment. Polish local press has aired concerns that K2's frontal armour protection would be insufficient to withstand Russia's 'Kornet' anti-tank guided missile (ATGM) family passively. One particular line of reasoning argued is that due to being expected to fight in Korea's mountainous terrain, the K2 design focusses more on manoeuvrability than protection, and is thus less suited to the generally flatter terrain conditions in Central and Eastern Europe, which are somewhat more permissive for heavier vehicles due to lower power/weight ratios required on flat land, and longer typical engagement ranges in the more open terrain.

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Credit: Polish MoD/ kpr. Piotr Szafarski

K2 MBT traverses muddy ground during a demonstration.

These perceived inadequacies were supposed to be addressed in the 'K2PL' variant. Speculation arose that the K2PL would also receive hard-kill active protection systems and in order to achieve this, the K2PL would be heavier (over 60 tonnes compared to the 56 tonnes of the K2 variant) and longer (with seven instead of six roadwheels per side).

It is still possible, albeit unlikely, that the new hull would be developed. "The K2PL in its maximum version would be comparable to the M1A2SEPv3 tank in terms of armour protection, crew safety, and overall survivability," according to Polish tank specialist Damian Ratka (Defence24). "At the same time, it would still be a lighter and more economical vehicle thanks to a diesel engine instead of a gas turbine. It would also maintain a greater ability to overcome water obstacles with a depth of about 4-5 metres."

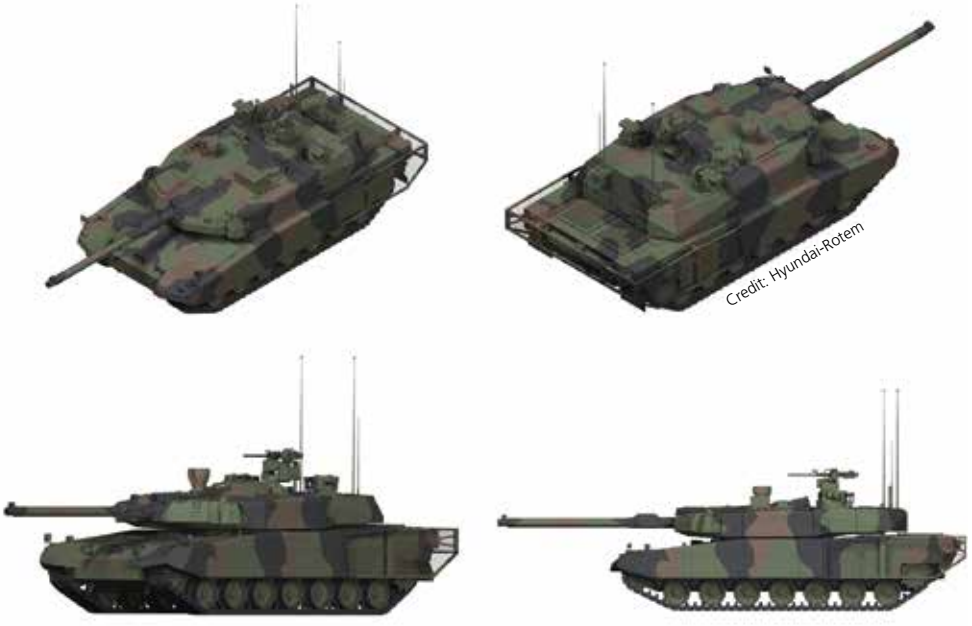
Such revisions are possible, but they would increase overall costs, which may persuade the Poles not to introduce such significant changes.

Indeed, taking a broad view of tank performance over the past couple of decades suggests that there may be more effective priorities than pursuing passive armouring to extreme levels. The Kornet has a powerful 152 mm tandem-HEAT warhead, and its designer KBP has stated it is capable of penetrating 1,100-1,300 mm of Rolled Homogenous Armour equivalent (RHAe). Operationally, heavier tanks than K2, including Israeli Merkava IVs in 2006 and Saudi M1A2S Abrams in 2015 have been defeated by Kornet. Moreover, while increased weight would enhance crew protection, it would reduce the tank's operational mobility, making it more difficult to cross bridges with a lower load-bearing capacity. This is of particular relevance to the Central and Eastern European theatre, which contains a large number of rivers and streams.

Ultimately, it seems that the minimalist variant of the K2PL, which does not differ from the K2 in terms of its hull design, will prevail. Currently, Poland lacks the know-how to design and build MBTs, and even know-how for developing significant components of Soviet-era tanks, such as the T-72, has been lost over the years. The scope of technology transfer to the Polish defence industry is also not fully known in much detail. Under present plans, WZM in Poznań will be responsible for tank assembly, hull and turret production, hydro-pneumatic suspension production, gun and autoloader assembly, and other selected tank components. The company presently services Poland's Leopard 2 fleet.

However, beyond K2PL there are also other areas for possible cooperation. "Potential for joint ventures goes beyond defence," notes Ratka, "Prospects for hydrogen energy are worth considering, both for civilian applications (such as public transport, e.g., railways) and military applications, including development of propulsion systems for various types of vehicles."

The potential involvement of Poland in the K3 tank project, which is expected to be equipped with a 130 mm gun and an unmanned turret, also remains shrouded in uncertainty. Poland has been invited to participate in this programme. It is anticipated that the K3 will have a fully isolated ammunition storage and KAPS active protection system. The crew, will be fully isolated in a protected compartment located in the front of the tank, reminiscent of the T-14 Armata design. It is possible that the K3 will eventually become the new Polish MBT, though the Ministry of National Defence is still pursuing the Wilk (wolf) programme, which involves either domestic production or international cooperation. It is most likely that the Wilk will be based on either an American or, in the most probable scenario, a Korean solution. When the K2PL concept will be presented is still an unknown, as the project details remain in discussion between Poland and South Korea. ■



Credit: Hyundai-Rotem

Graphic shows the notional layout of the longer and heavier conception of K2PL.

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Next Generation Rotorcraft Capability: NATO's Joint Helicopter Development Programme

Sidney E. Dean

NATO's Next Generation Rotorcraft Capability (NGRC) programme aims to refresh the aviation fleets of participating member states with an advanced medium-lift multi-role helicopter.

Goal of the Programme

A significant portion of the medium-lift multi-role helicopter fleets of Alliance members will reach the end of their service life in the 2035-2040 timeframe, with additional airframes retiring during the following decade; overall, non-US NATO armed forces are expected to replace up to 1,000 medium-lift rotary aircraft by 2050. Traditionally, nations have pursued individual weapon system acquisition projects, either through domestic development of new aircraft or import of operational foreign systems. Numerous reasons exist for pursuing a joint acquisition programme instead. These include economies of scale, the ability to combine the most advanced design and manufacturing capabilities of the participating states, and the outlook for optimal interoperability of the future fleets.

NGRC was launched on 19 November 2020 with the signing of a non-binding Letter of Intent (LoI) to pursue the multinational development programme. The five signatories – France, Germany, Greece, Italy, and the United Kingdom (as the lead nation) – then proceeded to develop both a statement of requirements to guide the concept development phase, and a long-term multi-phase cooperation plan for realising the full project all the way through fielding. On 16 June 2022, the signatories, now joined by the Netherlands as a sixth partner, signed the binding Memorandum of Understanding (MoU). This formally launched the concept stage of the project, with a combined initial budget commitment of EUR 26.7 M. Canada will join the programme in the summer of 2023, and additional NATO members may also come on board – most likely as observers – as the project progresses.

Credit: NATO

Representatives of six NATO member states signed the NGRC MoU on 16 June 2022 in Brussels.

The NGRC programme will provide participating Alliance members a multinational framework for pooling their resources and efforts to design, develop, and eventually procure the new helicopters. The NGRC is classified as a NATO High Visibility Project (HVP), a term used for multinational initiatives designed to address key capabilities. HVPs are usually launched at the defence minister level, underscoring both the consensus regarding a major requirement, and enhancing the probability that member states are fully committed to the joint project.

The NATO Support and Procurement Agency (NSPA) acts as the contracting authority for the NGRC and is the executive arm of the NATO Support and Procurement Organisation (NSPO), of which all 31 Alliance nations are members. The NSPA is currently organising the concept study phase and providing programme management (procurement and finance); it will also devise and manage the acquisition strategy for upcoming stages. The agency's Cyril Heckel is the official NGRC programme manager.

Roles, Missions, Capabilities

Today's army and air force medium-lift helicopters perform a wide array of missions including assault carrier, special operations transport, battlefield resupply, combat search and rescue, and casualty evacuation/medical evacuation (CASEVAC/MEDEVAC); NGRC must be capable of fulfilling all of these roles. The future helicopter is also supposed to replace medium-lift helicopters in naval service, which means it must be capable of landing on decks and performing such tasks as anti-submarine warfare, maritime reconnaissance and targeting support, and potentially anti-surface warfare. The target aircraft should display significantly improved flight characteristics when compared to current operational systems.

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Credit: USAF

The French Air Force's optionally armed EC725/H225M multirole helicopter performs the range of missions expected of the future NGRC, namely troop transport, casualty evacuation, combat search and rescue, special operations, maritime surveillance and anti-submarine warfare.

NSPA presented an initial list of 15 system requirements plus another ten desired attributes in May 2021 in preparation of an industry day in September 2021; these requirements and preferences were confirmed in February 2023 by programme manager Cyril Heckel during the IQPC International Military Helicopter (IMH) 2023 conference in London. Whether all requirements survive past the concept study – and the intense review of what is technically feasible – remains to be seen, but for now the agency is seeking an optionally-manned platform with a minimum range of 1667 km (900 NM), a 741 km (400 NM) mission radius, plus 30 minutes of loiter time, and an overall eight-hour mission endurance (with auxiliary tanks fitted). The objective maximum cruise speed is 220 kn or higher, with 407 km/h (180 kn) as the absolute bottom threshold. These baselines would provide NGRC with approximately 50% more speed and double the range of current medium-lift utility helicopters, placing performance parameters closer to the US Army's Future Long-Range Assault Aircraft (FLRAA); the American aircraft is expected to become fully operational at approximately the same time as NGRC. Being able to keep up with one another would of course be advantageous for future NATO operations.

The target take-off weight lies between 10,000 and 17,000 kg, with a 2,500 kg internal payload capacity and a combined internal/external payload of 4,000 kg. The acquisition price per airframe must not exceed EUR 35 M, and the hourly flight cost should lie between EUR 5,000 (objective) and EUR 10,000 (maximum). The aircraft must also have a 75% mission availability rate. As reiterated by Cyril Heckel during the IMH conference, all performance parameters are to be met with minimal differences in aircraft configuration in order to minimise complexity and cost.

Additional required goals are numerous and include: an internal capacity for 12–16 combat equipped soldiers; the ability to perform special operations, anti-surface warfare, electronic warfare (EW), search-and-rescue, personnel recovery and MEDEVAC missions; full-operational capability from frigate/destroyer type vessels; and being able to operate in the face of enemy EW threats. Desired attributes include: a two-minute automated rapid start routine; digital cockpit and avionics; aerial refuelling capacity; the ability to launch and control drones (manned-unmanned teaming); and deployment of advanced crew served weapons including missiles and so-called Air-Launched Effects, a blanket term which includes loitering munitions with a broad capability spectrum ranging from reconnaissance and surveillance to kinetic effects and EW.

Credit: Royal Navy/Open Government Copyright

The British Royal Navy will retire its ship-based, optionally armed AW101 Merlin helicopters by 2040, and could replace them with the NGCR.

Programme Elements

As defined by NATO, NGRC offers a multinational framework under which its participants can combine efforts towards the design, development and eventually the acquisition of the next generation of medium multi-role rotorcraft capabilities. The plan is to create a clean-sheet design rather than adapting a currently operational or developmental aircraft. Working closely with industry, the governments will assess how to sync their operational requirements and desired aircraft characteristics with technological developments, as well as assessments of the future operating and threat environment. "NGRC to me is about transformation capability, delivering an aircraft or an airframe or a system that is an open system architecture based on digital backbones and is aimed for us as soldiers and airmen to be able to modify that aircraft to keep up with the pace of the threat," said British Army Col. Alex Willman, capability sponsor of combat aviation within the UK's futures directorate, after the MoU signing.

The programme's concept study phase commenced in June 2022, and is subdivided into five major areas of interest. Studies are being prepared regarding the concept of operations, novel powerplant solutions (to review the viability of hybrid-electric and other non-traditional propulsion technologies), modular open systems architecture (MOSA), sustainability, and to survey rotorcraft technology innovations which could be applicable to NGRC. A portion of these studies will be contracted out to industry following an open competition, while others – such as the technology review – will be conducted at the government or alliance level for security reasons. The studies should be completed by mid-2024 (some earlier), providing a roughly 18-month period for

Credit: USAFE

Producing multiple national variants of the NH90 medium helicopter (seen here in the French Army variant) has complicated sustainment and has contributed to reliability issues – a mistake the NGRC programme office hopes to avoid.

exhaustive concept reviews and to adapt the final concept of operations (CONOPS) to the results of the technical studies.
The NSPA hopes to conclude the concept review phase in 2025. A major challenge during this period will consist of harmonising the fundamental – and sometimes contradictory – requirements and priorities of the individual participant nations into one common framework, while avoiding a multiplication of variants which would increase costs and reduce efficiency, NSPA's Heckel added.

Programme Activities to Date

The first formal meeting of the NATO Support and Procurement Organisation NGRC Acquisition Support Partnership took place on 29-30 November 2022 in Luxembourg. All six MoU signatories attended the meeting chaired by the NSPA; Canada attended as an observer prior to achieving full membership. By January 2023, the NSPA was able to announce that the NGRC programme team had been "partially activated."
The first two pre-solicitation conferences for the NGRC were conducted, respectively, in March and May 2023. The first conference held on 30-31 March in Luxembourg was dedicated to the overall concept stage of the project. More than 20 rotorcraft industry firms participated and were briefed on the NSPA's expectations and requirements for the new aircraft. According to the NATO press release, Agency presentations focused on the procurement strategy for the concept stage studies and on the project's special Study Number One. "This first study will analyse and compare novel power plant solutions for rotorcraft based on Strength Weakness Opportunity Threat analysis" to include factors such as capability, availability, cost and logistic footprint, the release noted. The second pre-solicitation conference, held on 22-23 May, focused on the non-proprietary Open System Architecture Study. The 24 companies in attendance received an overview of the open system requirements, and in turn offered their views on the strengths, weaknesses and issues surrounding candidate MOSA concepts in terms of capability and supportability. The comprehensive and formal Request for Proposals is expected to be promulgated in summer 2023, initiating across the board concept development and presentation by industry.

Early Speculation Regarding Aircraft Concepts

Many observers believe that supporting European industry is a secondary goal of the NGRC programme. Early on there were concerns that Britain – which in 2022 signed an information sharing agreement with Washington regarding future rotorcraft lift programmes – might try to steer the NATO programme towards acquisition of the US Army's FLRAA. Specifying that NGRC will be conceived as a clean-sheet programme did much to alleviate those concerns. Presuming that a European firm or consortium will ultimately receive the development contract or contracts, Airbus and Leonardo (either separately or jointly) are the leading contenders going in, with several specialised contractors able to offer propulsion, avionics and other mission systems. However, as a matter of principle, industry partners from any NATO nation remain free to tender their technology, which opens the door for US firms to ultimately participate in some form.
While NGRC is geared toward a clean-sheet design, this could ultimately be interpreted as precluding the acquisition of an upgraded variant of a currently operational military or civilian system. Beyond that restriction, some developmental or conceptual projects could be leveraged as a basis of the future medium multi-role helicopter with several already being proposed by industry. These include the Airbus Racer (Rapid and Cost-Effective Rotorcraft) concept for a high-speed ver-

Credit: Leonardo

Technology from Leonardo's developmental Next Generation Civilian TiltRotor (NGCTR) could flow into the NGRC concept design.

Credit: Airbus

Airbus has proposed considering the firm's conceptual Racer high-speed helicopter as a potential starting point for the NGRC.

tical-lift aircraft, which is currently oriented toward civilian and public safety applications. The Racer design already meets some NGRC baselines including flight speed and inclusion of hybrid-electric power system; first flight of the technology demonstrator is expected in 2023. Another potential starting point could be the Next-Generation Civil TiltRotor (NGCTR) being developed by Leonardo, which is designed for a cruising speed of 519 km/h (280 kn) and range of 1,852 km (1,000 NM), with a (civilian) passenger capacity of 18-25. The first flight of the demonstrator is expected in 2024.

Leonardo is also cooperating with Sikorsky to evaluate the suitability of the American firm's X2 rotorcraft technology for the European market. The technology forms the backbone of several Sikorsky designs including the SB-1 Defiant, which ultimately lost the competition for the US Army's FLRAA contract. Sikorsky is now concentrating on the international utility helicopter market. "We certainly think that the X2 fits very well with a number of the requirements that they [the NGRC programme] have, and we will continue to work that as time goes on," said Sikorsky president Paul Lemmo. All three of the referenced designs would fulfil predictions made by many industry observers and corporate representatives who point out that the high speeds required of the NGRC will require an unconventional design, perhaps including a pusher propeller in addition to the main rotor, or a tiltrotor design.

NGRC - Moving Forward

The concept phase will provide the participating nations with some early design proposals, before tackling the development stage and the preliminary design review post-2025, according to Heckel. The goal is to exit the concept phase with two or three competing designs suitable for further development and evaluation going forward. The preliminary design review will be followed by award of development contracts. The programme office is recommending prototype testing as part of the development phase. NSPA's Heckel estimates that prototype testing could take place around 2030.

Given the early stage of the programme, timelines for future NGRC stages are tentative. Advancing to a full development phase will require a new government-level agreement among the participating nations. Such an agreement would address such – potentially challenging – issues as division of work among the nations, design details, and the possible admission of other NATO members as full partners in the programme. Some points of contention regarding performance requirements – which will in turn impact factors such as size and cost – are already coming to the fore. For example, the priority given by the UK and Italy regarding high flight speeds is not shared by the French Army. Airbus warned early on that the 25 priorities presented by the programme office would require a larger, heavier and potentially more expensive aircraft. Trade-offs must be expected as the programme progresses.

The programme office is adamant that a multitude of national variants should be avoided, as this could lead to sustainment issues and higher costs. Optimally, there should be a single airframe and the modular design should enable aircraft to be refitted for various mission types as needed. Two variants are considered the maximum acceptable outcome if the full spectrum of operations cannot be achieved by a single design.

For the duration of the concept phase, the programme is restricted to the current seven members. After 2025, when a development decision is made, the programme is likely to open up again for additional participants, bringing in additional design and production resources, but potentially complicating decision-making and consensus going forward. Presuming that the programme is not terminated prematurely, and leads to a production decision, Alliance nations not participating in the programme will still be eligible to acquire the NGRC, greatly enhancing interoperability and potentially leading to lower unit costs. Conversely, none of the seven current programme members will be required to procure the NGRC. Should the production schedule be delayed, or the aircraft's profile not meet a nation's specific requirements, other options will be available, including the US military's new FLRAA.

The first operational aircraft are expected to enter service somewhere in the 2035-2040 timeframe, with a target of 2035. Given the large number of helicopters due to retire between 2035 and 2050, an Initial Operational Capability (IOC) later than 2035 would run the risk of creating a capability gap in at least some Alliance fleets. Current expectations foresee production and procurement running through 2059, with at least three major block changes during this timeframe to accommodate major technological developments and operational requirements. Once fully operational, the NGRC aircraft family is expected to dominate non-US medium rotary-lift aviation into the late 21st century. ■

Credit: Lockheed Martin/Sikorsky

Sikorsky X2 architecture, shown here on the S-97 Raider demonstrator aircraft, employs a rigid co-axial main rotor supported by a tail-mounted pusher propeller, which delivers high speed in forward flight while enhancing agility. Aspects of this propulsion concept, regardless of the prime contractor, could be applied to the NGRC.

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Nuclear Options

Tim Guest

This article looks briefly at some of the threats to world peace from nuclear weapons in today's geopolitically explosive world. These threats have brought us to the edge of a very dangerous abyss. It also touches upon nuclear deterrence as the option favoured by Western powers and the Alliance, bolstered by strength and nuclear options that include US strategic forces and land-based missile systems.

If an aggressor decides to use a nuclear weapon in the context of today's global geopolitical tensions, the result will not be good for any life form on this planet. There will be no winners and, undoubtedly, a nuclear response will follow, an option that did not exist before when in WW2, the world's eyes were opened to the horrors of what unleashing a nuclear 'option' on the battlefield looked like, with Hiroshima and Nagasaki suffering the effects of what, today, would be seen as tactical yields. The Japanese possessed no atomic bomb with which they could respond and so the Americans had no fear when they dropped 'Little Boy' and 'Fat Man' on their respective targets.

Since those horrors in 1945, and despite other lesser conflicts, Cold War tensions, and more – including the Cuban Missile Crisis – there has been a relative period of peace from large-scale confrontation, with a largely rules-based approach followed by all powers sharing the planet. One could almost be forgiven for thinking that two world wars had taught enough lessons to last an eternity.

Credit: USAF/Staff Sgt. Trevor McBride

A USAF weapons system officer changes radio frequencies in a B-52 Stratofortress during a mission over the Baltic Sea, October 2019.

The Nuclear Spectre over Ukraine

Yet a rules-based world no longer seems to prevail. Nuclear weapons are now being waved around in threat displays on the battlefields of Ukraine by Vladimir Putin, and in regular shows of technological capability though overt aggressiveness by North Korea. Indeed, Putin is obviously willing to flaunt international conventions as has been displayed with attacks on civilians and civil infrastructure, and his disregard for causing mass destruction wrought from the breaching of the Kakhovka Dam in southern Ukraine. This caused extensive flooding along the lower Dnipro River and suggests he may be more than willing to escalate further. At the time, Ukrainian President Zelensky called it 'an environmental bomb of mass destruction' and the country's prosecutor general's office called it a possible crime of 'ecocide'. However it is seen, Putin's nuclear sabre rattling since last February's invasion of Ukraine has been a mainstay of the Kremlin's playbook to keep Ukraine and the West afraid and guessing. By way of example, Ukrainian intelligence claimed in late June 2023, that Russian leadership may even instigate a nuclear incident around the Zaporizhzhia nuclear power plant. Were that to happen, how the West would respond is uncomfortably uncertain, for damage or destruction of the power plant could result in radiological contamination across a wide European geographical landscape. Would such an act warrant a NATO response of any kind, since Alliance nations would certainly be affected by the fallout? In 2022, the Ukrainian Hydrometeorological Institute simulated what a disaster at Zaporizhzhia might look like, with a radioactive cloud modelled to disperse over 13 countries, including the three Baltic States, Belarus, Czech Republic, Hungary, Moldova, Poland, Romania, Serbia, Slovakia, Russia and, of course, Ukraine. Considering contamination after the 1986 Chernobyl disaster was carried as far as Norway, Sweden and north Wales, this list may be conservative.

Russia's nuclear options also include tactical nuclear weapons stationed on Belarusian soil, which was begun in May 2023 and by mid-June Putin announced the first batch had been moved. President Lukashenko used language suggesting a willingness to use them, when he compared them to the weaponry supplied to Ukraine by NATO nations, stating: "they're all just weapons". While the US has been critical of the nuclear deployment, it has stated no intention of altering its own posture on strategic nuclear weapons, nor has it seen any signs that Russia might be preparing to use a nuclear weapon. That said, the

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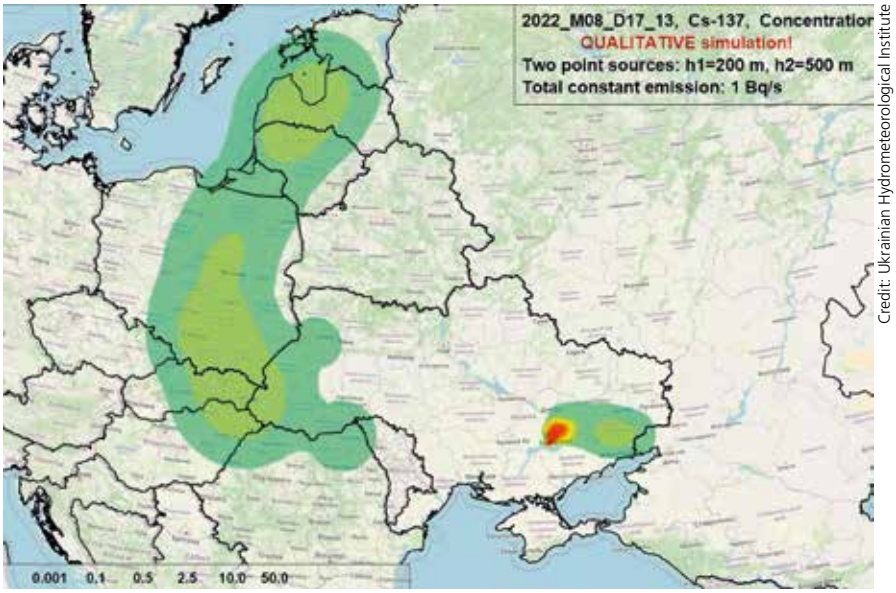
Russians have not revealed which tactical nuclear warheads have been deployed, although Lukashenko has said they are three times more powerful than the atomic bombs dropped on Japan in August 1945. Putting that in perspective, the enriched uranium-235 'Little Boy' dropped on Hiroshima was about 15 kilotons, equivalent to 13,600 tonnes (15,000 US tons) of TNT, while the plutonium-239-based 'Fat Man' bomb dropped on Nagasaki was about 21 kilotons. Sobering, considering Lukashenko cautioned in the same breath that any aggression against Belarus would result in an instant response, with targets already defined.

That the same forces who blew up the Kakhovka Dam possess tactical nuclear weapons, and are currently in a defensive posture, combined with the fact that the US has upped the weapon-supply ante with deliveries of cluster munitions to Ukraine, has caused concern that tactical nuclear weapons will be used if the counteroffensive looks like succeeding. The likelihood that they will be used is thought to be even greater should Russian forces look like they are being routed, and especially, if Crimea, including the naval base in Sevastopol, comes under serious threat. Basically, if Russia looks like losing, Putin, may simply give the order to use tactical nuclear weapons – either from Russian or Belarusian territory, to force Ukraine into submission. One last, desperate attempt to take control and save himself while possibly obliterating major cities and civil infrastructure.



Credit: Ukrainian Hydrometeorological Institute

Nuclear fallout from Zaporizhzhia; initial spread model. Later models show fallout reaching beyond the Baltics.

Threats from Elsewhere

Beyond the immediacy of the nuclear threat from Russia in Ukraine, as already mentioned, North Korea keeps nuclear tensions high on the Korean Peninsula and beyond with its repeated test launches of ballistic missiles into the East Sea, also known as the Sea of Japan, and nuclear developments showcased for all the world to see. What option does the West have in this regard? Diplomacy to try and get the regime to end its nuclear programme has failed miserably.

Indeed, in 2018, Former US Secretary of State Henry Kissinger, said that North Korea was the greatest threat to global peace at that time and that, "the essence of the matter: North Korea acquired nuclear weapons to assure its regime's survival; in its view, to give them up would be tantamount to suicide." Chillingly, around the same time, he also posited that the world was almost at the point, or may soon reach it, when taking the option of a pre-emptive strike was the only remaining way to deal with North Korea, since diplomacy, Chinese co-operation and all other means had failed – although no administration members have ever suggested anything similar. Certainly, this geopolitical cauldron cannot be ignored.

Then there's Iran, not yet a nuclear power, but allegedly heading in that direction. In early June 2023, the country's Islamic Republic News Agency reported the unveiling of a medium-range ballistic missile (MRBM) named Fattah. Interestingly, the missile appeared to use a manoeuvrable re-entry vehicle (MaRV) design, featuring a manoeuvring second stage with aerodynamic control surfaces, and appearing to be paired with a rocket motor with a thrust vector control (TVC) capability. These features would respectively allow it to manoeuvre in both endo-atmospheric and exo-atmospheric conditions, significantly complicating the task of intercepting it.

In terms of official statements regarding its capabilities, Revolutionary Guards Corps head, Amirali Hajizadeh, was quoted by Iranian state media as saying that, "The precision-guided Fattah hypersonic missile has a range of 1,400 km and it is capable of penetrating all defence shields." State television said the missile the missile's top speed could reach Mach 14 (15,000 km/h), which is not particularly surprising for a ballistic missile. While Iran has consistently denied any ambition to obtain a nuclear bomb, its resumption of nuclear-oriented activities since 2018, after the US withdrew from the 2015 nuclear deal between six leading nations has reignited fears that producing a nuclear bomb remains its ambition. Whether Israel would stand by and watch that happen is unlikely.

Credit: Tasnim News Agency/Hossein Zohrevand, via Wikimedia Commons

The Fattah MRBM shown at its unveiling ceremony on 6 June 2023.

Credit: US Navy/Navy Petty Officer 2nd Class Dominique Pineiro

Crew of a Boeing B-52H at Minot AFB, North Dakota during nuclear triad operations.

No analysis on the threat to world peace from nuclear weapons would be complete without mention of China. Its 'Belt and Road' initiative since 2013 has given Beijing a footprint, a foothold even, the world over, through a global infrastructure development strategy to invest in more than 150 countries and international organisations. Yet, its militarisation of the South China Sea and bellicose statements in the direction of Taiwan have been a cause for significant concern in the West. Kissinger said recently that he believed US-China tensions are imitating those of the Cold War era. This time, however, with the possibility for destruction having increased drastically, including the likelihood that the US and its allies will be at war with China by 2030. If that is so, the potential for nuclear exchange, both at tactical and strategic levels, is significant.

However, rather than continuing along such alarming lines the article will continue with a look at US and NATO ally fundamentals of nuclear deterrence, along with other reassuring developments.

The Option of Deterrence – a Political Choice

In its 2022 Nuclear Posture Review (NPR), the US Department of Defense (DoD) outlined the 'Declaratory Policy' of the US: 'As long as nuclear weapons exist, the fundamental role of US nuclear weapons is to deter nuclear attack on the United States, our allies, and partners. The US would only consider the use of nuclear weapons in extreme circumstances to defend the vital interests of the United States, or its allies and partners.'

That said, the US has reduced the size of its land-based nuclear weapons stockpile by over 90% since the height of the Cold War, including the number of nuclear weapons stationed in Europe, which nonetheless remain a fundamental part of NATO's nuclear calculations. Indeed, for NATO, US nuclear weapons are the mainstay of the Alliance's nuclear arsenal. They are also a core component of its overall capability for deterrence and defence, alongside conventional and missile defence forces. As long as nuclear weapons exist, NATO makes clear that it will remain a nuclear alliance with a deterrent policy and a non-offensive nuclear capability intended to preserve peace, prevent coercion, and deter aggression.

Two documents set out NATO's current nuclear policy which have been agreed by all Alliance members; one is 'The 2022 Strategic Concept', and the other 'The 2012 Deterrence and Defence Posture Review (DDPR)'. In the concept document agreed at the 2022 Madrid Summit, deterrence and defence are stipulated as core tasks and principles of the Alliance based on an appropriate mix of nuclear, conventional and missile defence capabilities, complemented by space and cyber capabilities, with Article 30 of the Strategic Concept stressing that, "NATO will take all necessary steps to ensure the credibility, effectiveness, safety and security of the nuclear deterrent mission. The Alliance is committed to ensuring greater integration and coherence of capabilities and activities across all domains and the spectrum of conflict, while reaffirming the unique and distinct role of nuclear deterrence. NATO will continue to maintain credible deterrence, strengthen its strategic communications, enhance the effectiveness of its exercises and reduce strategic risks."

That said, for such deterrence to be effective, NATO makes clear that Alliance unity and resolve in such deterrence must be underpinned through the broadest possible participation by those allies concerned with agreed, nuclear burden-sharing arrangements. To this end, it was the 2012 DDPR that, while noting the fundamental purpose of Alliance nuclear forces is that of deterrence, also impressed that any decision to take a nuclear option is, essentially and definitively, a political one. So, despite Alliance forces maintaining and being the custodians of its effective deterrence, nuclear weapons are under political control in all circumstances,

Credit: US DoD

Air Force Global Strike Command unarmed Minuteman III launch, February 2023.

with nuclear planning, consultation and actions within the Alliance conducted purely in accordance with strict political guidance.

To that end, the key principles of NATO's nuclear policy are established by all NATO heads of state and government, with the development and implementation of Alliance nuclear policy the responsibility of its Nuclear Planning Group (NPG), which provides the forum for consultation on all issues that relate to NATO's option of nuclear deterrence. With the exception of France, all members of the Alliance are in the NPG.

Credit: US DoD/Air Force Senior Airman Clayton Wear

The US and its allies rely on a strong strategic deterrence. Pictured: An unarmed Minuteman III ICBM test, February 2020.

NATO's Nuclear Options and Capabilities

While the circumstances under which NATO might have to use nuclear weapons are remote, their use by a belligerent against an Alliance member would fundamentally alter the nature of any conflict. In such a scenario, NATO states that it has the 'option, capabilities and resolve to impose costs' on an adversary that would be unacceptable and far outweigh the benefits that any such enemy force could hope to achieve by using nuclear weapons. Indeed, NATO's strategic forces, particularly those of the US, are the greatest guarantee of Alliance security, along with the independent strategic nuclear forces of the UK and France, which have deterrent roles in their own right, with separate decision-making centres. France, the UK, and the US contribute to deterrence by also complicating the defensive/offensive calculations potential adversaries must make. Not only must they contend with NATO's overall decision-making, but also the independent decision-making from political leaders in the US, the UK and France, should the adversary choose to attack an Alliance member and use nuclear weapons.

As stated above, NATO's nuclear deterrence posture relies on forward-deployed US nuclear weapons in Europe, in addition to infrastructure provided by allies concerned, together with their own nuclear-relevant capabilities. Several NATO member countries

Credit: USAF

The world faces greater peril from belligerent nuclear powers than ever, with effective deterrence remaining the West's favoured option. Pictured: CG render of an LGM-35A Sentinel, which will replace Minuteman III.

contribute a dual-capable aircraft (DCA) capability to the Alliance, which are available for nuclear roles at various levels of readiness central to NATO's nuclear-deterrence option, and for which they are equipped to carry nuclear bombs in a conflict. Such nuclear sharing plays a vital role in the cohesiveness of the Alliance and the indivisibility of security of the whole Euro-Atlantic area. That said, while the Allies provide military support for the DCA mission with conventional forces and capabilities, the US maintains absolute control and custody of its forward-deployed nuclear weapons.

America's Approach and Nuclear Triad

On land, at sea and in the air, a compilation of platforms and weapons, the three legs of the US nuclear triad, serve as the backbone of America's national security, as well as offering wider security to its allies and NATO member countries. This triad, along with assigned forces, provides 24/7 deterrence and stands ready to deliver a decisive response, anywhere, anytime. Indeed, the aforementioned 2022 NPR states that the US must be able to deter both large-scale and limited nuclear attacks from a range of adversaries. It also states that the capability to deter limited nuclear attacks is critical, given that some adversaries, "have developed strategies for warfare that may rely on the threat or actual employment of nuclear weapons in order to terminate a conflict on advantageous terms". The NPR adds: "given the US global alliance network is a military centre of gravity, the US will continue to field flexible nuclear capabilities and maintain country-specific approaches that reflect our best understanding of adversary decision making and perceptions".
The US' domestic nuclear forces include more than 10,000 people, who provide up to 400 on-alert, combat-ready LGM-30G Minuteman III intercontinental ballistic missiles (ICBMs), in hardened silos across five states and make up the most responsive leg of the nuclear triad. These strategic weapons are dispersed to protect against attack and connected to an underground launch control centre through a system of hardened cables. This ICBM force has remained on continuous, round-the-clock alert since 1959, though is soon to be replaced by the USAF LGM-35A Sentinel weapon system, (formerly the Ground-Based Strategic Deterrent programme), which will begin the replacement of Minuteman III and modernisation of the 450 ICBM launch facilities in 2029. The Sentinel is scheduled to attain an initial operational capability (IOC) in 2029, and full operational capability in the mid-2030s.
Following detailed environmental analysis, clearance to begin the construction phase of Sentinel was given in May 2023. The effort to modernise the land-based leg of the US nuclear triad affects multiple states, covers thousands of miles, and impacts communities in Arizona, Colorado, Montana, North Dakota, Utah and Wyoming.
While up for replacement, Minuteman III remains at total readiness. Indeed, in April 2023, a joint team of USAF Global Strike Command and USN personnel aboard the Airborne Launch Control System launched an unarmed Minuteman III ICBM equipped with one test re-entry vehicle from Vandenberg Space Force Base in California. This was part of routine, periodic activities, with such tests having occurred over 300 times before. the US emphasised at the time that this recent test was not the result of current world events. A previous test launch had taken place in February.
The ICBM test launch programme demonstrates the operational capability of Minuteman III and ensures the US ability to maintain a strong, credible nuclear deterrent. Data collected from test launches is used for continuing force development evaluation. As for USAF Global Strike Command, this is a major command with headquarters at Barksdale AFB, Louisiana, which oversees the nation's three intercontinental ballistic missile wings, the USAF's entire bomber force, including: B-52, B-1 and B-2 wings, the Long-Range Strike Bomber programme, Air Force Nuclear Command, Control and Communications systems, and operational and maintenance support to organisations within the nuclear enterprise. Approximately 33,700 personnel are assigned to two numbered air forces, with nine wings, two geographically separated squadrons, and one detachment, based in the continental US and deployed around the globe.

Credit: USAF/Senior Airman Eugene Oliver

Two USAF B-52 Stratofortresses fly over RAF Fairford, England, 22 August 2020.

Sobering Thoughts

Back to Ukraine. Certainly, NATO, and the West in general, will have their respective nuclear doctrines, plans, options set out, but if the unfolding scenario between Russia and Ukraine does not go Putin's way, this may lead us into the most dangerous period of the war so far. Having a response ready, were that to happen, is essential. We've already been tested: a critical infrastructure event causing mass destruction. A nuclear detonation could become the next big test. ■

Unravelling Threats: Poland's Struggle Amidst A Security Crisis and Diplomatic Tensions

Robert Czulda

A seemingly innocuous event in December 2022 has snowballed into a serious dispute between Poland's military and its leadership, sparking questions about the country's security and command system. This clash, coupled with diplomatic tensions with Ukraine and concerns over Belarusian provocations, creates an unfavorable situation for the government in the face of upcoming parliamentary elections.

On 16 December 2022, no one anticipated that a serious dispute between the military and decision-makers would soon ignite in Poland – not serious enough to cause a purge among commanding officers, but significant enough to raise valid questions about Poland's security and command system. At that time, a mysterious object fell on the Polish territory, but it exploded – not literally, but politically – only six months later. It was at the end of April that the remnants of the object – soon identified as a Russian Kh-55 nuclear-capable subsonic air-launched cruise missile – were accidentally found in one of the forests. The missile, without a warhead, had flown across half of Poland and then crashed near the city of Bydgoszcz (where NATO's Joint Force Training Centre is located).

Prime Minister Mateusz Morawiecki immediately stated that he learned about the incident from the media. Defense Minister Mariusz Błaszczak at that time blamed the military, especially General Tomasz Piotrowski (Operational Commander of the Polish Armed Forces). Controversy arose from accusations that it was the general's fault, as Polish command was supposed to be aware of the incoming threat. There were even reports of Polish and American planes in the air at the time, but ultimately the Russian missile was lost both to ground radars and aircraft. General Rajmund Andrzejczak (Chief of the General Staff) quickly spoke out, indirectly accusing the minister of lying. He stated that politicians had been informed about the incident.

Credit: Polish MoD/Aleksander Perz

A Polish PT-91 Twardy tank on exercise. Around 60 of these tanks have been delivered to Ukraine.

Although the dispute between ruling politicians and active military personnel may be the greatest political crisis in the history of democratic Poland, no one has yet faced consequences (even though someone must have lied). Minister Błaszczak maintained his position, as did both military figures – reportedly due to their support of Polish President Andrzej Duda, who values both Piotrowski and Andrzejczak. Emotions had not yet faded away when another unidentified object, likely an observation balloon, flew into Poland from Belarus in May. However, the Polish military subsequently lost radar contact with the object, and it has not been located thus far.

This crisis may still have a political outcome. The current government is building its popularity on a narrative of unprecedented strengthening of Poland's security. Pro-government voices have even claimed that Poland is currently the safest in its thousand-year history. This is one of the government's standard slogans. The missile crisis is a blemish on the government's image – perhaps a small one, but there are other such blemishes, and parliamentary elections will take place in Poland on 15 October 2023. Their outcome is uncertain – a number of issues, including persistently high inflation, are boosting the popularity of the populist and pro-EU opposition, which lost power in 2015. Even if the current government wins, it may be forced to seek an agreement with Konfederacja – an increasingly

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popular coalition of various right-wingers who sympathise with Russia and are sceptical of aiding Ukraine.

Tensions with Ukraine

The recent internal debate has been heated up by a noticeable deterioration in Poland's relations with Ukraine. Although the Polish government, as well as the majority of society, still perceives a need to support Ukraine – whether for moral reasons (assisting those in need) or pragmatic reasons (Ukrainians have been weakening Russia, which is and will remain Poland's top threat) – enthusiasm towards Kyiv seems to be diminishing. A decline of interest in a war is not unique, and it is also evident in other European countries. Over time, for many in Europe the war in Ukraine has become more quotidian and less captivating than it was at the start.

This fall of Polish enthusiasm, which had been so visible after February 2022, is undoubtedly influenced by a series of recent diplomatic incidents. The first of these was an agitated reaction from Kyiv to words of the Polish Ministry of Foreign Affairs spokesperson, Łukasz Jasina, who said that Ukrainian President Volodymyr Zelensky should "apologise for Volhynia". This refers to a series of massacres carried out during World War II by the Ukrainian Insurgent Army (UPA), with the support of Ukrainian civilians, in which up to 100,000 Poles were brutally murdered, including women and children. UPA and its leaders are still seen by many Ukrainians as heroes, while for Poles, they are considered criminals on par with Nazi Germany. It's worth adding that last year, Jasina made another controversial statement – he claimed that Poles "are servants of the Ukrainian nation".

Credit: Polish MoD/Mateusz Burda

A Polish M120 Rak Mortar carrier, based on the KTO Rosomak 8×8 wheeled platform. Approximately 200 Rosomaks are due to be delivered to Ukraine.

Very soon, Kyiv threatened to refuse permission for exhumations of victims of the Volhynian massacre, which is particularly distressing for many Poles, especially those whose relatives were murdered by the Ukrainians during World War II. Another dispute erupted on 31 July, when Marcin Przydacz, the chief of staff to President Andrzej Duda, stated that Ukraine should show more gratitude in return for Poland's support. In response, Kyiv summoned Polish Ambassador Bartosz Cichocki. This matter is also sensitive, as Ambassador Cichocki was one of those who did not leave Kyiv during the Russian assault on the Ukrainian capital last year. Polish Prime Minister Mateusz Morawiecki reacted to Kyiv's actions, describing them as a "mistake that shouldn't happen" in relations with a country that has provided "tremendous support".

Simultaneously, bilateral relations are increasingly influenced by the grain crisis. Poland, as well as other EU member states in Central-Eastern Europe, have been complaining for months that Ukrainian grain is illegally entering their domestic markets. Ukrainian grain is only permitted to transit through territories of European Union countries. In reality, Ukrainian grain usually avoids inspection and can be of lower quality compared to European products, but it is cheaper. This poses a problem for local farmers. Poland is threatening a complete closure of its border to Ukrainian grain if the European Union doesn't address the issue, while Ukraine accuses Poland of violating regulations. This, in practice, is currently the most significant source of tension in the bilateral relations, and is unlikely to be diffused quickly.

Relations are not improved by statements like those made in August 2023 by Mykhailo Podolyak, now an adviser to President Zelensky, who admitted that "while Poland is currently the closest partner to Ukraine," this will only be the case "until the end of the war," and after its conclusion,

"we will compete for access to markets, fiercely defending our own interests." Although these words are not shocking in any way, some people in Poland – who looked towards the future of Polish-Ukrainian relations and even dreamed of a Polish-Ukrainian federal state – found them surprising. Podolyak's words were

Credit: Polish MoD/Michal Czornij

Poland has deployed snipers to its border with Belarus.

also instrumentally used by the Russian propaganda machine, which eagerly began spreading them on social media.

Some commentators have explain Kyiv's actions as disappointment over the outcomes of the NATO Summit in Vilnius in July 2023, where Ukraine didn't receive candidate status for NATO and the NATO-Russia Founding Act from 1997 was not invoked. Poland, however, is not the only country with whom relations with Ukraine have cooled in recent times. Similar diplomatic tensions with the UK rose to the surface in July, following highly critical statements from British Defence Secretary Ben Wallace, who also called on Ukraine to express gratitude and stated that the UK is "not Amazon" for weapons. Other commentators have looked for reasons behind Ukraine's more assertive stance towards Poland in Kyiv's cynicism. Poland, which has already provided Ukraine with nearly all the military equipment it can, is losing significance in Kyiv's eyes. It is widely agreed, at least in Polish governmental circles, that Ukraine is increasingly focusing on building relations with Germany, especially as during the Vilnius Summit, US President Joe Biden backed Germany's Ursula von der Leyen to become the next NATO Secretary General. Other commentators have raised the possibility of factional infighting within Kyiv.

Credit: Polish MoD/Aleksander Perz

In early July 2023, the Polish government deployed over 1,000 soldiers to Podlaskie, on the Belarusian border.

Some commentators and experts associated with the Polish government are concerned that the US might intend to build the future of Europe's security not based on Poland (as an emerging leader in Central-Eastern Europe), but on Germany, despite the presence of anti-American scepticism and pro-Russian sympathies in Berlin – which have not been entirely eradicated by Russian aggression in Ukraine. Biden's remarks about von der Leyen could indicate such a scenario from the White House. For Poland and its regional ambitions, this is bad news, as increasing the role of Germany could mean marginalisation of Poland and its projects, including the Intermarium, a regional political, economic, social and military cooperation effort, based on the Three Seas Initia-

Credit: Polish MoD/Aleksander Perz

Following the August 2023 incident with helicopters from Belarus, Poland deployed its Poprad VSHORAD systems close to the border.

tive, which was launched in Croatia in 2016. If this forecast holds true and the Americans are indeed favouring Berlin over Warsaw, then perhaps series of diplomatic disagreements between Poland and Ukraine can be a deliberate action by Kyiv. In this way, Kyiv might be trying to contribute to the defeat of the Polish current government in the upcoming parliamentary elections. The opposition in Poland is perceived to be more pro-German and less supportive of projects like the Intermarium. Such a plan is favourable for Berlin, which has strained relations with the current leadership in Warsaw. Pro-government media in Poland have repeatedly published a political statement from German politician Manfred Weber, the Leader of the conservative European People's Party (EPP) in the European Parliament, who recently admitted in an interview with Frankfurter Allgemeine Zeitung that his party aims to remove Poland's current ruling Law and Justice (PiS) party from power.

Threat from Belarus

What caught the attention of the Polish public once again is the reported presence of Russia's Wagner mercenary group operating in Belarus, and subsequently near the Polish-Belarusian border (414 km in total). This region, simultaneously serving as the eastern border of NATO and the European Union, has long been unsettled. It is an arena of growing migratory pressure, artificially created by Russia as part of its hybrid warfare effort. The surge in migration across this border emerged in 2021, just months before the war in Ukraine started. Polish security forces used non-lethal force to stop illegal migrants, and erected a wall to reduce the rate of crossings. Despite this, the Polish Border Guard still recorded 12,000 illegal attempts to cross the border between January and July 2023.

In early July 2023, the government dispatched over 1,000 soldiers to Podlaskie in northeastern Poland, mainly from the 12th Mechanised Brigade and the 17th Mechanised Brigade. Additional vehicles, including Poprad wheeled very short-range air defence (VSHORAD) systems and Rosomak wheeled APCs, were also deployed. An additional 500 police officers, along with horses, dogs, and special units from Poland's Antiterrorist Operations Bureau (BOA), were sent to reinforce the Polish Border Guard, which has 5,000 officers in the region. The Border Guard is increasing the number of weapons in its eastern outposts – patrols are to be equipped not only with handguns but also with rifles, primarily consisting of the indigenously designed and manufactured MSBS GROT 5.56 mm assault rifle. In addition, there are plans to acquire further equipment, including vehicles.

In early August 2023, Polish airspace was violated by two Belarusian helicopters (a Mi-8 and a Mi-24). Initially, the Polish Ministry of National Defense denied the reports, but when photos of the helicopters over Białowieża appeared on social media, the official narrative changed. The reasons for this incursion are unknown – it could have been a provocation or an accident. At that time, Aleksandr Lukashenko was in his residence in Viskuli, located near the Polish border. In response, the Polish Armed Forces relocated helicopters (Mi-24s and W-3 Sokół/W-3PL Głuszec) from the 1st Land Forces Aviation Brigade and the 25th Air Cavalry Brigade near the border with Belarus.

Genuine worries exist that such violations might become more frequent, requiring a response not just from Poland but also from NATO. The Polish border with Belarus could be completely sealed in the event of any incident, even involving the Wagner Group, as stated by Interior Minister Mariusz Kamiński. While the idea that Wagner Group would invade Poland is nonsensical, further subversive and primarily psychological actions are highly likely. It is now anticipated that members of the Wagner Group could assist illegal migrants in breaching the EU border. Poland also assumes that members of the Wagner Group could also disguise themselves as migrants and target Polish security personnel. Incidents of attack are already occurring from the Belarusian side – rocks, sticks, and laser pointers are being directed towards Poland. There is also a fear that Wagner personnel might also infiltrate the border alongside migrants, using Belarusian or Ukrainian passports to carry out hostile actions within Poland. It cannot be ruled out that the Wagner Group might then escalate ethnic tensions in Poland or even attack migrants on the Belarusian side from Polish territory, thereby gaining an argument to support Russia's narrative of an aggressive and provocative Polish regime.

On the one hand, Belarus denies Polish reports and claims that they were "voiced by the Polish military-political leadership to justify further increases in forces and resources along the border with Belarus." However, it's hard not to see that such acts as provocations out of the Kremlin playbook. First there were talks about nuclear weapons being stationed in Belarus, and then about sending the Wagner Group there. Even manipulated photos surfaced on the internet, showing alleged members of the Wagner Group posing by Polish border markers.

Perhaps the Russians hoped for an armed reaction from Poland, which would allow them to support their narrative of an aggressive NATO and imperialist Poland, aiming to reclaim its former eastern territories located in western Belarus and Ukraine, which used to be a part of Poland before World War II. However, no armed response occurred – the Polish military allegedly didn't even detect the helicopters. This has led to further political polarisation in Poland and a weakening of the government's prestige. There are no lack of voices claiming that the failure to detect Belarusian helicopters is a disgrace for Poland's armed forces and government. ■

Coordinating Naval Programmes in Europe

Guilia Tilenni

The War in Ukraine and a general increase in military spending is pushing several countries to modernise their ageing naval fleets, thus boosting the order books of shipyards after years of negative outlook. If this is good news, the situation remains complicated within the EU, where shipbuilders' economic outlook is less prosperous compared with Asian and US competitors, and coordinated programmes often struggle to kick off.

In a study published in 2020, the EU Institute for Security Studies (EUISS) noted that between 1999 and 2018, EU navies lost more than 30% of their frigates and destroyers and more that 20% of their submarines. Surprisingly, these significant reductions came at a time when navies were increasingly called to action. Tensions in the Mediterranean, Black and Baltic Seas, exacerbated by the war in Ukraine, coupled with the "intense geopolitical competition" taking place in the Indo-Pacific region and around the key maritime chokepoints all represent crucial threats to EU security. More than 70% of the EU's external borders are maritime and combined, its member states form the largest exclusive economic zone in the world. Maritime communication lines remain crucial for trade and oil and gas supply, and undersea cables account for 99% of global data transmissions.

By 2025, EU countries are expected to spend EUR 55.5 Bn on maritime technologies. However, official EU documents report that less than 20% of investments in defence programmes are coordinated among its member states. In the absence of a common foreign policy agenda, cooperation is pursued only when the political objectives and operational requirements of two or more EU countries converge.

Moreover, several of the most important member states in military terms have national shipyards they can be relied upon to modernise their respective fleets: Fincantieri for Rome, Naval Group for Paris, Navantia for Madrid, Lürssen and ThyssenKrupp Marine Systems for Berlin, Saab for Stockholm, and Damen for Amsterdam. Most of these are first-class system integrators, with a strong positioning on the global market.

Credit: US Navy/Petty Officer 3rd Class Ezekiel Duran

An Arleigh Burke class guided-missile destroyer USS Forrest Sherman (DDG 98) conducts a replenishment-at-sea with Italian Navy Vulcano class logistics support ship ITS Vulcano (A5335). The LSS is a cooperative programme between France and Italy.

So far, EU member states have fought to keep each of these national champions alive, often for electoral or national security considerations (keeping occupation levels unchanged, maintaining national know-how, etc.). On paper, each member state has officially identified collaboration as an interesting opportunity in industrial, economic, and strategic terms. Indeed, joint programmes help in reducing costs and increasing interoperability. Yet in practice, EU members have largely rejected calls for EU-wide cooperation coming from the European Commission or the European Parliament.

On the one hand, they act in this way to protect their respective national companies. On the other, they have done so because joint projects led by consortia have often proved ineffective so far. As a result of a compromise among several member states, common programmes are often a sub-optimal solution in terms of operational requirements. Their management might be complicated due to the high number of relevant stakeholders, resulting in products delivered behind schedule, and sometimes no longer consistent with the initial needs and scope. Cooperation in the naval sector therefore remains mainly bilateral or multinational, and limited to specific programmes.

For their part, shipyards are generally not attracted by joint development programmes, as a significant part of their backlog originates from export, following tenders in which they often compete with other European producers. And in some cases, export opportunities can be found in the EU countries that do not

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Credit: Italian Navy

Italian Navy FREMM frigate ITS Carlo Margottini (F 592) during Exercise Formidable Shield 2023. FREMM vessels are one example of bilateral cooperation under the OCCAR umbrella.

have the know-how needed to build up their own fleet.

As with other defence-related industrial segments, a multiplicity of producers and systems has been the preferred choice so far. However, the evolving situation of the global naval market requires a new approach. The World Defence Shipbuilding 2022 report confirms that East Asian countries, in particular China, Japan and South Korea have joined the club of the largest producers of military vessels. Even though they remain significant on the global market if considered in aggregate terms, EU shipyards are lagging behind. In the short- to mid-term, they will lose much of their competitiveness on the global market, and their aggregation might become the only solution to survive mounting international competition. For the time being, companies and states are simply trying to maintain the status quo, and aggregation is not on the agenda. Indeed, aggregation would mean a sacrifice for each shipyard, as it would require profound changes in their structure, with consequent job losses.

In the coming years, EU countries will have to redefine the structure of their shipyards. Focusing on enhancing the position of the whole European shipyard sector rather than the positioning of each shipyard would probably be the most effective solution. However, such a shift is almost impossible without a rapprochement of foreign policy agendas, which currently seems unlikely. Again, member states officially agree that a broader integration of the European defence-industrial base is crucial to maintaining the bloc's independence, as all the EU strategic documents on the matter stress. Maintaining the status quo will likely bring about a loss of strategic autonomy, as foreign buyers might put the survival of European shipyards at risk.

Shifting from the multiplication of national naval programmes to an EU-wide coordination of naval programmes might be a first step to reconfigure EU shipyards and to work on shaping the future functioning of the European market. Numerous EU tools might help in this shift and, as will be further analysed, some forms of coordination are already emerging.

Coordinating Naval Programmes at EU Level

To help EU member states fill their capability gaps and encourage them to favour EU solutions to off-the-shelf purchases abroad, the EU is trying to revamp a range of management and financial tools that have barely been exploited so far. The Coordinated Annual Defence Review on Defence (CARD) is intended to support member states in the identification of common capability gaps and, consequently, of potential cooperative programmes that might be developed jointly by using EU tools. The Permanent Structured Cooperation (PESCO) provides a framework and a structured process to gradually deepen cooperation starting from the most sought after missions, according to CARD reports. The European Defence Fund (EDF) plans to pledge EUR 8 Bn for defence projects between 2021 and 2027 with funds allocated to the programmes selected through an annual call for proposals. The relevant topics, which include naval combat and underwater warfare, are identified according to existing PESCO programmes and the priorities identified in the CARD and in the Capability Development Plan (CDP) outlined by the European Defence Agency (EDA).

Concerning the coordination of programmes, member states have the option of entrusting the Organisation Conjointe de Coopération en matière d'ARmement (OCCAR) with facilitating and managing cooperative armament programmes through their life cycle. OCCAR's portfolio currently includes 17 major armament projects, five of which concern naval vessels, with different configurations and objectives.

Among these, the FREMM programme was launched in 2005 for the construction of 18 multi-mission frigates. Italy and France remain the only participants, and the vessels produced within the programme are slightly different in terms of equipment. Similarly, the LSS (Logistic Support Ship) programme is another Franco-Italian collaboration producing substantially different ships. Another notable example is the Maritime Mine Counter Measures (MMCM) programme, under which France and the UK aim to equip their navies with autonomous mine hunting capabilities by 2024.

Despite being integrated into a more European framework, these programmes are managed with a standard structure, which sees the collaboration of two states and the relevant national companies. In recent years, however, an interesting example of coordination has emerged in the European landscape.

Naviris: A New Approach for Coordinating Naval Programmes?

In 2019, Italian company Fincantieri and the French Naval Group negotiated the acquisition of Chantiers de l'Atlantique (a shipyard located in Saint Nazaire, France) and decided to establish a 50/50 joint venture. The main idea was to combine their respective expertise to launch new programmes and find new export opportunities, thereby somehow trends that were emerging in the global market.

Since then, Naviris has been involved in six R&D projects and has overseen the development of the European Patrol Corvette (EPC). Approved in November 2019 as part of the third batch of PESCO projects, the EPC programme aims to design and developing a shared modular

corvette, with a displacement of under 3,000 tonnes, a maximum draft of 5.5 m and a length no longer than 110 m. The development of a European Patrol Class Surface Ship (EPC2S) is defined as an "EU-wide approach for modular naval platforms adaptable to various sea basins and member states' requirements/programmes". It was identified as a potential area of cooperation in the 2020 and the 2022 CARD reports. Led by Italy, the programme also involves France, Spain and Greece, and was joined by Romania in June 2023. The EDA supports participants through the development and the adoption of Common Staff Targets (CSTs), Common Staff Requirements (CSRs) and a Business Case (BC). The first prototype is scheduled for 2026-2027.

In December 2021, Fincantieri, Naval Group, Naviris and Navantia submitted an industrial offer for the Multirole and Modular Patrol Corvette (MMPC) call opened within the European Defence Fund's framework to support the development of the EPC programme. In July 2022, Naviris was officially appointed as prime contractor for the consortium, and was joined by Greece, Denmark and Norway. This grant is valued at EUR 60 M and involves a 24 month initial development phase dedicated to technological building blocks for military units and the initial study for a joint project, which does not include a combat system, at least for the time being. As of June 2023, the partner countries were still finalising the Memorandum of Understanding, and the programme was expected to start in the autumn. In March 2023, the European Commission issued a second call for tenders dedicated to the completion of the original design and details of the MMPC, which may end with the creation of prototypes of the platform. The funding for this second call amounts to EUR 714 M. A Naviris source told the author that the exact list of participants to this second call, whose deadline expires in November 2023, is still to be defined, and will likely include only the nations that plan to produce and procure the vessels at the end of the study.

Credit Courtesy of Naviris

The EPC programme focusses on the creation of a modular platform, likely to be modified according to the needs of each country.

Between 2020 and 2022, Naviris has been prime contractor of a feasibility/de-risking study for the modernisation of the Horizon class destroyers in service with France and Italy, jointly developed between 2000 and 2010 by Fincantieri and Naval Group. Following the signing of a Memorandum of Understanding during the 2023 Paris Air Show, the joint venture was officially selected for the Mid-Life Upgrade (MLU) of the platform and its combat systems, while co-contractor Eurosam will work on the modernisation of air defence systems. According to sources in Naviris and Fincantieri, the joint venture can be considered a success story so far, with the EPC programme progressing on schedule for the time being.

Credit: US Navy/Petty Officer 3rd Class Kenneth Abbate

French destroyer FS Chevalier Paul (D621), belonging to the Horizon class, jointly developed by Naval Group and Fincantieri. The upcoming upgrades will be managed by Naviris.

Is Coordination Enough to Solve Market Fragmentation?

Most official EU documents argue that coordination in the naval sector is crucial to protect EU interests. The need for "effectively and comprehensively" assessing security challenges at sea and responding to them is so strong that the naval operational environment is the only one with a dedicated EU strategy. First approved in 2014, the EU Maritime Security Strategy (EUMSS) identified cooperation as a good way to develop the "necessary sustainable, interoperable and cost-effective capabilities" required to protect EU interests. In the 'Enhanced EU Maritime Security Strategy for evolving maritime threats' release published on 10 March 2023, the European Commission reiterates the need to step up the EU common

Credit: Cédric Quillévéré (via Wikimedia Commons

Aerial view of Chantiers de l'Atlantique's main construction site, at the heart of a dispute between Fincantieri and Naval Group

response to naval threats by developing a full spectrum of maritime capabilities. The EU has committed to develop common requirements for surface and underwater defence technologies, build interoperable unmanned systems and joint test and experimentation exercises to develop future maritime capabilities. It will also increase modern mine countermeasure capabilities and support the development of joint enhanced maritime patrol aircraft capabilities.

When it comes to European defence, the lack of consistent political commitment from member states often ends in lofty announcements followed by insufficient action, or, more often, simply remaining on paper, despite the official commitments undertaken by EU governments when signing official documents. As regards shipyards, at a time when China is deciding on mergers to create a few big players in the market, mergers are no longer on the agenda in Europe, with competition between shipyards remaining the norm in recent years.

The relationship between Naval Group and Fincantieri is an interesting example. In February 2018, the French L'Agence des participations de l'État (APE) and Fincantieri Europe signed a share purchase agreement for STX France, supposed to mark the last step of a year-long acquisition dispute around St.Nazaire's Chantiers de l'Atlantique. According to the preliminary agreement, the Italian group was expected to purchase a 66.6% share of STX France for EUR 79.5 M. However, the French state (a 33.3% shareholder of STX France with pre-emption rights on the remaining shares) opposed the agreement for several reasons, including job preservation, maintaining local production, and avoiding a technology drain abroad. Worried about Fincantieri's operations outside Italy (mainly in the US), France finally offered the company a 51% share of STX France. Following Fincantieri's refusal, Paris decided to purchase the remaining STX France shares, thus becoming the 100% shareholder. After several years of negotiations, Rome and Paris officially announced the termination of Fincantieri's acquisition programme in January 2021, officially due to the economic consequences of the COVID-19 pandemic.

The ties between these two shipyards highlight the current distortions of the EU naval industry: they share a 50/50 joint venture and work together on some EU-wide programmes, but remain competitors in some tenders, such as the one for the corvettes in Greece (one of their EPC partners). In the meantime, Fincantieri is also one of Naval Group's subcontractors for some joint projects, a rare case in which the company supplies something to another EU country that has a primary role in shipbuilding, a Fincantieri source told the author. The same source also recalled that all the main European countries have their own shipbuilding capacities, which makes them "self-producers". In other words, this means that the respective national Navy is the main reference customer for each of these companies.

As EU nations do not seem particularly committed to finding viable and long-lasting solutions to the problems affecting shipyards, a solution might come from the shipyards themselves. Indeed, they might use their experience and lessons learned to suggest how the EU naval market can evolve. In his intervention during the first Euronaval talks in June 2023, Davide Cucino, head of European Union Affairs at Fincantieri and Chairman of SEA Naval, noted that a stronger collaboration among European shipyards and between shipyards and users is crucial to find the best balance between a complex industrial development, characterised by long life cycles in a changing security environment, and limited budgets. SEA Naval is a permanent working group established within the Shipyards' & Maritime Equipment Association (SEA Europe), which advocates for European shipyards' priorities. The idea is to support EU institutions and members states by providing an industrial point of view and expressing their needs when it comes to EU programmes and the European Defence Fund. It includes 90% of naval systems integrators and shipyards in Europe, namely Damen, Fincantieri, NVL, Naval Group, Navantia, Saab, and thyssenkrupp Marine Systems. Three industry associations Assonave (Italy), GICAN (France) and VSM (Germany) are also part of the working group.

So far, the EPC programme seems a good starting point towards stronger cooperation at the European level, and Naviris is proving effective regarding programme coordination, with projects progressing on schedule. According to the interviewed industry sources, Naviris might go beyond the coordination of a couple of joint naval programmes, paving the way to a transition towards a more integrated sector. In fact, this is one of the reasons the joint venture has been established. "Confronted with similar market challenges on both sides of the Alps, Fincantieri and Naval Group are pooling a portion of their strengths to jointly develop new synergies and retain their leadership position. Building our sovereignty and controlling our future is tantamount to reinforcing our autonomy", the Naviris' website states.

Despite the fact that the direction to take and results to be achieved are yet to be defined, a profound transformation of the EU naval market might be the only solution that European countries possess in order to maintain their strategic autonomy and avoid buybacks from non-EU companies. This is particularly important given that competitors are continuing to grab market share, and the capability shortages triggered by the War in Ukraine might divert attention away from naval programmes, potentially risking the progress made to date. ■

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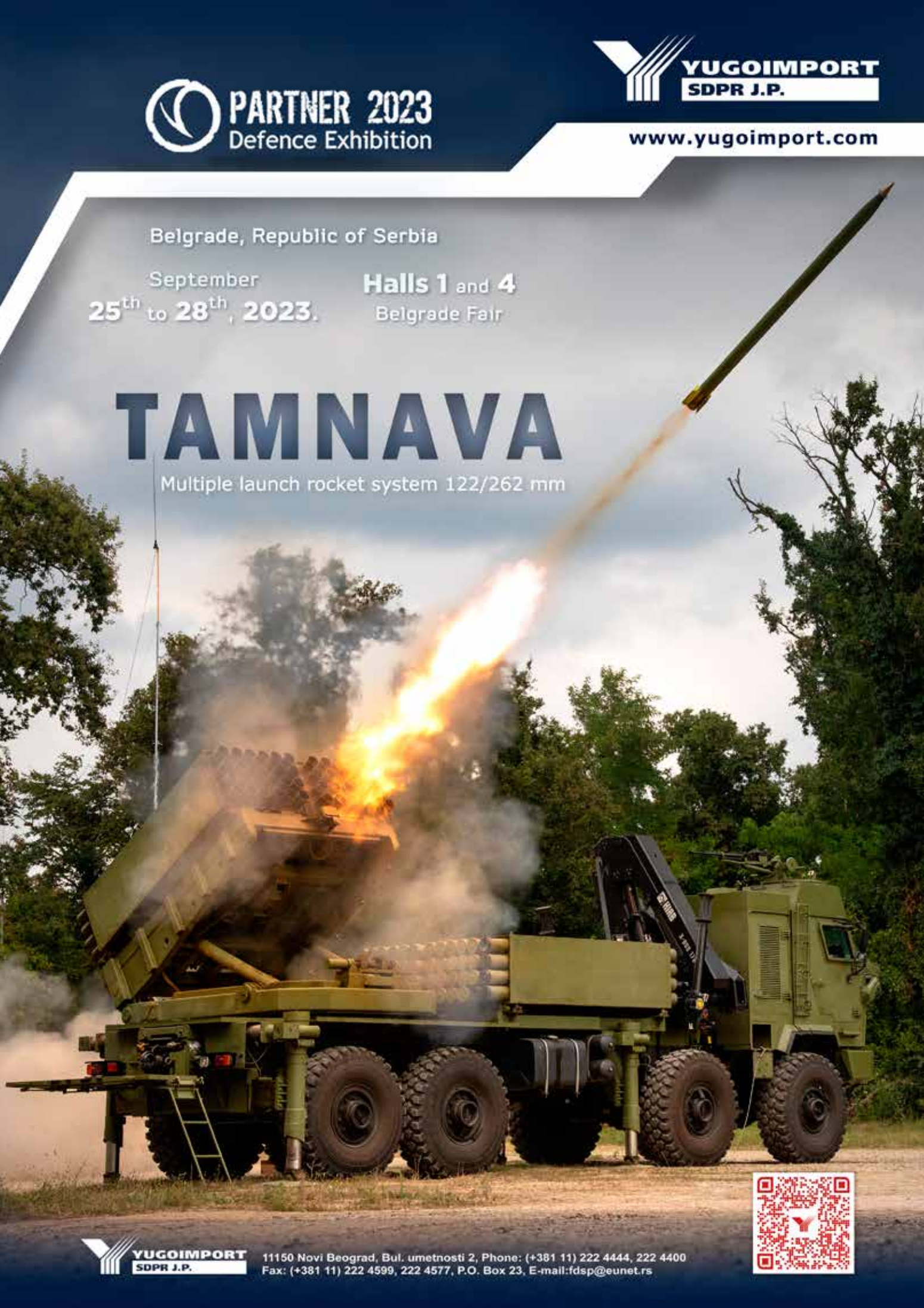

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