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Winter 2024

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FROM THE EDITOR

Welcome to our first edition for 2024. The World Defense Show gets underway in Saudi Arabia in February against a backdrop of simmering tensions and instability across the region. The war in Gaza "risks inflaming an arc of instability stretching from the Eastern Mediterranean to the Gulf of Oman," the UK's Chief of the Defence Staff Admiral Sir Tony Radakin warned in his annual RUSI lecture in December.

Signs of those tensions are already emerging in the Red Sea/Bab-al-Mandeb Strait/Gulf of Aden, one of the world's most critical maritime choke points, where merchant ships are coming under attack from Houthi anti-ship ballistic and cruise missiles, as well as drones, causing major disruption to global trade. The Houthi attacks saw the the US and UK navies launch strikes against targets in Yemen, while the US Navy stood up Operation Prosperity Guardian (OPG) in mid-December to protect merchant shipping.

But as Dr Lee Willett, who previously ran the naval/maritime desks at the Royal United Services Institute and Janes, points out in his opinion piece on page 47, for Western countries more broadly, and for allies and partners, a consequence to bear in mind when maintaining the international rules-based order through delivering good order at sea and freedom of navigation is the resultant requirement to build and sustain credible naval strength.

However, with merchant ships being targeted by a more sophisticated enemy, navies that have been cutting fleet numbers in recent years may have to seriously rethink their strategy. Maritime security just got a whole lot more complicated, and naval assets cannot be in two places at once as the UK's Royal Navy is discovering as it plays musical chairs with its destroyers and frigates so it can maintain a presence in the Red Sea, whilst performing other maritime duties.

Just as the war in Ukraine saw European countries respond by boosting defence spending, how are major powers in the Middle East. which were boosting their domestic industry, before the most recent conflict, likely to respond to the growing tensions and insecurity across the region? Check out our story on page 8. Despite the war in Gaza, it appears some Arab countries are not quite ready to tear up the Abraham Accords, just yet, which saw them normalise diplomatic ties with Israel.

Some of these countries are looking to significantly grow their defence industrial bases and are forging partnerships with Western defence primes, including Israeli defence companies.

In this issue, we also dissect the impact of unmanned air systems, more specifically rotary wing drones on anti-submarine warfare. Does their persistence at sea, and many other benefits, mean that the elusive submarine threat is a thing of the past? Check out former naval officer Tayfun Ozberk's story on page 50.

Counter-UAS has brought us some of the most far-fetched ideas for catching or neutralising rogue drones. Think Ghostbusters-style non-kinetic jammers or drones with nets to entange a quadcopter's propellers. But as we enter the Second Drone Age with unmmaned air systems that have the ability to cause significant harm, disruption and loss of life becoming more widely and readily available, are counter-UAS solutions keeping pace? On page 30, we speak to C-UAS providers, DroneShield, MARSS, Chess Dynamics and Israeli company XTEND, to get their take. ■

Happy reading,

Anita Hawser
Editor

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AN ARC OF INSTABILITY

The war in Ukraine has had a profound impact on Europe's defence and security posture. With the situation in Gaza threatening to cause wider regional instability and volatility, are Middle-East countries likely to spend even more on defence and accelerate plans to boost their domestic defence industries?

By Anita Hawser

Sailors assigned to the Arleigh Burk-class guided-missile destroyer *USS Mason* during a replenishment at sea in the Red Sea while *Mason* operates in support of Operation Prosperity Guardian *(US Navy photo by Mass Communication Specialist 1st Class Chris Krucke)*

Just as Russia's invasion of Ukraine has shaped the defence and security environment in Europe, how are the events in Gaza and its spillover into the Red Sea, where Houthi rebels have launched missile and drone strikes on merchant and naval shipping vessels, likely to shape defence and security in the Middle East?

The first war on European soil for over 60 years saw European countries increase defence spending. Finland and Sweden shrugged off their 'neutral' status to apply for NATO membership. Russia's full-scale invasion of Ukraine also awoke Germany from its long slumber, with Chancellor Olaf Scholz announcing a special one-off €100bn fund for defence, although critics say little has happened since the announcement was made. "For at least the next decade,

Russia will be central to European security concerns, and will be important in driving defence policy developments and acquisition plans," James Hackett, head of defence and military analysis for the International Institute of Strategic Studies (IISS) wrote in the 2023 Military Balance.

The full effects of increased defence spending in response to the war in Ukraine are unlikely to be felt until full-year 2023 results are announced by leading international defence primes. However, according to SIPRI's Top 100 Arms-producing and Military Services Companies 2022, Russia's invasion of Ukraine and geopolitical tensions around the world fuelled a strong increase in demand for weapons and military equipment, with defence companies in Asia and Oceania seeing their revenues rise by 3.1% to reach $134 billion in 2022.

WHEN WILL NEW ORDERS TRANSLATE INTO HIGHER REVENUES?

Wars often lead to increased defence spending, but not every company, or country, benefits equally. In 2022, Middle Eastern companies (mainly Turkish and Israeli companies) recorded the biggest percentage rise in arms revenue of any region. All seven Middle East-based companies in the Top 100 recorded combined arms revenues of $17.9 billion, an 11% year-on-year increase. Total arms revenues of the four Turkish companies in the Top 100 reached $5.5 billion — a 22% increase compared to 2021, with companies like Baykar, the manufacturer of the infamous TB-2 drone, which scored some early victories against Russian military assets in Ukraine, entering the Top 100 for the first time with its arms revenues rising by a whopping 94%, the fastest growth of any company in the SIPRI ranking.

Interestingly, while leading US primes such as Lockheed Martin and Raytheon saw an influx of new orders linked to the war in Ukraine, year on year the arms revenues of the 42 US companies in the Top 100 fell by 7.9% to $302 billion in 2022. SIPRI analysts attributed this to companies' existing order backlogs and difficulties in ramping up production capacity, adding that the revenue from increased orders is only likely to be reflected in company accounts in two to three years.

"We expect to see the huge backlog and new orders recorded since the war in Ukraine started to translate into higher revenue from 2023 and for years to come, as companies' production capacities start to catch up and many procurement plans announced since 2022 start to materialise," SIPRI analysts told *Defence Procurement International.*

Preliminary data suggests that global military spending will continue to increase in 2023, further driving defence industry growth. "Factors that slowed growth in 2022, such as high inflation and economic crises, are less significant from 2023, paving the way for more substantial growth going forward," say analysts.

But now the world's attention has turned to yet another conflict, the war in Gaza. At the time of writing, the UK and US had carried out air strikes against Houthi forces in Yemen in retaliation for the barrage of missile and drone attacks it had launched against merchant shipping vessels and naval assets in the Red Sea. However, Houthi attacks on vessels continued despite the strikes from UK and US navies.

In his annual RUSI Lecture in December, the UK's Chief of the Defence Staff Admiral Sir Tony Radakin warned that the simmering tensions and dire conditions in Gaza risk inflaming an arc of instability stretching from the Eastern Mediterranean to the Gulf of Oman. "That is why the UK deployed air and naval assets to the region: to be ready for contingencies, contribute to relief operations, and to safeguard wider regional stability. But the level of uncertainty and degree of potential volatility for the whole of the Middle East is worrying," he said.

MIDDLE EAST LOOKS TO BOOST DOMESTIC DEFENCE INDUSTRY

SIPRI analysts say It is still too early to tell how the war in Gaza will impact military spending and arms companies in the Middle East. However, they say the current growth of companies in the region is expected to continue. Giorgio Cafiero, CEO of Washington-DC-based Gulf State Analytics says some Middle Eastern countries could respond by buying more arms in the upcoming period. "That's an assumption I feel pretty safe making right now," he says.

Major powers in the Middle East have been boosting their domestic industry for years before the most recent conflict. However, due to its security conditions, SIPRI analysts say Israeli companies have shown a higher level of flexible manufacturing capacity in the past and can scale up production more rapidly to fulfil a sudden increase in orders.

> *"SAMI and EDGE have been experiencing rapid growth in recent years through substantial government investment in domestic production and partnerships with Western primes, including with Israeli companies."*

"Although not figured in the Top 100 this year (partly due to lack of available data), state-owned companies in Saudi Arabia (SAMI) and the UAE (EDGE) have been experiencing rapid growth in recent years through substantial government investment in domestic production and partnerships with Western primes, including with Israeli companies," SIPRI analysts say.

The UAE's EDGE Group spent much of 2023 acquiring technology companies like Finland's Milrem Robotics, a leader in the fields of robotics and autonomous systems and announcing partnerships with Western defence primes. It has signed over 20 agreements and joint ventures with several major industry players including Raytheon Emirates, ICOMM, John Cockerill, BAE Systems, Lockheed Martin, HAL, L3Harris, and Fincantieri, among others.

In 2022, Saudi Arabia was the fifth largest defence spender in the world behind Russia and India, spending some $75 billion on defence — a 16% increase on 2021 levels — according to data published by SIPRI. But under its Vision 2030 strategy, Saudi Arabia aims to support the localisation of the national defence industry with more than 50% of spending on military equipment and services by 2030 expected to be met by indigenous defence companies.

Having recently taken part in the Red Sands Live Fire Exercise 23.2 which aims to strengthen military ties between the US and Saudi Arabia while developing unmanned air systems' (UAS) combative procedures to increase the defensive readiness of the two nations against emerging UAS threats, global technology company, MARSS says UAS activity continues to rise in the region.

"The threat that these systems pose is constantly evolving. This pertains predominantly to maritime and air threats, with borders and air defence the main areas of concern, and where a good amount of time and budget are being allocated," says Josh Harman, MARSS' vice president and business development lead. Right now, alongside its customers in the region, Harman says it is focusing on battlespace management systems for land, sea and air.

SAUDI ARABIA WANTS TO EXIT YEMEN

However, for Saudi Arabia which has battled Houthi rebels with mixed success

Israeli soldiers in Gaza *(Copyright: IDF)*

since it intervened in Yemen in 2015, the concern right now, according to Cafiero, is to continue negotiating a solution with the Houthis that gives the kingdom a way to exit Yemen. "The events in the Red Sea since October have not changed that desire," he says. "To put it bluntly, they want to focus on Vision 2030 and negotiate a dignified exit from Yemen. The Houthis could retaliate at a time in which this economic transformation [Vision 2030] requires stability and security."

Given the high probability that events in Gaza and the Red Sea could create wider regional tensions or even conflict, Cafiero says Saudi Arabia may decide to accelerate its Vision 2030 ambitions to try and become more autonomous from the United States, which is the biggest supplier of weapons to the kingdom, with more than $100 billion in active foreign military sales.

Cafiero says Saudi Arabia is concerned about US action taken against the Houthis. "They do not want to see a renewal of conflict between the kingdom and the Houthis." However, having renormalised diplomatic relations with Iran 10 months ago, Cafiero says the kingdom has concerns about the Gaza crisis spilling over into the Gulf and getting Iran more directly involved in ways that could throw the Saudi-Iran detente off track.

THE UAE IS NOT GOING TO TEAR UP THE ABRAHAM ACCORDS

The Abraham Accords had seen Israel normalise relations with Arab states such as Bahrain, the UAE and Morocco. These states have since shown a keen interest in acquiring Israeli defence tech and know-how. In September 2022, the United Arab Emirates (UAE) selected the Israeli-developed Spyder air defence system to protect itself against armed UAVs and drones launched by the Houthi rebels in Yemen.

The initial contract was valued at $460 million, according to Israeli defence reporter Arie Egozi. Morocco also concluded a $500 million deal with Israel to acquire the Barak MX air and missile defence system manufactured by Israel Aerospace Industries (IAI). However, given the war in Gaza, Cafiero says the UAE and other Arab states are unlikely to conclude or continue such acquisitions until the temperature in the region eases somewhat.

"The war in Gaza is in a high-intensity phase at the moment and I don't think it can last that much longer," says Cafiero. "It is a matter of weeks, not months before Israel will need to transition to a lower-intensity conflict. The state of the Israeli economy is terrible, and the number of Israeli soldiers injured is probably much higher than what the Israeli Defence Forces have reported."

However, regardless of what happens in Gaza, Cafiero believes the UAE and Bahrain's leaders are committed to staying in the normalisation camp. "They do not plan on abrogating the Abraham Accords, even though it is not popular among the local population in both countries," he says.

A question to consider though, he adds, is whether there any lines Israel could cross that would result in a change of heart. But having visited GCC states late last year, he says the consensus among most experts is that UAE-Israel normalisation is irreversible. "The UAE is probably never going to tear up the Abraham Accords no matter what happens to the Palestinians in Gaza," he says. ■

OPINION

AN OUNCE OF PREVENTION

The wars in Ukraine, and now Gaza, are a reminder that countries facing similar or unrealised threats should prepare first, deploy second. *By Peter Polack*

Since 1948, the state of Israel has had several short wars with its neighbours that eventually led to long-term rapprochement with most of them.

However, this has not been the case with its nearest neighbour, the Palestinian enclaves of Gaza and the West Bank, with whom Israel has had continuous conflict. The latest conflagration has become an existential contest for the Palestinian homeland and an asymmetric joust for the latest terrorist group iteration claiming to represent a people often besieged and occasionally, the besiegers.

Hamas is only the latest pretend, default, quasi-government that arose from the ashes of Black September, Fatah and the Popular Front for the Liberation of Palestine (PFLP). It is laughable that there are support protests for a group so awash in blood and mayhem hiding under the brittle sheet of the Palestinian people who have themselves been unable to project a unified front to the world.

Perhaps the Palestinians are the only group in recent history to go backwards from territorial and political advancement during an occupation, colonial or otherwise. They have substantially less than before the mindless 7 October attacks. A bigger question would be who orchestrated the change in Hamas from throwing rocks to lobbing missiles into Israel. The usual suspects of Iran and Hezbollah may be a simplistic answer. The director(s) of the spotlight moving would be closer to the truth.

Hamas' latest co-conspirators have been politicians, experienced military officials and naive Kibbutzim closest to the perilous borders with deadly neighbours. Videos have emerged of various Kibbutz security gates that resemble more the suburban enclaves of California with thin entry points that were unable to resist the most basic assault.

> ***While the West vacillated on delivery of weapon systems to Ukraine, Israel had all that it needed sitting in storage for a rainy day, unhelpful to a Hamas rampage that washed the border Kibbutzim in blood.***

Given the human proclivity for avoiding unpleasantness or the Ostrich complex, it is unsurprising that the Kibbutznik embraced the faux security of safe rooms instead of a comprehensive defence to life in a virtual war zone. Reality bites.

This was eclipsed by the height of younger generation chutzpah in the music festival held only a few miles from the border breaks of Gaza by Hamas. Dancing with tigers.

The people of Ukraine have no capacity for the Kibbutz verisimilitude. They have been the subject of a grand invasion by Russia since 2014 while the world slept, only barely awakening for an attempt to eliminate the state of Ukraine in February 2022.

Israel has been conspicuously absent as a major supporter of the besieged Ukrainians who are now more akin to the people of Gaza without the world's howls of protest. Many countries who abstained from the UN vote against Russia now cry for peace, withdrawal and a cessation of hostilities by Israel. The Israeli response can be found in the Torquato Tasso poem, *Jerusalem Delivered*, for every drop of blood a sea of tears.

While the West vacillated on delivery of weapon systems to Ukraine, Israel had all that it needed sitting in storage for a rainy day, unhelpful to a Hamas rampage that washed the border Kibbutzim in blood.

Grateful Ukrainians, on the other hand, name their children after the US-made Javelin in a recent conversion of the defence industry from dealers in death to saviours of the world. This has always been the case, but sometimes desperation drives people to common sense. Every single employee of every single

defence contractor supplying Ukraine has had a hand in defending the free world.

Regrettably, the hundreds of young Israelis fleeing Hamas were from a country with one of the most technologically advanced military forces, albeit undeployed. Countries of the world facing similar or unrealised threats should adopt the Ukraine method, preparation first, deployment second.

Like Israel, the world has got to have a "come-to-Jesus" moment, as they say in West Texas. Every single politician in the US and Hungary who opposes aid to Ukraine should be voted out of office. Former US President Lyndon B. Johnson once called upon Vietnamese boys to do the necessary fighting in Vietnam. Well, Ukrainian boys, girls, men, women and babies are all dying.

People should centre their crowdfunding on dollars for the new white knights with names like Rheinmetall, Saab and BAE Systems to go around political malarkey. It is a small price to pay to prevent Big Hamas or Russia from destroying the world.

The present state of affairs is a continuum from the supposed academic enlightenment of non-alphabetical grades, non-exam grade support to retrospective bleaching of conquest in various forms. There are only winners and losers. A failure to embrace this concept will only lead to an accelerated replacement of the human race with ostriches scrolling through their iPhones. As the boxing referee warns at the start of each match, protect yourself at all times. ■

Peter Polack *is the author of The Last Hot Battle of the Cold War: South Africa vs. Cuba in the Angolan Civil War (2013) and Guerrilla Warfare: Kings of Revolution (2018). He was a contributor to Encyclopedia of Warfare (2013) and his latest book entitled Soviet Spies Worldwide: Country by Country, 1940–1988 will be published by McFarland in 2024.*

A column of smoke resulting from the Israeli bombing of the Gaza Strip March 2023. *(Photo by Mohammed Ibrahim on Unsplash)*

THE LEOPARD 2A7V NOW YOU SEE IT, NOW YOU DON'T

The German Army's new Leopard 2A7V fitted with Saab's Barracuda MCS not only reduces the chances of detection on the battlefield, but also has a host of other benefits for crew and systems inside the vehicle.

By Ralph Zwilling

During German Army preparations for the 15th rotation of the NATO Enhanced Forward Presence (eFP) battlegroup in Lithuania in November, the Leopard 2A7V main battle tanks of 3rd Company, 104th Panzerbataillon were seen for the first time fitted with Saab's multi-spectral Barracuda Mobile Camouflage System (MCS).

In 2017, Saab received an order from Krauss Maffei Wegmann for the MCS to be fitted to the new Leopard 2A7V. Around the same time, the US Army announced that it was assessing the Barracuda MCS for its Stryker infantry combat vehicles. The Australian Army has also fitted the Barracuda MCS to a Leopard tank. Saab is also a preferred supplier to Oshkosh Defense which will see the Barracuda signature management system fitted to the Joint Light Tactical Vehicle.

The Bundeswehr refers to the MCS as thermal protection equipment, which serves two purposes. On the one hand, it can be used to apply camouflage without having to repaint the vehicle. On the other hand, it reduces the heat radiation

The Leopard 2A7V fitted with the Barracuda MCS: Signature management minimises the contrast between an object and the background, which makes sensory detection more difficult. *(Photo: Ralph Zwilling)*

of the vehicle, but also the heat input and thus the temperature in the interior. The thermal protection equipment of the Leopard 2A7V consists of elements for the chassis and the turret. The individual elements are attached to the vehicle using velcro fasteners.

Since combat vehicles such as the Leopard 2A7V can be easily detected when maneuvering on the battlefield, the multi-spectral capabilities of the Barracuda MCS and fully optimised sensor protection are critical to ensuring covert mobility. The advanced camouflage allows combat vehicles to be effectively protected against enemy sensors and target acquisition systems.

But MCS is not just about reducing the vehicle's thermal signature and detection on the battlefield. It also reduces the temperature inside the vehicle, which helps extend the service life of the installed electronic equipment as well as the endurance of the crew.

SIGNATURE MANAGEMENT: HOW DOES IT WORK?

The MCS, which is customised for each vehicle, consists of a combination of different materials, which influence the electromagnetic properties, reducing detection, protecting against shiny and hot surfaces and dust formation.

At the heart of the MCS is what is known as signature management. The technology minimises the contrast between an object and the background, which makes sensory detection by the enemy considerably more difficult. Signature management reduces exposure and distance identification, which forces enemies to move closer to engage.

The MCS offers multispectral capabilities over a wide range of sensors. For example, it has a high UV reflectance, making vehicles equipped with it better suited to arctic environments. Ultraviolet light has shorter wavelengths than visible light and cannot be seen by the human eye.

The Leopard 2A7V Mobile Camouflage System consists of many different panels with are mostly attached with heavy duty velcro. *(Photo: Ralph Zwilling)*

The non-glossy surface structure, the selected camouflage pattern and the camouflage colours used in the MCS allow vehicles and objects to blend in better with their surroundings and make visual detection more difficult.

Natural environments reflect differently depending on a variety of factors, including climate and interactions with solar radiation. Modern night-vision devices are needed to detect reflections at night. The MCS has a camouflage pattern and surface texture that are perfectly adapted to the near-infrared reflections of the environment.

Short-wave infrared sensors are extremely sensitive to light and provide high-resolution images in low-light conditions. These sensors can easily detect laser beams from laser detectors. By following spectral reflections of the environment, the MCS counteracts the danger posed by short-wave infrared radiation.

All objects emit thermal energy. This radiation can be detected by thermal imaging cameras that operate in the medium- or long-wave infrared range. The MCS adapts to the background radiation of a natural environment because of the materials and structures used to interact with the environment through convection, reflection, radiation and insulation.

Radar systems use radio waves to determine the distance, direction and speed of objects. This is done by emitting radiation and retrieving information from the reflected radiation. By using the MCS, vehicles equipped with it can be protected from Synthetic Aperture Radar (SAR) systems, which generate high-resolution images, as well as from fire control radars and homing missiles.

In addition to the Leopard 2A7V main battle tank, various variants of the Fennek are equipped with the Barracuda MCS. The Bundeswehr plans to equip other combat vehicles with the MCS in future. ■

ABOUT THE AUTHOR

Ralph Zwilling has authored numerous reports and books for military publishers and magazines as a freelance journalist and photographer. He is best known for his knowledge about the Stryker Interim Armoured Vehicle and often photographs US Army Europe and other NATO armies' training exercises.

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75 YEARS

NORA B-52 NG

SELF-PROPELLED GUN-HOWITZER 155 mm

OTOKAR, A GLOBAL PLAYER IN THE DEFENCE INDUSTRY

Otokar, the global land systems manufacturer of Türkiye, celebrated its 60th anniversary last year. Otokar was established in 1963, and the company operates within its 552,000 sqm of production area in Arifiye, Sakarya with over 3,000 employees.

Being a Koç Group company, Otokar offers solutions tailored to the needs of its customers using its indigenous technology, design, and applications. Otokar land platforms are globally renowned for their survivability, superior mobility, and modularity.

Being a listed NATO and United Nations supplier, today, more than 33,000 Otokar military vehicles are actively in service in more than 40 countries and 60 end users in different climates and geographies around the world.

Otokar is also at the forefront with its technology transfer and local production capabilities in the global defence industry. In line with the company's goal of being close to its present and potential users and increasing its exports in targeted regions, Otokar has established subsidiaries in five countries, including Kazakhstan and the United Arab Emirates (UAE). With these subsidiaries, Otokar intends to take advantage of various opportunities not only for know-how and technology transfer, but also for local production, joint product development and engaging in local business partnerships.

Being appreciated in global markets with its wide product range and comprehensive integrated logistics services for many years, Otokar has undersigned the world's important land platform projects. Otokar military vehicles serve in almost every part of the world, from Europe to South America, from Southeast Asia to the Americas, from Central Asia to Africa as well as the Gulf countries. Various Otokar armoured vehicles

The Otokar Arma 8x8 *((Copyright: Otokar)*

Otokar's Tulpar armoured vehicle *(Copyright: Otokar)*

go through tirals in harsh climate conditions, for example, the Arma 8x8 and Tulpar armoured combat vehicles that had completed the rigorous tests in Kazakhstan.

Recently, Otokar achieved new success in Europe. In October 2023, it was awarded a €130 million contract for the supply of the ARMA 6x6 Armoured Personnel Carrier to Estonia. Having combat-proven success in different parts of the world, ARMA 6x6 vehicles will be used by the Estonian Land Forces. Estonia will be the second NATO country to operate the ARMA.

Otokar has also undersigned land system programmes in global markets. Al Jasoor, the joint venture company between OTOKAR and EDGE Group established in Abu Dhabi, received an order in 2017 for the procurement of 8x8 tactical wheeled armoured vehicles for the UAE Armed Forces. Despite the pandemic, the delivery of 8x8 amphibious vehicles was successfully completed on schedule.

RESEARCH & DEVELOPMENT

In the last decade, Otokar allocated 7% of its revenue for R&D and testing activities. The company reflects the experiences it gains in different climates and geographies around the world through its vehicle development activities.

Thanks to its combat-proven know-how in land systems and related R&D, engineering and testing capabilities, Otokar analyses different needs and expectations of its users, simulates these requirements in-house and develops solutions that meet these requirements in the fastest manner. The company continues to introduce innovative solutions in land systems by considering the current and future requirements of modern armies and security forces.

Otokar has a state-of-art RDT&E Centre which is equipped with system-level simulators, test equipment, and computing systems to generate and evaluate information for faster testing of vehicles using advanced technology. Otokar R&D capabilities include CAD software for product design, simulation, and analysis, prototyping workshops, and a unique Test Centre which houses Türkiye's highest capacity hydraulic road simulator and a Climatic Test Chamber equipped with a 1,500 HP Dynamometer, which is the only one of its kind in Türkiye and amongst a handful in Europe.

The Test Centre is also home to Türkiye's largest and the world's best Electromagnetic Compatibility Test Centre (EMC/EMI), which serves as an accredited independent EMI/EMC Test Centre for all R&D activities of domestic and foreign automotive and defence industries. Otokar Test Centre activities support design activities by simulating real-life conditions and generating invaluable feedback based on data. That is how the company can meet various user expectations under various ambient conditions and gain a worldwide edge over its competitors.

LAND SYSYEMS FOR VARIOUS MISSIONS

With a vast range of armoured tactical vehicles in wheeled (4x4, 6x6 & 8x8), tracked and unmanned tracked, along with different turret solutions, Otokar is considered one of the most sophisticated land defence companies worldwide.

Otokar designs and manufactures a wide range of tactical armoured vehicles including 4x4 COBRA, COBRA II, COBRA II MRAP, AKREP II, URAL, ISV, ARMA 6x6, ARMA 8x8, and ARMA II 8x8. Otokar products are recognised for their survivability, superior mobility, and modularity. Otokar's combat-proven wheeled vehicles serve in challenging terrain and extreme weather conditions and have demonstrated their performance in various operations.

Otokar's TULPAR tracked armoured vehicle family is designed as a multi-purpose vehicle platform with its significant ballistic and mine protection and high payload capacity to meet the requirements of modern armed forces for all types of missions on the battlefield.

TULPAR's high power-to-weight ratio, all-terrain high-performance suspension and automatic track tensioning system offer superior mobility in diverse terrain and climatic conditions. TULPAR Light Tank, which is a part of the family, is integrated with a 105 mm to 120 mm weapon system and provides a state-of-the-art solution with high firepower.

ALPAR, showcased for the first time at IDEF 2023, was developed as an unmanned platform that can perform tasks together with manned and unmanned elements in the battlefield to meet the robotic and unmanned ground vehicle requirements of the armed forces. ALPAR offers new capabilities and empowers commanders in the field in the planning and execution of combat power in the most effective way in tactical operations. ■

Otokar's Alpar *(Copyright: Otokar)*

HPI-High Pressure Instrumentation

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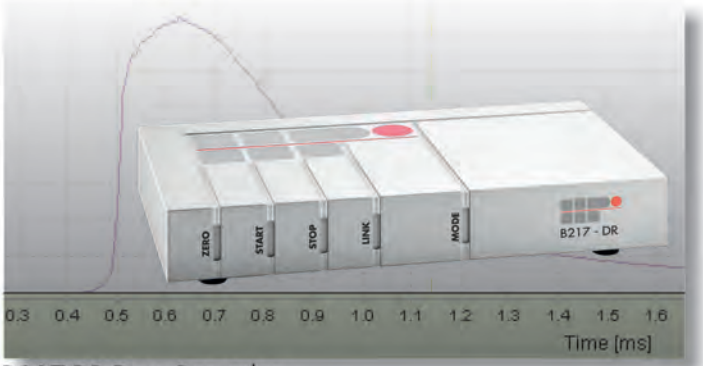
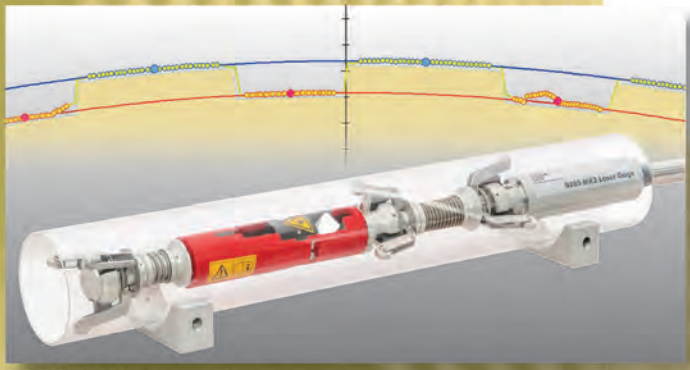
HIGH PRESSURE INSTRUMENTATION

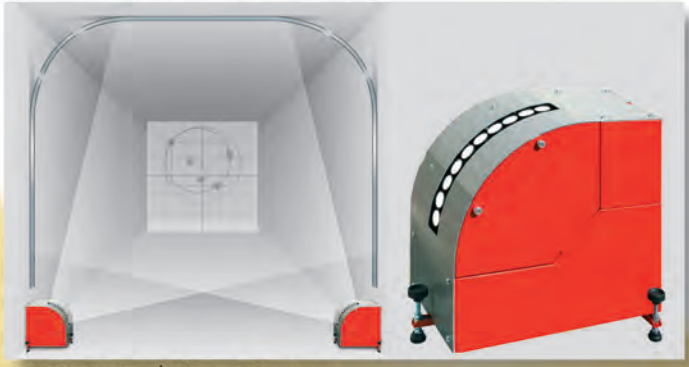
Is the number one supplier when it comes to Ballistic Measuring Equipment for interior-, exterior- and terminal ballistic applications. The Sensors, Hardware, specific Software and Data Recording Systems are applied in R&D, acceptance and routine tests by manufacturers of ammunition, weapons, military and civil Proving Ranges. Continuous developments, uncompromising quality, high accuracy and worldwide service make HPI stay ahead of the rest.
A new field of HPI´s activities is the supply of measuring equipment for testing Protection Material such of helmets, body armor, armored steel plates and safety glass according to NIJ Standards.

Piezoelectric High Pressure Transducers – GP Series



B217-DR Data Recorder


B285 MK2 Laser Gage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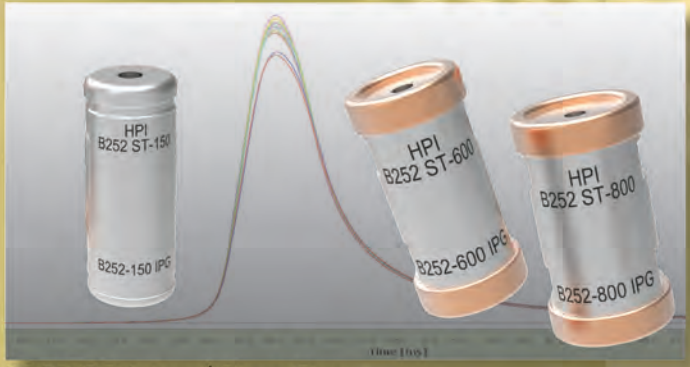
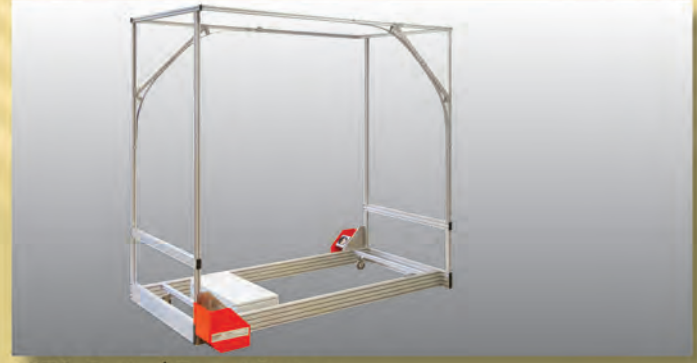


B252 IPG Internal Piezo Gauge


B573 Optical Target System


B481 Doppler Radar System


B472 Precision Light Screen, B462 Measuring Frame

THE LAND ROVER LURCHES AHEAD

The iconic Land Rover lurches from the past to the future as the British Army uses it as a testbed to better understand the impact of vehicle electrification on the battlefield.

By Anita Hawser

The Land Rover is to the British Army, what the HMMWV (Humvee) is to their US counterparts. Both vehicles are engrained in popular culture and at some point, most soldiers would have got to drive or ride in either vehicle.

The Land Rover, of course, has a lot more history behind it, having been a workhorse of the British Army since 1949, while the Humvee only came into service in the mid-1980s.

These days, the Land Rover, which was modelled on WWII jeeps, plays less of a frontline role and is used more for training. Most of the British Army's Land Rovers are no longer in service except the Land Rover Wolf, which is based on the Defender model and is still used as a light military vehicle.

The Army is also looking to the future, putting out an RFI "seeking market information as to military light utility platforms … to replace Land Rover and other similar vehicles as part of the General Support Utility Platform Programme."

But there is still life in the 75-year-old-vehicle yet, with four in-service Land Rovers — two protected and two general service — being adapted as fully electric vehicles under Project LURCHER.

In-service Land Rovers — two protected and two general service — are being adapted as fully electric vehicles under Project LURCHER (*MoD/Crown Copyright*)

The Land Rover may not be going to Ukraine or the frontline any time soon, but it is being used as a test vehicle to help the British Army better understand the applications and constraints of vehicle electrification technologies.

Last April, Babcock, was awarded a one-year contract on behalf of the Ministry of Defence to convert four in-service military Land Rovers, from diesel fuelled to electric vehicles (EV) using a drop-in kit and modified battery system.

Babcock is acting as a systems integrator on Project LURCHER, while the EV drop-in kit is provided by UK company Electrogenic, which designs and builds EV drivetrains for car manufacturers and for converting existing vehicles to electric drive, including classic Land Rovers.

George Woollard, head of R&D development programmes at Babcock, says Electrogenic had already converted around 20 or 30 Land Rovers before the MoD contract. "So, they had a pedigree and key technological features," he says. "They build all their batteries themselves and their bespoke vehicle control unit software was developed in-house."

Babcock knows the army's Land Rovers well. It provides through-life equipment support for the vehicles and has put forward its General Logistics Vehicle (GLV), which it showcased at DSEI last year, for the RFI to ultimately replace the Land Rover.

Interestingly, when Babcock was building the GLV in its workshop, at the same time it was also working on the electrification of the Land Rovers for Project LURCHER. "There was this contrast between the new world and the old world," observes Woollard.

At the time of writing, Babcock was finalising the electrification of the last of the four EV Land Rovers. "We have already handed over two vehicles to the customer, the two armoured ones, which were the more complex conversions given that the armour adds more weight and is challenging to integrate the wiring," says Woollard.

One of the two EV armoured Land Rovers was recently displayed at DSEI in September, while another was put on show at the Tower of London, during an army event. "At both events, we received positive feedback from people, and they are excited to hear about the trial data once it comes out," says Woollard.

The four EV Land Rovers will be put through their paces by the Armoured Trials and Development Unit (ATDU) at MoD Bovington to test the vehicles' operational advantages and disadvantages. Trials are expected to start sometime in March/April this year. The vehicles' performance will be assessed over steep terrain, wading and towing, and different climate-related conditions.

While hybrid electric drives have been fitted to other Army vehicles such as the Jackal and Foxhound, Woollard says the Land Rovers are the first fully electrified vehicles to be trialled in a battlefield scenario by the army. "They are looking forward to exploring the different kinds of data points that will come out of the trials," he says, adding that preliminary feedback suggests several benefits compared to Land Rovers powered by Internal Combustion Engines (ICE).

Woollard says the challenge with the army's old Land Rover fleet is that there is a limited supply chain to support the vehicles, so electrification is unlikely to be done at scale. He says Babcock's job is to support the vehicles through trials and understand the limitations and benefits of the EV platform. First impressions, appear promising.

Woollard says the electrified Land Rovers deliver a significantly improved driving experience. "The EV Land Rovers perform better off road than their internal combustion engine counterparts. There is less of a cognitive burden on the driver because of the lack of manual gears needed. A lower thermal signature, and lower acoustic signature, all of which have been proven, could also have a benefit on the battlefield."

One of the key areas the army is keen to understand better during the trials, says Woollard, is to have a vehicle that can offer more power and act as a kind of mobile charging device.

"One of the requirements of the LURCHER vehicles is the ability to offload power from the vehicle to charge auxiliary devices," Woollard explains. "So, in the future, you could have a portable power device, or mini-grid, whatever you want to call it, on the battlefield.

The ability to offboard power from an operational perspective could significantly reduce the burden of fuel demand at bases.

There are also fewer moving parts in an electric vehicle — ICE vehicles have 400 moving parts while EVs only have around 20 moving parts – so the logistics support required would be greatly reduced as well as the burden on fuel supplies. The ECM impact of electrification of the Land Rovers will also be assessed during the army trials.

"Everyone is looking at future technologies," says Woollard. "What's most exciting about Project LURCHER is that it incorporates new future technology onto an iconic platform so everyone can see the tangible benefits. I'm looking forward to seeing the results that will inform the future operational strategies of the military." ■

DIGITALISATION OF MORTAR SYSTEMS

Hirtenberger Defence Systems is a worldwide active developer, manufacturer and provider of mortar systems. The product range, consisting of mortar ammunition, weapon systems, auxiliary field equipment, aiming and sighting systems and solutions for the digitisation of mortar systems illustrates the variety of technologies and know-how.

The conduct of battle has always been determined by the factors of forces, space and time. The challenge of future battles in the context of national and alliance defence are similarly challenging for many modern armed forces and are presented as follows: In principle, a fight against a peer opponent must be assumed. Furthermore, based on experience from the Ukraine conflict, it must be assumed that wars or conflicts can arise without long warning times. The reality for the commander is likely to be as follows:

• Overstretched spaces must be held or taken with the limited strength and resources available

• Operations are conducted on a "glass battlefield." Receiving information, reliable transmission and the processing of all incoming data is therefore of crucial importance

• Digitisation of the battlefield requires good Communications, Command and Control (C2) systems, and Battle Management Systems (BMS), and requires redundancy in the event of disruptions. In view of the austerity measures taken by many armed forces, due to Covid-19, modernisation projects, and maintaining operational readiness, this can only succeed if, in addition to weapons effectiveness, systems are efficient.

Hirtenberger 81 mm M8 System with MDAS
(Mortar Digital Aiming System)

Hirtenberger 60 mm M6 C Commando Mortar System with GRAM System *(Grid Aiming Mode)*

SYSTEMS READY FOR USE TO INCREASE THE COMBAT EFFECTIVENESS OF MORTARS

Hirtenberger Defense Systems (HDS) manufactures cost-efficient mortar systems, that will increase combat effectiveness. These systems are provided in all common NATO calibres.

GRID AIMING MODE — GRAM

Hirtenberger introduced the GRAM electronic aiming device to the market in 2017. It now has additional functions. This device is scalable and increases the combat effectiveness of all common 60 mm mortars, including the commando mortar variant. With a weight of only 900 g, the GRAM system combines several sensors for determining the position of the barrel in space and has a wireless interface for communication with the fire control computer.

Attached to the barrel by means of a clamp, the integrated position sensors enable the lateral and vertical inclination of the barrel to be determined more precisely than classic levels. GRAM allows 60 mm mortars to be aimed and fired digitally, this enables fire orders to be executed quickly, as orders are transmitted seamlessly from the observer to the mortar using radio data transmission, negating errors in voice transmission.

The potential of GRAM is not exhausted as the use of the weapon no longer depends on visually aligning the mortar and target, other methods of using the system are also conceivable. The use of the commando mortar, in conjunction with the GRAM, is no longer limited to direct aiming. with the electronic aiming device, a commando mortar can fire indirectly from behind cover and as precisely as a 60 mm bipod mortar. The digitisation of mortar systems is achieved by connecting to existing fire control, command and weapon deployment systems via standardised interfaces. This means that the mortar can be used not only with battle management systems, but also with simulation systems to process trainers based on VBS.

REQUIREMENTS FOR FUTURE MORTAR SYSTEMS

Infantry mortar fire support plays an important role in such scenarios as they can be deployed quickly, with comparatively small forces, a small logistical footprint, and can quickly cover large areas. However, in order to make this contribution to combat operations, future mortar systems must meet several criteria. Survivability, speed of action and the ability to integrate into the digital battle space must be significantly improved in many armed forces.

Additionally, it is also important to increase the effectiveness of the weapon systems - in terms of accuracy, range - and to simplify the training of operators. Since the requirements described already exist today due to ongoing operations, there is not much time left for the development of new systems with inherent risks due to the development of such systems, which are sometimes difficult to control, throughout the entire development phase until they are ready for use.

To equip Android-based smartphones, Hirtenberger has developed a GRAM app, which expands the Android device into a complete fire control computer and makes the overall system even more cost-efficient, as there is no need to purchase additional IT hardware. Communication with the GRAM takes place via a Bluetooth connection, the target data can also be transferred directly from the target locating device to the app via Bluetooth at close range, if this connection is not available data entry can be done manually.

MORTAR DIGITAL AIMING SOLUTION — MDAS

The MDAS is a digital aiming device for 81 mm and 120 mm mortars. The setting up and aiming of bipod mortars can be carried out using this system independently of aiming circles or sights and also without connections to the Global Navigation Satellite Systems (GNSS).

The MDAS weighs less than 12 kilograms and consists of two hardware components. These consist of a navigation system-independent, gyroscope-based sensor package including a battery unit and a display, which is attached to the mortar in place of a sight and shows the orientation of the weapon system. MDAS is ready for serial production and is currently being tested in a Central European country.

The concept behind MDAS offers several advantages:

- It works independently of the weapon system and can increase the combat value of the mortar systems in use as a retrofit, and therefore integrate the mortar systems into the BMS. This simplifies both the management and the use of the systems.
- Furthermore, digitisation enables a significantly faster transmission of target information than voice. Depending on the stability of the data connection, transmission errors are eliminated, and this allows faster target engagement. MDAS simplifies the tasks of the fire unit, aiming with a digital display is easier to learn and operate in comparison to a conventional optic sight. As a result, training is easier and faster, and the unit size required for firing can be reduced. The freed-up personnel, who are still required to transport the weapon system for combat purposes, can then be used for other tasks.

Using MDAS independently of the navigation system also allows it to be used in a scenario determined by electronic combat. MDAS allows the mortar, where necessary and appropriate, to continue to be used in the conventional manner with sight and aiming posts. ■

Hirtenberger 120 mm M12 System

DroneShield says it made its non-kinetic jammer in the shape of a gun so it was something cool that soldiers would tell their buddies about. *(Photo courtesy of DroneShield)*

DETECT, TRACK, IDENTIFY, AND COUNTER

The Second Drone Age is here. But are first-generation Counter-UAS solutions still fit for purpose? We speak to leading manufacturers about how they are evolving in line with the new drone world and "Drone Powers".

By Anita Hawser

From non-kinetic drone guns that look like something out of Ghost Busters, and solutions that entangle rogue drones in nets, to systems that use sophisticated radars and other technologies such as AI to try and distinguish between small birds and small commercial-off-the-shelf drones, the world of counter-UAS (Unmanned Air Systems) has given us all sorts of seemingly

creative and far-fetched solutions. But are any of them really that effective? As the wars in Ukraine, the Caucuses, Libya and now Gaza demonstrate, practically anyone these days can cause major disruption, terror or threat to life and critical infrastructure using weaponised drones.

Houthi rebels proved that with their bold attacks on Saudi oil infrastructure in 2019, and they're demonstrating it again in the Red Sea with their attacks on naval and merchant vessels, which is causing major disruptions to global trade.

This is a radical departure from the First Drone Age, where military superpowers like the US, Israel and China dominated the supply and use of such technologies, specifically when it came to lethal strikes using armed drones or Remotely Piloted Air Systems. In the Second Drone Age, as some are now calling it, "new 'Drone Powers', and the 'new drone world', present fundamentally different challenges to those faced during the First Drone Age," writes Dr James Rogers, DIAS Assistant Professor in War Studies at the University of Southern Denmark's Centre for War Studies and an Associate Fellow of LSE IDEAS within the London School of Economics. He made the point in a chapter on Future Threats: Military UAS, Terrorist Drones, and the Dangers of the Second Drone Age in the Joint Air Power Competence Centre's: *A Comprehensive Approach to Countering Unmanned Air Systems*.

Rogers says the recent 'state versus state' drone wars in the Caucasus and Libya show that the politically motivated supply of military UAS has contributed to international instability and conflict escalation. The supply of both "commercial and military-grade remote technologies to non-state actors, allegedly by countries like Iran or through commercial shell companies, exacerbate the manifest threats present in this altered security environment." The relaxation of commercial drone regulations in response to COVID-19 will only exacerbate this problem, he adds, as belligerents seek to move against perceived weak points.

But what does the Second Drone Age and the proliferation of drone powers mean for the world of counter-unmanned air systems? Are C-UAS solutions evolving quickly enough to address this 'new drone world'? After all, countering a single rogue drone at Gatwick Airport, which saw the airport close for almost three days in December 2018 or dealing with makeshift explosive devices attached to Chinese-made DJI Phantom quadcopters, seems small fry these days compared to dealing with a swarm of Iranian-made Shahed 136s raining down on a city or a barrage of 18 one-way attack drones — designed to explode upon impact — heading straight for commercial shipping vessels in the Red Sea.

XTEND's Griffon uses a net to entangle the propelllors of rogue drones *(Photo: XTEND)*

Houthi rebels' most recent attack in the Red Sea — its largest to date — was countered by Sea Viper missiles and guns on board the Royal Navy's Type 45 destroyer *HMS Diamond*. But using a billion-pound warship and missiles which reportedly cost £1 million a pop, isn't the most desirable nor cost-effective solution for countering a much cheaper, but increasingly complex drone threat. "Right now, the main focus [in C-UAS] is price-per-defeat," says Josh Harman, Vice President and business development lead at global technology company, MARSS. "If you compare this to the history of IED threats, it's very similar.

The enemy comes up with simple techniques to create a threat. We respond with elementary systems that then evolve right behind the threat to complex systems. Historically, our defeat option is 10x the price of the threat — and now, we are trying to engineer our way out of this price discrepancy. More affordable kinetic and directed options are where most R&D is these days."

Militaries, like the US, are throwing money at counter-UAV research and procurement. According to the Congressional Research Service, in FY2023, the Department of Defense (DOD) planned to spend at least $668 million on counter-UAS (C-UAS) R&D and at least $78 million on C-UAS procurement. In 2021, the Joint Counter-small Unmanned Aircraft Systems Office (JCO), released a DOD C-sUAS strategy, encompassing doctrine, training, equipment and identifying any potential shortfalls to counter present and future sUAS threats. "Materiel solutions alone cannot counter the sUAS threat or

A graphic showing MARSS' AI-enabled autonomous Interceptor that offers an intelligent, cost-effective and low-collateral solution to neutralise hostile drones. Fully integrated with NiDAR CUAS, this high-speed craft is capable of defeating category I & II drones head on from up to 5km+

mitigate hazards," the strategy states.

In the UK, DSTL's C-UAS technical authority says the uncrewed air systems threat is increasing in sophistication and complexity and is in danger of outpacing existing Counter-UAS developments. "Continual R&D is needed to close any potential gaps that emerge and to provide suitable counter," they said. "This is a complex problem, it is not just about effectors; detect, track and identify are equally important."

We spoke to a variety of C-UAS companies about their technology and how the evolving drone threat, and new technologies such as AI, are transforming the industry.

DRONESHIELD

Oleg Vornik, CEO of Sydney, Australia-based DroneShield says the US is by far the biggest market for C-UAS solutions and remains, by far, its biggest customer.

Last year, US government agencies contributed approximately 70% of DroneShield's revenues, including a record $33 million order in July 2023. "We're now seeing counter-drone become mainstream and it's being reinforced in customers' minds that drones are the way of future wars," he says.

But why buy from a scale-up in Sydney and not from a US company? Vornik says DroneShield's success in the US C-UAS market is down to the fact that it has outworked and outspent its competitors. "One of our key differentiators is that more traditional businesses try to extract profit every year while our goal is growth. We invest substantially in tech every year, which makes us more aggressive in terms of how we develop the technology. This has included an investment in our substantial engineering team and fostering a fast-paced development culture."

DroneShield has more than 80 engineers and builds everything from individual circuit boards down to the chips, jammers and waveforms it uses in its C-UAS solutions. "An enormous amount of money is spent on R&D, and we release new software versions every quarter and a couple of new hardware platforms a year," says Vornik. It is only now, in its 10th year of operations that the company is reaching profitability having had its first cash-flow positive and profitable year in 2023 with cash receipts rising to AUD$70 million.

DroneShield started with a 5 kg DroneGun and a 10kg backpack which uses non-kinetic jamming to intercept rogue UAS. Explaining why it developed a jammer in the shape of a gun, Vornik says militaries buy emotionally, just like normal consumers. "It's also something cool they'd tell their buddies about, which would help make the product go viral," he says. It has since added other solutions such as a command-and-control centre which uses advanced software algorithms for detecting, identifying, and automatically tracking drones of any size.

The latest iteration of its effector gun, the Mk4, which weighs 3 kg, can "disrupt the control, navigation and video of multiple drones simultaneously." Upon being jammed, the UAS will either land

on the spot or return to its operator or starting point. Vornik says lots of UAVs can be jammed at the same time. "A jamming signal goes across an area and all drones in that area will become equally affected," he says.

Responding to Ukrainian and Russian claims about the development of jamming-resistant drones, Vornik says jamming technology is improving all the time, and that there needs to be a degree of scepticism about capability claims, as they serve in part as emotional warfare. "Allowing a drone to fly blind until it regains its signal gives you a short window, but I expect it will be a cat-and-mouse situation for some time," he says.

"For us, it's about pushing the boundaries, increasing the range and effectiveness of our jammers, and making sure we can still be effective when jamming-proof resistant drones are released," says Vornik.

XTEND

In addition to non-kinetic jammers shaped like guns, Israel's XTEND uses kinetic means — another drone — to take down drones. Its Griffon C-UAS system developed for Israel's dismounted forces, uses a net to entangle the propellors and drop the drone to the ground. In another variation, the drone is carried away. Aviv Shapira, co-founder and CEO of XTEND, says the Griffon is designed to destroy the motors of a drone and can be airborne within seconds of a threat alert.

He says the company has sold 150 systems to the US and Israel and some users in APAC. Shapira claims the Griffon can intercept a target with a 90% success rate, but admits its solution is better at countering a single drone than swarms of drones, although if you buy hundreds of them it becomes like an "Army of Drones", he adds. He says EW guns are only effective if the threat is within 300 m to 400 m, whereas the Griffon can intercept at a 5km range.

However, Vornik says "drone-on-drone" C-UAS solutions are a gimmick. "Apart from a cool-looking demo when it comes to protecting a base you might have a swarm of 10 hostile drones. You need to detect them. Detection usually gives you two minutes of warning time. If you're waiting for a good drone to fly up and find a bad drone and take it down, what happens with the other eight or nine drones?" Jamming, on the other hand, he says, switches on instantaneously as soon as a drone or drones are detected, and it affects the whole area.

> *If a drone disappears behind a tree, normal video tracking will lose contact with it. With AI, we can teach the system what a drone looks like, and as soon as it reappears it will reacquire it automatically.*

MARSS

MARSS, which describes itself as a global technology company, started more than a decade ago protecting critical infrastructure in the Middle East against multi-domain threats. "We figured someone would respond to this new threat [drones]," says CEO and founder Johannes Pinl. "But we didn't realise how difficult it would be. Category 1 and 2 drones look like a small bird on radar. That was the fundamental challenge with C-UAS systems."

At that point, AI was still in the early stages and Pinl says traditional AI algorithms hit limits. "We built up an AI team to focus on this problem." At the heart of the solutions it now offers, is MARSS' NiDAR CORE, an AI-powered Internet of Things platform, which uses what Pinl calls "hybrid intelligence", a combination of AI, traditional algorithms and human expertise to detect threats, including UAVs. "AI alone does not do the job," according to Pinl.

MARSS uses RF monitoring, EO, infrared and other sensors and combines all the information captured by the sensors. He claims its solution can detect more than 1,000 targets an hour. But that information needs to be filtered, so MARSS uses AI to predict what the UAS is going to do next. "AI is very good at looking at how they behave. Is it a drone, as opposed to a bird," he explains. "It can detect certain patterns."

When it comes to countermeasures, Pinl says you need to react quickly at machine speed. "New conops are being developed every day. They need to be highly agile to adapt to the new battlefield." MARSS' "hit-to-kill" short-range interceptor drone utilises next-generation techniques to be much smarter and more effective and is designed to survive impacts with Class I drones. It can stay airborne for up to 20 minutes. "As a result, Interceptor MR is very well suited towards tackling drone swarms, in combination with MARSS' NiDAR C2 systems," says Josh Harman, MARSS vice president and business development lead.

The global technology company is also working with various partners to test and integrate Directed Energy Weapons (DEW) with NiDAR's C-UAS capabilities. "Microwaves, lasers are future technologies that can potentially play a large role in C-UAS," says Harman. "While DEW remain several years away from use on the battlefield, the ongoing tests taking place, alongside the limited deployment actions and extensive scrutiny, will all help these capabilities to develop further."

In theatres like Ukraine, Vornik of DroneShield says hand-held mobile C-UAS systems work best as they are cheaper and harder for the Russians to target. But no matter what approach you take

Chess Dynamics' C-UAS system combines electronic-scanning radar target detection, electro-optical tracking/classification and directional RF inhibition capability (Photo: Chess Dynamics)

to countering drones — kinetic or non-kinetic — or the systems you use to detect and classify drones, most C-UAS providers agree that a single solution doesn't cut it.

David Eldridge, a Sales Director at CHESS Dynamics, which has provided military-grade C-UAS solutions for recent conflicts, says a layered response is needed. He compares it to a set of golf clubs and deciding which club or putter is the best one to use. "Laser interceptors may be ok for protecting the Pentagon, but if I'm in a trench, I'm still going to want a simple yet dependable soldier-borne solution for the task, so there is a huge justification for having a range of solutions," says Shapira.

One thing that has radically changed since C-UAS's early beginnings is using AI for tracking, identification, classification and generally quicker decision-making.

Having started out as a traditional video tracking company, Eldridge says AI has significantly enhanced Chess Dynamics' video-tracking abilities. "If a drone disappears behind a tree, normal video tracking will lose contact with it. With AI, we can teach the system what a drone looks like, and as soon as it reappears it will reacquire it automatically." Eldridge says it is using neural networks for drone classification purposes. "AI is a step change in capability, in terms of robustness of tracking and then the ability to classify," he says.

DroneShield now has an enormous database of drone radio frequency and optical/thermal data of over 35,000 samples, and started training AI on this data about five years ago when its engineering team realised that doing manual "fingerprints" for drone types was no longer practical. This was then accelerated as part of an Australian Department of Defence project working on C-UAS computer vision and then sensor fusion. "Our initial multi-sensor approach was super basic," explains Vornik. "Right now, it's a lot more sophisticated as we're using AI in probabilistic ways to take inputs from different sensors — the sensor sends a whole lot of information, which the engine fuses and you have this RF, acoustics, radar, and camera profile."

His advice to anyone investing in C-UAS is to not think about it as a one-off purchase. "Instead, think about it as investing in a relationship. You need someone who continues to push out new hardware and software. It's very collaborative where we get information from our customers." ■

ILLUMINATING THE FUTURE OF TACTICAL EXCELLENCE

Streamlight Inc.

For over 45 years, Streamlight® Inc. has designed, manufactured, and marketed high-performance lighting devices. Today, we offer a broad array of portable lighting solutions from lanterns and weapon-mounted lights to scene lighting tools. These products have been tried, tested and proven successful for specific use in military scenarios among many other industries.

Released in January 2022, the Sidewinder Stalk® is the future of lighting solutions for military scenarios. It is a multi-function military helmet light system featuring multiple colour LEDs, an Identification Friend or Foe (IFF) beacon, a strobe feature, and a flexible stalk for aiming light where it is needed.

The light features several attachment methods for mounting to helmets or MOLLE gear and operates from multiple power sources, including a single CR123A lithium, AA alkaline or AA lithium battery. On high mode, using a CR123A battery, the white LED delivers 76 lumens; on low, the light offers three-plus days of run time.

The versatile light features a variable colour LED housed in a head that is mounted to the light's bendable stalk. In addition to bright white light, tactical users can select from red, blue, or green LEDs in three output modes for low-light applications such as map reading and cockpit navigation or use the light's IR Illuminator while using night vision devices.

An integrated IR IFF beacon also permits operators to covertly signal positioning and movements on the ground.

The Sidewinder Stalk is equipped with a spring steel clip which can be attached to MOLLE vests or helmet mounts. The light is also available in two additional models: the ARC Rail™ model, which features a clip and mounting plate to fit military helmets with the ARC Rail™ mounting system, and the E-Mount model, which fits on the brims of PASGT, ACH and ECH style helmets. The new light will also fit existing Sidewinder Compact® II mounts.

"The Sidewinder Stalk combines all combat illuminator colours plus a signal beacon in a single light system, reducing the amount of gear needed in the field," said Streamlight president and CEO Ray Sharrah. "It offers multiple attachment methods for mounting on military-style helmets, MOLLE vests or even patrol caps for hands-free operation. With its multi-fuel capability, users can power the light with a CR123A lithium, AA Alkaline or AA lithium battery, depending on preference and availability. It's the ultimate configurable tactical light."

The new light uses a white LED that offers 76 lumens of bright light on high and up to 95 hours of run time on the low mode when using a CR123A battery; with an AA lithium or AA alkaline battery, the light delivers 57 lumens for 66+ hours on low. The light also includes an IR LED that provides 5.0 lmW/sr (min), a red LED with a 9-lumen output, a blue LED that offers 8 lumens and a green LED with a 20-lumen output. A 3535 IFF IR LED delivers 5.0 lmW/sr (min) radiant intensity. Each of the lighting modes provides three intensity levels and a flash/signalling mode.

The Sidewinder Stalk features a push-button switch for on/off and intensity control, starting at the lowest output and progressing to the brightest output in three discrete steps. A rotating selector knob is used to select output modes, preventing accidental mode changes. The IFF strobe is activated by a three-position ambidextrous switch.

The Sidewinder Stalk features a high-impact, super tough nylon case, which offers exceptional durability and weather resistance, and a long-lasting polycarbonate lens with a scratch-resistant coating. With O-ring and gasket-sealed openings, the light has an IP67-rated design and is dust-tight and waterproof to 1 metre for 30 minutes. It meets MIL-STD-810H, Method 512.6 Immersion guidelines. ■

GOING FOR GOLD

A Super Hercules aircraft assigned to the 36th Airlift Squadron sits on the flight line during the morning fog at Yokota Air Base, Japan, April 30, 2021. *(US Air Force photo by Yasuo Osakabe)*

The military transport aircraft market just got a lot more crowded. In addition to the gold standard, the C-130, buyers are embracing new variants that can perform a wider variety of roles and that aren't as heavy on the pocket.

By Jack Richardson

Long-range strike weapons for Ukraine and protecting merchant and naval shipping vessels against drone and missile attacks in the Red Sea may be the current focus of the global defence industry, but there is another market which remains as important as ever. 2024 marks 70 years since the first flight of the C-130 Hercules military transport aircraft and this iconic aircraft is now facing stiff competition to supply the world's air forces.

In its latest C-130J Super Hercules configuration, Lockheed Martin offers this aircraft across a range of variants, including as a tanker and for special operations. With its four turboprop engines, the longer C-130J-30 variant can fly up to 2,160 nm with 40,000 lbs of cargo. To date, the C-130 has been produced or modified to support upwards of 100 different mission requirements. "No other aircraft matches that level of versatility," says Tony Frese, vice president of business development for Air Mobility and Maritime Missions programmes at Lockheed Martin. Theoretically, the C-130J's main competitor, the A400M Atlas boasts better performance with a range of 4,800 nm and up to 55,000 lbs of cargo, while every example can be configured as a tanker.

However, for all its merits, the aircraft has so far had limited exports. According to Professor Keith Hayward, a retired political scientist who now researches the aerospace and defence sectors, this is down to well-publicised issues with the A400M's engines impacting its reliability. Responding to criticism of the aircraft's reliability, Airbus said "the A400M offers unique advanced capabilities, and aircraft programmes of similar complexity (for example, new aircraft with a new powerplant) and even simpler ones may face some 'teething' issues in their first years of operations. A400Ms to be delivered to new customers (such as Kazakhstan and Indonesia) will benefit from all the lessons learned and the progress made since first deliveries," the Airbus spokesperson says.

Alongside broadening the A400M's portfolio, with trials of a modular aerial firefighting unit to fight wildfires, Airbus says it is "constantly listening to the market and identifying new operational needs that could benefit and support its customers." To this end, the European Defence Fund announced an investment in June 2023 for an 18-month feasibility study under the Future Air System for European Tactical Transportation. Renderings depict a smaller, twin-engine version of the A400M which has been informally referred to as the 'A200M'. If deemed viable, it would be developed from 2030-2040. This type would serve as a replacement for legacy C-130s and Airbus C-295s in service around Europe. However, this share of the market is already being cornered by a strong incumbent.

A MILITARY TRANSPORT AIRCRAFT THAT DOESN'T JUST CARRY CARGO

Embraer's C-390 Millennium (which features twin jet engines and a maximum payload of 57,000 lbs over 1,080 nm) can perform a wide variety of roles. It has the option of an extra crew member on the flight deck for air-to-air refuelling and Search & Rescue (the latter using a detachable EO/IR pod). The emphasis on versatility seems to have paid off with the Netherlands ordering five aircraft, which has been attributed to the C-390's high availability and ability to conduct multiple roles within the same airframe.

Portugal received its first aircraft in 2023 while Austria, the Czech Republic and Hungary have also placed orders for the C-390 Millennium. Perhaps the aircraft's most significant order to date is the announcement in December 2023 that it had won South Korea's Large Transport Aircraft II competition, for an undisclosed number of aircraft. In addition to its cost-effectiveness and whether it can carry out the roles of the C-130J, Hayward said that the key challenge for the C-390 is how close it will be able to get to the frontline with its jet engines (considering the nature of unprepared landing strips). In addition to its straight wing offering low-speed performance (key for aerial refuelling operations), Frese of Lockheed Martin lists the reliability, durability and

The A400M at the 2023 Royal International Air Tattoo *(Copyright: Airbus SAS 2023)*

The Portuguese Air Force's KC-390 or C-390 Millennium as it is known to the rest of the world *(Copyright: Embraer)*

versatility of the C-130J's turboprops as one of its key strengths. This is a key debate as jet designs are proliferating in the sector.

South Korea has the MC-X concept for a twin-engine jet transport aircraft developed in blocks. Block one is planned to be deployed for basic transport functions but block two examples will expand into other roles including aeromedical evacuation and air-to-air refuelling with hoses and drogues. Beyond block two, manufacturer Korean Aerospace Industries plans for the MC-X to cover air-to-air refuelling with a boom, combat search and rescue, anti-submarine warfare, electronic warfare and perhaps most intriguingly, deploying ballistic rockets.

The latter proposal aims to provide South Korea with a standoff ballistic missile launching capability and the potential for customers to use the airframe to conduct horizontal satellite launches. As for industrial considerations, South Korea has signed an MoU with the UAE to share development costs and for the latter to induct the type. "That would always make sense and if you can get a collaborative partner, in theory, you can get a captive market," says Hayward.

The MC-X has emerged at a time of growing interest in the military transport market across East Asia, with Japan still attempting to sell its Kawasaki C-2 twin-jet aircraft. With the market set to become more crowded, a spokesperson for Kawasaki told *Defence Procurement International* that its product enjoys high speeds and long-range, adding: "The Kawasaki C-2 bridges the gap between the C-130 and C-17, being sized approximately twice as large as the C-130H and approximately half as large as the C-17 in terms of take-off weight."

Although barriers to entering the transport aircraft market remain high, as Russia tries to bring its Il-276 design to market, China could add another competitor to the fray with its Xian Y-20. According to Hayward, this aircraft could prove attractive to customers with lower budgets. "The Chinese do have the money; they have the market and the motivation."

When asked how Lockheed Martin plans to future-proof the C-130J to compete with newer designs, Frese replied: "Looking across the C-130 portfolio, it's easy to see how this workhorse evolves. The aircraft's core design is solid and truly designed for the tactical mission that lends itself to natural advancements in technology, materials and mission capabilities." He listed improvements in sustainability, communications, palletised munitions and even single pilot operations as pathways ahead for the C-130J, predicting the aircraft will reach its centenary in 2054. With this incumbent strength, it appears the main way for challengers to dislodge the 'Herc' will be through offering a larger aircraft that can match its versatility and reach more places. ■

ABOUT THE AUTHOR

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INDUSTRY 5.0 MAKES ITS MARK AND HERALDS THE HUMANISED FUTURE FOR A&D MANUFACTURING

Matt Medley, Global Industry Director, Aerospace & Defence (A&D), IFS, highlights the implications of Industry 5.0 on A&D manufacturing, from digital threads bridging manufacturing gaps and addressing skill shortages, to prioritising ESG strategies and protecting supply chains with hyper-globalisation pullbacks.

Globally, Industry 4.0 is now mainstream across all manufacturing processes, and A&D, although a late starter, is now in full flow introducing 4.0 technologies.

But A&D manufacturers are having to move on quickly as Industry 5.0 has arrived to marry both tech and human workers into the manufacturing process.

Industry 5.0 looks to incorporate technology in a societal environment and complement the groundwork laid by Industry 4.0 technologies by prioritising research and innovation to ensure a sustainable, human-centric, and resilient future for the A&D manufacturing industry.

The vision for Industry 5.0 is evident in the European Commission Policy Brief— "that aims beyond efficiency and productivity as the sole goals and reinforces the role and the contribution of industry to society."

North American manufacturers are just as eager for Industry 5.0 as seen in a recent Boyden Executive Survey looking at the human-centricity aspect and the growth and structural benefits it brings.

1. INDUSTRY 5.0 TAKES 4.0 TECHNOLOGIES TO THE NEXT LEVEL WITH A HUMAN-CENTRIC APPROACH

Even though the foundations haven't settled, technology is acting as the bridge for 5.0's core themes. IoT, additive manufacturing, augmented reality, and digital twins have all gained ground with manufacturers to improve their efficiency and make them more data driven.

This has allowed a "digital thread" to be built across A&D equipment from design, through to prototyping, manufacturing, and even in-service support. Enter the collaborative robot, or "cobot". The International Centre for Industrial Transformation views Industry 5.0 as "…an add-on to Industry 4.0, building upon the groundwork laid by these smart technologies. While the focus of Industry 4.0 was connectivity, digitalisation and automation, Industry 5.0 highlights the importance of human-robot collaboration and the relationship between man and machine, or 'cobots'."

MAN AND MACHINE COLLABORATION

New technology applications are emerging as part of Industry 5.0 that focus more on the people executing the manufacturing. In an A&D context, we will start to see and have already seen technology and equipment from a military background become commercialised.

Human-centric robotic developments do include the rise of "cobots", where human operators can efficiently and safely work next to robots to perform key manufacturing tasks. As part of its "Smart Factory 2025" initiative, Audi has flagged one of its key aims to enhance this type of human-robot interaction (HRI). Beyond physical technologies, there are also interesting neurological tech applications such as brain-computer interfaces (BCI), for example Neuralink, which allow humans to control machines with no physical constraints.

2. COMBATING INDUSTRY SKILL SHORTAGES BY MAKING A&D MANUFACTURING MORE APPEALING

The latest stats from EY, conducted with the Aerospace Industries Association (AIA) and the American Institute of Aeronautics and Astronautics (AIAA), on the state of the A&D manufacturing workforce show it is experiencing a skill shortage like the wider manufacturing sector.

Nearly 69% of A&D manufacturing respondents strongly agree or agree that their organisation's staff turnover has significantly increased within the last year—demonstrating the intense competition and lack of readily available labour with the current workforce predominantly 55 or above (28%), the highest of any age demographic.

IMPROVE SAFETY AND EMPOWER EMPLOYEES WITH ASSISTIVE WEARABLES

The increasing development and use of the man/machine and technology/human interface can help provide some immediate relief for older workers and attract younger generations into the A&D manufacturing workspace.

Assistive wearable tech can improve the safety of workers and boost productivity. The use of cutting-edge technology means more highly skilled and well-paid jobs are available as manufacturing becomes smarter and more intelligent—helping to remove the traditional view of the industry as being a low-skilled job market.

HYPER-PERSONALISATION MAKES PURCHASING AND MADE-TO-ORDER A REQUIREMENT FOR A&D MANUFACTURING

Consumers will benefit from the human-centric approach of Industry 5.0 too as hyper-personalisation and products made-to-order become an everyday expectation of A&D manufacturers. Smarter factories and digitally focused products provide that coherent digital thread that can feed data back into the manufacturing process to allow quick changes to products.

A&D manufacturers need to stay agile, and that means having some key functionalities in the enterprise software they use. Take the example of Middle Eastern defence manufacturer Calidus, which manages the complex process of delivering aircraft or change orders to a customer. Using IFS software has taken the burden away from manual processes and has allowed access to information across the board to remove cross-departmental confusion.

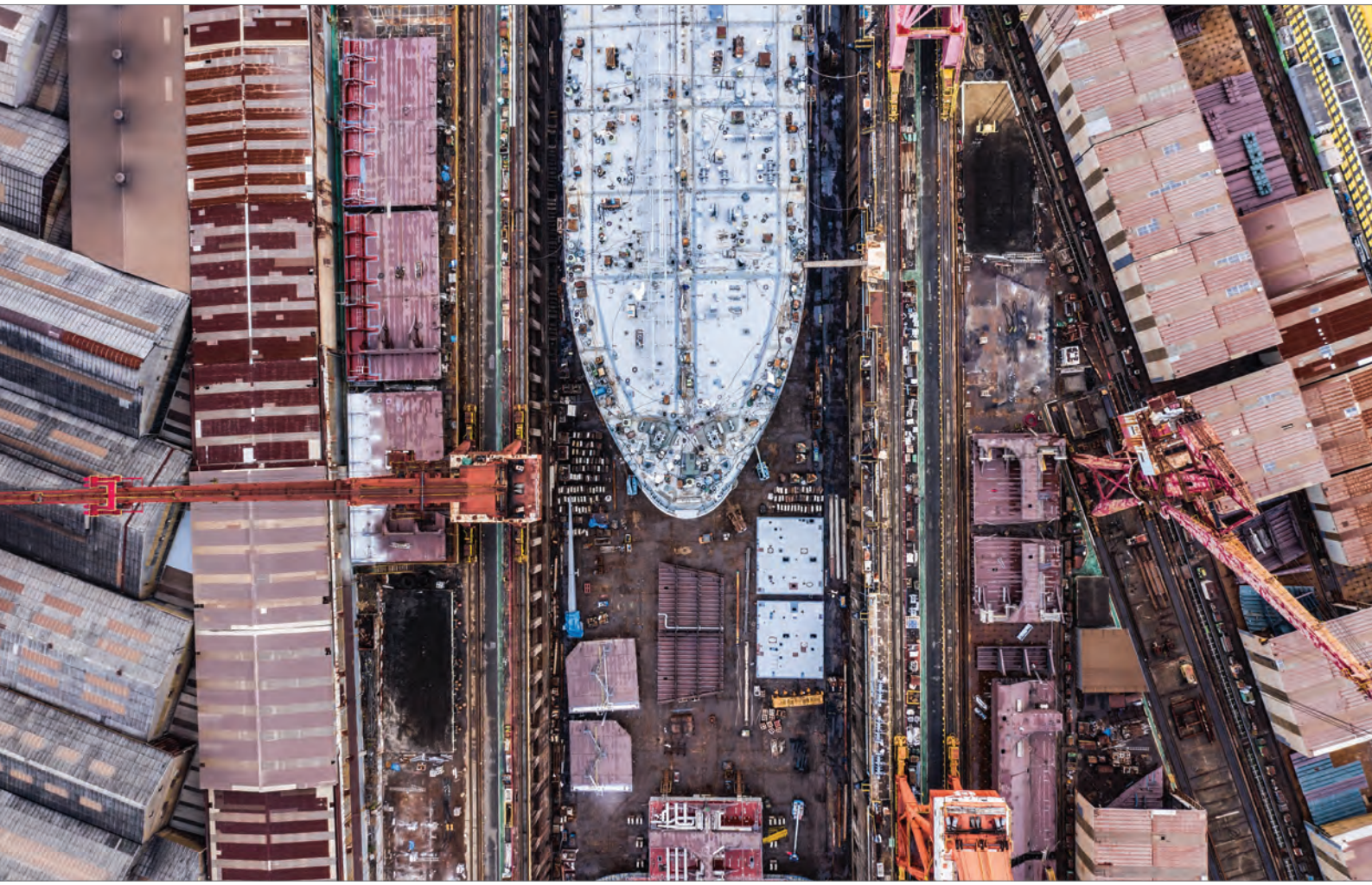
3. A&D MANUFACTURERS SHIFT THEIR BUSINESS STRATEGIES TO ENVIRONMENTAL, SOCIAL, & GOVERNANCE (ESG) STRATEGIES

A key part of Industry 5.0 is the focus on societal and sustainability goals and touching all three elements of any company's ESG strategy. The recent EY CEO Outlook cited 69% of advanced manufacturing executives are integrating ESG as a core aspect in all their products and using differentiated technologies to boost customer loyalty.

Implementing Industry 5.0 will have a positive impact on staff acquisition and retention—especially at a time when workforce competition is extremely high. It will touch on the human-centric approaches throughout the business hierarchy.

A&D MANUFACTURERS ARE ALREADY IN THE ENVIRONMENTAL SPOTLIGHT

Customers and regulations are increasing the environmental pressure on A&D manufacturers. KPMG highlights sustainability as a key A&D industry focus: "A&D manufacturers may not be able to reach their goals unless they integrate carbon reduction strategies throughout their ecosystems. This is particularly important within their hugely complex supply chains."



A&D manufacturing CEOs are responding, with the help of new technologies and manufacturing models, but to address their environmental output they need visibility. This is where the enterprise systems they use to manage their entire value chain can help them adopt sustainable and circular manufacturing operations.

4. THE RISE OF RESHORING IN THE WAKE OF HYPERGLOBALISATION

Industry 5.0 will also contain a key focus on resilience. Onshoring and repatriation of formerly outsourced manufacturing and shipping are huge focus areas for protecting supply chains and addressing environmental impacts—reflecting a potential pullback in the hyperglobalisation we've seen over the last few decades.

As evidenced in the European Commission policy paper: "The need for a new industrial paradigm, beyond Industry 4.0, has become more necessary over the years with increasingly complex and pressing economic and societal challenges."

A&D SUPPLY CHAIN MANAGEMENT BOOSTED BY ENTERPRISE TECHNOLOGY

As many as 72% of senior decision-makers who responded to research commissioned by IFS said they have increased their use of domestic suppliers. New technology will help them deliver the fast Time to Insight (TTI) they require for improved forecasting of demand and provide more detail throughout supply chains. Reshoring will require exceptional supply chain management and 37% of the respondents to the IFS study are prioritising this by investing in technology.

INDUSTRY 5.0 GROUNDWORK

The next evolution of smart and intelligent manufacturing is Industry 5.0—it has the potential to revolutionise A&D manufacturing. By focusing on human-centricity, sustainability and resilience, Industry 5.0 can optimise Industry 4.0 technologies for manufacturers to help improve their productivity, efficiency, and profitability. ■

OPINION

RED SEA SHIPPING ATTACKS POINT TO HARD CHOICES FOR NAVIES

A non-state actor has been able to employ high-end military capability to pose a significant threat to international shipping. When adding in the return of state-based threats, Western navies may need to reassess ship numbers and fit more ships with higher-end capability.

By Dr Lee Willett

On 11 January 2024, the US and the UK launched offensive strikes against Houthi rebel sites in Western Yemen. These are the sites from which the Houthis launched a barrage of missile and drone attacks against merchant shipping vessels in the southern Red Sea, which has caused significant disruption to major transit routes for global trade.

A strongly worded warning released on 3 January by the United States and signed by 14 countries, called for the immediate end of what the statement referred to as illegal attacks, saying that "the Houthis will bear the responsibility of the consequences should they continue to threaten lives, the global economy, and free flow of commerce in the region's critical waterways."

The consequences consisted of strikes by US Navy carrier-borne and UK Royal Air Force land-based strike aircraft, and US Navy destroyer-based Tomahawk cruise missiles. The Tomahawk strikes continued for a second night.

The strategic challenge in this crisis is that the Red Sea/Bab-al-Mandeb Strait/Gulf of Aden corridor is one of the world's most critical maritime choke points. It, plus Suez to the north, are significant because they connect not only two oceans but today's two principal global theatres – the Euro-Atlantic and Indo-Pacific.

The Straits of Hormuz have similar strategic importance, because of the volume and value of oil and gas that pass through them.

Iran sits immediately north of Hormuz: Its Yemeni proxy – the Houthis – reside to the northeast of the Red Sea/Bab-al-Mandeb/Gulf of Aden. Through steering and arming the Houthis, Iran's influence now extends across both choke points. The US and UK's offensive strikes, and the defensive-focused, US Navy-led Operation Prosperity Guardian (OPG) which was established in mid-December to protect merchant shipping, came about as much to deter Iran as its Houthi proxy.

The Houthis bore the operational-level consequences of the strikes. They will now be aware not only of the leverage they hold over shipping transiting the region but also of the kinetic consequences of pulling this lever. For Iran, as for the Houthis, the Red Sea shipping crisis is a means of complicating US policy and responses towards the ongoing Israel-Hamas conflict in Gaza, by escalating matters into a region-wide security crisis. One of the strategic rationales for Iran in pulling the Houthis' strings is that such activity is part of a pattern of wider efforts by countries that are not aligned with the United States to challenge the established, Western-centric international rules-based order. For Western countries more broadly, and for allies and partners, a consequence to bear in mind when needing to maintain the international rules-based order through delivering good order at sea and freedom of navigation is the resultant requirement to build and sustain credible naval strength.

At a multinational level, NATO, the European Union, and coalitions of the willing (as drawn together for OPG) bring together collective, highly capable, and largely integrated naval powers at a level that prospective adversaries can only aspire to. However, at a national level, many Western countries have seen national naval mass reduced significantly during successive post-Cold War decades of platform number cuts. Modern Western warships providing shipping security through OPG's defensive operations are firing high-end systems like

> *The strategic challenge in this crisis is that the Red Sea/Bab-al-Mandeb Strait/ Gulf of Aden corridor is one of the world's most critical maritime choke points.*

The UK Royal Navy Type 45 destroyer *HMS Diamond* is pictured participating in the multinational Red Sea shipping security mission Operation Prosperity Guardian. Only weeks previously, the ship was operating in the High North as part of the UK's Carrier Strike Group. *(UK MoD/Crown copyright 2024)*

Raytheon's Standard Missile and MBDA's Aster surface-to-air missile (SAM) systems. Indeed, even Middle Eastern regional navies are procuring new frigates and corvettes fitted out with Western SAMs like MBDA's Aster and VL MICA and Raytheon's RIM-116C RAM Block III.

However, capability may not be the problem so much as numbers. A warship cannot be in two places at once. Western navies are still bearing the consequences of cuts in numbers and are now doing so with two major conflicts underway in the Euro-Atlantic theatre and with international crises like the Red Sea situation drawing vessels away from these and other equally significant commitments.

Nick Childs, senior fellow for naval forces and maritime security at the International Institute for Strategic Studies, says navies often have fewer warships than they did even a few years ago. "So, even the US Navy and Royal Navy will be hard-pressed to maintain their current Middle East presence indefinitely without denuding other commitments."

The UK Royal Navy Type 45 air-defence destroyer *HMS Diamond* has played a key role in defending shipping in the Red Sea. The ship only returned in early November from a UK Carrier Strike Group deployment to the North and Norwegian seas but was Gulf-bound within two weeks. *Diamond* was scheduled to be present in the Gulf alongside the Royal Navy's forward-deployed, Bahrain-based Type 23 frigate *HMS Lancaster*. Instead, both ships are now in the Red Sea.

On 9 January, the UK announced that the Type 23 frigate *HMS Richmond* would deploy to the Red Sea too, to deputise for *Diamond* or *Lancaster* if either vessel needed to break off, including for resupply.

Some Western navies are already looking to make small, incremental increases to force levels. However, given the rate and scale of increase in international instability, this may not be enough. "There may be a case for further significant investment in bolstering fleet numbers and for saying that existing efforts do not measure up to the challenge," says Childs. "Yet the challenge is bolstering numbers quickly, especially without resources and industrial capacity in place."

Another consequence of the Red Sea shipping crisis for Western navies is that the Houthis are bringing anti-ship ballistic and cruise missiles and uncrewed air and surface systems to the fight, and employing some of these capabilities in new operational contexts such as against merchant ships for the first time.

Throughout the post-Cold War period, Western navies argued they could manage with reduced budgets and platform numbers by developing two-tiered force structures, with lower-end capability ships designed for missions where they would not encounter state-based, high-end threats.

But non-state actors like the Houthis now pose a more sophisticated threat to commercial and naval vessels, which suggests that such a division of labour may no longer be an option.

This division of labour can be enabled by embracing new technology, to generate enhanced outputs without having to build platform numbers. However, Childs says the Red Sea security situation suggests that presence and platforms are still important. "For some countries, with what feels like a real awakening of perceptions about the importance and vulnerability of maritime trade and communications, this may be the time to make some real strategic choices, including on whether the priority should be investing even more in naval and maritime capabilities," he says. ■

Dr Lee Willett *is an independent writer on naval, maritime, and wider defence and security issues. He previously ran the naval/maritime desks at the Royal United Services Institute and Janes.*

A SILENT SENTINEL AGAINST SUBMARINE THREATS

Rotary wing unmanned air systems are rewriting the rulebook on anti-submarine warfare. Compared with manned assets, they can provide persistent surveillance for longer periods, which puts submarines under pressure for longer. But will they make the elusive submarine threat a thing of the past?

By Tayfun Ozberk

In the ever-evolving landscape of naval warfare, a symphony of cutting-edge weapons and sensors, born from the relentless march of technology, is reshaping strategic dynamics on the high seas. Lessons drawn from the Russia-Ukraine conflict has ignited a paradigm shift, compelling nations to reevaluate their doctrines. A palpable sense of urgency prevails as countries diligently forge new CONOPS to seamlessly integrate these innovations into their naval fleets.

Many experts agree on one thing: naval warfare is moving fast, the risks are higher, and defending has become more complex. In the midst of all this, the underwater world remains fascinating and mysterious.

Anti-submarine warfare (ASW), a perilous endeavour for surface ships, hinges on the precarious balance of risk. Any vessel entering the torpedo danger zone of a lurking submarine becomes an open target, vulnerable to the deadly salvo of torpedoes. This vulnerability underscores the pivotal role of ASW helicopters and Maritime Patrol Aircraft,

An AH-1Z Viper with Marine Light Attack Helicopter Squadron 267, Marine Aircraft Group 39, 3rd Marine Aircraft Wing , flies past a US Navy destroyer and submarine during Summer Fury 21 at San Clemente, California (*Photo: US Marine Corps photo by Lance Cpl. Isaac Velasco)*

as submarines, by their nature, remain impotent against aerial threats.

Yet, a transformative tide is sweeping across naval strategies as unmanned systems carve out their niche as a compelling alternative to traditional air targets. The US Navy has chartered a course into the future, outlining plans to employ Unmanned Aerial Vehicles (UAVs) in ASW operations. The MQ-9B SeaGuardian, adorned with the Sonobuoy Management Control System module, is set to become a silent sentinel against submarine threats.

On the opposite side of the world, the Turkish Navy is using the Aksungur UAV, which is impressive for its ability to stay in the air for an incredible 60 hours. It's not just watching the surface for periscope surveillance; there are plans to give it a sonobuoy launcher and listener, making it even better at ASW. At the same time, unmanned surface vehicles are getting upgraded with towed arrays, dipping sonars, and torpedoes, transforming them into protectors in the deep waters.

In the midst of all these advancements in maritime technology, rotary-wing drones bring a unique mix of flexibility and power, representing a significant step forward in naval warfare's devvelopment.

A NEW ACTOR IN ASW OPERATIONS

The integration of unmanned systems will emerge as a pivotal strategy to counter the challenges posed by submarines. Rotary-wing drones bring a unique set of advantages to ASW operations, addressing some of the longstanding challenges faced by traditional approaches.

They exhibit unparalleled agility, allowing them to navigate through complex maritime environments with ease. Unlike fixed-wing aircraft, rotary wing UAVs can hover over specific areas, providing extended surveillance capabilities critical for detecting elusive submarine threats. In addition, deploying sonobuoys on these assets will provide a useful capability for ASW operations.

Ugur Asatekin, a retired Turkish Navy officer and ASW expert, highlights the limits of manned assets in ASW operations. "While the choice of aircraft profoundly shapes anti-submarine warfare capabilities in terms of weapons and systems, fixed-wing aircraft operate within dynamics that impose certain limitations." "These constraints include the time required to reach the operational area, reaching every location depending on base zones, limited airborne duration, and the inherent challenges associated with organic helicopters on board ships, encompassing factors like personnel restrictions, meteorological considerations, and material constraints."

> *The ability to be rapidly deployed in situations where the threat emerges unexpectedly and in evolving tactical situations and short logistical support time for sonobuoy deployment can be written as the first benefits of UAS-based solutions.*

Asatekin emphasises the benefits of using an UAS-based solution in ASW operations which ensures that submarines can be detected, monitored and kept under pressure for a long time. "The ability to be rapidly deployed in situations where the threat emerges unexpectedly and in evolving tactical situations and short logistical support time for sonobuoy deployment can be written as the first benefits of UAS-based solutions," he says.

He also touched on personnel limitations, and claims that it wouldn't be a huge problem even if the unmanned asset is lost during a conflict. "Eliminating the current personnel limitations in manned systems and enabling them to operate in the field for longer periods is an important benefit," Asatekin added. "Even if it can be considered as an easy target during a

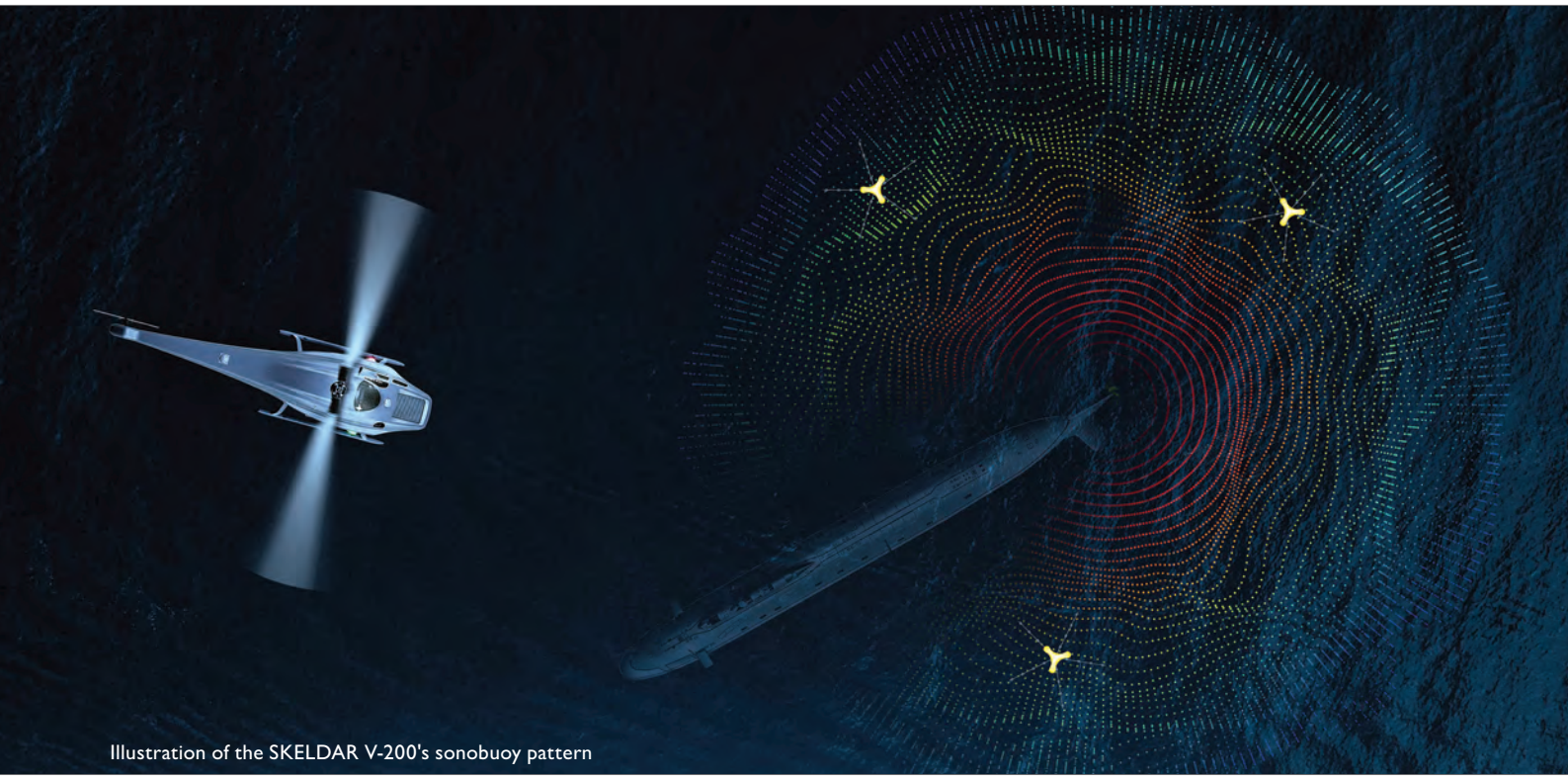


Illustration of the SKELDAR V-200's sonobuoy pattern

SCHIEBEL
CAMCOPTER® S-100

MARITIME SUPREMACY

UNMANNED MULTI-SENSOR ISR

A SKELDAR V-200 fitted with sonobuoys at DSEI 2023

conflict, its possible loss is psychologically more acceptable than manned systems, so it can be deployed in such situations depending on tactical decisions."

SKELDAR V-200 TO DEPLOY SONOBUOYS

UMS Skeldar's V-200 VTOL UAS stands out as a prominent example, equipped with the capability to carry sonobuoys for ASW operations. The SKELDAR V-200 rotary wing UAS is used for a wide range of applications such as reconnaissance, identification, target acquisition and electronic warfare. It is a medium-range UAS that can hover for hours while providing real-time information to a control station or remote video terminal. The compact solution is fully autonomous, controlled by high-level-commands such as "Point and Fly" and "Point and Look".

In addition to survelliance capabilities, integrating sonobuoys provide a vital tool for underwater acoustic detection. This integration enhances the UAS' ability to detect and track submarines, contributing to a more comprehensive and layered approach in ASW strategies.

UMS SKELDAR's ASW solution consists of two unmanned aircraft equipped with six passive sonobuoys that are dispensed to recognise a submarine from the host vessel. A second unmanned aircraft equipped with a data relay can stay airborne for up to six hours while transmitting data back to the host vessel, explains Adrian Stettler, sales & marketing director at UMS SKELDAR, and Project Manager for its ASW solution.

Stettler says they started working on a sonobuoy-based ASW capability at Euronaval in 2022. "Development work has progressed well since then, and at DSEI 2023, we were able to present a mock-up of the dispenser alongside our partners, Ultra Maritime," he says. Touching on the challenges of developing an ASW-purposed rotary wing drone, Stettler says the SKELDAR V-200 has a maximum payload capacity of 50 kg, which, with today's technology, allows for six sonobuoys to be deployed by the UAS.

"Over the last decade, technology has miniaturised, which has allowed for the same technological capabilities that were once offered by F-class sonobuoys to be found in G-class buoys. We anticipate that this trend will continue, and the number of buoys that can be mounted onto UAS in our weight and size category will increase along with their technical capabilities."

He also highlighted the importance of the V-200's rapid response capability. "Typically, manned assets for ASW operations are deployed from land, ultimately slowing response times down. Furthermore, the possibility for this solution to be placed aboard smaller vessel classes that cannot host manned assets is another key advantage. It is also important to mention that hard infrastructure is not required to deploy our UAS," he says.

An ASW-ready SKELDAR V-200 could ultimately bring additional or extended ASW capabilities to host vessels that cannot accommodate large, manned assets. Ship-based automatic take-off and landing (ATOL) enables landings on dynamic surfaces such as pitching and rolling ship heli-decks. Independent positioning assistance enables the V-200 to land in 2-knot winds (NATO Sea State 3-4) as well as in reduced visibility conditions such as nighttime, fog, and heavy rain.

The integration of rotary-wing UAS in ASW operations marks a significant leap forward in naval warfare capabilities. Their enhanced flexibility, rapid response, risk reduction, sonobuoy integration, and prolonged endurance make them invaluable assets in countering the stealth and complexity of modern submarine threats. As naval forces continue to adapt to evolving challenges, rotary-wing UAS are poised to play a pivotal role in shaping the future of anti-submarine warfare. ■

ABOUT THE AUTHOR

Tayfun Ozberk is a former naval officer who is expert in surface warfare. After serving in the Turkish Navy for 16 years, he started working as a naval analyst writing articles for several media outlets. He's based in Mersin, Turkey.

ENSURING WATER SECURITY: NORTH WATER GREENLAND'S STRATEGIC WATER RESERVE

North Water Greenland

In a world grappling with the growing challenges of water scarcity and emergencies, North Water Greenland emerges as a steadfast guardian, delivering a strategic water reserve through bulk tanker vessels for acute or emergency deployment.

With exclusive extraction licenses granting access to pristine water sources in Greenland and the US, we stand as a beacon of hope, capable of supplying more than 1,000,000 m3 of clean water daily. This abundance equates to providing clean drinking water for 10 million citizens in the developed world every day and offers a crucial lifeline in emergency relief during disaster situations.

OUR MISSION AND UN SUSTAINABLE DEVELOPMENT GOAL:

North Water Greenland is not just a company; it is committed to addressing global water challenges. Rooted in the UN Sustainable Development Goal 6—Clean Water and Sanitation, our mission is to contribute to a sustainable future by ensuring the availability of clean drinking water, especially in times of crisis. With our dedicated team and advanced technologies, we undertake the responsibility of delivering pristine Arctic water to regions and large cities in need.

OUR PROCESS:

Our strategic water reserve is the result of a meticulous process designed for efficiency, safety, and reliability. The journey begins with the capture of water from pristine arctic rivers in Greenland, ensuring the highest quality at the source. Alternatively, drinking water is sourced from Florida in the US. This water is then transported in clean bulk tanker vessels to destinations worldwide. Onboard these vessels, our commitment to quality assurance is unwavering. State-of-the-art lab equipment and UV disinfection measures are employed to guarantee the safety and purity of the water throughout its journey.

Upon arrival at the designated harbour, our bulk tanker vessels transfer the water to local water reservoirs or water distribution systems, facilitating easy access for the communities in need. Consumers receive not just water but clean, high-quality drinking water that meets the highest standards.

Capturing water from the Arctic

Water transport in bulk tanker vessels


Assurance for safety and purity of the water


Water distribution systems

SHIPMENT SIZES AND ENGAGEMENT TYPES

Our shipments, ranging from 30,000 m3 to 150,000 m3, are meticulously planned and executed. We employ tanker vessels of various classes, from medium-range (MR) to SuezMax, ensuring the flexibility to meet diverse needs and challenges. North Water Greenland offers engagement options tailored to the requirements of our partners and clients.

BUY WATER AND BRING YOUR OWN PICKUP BULK TANKER VESSEL

For those who prefer a hands-on approach, this engagement type allows clients to purchase water directly from the source and use their pickup bulk tanker vessel for transportation.

BUY WATER FOR DELIVERY WITH CHARTER VESSEL OPTION

Clients can opt to purchase water with the convenience of having it delivered to their destination. This engagement type includes a down-payment for chartering a vessel, ensuring low client involvement and relying on North Waters' team of experts.

EMERGENCY INSURANCE WITH A SUBSCRIPTION

Acknowledging the urgency of emergencies, North Water Greenland offers an insurance-backed subscription service. In the event of a crisis, clients with this subscription can have water delivered promptly to address acute water shortages.

ADDRESSING EMERGENCY WATER SHORTAGES:

Emergency water shortages demand swift and decisive action. North Water Greenland recognizes the critical nature of such situations, whether triggered by natural disasters or human-made crises. Our strategic water reserve is a key component in the arsenal of tools available to respond to these emergencies effectively.

By collaborating with local authorities, organizations, and communities, we aim to fortify preparedness and resilience against water crises. Our approach goes beyond delivering water; it involves building a network of support, knowledge-sharing, and proactive measures to safeguard public health during emergencies.

In conclusion, North Water Greenland's strategic water reserve is more than a product; it's a lifeline for communities facing water challenges. We invite governments, defense organizations, emergency relief agencies, and humanitarian organizations to join hands with us in creating a more water-secure and sustainable world. Together, we can turn the tide against water scarcity and ensure that clean, safe water is a right accessible to all, even in the most challenging times. ■


Ready to drink

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2. WATER TRANSPORT

3. QUALITY ASSURANCE

4. DELIVER THE WATER

5. READY TO DRINK

PULL UP THE DRAWBRIDGE

Has British cybersecurity start-up Goldilock finally cracked the conundrum of computer networks and IT systems that are always connected to the internet, which makes them more vulnerable to attack?

By Anita Hawser

In the final part of General Sir Chris Deverell's 40-year career in the British Army, the concept of cyberspace as a warfighting domain was still working its way through.

NATO had changed its fundamental description of the battlespace from a world in which it needed to think about land, sea and air into one which also included space and cyberspace, which Deverell says was a profound change. GCHQ and the UK Ministry of Defence formed the National Cyber Security Centre which plays an important role in the UK's growing arsenal of cyber defence and offence capabilities, and as a commander in the UK's Strategic Command (formerly Joint Forces Command), Deverell got to know Special Forces' intelligence, information systems, networks, and cyberspace capabilities, both offensive and defensive, in detail.

It led him to the conclusion that there is no 'silver bullet' for cyber and that multiple layers of defence are what is required. Having retired from the army in 2009 convinced of the need for more innovation in cyber and defence, Deverell went on to invest in and advise several innovative start-ups in the AI and cybersecurity spheres, which resulted in him becoming a strategic advisor for defence to Goldilock, a British cybersecurity company and creator of a unique physical network isolation solution "Drawbridge".

"Goldilock interested me," he explains, "because they offer a new, very secure layer that we haven't had before. Whilst there are implications of physically disconnecting networks, you can reduce the [cybersecurity] risk to zero. When the network is disconnected, other bad things may happen, and you must think about those in the design of your systems. But you can prevent someone from coming into your network and wreaking havoc." Deverell then became interested in the people behind Goldilock and the company and how they were progressing. "I have seen a lot of start-ups in the last seven or eight years that can have the most brilliant idea, but just can't execute it," he says. "However, I felt that the team behind Goldilock could execute their great idea."

In November, Goldilock was selected as one of 30 participants out of 1,300 applicants accepted into the NATO DIANA accelerator programme, which collaborates with prominent researchers and entrepreneurs across the military alliance, empowering them to develop technologies that safeguard citizens of NATO countries.

Amidst a rapidly evolving threat landscape fuelled by state-aligned actors, AI concerns, and the ongoing Ukrainian and Middle Eastern conflicts, the programme offers an intensive curriculum and 'boot camp' that integrates the NATO innovation network and strategic business partners from the commercial and defence markets.

Goldilock was selected for the DIANA programme because of its innovative physical disconnection solution to cybersecurity, which challenges the notion that IT networks and systems need to be constantly connected to the internet. Inspired by the concept of 'cold' storage, which is well-known in the cryptocurrency world as it refers to crypto wallets that are not connected to the internet, Goldilock CEO and founder Tony Hasek, who served in the Canadian military, started experimenting with the idea of something that can be alive [connected]

and dead [not connected] at the same time. "Something that you could be confident was secure but at the same time very accessible," he explains.

It led Hasek down all sorts of rabbit holes, but he says he ended up inventing something simple and with a much broader use case. "The problem with the internet is the internet itself," he explains. "All the protocols and everything that we use to secure things on the internet are controlled over the internet. That means security controls are vulnerable, which goes all the way down to the kernels of the software that people use."

But if you physically disconnect something from the internet, Hasek says it comes back to that cold storage paradox that it's useless because it's not connected. So, you need to find a way to physically connect and disconnect quickly and to do that without using the internet.

Goldilock ended up creating security which operates at layer one, says Hasek, which was something that people didn't usually like to deal with because it is cumbersome and very difficult to manipulate. "So, what we've done is made that very fast, more responsive and given people another arrow in the quiver."

> *What consequences emerge if your network is penetrated? What happens if you disconnect your network? And how do you disconnect it? You don't have to have it permanently connected or permanently disconnected. These are choices you can now make.*

Goldilock's hardware/software solution enables users to issue an authenticated remote non-IP command to instantly and physically isolate and ringfence systems within seconds, from and to anywhere without using the internet. Disconnection from the internet is triggered port by port, so it can be controlled at a granular level — right down to the network segment or endpoint. "Your network is still running' says Hasek, "it's just disconnected from other networks. So, you can still do the things you need to do but you don't have to worry about the external threat."

Goldilock's technology is already being used by crypto custodians that store and secure cryptographic keys for cryptocurrency users or investors. He says Ukraine military's cyber command was among its first customers. The technology is also used in the energy infrastructure space with a major UK oil and gas firm being a recent adopter. Small-to-medium-sized companies also see it as a method of "hyper-securing" backups.

In principle everything, including highly classified defence networks, can benefit from the ability to physically connect and disconnect a network at speed, says Deverell. But he says it requires defence and other industries to think differently about their networks and the risks they face. "What consequences emerge if your network is penetrated? What happens if you disconnect your network? And how do you disconnect it? You don't have to have it permanently connected or permanently disconnected. These are choices you can now make."


Sir Chris Deverell


Tony Hasek

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Goldilock rack unit (*Photo courtesy of Goldilock*)

At the time of our interview in mid-December, there was a massive cyberattack on Ukraine's largest mobile network operator, Kyivstar, which blocked access to the internet and mobile communications. Unfortunately, their remedy to it, says Hasek, was to physically disconnect large portions of the infrastructure. "We spoke to them [Ukraine] several months ago and they were like, 'Well, we don't know if we need this [Goldilock]. That's not to slam dunk on them, but it's indicative of a whole change in mentality and thought."

The procurement of systems like Goldilock must be done carefully, adds Deverell. "Unfortunately, cyber is still treated as IT and not warfare purchasing, which is the only way to accelerate things. You need to take out the risk but still allow the military to innovate, test and do things quickly," he says.

One of the biggest advantages for Goldilock of being accepted into the NATO DIANA accelerator programme, says Deverell, is that it will give them access to customers that would otherwise be hard to secure, as well as an understanding of NATO requirements. "It's not necessarily NATO that will procure stuff," he explains, "but the knowledge will be shared between NATO countries."

Physically connecting and disconnecting systems or devices from IP networks seems like an obvious solution to prevent them from being attacked, so why has it taken so long for someone to develop a solution? "The first key thing is the physical disconnection," explains Hasek. "There are many ways of disconnecting networks that are software controlled, and they're not real but virtual. So, you're telling a piece of software to ignore this traffic or that traffic, but that can be compromised because it's software. And so that's the first part of this. And the second part is how do you do it without using the internet? Because if the internet itself is the attack vector, and it's compromised, you need to go around it."

Hasek jokes that it took two years of bad golfing by himself, to figure it out. In the end, the technology Goldilock uses is relatively straightforward. The hardware looks like a router, which contains two sections. One section is the non-IP connected controller, while the other contains actual physical relays that when electrically triggered from the control portion a smart cable breaks and heals itself.

The development of solutions like Goldilock comes at a time when security, instead of being bolted on as an afterthought to hardware, software or IT solutions, is designed into applications. But does that negate the need for a solution like Goldilock? Deverell doesn't think so. Despite security increasingly being a feature in many new systems, he says they still have this underlying vulnerability. "It is also incredibly hard especially if you look at the Internet of Things and industrial control systems to change these things. You've got a requirement to continue to always deliver a service. So, we're still going to be seeing 1980s technology inside some of our most critical systems in 20- or 30-years' time because swapping them out is so difficult." ■

A STEEP LEARNING CURVE FOR THE MILITARY

5G could radically transform ship-to-shore, military logistics and battlefield communications. But with much of its development being spearheaded by the civilian telecoms sector, defence needs to better articulate its needs if the technology is to truly deliver for them.

By Anita Hawser

5G was meant to revolutionise telecommunications. Greater bandwidth, lower latency and the ability to more easily share video and other forms of data from multiple sensors and devices are just some of the many-touted benefits of the fifth-generation cellular wireless standard.

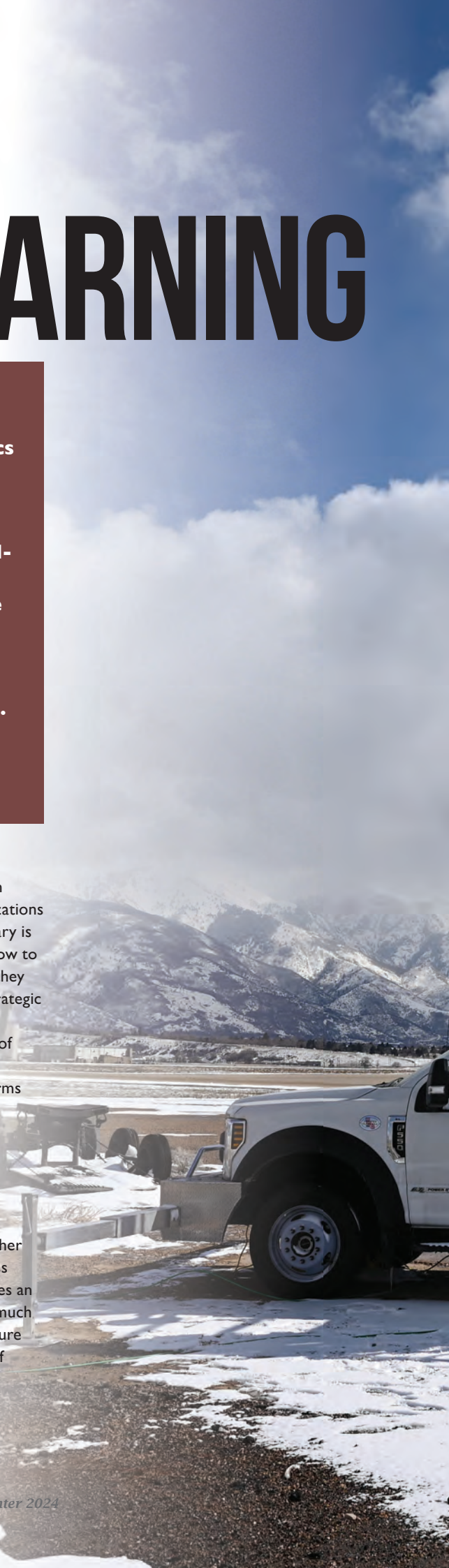
However, the reality hasn't quite lived up to expectations. This is due to several factors, say experts. Firstly, 5G — or offerings purporting to be 5G — have been rolled out on existing 4G towers which don't fully support the speeds or full spectrum band to deliver on 5G's real promise.

The complete transformation of the underlying telecommunications architecture that 5G promised hasn't been fully realised yet as the infrastructure required is expensive which has dampened telco providers' enthusiasm for the heavy investment needed. "The infrastructure changes needed for 5G are the biggest hurdle," says Gregg Melanson, former executive Vice President and Chief Growth Officer at Illuminate, which provides communications and data surveillance technologies to government and military customers around the world.

But these hurdles haven't stopped the military from experimenting with 5G-enabled networks and communications on and off the battlefield. "The military is really at the forefront of exploring how to deploy 5G to its advantage because they realise it gives them a tactical and strategic edge if they can master it," observes Stefan Pracht, senior Vice President of product marketing at Axellio, which provides network intelligence platforms for the Department of Defense and intelligence communities.

5G'S MULTI-LAYER ENCRYPTION IS MORE SECURE

5G is often thought of as just another evolution of 3G and 4G mobile access technology, but Pracht says it provides an end-to-end network that delivers a much faster, lower latency, and a more secure network for a much higher density of



A 5G mobile test station sits on the flight line at Hill Air Force Base, Utah, Feb. 25, 2022
(US Air Force photo by R. Nial Bradshaw)

end devices, even embracing the needs of applications hosted in the cloud. 5G can also work across a wide spectrum from below 1GHz to 300 GHz. "With this, you can build vast broadcast networks that cover a wide area while you can also create extreme short-range networks, which are important on the battlefield because they don't leave much of a footprint that adversaries can monitor," Pracht explains. Another aspect is about making networks more secure. "When you think about how other wireless technologies have been compromised, 5G provides more advanced and multi-layer encryption. It has the most secure end-to-end encryption that's available on the market, which so far is unbreakable. On top of that, you can layer additional end-to-end encryption on top of those connections as well."

5G also incorporates technology for reliably accessing applications in the cloud, unlike previous wireless mobile technologies that narrowly focused on wireless connectivity. One of the challenges the military has when they're on the battlefield in the middle of a desert, says Pracht, is they may not have the network connectivity that they're used to. "And when you need to calculate, let's say massive amounts of weather data, and you don't have the connectivity to shuttle that back to a supercomputer in the United States, you want computing power at the edge. 5G is so much more than just wireless network connectivity, creating really an end-to-end delivery platform that considers different end devices and use models including edge computing."

Illuminate, which provides communications and data surveillance technologies to government and military organisations around the world, says it is talking with military base officials in the US about setting up private 5G networks, primarily for the secure transfer of data. Some of these bases are still using old 2G and 3G networks, which are not secure and extremely slow.

5G allows for the quick and efficient sharing of data across networks in multiple different locations. "In a contested battlespace making that successful connection is tantamount to success," says Melanson. "It enables more things including the sharing of information that can help soldiers achieve success and give them situational awareness at greater speed and scale."

US Marine Corps Lance Cpl. Jesse Rushing, a transmission systems operator with Headquarters Battalion, Marine Air Ground Task Force Training Command, Marine Corps Air Ground Combat Center (MCAGCC) installs a 5G antenna for a 5G network demonstration. *(US Marine Corps photo by Pfc. Ryan Kennelly)*

SHIP-TO-SHORE 5G

Using a 5G mesh network supports different devices and sensors which could give soldiers a better understanding of what's going on inside the battlespace, says Melanson. And because of its lower latency, soldiers can receive information in as good as real-time. Although the military is still experimenting with 5G, he points to several promising projects, including "smart warehouse" applications for the Department of Defense's Naval Base Coronado in San Diego.

The US Department of Defense (DOD) selected AT&T as the primary 5G networking services provider for two of four US military test sites where it is testing 5G capabilities. AT&T says its 5G spectrum and private 5G Core and Radio Access Network (RAN) demonstrated data throughput speeds greater than four gigabits per second with less than 10 milliseconds of latency.

According to AT&T, delivering 5G across the 120,000 square foot Naval Base Coronado warehouse will securely connect smart warehouse application infrastructure to provide high-speed, low latency 5G connectivity for autonomous mobile robots, video cameras, Internet of Things (IoT), and AR/VR systems that will enable inventory tracking.

The tests at Coronado Naval Base support the development of a 5G-enabled Smart Warehouse focused on transhipment between shore facilities and naval units, to increase the efficiency and fidelity of naval logistic operations, including identification, recording, organisation, storage, retrieval, and transportation of materiel and supplies. Additionally, the project will create a proving ground for testing, refining, and validating emerging 5G-enabled technologies.

The US Army is also experimenting with 5G for secure connectivity on training devices, specifically the Instrumentable Multiple Integrated Laser Engagement System (I-MILES) and the Army's Integrated Visual Augmentation System (IVAS).

Communications in contested environments are also a promising use case. In 2021, Lockheed Martin was awarded a contract by the Under Secretary of Defense for Research and Engineering's (OUSD R&E) FutureG & 5G Office and the USMC to deliver the final Phase 1 Initial Prototype 5G testbed variant for the Open Systems Interoperable and Reconfigurable Infrastructure Solution (OSIRIS) to the Marine Corps programme management team at USMC Base Camp Pendleton, California.

> *Mobile carriers have developed, integrated and operated mobile wireless technologies for decades, which is new to the military. So that's where we're up against a pretty steep learning curve that requires mobile carriers, vendors, and the military, to work closely together.*

OSIRIS is a 5G communications network infrastructure testbed for expeditionary operations. Specific mission applications (a trailer-mounted 5G Nomadic Tower, ATV Mounted 5G Relay and deployable 5G operations facility) will be integrated on the testbed for experimentation. The objective is to increase bandwidth while also maximising virtualisation of shared resources like radios to provide increased bandwidth for Marines operating in contested environments.

Across the pond, in the EU, Ministry of Defence representatives from France, Germany, Hungary, Italy, Latvia, Spain, and Sweden recently met for their first workshop with the 5G Communications for Peacekeeping and Defence (5G COMPAD) project to discuss and agree on 5G use cases and the operational use of 5G military communication systems in the land, naval, and air domains. The participants also addressed associated system requirements and expected benefits and challenges of the 5G COMPAD project.

5G COMPAD, which includes partners from European telecom and defence industries, aims to reduce hurdles faced by European armed forces, which currently rely on expensive, hardware-locked communication systems with limited data rates and interoperability. The project, which is funded by the European Defence Fund, will provide a reference architecture for a 5G-based communications system for Forward Operating Bases, and deployed and homeland quarters that is compatible with existing systems and platforms. Validation is expected in 2025.

RISK BENEFIT TRADE-OFFS

Meanwhile, UK defence is taking more of a measured approach to 5G. "The technologies that underpin 5G, which are delivering significant advances in civil telecommunications, will form part of our future military systems whether badged '5G' or not," says Richard Leigh, Communications and Networks Research Programme Manager at Dstl. Leigh says it is essential that defence understands these technical developments and benefits from the billions of pounds in research, development and infrastructure deployment in the civil sector. However, 5G covers a huge spectrum of possibilities, he adds, each with a complex set of risk-benefit trade-offs.

"The business drivers behind the development of 5G are geared towards capacity and availability, not towards

US Air Force Tech. Sgt. Ron Richards, 86th Communications Squadron non-commissioned officer in charge of cable operations, stands by a recently activated 5G cell tower at Ramstein Air Base, Germany. (*US Air Force photo by Airman Jared Lovett*)

military use," he explains, adding that the defence opportunities of 5G need to be carefully weighed against the challenges associated with these applications, especially in circumstances such as a contested environment in the presence of a capable adversary.

Dstl is assessing the applicability of 5G across a variety of defence use cases, says Leigh, and is working with customers and industry partners to fully explore the potential of 5G capabilities and its vulnerabilities before adoption into service. Despite 5G's considerable benefits, Pracht of Axellio says the 3rd Generation Partnership Project, which defined what 5G is, is geared more towards mobile carriers than the military and their unique use models, especially on the battlefield in adverse conditions. "That makes it fairly complicated for defence vendors to implement," he explains, "because the standards aren't as detailed in these areas as we need for all those specialised applications, which can lead to compartmentalised stovepipe solutions, which can be very limiting for military applications."

A drone system on its own may work great on 5G, but if you then try to operate it simultaneously with other sensor networks you may run into interoperability issues, says Pracht. "That is where the military has a role to play in guiding the industry to build interoperable solutions that address the unique needs and applications the military require. " While enhanced 5G end-to-end encryption makes the data safe, it also makes it difficult to monitor, he adds. "When you think about firewalls and intrusion detection systems, they're all looking into the packet to inspect for potential threats or misuse. But now, with more sophisticated encryption, you lose this vital visibility, making your environment more vulnerable for adversaries to breach."

Then when you start to think about connecting different devices from vendors using 5G, that too will be challenging for the military, explains Pracht. "These vendors may be experts in building drones, but they're not experts in building a reliable communication channel to the drone to control what it does and to feed down the sensory data that the drone is collecting. So, by interconnecting these different devices through a single network, you introduce vulnerabilities and weaknesses into that delivery chain."

If 5G is to develop in ways that are useful to the military, Pracht says they need to drive its development, not industry. "The military need to step up and bring the industry with them to say, 'This is what we need,' and not just rely on industry to say, 'We can build all of that.'" While there are plenty of ongoing 5G trials, Pracht says they're occurring in pockets. "You run the danger of building the perfect solution for that pocket whether it's ship-to-shore 5G or battlefield drone 5G. But then when you want to roll it out in a conflict working with your allies, how is that working together?"

He says it is not about building the perfect drone or wearable sensor network, but a universal joint forces network that cuts across the US military and all its allies. "The industry has built the individual technology components and standards that are necessary to build such a system," says Pracht. "Now, how do you take all of that and build a military wide, globally interoperable network? That requires someone who has not just commercial interests, but more operational and deployment defence experience."

5G has fundamentally changed the playing field, not just by defining a new wireless access technology, but thinking through how you deliver applications from many end devices in various environments, all the way to the application itself, reliably at speed, and securely. "Mobile carriers have developed, integrated and operated mobile wireless technologies for decades, which is new to the military. So that's where we're up against a pretty steep learning curve that requires mobile carriers, vendors, and the military, to work closely together to take advantage of this tactical and strategic edge 5G can provide." ■

THE MOST SOPHISTICATED TRACKING SECURITY FOR GLOBAL SUPPLY CHAINS

Zenatek

In military supply chains, tracking regulations and security fall under the control of military logistic departments and authorities.

One might assume that these authorities provide cargo monitoring at its best. Unfortunately, there is evidence to suggest that this assumption is not warranted. There are military deployments in which tens of thousands of containers or pallets per year remain unaccounted for, without a proper e-tracking system. Such waste or misplacement of costly resources is bad enough, especially if the resources represent depreciating or perishable assets. Much more importantly, the troops involved may suffer the consequences of improper tracking and may not be as well protected or as well fed as they should be.

Improperly tracked or missing containers hold not only food items and supplies necessary to sustain troops and keep them healthy, but also equipment and material, including vehicles, air conditioners, earth-moving equipment, and more.

It is not unusual for key shipments to arrive late, or to miss transshipment. They may even be untraceable in ports and countries suffering critical logistics issues themselves. Moreover, some transporters have been known to hide their problems, keeping missing containers in certain port yards or other "off-the-grid" facilities. Such transporters are not always happy that clients may want to monitor and analyse the whole transport process to ensure their money has been well spent. There is also the problem of frequent overcharging of demurrage fees to clients.

POSITIONING ENHANCEMENT INTELLIGENCE FOR DEVICES USING ON EDGE NEURAL NETWORK

The new ZTD device uses standards (OPC UA) and devices (IoT Tracker) to the ASSIST-IoT architecture along with an innovative edge enabler that fuses IMU and GNSS data coupled with artificial neural networks, optionally chip-based, to improve monitoring of port equipment and containers.

Tracking of goods equipment from Europe to Russia

The upcoming device release is based on next-generation satellite technologies (SatNav, SatCom, SatEO), used with the latest data intelligence and certification technologies (Edge AI, IoT and DLT) to offer Remote Container Monitoring (Monitoring-As-A-Service) services, increasing the security and reliability of the entire supply chain.

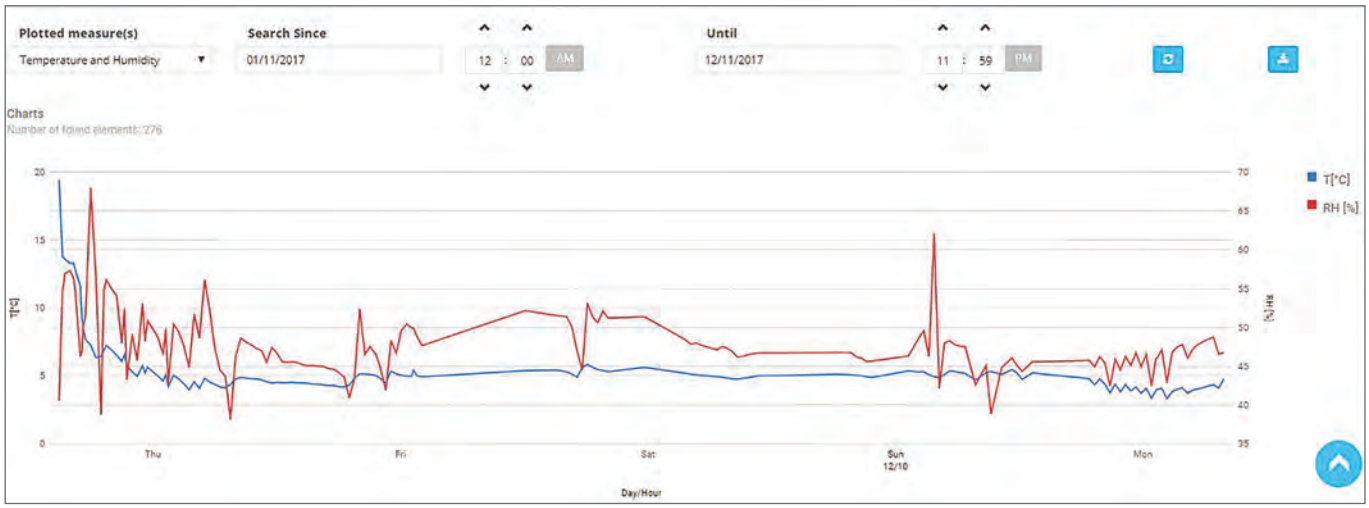


Chart of temperature and humidity related to a transport of ammunition

With modern, technologically advanced real-time monitoring provided by Zenatek Tracking Service (ZTS), these problems can be eliminated quickly and efficiently. Our service is very reasonable and cost-effective, and we have a proven track record of excellence in the field. Today, we track goods globally and have recently expanded our service, extending it to a much broader range of goods without sacrificing the discretion our clients' demand.

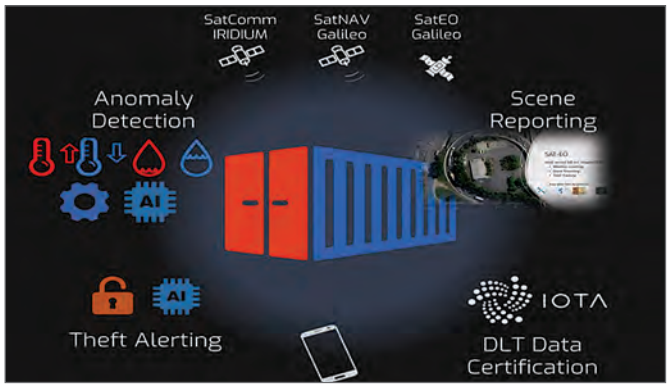
ZTS was designed to maintain strict cost control. Our primary aim was to develop a rock-solid goods tracking system that would remain affordable while meeting the needs of our service's end users. We have created a system that is intentionally simple and stable, based on user-friendly web-based software. For practical purposes, it is not necessary to verify the location or positioning of the goods every 30 minutes. Nor is it necessary to implement overstated monitoring requirements that increase battery costs and may lead to the hardware device being returned to the sender. However, it is critically important to have the capacity to determine and trace all shipments' routes, and to receive immediate alert notices when something unexpected or unpleasant happens to a shipment. These alerts are sent by Zenatek's web-based system via e-mail to any computer, smartphone or other device assigned by the client.

To provide an accurate geographical position for a monitored shipment at any point, the ZTS tracking device may use its internal GPS, which is compatible with the GPS/Glonass standard and is also Galileo-ready. Alternatively, it can leverage information from mobile network cellular towers. The user can remotely configure all of the system's communication parameters, even after a shipment has departed the loading point.

ZTS can also store a container's packing list, password-protected, in the web-based application, together with bill-of-lading documents and health certificates, thereby enabling the receiver to trace the shipment's contents and route with a mere finger-click on a tablet. The ZTS device will also trigger alarms when a reefer container's internal temperature and humidity deviates from a predetermined level set by the client.

It then alerts the user when the temperature and humidity return to the required level. Additionally, it will alert the user if flammable goods within a container are approaching the point of ignition, or if a container's doors or a pallet's seals are subjected to tampering. It will similarly alert the user if a container or pallet is turned on its side, capsized or involved in a destructive incident.

The ZTS device has a geo-fencing capability. This means that if a trailer or container is placed in a new location or moved to another part of the current port, the device will wake up and alert the user. The device also provides geo-coded proof-of-delivery information to the client, who can then rest secure in the knowledge that the shipment has reached its



destination, and that there has been no unauthorised opening of a container's doors or tampering with a pallet. The device conforms to international regulations, including FCC and EU standards, not to mention that it is also HERO-compliant.

Other currently available tracking technologies do not fare well in performance comparisons with ZTS, and some of those products can be very expensive. Some operate based on monthly fees, or payments per communication received by the client, or both. Zenatek, on the other hand, designed and manufactured ZTS with affordability in mind. ZTS devices need not be retrieved at destination points because all traced route and shipment information is in the system and has already been transmitted — the devices may be used on a "one-way" basis. This eliminates all costs associated with unit and data recovery tasks, such as recovery personnel costs, and unit forwarding, reconfiguring, and restocking. These aspects of ZTS in particular make it ideal for military logistics applications.

Pallets may be transported and tracked in containers; they may be transferred to train or truck, and then reloaded into containers based on any intermodal chain. ZTS will track accurately and provide status reports throughout, monitoring for any damage, tampering, interference, or deviations.

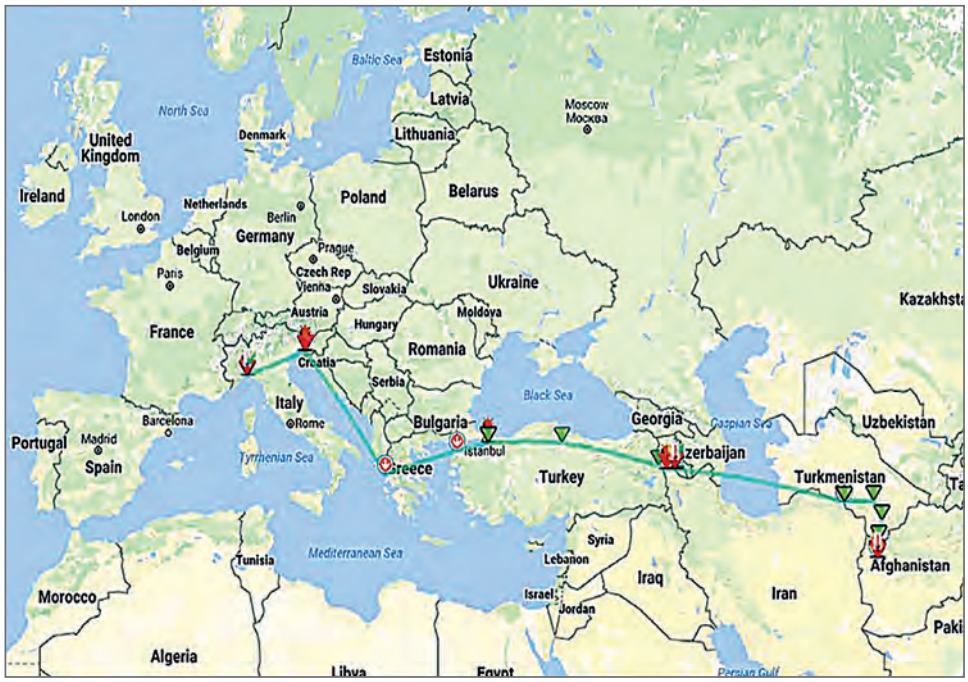
Real-time status updates and event alerts allow users to respond quickly to changes and emergencies. ZTS affords users the possibility of prompt, effective damage control, even to the extent of rerouting an entire shipment if necessary. The benefits are obvious, particularly concerning time-sensitive or temperature-sensitive shipments.

Users can also elect to provide receivers with access to ZTS web-based applications so that they are equally informed as to a shipment's status and current location. Clients can predetermine the range of the information to be made available; they may change access to and frequency of status updates for any or all of the available information. All data is contained within an encrypted data stream for full security, maximum confidentiality, and protection.

Today, one of the mostly frequently used tracking technologies is RFID (Radio Frequency Identification). Unfortunately, RFID technology depends on the acquisition of a costly infrastructure of porticos and hardware at fixed sites, or unreliable hand-held transceivers that need constant maintenance. An RFID device could, at least theoretically, be manipulated to form part of a weapon (for instance, as a triggering device) designed to attack a specific shipment.

ZTS leaves RFID technology and its associated problems and expenses behind. With ZTS, clients now have access to a one-price solution that includes all costs associated with the technologies and services provided.

We live in a world that seems increasingly insecure, and some would resort to violence in their attempts to disrupt international civil and military supply chains. The threat of terror attacks targeting global logistics through vulnerable transport systems can never be eliminated, but it can certainly be reduced. The continuing use of unchecked and unmonitored containers, pallets, trailers, and rail cars, when viewed in combination with current business practices in many congested ports, represents a hidden but very real danger. With Zenatek service these potential threats can be seriously reduced. ■



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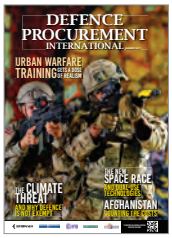

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