

European Security & Defence

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COUNTRY FOCUS:
ITALY



Dutch Defence Industry

- Royal Saudi Air Force
- Advances in Naval Mine Warfare
- Battlefield Lasers
- High-End Thermal Imaging
- Internet of Military Things
- CBRN Reconnaissance



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Winter is Coming



On 1 July 1944, the United States convened a conference at a ski resort hotel in Bretton Woods, New Hampshire. Delegates of 44 allied nations were there to discuss the post-war global order with America, then the world's military, financial and economic superpower. The American proposal was simple. Instead of absorbing the European and Axis empires and establishing Pax Americana, the Washington delegation proposed three things: free access to the American market, protection of shipping lanes, and security from the Soviets, including a nuclear umbrella. In return, the 44 nations would allow America to fight the Cold War in any manner it chose. Exchanging their national security policies for those three gifts was a no-brainer, and globalization was born.

In the following years, organisations administering the new world order grew in number, size and power. They now include NATO, the UN, the World Trade Organisation (WTO), the World Bank, the International Monetary Fund, the G7, and others. In 72 years, these organisations changed the 44 Bretton Woods members from needy supplicants to powerful competitors. The problem is, they continue to draw on the economic concessions and largesse of the country that founded the system – the United States. Then the disruptor of globalisation entered the White House in 2016.

Trump's election astonished globalist bureaucrats and Deep State careerists in Washington. Together with the Democrat Party and the mainstream media, they spent the next four years vilifying the president and preparing for the 2020 election. Trump spent those years expanding the economy, reducing taxes, increasing jobs, and ending U.S. dependence on foreign oil. He also earned the eternal enmity of the Bretton Woods globalists by leaving or replacing multilateral alliances like NAFTA and the Trans Pacific Partnership, by insisting on tariffs favouring the US despite WTO complaints, and by confronting NATO allies with demands they pay the agreed-upon amounts for their defence.

Resistance to Trump reached a peak when the Democrat Party, mainstream media, social media, and some senior US bureaucrats stole the 2020 election by combining fraudulent mail-in ballots, rigged ballot counting machines, and brazen fraud at polling places. There are too many videos and sworn affidavits to doubt that during a pause in ballot counting in several key states, millions of ballots appeared and radically changed the contest. If one needs details, there are the studies by Dr. Peter K. Navarro.

Having captured the White House and Congress by exploiting the flaws inherent in a mail-in voting system, the Democrats decided to make the system permanent. Just days after Biden's inauguration, an 800-page bill appeared in the Democrat Congress. Among many other things, HR-1 will:

- Require that all states implement universal voter registration. Voters will not be required to register in person, but can be registered from databases, whether or not they are illegal aliens or felons.
- Bar states from passing any laws about mail-in voting.
- Require that voters without an ID be allowed to vote if they simply sign a statement saying they are who they say they are.
- Create a new Federal Election Commission of five members appointed by the president. The president's party would get three of five seats and be able to make changes to electoral rules at any time.

In reaction to such alarming legislation, suppression of freedom of speech, calls from Democrats to confiscate firearms and to send "Trumpists" to re-education camps, it is no surprise that Texas state legislator Kyle Biedermann introduced a bill to allow Texans to vote on secession from the United States. It is too early to know if other states will join Texas, but as characters in the TV series *Game of Thrones* said when danger approached, "winter is coming," American conservatives now know that grave internal dangers are on their nation's horizon. The chill of that winter will reach Europe.

Chet Nagle

Photo: Kalashnikov



Optical scopes constitute the state-of-the-art in gunsights.

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Photo: ODU



Military connectors have to withstand harsh environmental conditions.

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1:1 scale

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DNV GL Changes Name



Image: DNV GL

(jr) Assurance and risk management company DNV GL will change its name to DNV on 1 March 2021. The move comes

after a comprehensive review of the company's strategy as it positions itself for an environment in which many of DNV's markets are undergoing fundamental change. The present name has been in place since the 2013 following the merger between Det Norske Veritas (DNV) and Germanischer Lloyd (GL). The name simplification is a natural consequence of a successfully completed merger and of having operated as a fully integrated company for several years now.

EDGE Group Becomes Strategic Partner for IDEX & NAVDEX



Logotype: ADNEC

(jr) The International Defence Exhibition and Conference (IDEX 2021) and the Naval Defence Exhibition (NAVDEX 2021) have signed an agreement with

Abu Dhabi based advanced technology conglomerate EDGE Group to become the exhibitions' strategic partner. The agreement comes in line with IDEX's ongoing strategy to develop collaborative opportunities with leading Emirati companies specialising in defence and technology.

IDEX 2021 and NAVDEX 2021 are organised by the Abu Dhabi National Exhibitions Company (ADNEC) in cooperation with the Ministry of Defence and the General Command of the UAE Armed Forces. They will be held under the patronage of His Highness Sheikh Khalifa bin Zayed Al Nahyan, President of the UAE, from 21 – 25 February 2021 at the Abu Dhabi National Exhibition Centre. The events showcase the latest developments in the defence sector with both highlighting the latest in military technology, helping develop the national security sector.

Hensoldt Reorganises Sales



Logo: Hensoldt

(jr) Hensoldt AG is reorganising its sales organisation with Stefan Hess,

Head of Public Affairs, now also responsible for the Governmental Business Development for Germany, France and the UK as well as

with the EU and NATO. Russell Gould, Managing Director of HENSOLDT UK, is taking over responsibility for the international Business Development to further strengthen Hensoldt's business in global growth markets. Both will become members of the Group Executive Committee and succeed Sabine Hipp, Head of Sales & Marketing, who is taking early-retirement after more than 35 years with the company. She will continue to serve the Executive Board as a Special Advisor until the end of March 2021.

The sales organisation will be divided into two segments: Governmental Business Development and International Business Development. Hensoldt is therefore taking account of its global presence and increasingly international strategic orientation. With a stronger focus on the national and international markets, the company is moving even closer to its customers and can serve them even more individually.

Stefan Hess has been working for Hensoldt since 2016 and has built up the Public Affairs department. He has many years of experience in industrial policy, customer needs and major programmes and in addition has an excellent network throughout the German and European defence industry.

Russell Gould has led the UK operations of Hensoldt and its predecessor companies for more than 13 years. He has been involved in the strategic development of international business for more than 35 years. In addition to leading the International Business Development, he will continue to serve as the Managing Director for Hensoldt UK.

Elettronica Overhauls Management Structure



Photo: Elettronica

(jr) Elettronica has adopted a new organisational model to support the further growth of its products, processes and markets.

The Board of Directors, led by the Chairman and CEO Enzo Benigni (pictured) and by the Vice Chairman Roberto Turco, has appointed Domitilla Benigni as co-CEO alongside Mr Benigni. Mrs Benigni, will also continue to hold the role of COO while holding specific powers to ensure a greater focus on long-term strategic choices, innovation, sustainability and profitability.

With a view to improving communication with Italian and international institutions, the Governmental and Institutional Relation

Unit has been established under the management of Lorenzo Benigni in his capacity as Senior Vice President Governmental and Institutional Relation.

The company's operating management will be consolidated and reinforced by creating three new operating units reporting directly to the CEO and COO:

- The Engineering & Operations Unit, supervising the coordination and integration of all the company's operating areas, will be headed by Simone Astiaso.
- The Strategy, Innovation & Transformation Unit will build the company's medium and long term strategic corporate and product sustainability and will be headed by Gianni Maratta.
- "Future Business: Tempest, EFA, EVO and Public Financing" will coordinate activities aimed at achieving the aims of the main consortium programmes and of the Italian and international funds. This unit will be managed by Alberto De Arcangelis.

Moreover, the Planning and Risk Management Unit, headed by Ermanno Petricca in the capacity as Chief Risk Officer, has been created to supervise the risk management process and the Digital Proposal Configuration system.

Teledyne to Acquire FLIR Systems

(jr) Teledyne Technologies Incorporated and FLIR Systems, Inc. have entered into a definitive agreement under which Teledyne will acquire FLIR in a cash and stock transaction valued at approximately US\$8Bn.

Under the terms of the agreement, FLIR stockholders will receive US\$28.00 in cash and 0.0718 shares of Teledyne common stock for each FLIR share, which implies a total purchase price of US\$56.00 per FLIR share based on Teledyne's five day volume weighted average price as of 31 December 2020. The transaction reflects a 40 per cent premium for FLIR stockholders based on FLIR's 30-day volume weighted average price as of 31 December 2020.

As part of the transaction, Teledyne has arranged a US\$4.5Bn 364-day credit commitment to fund the transaction and refinance certain existing debt. Teledyne expects to fund the transaction with permanent financing prior to closing. Net leverage at closing is expected to be approximately 4.0x adjusted pro forma EBITDA with leverage declining to less than 3.0x by the end of 2022.

Teledyne expects the acquisition to be immediately accretive to earnings, excluding transaction costs and intangible asset amortisation, and accretive to GAAP earnings in the first full calendar year following the acquisition.

■ Fourth Country Selects ASCOD

(jr) A fourth country has selected the ASCOD tracked armoured vehicle to meet its requirements. This comes after manufacturer General Dynamics European Land Systems (GDELS) has received a contract from Elbit Systems. The vehicles will be fitted with the latest 105mm large-calibre turret and delivered to an Asian-Pacific customer over a period of three years. According to the website defence-blog.com, the customer is the Philippine Army and the contract is valued US\$196M. With its modular design and open system architecture, the ASCOD can be outfitted easily for multiple roles, including as a Light Tank (LT) or Medium Main Battle Tank (MMBT) and equipped with large-calibre cannons up to 120mm. Three other nations – Austria, Spain and the UK – have selected the ASCOD as their preferred tracked armoured vehicle platform. The vehicles for the fourth customer will be branded with the name SABRAH.



Photo: GDELS

According to Dr. Thomas Kauffmann, Vice President of International Business and Services for GDELS, this decision indicates a clear trend in the armoured vehicle segment to medium weight (\leq MLC 50) and multi-role platforms, which provide modern armies with commonality, interoperability, flexibility, as well as advanced military mobility, while significantly reducing logistic complexity and cost of ownership. With this contract, the number of ASCOD vehicles in service or under contract reach 1,000 units.

■ Encrypted Communications for E-99M

(gwh) Encrypted communications for the five Embraer E-99M surveillance aircraft operated by the Brazilian Air Force (Força Aérea Brasileira, FAB) will be supplied in the form of SOVERON radios from Rohde & Schwarz. The E-99Ms will be used for detection, tracking, identification of flying objects and air traffic control. They com-

plement ground radar signals and improve situational awareness. The information obtained is transmitted to ground stations or other aircraft using secure software-defined radios and waveforms from the SOVERON family.



Photo: Rohde & Schwarz

The FAB has operated the E-99M since 2002. The main sensor is the ERIEYE-ER radar with Saab's AESA technology, a system which also characterises its external appearance. Additionally, the mission systems, sensors and electronic countermeasures are being renewed and supplemented. Six mission planning systems and operator stations have also been ordered to train the crews of the aircraft. The first modernised aircraft was recently handed over to the FAB.

■ Netherlands Orders Avon Protection FM50

(jr) Avon Protection have received an order from the Netherlands for FM50 masks and FM61EU filters under a NATO Support & Procurement Agency (NSPA) contract. The country joins Norway, Belgium and



Photo: Avon Protection

Finland in purchasing the FM50 to protect their militaries. Developed in conjunction with the United States' Department of Defense to counter the multiple CBRN threats met in modern war fighting, anti-terrorist and peace-keeping operations, the FM50, according to the company, is the most operationally proven and widely deployed battlefield respirator in the world.

■ France to Receive First SERVAL VBMRs from 2022

(gwh) The French land forces will receive a total of 689 SERVAL light armoured multi-role vehicles (Véhicule Blindé Multi-Rôles, VBMR) under the SCORPION programme, with the production of 364 examples under contract. According to the production schedule for 2022, the first twelve production vehicles are to be delivered in the first half of that year and a further 96 in the second half.

The production consortium of Nexter and Texelis has already delivered ten prototypes which are currently undergoing qualification tests. This process is so far advanced that series production could already be initiated.

The 4x4 SERVAL VBMR is a light version (in the 15 tonne weight class) of the TITUS 6x6 with three versions planned: Patrol, Reconnaissance and Communication. Systems common with the other SCORPION vehicles (GRIFFON, JAGUAR and LECLERC) for optimal integration with the SCORPION system network include:



Photo: Nexter

- Electronic core
- SCORPION combat information system
- Threat sensors
- Remote weapon station.

The SERVAL is designed for use in combat zones in the middle segment of land forces, mixing flexibility, strategic mobility and payload transport capacity, complementing the capabilities of the other SCORPION vehicles. Another variant of the SERVAL is being developed as a motorised protection solution according to the requirements of the Gendarmerie for operations in mainland France and overseas.

■ GA-ASI Demonstrates BLOS Command & Control with MQ-9

(jr) General Atomics Aeronautical Systems, Inc. (GA-ASI) has completed the first Beyond Line of Sight (BLOS) High Frequency (HF) Command and Control (C2) demonstration for an Unmanned Aircraft System (UAS). The HF C2 capability does not require a Sat-

ellite Communications (SATCOM) link and is capable of providing BLOS connectivity up to 8,000 miles, depending on transmit power and link geometry.

Photo: GA-ASI



For the demo, GA-ASI integrated the US Government's Collaborative Operations in Denied Environment (CODE) autonomy software into the Open Operational Flight Profile (OFP) of an MQ-9A Block 5 Remotely Piloted Aircraft (RPA) and flew the MQ-9 using improved diagonal tails with conformal HF antennas incorporated into the leading edges.

GA-ASI's MQ-9 housed a FlexRadio Systems' FLEX-6600 HF software-defined radio and associated hardware to translate and execute an autonomous mission plan. GA-ASI created a specialised HF software adapter to manage the unique latency and throughput constraints of the HF waveform to demonstrate BLOS command and control of the RPA.

The demonstration was flown out of Laguna Army Air Field/Yuma Proving Grounds on 16 December 2020. The MQ-9 was commanded from Austin, Texas approximately 1,000 miles away over an HF C2 link. This capability enables an operator to task the MQ-9 without needing SATCOM, providing a means to operate in SATCOM-denied, contested environments.

■ Hensoldt UK Launches SPEXER 600

(jr) Hensoldt UK has launched the SPEXER 600 multi-mission, X-Band ground based surveillance radar utilising the company's SharpEye solid state transceiver technology. SPEXER 600 complements the SPEXER family of Active Electronically Scanned Ar-



Photo: Hensoldt UK

ray (AESA) radars, offering a cost effective and truly crew portable field deployable solution.

Designed to meet user requirements to detect multiple threats in the modern battlefield or security environment, it offers a number of modes allowing multiple functions to be carried out by a single radar sensor. The built in tracker reduces the need for additional electronic units, making it a lightweight, crew portable unit that can be set up in a few minutes. In fixed installations the low weight allows it to be installed without any specialist masts or structures.

Controlled either locally or remotely from a command centre, SPEXER 600 can be easily networked with other sensors.

■ IAI & DRDO Test MRSAM

(jr) MRSAM, an advanced air and missile defence system that provides protection against a variety of aerial platforms, has been successfully tested.

MRSAM is used by the Indian Air Force, Indian Navy and Israeli Defence Forces. The system includes an advanced phased array radar, command and control, mobile launchers and interceptors with advanced RF Seeker.

Photo: IAI



MRSAM is jointly developed by Israel Aerospace Industries and India's Defence Research and Development Organisation (DRDO). IAI is in collaboration with Israeli and Indian firms, including:

- Rafael
- TATA
- BEL
- L&T
- BDL

The current test, conducted at the Indian test range, validated all components of the weapon system to the customer's satisfaction. Israeli specialists and Indian scientists and officers participated in and witnessed the test.

■ KNDS Continues E-MBT Development

(gwh) Krauss-Maffei Wegmann and Nexter Defense Systems (KNDS) are continuing to develop the Enhanced Main Battle Tank (E-MBT) as an offering for the transition from current MBT technology to the land combat system of the future.

Photo: KMW



Three years after the Franco-German holding company KNDS was founded, the company unveiled a MBT at the Eurosatory 2018 defence technology fair, which was composed of the hull and chassis of a LEOPARD 2 and the turret of a LECLERC. The project is considered the young company's first significant joint venture – financed with its own funds – and is a "true KNDS product", Nexter said. During in-house testing, the E-MBT had proven the concept's viability in driving and firing trials.

The ongoing joint development aims to present a prototype at Eurosatory 2022, with many components on the test bench, so the new prototype will have many significant technical differences in the LEOPARD 2 hull and LECLERC turret. The weight advantage is to be maintained.

The start of series production is targeted for 2025 which would make the E-MBT available as a transitional solution if an interim generation were necessary until the introduction of a new land combat system (MGCS) and would be an alternative for nations not interested in procuring MGCS.

■ Hellenic Air Force to Fit RAFALEs with MBDA Products

(jr) Greece has signed a contract with MBDA to provide weapons for 18 RAFALE combat aircraft intended for the Hellenic Air Force (HAF).

A signing ceremony was held in Athens in the presence of the French Minister for Armed Forces, Florence Parly, and the Greek Minister for Defence, Nikolaos Panagiotopoulos. Lieutenant General Theodoros Lagios, General Director for Defence Investments and Armaments of the Greek Ministry of Defence and Eric Béranger, CEO of MBDA, signed the contract on behalf of their respective sides.

The new aircraft's weapons will benefit from the strong commonality with those from the



Image: MBDA

MIRAGE 2000s and MIRAGE 2000-5s currently in service in the HAF. Like these, the RAFALES will be armed with:

- SCALP cruise missiles
 - AM39 EXOCET anti-ship missiles
 - MICA multi-mission air-to-air missiles
- MBDA will also supply METEOR beyond visual range air-to-air missiles.

■ Austria Awards PANDUR Contract to GDELS

(jh) The Austrian Ministry of Defence has awarded General Dynamics European Land Systems-Steyr a contract for the delivery of 30 PANDUR 6x6 Evolution (Evo) wheeled armoured vehicles. The new vehicles are configured as armoured personnel carriers (APCs) and can be quickly converted

for other applications such as CASEVAC (casualty evacuation) due to their modular design. In addition to the 34 vehicles purchased in 2016 and based at the centre of excellence at the Jägerbataillon 17 in Straß / Styria, the Austrian Armed Forces will operate a fleet of 64 new PANDUR 6x6 Evo. The vehicles will be delivered between 2022 and 2023 PANDUR vehicles have successfully served in domestic and international peacekeeping missions since 1996. The sig-



Photo: GDELS

nificantly modernised version of the PANDUR MTPzUN, the PANDUR Evo, offers an unmatched compact vehicle design with a crew of 11 soldiers, superior mobility, and a significantly increased level of protection against mines and IED threats. The vehicles will be completely manufactured in Austria,

thus benefiting the local economy and securing hundreds of skilled jobs. More than 200 suppliers, mainly SMEs, participate in the programme.

■ IAI to Attend IDEX 2021

(jr) Israel Aerospace Industries (IAI) is to attend the IDEX exhibition for the first time. Expected to be held in Abu Dhabi, United Arab Emirates from 21 February to 25 February, IAI will have its own booth with visual and interactive displays at the exhibition. The company will exhibit a wide range of systems with an emphasis on aerospace systems, civil aviation, mission aircraft and more. Throughout the exhibition IAI will focus on promoting communication and local cooperation with local government agencies, defence forces, local industries and academic initiatives in order to further expand the company's activity in the region.

Boaz Levy, IAI's President and CEO said: "Israel Aerospace Industries applauds the agreements signed by the two countries, agreements that open a window for extended co-operation, sharing of knowledge, promoting investment, development and localisation of joint technology. IAI sees our activities in the region as an opportunity to promote coop-

Marketing Report: Yugoimport SDPR J.P.



TAMNAVA 122/262 mm Multiple Launch Rocket System (MLRS)

The TAMNAVA 122/262 mm MLRS is designed as a modular system. Its modularity is reflected in the possibility of deploying launch pods armed either with 262 mm rockets or with any variant of the 122 mm calibre rocket family. The 122/262 mm MLRS is a completely automated weapon, equipped with GPS and INS, that is able to execute a predetermined mission fully autonomously.

The basic option uses disposable launch pods. The 122/262 mm MLRS is capable of receiving two spare 122 mm launch pods. The system is (un)loaded with a crane mounted just behind the armoured crew cab. An alternative is to use disposable launch tubes.

Load options include either four 122 mm launch modules, each with 24 rockets, or two modules of 122 mm and two of 262 mm, the latter with 6 rockets each. The system has been exhaustively tested at -30°C to +50°C, and has successfully engaged targets out to 40km (122 mm) and 70km (262 mm).

A typical TAMNAVA detachment includes the launcher vehicle – a KAMAZ 6560 8x8 with armoured cab – and a support / resupply vehicle that includes a standard loading / unloading crane for transferring launch pods. The KAMAZ or MAN vehicle provides protection for the crew of three as well as outstanding mobility. The system can be brought into action within two minutes, and out of action in 60 seconds, enhancing its survivability. Once in position remote operation is also possible.

Weighing up to 38,000 kg., the system is transportable by rail, road, sea and air, and can self-deploy over strategic distances as well. A high degree of tactical mobility is ensured by the vehicle, with added flexibility through elevation (0° to 60°) and azimuth (± 110°).

The TAMNAVA is a modern, rugged, reliable and accurate MLRS system that offers a single rocket fire option as well as the classic "ripple salvo" of 0.3 to 1.5 seconds with a .1 second interval.



Photos: Yugoimport



For further information please come to the Yugoimport stand at IDEX, booth 12/D-30, or visit www.yugoimport.com.

Photo: IAI



eration within the regional eco-system and is open to promoting defence as well as civilian endeavors on a range of topics, such as space and satellites, air defence and rocketry, intelligence, robotics, UAVs, cyber etc. This exhibition is a harbinger of long-term activity in the UAE and in the region as a whole."

■ Pearson Engineering to Supply Mine Ploughs to the Indian Army

(jr) Pearson Engineering is under contract to supply over 1500 Track Width Mine Ploughs (TWMP) to the Indian Ministry of Defence. The order, which will see the Pearson plough integrated with the T-90 S/SK tank, will be delivered in partnership with BEML Limited. With previous experience in integrating counter-mine capabilities with the T-72, T-90, ARJUN Mk1 Main Battle Tank (MBT) and BMP-2 Armoured Vehicles, Pearson Engineering is proud to be a current supplier to the Indian Army.

Photo: Pearson Engineering



The track width mine plough will enable the Indian Army's T-90 MBTs to move through mined areas whilst remaining highly mobile. Pearson Engineering has a long heritage in the supply and integration of mine ploughs to Armed Forces around the world.

■ Rafael Completes Phase Two of Transparent Battlefield Study

(jr) Rafael has completed the second phase of Germany's Transparent Battlefield study while also having performed a demonstration of its BNET advanced SDR communication and FIRE WEAVER sensor to shooter system for the German Army. The event took place in Paderborn, Germany, in the presence of representatives from the Bundeswehr and various partners and industries. The demonstration included live traffic from the Aeronautics PEGASUS Drone, along with the FIRE WEAVER sensor-to-shooter system, all carried over the BNET advanced software defined radio (BNET Hand-Held and BNET

Vehicular). The demo was hosted by Atos Information GmbH, which acts as the prime contractor for the Transparent Battlefield Study, and included its C2 software as an integral part of the demo.

BNET is a spectrum-aware SDR – utilising the spectral arena of the battlefield to the fullest in a cognitive way. It uses Multi-frequency Channel Reception (MCR), which allows it to receive and analyse information from numerous frequency channels, simultaneously, using a single RF head.

FIRE WEAVER is a networked sensor-to-shooter system which provides the tactical

Photo: Rafael



forces with a GPS-independent geo-pixel-based tactical common language among all the sensors and shooters. This provides optimal situational awareness and improved understanding of the battlefield. FIRE WEAVER uses Rafael's advanced artificial intelligence algorithms, processes the battle data, analyses it and prioritises fire allocation.

Rafael has partnered with Atos Information GmbH on a project involving the creation of a programme named "Transparent Battlefield", in which unmanned aerial systems and combat vehicles are used to create a 3D picture of mobile operations in real-time. The work will be performed on order to the German procurement authorities, the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support. Following the completion of the first and second phases, further phases are expected to take place in the coming years.

■ Bundeswehr Orders More Trucks from Rheinmetall

(jr) Germany's Federal Office for Bundeswehr Equipment, Information Technology and In-Service Support (the BAaINBw) has placed an order with Rheinmetall MAN Military Vehicles (RMMV) for a further 1,401 military trucks. This has a gross total value of €543M, with the vehicles coming under the Bundeswehr rubric of Unprotected Transport Vehicles (UTFs). Funding for the extra procurement of a thousand of these vehicles comes from the German Federal Government's Pandemic Recovery Package. A framework contract for the procurement of modern military trucks

Photo: Rheinmetall



signed in July 2017, which originally envisaged the purchase of 2,271 vehicles, has now been augmented to enable procurement of a further 1,000 trucks, bringing the current total to 3,271 UTFs.

A current call-off from the original framework contract comprises a total of 292 5-tonne trucks and 109 15-tonne trucks. Including related services, the 401 vehicles in this call-off come to €154M, including VAT. Delivery is to be complete by the end of 2021. Furthermore, another 1,000 trucks (including 150 5-tonne vehicles and 850 15-tonne models) are to be purchased in 2021 and 2022. They represent sales of €389M, including VAT. Funding will come from the German Government's Economic Recovery Package, with delivery to be complete by the end of 2022. The armed forces of the United Kingdom, Australia, New Zealand and Denmark rely today on trucks from Rheinmetall. Norway and Sweden have each placed substantial truck orders with RMMV as well.

■ Saab Signs Next Generation Corvette Contracts

(jr) Saab and the Swedish Defence Materiel Administration (FMV) have signed two agreements concerning the next generation of surface ships and corvettes. This concerns the Mid-Life Upgrades (MLU) of five VISBY class corvettes, as well as a Product Definition Phase for the next generation VISBY Generation 2 corvettes. The contracts include requirements' analysis and are respectively the start of the modification work of the five corvettes and the acquisition of the VISBY Generation 2. Collectively, the agreement is valued at 190 MSEK.

The first VISBY class corvette was launched on 8 June 2000 and five examples are currently in operational service. The product definition phase regarding MLUs aims to make the five ships in the class operationally relevant beyond 2040. In addition to

Photo: Saab



modifying the ships' existing systems, an air defence missile system will be added as a new capability. The RBS15 anti-ship missile system will be upgraded to the latest version as well as will the torpedo system with the new Saab Lightweight Torpedo.

■ Sikorsky & Boeing Unveil DEFIANT X

Sikorsky and Boeing have released details of the advanced helicopter they are entering into the US Army's Future Long-Range Assault Aircraft (FLRAA) competition. The aircraft, named DEFIANT X, is pitched as the fastest, most manoeuvrable



Image: Sikorsky

and most survivable assault helicopter in history.

DEFIANT X is a weapon system that builds on the handling qualities and transformational capabilities proven by the team's technology demonstrator, the SB>1 DEFIANT®. DEFIANT X flies twice as far and fast as the venerable BLACK HAWK® helicopter it is designed to replace. Currently undergoing testing in a digital combat environment, the aircraft continues to prove itself the most survivable platform for mission requirements.

With its rigid coaxial rotor system and pusher propeller, DEFIANT X incorporates Sikorsky X2 Technology™ to operate at high speeds while maintaining low-speed handling qualities. This critical capability provides soldiers with increased manoeuvrability and survivability in high-threat air defence environments, allowing them to penetrate enemy defences while reducing exposure to enemy fire. Compared to the SB>1 DEFIANT, the DEFIANT X airframe has enhancements to improve aerodynamics and reduce the thermal signature.

The Army is expected to release a request for proposal on FLRAA later this year and is planning to award a contract in 2022.

■ Rafael's SPIKE SR Missile Evaluated by US Army

(jh) Rafael Advanced Defense Systems Ltd. and Rafael Systems Global Sustainment (RSGS), a US subsidiary of Rafael, demonstrated the SPIKE SR (Short Range) missile at the Army Expeditionary Warrior Experiment (AEWE) 2021 in January. AEWE 2021 is assessing advanced technologies in support of US Army modernisation efforts, including the Army's six modernisation priorities. As a portable, electro-optical guided missile,



Photo: Rafael

designed for infantry applications, SPIKE SR is to enhance soldier lethality, one of the six priorities.

PROTECTED MOBILITY AT YOUR SERVICE!



As a member of the Spike Family of anti-tank guided weapons SPIKE SR, is a shoulder-fired missile with an enhanced range of 2,000 metres. SPIKE SR features easy handling and allows lower echelon infantry to rapidly qualify and sustain a high level of operation with minimal training. AEWE assessed SPIKE SR as a precision munition system for infantry squads, for which portability and simplicity of operation is essential. AEWE also assessed the system for its ability to allow close-combat formations to dominate the operational environment and handle new threats in a near-peer conflict.

During the assessment, live SPIKE SR missiles hit both static and moving targets in day (EO) and IR modes. Challenges included overcoming battlefield obscurants that effectively eliminated the target from the field of view. During the assessment, soldiers received instruction on the operation of the weapon, including indoor and outdoor training. US Army evaluators provided positive feedback on the system's light weight, lethality and ease of use compared to what is currently in use by the US Army.

■ TROPHY APS for German LEOPARD 2 MBTs

(jh) The German Federal Ministry of Defence intends to conclude a contract with the State of Israel for the delivery of 187 TROPHY standoff Active Protection Systems (APS) as well as further services such



Image: esut.de

as spare parts, peripherals, training and ammunition. The systems are to equip 17 of Germany's LEOPARD 2 MBTs. In parallel, Krauss-Maffei Wegmann (KMW) will be under contract for the adaptation of 17 LEOPARD 2 A6 A3 MBTs to the A7 A1 configuration and the integration of the APS with these main battle tanks and a further Leopard 2 VT-ETB II, including the production and delivery of accessories and spare parts. Together, the contracts cover a total order volume of €120.2 million.

According to the German MoD, TROPHY - developed by RAFAEL Advanced Defense Systems - is the most sophisticated and proven standoff active protection system currently available.

■ AH-64E APACHE Helicopters for Kuwait

(J C Menon) The US has approved the sale of eight AH-64E APACHE helicopters and related equipment to Kuwait at an estimated cost of US\$4Bn. The State Department has made a determination approving the



Photo: euro-sd.com

possible Foreign Military Sale to Kuwait and the Defense Security Cooperation Agency has delivered the required certification notifying Congress of this possible sale.

The Government of Kuwait had requested to buy eight AH-64E APACHE helicopters and remanufacture 16 of their AH-64D APACHE LONGBOW examples alongside 22 T700-GE 701D engines and 36 remanufactured T700-GE 701D engines in addition to 27 AN/AAR-57 Counter Missile Warning Systems (CMWS) and other related equipment.

According to a State Department spokesperson, the proposed sale will supplement and improve Kuwait's capability to meet current and future threats by enhancing Kuwait's close air support, armed reconnaissance, and anti-tank warfare mission capabilities.

"The proposed sale of this equipment and support will not alter the basic military balance in the region," the spokesperson said. The principal contractors associated with this sale will be Boeing, Lockheed Martin, General Electric and Raytheon Corporation. There are no known offset agreements proposed in connection with this potential sale.

■ Follow-on Contract for BIRD's Radar Control and Display

(jh) BIRD Aerosystems has received a follow-on contract to develop additional advanced capabilities for its RCD (Radar Control and Display) that controls HENSOLDT's PreciSR™ advanced multi-mode radar family.

After successfully completing the first phase of development and customisation



Photo: Bird

of BIRD's RCD to HENSOLDT PreciSR™ earlier this year, the next phase of development has been agreed upon by the companies and will include developing specific and more advanced capabilities tailored for HENSOLDT customers. The new capabilities include, for example, dynamic SAR imagery footprints, control of multi-layered data visualisation, and enhanced real-time radar information and status.

BIRD will also provide an ILS package that includes RCD training and system documentation, to be provided to HENSOLDT and its customers.

■ CAE Simulators for Franco-German C-130J Squadron

(gwh) The Franco-German transport squadron established for the joint operation of C130-J transport aircraft in Évreux-Fauville, France will receive simulators from CAE in order to train flight crews and loaders.

In early January 2021, CAE reported that the prime contractor for the C-130J, Lock-



Photo: CAE

heed Martin, had awarded the Canadian company a contract to design, develop and manufacture a suite of C-130J training devices. The simulator suite consists of a C-130J full-mission simulator that can be reconfigured between the C-130J-30 air-lifter and the KC-130J tanker variants. There will also be a C-130J fuselage trainer to train loadmasters. Lockheed Martin has overall responsibility for the delivery of the training equipment, learning management system, courseware and options for five years of training services. The simulators will be delivered in 2023, ahead of the planned opening of the new training facility where French and German aircrew and maintenance personnel will be trained from 2024.

The binational C-130J squadron consists of a total of ten SUPER HERCULES aircraft, broken down as five each of C-130J-30 air-lifters and KC-130J tankers. France and Germany operate the fleet under a unique partnership where the countries share aircraft used for aerial refuelling, airdrop cargo and other cargo missions.

■ France to Purchase E-2D HAWKEYE

(J C Menon) France plans to buy three Northrop Grumman-made E-2D ADVANCED HAWKEYE aircraft to provide advanced radar capability to the country's air defence



Photo: author

fleets. The French Government has signed a Letter of Offer and Acceptance (LOA) with the US administration signifying their intent to purchase the E-2D, which allows the US Navy to begin contracting activities with Northrop Grumman for production of the aircraft. The signed LOA secures the sale that will include:

- Three E-2D aircraft
- Non-recurring engineering
- Spares
- Repairs and support equipment
- Training and follow-on support

The anticipated contract award will be in 2022 with aircraft delivered to France in 2028 at the latest.

The French Navy has been operating the E-2C HAWKEYE since 1998 and is the only country other than the US to operate its E-2s from an aircraft carrier. This capability enables interoperability exercises that support HAWKEYES from each other's carrier flight decks. With the US Navy's fleet transition to E-2D squadrons, the French Navy intends to maintain interoperability and partnership by taking steps to procure three E-2D aircraft.

■ New Computers for Dutch Combat Vehicles

(gwh) Dutch combat vehicles will be equipped with MK7 tactical computers over the next 30 months at a cost of almost €20M. Tactical computers are the basis for Battlefield Management Systems (BMS), managing data from sensors and communications equipment, making it available at the various workstations in the combat vehicle.

Elbit Systems has presented its seventh-generation Enhanced Tactical Computer (ETC) at the Dutch Defence Exhibition of the Nederlandse Industrie voor Defensie en Veiligheid (NIDV).

The MK7 complies with NATO's Generic Vehicular Architecture (GVA). It is backward compatible and includes powerful Commercial Off The Shelf components such as the Intel i7 Quad Core processor and a solid-state drive. The new tactical computer features a 12.1" sun-readable LCD display, a high-resolution capacitive touchscreen, a GPS and a video recording function.

Similar to previous generations of ETCs, the ETC MK7 is designed to operate in harsh environmental and Electromagnetic Interference conditions, fully complying with MIL-STD-810G & MIL-STD-461E standards and interfaces with analogue and digital radio systems.

The MK7s replace the ETCs introduced in the Netherlands more than ten years ago. The new ETCs offer enhanced and more robust Command and Control (C2) and tactical data processing capabilities, improved security for processing and storing secured mission information, and a solid growth path for advanced C2 applications.



Photo: Elbit

In mid-December 2020, the Dutch procurement agency ordered software-defined PNR-1000 radios for data and voice links from Elbit Systems for €45M. Modules for vehicle integration are also being procured for the portable digital radios which feature blue-force tracking for continuous display of own forces' positions. The tactical computers described above support the operation of the radios.

■ F-35 Sustainment Deal Awarded

(J C Menon) Lockheed Martin has been awarded a US\$1.28Bn Unfinitised Contract Action (UCA) by the F-35 Joint Programme Office to support operations and sustainment of the global F-35 fleet through 30 June 2021.

The UCA provides initial critical sustainment activities for a worldwide fleet while negotiations continue on a long-term contract to build enterprise capacity and affordability to support the future fleet of more than 3,000 aircraft. The UCA funds industry sustainment experts supporting operations worldwide, individual bases,



Photo: author

depot maintenance, pilot and maintainer training in addition to sustainment engineering across the globe. It also covers fleet-wide data analytics and supply chain management for part repair and replenishment to enhance overall supply availability. The F-35 Joint Programme Office, together with each US Service, international operators and the F-35 industry team, leads F-35 sustainment and the Global Support Solution. Under the existing sustainment organisation, Lockheed Martin and industry partners BAE Systems and Northrop Grumman provide critical sustainment support for over 600 aircraft in areas such as training, base operations, repairs, global supply, and sustainment support to F-35 customers.

More than 600 F-35 aircraft have been delivered and are operating from 26 bases around the globe. More than 1,200 pilots and 10,000 maintainers have been trained and the F-35 fleet has surpassed more than 345,000 cumulative flight hours.

■ GA-ASI for SKYBORG VANGUARD Programme

(jr) General Atomics Aeronautical Systems, Inc. (GA-ASI) has been selected by the Air Force Life Cycle Management Centre (AFLCMC) to support the SKYBORG VANGUARD Programme. SKYBORG will become the foundation of Artificial Intelligence (AI)/Machine Learning (ML) autonomous capabilities for a family of future USAF Unmanned Combat Aerial Vehicles.

GA-ASI will modify two of its company-owned AVENGER Remotely Piloted Aircraft (RPA) with upgraded data-links and the core SKYBORG System Design Agent (SDA) software, as well as other payloads. These AVENGERS will then be used as part of various experimentation events in 2021 and 2022, which will enable manned air-



Photo: GA-ASI

craft to control AVENGERS while in flight and relay specific information between the manned and unmanned aircraft. Flights will be conducted from GA-ASI flight centres in Southern California.

SKYBORG will provide the foundation on which the Air Force can build an airborne autonomous 'best of breed' system that adapts, orients and decides at machine speed for a wide variety of increasingly complex mission sets.

■ HELIOS to be Fitted to US Destroyer

(J C Menon) The US Navy (USN) will field a High Energy Laser with Integrated Optical-dazzler and Surveillance (HELIOS) on a de-



Image: Lockheed Martin

stroyer for the first time later this year. The USS PREBLE will be the first to be equipped with HELIOS, which will function as a close-in weapon to defend against enemy cruise missiles. The 60-kilowatt HELIOS is much more powerful than the 20-kilowatt laser weapon system the USN tested aboard afloat forward staging base USS PONCE six years ago. HELIOS will be the only deployed laser system integrated into an operational Flight IIA DDG and follows the recent demonstration by Lockheed Martin and the USN of full laser power in excess of the 60 kW requirement. The scalable laser design architecture spectrally combines multiple kilowatt fibre lasers to attain high beam quality at various power levels.

HELIOS combines three key capabilities, brought together for the first time in one weapon system:

- A high-energy laser system: The high-energy fibre laser will be designed to counter UAVs and small boats. The energy and thermal management system will leverage Lockheed Martin's experience on Department of Defence programmes. The cooling system will be designed for maximum adaptability onboard ships. In addition, Lockheed Martin will bring decades of shipboard integration experience, reducing risk and increasing reliability.

- A long-range ISR capability: HELIOS sensors will be part of an integrated weapon system, designed to provide decision-makers with maximum access to information. HELIOS data will be available on the Lockheed Martin-led AEGIS Combat System.
- A counter-UAV dazzler capability: The HELIOS dazzler will be designed to obscure adversarial UAV-based ISR capabilities.

Lockheed Martin completed the Critical Design Review and Navy Factory Qualification Test milestones in 2020, demonstrating the value of system engineering rigour and proven AEGIS system integration and test processes on the way to delivering operationally effective and suitable laser weapon system that meets the USN's mission requirements. In March 2018, the company was awarded a US\$150M contract to develop two of the systems – one for shore testing and a second to be installed on a destroyer. The USN initially planned for the installation in 2020 for what it is calling the Surface Navy Laser Weapon System (SN-LWS) Increment 1.

■ Northrop Grumman LAIRCM for Egypt

(J C Menon) Egypt will buy one AN/AAQ-24(V)N Large Aircraft Infrared Countermeasures (LAIRCM) system from the United States to protect its Airbus 340-200 Head-of-State transport aircraft to improve the survivability of the Airbus from missile attacks. The principal contractor will be Northrop Grumman with an estimated total cost of US\$104M.

The Generation 3 podded LAIRCM system, known previously as GUARDIAN, is an infrared countermeasure system that detects, tracks and jams incoming missiles. It incorporates advanced missile warning sensors, a compact laser pointer/tracker and a processor in a single pod that can be readily transferred between aircraft to meet rapidly changing mission requirements.

Each LAIRCM system consists of:

- Three GUARDIAN laser turret assemblies
- One LAIRCM system processor replacement



Image: author

- Five missile warning sensors
- One control indicator unit replacement
- One smart card assembly
- One high capacity card/user data memory card.

Northrop Grumman's infrared countermeasure systems have been installed on more than 1,800 large and small fixed wing, rotary wing and tilt-rotor platforms of more than 80 types.

■ Lincad's Team Leidos Contract Extended

(jr) Lincad's battery supply contract with Team Leidos has been extended by twelve months. Under the terms of the contract the company is to continue supplying a range of primary batteries for distribution to British armed forces deployed around the world.

The batteries are mostly lithium chemistry, with many used in mission-critical applications meaning they are required to con-

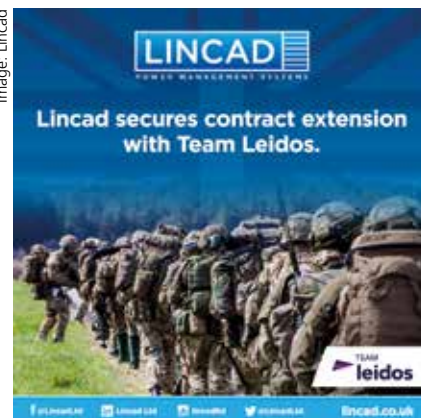


Image: Lincad

form to exacting UK Defence Standards. Lincad has invested further in its battery testing facilities to ensure that product supplied continues to maintain these required standards. Lincad also provides Team Leidos expertise in packing and labelling, ensuring suitable packaging for various transport modes, which includes full adherence with IATA transportation regulations. The original three-year contract with Team Leidos began in Q1 2018. After demonstrating good performance during the contract, Leidos has agreed to extend the contract until Q4 2021.

Team Leidos was founded to ensure continuous supply of mission-critical equipment and global expertise to the UK defence industry. The organisation is assisting in implementing the Ministry of Defence's Logistic Commodities and Services (Transformation (LCS[T])) programme, designed to improve the UK's defence supply chain.

C-390 MILLENNIUM SUCCESSFULLY ACCOMPLISHING MISSIONS

The C-390 Millennium multi-mission aircraft is in-service with Brazilian Air Force delivering exceptional performance and fulfilling all expectations, most notably with support during the Covid-19 pandemic. The C-390 is also the aircraft of choice for Portugal and now Hungary too. Both these air forces have selected the C-390 to meet their own unique and demanding operational requirements. By combining state-of-the-art systems and proven technologies with a worldwide network of reputable suppliers, the C-390 Millennium is a versatile addition to any air force. The C-390 is the most reliable, easy to operate and efficient aircraft in its class.

#ForADifferentWorld



Turkey's New Role in NATO

Korhan Özkilinc

Turkey is important to NATO because of its geopolitical proximity to the Middle East, Central Asia, and Europe. Nevertheless, some of Turkey's political decisions are causing unease in the West.

In January 2020 at an event in Brussels with high-ranking NATO ambassadors from Germany and the US, the audience asked an important question: Would Turkey's political stance continue to be bearable as a member of NATO? The answer from both officials was a diplomatic Yes! The arguments made were accurate, because Turkey plays a major role in the fight against terrorism and at the same time makes a major contribution to controlling migration. Moreover, because of its geopolitical interface with the Middle East, Central Asia and Europe, Turkey is of immense importance to NATO. As of 1 January 2021, the Turkish Army has taken over the lead of NATO's Very High Readiness Joint Task Force (VJTF), placing thousands of soldiers on standby, ready to deploy within days. This spearhead force is based on the 66th Turkish

High Price to Pay for NATO Membership

Turkey paid a high price in blood to join NATO. In 1950, without the approval of the parliament in Ankara, the ruling party - Demokrat Parti - decided to send Turkish troops as UN peacekeepers to the Korean War. The Turkish Brigade landed in Korea in September 1950 where about 1,000 Turkish soldiers out of a Brigade contingent of 5,000 soldiers died (from a total of approximately 15,000 troops over a three-year period). For the young republic, there were two main reasons for becoming a NATO member. Firstly, because of the threat from neighbouring USSR, and secondly, the ailing condition of the Turkish armed forces. Turkish generals hoped to secure US assistance in arming and modernising the Turkish army. This wish was granted and on 18

most volatile crisis regions. The danger spots in the north are with Ukraine and Russia, in the east with the troubled South Caucasus and Iran, in the south with the Arab countries Iraq and Syria, which remain in a state of war. The troubled neighbourhood has boosted Turkish interest in NATO and collective defence, and inevitably in Turkey the NATO bases are being updated and new ones built. Izmir on the Turkish Aegean Sea is the home of NATO's Allied Land Command (LANDCOM), which commands its land forces. LANDCOM is the Alliance's advocate in land warfare, with the 3rd Corps of the Turkish Army and the NATO Rapid Deployable Corps-Turkey playing an important role. Its headquarters are located in Istanbul which is a high-readiness, joint, multinational force, responsible to the Supreme Allied Commander Europe. Other important bases in Turkey are the



Photo: MoD Turkey

The Turkish Army is one of NATO's largest in terms of size and manpower.

Mechanised Infantry Brigade with about 4,200 soldiers from a total of 6,400 soldiers serving in the VJTF, which includes units from Albania, Hungary, Italy, Latvia, Montenegro, Poland, Romania, Slovakia, Spain, the UK and the US. NATO leaders had set up the VJTF at the Wales Summit in 2014 because of Russia's destabilisation of Ukraine and ongoing troubles in the Middle East.

February 1952, Turkey and its neighbour Greece were awarded NATO membership.

NATO Bases in Turkey

A quick look at a map shows that Turkey has an enormous zone of influence. Its long coastline from the Mediterranean Sea to the Aegean Sea and the Black Sea has the country bordering some of the world's

early warning radar system in Kürecik near Malatya, which is an integral part of NATO's missile defence architecture. In addition, two air force bases are integrated in the region – one in Central Anatolia in Konya and one in the south of the country in Adana Incirlik not far from Syria. Moreover, there are important institutions such as the NATO Centre of Excellence Defence Against Terrorism (COE-DAT) in Ankara as

a base of operations in the fight against international terrorism. COE-DAT is an advisory body to the Allied Command Transformation (ACT), and relations with Allied Command Operations (ACO) are generally coordinated by the ACT. In addition, COE-DAT maintains relations with numerous NATO bodies and non-NATO agencies. Recognised by NATO in 1999 as the first NATO Partnership Training and Education Centre, the Partnership for Peace Training Centre (PTC-TUR), which holds the NATO Quality Assurance Unconditional Accreditation Certificate, has trained 18,280 people from over 108 countries since its inception in 1998.

Participation in NATO Missions in the 1990s

As the second largest army in the NATO Alliance, Turkey has participated in many NATO missions. Since the early 1990s, Turkey has been politically and militarily active in the Balkans. From 1993 to 1996, the Turkish armed forces participated in "Operation Sharp Guard" in the Adriatic Sea with the aim of enforcing economic sanctions and the arms embargo against the former Yugoslavia. During the same period, they also participated in "Operation Deny Flight" and towards the end of 1995 Turkey also participated in "Operation Deliberate Force" to maintain the no-fly zone over Bosnia and Herzegovina. Since 1999, Turkey has been part of the Kosovo Forces "KFOR", with several hundred Turkish soldiers on the ground supporting the mission. In August 2001, Turkey participated in "Operation Essential Harvest", which was carried out in North Macedonia to disarm the parties in the spirit of the peace process. From March to October 2011, Turkish frigates and submarines participated in "Operation Unified Protector" designed to protect the Libyan population from violence, with the aim of disarming and enforcing the no-fly zones. Turkish troops have been involved in the "International Security Assistance Force" (ISAF) since the beginning of the NATO mission in Afghanistan from 2001 to 2014; ISAF was a reconstruction mission integrated with security missions under NATO command. From 2014, this was transformed into "Resolute Support". As a follow-up mission to ISAF, Turkey continues to advise and support the Afghan security forces to this day in Kabul. In addition, Turkish trainers have been very active in Iraq since 2004. The Turkish Navy is involved in "Operation Active Endeavour" following 11 September 2001, which served as

a measure of solidarity and determination against international terrorism in order to deter terrorist activities in the Mediterranean region. The Turkish Navy also participates in the Standing NATO Maritime Group 1 and 2, and Operation Sea Guardian was agreed at the NATO Summit in Warsaw in June 2016, which is still used today for maritime surveillance, counter-terrorism and capacity building in the Mediterranean. In addition, on 11

in NATO, particularly in terms of logistics and ammunition planning. The latest models of Turkish armed vehicles, anti-tank missiles and howitzers have been provided to the VJTF force. Furthermore, Turkey is currently one of the Associated Nations of Eurocorps. Starting in 2021, the NRDC-T will host the STEADFAST JUPITER-JACKAL for five years. In addition, Turkey will assume the duties of Maritime Component Commander (MCC) for spe-



Photo: NATO

Turkish President Erdogan at the NATO Conference in London in December 2019

February 2016, NATO defence ministers made a rapid decision to assist Greek and Turkish naval vessels in the Aegean Sea in dealing with the migration crisis, called "NATO Deployment in the Aegean Sea". Since its inception, 31 ships from eight nations have been involved, supporting Frontex - the European Border Agency. It should also not be forgotten that there were two cases when French and German frigates wanted to investigate Turkish cargo ships which resulted in short-term disagreements with Turkish officials.

Turkish Participation in Recent NATO Missions

In 2001, the Turkish General Staff gave the order for the 3rd Corps to transform itself into a NATO Response Corps, which it completed in 2003 and then subsequently expanded into one of the seven special units of the NATO Special Operations Forces (SOF). It thus became the NATO Rapid Deployment Corps Turkey, abbreviated NRDC-T. Thus, Turkey supports the enhanced NATO Response Force (eNRF) every year, which includes the Very High Readiness Joint Task Force (VJTF). Turkey has made significant investments in the unit, which is one of the most mobile

cific operations from 2023 to 2028 under Allied Maritime Command, MARCOM for short. Under MARCOM, Turkey is also involved in SNMG-2 and SNMCMG-2. Turkey is capable of taking on additional tasks within NATO.

Political Context

From Turkey's point of view, withdrawal from NATO is highly unlikely, because this would result in Turkey becoming isolated in foreign policy terms because NATO opens up a platform for talks with the most powerful countries in the world. From a NATO perspective, a withdrawal would be a major blow to the Alliance's security architecture. Other NATO members like Greece or Bulgaria and Romania cannot secure the south-eastern flank robustly enough against threats. Moreover, the 1936 Montreux Strait Agreement allows Turkey to regulate the presence of Western warships in the Black Sea, essentially minimizing confrontation with Russia. When Turkey shot down a Russian warplane over Turkish airspace in the Syrian border area in late November 2015, Russian President Vladimir Putin slapped Turkey, which until then had been friendly with Russia, with tough sanctions. Now in 2021, Turkey has be-



Through its military operations in northern Syria, Turkey has successfully enforced its own security interests against Kurdish separatists.

come an important partner from Russia's point of view, with Russia building a nuclear power plant in Turkey, and Russian gas is flowing to international markets through the recently completed Turkish Stream. There is also growing tourism, with the volume of trade amounting to around US\$25Bn. More importantly, Turkey has acquired the S-400 missiles from Russia, thereby jeopardizing the purchase of the F-35 JSF from the US. However, it is clear that Russian President Putin is trying to split Turkey from NATO by exploiting Turkey's weaknesses with the aim of bringing down the Western world's security architecture in the Middle East and Central Asia. From Turkey's perspective, it is trying to balance its relationship with Russia over Ukraine while trying to meet NATO's needs in the region – essentially performing a complicated juggling act. In February 2020, Turkish President Recep Tayyip Erdogan and Ukrainian President Vladimir Zelensky signed a far-reaching defence agreement. In late 2020, it became clear how Turkish-Ukrainian security cooperation would be expanded through the Crimea Platform and the Quadriga "2+2" formula of foreign and defence ministers. Ukraine and Turkey have intensified such cooperation in the construction of a number of military products e.g. the Turkish drone Akinci (Raider) manufactured by BAYKAR and its unmanned systems powered by Ukrainian Ivchenko Progress turboprop engines. Ukraine has already purchased 12 Bayraktar TB-2 UAS drones and is due to receive a total of 48. Representing an even larger dimension, are the four Turk-

ish MILGEM corvettes produced for the Ukrainian Navy. A major reason for the Turkish-Ukrainian axis is the annexation of Crimea by Russia; Turkey does not recognise the annexation and is involved in the solution. This is because the Crimean Tatars are an ethnic group closely related to the Turkish people; they are also known as Crimean Turks, with about 6-7 million living in Turkey who are able to exert immense pressure on the Turkish government if necessary.

The South Caucasus

In the South Caucasus, Turkey maintains geopolitical alliances with Georgia and Azerbaijan, in a region where Israel is also very active; to some extent both Turkey and Israel maintain geopolitical alliances in a similar vein as they do in Syria and Libya against Russia and Iran, although a tense relationship exists between Turkey and Israel regarding the Eastern Mediterranean. Azerbaijan's victory on the battlefield against Armenia and the recovery of seven formerly occupied districts around Nagorno-Karabakh and the southern part of this enclave would not have been possible without the help of Israel and Turkey. Russia has therefore been stopped to some extent in the Caucasus by both countries for the time being and, more importantly, a bulwark has been established against Iran which has traditionally maintained close relations with Armenia. Therefore, Turkey with its geo-cultural ties is geopolitically and strategically indispensable for NATO; without Turkey, the Alliance would be correspondingly less

capable of action. The fact that Turkey and Russia have become very close is a homemade problem of the West's making, because Turkey, especially in the Black Sea and the Middle East, was discouraged and politically neglected by the West for a long period of time.

Turkey's Strategic Interests

It is, of course, Turkey's right to pursue its strategic interests with Russia, but some consideration of NATO by the Erdogan government would not be amiss. What should be addressed here is that the EU is not acting effectively in the Black Sea region, otherwise political developments would have been different. The verbal attacks of President Erdogan against the US and the EU show a "pro-Russian" attitude but this is an illusion if one takes into account two decades pan-Turkish nationalism. Furthermore, the attitude of Turkey in Syria, Yemen, Libya and Azerbaijan show a clear attitude against Russia. The main features of this pan-Turkish nationalism were established not by President Erdogan but by Kemal Atatürk, the founder of the Turkish Republic. Therefore, we should ask ourselves whether the Astana process has not failed long ago. Whether Russia and Iran really want the peace in Syria is doubtful in the current situation. Through its military operations in northern Syria, Turkey has succeeded in enforcing its own security interests against PYD, i.e. PKK, thereby disrupting the foundation of an independent Kurdish state for some time. However, one thing should be revisited, because for more than five centuries, the Islamic-based people of Turkey and the Jewish-based people of Israel have been linked by common values. Unfortunately, relations have been disrupted since the Mavi Marmara incident in May 2010. A peaceful two-way understanding would restore rational logic and resolve the crises in the Eastern Mediterranean on a larger scale. The basic order would not only bring benefits in both directions, but many would also be pleased in Washington and Brussels. One more thing, however, should be taken into account: The dynamics in the Middle East and Central Asia make Turkey not only important, but also contentious; dealing intelligently with Ankara would therefore affect the future prosperity and security of NATO and the European Union in a positive way. Turkey's leadership of VJTF should not be seen as a challenge, but an opportunity to contribute to a better understanding with NATO and the EU. ■

Nexter,

Land defense architect and system integrator in France, is a major reference in armored combat systems, artillery, and in the ammunition field. Nexter designs innovative solutions for land, air, sea and security forces, in order to bring French and foreign armed forces a **decisive operational advantage**.

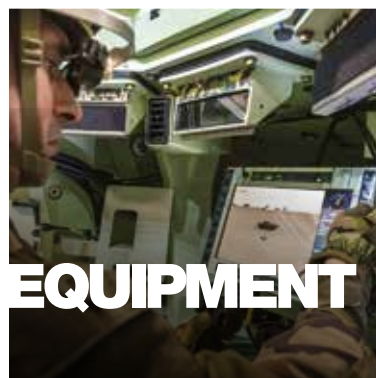
ARMORED VEHICLES



TURRETS & GUNS



AMMUNITION



EQUIPMENT



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Cooperation for International Security

Luca Peruzzi

Italy has always been deeply committed to the main international organisations, within which it plays a leading role, also in terms of participation in initiatives and missions aimed at supporting international security and stability.

Currently, the Italian Armed Forces provide a daily average of more than 15,000 soldiers in 39 missions in 24 countries, of which about 7,500 are employed beyond the country's borders; 7,800 are involved in internal security and public utility roles, notwithstanding the pandemic, which is heavily influencing operations both internally and externally. Italy is currently the second highest contributing country to NATO missions and participates in the first group of Member States contributing to European Union (EU) missions. It is also the 20th State contributor to United Nations (UN) missions, the first among western countries. In this context, "the strong Euro-Atlantic and European vocation, which represents a priority in our country's foreign policy, is clearly reflected in the military policy that the defence sector elaborates and promotes within the main international organisation of NATO, EU and UN", the Minister of Defence Lorenzo Guerini said recently. Italy considers NATO as the main reference organisation capable of effectively ensuring dissuasion, deterrence and defence. "The European strategic autonomy" is viewed by

Photo: Italian MoD



Italy has been a key contributor to Afghanistan security. Depicted here are Italian Army assets near Herat.

Mr Guerini "as a confirmation of Europe's role as a pillar in the collective security structure based on the trans-Atlantic pact. Today, as in the past, NATO, Europe and the US must stay connected – at the centre of a reciprocal security and defence relationship."

During the NATO leaders' meeting held in December 2019, the Allies discussed the strategic challenges facing the Alliance and the consequent adaptation needs of NATO. The resulting commitment to the neglected southern flank with the 'Implementation of the Enhancement of the Framework for the South' and the 'Regional Hub for the South', within the Joint Force Command Naples, is viewed as a way to project stability in the area and countries neighbouring the southern flank of the Alliance. Italy is preparing itself to guide the soon to-be established Multinational Division South (MND-S) Command with the task of coordinating NATO's Mobile Training Team operating in the area.

As a co-founder of the European Union, Italy will continue to ensure its support for all initiatives aimed at giving substance to the European Union Global Strategy (EUGS), in complementarity with NATO and according to their respective specificities, with the aim of developing capabilities such as to meet the needs of protecting European territory and its citizens. The Permanent Structured Cooperation (PESCO), supported by the Eu-

Photo: Italian MoD



Italian Minister of Defence Lorenzo Guerini



ropean Defence Agency (EDA), is a key enabler of EU integration in the security sector, and Italy is currently involved in 24 projects, 9 of which are nationally led. With regard to the EU's military capabilities, Italy supports the development of the Coordinated Annual Review on Defence (CARD) efforts, in order to fill the gap between EUGS and the operational and planning requirements.

Pursuing a consolidated policy of full support to the UN, Italy actively participates in the organization's initiatives and continues to provide an important contribution to peacekeeping in terms of human, financial, training and logistics resources. Currently, the defence sector participates in six UN missions, with a maximum authorised presence of about 1,100 personnel.

In September 2019, Italy joined the European Intervention Initiative (EI2) whose ultimate objective is to develop a shared European strategic culture, which will enhance the 'Old Continent' countries' capabilities to carry out military operations under the framework of the EU, NATO, UN and/or an ad hoc coalition. Within the initiative, Italy has proposed to establish a 'Mediterranean area of interest' working group.

In addition to international commitments, as anticipated, all Armed Forces are involved in internal security and public utility duties on their national territory, with the Carabinieri having a dual commitment as an armed force, also tasked with domestic policing duties. The pandemic saw a strong involvement of medical, logistics support and frontline units in support of the government and local authorities, including nation-wide drive-through facilities, in addition to vaccine transport and distribution support with aircraft, helicopters and land vehicles, a commitment that puts considerable pressure on all Armed Forces.

International Commitments and National Interests

The protection of national interests through participation in foreign operations has evolved towards an approach based on 'strategic areas' in order to increase the country's presence in places of clear national interest. Italian strategic objectives, including the protection of national interests and dialogue with all regional actors, focuses mainly in the 'Wider Mediterranean' area, spanning from the Gulf of Guinea to the Indian Ocean/Arabic Gulf throughout the Mare Nostrum basin. "We must take note that we are in a geopolitical moment charac-



Photo: Italian MoD

The Italian Army's deployable hospital was used right at the beginning of the pandemic.



Photo: Italian Air Force

The Italian Air Force's F-35A combat aircraft gained operational momentum within NATO air policing.



Photo: Italian MoD

Italian Armed Forces are employed in 24 countries in support of UN, NATO, EU, and international organisations.



Photo: Italian Navy



The Italian Navy is actively involved in multinational operations in the 'Wider Mediterranean' area of strategic interest for Italy.

terised by great changes, the development of which intersect mainly in the Mediterranean area, making it a region of increasing complexity, as confirmed by the increasingly marked presence of actors coming from outside the area", Minister Guerini stated, highlighting that the pandemic is a factor of additional instability.

In the Mediterranean region, in addition to the national operation 'Mare Sicuro' with naval, aircraft and unmanned platforms in the Central Mare Nostrum area and the support package to the Libyan Navy and its Coast Guard, Italy follows the evolution of the Libyan crisis. It contributes to the political negotiations between the national and international parties to the conflict, through its involvement in the Italian Mission of Assistance and Support on Libyan soil. Italy also leads and participates in the EU CSDP mission EUNAVFORMED IRINI by providing the headquarters infrastructure and accommodation, personnel, naval and air assets. This mission's main task is ensuring compliance with the arms embargo placed on Libya, according to the provisions of various UNSC resolutions. Italy implements a policy of maritime military presence, though not continuous, in order to protect national energy interests especially in the context of the Cypriot Exclusive Economic Zone (EEZ); looking at this area, the Italian MoD wants to join the UNIFIL naval force in 2021. Moreover, a law to establish a national EEZ is awaiting approval by the Parliament. In the Sahel and West Africa, the national

commitment is demonstrated through support to EU and UN initiatives in Mali, the Sahel and Niger. Furthermore, in the context of the initiatives promoted by the "Coalition for the Sahel", Italy will contribute to the Takuba operation, launched to support local security forces with the deployment of Special Forces, specifically in combatting the growing phenomena of jihadist origin in the area between Niger, Mali and Burkina Faso. To protect national companies' interests and

sea traffic lanes, in addition to capacity building support in the Gulf of Guinea, since 2020, Italy is contributing with other international stakeholders in patrolling the area's waters with Italian Navy frigates involved in different counterpiracy operations as a result of growing attacks. In the Western Balkans area, Italy, together with its international partners, supports the consolidation of democratic institutions and their path towards progressive accession to the European Union and NATO.

Photo: Italian Air Force



Italian Armed Forces have been at the forefront on international cooperation during the pandemic.



In the Middle East, Italy is maintaining its level of engagement in the UN mission "United Nations Interim Force in Lebanon" (UNIFIL), whose contribution to maintaining peace and security throughout the area remains crucial. In Iraq, the national military presence continues to be essential for the reconstruction and maintenance of the local and Kurdish security forces. The growing role of the NATO Mission in Iraq (NM-I) offers Italy the possibility to consolidate a role of privileged interlocutor of Iraq. At the same time, given the value of Hormuz as a strategic communication and energy route, Italy joined the French-led initiative (European-led Maritime Awareness Strait of Hormuz - EMASoH) to lower tensions and ensure freedom of navigation in the area.

In the Horn of Africa, Italy is also playing an important role, both thanks to the national contingent deployed within the EUTM Somalia mission - continuously under Italian command since 2014 - and through bilateral training programmes for Somali and Djiboutian personnel at the national base of Djibouti (MIADIT). Italy is also a long and continuing supporter of the naval EUNAVFOR Somalia - Operation Atalanta to counter piracy in the Horn of Africa and Indian Ocean and is contributing to capability building activities of littoral countries.

In the context of NATO operations in Afghanistan, Italy will continue to guarantee the leadership of the Train Advise Assist Command - West (TAAC-W) in Herat through the provision of support to training and mentoring the Afghan Forces, as well as additional personnel in Kabul. The Italian Government will decide on the military presence in Afghanistan, together with other NATO countries, in the coming months.

Italy continues its commitment to NATO's Air Policing activities with Italian Air Force EUROFIGHTER TYPHOONS and F-35s and in the context of enhanced Forward Presence (eFP - in Latvia) with the Italian Army, in addition to the contribution in terms of surveillance and maritime security through the Navy's participation in the Standing Naval Forces, as well as Operation Sea Guardian. The Italian Armed Forces are also involved in the European-led forces, such as the EU Amphibious and Land Battle Groups.

Growing Budget and Long-Term Funding

After a five-year decline since 2020, the defence budget has been increasing in size. After an initial return to growth last



Photo: Italian Navy

The Italian Navy is enhancing its underwater frontline and support components.

year with the current Minister of Defence, Lorenzo Guerini, the approved defence budget for 2021 indicates an increase from €22.9Bn in 2020 to €24.5Bn in 2021; the three-year programming document indicates a further rise in 2022 to €25.1Bn, followed by a reduction to €23.4Bn in 2023.

As highlighted in the DDP 2020-2022 document released last October, with the 2021 national budget law approved last December, the Italian Government has also introduced a new multi-year financing instrument in support of the defence sector, which represents a breakthrough in the investments sector. In the last decade, the uncertainty of funding has lengthened defence procurement programmes resulting in the introduction into service of platforms and weapons systems later than expected and without in-service support. Moreover, the funding for both operations and procurement have been further stretched by rising personnel expenses. The procurement funding however, not only originates from the ordinary defence budget, but also from the Ministry of Economic Development, as well as extra-ordinary funding established in recent years. According to Minister Guerini, if the overall funding budget is supported by the Parliament in the coming years, it will be possible to achieve the gradual alignment in the medium term of the defence budget, to the average expenditure of European countries (1.58% of the GDP).

The certainty of available funding will also support the financial commitment to the European Defence Industry Development Programme (EDIDP), a pilot

initiative of the European Defence Fund (EDF). This programme is entering into its operational phase and seeing consortia formed by the national industries of the sector, which participate in 9 of the 15 total projects, 2 of which are Italian-led. According to Minister Guerini, the DPP document goes in this direction, highlighting the national impact of the investment and international programmes that provide adequate visibility and economic return to the national industrial sector. Speaking during last November's Parliament hearing, Minister Guerini highlighted the need for a strategy based on two requirements: i) the development of a clear 'Industrial Defence Strategy' that allows for further strengthening of cooperation between the defence, industry and universities, in order to give even greater impetus to research and development in the high technology sectors; and ii) the full implementation of effective export support, through the G2G mechanism, which saw the development of a first practical application in the context of cooperation with the Austrian Defence sector in the rotary-wing segment, the first significant example of the potential of this new tool.

Minister Guerini also highlighted the need to proceed with the revision of the regulatory framework that governs defence personnel, both military and civil. "The latter requires updating in order to withstand the challenges of our time. There is a need to proceed with a revision of the legislation, in order to adapt it to new needs, especially in the personnel sector, where the problem of aging requires a quick solution."



Italy's Strategic Concept

General Enzo Vecciarelli

The re-definition of global balance following the Cold War has led to a defence-security gap that has widened further, as clearly exemplified by the various crises breaking out in close proximity to Europe, both to the East and South.

From an Italian perspective, the current strategic concept is extremely complex and features dynamic forces that have an impact on our country and our reference system of alliances (NATO, EU, and UN). The renewed competitiveness between state and non-state actors, at both global and regional level, is emerging with increasing frequency in the Mediterranean Sea, which has once again become the centre of geopolitical contest. This is due to it being a site of resources and having resumed its importance as a "middle sea", a crowded communication channel between the Atlantic and Indian Oceans.

Furthermore, the new operational domains are more frequently a theatre of strategic competition, which include cyber and space, in addition to the traditional land, sea and air space domains.

Against this backdrop, I deemed it appropriate to elaborate my vision and guidelines into a Strategic Concept to have an integrated, effective, balanced military instrument that can operate with "systemic effectiveness and overall relevance" and that can also contribute to protecting our national interests. In the year since its publication, many of the Concept's notions and forecasts have been proved valid with recent contexts where the pandemic crisis has acted as an accelerator of instability. This has facilitated actors that rely on a definite strategic agenda and can now exploit unexpected room for manoeuvre.

Speeding up the joint integration process has become even more important in organisational and operational terms in order to continue to pursue the organisational rationalisation of the defence sector as cohesively as possible. This should be done by switching to a paradigm, which is oriented towards capability development that is sus-

Photos: Italian Armed Forces



General (Air Force) Enzo Vecciarelli has been the Italian Chief of Defence since November 2018. He oversees the Chiefs of the Armed Forces and, with regard to technical-operational matters, the Defence Secretary General. He presides the Armed Forces' Chiefs of Staff Committee and is also a permanent member of the Supreme Defence Council.

tainable over time and based upon emerging technologies.

In fact, my vision entails innovation and digitalisation as the main evolution accelerators and as the glue that holds the entire defence organisation together. We are currently experiencing an era in which it will be crucial to harmonise the ability to operate and the ability to connect, namely, to have a network able to guarantee uninterrupted connectivity among operators and assets that are often automated, thereby ensuring information superiority to facilitate prompt decision-making.

Therefore, gaining and maintaining a technological advantage against one's competitors will be key. Consequently, the military should be informed by methods that allow for identifying specific technologies able to

guarantee operational and organisational advantages immediately, as well as in the medium term. It will be necessary to adjust the recruitment, education and training processes to the current situation and its possible future evolution, steering them towards the acquisition of new skills required to cope with future challenges.

Meanwhile, the Armed Forces have implemented organisational measures to continue with integration across the five operational domains, while focusing on developing and acquiring strategic enablers, which are inherently effect multipliers across any environment and component. Against this background, the Joint Cyber Operations Command (Comando interforze delle Operazioni in Rete - COR) and the Joint Space Operations Command (Comando interforze delle Operazioni Spaziali - COS) have been established to act as bodies with common features in charge of the cyber and space domains respectively.

The need to achieve full capability to operate effectively and generate multi- and cross-domain effects is already transforming the Joint Operations Headquarters (Comando Operativo di Vertice Interforze - COVI) which, in the near future, will guarantee the unity of Command and Control across all operations and domains. At the same time, the concept for the deployment of Armed Forces beyond national borders has been revised in order to utilise the best resources in areas and within missions in synergy with the other instruments of national power (diplomatic, information, and economic). Moreover, as with the cyber and space domains, further cooperation should be pursued with other state bodies, with industry and academia, balancing financial capability on the one hand, and the creativity and ingenuity that have always characterised our economic, industrial, and military communities on the other.

Italy's Security Policy

National security and defence policy centres around a multilateral paradigm based

Author

Air Squadron General **Enzo Vecciarelli** is the Chief of the Italian Defence General Staff.



upon compliance with international law, and a system of alliances that depends on the major international organisations (NATO, EU, and UN). The Italian Armed Forces will continue to carry out their missions: defending the State, defending the Euro-Atlantic and Euro-Mediterranean space, contributing to international peace and security, backing the protection of free institutions, and carrying out tasks in the event of disasters.

In fact, the defence and security of the national territory, maritime space, air space, and population widely depend on international security and defence. Accordingly, the Italian Armed Forces conduct several operational activities in various theatres of crisis. They have a high strategic impact, encompass the entire conflict spectrum, and range from capacity building in support of partner countries that are most engaged in combatting international terrorism, to activities designed to prevent traditional conflicts and inspired by the principle of transatlantic solidarity.

Within Italy, the Armed Forces support the domestic institutions and local authorities in preventing terrorism and strengthening internal supporting the security; they also contribute their assets to operations and activities that can have a remarkable social impact, notably during times of emergency, as proven by their significant support in managing the COVID-19 health crisis. This has resulted in relevant inter-ministerial and joint synergies. In cooperation with the COVID-19 Commission appointed by the Presidency of the Council of Ministers, in support of the Ministry of Health, and in coordination with local health authorities and the Civil Protection bodies, the Joint Operations Headquarters has planned and managed the Armed Forces' overall efforts. This occurred during the first wave of the pandemic through several activities such as: repatriation of nationals by inter-continental military airlift, setting up of field hospitals, biocontainment transport, support to civilian facilities through medicals, setting up of the COVID-19 hub at the Celio Military Hospital in Rome, and sanitisation of facilities. During the second wave, Operation IGEA has made available 200 drive-through test sites located across all Italian regions which carry out COVID tests, and Operation EOS was initiated to distribute the vaccines, according to Defence Minister Guerini.

Currently, on average, Italy's foreign engagement amounts to more than 15,000 service personnel deployed on 39 missions in 24 countries, including 7,500 personnel continuously deployed beyond the national borders with 7,800 personnel engaged



Italian Armed Forces have been heavily involved in the COVID 19 health emergency since the beginning of the pandemic. Depicted here is an Italian Air Force's B 767 tanker/cargo aircraft taking Italian citizens back from Wuhan.



Italian Armed Forces continue to support NATO, EU, UN and other international organisations' missions with an average of over 7,500 personnel.

at home performing domestic security and public service tasks.

The Organisation of the Armed Forces

The operational land component is based upon one multinational Corps - HQ NATO Rapid Deployable Corps-Italy, (NRDC-ITA) – for planning and conducting complex operations to perform functions such as the Joint Task Force HQ, Corps HQ, Land Component Command and Multicorps LCC, in case of Article 5 operations; two Divisional Headquarters to which 4-5

manoeuvre brigades report. They ensure preparation, training, and maintenance of reporting units to be employed at home and within the many international missions in which the Italian Army is engaged; 11 Manoeuvre Brigade Headquarters, including light, medium and heavy forces; Combat Service Headquarters and Combat Service Support Headquarters to provide combat support and logistics support assets at Division and Corps level. This organisation also includes the necessary bodies in charge of territorial, administrative, logistics, infrastructural, and training functions.



The Italian Carabinieri's Armed Force accomplishes both police, homeland as well as military missions in country and abroad.

The Maritime Component

The Maritime Component performs the Navy's operational functions through a Fleet Command in charge of maintaining operational capability, preparation and training of the surface force, submarine component, aboard the fixed-wing and rotary wing component, amphibious and landing units, and the minehunting force. As the High Command of the operational area, it carries out planning, conduct, execution and control tasks. Three Divisional Headquarters provide the capabilities to generate a deployable Task Group (1st Division) to carry out the missions assigned within Maritime Security Operations (MSO); a deployable Task Force/Group (2nd Division) providing a Maritime Rapid Reaction capability; one amphibious deployable task group (3rd Division) to which naval units report for amphibious operations involving aircraft carriers and amphibious transport; one Mine Countermeasure Headquarters for minehunter and hydrographic units; one Patrol Forces Command for coastal surveillance and defence to which patrolling units report; one Amphibious Forces Command to which the San Marco Marine Brigade reports; one Naval Aviation Command to which aircraft and helicopter stations report, along with the relevant flight groups; one Submarine Command to which the submarine fleet reports.

The Air Component

The Air Component is supported by three High Commands: the Air Command, to which the Aerospace Operations Command, the Logistic Command, and the

Headquarters, Air Force Schools, with training/operational, logistics, and educational functions report, respectively. Two Air Region Commands are responsible for territorial functions. The Air Command trains and organises Units for them to acquire and maintain proper operational readiness and logistics autonomy. The units, in turn, guarantee national airspace security around the clock.

The Logistic Command

The Logistic Command provides technical and logistics support to maximise the operational capability of the Air Force. The Headquarters, Air Force Schools, deals with recruitment, education, and training. The training institutions and the Flight Schools report to it.

The Carabinieri Corps

Through the Chief of Defence (CHOD), the Carabinieri Corps reports to the Minister of Defence for its military missions and tasks, including the operational deployments abroad to create security conditions and restore orderly conditions in the areas of intervention. The Corps also contributes to rebuilding local police forces and restoring their functions through training, assistance, and advice (TAA) and observation efforts. The 2nd Mobile Brigade is the operational component responsible for the implementation of international military cooperation. Through its dependant units, the Brigade is the backbone of the "Multinational Specialized Units" (MSU), i.e. an international police force. Established to join ranks with theatre-deployed military forces and local police forces – or UN forces – to preserve the rule of law, the MSU have been tasked with information gathering and criminal investigations, thus making up for the shortcomings of local police forces. In the aftermath of September 11, 2001, capturing terrorists and war criminals has been included among their duties. Among the capabilities of the Carabinieri Corps is the Centre of Excellence for Stability Policing. Established in partnership with the US Department of State, the Centre is a doctrinal and training unit focused on Stability Policing Units that cooperates with the UN and other international organisations.

Capability Development and Future Prospects

As far as capability development is concerned, an effective Joint Component serving as an enabler in all domains will be required to create capabilities, such as



The Italian Navy deploys its Fleet around the world in support of national interests. Its out-of-area missions cover principally the waters in the 'Wider Mediterranean' area, spanning from the Gulf of Guinea to the Indian Ocean, passing through the Mediterranean basin.



Integrated Command and Control (C2); Joint Intelligence, Surveillance and Reconnaissance to ensure coordinated and synchronised support through decision-making, planning and deployment of Joint Fire Support and anti-aircraft and anti-missile defence as part of the wider NATO Integrated Air and Missile Defence; ability to conduct special operations, project and deploy based on an expeditionary approach, employ an adequate pool of enablers for Combat Support and Combat Service Support, and operate effectively in the cyber and space domains. In the cyber domain in particular, the resilience of network and information systems, protection, and efficiency should be sought to provide protection and mitigate the effects of the rapid obsolescence of ICT technology. Moreover, as set forth in the national and international regulatory framework, facing cyber threats, investigating opportunities to encourage the development and / or adoption of innovative approaches – such as Cloud Computing, Artificial Intelligence and Machine Learning – and promoting specific research projects, will also be necessary.

In the space domain, the Italian Defence sector will have to update its developmental approach and achieve adequate capacity to assess threats from and to space, and to conduct space operations effectively while complying with international law. Capability development for the Land Component aims at shaping a balanced and flexible pool of modular, scalable, and properly digitised capabilities that can be readily deployed and integrated into joint and / or multinational forces to tackle crises and deploy within the broadest spectrum of conflict, including high intensity scenarios.

At the core of the adaptation process will be the "Combined Brigade System", i.e., a complex macro-capability consisting of organic sub-capabilities such as combat, combat support, combat service support, and command support units. It will be characterised by diverse operational platforms that have been suitably enhanced with additional capabilities, e.g., cyber / space, anti-aircraft defence, and C-UAS, information manoeuvre, to provide the required multi-domain effectiveness and to oppose new threats that may not necessarily be "physical" in nature.

The Maritime Component should be capable of providing continuous defence and integrated security of maritime spaces under national sovereignty through presence and surveillance, the protection of strategic sea lines of com-



Italian Armed Forces play a key role supporting national authorities in fighting the COVID 19 pandemic. Shown here is Italian Army personnel sanitising an urban area.



Italian Air Force's F-35As involved in air policing missions over Island



Carabinieri play a key role in national and international out-of-area missions.



Medical personnel from the Italian Navy supporting national health authorities in the fight against the pandemic. The Italian Armed Forces play a key role in vaccines distribution.

munication, the protection of resources and economic activities in areas of primary national interest, and policing of the high seas. At the same time, the maritime component should be able to project force from / to sea and operate in the widest spectrum of conflicts – including high-intensity scenarios – and within joint and / or multinational formations, thus providing command and control capabilities, deployability,

and precision engagement of targets in every domain in support of other components.

The modernisation of the underwater component has also been planned, together with the completion of the maritime patrol capability, the development and acquisition of new long-range precision munitions, and the renewal of the national hydrographic and mine counter-measures capability.

The Air Component will provide surveillance and defence of the national and Euro-Atlantic airspaces. It will also ensure that forces are protected from the air, while operating in the widest spectrum of conflicts in every domain – including high-intensity scenarios – and within joint and/ or multinational formations. At the same time, it will achieve air superiority, protect forces from air and missile threats, and provide command and control capabilities, high deployability and strategic transport, adequate defence capabilities, support to land forces and precision engagements – also in depth – as well as carry out surveillance and reconnaissance tasks in areas of national interest. The focus will be on strengthening multidimensional surveillance and command and control capabilities, persistent aerial reconnaissance, and information superiority; maintaining/renewing the air component and anti-aircraft defence; strengthening the strategic transport assets and the helicopter component dedicated to Search and Rescue missions, and rotary wing training; modernising and acquiring precision, long range ammunition to engage in every domain, also to the advantage of other components.

The Carabinieri Corps should be able to prevent and fight crime and carry out military police tasks; contribute to the integrated defence of the national territory and to operations abroad, in particular through its Stability Policing capabilities – i.e., for training and / or replacing local police forces. In this regard, with special reference to the tasks closely related to the defence sector, tactical ground and helicopter mobility will be enhanced, as well as IT security.

The provisions outlined above are part of a structured, compound and uninterrupted process through which the defence sector – in collaboration with the Secretariat General of Defence, for the procurement issues, and the Services – ensures that modernisation of the military takes place according to a capability-based logic.

In this regard, the overall development of the military instrument can be achieved by bringing together what is known as Essential Operational Capabilities, i.e., Force Preparation, Force Protection and Engagement Capabilities; Command, Control and Communications (C3), Force Support, Force Projection, and Information Capability. The ensuing capability development programmes will leverage the expertise of national industries and draw on bilateral, multilateral, NATO, and EU symbiotic endeavours, in order to achieve mutual benefits, economies of scale, and interoperability. ■



“International cooperation in the military procurement sector has always been of crucial importance.”



Foto: SGD DNA

ESD: Can you briefly elaborate on the role, organisation and duties of the SGD/DNA? Are there other organisations involved in defence procurement in Italy?

Lt.Gen. Falsaperna: The Secretariat General of Defence and National Armaments Directorate is the Technical-Administrative Branch of the Italian Ministry of Defence. It is a complex organisation, whose duties within the Ministry of Defence involve the management and control of national and international activities in the fields of industrial policy and defence materiel cooperation – including those related to the modernisation and renewal of military systems, vehicles and equipment – as well as the development of policies concerning innovation and technological research.

The operational requirements related to equipment and materiel for the armed forces are defined – in line with the policy guidelines expressed by the Minister of Defence – by the Chief of Defence (CHOD), who acknowledges, examines and harmonises the requests coming from the Armed Forces General Staff in order to meet the global needs of the military sector. Accordingly, he sets priorities and identifies the necessary financial resources, planning the allocation of funds after approval by the Minister. At this point, it is up to the National Armaments Director to define the best acquisition

Like many other countries in Europe, Italy is currently investing a lot of money in modernising and equipping its armed forces. ESD had the opportunity to speak to the head of Italy's procurement authority, SGD/DNA, Lieutenant General Nicolò Falsaperna.

strategy and submit it to the Minister for approval, in agreement with the CHOD. The procedure is then implemented by the “operational body” of the Technical-Administrative Branch, which includes the Technical Directorates of Land Armaments, Naval Armaments, Air Armaments and Airworthiness, the Directorate of Information Technology, Telematics and Advanced Technologies, and the Directorate of Works and State Property. The armed forces also contribute to defence procurement, within the limited scope of exercise and training requirements. In this context, the defence industry enjoys an important role. This role has historically held high strategic value as one of the most important sectors in the national economic system, in terms of capacity and sovereignty of the military sector, projection on international markets, protection of skilled employment, modernisation of national technological assets and, last but not least, strategic enhancement of the country's international role.

ESD: What effects did the establishment of the Permanent Structured Cooperation pattern (PESCO) have on your organisation's structure and work? What developments are to be expected in this regard?

Lt.Gen. Falsaperna: In line with the policy of the Ministry of Defence, the activities of the Secretariat General pursue increasing levels of integration in the defence field with partner countries of the European Union. The Permanent Structured Cooperation (PESCO) and the European Defence Fund (EDF) are among the means by which this integration is conducted. In particular, I believe that PESCO is a novel defence package, one which has opened new perspectives and identified priorities in defence matters. In addition, with EDF support, the option of joint programmes among European Union Member States has become increasingly important, also from an investment efficiency perspective. The development of EU military capabilities promotes the work of the Secretariat.



Foto: SGD DNA

SGD DNA Headquarters



Photo: Italian Air Force

**The first of Leonardo's M-345 basic advanced trainers on delivery to the Italian Air Force**

iat General, which supports multilateral cooperation, acting as a driving force for the industries involved, resulting in positive effects on industrial orders and also on employment. In this context, it is essential to work in synergy with the Defence General Staff, which guides the Italian participation in PESCO by elaborating directives and priorities concerning capability development. Promotion, support and coordination of industrial cooperation activities are carried out by the Secretariat General in order to finalise the relevant procurement activities.

ESD: To what extent does the SGD/DNA assume responsibility for the R&D component of armament programmes? Do you have your own R&D personnel?

Lt.Gen. Falsaperla: In my specific capacity as National Armaments Director, I am responsible for research and development, and the production and procurement of weapon systems. These functions, as outlined in the Guidance Act of the Minister of Defence and, in more detail, over a three-year period in the Multi-annual Planning Document. This allows the military branch to bridge its capacity gaps and calibrate the future armed forces' intervention capabilities, according to the multiple operational needs. To this end, the Directorate harmonises defence objectives with the national economic-industrial and technical-scientific policies. As far as technological research is concerned, the Directorate identifies, defines, promotes, coordinates and co-finances the relevant projects, addressing technological research towards the needs of development programmes. This happens particularly in the sectors

of top-priority interest for the defence sector (the so-called clusters), in synergy with the national defence industry and research centres, also in the academic field, and with the aim of creating demonstrators in a representative environment (seventh level of the common Technology Readiness indicators). These activities are carried out both nationally, through the National Military Research Plan, and through European cooperation, with projects under the aegis of the European Defence Agency and, in the future, through the research dimension of the European Defence Fund, but also at an extra-European level through bilateral or multilateral relations.

Moreover, the Directorate supports national participation in the activities of the NATO Science & Technology Organiza-

tion cooperative work programme, and coordinates the national contribution to the in-house scientific research activities of the NATO Centre for Maritime Research and Experimentation (CMRE). Carrying out of research, development and procurement measures is also implemented through the General and Technical Directorates.

Individual research projects are carried out by consortiums outside the Defence Administration, with the exception of Testing & Evaluation activities, which are coordinated by the Secretariat General under the control of individual armed forces.

ESD: As the budget available for procurement is provided from the defence budget (Ministry of Defence), the Ministry of Economical Development and other State funding, which is the likely trend of available funding from today to the first half of the 2030s?

Lt.Gen. Falsaperla: The well-established institutional collaboration between the Ministry of Defence and the Ministry of Economic Development (MiSE), each within the scope of their respective jurisdiction, has enabled the Italian defence sector to undertake and support a series of important initiatives aimed at renewing and improving the nation's military establishment. In this regard, the defence programmes funded by the MiSE have been characterised by a strong push towards innovation and technology, acting as a driving force for the industry, the national economy and the whole country's institutional and economic system. Over the past ten years, the MiSE has strongly supported the Ministry of Defence with

Photo: CIO

**The CENTAURO 2 armoured vehicle**



dedicated funds; its economic contribution will certainly remain significant over the next decade, although it is currently difficult to estimate precisely.

ESD: What are the most important defence programmes currently carried out by your organisation?

Lt.Gen. Falsaperla: We are carrying out an important number of programmes with diversified operational relevance (simple and complex), dealing with all programmatic development activities. I will only mention the most important ones, listed according to their specific sector. In the land sector, with the “New Blindo Centauro”, we intend to equip the cavalry units of the Italian Army with an armoured vehicle suitable for operating in the new operational contexts in terms of safety, protection and interoperability. The “VBM Freccia” is a protected, fast and agile vehicle intended for transport and combat, and suitable for ensuring the fulfilment of command functions. In the naval sector, innovative design PPAs (Multipurpose Offshore Patrol Vessels) are being developed to monitor and control maritime areas of national interest, monitor maritime and economic activities and support rescue operations in case of natural disasters. Furthermore, I will mention the FREMM programme (European Multi-Mission Frigate) in cooperation with France – both in the “general purpose” version, with high operational flexibility, and in the anti-submarine version – and the U212 type NFS (Near Future Submarine) programme, an evolved version of U212A to meet and improve surveillance capabilities of maritime and underwater domains. In the aeronautical sector, regarding fixed-wing aircraft, we are carrying out a four-nation programme (IT, DE, FR and ES) for the development of a European MALE (Medium Altitude Long Endurance) class Remotely Piloted Aircraft System (RPAS) which, starting from 2025, will be employed as an “Armed ISTAR” capability. In the same field, the M345 aircraft is actually an integrated training system (composed of aircraft and simulators) which meets stringent cost-effectiveness requirements, and will be competitive with the new-generation basic training aircraft currently present on international markets, in terms of both initial acquisition and operating costs. As regards rotary-wing aircraft, the NEES (New Exploration and Escort Helicopter for the Army) will replace AH-129 helicopters in order to ensure operational continuity and increase capabilities to promptly support the “boots on the



Photo: Giorgio Arra

First of class PAOLO THAON DI REVEL PPA (Pattugliatore Polivalente d'Altura)



Photo: Leonardo

Leonardo's AW169 LUH

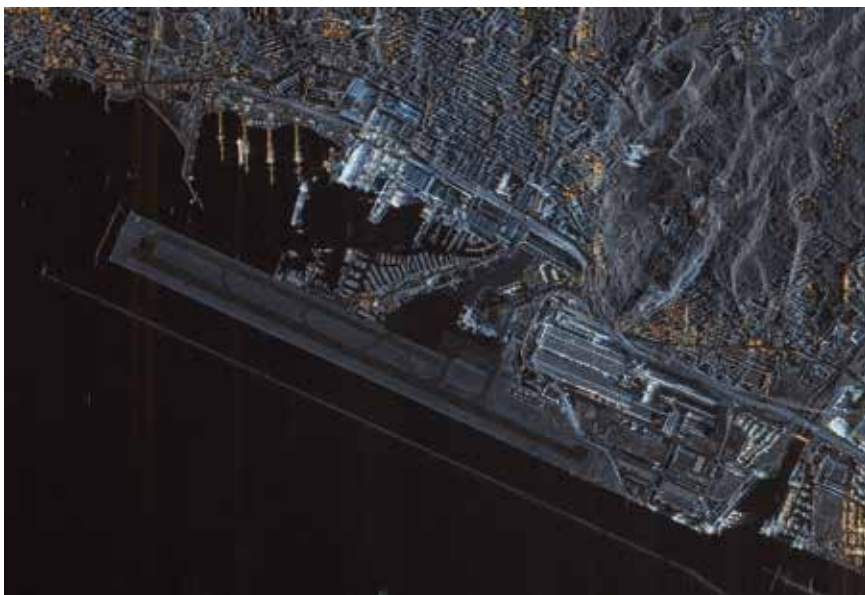
ground”. I would also like to mention the recently launched LUH 169 programme, a “light” helicopter which represents a new-concept platform that will replace machines introduced into service between the end of the 70s and the mid-90s. This system must be able to carry out a full spectrum of operational activities (in land, maritime and coastal environments), also with a dual-use connotation (able to support any military activities carried out for non-military purposes, mainly in direct or indirect support and in favour of national and non-national communities), combining the technical features of the lines currently in service. As far as armaments are concerned, I will only mention some advanced missile and ammunition programmes such as VUL-

CANO, TESEO Mark II Evolved, METEOR, STORM SHADOW, CAMM-ER and IRIS-T. In the space sector, it is worth mentioning the COSMO-SkyMed 2nd generation programme for Earth observation, the SICRAL 3 programme for SATCOM and MUSIS-CIL (Multinational Space-based Imaging System-Common Interoperability Layer), aimed at enabling Italy and France to exchange capabilities related to Earth observation.

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



Photo: Leonardo



Italian COSMO-SkyMed 2nd Generation satellite SAR image of Genoa airport

Lt.Gen. Falsaperla: As mentioned, international cooperation in the military procurement sector has always been of crucial importance to the Secretariat General, both in European, NATO and multilateral contexts. In this regard, I would like to mention that Italy is one of the founding members of OCCAR (Organisation Conjointe de Coopération en matière d'Armement), an international organisation mainly dealing with the "through-life management" of cooperative programmes concerning defence equipment, standing out as a reference model and a centre of excellence in this sector. Among the programmes currently managed by OCCAR, the FSAF (Future Surface-Air Family) programme includes the following surface-to-air missile systems, land and naval respectively:

- SAMP / T (System Sol-Air Moyenne-Portée / Terrestre) for the Italian Army, developed and produced jointly with France;
- SAAM (System surface Air Anti Missile) for the Italian and French Navies, developed and produced jointly with France;
- PAAMS (Principal Anti Air Missile System) for the IT, UK and FR Navies, developed and produced jointly with France and the UK.

All three systems share the ASTER ammunition, jointly developed and manufactured by IT, UK and FR. The programme has been managed by OCCAR since 2012. The FREMM programme is the most ambitious and innovative among European naval defence projects. These multi-role frigates, designed to meet the needs of the French and Italian Navies over their

entire life-cycle in a changing environment, will set new standards for design and construction costs.

The LSS - Logistic Support Ship project - includes the development and production of five ships for Italy and France, together with in-service support. The ships have been designed with enhanced "dual-use" features, supporting both military operations and civilian rescue operations. The EURO-MALE RPAS (Medium Altitude Long Endurance - Remotely Piloted Aircraft System), supported by IT, FR, ES and DE, was integrated into OCCAR in 2016 and will be used all over the world as

a special support to ISTAR (Intelligence, Surveillance, Target Acquisition and Reconnaissance) missions.

Moreover, as already mentioned, the MUSIS-CIL (MULTinational Space-based Imaging System-Common Interoperability Layer) project is being carried out in cooperation between France and Italy.

Another multinational programme assigned to OCCAR for management aspects is ESSOR (European Secure Software Defined Radio). It is a cooperation between six nations (ES, FI, FR, IT, PL and SW) and aims at the development of a common European Software Defined Radio architecture, based on the American Software Communications Architecture (SCA); it also includes security aspects and, the development of a broadband waveform which is proposed to be a standard in the NATO context. From an industrial point of view, the programme has been awarded to a specifically formed consortium, called "a4ESSOR SAS", formed by companies from the six participating countries (INDRA (ES), BITTIUM (FI), THALES (FR), LEONARDO (IT), RADMOR (PL) and SAAB (SW).

Other international programmes include the NH90, managed by the NATO Agency NAHEMO (NATO Helicopter for the 1990s Design and Development, Production and Logistics Management Organization) founded by IT, FR, DE, PT (which left the programme in 2014), NL, BE, and further extended to another six nations ("Community Nations"): SW, FI, NO, AUS, NZL, and ES.

Photo: CIO



CIO's 8x8 AIFV for the Italian Army and its embarked team of soldiers



Another example of cooperation is the F-35 Lightning II / Joint Strike Fighter (JSF) programme, a so-called 5th generation aircraft developed and manufactured by Lockheed Martin (USA), involving the participation of USA, UK, IT, NL, CAN, AUS, NO, and DK. The EF2000 and TORNADO programmes are also managed internationally, within the NETMA organisation.

I will finally mention the METEOR missile programme, managed by a programme office (IJPO) based in Bristol (UK).

As regards public-private partnerships, this is new territory that we are certainly keen to explore; at the moment, only minor programmes are managed in this way, but there will undoubtedly be important developments in the near future.

ESD: Is the Italian law on G2G - as modified in 2019 - able to support the national Italian industry and interests in the export domain or do you see a need for further modifications?

Lt.Gen. Falsaperla: The latest changes to the national law on G2G have expanded the range of opportunities to support the export of Italian defence materiel, thus, completing the previous legislation which allowed the defence sector, and the Secretariat General in particular, to facilitate and support ongoing and future commercial negotiations with countries that might be interested in purchasing systems produced by Italian companies. In fact, it is important for those companies to be successful on the international market in order to consolidate their production capabilities and continue to invest adequately in R&D. In this respect, the recently introduced possibility to act as a contractual agency towards a foreign state not only expands the defence sector's range of action in the context of international cooperation with friendly and allied states, but also enhances the effectiveness of governmental support to the industry, providing a full range of solutions to the advantage of the competitiveness of national commercial offers. To complete the regulatory framework in this sector, studies are taking place to identify any changes to the rules governing the detailed execution and implementation methods for the formalisation of a G2G agreement.

ESD: To what extent is the Italian defence industrial base capable of responding to the material requirements of the Italian Armed Forces? Are there areas where you have to rely on foreign contractors?

Lt.Gen. Falsaperla: Are there any materiel requirements of the Italian Armed



Photo: via author

The sail training ship AMERIGO VESPUCCI right next to the new FREMM frigate VESPUCCI



Photo: Italian Air Force

Italian Air Force EUROFIGHTER TYPHOON participating in exercise RED FLAG 2020

Forces that constitute long-term future challenges for your organisation?

The Italian Aerospace, Defence and Security Industry, including Large, Small and Medium-sized Enterprises, guarantees a high level of capability and sovereignty for the military in terms of know-how, production capacity and innovation. It also ensures the necessary Security of Supply, guaranteeing to the Armed Forces the availability of most weapon systems, materiel and services necessary for the accomplishment of their missions. Direct production by the national industry is suitably accompanied by a stratified and multi-faceted cooperation activity at an

international level, which – involving allied and friendly states, as well as their relevant industrial capabilities – creates productive synergies and technological collaboration of clear value and mutual benefit. In this context, the role of the Secretariat is to further enhance the Italian industrial and technological base, which boasts impressive results in terms of centres of excellence, research and development capacities, product portfolio, as well as size of the production system and employment rates.

The interview was conducted by Luca Peruzzi.



The Italian Defence Industrial Base

Carlo Festucci

The AIAD was founded in 1946 as the Association of Aeronautical Industries (AIA). With the advent of space activities, it subsequently changed its name to the Association of Aerospace Industries. In 1997, with the integration of the Grouping of Industries to Advanced Technology for Defence and the Defence and Space division of the National Federation of Electrotechnical and Electronic Enterprises, it included all major companies operating in the naval, military and land sectors.

In March 2009, AIAD became a Federation and is today known as the National Organisation of Italian Companies for Aerospace, Defence and Security; it boasts a large number of members which produce an annual turnover of €16.2Bn and employs over 50,000 employees (2019 figures). Leonardo and the different divisions cover about 85% of this total, however 75% of the federated companies are considered as Small and Medium Enterprises (SME).

AIAD maintains a close relationship with bodies and institutions representing their interests, at the national, European, and global level. It drafts and submits reports and industrial positions to the various Italian government departments; its ability to monitor and coordinate - which makes use of the experience and knowledge made available by an increasingly wide range of companies distributed throughout the country - has allowed it to consol-

Foto: AIAD



Guido Crosetto has been the President of AIAD since September 2014

Foto: AIAD



ordinating jointly with the General Secretariat of Defence and ICE (Italian Trade Promotion Agency), together with the Italian Space Agency. With this approach, the overall participation of national industries and a wide-ranging programme of bilateral meetings designed to explore and facilitate all possible cooperation between Italian companies and those of other countries is taken care of.

In recent years, the Federation has acted as co-organiser of SEAFUTURE, which will be held for the seventh time this year (14-17 June 2021). SEAFUTURE is an international event and business convention for maritime and dual-use technologies, unique in the Mediterranean basin since it is held within a naval base, and at the hub of the Mediterranean Sea for the Blue Economy.

The aerospace, defence and security sector is an extremely strategic area for the country. While on the one hand, Italy is provided with fundamental tools and capabilities for the defence of the national interest, on the other hand, it represents a valuable tool of geopolitical influence, able to increase the country's weight globally. Added to this is the economic contribution; the sector is worth €16.2Bn (less than 1% of GDP but much more significant [+14%] in terms of its positive contribution to the country's trade balance), and 15% of the value of the entire sector in Europe; 70% of this value goes to exports. In this regard, Italy ranks sixth in the world in terms of the cumulative value of defence equipment and technology exports over the 2009-2018 period.

Author

Carlo Festucci is the Secretary General of AIAD.



idate a solid image of authority, reliability and respect for its institutional mandate. Representing Italian industry, it is a member of the equivalent European Association ASD (AeroSpace and Defence Industries Association of Europe); the activity carried out within NATO, through the NIAG (NATO Industrial Advisory Group), is also very significant.

As part of its research and innovation activities, AIAD has established and coordinates three technological platforms for Aeronautics (ACARE-Italy), Space (SPIN-IT) and Security (SERIT). It is a founding member of the National Aerospace Technology Cluster (CTNA), whose membership includes all the national Technological and Industrial Districts of Aerospace competence.

AIAD conducts intensive and significant business abroad in support of its internationalisation efforts. It does so by co-



Aircraft

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We build aircraft designed around crews who will use them for training, defence, tactical transport and surveillance purposes. We also participate in some of the most advanced international programmes like the Eurofighter TYPHOON and F-35 JSF. Our wide portfolio satisfies all customer requirements, from full basic to lead-in fighter training, to complex defence and peace enforcing operations; from battlefield airlift to humanitarian support in demanding conditions; from command & control to intelligence, and surveillance & reconnaissance over both sea and land.

We provide airborne solutions that range from components through to full ISR/ISTAR, airborne sensors and effectors that operate across the full electromagnetic spectrum from DC to Light (and beyond into UV). Our systems are based on integrated and agnostic architecture, capable of operating on any platform and with any onboard equipment. We are a world leader in airborne radar applications and have extensive expertise in advanced long-range electro-optical surveillance and targeting systems, RF sensors, electronic warfare systems, and anti-submarine warfare systems.

With a long history of experience and know-how, we partner with major com-

mercial airline manufacturers to design, build, test and integrate conventional and composite structures and components. Our highly automated facilities are specialised in manufacturing large and complex structures. We manufacture large and complex carbon fibre structures built with unique and innovative technologies. With tactical rotary and fixed wing, optionally piloted Rotary Unmanned Air Systems (RUAS), aerial targets, and as a key partner in all major European Unmanned Combat Aerial Vehicles (UCAV) and Medium-Altitude Long-Endurance (MALE) unmanned aerial vehicle initiatives, we are at the forefront of autonomous flight. Furthermore, the industrial collaboration between Italy and the Czech Republic stands out in the field of aircraft propulsion.

The Space Industry

The space industry in Italy is comprised of a few Large System Integrators (LSIs), able to assemble complex systems (satellite or launching systems) and a wide community of SMEs, connected to each other through a complex network of relationships. The space sector is a high technology strategic domain where Italy plays a leading role because it is one of only a limited number of countries worldwide able to count on a fully equipped supply chain of products, expertise and services. This Italian position is made possible thanks to the high technological content, the wide range of dual-use applications (civil and military) and a strong, beneficial relationship between Research and Enterprises.

From an economics point of view, the Italian space sector is constantly growing: in 2017, there were approximately 200 Italian companies involved (80% are

SMEs with a high percentage of micro-enterprises), of which 100 have "space" as their core business. The total turnover in 2017 was around €2Bn, placing Italy in third position in Europe after Germany and France. In 2017, the economic return for each Euro invested was four Euros. The total amount of employees in this sector is today roughly 6,000 with an increase in the number of workers over the last three years of more than 3%.

The Naval Domain

The international setting and the Italian industries championing the naval domain and underwater technology, enable us to proudly state that Italian companies enjoy globally recognised excellence. The Italian defence and security industrial capability and knowledge does not have an equal in terms of tradition, completeness/inclusiveness and technological and innovation excellence.

The Italian industrial segment is able to provide the widest range of components to meet the most demanding requirements, but also global solutions inspired by potential for tomorrow's challenges. And this includes a comprehensive integration capability, ranging from platform, equipment, weapon systems, to technological and innovative solutions. A broad overview of the Italian naval/underwater capabilities represented by AIAD needs to mention the following actors:

- The main Italian corporations, which are leaders in underwater equipment, torpedoes, acoustic technology, builders of modern submarines and shipyards globally.. They are experienced and cooperate with local partners in the transfer of technology. The tradition of international cooperation of



IVECO Defence Vehicles is one of Italy's most prominent defence contractors.



Foto: Fincantieri

**Fincantieri is among the world's largest shipyards.**

these major Italian corporations has left a positive legacy in several countries and has generated mutual benefits to the armed forces involved, to the Italian and End User supply chains and to the innovation hubs and universities participating in these programmes.

- The leading facilities and Italian companies which specialise in equipment for surface vessels, underwater and unmanned vehicles and providing ITAR-free solutions, also excel in the realm of electronic warfare.
- I have to mention the unique Italian manufacturer of compact submarines, recently selected by the Italian Navy for its innovative technology dedicated to submarine rescue.
- There are many more niches of excellence in Italian SMEs: they continuously release studies, projects, developments and updates in the naval and underwater domains, from personal diving equipment to mine warfare, to survey and environmental monitoring.

The synergy between SMEs and the national corporations allow the Italian defence and security industry to play a key role in an extremely diversified operational context, such as deep diving, protection of coastal installations, seabed resident equipment, solutions for Special Forces and vehicles for amphibious forces, with an important overlap and exchange of experience with dual-use and commercial applications.

The pandemic crisis has affected all sectors of the economy, including the defence industry, but it has also shown some broader issues within the defence world. It has made us realise that defence is not only about the military, but it also consists of a country's ability to react to such emergencies. We have seen the defence industry in a different light than in the past. History has shown how the Italian Armed Forces have been engaged in front-line emergencies and in operational theatres, acquiring knowledge and skills that are universally recognised. We have seen how the Italian Armed Forces have set

up field hospitals, employ and deploy doctors and nurses, establish the first swab centre in Italy, deploy the Corps of Engineers, and take care of things that we very often forget and remember only during times of natural disasters. But we have also seen the importance of defence in the health sector. Two years ago, the defence industry was one of the few strategic and technological assets left in Italy, a country which has remained at the forefront globally of certain sectors in which Italy is the world's leading manufacturer; think of packaging machines, for example, or certain mechanical engineering parts. But from a technological point of view, if we exclude pharmaceuticals, there are very few industrial sectors left in which we are among the world's leading manufacturers and in which, when we sit down at the table with another country, we have something to offer that others do not.

It is therefore fair to add the resilience and pragmatism typical of the Italian mentality. In this particular historical moment, there have been numerous examples of how the defence and security industries have come to the rescue. They have provided not only their own means, but also their own skills and resources to design and develop products and cutting-edge solutions in extremely short timeframes (hyperbaric oxygen therapy against COVID-19, breathing apparatus, air ionizers to sanitise air and surfaces, production lines converted to produce respirators, etc.). These represent concrete examples of the extraordinary ability of Italian industry to respond promptly, effectively and to the highest standards to the most challenging requirements of their customers.

The defence sector has remained one of the few areas, in which all its different sectors are still present: aeronautics, helicopters, cyber security, land, naval and electronics. We could add two other sectors, which are not closely associated with the defence sector, but which will become increasingly important in the future: space and underwater. The space sector is now better known, the underwater sector less so. Nevertheless, it is sufficient in this respect to reflect on the fact that the telecommunications, energy resources and the exploitation of some particular subjects will be in the underwater domain in the next few years. Few people will be aware that Italy is a country that boasts probably the greatest number of underwater technologies in the world, but they are totally disconnected from each other and scattered among dozens of small and micro companies. ■

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High-End Thermal Imaging Systems

Doug Richardson

The use of electro-optical (EO) systems operating at wavelengths ranging from the visible spectrum to the infrared has dramatically grown, but is no longer the prerogative of the major nations. Night-vision hardware is readily available to the armed forces of smaller countries, and even to non-state actors.

The more complex the observation task, the greater the need for image resolution. The Elbit Systems subsidiary Opgal Optronics Industries defines detection of potential objects of interest as normally requiring two pixels - enough to show that something is there. Recognition of what that object is requires six pixels, but identification of details requires 12 pixels. Historically, thermal imaging has been limited by low resolution in comparison to visible imaging, but last two decades has seen a move to resolutions such as 1024 x 768, 1280 x 1024, and 1920 x 1576 pixels. Originally developed for military use, these high resolutions have now become available in commercial sensors. For example, as its designation of ATHENA 1920 indicates, BAE Systems Sensor Solutions is based on a 1,920 x 1,200-pixel vanadium oxide (VOx) array. This uncooled microbolometer uses 12-micron pixel technology, and has a 60 Hz frame rate. Introduced last year, it is intended for use in security, surveillance, and targeting systems.

Photo: Lockheed Martin



Suitable for installation on one of the external weapon stations of an F-16 fighter, the Lockheed Martin LEGION POD currently carries a nose-mounted passive long-wave infrared receiver, but could be modified to accommodate other types of sensor.

IRST Technology

The US is retrofitting fighters such as the Air Force's F-15 EAGLE and the Navy's F/A-18E/F SUPER HORNET with IRST (infrared search and track) systems. Part of the F/A-18E/F SUPER HORNET Block III upgrade programme, the IRST Block II introduces improved optics and processing power, and is intended to increase the pilot's situational awareness. Flight trials on the SUPER HORNET began in late 2019, and deliveries to the USN are due to begin in 2021. The original IRST Block I used components from the infrared receiver used on the F-15K/SG, which was based on the IRST car-

Photo: Lockheed Martin



These screen captures illustrate the major improvement in thermal image quality expected when the current EOTS system of the F-35 fighter (left) gives way to the new ADVANCED EOTS (right).

Author

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

ried by the now-retired F-14 TOMCAT. It never entered full-rate production, the USN having decided to focus the programme on the Block II version. This uses a passive long-wave infrared receiver of improved design, an updated processor, plus an inertial measurement unit, and environmental control unit. The infrared receiver, processor, and inertial measurement unit are housed at the front of a fuel tank carried on the aircraft's BRU-32 bomb rack.

US Air Force F-15C and F-16 fighters can be fitted with Lockheed Martin's LEGION POD sensor system. Carried on one of the aircraft's external weapon stations, this combines a passive long-wave infrared receiver, a processor, and an inertial measurement unit. It is intended to provide a weapon-quality track solution without the need for the fighter to use its nose-mounted radar. On 8 July 2020, an F-15C EAGLE used the pod in a trial in which the system was used to launch an AIM-9X missile. Under a late-2020 USAF contract, Boeing and Lockheed Martin are to upgrade existing Block I LEGION PODS carried by the F-15C with the IR receiver and processor from the USN Block II IRST version.

The Lockheed Martin ELECTRO-OPTICAL TARGETING SYSTEM (EOTS) for the F-35 LIGHTNING II is a multi-function system that provides air-to-air and air-to-surface targeting capability without compromising the aircraft's stealth characteristics. Developed to combine forward-looking infrared and IRST functionality, the EOTS is internally mounted, and observes the outside world via a sapphire window located below aircraft's nose. A high-speed fibre-



Photo: UK Ministry of Defence

A series of hardware and software upgrades has allowed the Eurofirst consortium to maintain the combat effectiveness of the PIRATE (Passive InfraRed Airborne Track Equipment) used by the Eurofighter TYPHOON.

optic interface connects the system with the aircraft's integrated central computer. Lockheed Martin is currently delivering production Lots 13-17 of EOTS, and has delivered more than 700 systems. Lot 13 is will completed this year.

The system will be replaced by ADVANCED EOTS, part of the F-35's Block 4 development. It will introduce short-wave infrared, high-definition television, an infrared marker, and improved image detector resolution. These features are intended to provide

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Photo: Leonardo



Leonardo's SKYWARD-G was developed to equip the Swedish Air Forces's GRIPEN E and F fighters. The electro-optical unit is mounted in a fairing just forward of the aircraft's cockpit canopy in order to provide an adequate forward view.

increased target-detection and recognition ranges.

A Leonardo-led "Eurofirst" consortium that includes Thales Land & Joint System and TecnoBit developed the PIRATE (Passive InfraRed Airborne Track Equipment) carried by the Eurofighter TYPHOON. Based on long-wave infrared technology, it has been progressively upgraded by hardware and software improvements since the original configuration was developed in the 1990s.

Leonardo's SKYWARD IRST was selected for use on the Royal Swedish Air Force's GRIPEN E fleet, and has been adopted by one export customer. Known export variants are the Skyward-K for an unspecified Asian customer, and the SKYWARD-AB

planned for use on an unidentified tactical UAV by a customer in the Far East.

Electro-optical targeting systems have been a feature of modern Russian fighters such as the Su-27 'Flanker' and Su-57, and similar sensors are being used on the latest generation of Chinese fighters. The EOTS-89 and EORD-31 developed for use on China's J-20 and J-31 fighters were developed by Beijing A-Star Science and Technology. Both systems were reported to be ready to begin flight-testing in 2015. According to the developers, these sensors are expected to be able to detect a B-2 at a range of 150 km, and an F-22 at more than 100 km.

In some cases, a thermal imager is used as a sensor of a short-range SAM or AAA weapon. The Aselsan ATILGAN short-range SAM

system uses a sensor suite incorporating a second-generation, two-field-of-view focal plane array thermal imager, as does the same company's ZIPKIN Pedestal-Mounted Air Defence System (PMADS). Mounted on the rear of the Poly Technologies FB-6A self-propelled anti-aircraft gun and missile (SPAAGM) system is a one-person power-operated turret armed with surface-to-air missiles and a 12.7mm machine gun. Its sensor suite teams a TV camera, a thermal camera, and a laser rangefinder.

The new and improved Almaz/Antei TOR-M2 (SA-15 GAUNTLET) and its M2E export version incorporate a thermal imaging device to supplement the system's 3D target detection radar. An upgraded version of the 2K22/2K22M TUNGUSKA (SA-19 GRISON) hybrid gun/missile vehicle incorporating a new IR tracker was shown at the 2009 Moscow Air Show. The new sensor supplements the original day-only optical gunner's sight, and can provide data for the gunner's TTA (Teletoplovizniy Avtomat) automatic target tracker.

Unmanned Vehicles

With small unmanned air vehicles and modified versions of commercially-available drones now being seen as potential threats, thermal-imaging systems are also being promoted as a method of detecting this class of threat.

For example, Skylock developed its tripod-mounted long-range detection system to use visible-light and thermal sensors to detect aircraft or UAVs. Its thermal camera uses a zoom lens of 48.5-700 mm focal length to provide fields of view ranging from 11.9° x 11.3° to 0.79° x 0.69°. According to the company, an aircraft can be detected at range of up to 20 km, a UAV at up to 10 km, and a small drone at up to 3 km.

Airborne Sensor Packages

A sensor of relatively low resolution can provide detection of drones, but target-classification must be done by an operator. A high-resolution sensor is needed if automatic target-detection and classification are required. According to Opgal, its ACCURACII XR thermal imaging system can detect a drone by day or night at ranges of several kilometres, using automatic target recognition (ATR) techniques to identify whether a potential target is a drone. The decision as to which potential target is the riskiest must be done either by an operator or by AI software, so that the camera can be used for visual identification.

Photo: Aselsan



The sensor fit mounted in the central section of the turret carried by Aselsan's ATILGAN mobile short-range SAM system includes a second-generation, two-field-of-view focal plane array thermal imager.

One problem to be faced if recreational drones of the type flown by enthusiasts are seen as a threat is that most of these are of plastic construction, and are powered by electric motors, so emit a minimal heat signature. Detection range of this class of drone could be little more than 100m.

One novel recent use for thermal imaging was a 2020 project by the US Army Rapid Equipping Force, Program Executive Office Soldier, and the C5ISR Center of US Army Combat Capabilities Development Command in response to Covid-19. A tripod-mounted infrared sensor was used at the entrance to military facilities to detect individuals with an elevated body temperature that might indicate viral infection. Since this test did not require physical contact, being conducted at a range of about two metres, it maintained a safe stand-off distance between the tester and the subject. It took only a few seconds, so helped to maintain a faster flow of personnel into buildings and facilities.

Military applications are still forcing the pace of sensor development. Used by the US military for some two decades, wide-area motion imagery (WAMI) uses cameras able to capture images of wide areas – entire towns or even cities.

In 2006, the US Defense Advanced Research Projects Agency (DARPA) funded the creation of an airborne sensor package with a resolution of almost two billion pixels. The resulting project was given the designation GORGON STARE by the USAF. The first GORGON STARE system consisted of two sensor pods. One carried the electro-optical (EO) and infrared cameras (IR), while the other housed the digital processor and data-link hardware needed to send data to operations centres and frontline units. First fielded in March 2011, the Increment 1 system could cover an area of 16 sq km. It was followed in 2014 by the follow-on GORGON STARE INCREMENT 2. This combined an array of visible-light cameras mounted in one pod with IR arrays from Exelis carried in a second pod. By 2015, INCREMENT 2 had replaced the earlier version.

In mid-2020 when Logos Technologies announced that it had won a US\$6.7M contract to deliver two wide-area motion imagery (WAMI) sensor prototypes to the US Naval Air Systems Command. This was an instance where high-resolution civilian IR sensors were adapted for military use; the company's commercial BLACKKITE IR system became the basis of the USN's CARD COUNTER sensor package for the RQ-21A BLACKJACK. It allowed a single UAV to simultaneously monitor more than 12 square km of terrain.



Photo: U.S. Air Force

A thermal imaging system provides a speedy method of monitoring the body temperature of soldiers entering a building. This novel method of detecting increased body temperature was devised by the Program Executive Office Soldier at Fort Belvoir, Virginia.



Photo: U.S. Air Force

An MQ-9 REAPER equipped with GORGON STARE takes off at Kandahar Airfield, Afghanistan, in December 2015.

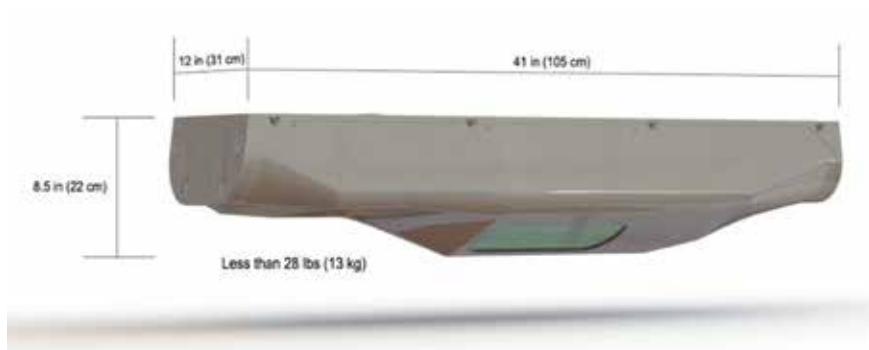


Photo: Logos Technologies

Developed by Logos Technologies as a payload for the Insitu INTEGRATOR UAV, the BLACKKITE-I infrared sensor system can monitor a city-sized area in near real-time, detecting and tracking all significant movers in the scene. It forms the basis of the USN's CARD COUNTER sensor package for the RQ-21A BLACKJACK.

Autonomous Ground Vehicles

One problem faced by developers of autonomous and semi-autonomous ground vehicles is that these require active illumination if they are to navigate at night, or inside tunnels, or within darkened buildings. In the spring of 2020, DARPA asked industry to help with the development of computationally intensive 3D infrared sensors able to exploit triangulation and ambient signals in thermal images in order to create to create passive sensors suitable for use in unmanned vehicles travelling at speeds of up to 40 km/hr.

Known as the INVISIBLE HEADLIGHTS project, this is intended to exploit artefacts in the scene that previously might have been considered clutter. According to DARPA, "An ideal sensor might be able to extract many orders of magnitude more data about the environment than is attainable using conventional infrared sensors. Enabling passive 3D vision for autonomous navigation will require near-zero noise and orders of magnitude greater measurement diversity than conventional sensors -- particularly at high speeds. More than likely this will require completely new types of infrared sensors."

During real-world military actions, the performance of EO sensors is often degraded both by natural phenomena such as poor light, glare from strong energy sources, and fog, as well as by deliberately-generated smoke or other obscurants. The latter can include infrared smokes designed to provide high obscuration at LWIR. The European Defense Agency (EDA) has launched the SPIDVE (Study on EO Sensors Performance Improvement in Degraded Visual Environment) programme to study the effects on EO sensors of such adverse visual conditions. It is conducting an assessment of the problem, and investigating the most promising technologies for image enhancement under Degraded Visual Environment (DVE) conditions. The goal is to restore partially or even fully the imaging capabilities of EO sensors when degradation is present.

In the mid-1990s, a Russian night-vision specialist told this writer that in an ideal world, the individual soldier would like to have an optical aid that works in the reverse of sunglasses, boosting rather than attenuating the light levels of an external scene. Needless to say, the soldier would also like such a device to be no bulkier or heavier than sunglasses.

Over quarter of a century later, such a specification may seem like something from the realm of science fiction rather being a realistic military requirement, but as the text of this article was being finalised, DARPA issued a Broad Agency Announcement for what it described as "Enhanced Night Vision in eyeglass form factors (ENVision)". This document expresses interest in hardware that will offer "extended visual access beyond NIR to include short-wave (SWIR, 1.5-3 μm), mid-wave (MWIR, 3-5 μm), or long-wave infrared (LWIR, 8-12 μm) through a common aperture", along with an "expanded FOV to near natural eyesight (100°)". ENVision plans to explore the possibility of achieving direct vision of the infrared through a process known as photon upconversion. This could eliminate the need for multiple components and could eventually lead to all-optical night vision (NV) systems in the future. These could take the form of NV spectacles or even NV contact lenses. Current plans seem to be focussed on supplementing or even replacing the image-intensifying goggles used by front-line soldiers, but in the longer term, the proposed all-optical systems might serve some of the roles currently filled by thermal-imaging sensors. ■

Marketing Report: Bren-Tronics, Inc.



Bren-Tronics is pushing the boundaries of lithium technology to satisfy the diverse demand of tomorrow's Defense requirements.

Bren-Tronics has cumulated over 45 years of experience in the design, production and management of complex and intelligent rechargeable batteries for diversified military applications. Always at the state of art, the company continues to innovate to provide the perfect match between power, energy and safety for the growing diversified demands and applications.

In addition to Bren-Tronics core legacy power solutions for tactical radio, optronics and

electronic warfare, the company is also able to design and supply lithium-based batteries for military systems as diversify as micro-drones, UAVs, UGVs or laser weapon.

These new military applications need a mix of high voltage, high current, low weight and enhanced autonomy to perform well. Thanks to his know how and unique technology Bren-Tronics can satisfy the increasing defense system manufacturer demands for this type of challenging battery.

Bren-Tronics recently won a major contract to provide hundreds of high voltage lithium technology batteries of several hundreds of kWh for a laser weapon system. The battery underwent extreme safety and rigorous military standards tests.

The company also secures multi million dollars contract to deliver thousands of batteries and chargers to a Near and Middle East customer. The application, kept secret, uses new Bren-Tronics extremely safe lithium-ion cells technology and complex battery management system to operate the system remotely from almost any location and conditions.

"From our know-how, long experience and unique technology, we are able to respond and fulfill any future military energy demand " said Mathyas Petit, Director of International Business Development.

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Connectors for Harsh Environments

Tim Guest

This article looks at some of the industry players specialising in connector design and development, highlighting certain performance parameters and the kinds of tests required for a new connector to make the grade and takes a look at a handful of the rugged military connectors on offer and in use among European/NATO forces.

Reliable connectivity on today's battlefield is essential and the humble connector plays a vital role in ensuring mission-critical equipment stays operational in even the harshest scenarios. Radios, situational awareness sensors, vehicle comms harnesses, individual soldier systems and much more, all share

thing other than harsh would be foolhardy in the extreme. And it's those scenarios of mud, sand, dirt, vibration, shock, water, catastrophic impacts and more – including the need to be soldier-proof – that place an unenviable burden on military connectors to be as rugged and near-indestructible as possible, even in the harsh-

Tested to Stringent Parameters and Standards

No matter the vendor, whether the likes of Amphenol, Fischer, Glenair, ODU, TE Connectivity (TE) and others, to be deemed suitable for military applications a connector will be put through a



The UltiMate 80's MIL-STD-810 and MIL-STD-202-compliant design is able to endure harsh environmental and mechanical extremes and is designed to distribute power for dismounted soldiers' batteries, hubs, radios, embedded electronic devices and wearables.

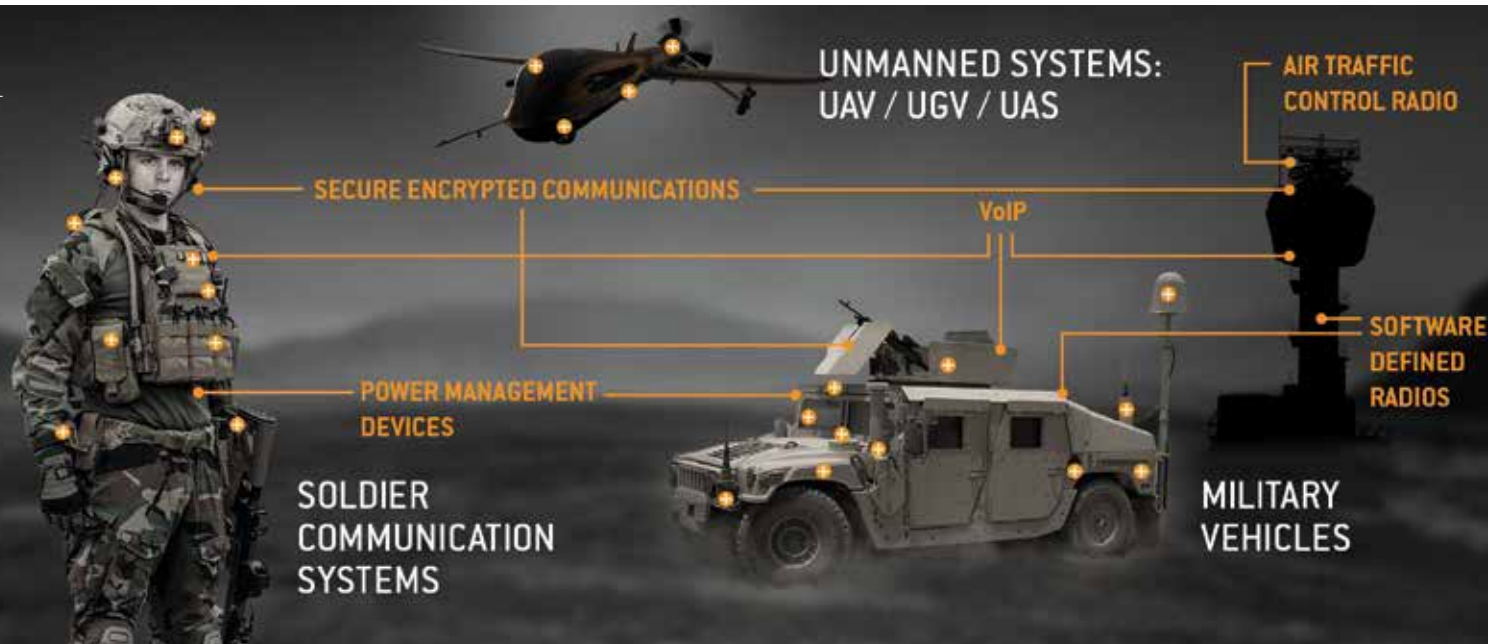


Vibration lab tests on the Series 151 MIL-DTL-55116 reproduce conditions that might be encountered in a moving armoured vehicle. In temperature cycling tests, the Glenair Series 151 MIL-DTL-55116 must be capable of five cycles of mating/unmating while meeting all electrical and air leakage requirements in conditions from -55°C to +85°C.

the need, as mission-critical, electronic equipment, for reliable connectivity. Playing their part in these connectivity stakes are a huge variety of connectors; seemingly insignificant bits of kit, connectors are anything but. They connect some of the most essential sensors and operational systems into the increasingly connected battlefield ecosystem and the successful prosecution of warfare relies heavily on their flawless performance; the failure of a connector could, potentially, spell disaster at the most critical moments. While there are undoubtedly many non-operational scenarios that do not fall into the 'harsh-environment' category, to describe the 'operational military environment' as any-

est of environments. It is no wonder, then, that these crucial components of warfare have been designed to the n^{th} degree to weather such extremes and to meet the most stringent MIL STDs. Today, through rigorous testing, a variety of established, specialist makers ensure their connectors meet the demands of modern warfare. This article looks at some of the industry players specialising in connector design and development, highlighting certain performance parameters and the kinds of tests required for a new connector to make the grade and takes a look at a handful of the rugged military connectors on offer and in use among European/NATO forces.

series of tests to meet relevant military standards and prove performance under the toughest conditions. According to a Fischer Connector's spokesperson talking to ESD, "The only way to ensure innovative solutions are suited to applications requiring faultless precision and high performance in harsh environments – and that they're built to last – is to put connectors through a battery of mechanical and environmental tests. These may include: endurance - number of mating operations and full rotations; bending/flexing - number of oscillations; random vibration – acceleration; immersion, e.g. IP68, sealed to 20m for 24 hours; corrosion resistance, e.g. in salt



ODU offers military connectors that can withstand harsh environmental conditions and are in use with a number of NATO forces. These high-speed, high-density connectors suit soldier communication systems, military vehicles and unmanned systems (UAV/UGV/UAS), as well as power management device applications, software defined and air traffic control radio applications, secure and encrypted communications, VoIP, computer/PAN and data recording devices.

fog and salt solution; temperature performance, e.g. from -55°C to +135°C. In the case of the Fischer LP360 7-pin connector, the first product in the Fischer Freedom Series, eight tests and proofs for endurance, oscillation, vibration, immersion, sealing, cleaning, corrosion, and temperature, put this product through its paces at Fischer's labs and in the field. The resulting rugged, lightweight LP360 suits dismounted soldier systems as part of a wearable connectivity solution; with a low-profile, it offers 360° mating freedom to optimize cable management, allowing easy integration into clothing and can be mated, routed and plugged in any direction, ensuring

cables can go straight to a device/sensor (e.g. NVG) with minimal twists and turns.

Glenair, likewise, puts its connectors through stringent performance tests highlighted by those for its Series 151 MIL-DTL-55116 QPL Audio Frequency Connectors. These tests illustrate well, the exacting testing regimes all MIL-STD connectors are put through, and it's worth looking at them in greater detail. To meet mating durability, for example, the 55116 connector must go through 3,000 cycles without mechanical damage to its dielectric, and without compromising contact resistance and air pressure requirements (tested sepa-

ately). Contact retention tests require individual contacts to withstand a sustained force of least 10 pounds of axial load, applied uniformly, at one pound per second; a further retention test, the pull test, on the other hand, requires the connector to withstand an abrupt axial force of 40 lbs applied to the shell, while another abrupt force of 25 lbs is applied to the cable. Neither test must cause visible damage and the complete connector must continue to lock and unlock without difficulty.

Vibration lab tests on the Series 151 MIL-DTL-55116, (the tests conform to MIL-STD-202G, method 201A and reproduce conditions that might be encountered in, say, a moving armoured vehicle), subject it to a simple harmonic motion, whose amplitudes and frequencies are known and varied during the test. Amplitude and frequency ranges are reached over a short duration, around a minute, then continually repeated; the whole test conducted in each of three perpendicular directions over two hours. When complete, connectors must show no evidence of cracking, breaking or loosening of parts, and male and female ends remain engaged.

When it comes to temperature extremes, no scenarios place greater consistent ambient temperature demands on equipment than Arctic and Desert conditions. Here, thermal contraction and expansion of metal would, respectively, play havoc if the metallurgical design/nature of a con-

Photo: ODU



ODU recently introduced a new additional locking kit for the Easy-Clean version of its ODU AMC Connector. This enables screw locking in addition to the connector's original break-away function making this connector highly suited to applications in high-vibration scenarios, such as vehicle-mounted radio installations where data and signal links need serious protection.



FISCHER ULTIMATE™ SERIES

Photo:
Fischer Connectors



NEW

The UltiMate 80's rugged 6-pin plug is lightweight and environmentally sealed, offering a connectivity solution for any soldier-worn device.

connector were unfit for purpose. 'Temperature cycling' tests, therefore, put these products through their paces. In the case of the Glenair Series 151 MIL-DTL-55116, it must be capable of five cycles of mating/unmating while meeting all electrical and air leakage requirements in conditions from -55°C to +85°C. This test conforms to MIL-STD-202, method 107, test condition A.

This connector is also tested for resistance to salt spray, (conforming to MIL-STD-202, method 101E, test condition B), and is subjected to eight hours in a 5% salt solution at 35°C ± 3°C, after which it must show no evidence of base metal corrosion. Resistance to water immersion is also tested for Glenair's 55116, and carried out when connected with test cables, and when plugs are mated to receptacles. After immersion in tap water, at a depth of six feet for 48 hours, there must be no evidence of leakage into the body of unmated connectors, nor into the body, or contact-face area, of mated connectors.

Ready for Harsh Environments

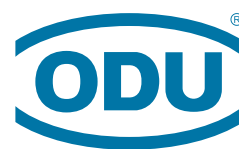
When Fischer's UltiMate Series, intended for field operations in extreme environments, added two power configurations a few years back, their suitability for 'full integration into all applications', such as with field radios, UAVs, radar and surveillance systems to optimize power connectivity, was underpinned by their rugged performance characteristics. Tested and proven suitable to meet IP68/69/hermetic sealing standards, with 360° EMC shielding, the new connectors are able to

withstand high levels of shock, vibration, corrosion, extreme temperatures, and 10,000 mating cycles.

Now, a further UltiMate Series connector, the UltiMate 80, (formally introduced at AUSA 2020 last October), is field-ready for unveiling to a European audience for the first time by ESD, offering rugged functionality compatible with NATO STANAG 4695. Fischer says this rugged 6-pin plug is lightweight and environmentally sealed offering a connectivity solution for any soldier-worn device/sensor/equipment and personal electronic ecosystem used by NATO armies in their soldier modernization programmes. The UltiMate 80's MIL-STD-810 and MIL-STD-202-compliant design is said by Fisher to be 'exceptionally rugged by any market standards'. It is able to operate and endure the harshest environmental and mechanical extremes endured by dismounts themselves and is designed to distribute power for dismounted soldiers' batteries, hubs, radios, embedded electronic devices and wearables. The connector displays high resistance to corrosion, being able to withstand 500 hours in a salt mist; it performs 10,000 mating cycles and can withstand a 100G shock resistance test. Its temperature cycle tolerance has been tested between -55°C and +135°C. This new connector is environmentally sealed and displays connector ingress protection, both mated and unmated, compliant with IP68 sealing, at 2m for 24hours.

A Legacy Connection

Back in the 1950s, the US Navy and Air Force competed to develop product specs for electronic components to be used in fighter aircraft. From this emerged a new breed of connectors appropriate for use in a much wider military context. Three products resulting from those 1950s' competitions have stood the test of time and are still proving invaluable today among NATO forces: TE's legacy line of DEUTSCH circular connectors M81511, MIL-DTL 26482 series 2, and MIL-DTL 83723 series 3; these have consistently delivered rugged, reliable connectivity in the harshest scenarios even as technology has evolved. These legacy connectors have enabled engineers to achieve high-performance operating efficiencies and improvements in cannot-fail applications, where preventing disruption, delays and unacceptable connectivity failures, that could impact mission-critical applications, has been the highest priority. ■



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The Internet of Military Things – Too Much Information?

Thomas Withington

People are talking about the Internet of Military Things.

What is it, how will it work and will we know when it has arrived?

The Internet of Things is a “commercial effort to integrate a wide variety of technical and commercial information-gathering components to provide new business opportunities based upon device and systems intelligence,” noted a report entitled *The Internet of Things for Defence*, published by Wind River. What then is the Internet of Military Things (IOMT)? “There is no universal definition,” says a spokesperson for the European Defence Agency (EDA), the European Union (EU) organisation coordinating defence collaboration across the EU’s member states.

That said, the EDA defines it as “a military capability to connect, manage and extract information from a huge number of different military data sources or sensors interconnected by a network infrastructure that could be civil or military but specifically directed and adapted to military applications.” Put simply, the sensors equipping platforms, personnel and deployed individually will be able to share information they gather across the battlespace in real time. Not only will they share this data they will also share health and usage information. This could range from an unattended radar warning when its batteries need replacing, to a soldier’s heartbeat and temperature revealing when they are approaching exhaustion or suffering hypothermia.

Network Centric Warfare

The march towards the IOMT is arguably an evolution of the Network Centric Warfare (NCW) revolution witnessed in the 1990s in the wake of the US-led Operation Desert Storm of 1991 to evict Iraq from Kuwait. The NCW was about fostering a high level of connectivity between personnel, platforms and installations using digital voice and data

Photo: Lockheed Martin



Defence experts believe that the information gathered and shared across the IOMT will play an important role in helping reduce the Clausewitzian Fog of War.

communications. Dr. Stephen Russell, Chief of the Information Sciences Division at the US Army Research Laboratory (ARL), argues that NCW “had a much greater emphasis on information and information-systems being purposed and prioritised for military applications.” The IOMT “is the next evolution of that,” he says. Although founded in NCW concepts, the EDA spokesperson argues, it focuses “mainly on sensor connectivity and data management, processing, storage and exploitation.”

Thus, not only are platforms, personnel and installations connected, but their weapons and sensors are too. The IOMT also forms part of the Multi-Domain Operations (MDO) trend. Definitions differ, but broadly speaking MDO emphasises the ever-deeper connection of personnel, platforms, subsystems, bases, sensors and weapons (participants) to provide supreme situational awareness across the battlespace without information saturation to facilitate all-domain manoeuvre. It is not unreasonable to argue that true MDO is but a pipe dream without the IOMT. Dr. Russell says that one can use industrial development as a model to understand how

connectivity has developed and deepened in the military sphere: “In the 1980s and 1990’s industry’s emphasis was on collecting and storing information so that this can be applied to business decision-making.” With these collection and storage mechanisms firmly established, by the 2000s industry was focusing on “automating and capitalising on this information, and on using it in much more complex, autonomous, and dynamic ways.” Compared to network centric warfare, the IOMT “is about the collective intelligence of all the smart assets acting in an integrated fashion to fluidly achieve complex military objectives,” says Dr. Russell: “It is that ‘collective intelligence’ characteristic that is particularly distinguishing for the IOMT.”

The bulk of battlespace participants have hitherto largely been ‘stove-piped’; they correspond with their user by providing them information and/or data on their status which is shared in a limited fashion across standard military communications. Dr. Russell says that the humble telephone is a good example of the contribution to warfighting the IOMT could make. The standard house-

Author

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

hold telephone and early cell phones had a single purpose; to connect two people who wanted to talk to each other. That is the phone's single purpose "and is separate from pretty much everything else, except the person on the other end of the wire." Consider today's ubiquitous smartphone. The handset is still a telephone, but through software applications it connects the user to a host of different possibilities, from ordering up a delicious chicken katsu curry to checking the latest cricket scores: "Imagine a battlefield where most, if not all, the systems can communicate, have awareness of their environment, can intelligently adapt for varied purposes, and understand both local and global objectives that may even cross organisational boundaries," posits Dr. Russell. Lorenz Lehmhaus, a defence consultant and owner of Defense Valley, believes that the IOMT will bring "complete battlefield transparency" expecting that it will help lift the Clausewitzian 'Fog of War'.

Application Forms

To this end, the IOMT has been muted for a myriad of applications. Most conspicuous is soldier healthcare. Millions of us are familiar with fitness monitors we wear on our wrists.



Photo: US DoD

The increasingly routine use of uninhabited vehicles on the battlefield will greatly benefit from the advent of the IOMT and the levels of connectivity that this will bring.

These constantly monitor our vital signs and gently admonishing us when we fail to achieve our 10,000 daily steps. Outfitting soldiers with sensors monitoring their vital signs and sharing this information with their comrades, commanders and medics could be the difference between life and death. A squad commander could receive warnings on their tablet computer or smartphone that one of their soldiers has dangerously high blood pressure and a rising temperature, warning of imminent heatstroke. The commander can remind them to drink enough water and tell them to rest in the shade for a while. In the worst-case scenario, medics en route to evacuate a wounded soldier will receive continuous real time information on

the soldier's condition. Based on that information, they can advise their comrades on what first aid to give and prepare their treatment for when they arrive at the scene. A similar approach is being taken vis-à-vis materiel. The space age saw telemetry harnessed for space flight. Spacecraft would continually send information on their key systems by RF (Radio Frequency) link back to controllers on the ground. Today, airliners continually transmit Health and Usage Monitoring (HUM) data back to the ground so that airlines can see how their aircraft are performing and when corrective or preventative maintenance may be needed. HUM systems used by platforms, sensors and weapons will similarly allow maintainers to keep track of their charges.



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There is unlikely to be a 'big bang' moment when the IOMT arrives on the battlefield. Instead, technologies underpinning the internet of military things are likely to enter operational service incrementally over the coming years.

Logisticians also benefit: HUM information could tell maintainers that the gun barrel on a main battle tank will need replacing after the next 20 shots. Maintainers can use this data to order a new barrel and have it ready for when the tank returns to base.

Drowning in Data?

It is a sine qua non that security will be integral to the networks carrying IOMT data. This will include communications and transmission security for the communications hardware and algorithms constituting the physical and software layers of these networks, and cyber security to prevent these networks accepting and carrying malicious code. One can readily comprehend the chaos and destruction that could be wrought if red forces gain access to blue force IOMT networks. Furthermore, IOMT networks must be able to safely, easily and quickly accept new devices.

One major consideration for the IOMT concerns the exponential increase in data which must be moved around the battlespace. Bandwidth is already at a premium, given the quantities of data and voice traffic need-

ed to fight wars large and small. Keeping the amount of data needing to be shared to a minimum will be vital. This could be helped by edge computing where data collected by a specific device is processed at the device before being shared on a network. The miniaturisation of electronics is helping immeasurably in this regard. The oft-quoted dictum of Moore's Law which posits that the number of transistors accommodated on a single chip doubles every 18 months means that even the smallest systems, such as a soldier's heart monitor, or the engine of a micro uninhabited aerial vehicle can potentially accommodate powerful computer processors gathering and processing the data needing to be shared across an IOMT network.

It may be possible to reduce the burden on conventional military communications to handle this volume of data by harnessing new approaches. The emergence of so-called fifth generation (5G) wireless communications holds promise. 5G promises a step change in data carriage boasting speeds of up to ten gigabits per second, according to some assessments, compared to the maximum of 100 megabits-per-second achievable with existing 4G wireless standards. Latency will

also be reduced. 4G can suffer delays of circa 20 milliseconds, which could reduce to five milliseconds with 5G. Fifth generation wireless will use frequencies of 400 megahertz/MHz to 3.4 gigahertz/GHz (low band), 2.4GHz to 4.2GHz (mid band) and 24GHz to 72GHz (millimetric wave). Some of these 5G frequencies already fall within standard very and ultra high frequency wavebands of 300MHz to three gigahertz. However, millimetric wave frequencies are in the upper part of the radio spectrum. These could host 5G line-of-sight networks to share IOMT data. 5G transmitters using these frequencies have the asset of being physically small, typically under 15 millimetres in size, meaning that transmitters could be fitted to the smallest of items of equipment. The EDA sees millimetric wave communications, together with avant-garde approaches to connectivity like optical and laser-based communications, showing promise while recognising that "several of the innovations brought by 5G could be used with adaptation to military requirements."

"Bandwidth demands are a common question" regarding the IOMT says Dr. Russell: "Many people tend to think of bandwidth from a purely capacity perspective, it's not." He says that one must remember that the IOMT is a dynamically composed common environment: A battlefield is not like village, it is always changing and moving, participants maybe entering an IOMT network, while others maybe leaving because of deployment or attrition. Moreover, the IOMT network is being used to support a specific objective, such as air-land manoeuvre to occupy an airfield in support of the commander's intent. Dr. Russell says that the IOMT network can be orchestrated with these considerations in mind, and employ techniques like data compression, adaptation, data usage management and network architecture according to the mission in hand and the operating environment: "The reality for the IOMT is all of these considerations will be in play and ideally autonomously optimised dynamically for mission requirements."

Are We There Yet?

One could be forgiven for thinking that the IOMT is some years away but "IOMT technology is already here and has been, for some time. Consider the advent of smart weapons and uninhabited vehicles," argues Dr. Russell. Mr. Lehmhaus agrees: "I assume we will never know the moment when the IOMT is a reality on the battlefield as the integration of technology is a continuous process." Moves are afoot to translate theory into practice. The ARL has teamed with several universities in Illinois, Massachusetts, California and



The IOMT will generate mind-bending amounts of data to enhance situational awareness and command and control. Technologies like cloud computing, artificial intelligence and machine learning will come to the fore helping to manage this torrent of data.

Washington DC, along with SRI International, under the Collaborative Research Alliance (CRA).

Dr. Russell says that this effort, which commenced in 2017, is developing theoretical and algorithmic scientific approaches to elements, which will underpin the IOMT. These include machine-learning safety, which focuses on detecting and communicating uncertainty in machine learning algorithms. This is essential for managing uncertainty or errors, which will inevitably crop up in IOMT software and hardware. Other areas include training sensors to detect and interpret information which maybe outside a sensor's usual focus or which may arrive in an IOMT network through atypical means. For instance, a radar may inadvertently detect weather phenomena as part of its mission to detect aircraft. This information can be shared across a network. While this radar is not usually tasked to collect weather information the data are nevertheless useful. These approaches, and the management of IOMT networks in general, will be helped in no small measure by artificial intelligence and machine learning. This will be vital as the amount of data zipping around a network may eclipse the brain's abilities to process: "Artificial intelligence algorithms and big

data and cloud solutions needed to process and analyse the information are currently available but at different levels of maturity. They are much more advanced than before but still with a strong improvement potential," says the EDA spokesperson. Like their counterparts in the USA, the EDA is involved in IOMT initiatives via their Capability Technology (CapTech) areas. These network experts across the EU looking at defence technologies of interest to member states. The EDA's Communications Information Systems and Networks (Information) CapTech runs projects like the Wireless Sensor Networks for Urban Local Areas or 'WINLAS' initiative. This looks at technologies which could help manage a large number of diverse sensors in urban operations. Similarly, CLAUDIA (Cloud Intelligence for Decision Support and Analysis) examines the application of cloud computing to collect and analyse data from a wide array of sources.

The CRA initiative is looking at collective intelligence. Dr. Russell says that this will enable "a network of assets to have self-awareness and autonomically reconfigure and react in response to adversarial battlefield conditions." He cautions that the remit of the CRA is not to develop new software and hardware, which can be directly used

to support IOMT applications. Instead, "its primary contributions are the foundational science underlying IOMT technologies." He says that these technologies could be typically developed to Technology Readiness Levels (TRLs) of two or three. According to US Department of Defence classifications, this would mean that practical applications can be considered for scientific principles which have been articulated, as per TRL-1. TRL-3 sees the start of active research and development. Dr. Russell is confident that some of the innovations and advancements developed via the CRA's work could rapidly accelerate to higher TRLs. He is confident we could see significant progress in these IOMT innovations over the coming decade. WINLAS and CLAUDIA are expected to conclude in 2023 and should reach levels between TRL-2, where the technology's concepts have been formulation to a maximum of TRL-5, where the technology has been validated in a relevant environment, according to EU definitions. Within and without the EDA there is even discussion of the Quantum IOMT where quantum mechanics is applied to the security management in an IOMT network. However, this will no doubt warrant an article in its own right. ■

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WB GROUP 



Scopes: Identification, Digitalisation and Range Superiority

André Forkert

Iron sights have been the standard for most hand weapons in the past. Only snipers were equipped with optical scopes. Even so, if optical solutions are now becoming the norm, iron sights will remain on pistols and as emergency back-up iron sights (BUIS) on nearly all weapons.

They can be available as foldable, fixed or a removable add-on. Sights with magnifications have allowed for enhanced target recognition and identification at increased ranges. The reasons are the improved hit efficiency per shot, and thus a saving in ammunition and logistical effort, and also because most ROEs (Rules of Engagement), such as with ISAF/RS, MINUSMA, EUTM, etc., make identification mandatory. Even machine guns are using scopes today. It is expected that all pistol procurements in the future will ask for OR (optical ready) weapons. For pistols, sights like the Meprolight RDS2, Aimpoint ACRO P-1, Trijicon RMR or Leupold DeltaPoint are available. Today's standard in scopes are the Trijicon 6x48 ACOG (standard for US Army and US Marine Corps), Zeiss ZO 4x30i (Bundeswehr), and the Specter OS4x LDS (UK SA80 L3)

Most of them have a fixed 4x magnification which allows for a performance of up to 600-800 metres. Often, larger magnification sights are teamed with red dot sights without a magnification like the Trijicon RMR or the Aimpoint CompM4/M5 (e.g. the French HK416 F). Alternatively, a 1x red dot can be used together with a "booster" like the Aimpoint 3X or 6XMag-1 or the EoTech G33/G45. In Israel and with several other armies and Special Forces, the Meprolight MEPRO M5 is the standard sight. Some troops require a more flexible sight with a magnification of 1-6 or 1-8x. As an example, the US Marine Corps will replace its 6x48 ACOG with the Trijicon 1-8x Variable Combat Optical Gunsight (VCOG), beginning in 2021. Another example for this range is the Kahles K16i 1-6X24 which is in use with military and police forces. For

Photo: HK



A HK416 in the United States Naval Special Warfare Development Group (DEVGRU) configuration, like used by the US Navy Seals, at Neptune Spear (the hunt for Osama bin Laden). As optics, an EOTech Holographic Hybrid Sight with an additional magnifier (or booster) is used. You can also see a laser light module at the front, a Surefire torch on the left side and the suppressor.

longer ranges, there are scopes available like the Steiner M5Xi 5-25x56 which was selected by the Hessian police for its middle range weapon HK G38 MDW. This way the shooter can engage at short ranges, as well as longer range targets with a single source. The goal is to be able to adjust quickly between higher and lower magnification to identify and engage targets at different ranges. Today's ranges for personal hand weapons are between 5 and 800 metres. Part of this standard and flexibility is the use of Picatinny rails or other mounting rails. As night fighting capabilities are also mandatory, these rails are a basic requirement for lights, lasers or thermal add-ons. The next step will be rails with integrated power sources. This is a projected requirement for the US Army Next Generation Squad Weapon (NGSW) programme. On top of

the rails, we will see more flexible mounts for red dots and their boosters. The original red dot manufacturer are offering them, as are specialised companies like W&E Platt PTY Ltd. from Australia with their Platt Flip mount or Eratac tactical mounts from Recknagel GmbH from Germany, or SPUHR from Sweden.

Russia uses the Jupiter Plant JSC 1P87/PK120 as a new but already widely used optic. This single magnification red dot sight can be used with the ZT310 3x magnifier. The presence of Picatinny rails on the receiver cover and handguard will allow the mounting of modern electro-optical sights of Russian and Western manufacture. This will include the fixture of in-line night or thermal imaging sights. Images released by the manufacturer and the Russian MoD have shown some

Author

André Forkert a former infantry officer, is Co-Editor of the German website www.soldat-und-technik.de.



Three key features make the Hensoldt SPOTTER 60 (20-60x72) the ideal instrument for the observation and identification of objects and target hit monitoring: high magnification, a 72 mm lens and a Mil-Dot reticle with continuously adjustable illumination, the size of which changes congruent with the magnification level. With the SPOTTER 45 (15-45x, shown), an excellent, optic is available for a wider range of applications.

AK-12s fitted with a 1P87 holographic sight. This non-magnified sight offers a self-illuminated reticule and wider field of view over the standard iron sights. The 1P87 can be fired with both eyes open and is night-vision compatible. Thanks to the use of optics, the new AK-12/AK-15 will be much more precise and ready for night operations. There are many images on the internet showing the new AK-rifles with EOTech XPS2/3-family sights, especially with Russian Special Forces. And the snipers of Putin's presidential guard (Presidential Security Service SBP) are using the Kahles K 6-24x56, as Serbia's Special Forces are doing.

DMR and Sniper Rifles

The Bundeswehr is using a Steiner M5Xi 5-25x56 MTC LT LPF-TreMor3 scope on its G22 A2 (Accuracy International Ltd.) and the G29 (C.G. Hanel RS9). The scope is combined with the Aimpoint Micro-T2. On the .50 BMG G82 (M82) the optic comes from Hensoldt/Carl Zeiss Optronics ZF 6-24x72. A Schmidt & Bender 1-8x24 PM II is used for the DMR G28 (HK417) Patrol configuration (1.6 kg lighter) and a Schmidt & Bender 3-20x50 PM II with the standard configuration. The DMR G27 (HK417) is using either a Zeiss ZO 4x30i RD in combination with a Carl Zeiss/Hensoldt RSA-S 1x red dot sight on top for the G27P, or a Schmidt & Bender 1.5-6x42 Short Dot for the G27. The French Army has also just ordered the Schmidt & Bender 1-8x24 PM II together with the

2,600 FN SCAR-HPR rifles and the Steiner M7Xi 2,9-20x50 LPF MSR2 for use on the HK417. According to Dr. Jörg Hennemann, Head of Marketing at Schmidt & Bender: "The 1-8x24 PM II Short Dot Dual CC is not a typical sniper riflescope. It is more a scope for a Designated Marksman Rifle (DMR). A 1-8 scope gives you also the capability to work from close distance up to several hundred metres, which is necessary in the urban area scenario." MINOX from Germany is also offering a tactical line with the ZP TAC line. Also available for example are the Minox ZP5 5-25x56 THLR Hybrid, ZP8 1-8x24, ZP5 3-15x50 or ZP5 5-25x56. The Swiss KSK is using the a PGM Hécate II with the LTE J10 F1 8-10x scope from Scrome and the French Forces are using the Steiner Optics (through Humbert SAS) M5Xi 5-25x56 LPF MSR2 on its PGM Hécate 2 in 12,7x99 mm.

Mark Lang, a sniper at the Dallas SWAT and Director of Sniper Training at the TacFlow Academy in the US adds: "Law enforcement generally is still trying to improve upon older riflescopes that have been in service for a decade or longer. Every agency is different, as is their ability to purchase new riflescopes. Typically, when a new precision rifle comes into service it will have a new riflescope, but not every agency is able to get rifles every 5-8 years, thus many police snipers are still using older riflescopes. We still see Leupold Vari-X 3s in service and they no longer manufacture those." For Mark, the most important trends at the moment are: "Continued improvement on turret locking systems that prevent unintentional movement either when stored, in transport or on operations. They do get turned and it's up to the sniper during a pre-shot checklist to ensure they are zeroed out. They also need to be durable enough for law enforcement. Thicker metal tubes and better internal components are also needed to withstand the abuse from over 8-10 years of service. Also important are glued sublet objective lenses for any riflescope that law enforcement will utilise. There are still many riflescopes even from big manufacturers who do not have this as a common practice." The Dallas SWAT just received their next generation sniper rifle - all snipers will be equipped with the Accuracy International AX Multi-Caliber in 308Win/338 Lapua Magnum, using the Nightforce ATACR 4 X16X42 scope. There are different needs for law enforcement (LE) and military (MIL) use. As standard capabilities for the next generation of riflescopes in law enforcement, Mark Lang come up with this list:

- Zero stop feature as standard for both elevation & windage turrets
- HD glass from either Japan or Germany, and not China



The Steiner M5Xi military 5-25x56 mm MSR2 is a scope with extremely high magnification, designed for long-range use, tactical and sniper rifles. It is widely used in the Bundeswehr and was recently ordered by the French forces.



The new PM II Digital line by Schmidt & Bender was developed on the basis of a specification for the optimum marksman situation. It combines the capabilities of a normal scope with the modern facilities of digital technology: The information from compatible external devices – laser distance measuring units, ballistics calculators or others – can be displayed at the touch of a button in the field of view of the marksman.



Swarovski is offering digitalised solutions such as the dS 5-25x52. The head-up display of the dS projects the essential measurement data distraction-free and in real time into the sniper's field of view.

Photo: Kalashnikov



The new opponent – AK-12 and Ak-15 – are using different Russian and western sights. In the back and forefront, you can see the EOTech XPS2/3-family sights.

- Adjustable illuminated reticle in both red and green
- Wider range of variable powered riflescopes (a low of 2 to a high of 20)
- Standard glued objective lenses to prevent lens shift due to impact for LE/MIL use
- Reticle patterns that are designed for law enforcement (military designs without a lot of clutter)
- MIL/MIL OR MOA/MOA riflescopes. We need our turrets to match our reticles. We do not need the MIL/MOA combination any longer
- Scope mounts that allow for mounting other important accessories such as mini red dots/ laser range finders, etc.
- A profile that allows common clip on night vision devices forward of the rifle-scope without impediment
- Switchview USA fold down throw lever on ocular end for positive indexing and quick power settings control.

Spotting Scopes

The standard spotting scope for the Bundeswehr is the 20–60x72 spotting scope from HENSOLDT Optronics, or just Spotter 60. It has three key features: high magnification, a 72 mm lens and a Mil-Dot reticle with continuously adjustable illumination whose size changes congruent with the magnification level. Hensoldt is also offering the smaller Spotter 45 (15–45x magnification). Also in use with the Bundeswehr is the Leica Televid Apo 20-60x77 with oblique view. Leica, Nikon and Swarovski are offering a range of high-class spotting scope, but officially only for hunting. Even if they sell to law enforcement and military agencies,

they don't want to be associated with this area. Around the world a lot of spotting scopes that come on the market for hunting can also be found for governmental use, like Optolyth, Levenhuk, Leupold, Bushnell, Vortex and many others.

From Swarovski comes the binocular BTX spotting scope set. This is intended to make long-term observation more comfortable, maintain high concentration levels and therefore lead to longer periods of use; a forehead rest is also integrated. The BTX combines the advantages of a telescope and binoculars. It is equipped with an inclined viewer and ergonomic forehead support. The spotting scopes have a fixed magnification of 30x and 35x, with the option of the 1.7x range extender they can be increased to 50x and 60x. Thanks to the bayonet lock, the extender is mounted between the objective and eyepiece modules of the ATX/STX/BTX family in no time at all. The exchange can be carried out directly by the user. An authority version with reticle and laser filter is also available. In addition, a smartphone can be attached as a camera.

Digitalisation

For some time now, Schmidt & Bender and their competitors have been working on scopes with digital displays. That way the shooter can be provided with additional information, like from a Kestrel 5700 Elite Weather Meter with applied ballistics, with ranges from a Laser Range Finder (LRF) or data from their spotter. Next steps are pictures and the future live feeds from Unmanned Aerial Vehicles (UAV) or other ISR

(intelligence, surveillance and reconnaissance) sources. However, it will take some more years to reach the full capabilities that users are asking for.

For the civilian market, but also for law enforcement agencies, Swarovski Optik KG has designed the "dS" riflescope with integrated digital intelligence. In addition to the pure optical line, a laser target range-finder (1,380 m) and ballistic computer are built in, which also measures temperature and angle and can record data such as wind. After measurement and calculation, the aiming point is automatically displayed corrected (via an LED that moves over the fixed reticle). It is controlled via its own app and Bluetooth. The whole thing was built into a 40 mm tube and can be viewed via an 800x600 Px LCOS display. The CR123A battery lasts for about 600 measurements and the operating temperatures are supposed to be between -10°C and +70°C. Currently, 4,500 different ammunition types are already stored in the computer, but own ammunition can also be entered manually. In addition to the correct stopping point, the dS displays the most important ballistic information in real time and without distractions on the head-up display.

Capabilities of the Meprolight's NYX (Uncooled Weapon Sight) include the capture and storage of still images, which can be downloaded to a PC later. For example, the shooter's view can be used as evidence in court or for forensics. A video-out with full overlay for command & control is part of the product.

Ronen Hamudot, Vice President Marketing and Sales from SK Group (Mepro-light, IWI): "Most of the operations are happening during hours of darkness. This results in a larger demand for night scopes and thermal devices. Beyond the obvious demands for accuracy and to be lightweight, we see a growing emphasis on the robustness of the product, more focus on MIL-STD compliance, the support of longer recognition and effective shooting distances."

Also, from Israel comes the Smart Shooter SMASH family of fire control systems. SMASH is a combination of lens, simple-to-install hardware with an advanced image-processing software. This way SMASH ensures that friendly forces are kept safe while every round hits its target, day or night. It even works as a Counter-UAV System. The system is in use in Israel and many other nations. The Indian Navy has just ordered it and it is also certified by the US Army, USSOCOM, NATO and tested by German Special Forces and the Royal Netherlands Army.



Photo: Smash

The SMASH X4 combines a x4 magnifying optic scope with SMART-SHOOTER's fire control capabilities thus providing extended detection, recognition & identification ranges for the shooter, as well as extended lethality ranges.

On the other side, even if digitalisation would be of great benefit, users also require a scope that will work under all conditions, even without electronics, no batteries, and no failure, only thanks to its glass channel.

Conclusion

Users are asking for greater flexibility and robustness of the products. NATO and other western forces are seeking longer range weapon systems to surpass the new AK-fami-

ly. This means a need for higher magnification lenses. The personal weapon will be a system, rather than a weapon. Part of the system is digitalisation, sights and ammo. It will include size, weight and power enhancements.

The next step, on top of the optical sights, will be separate Fire Control Systems. We got our first taste of this at the NGSW programme. A separate Fire Control (NGSW-FC) programme is placed with L3Harris and its partner Leupold, as well as with Vortex Optics.

In the end, it will be a visual augmentation system with options for different ballistic reticle designs. The standard range will vary between 50 and 1,500+ metres. Enhanced levels of accuracy and the implementation of next-generation target location devices will be a factor. All scopes need to work with light intensifier or thermal devices. As an example, the US Army selected the Individual Weapon Sights (IWS; uncooled 17 μ m thermal sensor technology) from Leonardo DRS for its Family of Weapon Sight-Individual (FWS-I) programme. The IWS add capabilities like the connection to a wireless network and to helmet, or head-mounted night vision devices. This is a first step into the digitalised system and much faster target acquisition for dismounted soldiers. ■

Marketing Report: Vected GmbH

VECTED
ENGINEERING. ADVANTAGE

Perfect Configuration for Any Application

Depending on the scenario, thermal imaging cameras can be used for a wide range of applications, such as observation tasks or as clip-on devices. VECTED configures all of its thermal imaging cameras individually for each customer.

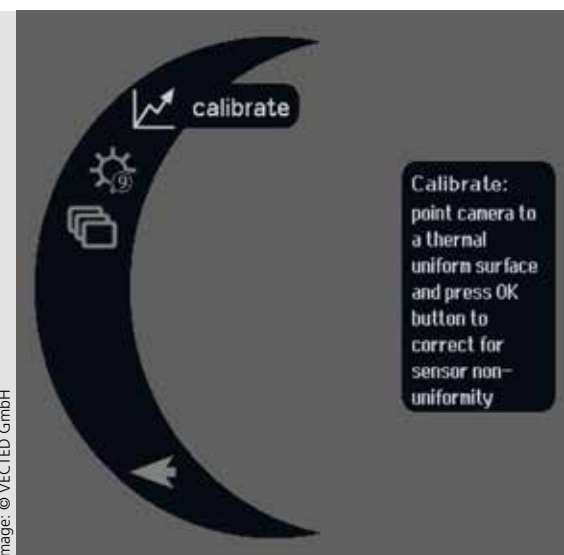
The aim of the Fürth-based company is to make it as easy as possible for users to operate thermal imaging cameras correctly. When it comes to deploy their thermal imaging cameras, users often find themselves in a tense situation. Ideally, they should only have to turn on the device and be able to use all preselected settings without any changes. This configuration service is included even for orders of just one camera.

A wide range of configuration options is available. For example, shortcuts can be assigned to frequently used functions. In addition, relevant false-colour imaging can be preselected for specific applications. Another aspect is the use of digital zoom which is only included in the configuration of cameras being used for observation or as a weapons sight. For ap-

plications in which both observation and clip-on functions play a role, VECTED offers the option of programming a variety of different settings. Additional customisation options are available for reticles which customers can supply individually for integration by VECTED.

The thermal imaging camera that is finally used is optimally set up for the user and is absolutely uncomplicated to operate, because all functions that are inappropriate for the user are removed from the user interface.

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The subitems of the main menu used in the field are significantly reduced compared to the training configuration.

VECTED GmbH

Dipl.-Ing. (FH) Wolfgang Schöberl
Managing Director
Melli-Beese-Str. 24
D-90768 Fürth, Germany

Tel: +49 911 960 687 0
Fax: +49 911 960 687 49
info@vedted.de
www.vedted.de

Hardware Upgrade: The Future of Rugged Devices

Gerrard Cowan

Military rugged devices continue to evolve, becoming lighter, smaller and more powerful. The industry is now looking to the future, with advances in areas like artificial intelligence (AI) and edge computing set to enhance the versatility of laptops, tablets and wearable technology.

Demand for rugged devices in the defence and security sector continues to grow, though it is fairly consistent in terms of form factors. The “sweet spot” for rugged tablets in the market tends to be 10-11 in displays, and 14-15 in for rugged laptops, notes Fred Kao, Chief Executive Officer of Twinhead, which owns Durabook, manufacturer of such systems as the Z14I rugged laptop and the U11I 11.6 in rugged tablet.

Photo: via author



Soldiers need devices that are smaller, lighter, and more portable, but with the additional advantage of ruggedness.

Information Access

Defence personnel are operating in new ways, due to digital transformation and increasing mobility. As new technologies are adopted and work processes become more streamlined, access to information – and the ability to share that information – has become more efficient. Meanwhile, data has become more prevalent, and analytics have brought greater intelligence to the domain. Kao labels rugged devices the ‘linchpin’ for many operations, and the reason is clear: they enable personnel to make the best use of new technologies like the Internet of Things (IoT), AI, augmented reality (AR) and cloud computing.

The evolution of demand in the military domain has generally followed similar trends to the consumer market. Customers want devices that are smaller, lighter, and more portable, but with the additional advantage of ruggedness. According to Robert Apple, business development manager (BDM) at Getac, which produces systems like the

UX10 rugged tablet – partly pitched at digitising military vehicle maintenance – and the new B360 Pro fully rugged laptop, technological innovation is enabling companies “to meet many of these expectations without compromising on rugged reliability”.

Material Changes

While magnesium alloy has traditionally been the primary material used in rugged chassis construction due to its excellent strength-weight ratio, in recent years, advances in plastic technology have seen a growth in the use of composite plastics. This has helped to further reduce overall device weight, Apple noted. However, the devices also retain the same level of strength and durability.

Rugged devices continue to become lighter, thinner, less bulky and more mobile, while remaining extremely rugged. There have been a range of significant improvements in recent years, including the shift from HDD to SSD storage, which has replaced moving parts to make devices more rugged. Traditional Serial ATA Attachment (SATA) interfaces are being replaced with PCI Express

(PCIe), Kao noted, which improves the performance of SSD storage and makes it faster. Security must continue to evolve “as defence organisations fight ever more complex risks and potential attacks on systems, data and intelligence”, Kao added. For rugged hardware, this is reflected in the growing use of security and data capture features like quick-release SSD, radio-frequency identification (RFID), fingerprint readers and other techniques. Rugged manufacturers have also kept up to date with connectivity innovations to integrate the latest wireless connections, such as 4G (soon to be 5G), Wi-Fi, GPS and Bluetooth 5.0.

User Requirements

A range of military users are increasingly adopting the Android operating system. This has enabled companies to supply more user-friendly interfaces, though there are continuing demands for enhanced security across the range. For companies like Zebra Technologies, manufacturer of the new TC21/TC26, TC52x/TC57x and MC3300x rugged mobile device, this has “been a key

Author

Gerrard Cowan is a freelance journalist and editor who focusses on aerospace, defence and finance.

He was previously a News Editor at The Wall Street Journal and Europe Editor at Jane's, and is the author of 'The Machinery' trilogy, published by HarperCollins.

driver”, said Andy McBain, Head of Earned Value Management, Regional Product Management, EMEA.

There are a number of common demands for military operators, notably that they be rugged enough to be carried across long distances and work in extreme weather conditions with an extended battery life; that they have a camera for recording and communicating details, as well as a screen that is legible in bright sunlight; and as enterprise-grade devices, that they include software for application deployment, security and operating system updates, McBain noted.

Looking to the future, there are a range of trends likely to disrupt the industry in 2021, such as computer and machine vision; temperature sensors; intelligent automation including robotics and AI; and prescriptive analytics, which uses AI and machine learning (ML) to help operators make decisions based on the data at their disposal.

Given the dynamic nature of the current global environment, the ability to execute in an agile manner is critical. “The need for greater visibility is driving these [trends] in our industry,” added McBain.

Data Demands

Digital transformation has already had a huge impact on defence and security, with technology now central to most operations and missions. In the coming years, it seems likely that the capacities for processing digital data will massively increase, while efficiencies and improvements will develop in areas like hardware, safety and productivity. Kao pointed to the potential of technologies like IoT, AI, AR, 5G and the cloud, noting that manufacturers are now building such capabilities directly into the hardware, something

he expects to increase in the medium-term. For example, with AR, rugged devices have the power, data story and functionality – where consumer off the shelf devices do not – to generate powerful graphics or data visualisations and advanced analysis at the source. IoT devices, central servers and other connected devices can share data to the rugged system, allowing for 2D or 3D mapping systems, and what Kao terms “a mash up of multiple data sources”. This can help support rapid repairs or planning team actions.

There is potential to connect rugged devices to aircraft or vehicles to support diagnostics: repair and maintenance technicians can identify faults, quickly access the necessary documentation to solve a problem, and overlay AR onto the graphic display to show the fix and speed repair time. Kao also pointed to edge computing, where computing tasks are conducted on the scene. This allows for selective, real-time data processing from within devices based on specific needs: for example, analysis of the vast quantities of data – including images and videos – collected by unmanned aerial vehicles (UAVs).

Future Focus

A new mentality towards innovation and defence transformation is coming to the fore in the military sector. Apple points to a number of areas where he expects developments in the next decade or so, with the help of rugged technology. This includes mobile communications and wearable technology, with companies like Getac offering technologies that are compact and light enough to be worn on a chest harness, “offering much greater intelligence and communication capabilities while on the move”.



Photos: Durabook

The Durabook Z14I rugged laptop



The Durabook rugged tablet U11I 11.6

Additionally, rapid developments in automation are transforming operations, while saving resources and boosting efficiency. The growing use of automated drones – controlled via portable rugged devices – is a good example of how this kind of technology is already being used.

“Doing so greatly improves situational awareness, without putting soldiers’ lives at unnecessary risk,” Apple said. ■



UNIVERSAL CHARGERS



RECHARGEABLE BATTERIES

Ground Support Equipment: Often Disregarded, yet of Vital Importance

Florian Lobitz

Ground Support Equipment (GSE), sometimes also called Aircraft or Aeronautical Ground Equipment (AGE), describes a wide field of special tools of wildly diverging technical complexity. Often perceived as the simple torqueing wrench, which should be available and functioning at any time, GSE nowadays has become a serious business in itself.

You never know what you have until it is gone" does not only apply to romantic relationships, but also to technical subjects, especially to background topics and the associated efforts usually not seen by the majority of people involved in a project management environment.

Background

Engineering and design of technical solutions usually aims at functionality, reliability and simplicity. Sometimes however, when geometric boundaries occur, when the prime objectives are driven by lowering production costs, or the overall reliability of the assembly, special tools and electronic test equipment gain importance. The range of GSE starts with simple mechanical tools right up to pricey optronic test benches and software based artificial intelligence. The initial situation has not changed at all. End-users claim maximum operational availability of a certain system. It does not really matter if a faulty system is a stationary installation or a mobile craft. What has evolved are certain technical requirements. With a few examples of the TIGER aircraft, I would like to raise awareness for an often-disregarded topic of vital importance.

Complexity

Besides a large number of standardised tools and commercial products, testability and maintainability determine the need for specific GSE. In general, if no existing stand-



The French TIGER HAD

ard is suitable for a task to be performed, a special GSE has to be adapted to its particular purpose and existing limitations. Those limitations range from the size of the tool itself linked to accessibility, or the geometry of the component to be worked on to electronic interfaces, adapters, communication buses and information processing. One example of a simple GSE is a guidance shaft as shown in Figure 2. This hollow cylindrical shaft the size of a cigar with a certain internal diameter and a particularly machined surface allows proper alignment of a torqueing tool required for working on the helicopter's main gearbox, one of the core drivetrain components. Before the development of this guidance shaft, a number of hard-to-reach self-locking nuts at a gearbox flange were damaged occasionally due to the improper application of force. Flanks of the nut showed signs of intense wear right up to total destruction of the nut. The planned introduction of this GSE will help ease the task itself and to reduce the number of defects significantly.

An example of a rather complex GSE is the On-Helicopter Electronic Warfare System Tester (OnHEST). Designed to test the functionality of the helicopter's warfare sensors on radar, laser or missile-launch detection, the OnHEST works with a simplified graphical user interface operated on a handheld tablet computer – state of the art technology adapted to end-user requirements.

However, the interior of the flight-line tester and the software processing within the OnHEST is highly sophisticated. In a nutshell, the system reads the helicopters' output in terms of internally processed data, the system's reaction, as well as counter-measure initiation, and compares it with the flight-line testers' simulation. This implies signal detection, signal processing and transformation into discrete digital information, which is then fed into a specially designed software and processed further. The output is – in a very simplified manner – a red or green display of the system's faulty or correct behaviour.

Author

Florian Lobitz is the TIGER Ground Support Equipment Manager at the OCCAR-EA (Organisation Conjointe de Coopération en Matière d'Armement).



**A CAD-Model of
a guidance shaft**

Impact

Complexity alone does not determine the relevance of a tool for an entire weapon system and its operational availability. Sometimes, very simple tools have enormous impact on fleet availability.

Just imagine the guidance shaft mentioned earlier. If the technician had no tool for proper alignment and positioning of his torquing wrench, the nut could break, be over-torqued or the flanks could sheer off. In a best-case scenario, the technician or his supervisor would identify the improper task performance, however in a worst-case scenario, the aircraft would lose a drive train component in-flight which would result in catastrophic system failure and death of the aircrew.

In comparison, a false utilisation of the much more complex test equipment for the electronic warfare system (EWS) might not detect sensor failure or faulty internal data processing. This could lead to alarm signals, which are displayed incorrectly or counter-measures that are not triggered accurately.

The general operability of the air-craft and the safety of the aircrew is, however not directly touched upon by this system. In case of an actual combat situation, this changes drastically of course.

However, if the impact of one particular tool has to be described, it only makes sense to bridge the gap to the other disciplines of the so-called area of Integrated Logistic Support (ILS).

Integrated Logistic Support

The highlighted disparity of complexity and impact is evident; however, it can be tempered with a row of surrounding ILS disciplines. GSE is not just touching other ILS disciplines in a state of co-existence. Each GSE is in fact poking through various layers of ILS and thereby linking those disciplines. Sticking to our two examples, the driving factors to be mentioned are an existing maintenance repair concept (MRC), compliance of technical publication and training tailored to the individual skill level.

The maintenance repair concept on the one hand describes a maintenance or repair procedure for a certain aircraft component. Taking specifications and limitations into consideration, the MRC outlines the necessary technical measures to be performed in order to guarantee enduring component operability. Technical publication on the other hand translates this cryptic information into a narrative task description accompanied by illustrations, drawings and pictures. The aircraft's technical publication is the handbook or user manual providing preventive and trouble-

shooting hints. In the end, this information sets the basis for maintenance training. To put it simply, maintenance training adapts the MRC information described in technical publication to the individual skill level of the technicians.

This sketch of a few disciplines within integrated logistic support, however, underlines the disparity of complexity and impact of GSE. In the end, the front-end serviceability of each piece of equipment is embedded thoroughly; therefore, our two examples, the guidance shaft and the On-Helicopter Electronic Warfare System Tester, can be operated by mechanics of the same educational level.

Future

In the future, basic mechanical GSE will, of course, remain in the overall pool of tools and special equipment, however the complexity is about to advance, especially, if we look at upgrades or entirely new developments of future weapon systems. Improvements in user interfaces will need to allow the skill level of technicians using the equipment to remain the same. This leads in particular to a highly sophisticated engineering development. The close hand-in-hand co-operation between the armed forces as the end-users on the one hand, and the industrial partners on the other hand, is therefore more essential than ever.

The enduring and uniting objective is once again to provide a maximum of operational reliability and force protection to the ones who protect us – anywhere, at any time. ■



Photo: Spherea GmbH, Ulm

On-Helicopter Electronic Warfare System Tester (OnHEST)

Unmanned Systems in Support of Future Autonomy

Alex Horobets

The trend that immediately comes to mind when talking about modern technology is the automation of processes and robotisation of military equipment – both individual units and in general. The process is aimed at tackling the issue of simultaneously solving a large number of tasks, which is beyond human capabilities.

The continuous introduction of modern technology into military equipment is constantly changing the nature of combat operations. This cuts the time required for information exchange and decision-making, which results in higher efficiency of combat missions compared to those using outdated technologies.

Superiority of Unmanned Vehicles with AI

Today, automated processes in military equipment and high-precision weapons implement the established order of action, and, accordingly, remain unable to independently assess the situation in a specific combat situation and make decisions based on such assessments. The next stages in the development of military technology should include a gradual increase in the level of automation and the introduction of robotic systems in certain types of weapons. The ultimate goal is the gradual elimination of human engagement in the many life-threatening phases of combat missions. The issue of introducing artificial intelligence (AI) into robotic military platforms remains controversial and unresolved.

At the moment, it is obvious that the more technologically advanced the army is, and the more effective unmanned platforms it employs, the more successful the military force becomes with fewer losses incurred in military operations. The flip-side of any high-tech army though is that a huge budget is needed to further develop technology and procure hi-end equipment. For example, the on-board systems of a fifth-generation F-35 fighter apply AI-driven computer algorithms for early detection of enemy targets, as well as elements of real-time augmented reality. However, such a fighter costs a staggering US\$78M.

For years, the US Air Force has been exploring possibilities of using AI both as a pilot

Photo: Euro-SD



The Russian URAN-9 tracked Unmanned Combat Ground Vehicle (UCGV)

aid, and as a separate unit. Since 2018, the Air Force Research Laboratory has been developing an autonomous fighter based on AI. In theory, and in many practical situations that have already been observed in tests, a machine controlled by a computer defeats humans in terms of information processing speed and decision-making. But with the current level of technology, it is probably premature to talk about the full-blown and wide-range introduction of such devices since plenty of potential emergency situations and hazards have yet to be worked out and tested.

The years 2019-2020 saw unmanned aerial vehicles being used in a number of regional conflicts, proving effective in asymmetric confrontation (recall Saudi Arabia and strikes from Turkish drones in Syria and Nagorno-Karabakh). Such efficiency points to the further development of UAVs, as well as unmanned ground vehicles and systems that would be capable of countering them.

Moreover, it is not only strike drones that pose a significant threat but also reconnaissance UAVs. The question arises whether AI-driven UAVs could be more effective in the near future than platforms operated by humans.

Trend towards Robotisation

This robotisation trend is not new. It all started in the second half of the 20th century, with the gradual automation of individual units of military equipment. Progress in microelectronics and computing capacity for information processing allowed the introduction of special equipment and software to facilitate the operation of weapons and military equipment. This ultimately led to reducing the response times to emerging threats.

The process of introducing AI technology in the military sphere could be significantly accelerated due to the relevant rivalry in

this regard between the US on one hand and countries like China and Russia on the other. The report by the Congressional Research Service on the use of weapons based on AI technology and autonomous systems, urges the Congress to address the issue of foreign actors applying AI-based military technologies. This issue has become especially relevant since 2018, when long-term strategic competition with China and Russia resumed.

Among the Russian projects, experts note the VIKHR reconnaissance-assault unmanned ground vehicle and the URAN-9 tracked unmanned combat ground vehicle (UCGV). The Russians are also developing the SARMA underwater unmanned vehicle to ensure navigation along the Northern Sea Route. However, Russian ground-based unmanned vehicles are not set to make independent decisions, since they are controlled remotely. Most likely, they will be used as an attractive PR stunt, while remaining an auxiliary tool for the armed forces, rather than gaining dominance. In contrast to the situation in Russia, the Congressional Research Service advocates a massive introduction of robots into the US Armys ground troops,



The VIKHR reconnaissance-attack ground robotic system with ABM-BSM 30 combat module based on the BMP-3 platform

Photo: Vitaly Kuzmin

with the creation of a new structure of the armed forces. In particular, the US military could use autonomous systems, deploying them in the combat zone to locate the enemy, as well as carry out attacks on the enemy by autonomous aerial, ground, or sea systems before the main contingent is deployed, in order to weaken their defences. The use of swarms of drones, which is often mentioned in American think tank reports, immediately comes to mind in this regard.

Worth noting is a US Army's Mad Scientist Initiative webinar held in September 2020, where the future of unmanned aerial systems (UAS) was discussed, as well as the possibility of their involvement in a future operational environment. Among the panellists were Sam Bendett (advisor, CNA), Zak Kellenborn (Senior Consultant, ABS Group), and David Goldstein (Acting Branch Chief for the Precision Targeting & Integration Branch and a Counter-UAS Team Lead, Army Futures Command).



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The Ukrainian PHANTOM UGV on display at the 'Zbroya ta Bezpeka' military fair, Kyiv, Ukraine, 2019

Drones

The drone swarm is the next step in the progress of UASs. It is expected that robotic systems, both fully autonomous and jointly operated on the combat field by AI and humans, will make up a major share of the total combat force. Drone swarms, which are small and relatively cheap compared to other military equipment, will be used in both offence and defence. Such autonomous self-organising systems are being considered for use in all domains – air, ground, sea surface, submarine, as well as underground.

With the development of drone swarms, a new challenge emerges of countering such systems (Counter-UAS). Practice has shown that the use of even relatively inexpensive modernised civilian drones is able to deliver a blow to infrastructure, personnel, and critical weapons systems, especially immobile targets, military bases, vehicles, and ships. This means that practically every object within a combat zone will have to employ effective counter-UAS means.

A particular feature of the evolving and expanding drone market is that the UAVs come in a variety of shapes, sizes, and functions. This includes tiny drones which soldiers can quickly deploy for reconnaissance and assessing the actual situation on the battlefield. In December 2020, the British Army accepted into service the first batch of BUG mini drones weighing just 196 grams. A joint project by UAVTEK and BAE Systems, the mini drone has a flight range - without recharging - of up to 2 km and a battery life of up to 40 minutes. Its

peculiar feature is being able to provide a visual image for the operator even in difficult weather conditions.

No less important are the ongoing processes of new technology development as part of joint efforts by DARPA and the US defence industry. Their work is expected to deliver a quality breakthrough, primarily, in the application of ground-based unmanned platforms. This includes solving the problem many developers have faced, which prevents the full-blown use of robotic platforms in combat conditions, leaving them on the sidelines only as auxiliary units assigned to perform a narrow set of tasks. The objective is to teach unmanned vehicles to safely manoeuvre and evade obstacles on rough terrain at high speeds, just as a human would do. To address the issue, a project worth US\$19.5M was launched to further develop autonomous skills of unmanned vehicles.

The aim is to ensure that such vehicles are not limited by software capacities or information processing speeds, but only by mechanical limits or those of on-board sensors. The tricky part is that for combat vehicles, developers cannot use algorithms already working well enough in commercial vehicles on laned roads. For off-road terrain, however, many more difficulties arise, which include the need to construct 3D surfaces, a large number of obstacles amid incomplete map data, the lack of road markings and traffic rules. In the course of research, algorithms will be developed to achieve effective performance of light tactical all-terrain vehicles at high speeds in difficult terrain conditions with minimal human intervention.

European Developments

In Europe, work is also underway to develop, test, and implement unmanned ground systems in ground forces. For example, Estonia-based robotic vehicle manufacturer Milrem has developed a hybrid tracked infantry complex with a THEMIS module principle, capable of performing a range of functions – from logistics and reconnaissance to supporting ground forces on the battlefield.

According to Milrem Robotics, THEMIS has proven to be effective since a 2019 mission in Mali, where the machine provided support to Estonian units as part of the Barkhane counter-terrorism operation.

Being modular and multifunctional, the platform also offers prospects for the integration of European arms manufacturers. In particular, Milrem Robotics has signed contracts with countries interested in further development in this area, such as Germany, France, and the Netherlands. Also, since 2018, Estonia has taken over the leadership of the industrial consortium developing an integrated Modular Unmanned Ground System (iMUGS), launched as part of the Permanent European Security Cooperation (PESCO). The project's team also includes France, Finland, Spain, Germany, Latvia, and Belgium.

The prototype will employ the THEMIS UGV and will present a hybrid controlled and unmanned modular platform in 2021; the aim is to further integrate unmanned platforms into doctrines and armies of EU Member States.

Another important player in the European market for unmanned ground platforms is the German manufacturer Rheinmetall Defence, which has long been developing ground robots to support ground forces. In November 2020, the company presented its new project, the MISSION MASTER unmanned ground vehicle. According to the manufacturer, the vehicle is designed to carry out high-risk reconnaissance missions and provide real-time data on operational conditions in the combat zone. According to DefenseNews, the Netherlands and the UK have already expressed interest in the project.

Ukrainian Innovations

Ukraine has also been developing robotic military equipment, although such platforms have not yet been officially adopted by the Ukrainian army. However, researchers continue to search for solutions

toward an effective application of robotic platforms in real combat situations. The projects in question, developed by both private and state-owned defence firms, include an unmanned armoured personnel carrier, PHANTOM, an unmanned ground vehicle, HUNTER, and a remote-controlled complex, CENTAUR.

Since 2018, the Robotics Design Bureau has been testing its HUNTER observation and strike vehicle in Ukraine. It boasts a silent operation, with no heat trails and uses AI to detect and recognise obstacles. Such features allow the system to be employed for the evacuation of wounded and for cargo delivery to the front line. In 2020, a video circulated on social media, shot at the Ukrainian military positions in Donbas, showing a HUNTER approach enemy positions and firing a heavy machine gun at fortified firing points at a range of 1,420 m and 1,200 m. There is no more information available about the features of the vehicle's practical use, but one of Ukraine's Army's battalions has been testing the HUNTER in combat conditions for several years already.

According to HUNTER's developers, the machine is capable of firing at ranges from several hundred metres to 2,400



Photo: via author / Youtube Screenshot

The new Ukrainian RSVK-M2 HUNTER unmanned ground vehicle undergoing tests in Eastern Ukraine

m. Since the HUNTER is invisible through thermal imagers, it is able to discreetly approach and get close to enemy positions. Also, following multiple tests in real combat conditions, the system has been improved and modified many times since 2016.

The Ukraine-based A. Drones is developing the CENTAUR remote-controlled complex with a maximum payload of

500 kg, which specialises in transportation, including of water, cargo and ammunition, as well as the evacuation of wounded, rather than providing fire support. A peculiar feature is that in combat conditions, the vehicle is extremely hard to detect, while conventional vehicles often come under fire from anti-tank systems while delivering cargo to the front line. Its prototype was the Israeli-made





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PROBOT, which is still used in the US and Israeli armed forces.

Ukrainian companies began developing robotic platforms almost simultaneously with other companies worldwide; what is needed now is an actual understanding on the part of the government of the need for such systems to be supplied to the army and used in combat. With official understanding regarding the role of robotic platforms in the structure of the armed forces, government orders will increase. In Ukraine, no such massive demand for ground-based robotic platforms has been observed yet, since there is a pressing need to procure higher priority types of military equipment required to defend Ukrainian territories.

Perspectives for Unmanned Systems

The situation regarding the purchase of UAVs is much better today than before. However, it will be impossible to ignore this direction as such, since the more advanced armies are increasingly focusing on robotic platforms. For example, the massive use of robotic ground systems in the US Army is

set to become a new reality in the near future. By 2024, American troops are expected to accept for service, 624 robotic mules by General Dynamics Land Systems under the Small Multipurpose Equipment Transports (SMET) programme. The first batch is expected to be delivered in the second quarter of Fiscal Year 2021.

According to Research and Markets, the volume of the military robot market is projected to grow from US\$14.5Bn in 2020 to US\$24.2Bn by 2025. Among the driving forces behind the market is the expanding use of UAVs and ground robots in life-threatening missions.

While the effectiveness of UAVs has already been repeatedly proven, including during the latest escalation in Nagorno-Karabakh in November 2020, where the Azerbaijani Army used a large number of UAVs against Armenia's traditional-type forces, a new trend is about the increasing use of unmanned ground vehicles. If ground-based robotic platforms prove their effectiveness in the same way as UAVs, this could significantly reduce the number of military personnel in general and that of soldiers required on the battlefield.

However, the widespread introduction of robotic platforms in all armies should not be expected anytime soon, since in many countries, we still see a priority for years ahead for the purchase of conventional weapons, and for updating fleets of aircraft, ships, tanks and armoured vehicles. Accordingly, a relatively small number of state actors will be able to finance the development of robotic platforms and allow themselves a serial purchase of new models. Also, it will take a long until human operators are withdrawn from final decision-making such as the order for opening fire. There are many issues still to be addressed with respect to full robot autonomy apart from technical ones, including legal and ethical problems. For example, how an erroneous attack on civilians might be prevented, or how might a machine be taught to differentiate between a real threat and a false one. Plenty of unresolved gaps also remain in the legal domain regarding the assessment of various situations that may arise from the use of robots. However, this does not exclude that drones such as those used for reconnaissance and logistics could become fully autonomous much sooner than the strike models. ■



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Viewpoint from Copenhagen



Photo: via author

Introvert, Eccentric, or Extrovert?

J. Bo Leimand

In Ines Geipel's latest book "Umkämpfte Zone" from May 2019, she writes that from 2015, both the political setting and political climate have changed dramatically. When she wrote this and dedicated her book to the changes in politics, she might not have been aware of the truth in those statement and thereby the messages to us all sitting in the middle of a pandemic. But what we witness today from Amsterdam, Berlin and Copenhagen, is not at all pleasant, neither from the side of the politicians nor from that of the mob – to use an Americanism.

"Men In Black" is a new protest group in Denmark that wears black clothing while demonstrating against the Danish Government's restrictions and the handling of the corona pandemic. On the group's Facebook page, they write that they 'meet on the streets for freedom'. The group also says that they do not deny that the coronavirus exists, but that their struggle is about how to deal with the pandemic.

Last weekend this group once again demonstrated on the streets of Copenhagen. It was a legal demonstration announced according to the rules enshrined in our constitution. However, when the demonstration was ending, something went wrong. A group of young men hung a puppet from a lamppost, setting it on fire. The puppet's face was a picture of our Prime

Minister and had a sign declaring that she should be executed.

This is quite unacceptable for all normal-thinking Danes and the newspapers are now full of analyses and explanations about how this could have gone so far. Three weeks before, the same protest group had asked its members to gather where doctors and nurses were living. The purpose for calling that demonstration is not clear, but one can only guess.

The young men involved in the puppet incident are now in police custody and might be charged with high treason. But at the other end of the scale, some jet-setting people are travelling to Dubai or Ischgl, just to escape from the "pandemic prison". This has also caused an uproar amongst Danes. In the middle of the spectrum, people are reporting to the police when more than five people gather at the same place having fun. These people are now called "the Corona Police". Have we seen that before in our history?

A well-known Danish psychiatrist, Henrik Day Poulsen, Ph.D., is writing in the Danish newspaper Jyllands-Posten that people can be categorised in three groups: the introvert, the extrovert, and the eccentric ("the nerds").

The introverts enjoy staying at home in safety while the eccentrics can easily be-

come engrossed in computer games and science literature. The extroverts, however, hate to be limited in their freedoms, and if you deny them the space to be creative and dynamic, you kill them softly. Home office is poison for the extroverts as the social dimension of work is removed. Those people can see common sense in the actions to counter Covid-19, but after a year with less and less freedom and all the restrictions, their patience has worn thin.

The question remains as to whether those people on the streets in Amsterdam, Berlin and Copenhagen are extroverts or just a mob. Or are they simply young people just waiting for their first sentence to be put on their CV?

Personally, I don't know, but I have a feeling that something has been boiling for some time and the ordinary people have not been in the focus of the elite both here in Denmark and elsewhere. Geipel's book is an eye-opener in respect to people's behaviour when they live under pressure, especially for a long period of time. The pressure from the pandemic is just the trigger and maybe it is time to re-invent the golden mean in Denmark and start talking about this pandemic in a way that we might have to accustom ourselves to living with it, in much the same way as Africa lives with malaria.

Life is dangerous after all – you risk dying.

Ground-Based Battlefield Laser Applications and Technology

Sidney E. Dean

For decades, laser systems have been considered the “weapons of the future”. Despite intense research in technologically and militarily advanced nations around the globe, they have yet to materialise as major offensive effectors.

Battlefield laser applications to date have largely focused on sensors, targeting systems, and suchlike. However, recent advances in energy management, optical systems, and miniaturisation have finally brought offensive and defensive battlefield lasers nearer to fielding. Currently, the greatest interest for ground-based laser systems exists for countering unmanned aerial systems (CUAS) and for countering enemy rocket, artillery and mortar ordnance (C-RAM), although other applications are also being considered.

Because of their superior energy efficiency and relatively compact size, solid-state lasers display the greatest potential as tactical weapon systems, and have replaced both chemical lasers and solid-state slab lasers in military R&D programmes. A major advance came about with the realisation that tactically relevant High Energy Lasers (HELs) can more easily be achieved through the process of Spectral Beam Combination (SBC). Instead of building a single laser capable of generating a tactically relevant beam in the 30, 50 or 100 kW range, numerous lasers with weaker output are combined into one system; their individual beams are coordinated to come together at the same target point, thereby creating the effect of a stronger weapon.

Demonstrators and Prototypes

This technological progress has allowed the construction of HEL technology demonstrators and prototypes which point the way to future operational systems. Numerous development and testing programmes are currently in progress or planned on both sides of the Atlantic. These include static deployment of lasers for point defence, and deployment of laser weapon demonstrators on Infantry Fighting Vehicles (IFVs) and trucks.

In Europe, Rheinmetall has been experimenting with tactical lasers for a decade,



Concept image of the 300 kW IFPC-HEL

and has demonstrated the ability to mount a 20 kW class laser demonstrator on the standard LANCE weapons turret of the BOXER IFV. As early as 2013, Rheinmetall demonstrated the ability to destroy three jet-powered UAVs in one pass at a distance of three kilometres using a 30 kW class HEL mounted on a static Oerlikon SKYGUARD air defence station; the same weapon destroyed 82 mm mortar rounds at a range of 1,000 metres. In November 2020, the German MoD awarded Rheinmetall a contract to demonstrate a 20 kW laser for one year aboard a frigate, with a possible follow-on phase on land. The DRAGONFIRE Directed Energy Weapon system under development for the British Armed Forces is pursuing a similar route. The 50 kW laser jointly developed by MDBA, Qinetiq, and Leonardo is currently under evaluation aboard a Royal Navy warship, but will also be considered for CUAS, C-RAM and missile defence for land forces.

In 2014, Israel's Rafael Advanced Defence Systems publicly introduced the vehicle-

mounted IRON BEAM laser air defence system weapon for CUAS and C-RAM missions. Utilising twin-mounted lasers in the “tens of kilowatt” range, IRON BEAM is understood to have an effective range of seven kilometres and be able to destroy a target within four to five seconds. IRON BEAM has been integrated into Rafael's new DRONE DOME CUAS system as a hard-kill option which was successfully demonstrated against multiple manoeuvring targets in early 2020. In January 2020, the Israeli Defence Forces (IDF) announced that it had successfully tested a combined CUAS/C-RAM system, which it plans to deploy on fixed and mobile platforms, as well as on an aerial platform. At the terrestrial level, the IDF has operated Rafael's THOR modular weapon system for years. THOR, which combines a 2 kW laser and a machine gun on one mount, can be adapted for various armoured vehicles to detonate IEDs, unexploded ordnance, and other hazards at a safe distance.

US Army Set to Field Laser Weapons

The US Army plans to field major laser weapons within the next two years. In 2019, the US Army's Rapid Capabilities and Critical Technologies Office (RCCTO) awarded rapid prototyping and contracts to accelerate fielding of combat-capable systems. "This is no longer a research effort or a demonstration effort. It is a strategic combat capability, and we are on the right path to get it in soldiers' hands," LTG L. N. Thurgood, US Army Director of Hypersonics, Directed Energy, Space and Rapid Acquisition, declared in August 2019. There are currently two major programmes underway.

MMHEL/DE-MSHORAD

The Multi-Mission High Energy Laser (MMHEL) programme is a technology maturation initiative to develop a prototype 50 kW Directed Energy effector for the Manoeuvre SHort Range Air Defense mission (DE-MSHORAD). The laser will augment other weapons deployed on the designated MSHORAD platform. MSHORAD seeks to defend combat brigades from UAVs and provide a limited C-RAM capability. Additionally, the system will be evaluated for the capability to engage manned helicopters and low-flying fixed-wing aircraft. Depending on the complexity of the target and the desired effect on the target, the actually-deployed power can be dialed up or down along a sliding scale.

The turret-mounted system consists of a 50 kW class ruggedized fibre-optic laser, a stabilised beam control system, infrared acquisition and targeting sensors, a modular battle-management system with optional manual, semi-automatic and automatic operating modes, and a laser cooling system. Energy generation and storage infrastructure is integrated in the carrier vehicle. The DE-MSHORAD system requires a three-person crew. The average cost per kill is estimated at US\$30, less than conventional ordnance, and much less than air-defence missiles.

In July 2019, Northrop Grumman and Raytheon were selected as competing contractors for the MMHEL development. For this competition, both firms are acting as sub-contractors for Huntsville (Alabama) based Kord Technologies, which acts as prime contractor for the MMHEL/DE-MSHORAD project. The competing prototypes will be evaluated in combat-realistic scenarios against a variety of targets in May 2021 at Fort Sill, Oklahoma. The prototypes will be operated by soldiers, not contractors, dur-



Photo: Lockheed Martin

In 2015, Lockheed Martin's 30 kW ATHENA laser system disabled the engine of a pickup truck.



Photo: Rheinmetall Defence

Rheinmetall concept of a future point defence system incorporating lasers



Photo: Credit: Rheinmetall

In February 2019, Rheinmetall concluded testing of a lightweight weapon station capable of mounting a 100 kW laser weapon.

ing the competition in order to guarantee maximum soldier input into the evaluation process.

After down-selection to one contractor, the Army will acquire three additional

units of the winning prototype. These will be field tested together with the prototype, aboard four Stryker IFVs forming one operational platoon. All four units will be combat capable. This operational

Photo: MBDA UK



The DRAGONFIRE laser demonstrator mounted on a truck

Photo: Rafael Advanced Defense Systems



Rafael's DRONE DOME CUAS system includes a laser hard-kill option.

Photo: Rafael Advanced Defense Systems



Rafael's THOR add-on system for armoured and up-armoured vehicles uses high-energy lasers to provide rapid route clearance and neutralise explosive hazards

evaluation phase will begin in 2022 and will constitute the first deployment of a laser weapon system by a US Army combat unit. When serial production begins, DE-MSHORADS will be assigned to combat brigades together with MSHORAD STRYKERS armed with automatic guns and STINGER missiles to ensure a full range of force protection capabilities.

IFPC-HEL

The Indirect Fire Protection Capability - High Energy Laser (IFPC-HEL) initiative is running approximately two years behind MMHEL, but promises to deliver a much more powerful weapon. It is based on the Army's truck-mounted High Energy Laser Tactical Vehicle Demonstrator (HEL-TVD), which began in 2012 as a 10 kW system and which passed critical design review as a 100 kW system in November 2019. HEL-TVD officially transitioned to the IFPC-HEL programme in January 2019, with the goal of fielding a 100 kW system. Recent technological breakthroughs prompted the Pentagon to revise its goals in January 2020, transitioning the HEL-TVD to the IFPC-HEL programme and raising its sights to the development of a 250-300 kW class objective weapon; ultimately the target could double again, leading to an aspirational weapon in the 600 kW class at some point. To achieve the 300 kW goal, the Army will leverage laser weapon technology developed by the US Navy and central agencies of the Department of Defense. "The Army's Directed Energy strategy leverages proven technologies that exist today," said Dr. Craig Robin, the RCCTO's Directed Energy Project Office lead. "Our task is to increase capability by scaling those technologies to rapidly deliver prototypes with residual combat capability." Lockheed Martin has been tasked with developing the laser, which Dynetics will integrate onto an Oshkosh 10-wheel Palletized Load System (PLS) truck. While the PLS is off-road capable, IFPC-HEL will be much less manoeuvrable, and with less protection than the STRYKER-based DE-MSHORAD. Accordingly, it is intended to provide 360-degree protection to fixed and semi-fixed sites, defending against rockets, artillery and mortars; unmanned aerial systems; rotary and fixed-wing threats; and, according to the Army, against "more stressing threats." This ambiguous term presumably refers to cruise missiles, as the Pentagon has identified 300 kW as the minimum strength laser capable of defeating cruise missiles.



Photo: Northrop Grumman

Concept study of the Stryker-mounted Directed Energy Maneuvre SHORAD system

Laser Contract Award for MBDA and Rheinmetall

(jr) Germany's Federal Office for Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) has awarded a consortium consisting of MBDA Deutschland and Rheinmetall Waffe Munition a contract to build, integrate and support the testing of a laser weapon demonstrator in the maritime environment. The order value is in the low double-digit million euro range. Work will be shared on a roughly equal basis. MBDA Deutschland is responsible for tracking, the operator's console and linking the laser weapon demonstrator to the command-and-control system. Rheinmetall is in charge of the laser weapon station, the beam guiding system, cooling and integration of the laser weapon system into the project container of the laser source demonstrator. The demonstrator is to be built, tested and integrated by the end of the 2021. Trials on board the German Navy frigate F124 SACHSEN are to take place in 2022. A breakthrough development in the history of defence technology, lasers engage targets at the speed of light, operating with great precision and producing very little collateral damage.



Image: MBDA

The 300 kW IFPC-HEL weapon is expected to be ready for demonstration in 2022. The Army's goal is to deliver four combat-capable lasers, integrated on tactical vehicles, for operational testing by a platoon in Fiscal Year 2024. Once fully operational, IFPC-HEL will be teamed with missile and microwave-armed trucks to provide a full spectrum defence to command centres, expeditionary bases, radars and other vital sites. However, this will not be the end state. The Pentagon has identified the next goal as the development of 500-600 kW class lasers, eventually followed by megawatt class systems.

Future Technology and Applications Outlook

One thing is clear: once offensive and defensive laser effectors become widely available for battlefield applications, they will augment kinetic weaponry, not replace it. Lasers have clear advantages in some areas, such as speed of engagement or "deep magazines"; they also have vulnerabilities such as limited effective range or degradation due to atmospheric conditions. Missiles and radar-guided guns stand out in this regard. Point-defence and mobile laser weapons will provide extra layers of force protection and offensive capacity – with the caveat that sophisticated opponents will be fielding equivalent weapons. Tactical advantages will be transient as one side or the other upgrades its technology. Ultimately, laser effectors will become standard weaponry, and will constitute simply one more element of the continuing tactical arms race. ■

The Brussels Backdrop

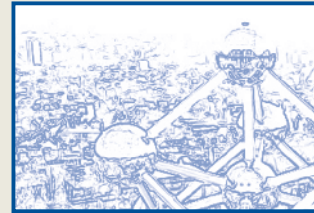


Photo: author



EU and NATO – A Synchronised New Approach to Transatlantic Partnership?

Hans Uwe Mergener

With the outcome of the American presidential election, a rarely perceived synergy is emerging between the Brussels suburb of Evere, where NATO is headquartered, and the Schuman-Place, around which the EU Council and Commission buildings are clustered. It goes so far that NATO Secretary General Jens Stoltenberg attended a meeting of the College of Commissioners, a weekly get-together of the Commission's presidents and directors – described as historic by both sides. It was mainly about synchronising the new approach to the transatlantic partnership. At their conference on 1-2 December 2020, NATO's foreign ministers agreed to plan for a NATO summit in the first half of 2021 – and not just as a gesture to Washington's new White House resident. Formally, it is about the starting signal for a new Strategic Concept of the Alliance. After an initial review of the report of the so-called Reflection Group, filed to counter allegations of being brainless, ministers convened to start the process for its elaboration. While this mandate can only be given by the heads of state and government, a NATO summit would offer a decent occasion for Joe Biden's first trip abroad.

Coincidentally, on 2 December the EU Commission presented an "EU-US Agenda for Global Change" encompassing proposals for concrete initiatives such as an EU-US Trade and Technology Council, for an intensified transatlantic dialogue on the responsibility of online platforms and big tech, and an agreement on artificial intelligence (AI). Obviously, the

outlined intentions for an "EU-US dialogue on security and defence" to promote a safer, more democratic, and a more prosperous world must of course involve NATO. On 10-11 December, the European Council emphasized the strategic importance of a renewed relationship with the US. European heads of state and government want to open a new door in relations with the USA, and supported the identified key areas of the agenda: the fight against coronavirus, economic recovery, climate change, technology, trade, multilateralism and shared values, and the promotion of democracy, peace and security. Simultaneously, they welcomed the full participation of the EU in the President-elect's proposed summit for democracy as it may create a new momentum for closer cooperation between the EU and 'Biden's America'.

In the meantime, an attempt was made at Schuman to pacify the semantic dispute about the strategic autonomy of Europeans, which culminated in a harsh exchange between French President Macron and Germany's Defence Minister Kramp-Karrenbauer. As Charles Michel, the EU Council President, underlined: it is about more than the military dimension of strategic autonomy. Upon our request, he said in a press briefing: strategic autonomy encompasses all areas of life. The EU must position itself more robustly and reduce its dependencies, which have just become apparent. The relations with China also need to be re-calibrated, and not only because of fair play in economic and trade relations. Ultimately, Europe's independence must also

be reflected in its approach to digital and climate policy. [On a sidenote: to this end, the Brussels EU summit took a landmark decision: by 2030, greenhouse gas emissions are to be reduced by at least 55 per cent below the 1990 level.] Asked about strategic autonomy, High Representative Josep Borrell becomes almost mischievous – in a good sense – by painting the opposite which is: dependency, only to end up with Europe's economic sovereignty. Strategic autonomy is what makes Europe more resilient in terms of digital economy, the role of the Euro as a global currency, energy, climate and international trade. One of many lessons learned in the course of the COVID-19 crisis.

What does this autonomy mean for defence and security? How can the EU shape its global ambition? Should nuclear deterrence in Europe remain American or become European, or be dispensed with altogether? These principal questions are on the table, at least for shaping NATO's new Strategic Concept. There is talk – not very flattering – in Brussels of a "typical German approach": words and deeds in foreign policy, especially in European defence policy, are not in harmony. Berlin is not only judged by its pecuniary contribution compared to its pledges, but also on the trial balloons it launched and which have since fizzled out, such as the protection zone in northern Syria, a mission in the Strait of Hormuz, a European Security Council, a Franco-German aircraft carrier, and a UN Security Council with an EU seat. The state of the Bundeswehr also fuels doubts about Germany's ambition and reality.

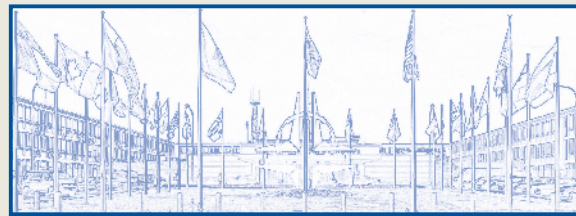


Photo: NATO

Due to the Covid-19 pandemic, the December 2020 meeting of the North Atlantic Council in Foreign Minister's session took place via teleconference.

In defence issues or security policy matters, Europeans continue to face challenges regardless of Germany's positioning. Cases like the dispute over the maritime borders in the eastern Mediterranean or Libya could serve as a test case of "strategic autonomy". The ability to act in the immediate neighbourhood must be demonstrated. The current example is Nagorno-Karabakh. The fact that capability gaps in EU operations are filled by other states, like Turkey in the case of EUFOR "Althea", the stabilisation operation in Bosnia and Herzegovina, or even

by Russia and Ukraine (transport), is critically questioned. Even EU parliamentarians agree that the EU must intensify its efforts towards more autonomy in security and defence policy matters. But as long as they do not manage to carry these convictions from the walls of their Brussels and Strasbourg parliamentary buildings to their home countries, they could just remain speech bubbles, not to talk about hypocrisy. Which leads to the assumption that strategic autonomy may be a meaningless slogan, at least in this policy area.

What stays is the fact that Brussels will be the scene of a summit in the next six months – some say in early 2021. The synergy between the organisations gives cause for optimism. Is it not a sign of alignment as Secretary General Jens Stoltenberg put the emerging process under the motto: "NATO 2030 – United for a New Era"? What remains to be seen is the extent and the dynamics of the EU to join in. Maybe the new US President's envisaged trip may offer the first opportunity to venture an assessment.

Satellite Navigation – Is this just Phantasy?

Thomas Withington

In the wake of Brexit, the British Government vowed to develop its own satellite navigation system upon losing access to secure parts of the EU's Galileo constellation. Were London's plans an escape from reality?

In September 2020, while much of the world's attention was understandably focused on the continuing Covid-19 pandemic the British government shelved plans to develop its own GNSS (Global Navigation Satellite System) constellation. Loss of access to the secure signal from the European Union's (EU) Galileo GNSS network, which the UK would have benefitted from by virtue of being an EU member effectively ended once the then Prime Minister Theresa May triggered Article-50, the formal process for the UK to leave the EU on 29 March 2017.

Galileo

Galileo is a flagship EU project worth almost US\$12Bn. It involves scores of European firms like Airbus, OHB and ThalesAleniaSpace, and employs thousands. After two testbed satellites, GIOVE-A/B, were launched using TSSKB-Progress SOYUZ-FG rockets from the Baikonur Kosmodrome in southern Kazakhstan on 28 December 2005 and 26 April 2008, a further 24 satellites were launched between 21 October 2011 and 25 July 2018. All these launches were performed with either SOYUZ ST-B or Airbus ARIANE-5ES rockets from the Guiana European Space Agency spaceport in French Guiana, South America.

The Galileo constellation began to transmit GNSS signals on 15 December 2016, reaching a full operational capability three years later. Galileo transmits two signal types, a publicly available signal providing an accuracy of up to one metre (three feet) and an encrypted signal reportedly providing 10mm of accuracy. The latter, known as the Public Regulated Service (PRS), is at the heart of Galileo's encrypted communications. The reported accuracy of the PRS is ideal for military users who need Precision

Photo: Thomas Withington



Scores of British military platforms like the AgustaWestland/Leonardo AH-64DIE APACHE Longbow/GUARDIAN attack helicopters used by the British Army Air Corps can use the encrypted M-Code transmitted by the US Department of Defense's GPS constellation.

Navigation and Timing (PNT) for navigation and targeting. The coding used by the PRS transmissions helps safeguard against electronic attack.

Methods of electronic attack against PNT signals can include straightforward jamming by which a more powerful signal is transmitted across the same frequencies as those transmitted by a particular GNSS system in a specific area in the hope that this will drown out the latter transmissions. Alternatively, spoofing will sample, manipulate and transmit similar GNSS signals to those being received in a specific area. This could alter the signal's waveform in such a fashion as to produce false information in GNSS receivers in a given locale. Spoofing can be achieved by manipulating the transmission's time signature or frequency to convince a GNSS receiver that the platform or person it equips is moving at a particular speed or in a particular direction, albeit false.

Coded GNSS transmissions help to avoid this as the GNSS receiver will only accept transmissions, which meet certain encryption requirements and will reject all others. Thus, unless the GNSS transmission is rec-

ognised as having a particular encryption the receiver rejects it, and hence the jamming or spoofing will not work. Users in the UK can still access unencrypted Galileo transmissions, but Brexit prevents the UK accessing the secure PRS signals.

Let Me Go!

By the time the UK's referendum result had forced it out of Galileo's secure elements the country had already contributed around US\$1.5Bn to the initiative. In August 2018, Mrs May's government pledged circa US\$122M to study the development of a UK sovereign GNSS system to provide a secure encrypted signal. On the surface, a UK GNSS constellation which was nicknamed Newton after Sir Isaac Newton, the English polymath, had attractions. Neither the US nor the EU could switch off the signal depriving the British military of secure PNT signals if the country became embroiled in a controversial war. Secondly, developing a GNSS capability would revitalise the British space sector no doubt having spin-offs into other areas of space exploration and non-space high technology sectors.

Author

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



Photo: SSTL

Surrey Satellite Technology was heavily involved in the secure element of the Galileo constellation. Members of the UK space industry are concerned that the lack of access to this part of the initiative could cause it to lose key skills.

China and the USA could develop and run their respective Beidou and GPS constellations because they are both rich. Russia developed GLONASS to keep sovereignty over GNSS provision but as an 'illiberal democracy' overt and widespread public criticism of the exorbitant US\$13Bn that the system is thought to have cost, according to the Russian Beyond media organisation, is unlikely. Like many big-ticket

projects in the space, defence and aviation domains, Europeans realised that the only way it could address the cost and complexity of developing a GNSS constellation was to pool resources. With the UK out of the club, there are serious questions as to whether developing a sovereign GNSS capability is financially feasible? Developing a UK GNSS system would not be cheap. An article entitled 'Galileo Row!

Brexit will bar UK from EU Sat-Nav programme, but Britain could build its own' written by Ann Swift, innovation fellow at the University of Portsmouth, southern England, stated that building a sovereign GNSS constellation could set the UK back a minimum of US\$6.5Bn. There is every chance that such costs could increase at precisely the moment when the UK will be experiencing a 'double whammy' economic contraction as a result of the damage wrought by the Covid-19 epidemic and Brexit.

No Escape from Reality

To put matters into perspective, an assessment in early December by the Organisation for Economic Cooperation and Development intergovernmental organisation forecast that the UK economy will have contracted by 6.4 percent by the third quarter of 2020. Even the most optimistic scenario published by the Office of Budget Responsibility, an official financial watchdog monitoring UK public spending does not expect UK Gross Domestic Product (GDP) to recover to 2020 levels until late 2022/early 2023 at the earliest.

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Office Address:

Mittler Report Verlag GmbH
Beethovenallee 21, 53173 Bonn, Germany
Phone.: +49 228 35 00 870, Fax: +49 228 35 00 871
info@mittler-report.de, www.mittler-report.de

Managing Directors: Peter Tamm, Thomas Bantle

Advertising, Marketing and Business Development

Stephen Barnard

Phone: +49 228 35 00 886, Mobile: +44 7984 033154
stephen.barnard@mittler-report.de

Stephen Elliott

Phone: +49 228 35 00 872, Mobile: +49 1590 173 0346
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Waldemar Geiger

Phone: +49 228 35 00 887
waldemar.geiger@mittler-report.de

Jürgen Hensel

Phone: +49 228 35 00 876, Mobile: +49 176 2386 3904
juergen.hensel@mittler-report.de

Dr. Andreas Himmelsbach

Phone: +49 228 35 00 877
andreas.himmelsbach@mittler-report.de

Advertising Representative, Russia & CIS:

Laguk Co., Yury Laskin, General Director
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PressUp GmbH, PO Box 70 13 11,
22013 Hamburg, Germany
Phone: +49 40 38 66 66-319, Fax: +49 40 386666-299
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Meanwhile, Brexit looks set to be the 'gift that keeps on giving' with this also making its presence felt on the UK's future financial health. Analytical firm IHS Markit forecast that sans the economic fallout from Covid-19 and assuming a deal between the UK and the EU on their future trading relationship, that UK GDP would enjoy a ten percent increase on levels seen in February 2020 by the fourth quarter 2025. Factoring in Covid-19 and assuming a deal between the EU and UK, the news is still bad. The best the UK can hope for is to reach a level of GDP similar that that seen in February 2020 by the fourth quarter of 2025. Assuming that no deal is reached between the EU and UK, a scenario looking increasingly likely as of late December 2020, the best the UK can hope for is a level of GDP ten percent lower than that seen in February 2020. This begs the question not only as to whether a sovereign GNSS constellation for the UK is desirable, but more importantly whether it is affordable? Forking out on an expensive satellite capability could risk be seen as a barely-disguised vanity project of questionable necessity by sections of the British electorate.

In July 2020, in conjunction with Bharti Global the British government took a US\$500M stake in OneWeb, an ailing communications company. OneWeb had plans to develop and launch a constellation of small satellites with a launch mass of 150 kilograms (330 pounds) which would provide internet access anywhere on the planet using Ku-band (13.4 gigahertz/GHz to 14GHz/15.7GHz to 17.7GHz) frequencies. Initially, OneWeb planned a constellation of 650 satellites, of which it had launched 74 at the time of its bankruptcy. Plans were afoot to eventually increase the constellation to 48,000 spacecraft.

The British Broadcasting Corporation reported that the government had bought a stake in OneWeb with a view to using the firm's technology as the basis for a sovereign GNSS capability. OneWeb's use of small satellites does provide financial benefits in reducing launch costs compared to conventional satellites given that the former use up less space and mass in a rocket than the latter. To put matters into perspective, ballpark figures state that a satellite can cost circa US\$2,500 per kilogram (2.2lb) to send into orbit. Thus, a OneWeb satellite can be sent aloft for circa US\$375,000. This compares very favourably with the US\$1.8M required for a Galileo-FOC satellite weighing in at 1,612lb (732.8kg). Given that small satellites are less expensive to build, launch and operate than their conventional equivalents, the logic is that more of them can be placed into orbit, providing global coverage at a competitive cost. Over the long term, it was mooted that the UK could use OneWeb's technology to launch multitudes of small satellites into a low earth orbit, typically at altitudes of up to 1,080 nautical miles (2000 kilometres) that could carry some form of PNT payload. These could be satellites designed solely to carry a PNT payload or have a PNT payload 'piggy backing' onto future OneWeb birds launched to carry global internet services.

Open Your Eyes

Is such a sovereign capability necessary for the UK? Probably not. Civilian and commercial users in the UK and elsewhere depend on GNSS provision for an array of services. These services are not only necessary to give you directions in your car, but they help deliveries to be made safely and on time and are even used beyond transport to provide precise timing for a myriad of users. Returning to our high school mathematics lessons navigation is a matter of calculating distance over time. For this, you need to know where you are, where you are going and how long it is taking you to get there. This is where timing comes in. GNSS satellites each carry several atomic clocks. Time signals are superimposed onto the GNSS signals sent back to Earth. According to the www.



Photo: Airbus

The UK purchased a large stake in OneWeb in the wake of her loss of access to the secure aspects of Galileo. However, the practicality of harnessing OneWeb's satellite technology to develop a sovereign GNSS constellation is a matter for debate.

gps.gov website, the time signal transmitted by the GPS constellation is sufficiently accurate for anyone using a GNSS receiver to determine the time within 100 billionths of a second.

Time signals provided by GNSS constellations are not only used for navigation. Banks and businesses use GNSS time signals to mark and track transactions. Every time you make a credit card purchase the time of the transaction is noted on your receipt. This may well be derived from a signal sent from space. One notable application is High Frequency Trading (HFT). This has nothing to do with radio wavebands, but everything to do with making cash. HFT uses sophisticated algorithms to track particular stocks and then to buy and sell at precisely the right moment before the price of the stock gets too high or too low. For example, you may have a large institutional investor like a pension fund which decides to sell off millions of shares in a particular stock when traders managing the fund believe that the stock is losing value. This will cause the value of the stock to decrease. As it is declining HFT software might buy the shares as they lose value. This is done in the hope that a trader will be able to sell the shares price at a higher

value later when their price recovers. In essence, HFT greatly accelerates the usual dynamics of trading in stocks and shares, yet it does so at much higher speeds than the pace of business once seen on frenetic trading floors, hence the imperative for precisely controlled timing mechanisms.

Traders and other commercial and civilian users in the UK do not necessarily need a sovereign GNSS to exploit the timing signals provided by Galileo and other GNSS constellations. As the UK will not lose access to the constellation's unencrypted transmissions its population can continue to use Galileo alongside GPS, Beidou or GLONASS for precise timing. Meanwhile, the UK military gets access to the all-important encrypted M-Code PNT transmissions from the United States' GPS constellation. Access to Galileo would be nice as a back-up for the UK in case she ever loses access to M-Code, although this is highly unlikely given the close nature of the UK's defence relationship with America. Likewise, a back-up option would be useful if for any reason the M-Code becomes unavailable through deliberate electronic attack. That said, the militarised GPS signal has shown itself to be highly resilient

to deliberate interference over the past few years. This resilience is only likely to deepen in the future as the US Department of Defence continues investments into the M-Code's integrity.

Face the Truth

Given that the UK gets access to M-Code and will continue to have access to unencrypted civilian GNSS signals from a plethora of constellations why has there been such a fandango in the UK about her leaving the Galileo initiative? Dr. Bledwyn Bowen, a lecturer in international relations at the University of Leicester and an expert on space policy, argues that much of the controversy was the result of concerns by the UK's space industry. As noted above, the British government had already contributed US\$1.5Bn to Galileo before it left the project. Likewise, suppliers in the UK were involved in the development of hardware and software for the project. For example, Surrey Satellite Technology helped build navigation payloads for the satellites. Dr. Bowen says that the British government is concerned that with its participation in Galileo at an end the UK may lose skills in niche technologies. Industry, meanwhile, is worried that it will be unable to compete for future Galileo contracts from the EU: "Twelve percent of the work on Galileo was done by UK companies, and most of that was in sensitive security grade work," Dr. Bowen observed. There is nothing to say that the UK will not develop some kind of PNT service at some point in the future, as she explores alternatives to a space-based sovereign GNSS constellation. Nonetheless, with a serious economic downturn on the horizon because of Brexit and Covid-19, this is unlikely to happen soon. Thus, there is every chance that parts of the UK space industry could join numerous other sectors of British manufacturing which will strongly feel the economic fallout from Brexit for many years to come. ■



Photo: European Space Agency

While the UK will lose access to the encrypted signals from the Galileo satellites because of Brexit, the country will be able to continue to use unencrypted transmissions.

CBRN Reconnaissance: Obsolete or Omnipresent?

Dan Kaszeta

Chemical, Biological, Radiological, and Nuclear (CBRN) reconnaissance is one of the component disciplines of military CBRN defence. Reconnaissance - recce or recon, depending on one's geography - sits alongside protection, detection, medical treatment, and decontamination as one of the pillars of CBRN defence. The classical missions of CBRN recce units and vehicles are to verify if CBRN attacks have taken place, characterise and map the perimeter of contaminated areas, and conduct route reconnaissance to check for CBRN hazards.

Throughout the Cold War era, CBRN recce technology lagged behind the actual doctrine. In reality, in the 1950s and 1960s, it was RN recce as portable radiation detection technology was more advanced, cheaper, and more available than comparable chemical or biological detection. Much CBRN recce doctrine evolved out of the tactical nuclear battlefield – the idea that radioactive contamination from use of battlefield nuclear weapons needed to be tracked and monitored. It was only in the 1970s that technology for chemical detection passed beyond the rudimentary stage. Even to this day, the capability to conduct biological recce is largely notional.

Photo: Rheinmetall



The Rheinmetall FOX vehicle was a major change in CBRN recce capability.

The Classical CBRN Platform

The classical CBRN recon platform was usually a lightly armed and armoured vehicle, often a variant of an existing recce vehicle platform. For much of the Cold War, the Soviet Union and its allies used the BRDM-2Rkh variant of their ubiquitous BRDM recce vehicle. CBRN variants of the BRDM still serve in many parts of the world. The US Army used Jeeps and M113 APCs, generally without much specialty equipment installed in them, until the very end of the Cold War. As late as 1993, training slides at US Army Chemical School showed soldiers leaning off the back ramp of an M113 with detector paper on a wooden stick as an actual technique.

Author

Dan Kaszeta is Managing Director at Strongpoint Security Ltd. and a regular contributor to ESD.

The Success of the FOX

The tail end of the Cold War coincided with great improvements in chemical detection. A sea change came with the German FUCHS reconnaissance vehicle, first fielded in a CBRN recce variant in the 1980s in Germany. Originally from Daimler-Benz (DE) and thence from Rheinmetall MAN and equipped with a mass spectrometer and other sophisticated detection equipment, the FUCHS CBRN vehicle (rebranded the FOX in US service) was a major change in capability. The chemical warfare panic in the first Gulf War saw the FUCHS pressed into service in various western militaries. At one point, about 120 were in service in the US Army. 11 were bought by the UK, retired in 2011, and brought back out retirement in 2014. Norway, Netherlands, Kuwait, and the UAE have used the FUCHS CBRN recce vehicle.

A Shrinking Niche

In broad terms, the niche filled by CBRN recce vehicles is shrinking for several reasons. Overall, many countries have much smaller conventional force structures, and smaller fleets of combat vehicles. Armies that once had scope for specialty CBRN recce vehicles in a large Cold War era force structure have smaller infrastructures that support fewer types and varieties of combat vehicles. Budgets are smaller and the CBRN threat is not as closely felt as it may have been in previous decades. With tighter budgets, CBRN funds may get spent on measures for overall force protection. Upgrading masks, or upgrading detection at the unit level, or upgrading decontamination capability may take precedence over specialty vehicles.

An important aspect of CBRN recce is that technical developments in both point and stand-off chemical detection actually pose some fundamental challenges to the concept of the traditional CBRN recce vehicle. Chemical and radiological detection devices continue to get better. Vitally, they are getting smaller and cheaper. The US DOD JCAD programme, won by Smiths Detection (UK) prompted a fundamental change in chemical warfare detection. The JCAD series, also fielded commercially by Smiths as the LCD, is smaller, lighter, and cheaper than previous generations of detectors. The Canberra (now part of Mirion) UDR-13 occupies a similar space in radiation.

The US JCAD forces one to rethink the entire concept of CBRN recce. The numbers of JCADs fielded in the US military are staggering. If every infantry squad and every combat vehicle is fitted out with chemical detection of reasonably high quality, then practically every manoeuvre unit can be a CBRN recce team. Similar advances in data connectivity and communications have been fielded and now the entire battlefield can have sensors proliferated around it. Chemical recce as a specific mission set and as a type of vehicle now occupies a narrow niche in militaries that can embrace this new approach.

Is there a Market?

For all of these reasons, the market space for CBRN recce vehicles is not a particularly deep field. Some significant effort has gone into component upgrades for existing vehicles. Indeed, one could have made a whole career out of USA M93 FOX vehicle upgrades. The British Army announced in October 2020 a £16M contract with Rheinmetall BAE Systems Land for upgrades to its small FUCHS fleet. This likely signals that no major new CBRN recce vehicles are going to be procured soon in the UK market.



Photo: US Army

The Nuclear Biological Chemical Reconnaissance Vehicle (NBCRV) is the CBRN recce configuration of the STRYKER infantry APC.

However, despite all of this, there are some products marketed in this space. In Europe, KMW (GE) holds a spot in this market segment with the MUNGO vehicle and the DINGO vehicle. Both of these are specifically marketed for the CBRN recce vehicle role. The KMW BOXER vehicle is also often cited as a possible candidate for CBRN recce missions and has appeared on and off as a suggestion in this space. Rheinmetall MAN still produces the FUCHS as a flagship product in this space. Their "Light CBRN Reconnaissance Vehicle" is geared towards the civil responder market. Patria and Environics (both Finland) offer vehicles and systems, respectively, in this space. Saab (Sweden) has had a "CBRNe Recce Vehicle" on the market for nearly a decade, based on the now decade old "Automated Warning and Reporting System". Indeed, the AWRS can be grafted on to other vehicles. Kuwait has bought Saab systems for CBRN recce. Thales (FR), as can be expected, also plays in this market niche. The Swiss branch of Thales produced a CBRN recce variant of the MOWAG Piranha IIIC. It is believed that 11 such vehicles were produced

for the Swiss Army. Thales also developed its ICAS 2 system around UK police requirements, but it could be useful in some military settings as well. FNSS (Turkey) has entered into this space with its PARS 6x6 CBRN recce vehicle, first seen at exhibitions in 2015. The PARS looks and feels like an attempt to emulate the Fuchs. India has its own homegrown NBC recce vehicle produced by DRDO, and it is a rare tracked entry in a market dominated by wheeled vehicles.

The major US programme in this arena is the M1135 Stryker, by General Dynamics Land Systems (USA). This is a dedicated CBRN recce version of the Stryker family of combat vehicles. Several hundred are believed to be in service, although in 2013 the US Army reduced the size of its overall buy. Significant phased upgrades to the M1135's systems are planned in the 2020s.

Outlook

The future in this space may actually be more interesting than the gradual shrinkage of the recce vehicle market. Continued proliferation of sensors and data around the battlefield improve "situational awareness." There is no impediment to this revolution in battlefield surveillance including CBRN sensors spread far and wide, thus possibly alleviating many of the original requirements for CBRN recce.

Similarly, the revolution in unmanned systems and standoff detection may push CBRN recce into the skies and onto small unmanned ground systems. The inherent danger of CBRN environments makes unmanned solutions desirable. Further, few commanders want to confront the paradox of sending out lightly armoured CBRN recce troops in front of the main battle force. The prospect of useful remote sensing, possibly by UAV, means that the days of CBRN recce teams and vehicles may be limited. ■



Photo: KMW

The MUNGO CBRN recce vehicle enables NIC detection and preliminary identification of NBC agents and comparable industrial hazardous substances. It can also be used to monitor contamination and document its extent.

The Impact of Secure Tactical Video Transmission

How Secure Tactical Video Transmission Impacted the Second Nagorno-Karabakh War

John Antal

On 27 September 2020, a short and decisive war in the Caucasus erupted that provides a glimpse of wars to come. Azerbaijan and Armenia clashed in a conflict in rough, mountainous terrain that lasted 44 days and ended in Armenia's surrender and Azerbaijan's triumph. The battlespace was the area of Nagorno-Karabakh, the contested region between Armenia and Azerbaijan. The Azerbaijanis executed their version of cross-domain manoeuvre to win a rapid and decisive victory against a defending and determined adversary. To achieve this, the Azerbaijanis invested a reported US\$24Bn to upgrade their forces, purchasing the latest Turkish and Israeli Unmanned Aerial Vehicles (UAVs) and Loitering Munitions (LMs). The effective use by Azerbaijan of these weapons in the war was stunning. The unrelenting tempo, precision, and lethality of the Azerbaijani aerial top-attacks devastated and demoralized the Armenians and played a definitive role in Azerbaijan's victory. These systems did not win the war by themselves, and UAVs have been over-hyped in many press accounts of the war, but the impact of the high-definition full motion video (FMV) provided by top-attack systems categorized this conflict as "the war of the drones." The Azerbaijanis used the secure FMV capabilities of their systems to enhance sensor-shooter integration, to obtain battle damage assessment, and for propaganda to win the information war. In these aspects, especially the use of secure tactical FMV video and data links, the conflict is a harbinger for wars to come.

Author

John Antal is a prolific author of military articles and books and a member of the US Army Science Board. He served 30 years in the US Army, with 26 years in tank and cavalry units. He also served as a staff officer in the US III Armored Corps and several high-level and multinational staffs.

Photo: Azerbaijani Ministry of Defence



An Azerbaijani HAROP Unmanned Aerial Vehicle (UAV) detonates over an Armenian T-72 Tank as another UAV flies to a target to the left.

Sensor-Shooter Integration

The first phase of the Azerbaijani effort was to employ their newly acquired high-tech UAVs and LMs, in addition to conventional artillery and rockets, to take down the Armenian air defence and command and control (C2) network. They did this in the first weeks of the war. Armenian air defence, made up of older Russian-made systems, could not stop the Azerbaijani UAV and LM attacks. Even when the Armenian air defence systems were operating, the aerial top-attack weapons penetrated the airspace and knocked out the defenders. Azerbaijan used a wide variety of UAVs during the war and the most effective and notorious were the Turkish-made BAYRAKTAR TB2 (Turkish defence company Baykar), the Israeli-made HAROP (Israel Aerospace Industries), and the fully autonomous Israeli-made SKYSTRICKER (Elbit Systems). The electro-optical sensors on the most sophisticated UAVs and LMs used by Azerbaijan are state-of-the-art Infrared (IR) and low-light High-Definition Television (HDTV) cameras that deliver secure tactical video reconnaissance, surveillance, and targeting data. During the war, the TB2 operated as an attack platform and as the "eye in the sky" for Azerbaijani forces to identify and designate targets for other

UAVs, LMs, artillery, rockets, and smart anti-tank guided missiles (ATGM), such as the Israeli-made Spike ATGM system. While the TB2 UAV identified Armenian forces in the designated strike zone, LMs circled autonomously overhead, automatically verifying their targets, and then diving into their victims to detonate their 23 kg (51 lb) warheads in a kamikaze-like attack. Prior to launch the HAROPs are programmed before launch to autonomously fly to a pre-defined strike zone. Once there, they loiter and the human operator can select one LM for target search and attack, while the others are monitored periodically. According to IAI, "The operator directs the selected LM to the target area and uses the video image to select a target, and to attack it. The HAROP tracks the target and then dives on it, detonating the warhead upon impact. If required, the attack can be aborted and the operator can re-attack with the same LM." The vital component is the HD camera system which allows the operator to gain situation awareness of the battlespace and direct the LM to attack targets designated by the operator.

Battle Damage Assessment

Once Azerbaijan knocked out enough Armenian air defence and C2 to achieve air

superiority over designated strike zones, the UAV and LM effort concentrated on targeting Armenian artillery, tanks, and infantry units in bloody top-attacks. Since the modern UAVs and LMs operated by Azerbaijan contained both situation awareness and weapons capability in the same platforms, the Azerbaijanis could accurately count their kills. Using the FMV from both UAVs and LMs to understand how many Armenian systems were destroyed or disabled, this information helped guide their combined arms assaults that led to the capture of terrain that dominated the major highways linking Nagorno-Karabakh through mountain passes to Armenia. Once the Azerbaijanis secured these vital roads, it placed the Armenians in Nagorno-Karabakh on the horns of a dilemma, with the choice to either fight to the death or surrender. Desperate to save their forces, Armenia proposed a cease-fire. Azerbaijan rejected the initial overtures as their ground forces moved to capture the major cities and decisive terrain in Nagorno Karabakh. Only after Azerbaijan achieved its objectives did they agree to a ceasefire. In a de facto surrender, Armenia accepted Azerbaijan's terms on 10 November 2020 and withdrew from Armenian-occupied territories surrounding Nagorno-Karabakh. Throughout the war, UAV and LM videos bolstered by robust secure tactical video feeds, provided the Azerbaijanis with superior situation awareness.

Information War

Azerbaijan, with the aid of Turkey, planned and prepared a high-tech conflict against Armenia for at least a decade prior to September 2020. Part of this strategy involved winning the information war. This effort was designed to confuse and demoralize Armenian forces and break the will of the Armenian population. Every precision UAV and LM attack was captured in high-definition video through a secure data link. The films depicted burning tanks and devastating explosions among groups of Armenian soldiers. The Azerbaijanis used these gruesome videos in countless propaganda films on the Internet and social media platforms. Armenia's viewed this footage and feared for their soldiers. In this propaganda effort, the Azerbaijani message was loud and clear: "We are winning. We will bring you death from above with our drones and you can't stop us." As Armenian losses surged and their lines continued to fall back, morale suffered. Courage is useless in the face of educated bullets, and the Azerbaijani top-attack munitions hit their targets with brilliant accuracy. These videos were cru-



Photo: wiki commons by Bayraktar

The BAYRAKTAR TB2 is a Turkish medium altitude long endurance (MALE) unmanned combat aerial vehicle (UCAV) that uses an Aselsan Common Aperture Targeting System (CATS) for electro-optical reconnaissance, surveillance, and targeting. Low-light and infrared high-definition cameras on the TB2 generate an unblinking eye of the battlespace. The Azerbaijanis used the Full Motion Video (FMV) capability of the TB2 to great advantage in the Second Nagorno-Karabakh War.



Photo: IAI image

The HAROP can be air-launched or launched from a truck, with as many as twelve loitering munitions per truck.

cial elements in Azerbaijan's propaganda effort. Leveraging the power of real-time video capture by unmanned systems to win the information war is relatively new and the Azerbaijanis played this hand skilfully.

Lessons Learned

As the 1973 Yom Kippur War was studied as an example of modern combined arms operations during the late 20th century, the Second Nagorno-Karabakh War holds lessons in the dynamic clash between attack and defence, the use of technology, and conduct of cross-domain manoeuvre for today. The increasing "democratization of technology," whereby high-tech weaponry such as UAVs and LMs become available to all, and the secure tactical video produced by these weapons that depicts the violence of each strike used as a powerful propaganda tool, has serious implications for western military forces. The battlespace is now transparent and there is nowhere to hide. As after the 1973 Yom Kippur War, the question on the minds of many western military leaders should be whether the

combat units of NATO would fare any better than the Armenians under the Azerbaijani whirlwind? Has NATO fielded the integrated air defence capability to counter UAV and LM assaults? How many NATO units have recently trained against UAV and LM swarm attacks? How will NATO integrate the command-and-control cross-domain capabilities of 29 multinational, multi-service UAV systems? These questions demand answers. Tackling this challenge should start with a detailed study of the Second Nagorno-Karabakh War to derive lessons learned, and then transform those lessons into updated doctrine, training, and equipment. One of the key lessons is the use of secure tactical video equipped UAVs and LMs to enhance sensor-shooter integration, raise situation awareness through battle damage assessment, and to win the information war. When the next conflict between peer-competitors occurs, the side that fails to learn the lessons of the Second Nagorno-Karabakh War will find themselves at a significant strategic and tactical disadvantage that they may not be able to overcome. ■

“Self-Reliance” and “Self-Respect”: Aero India 2021

Suman Sharma

Emblazoned with the overarching theme of ‘Self-Reliance’ as a mark of ‘self respect’ and ‘sovereignty’, India played host to its biennial flagship airshow – the 13th edition of Aero India 2021, albeit in a scaled down manner, with only 14 countries participating. With US\$135Bn announced for the modernisation of the Indian defence forces, India has become the world’s largest arms market.

Owing to the ongoing global pandemic, participation in Aero India saw a reduction in foreign participation from 165 foreign exhibitors in 2019 to only 78 this year.

The clarion call given by Prime Minister Narendra Modi in May 2020 for ‘Self-Reliance’ continued to be heard at this year’s airshow. Defence Minister Rajnath Singh reiterated the target of increasing the country’s defence base from US\$11Bn to US\$25Bn by 2025, including an export component of US\$5Bn. Minister Singh stated that defence exports have grown from US\$278M to US\$1.25Bn from 2015-2020 with a vast majority spearheaded by the private sector, adding that, the aero components sector is set to grow from US\$4.17Bn to US\$8.34Bn by 2024.

“The impetus on self-reliance and indigenisation in the aerospace and defence sector can allow foreign OEMs to deepen their network of Indian suppliers and partners to make in India, innovate in India and design in India. At Airbus, we continue to develop a globally competitive supplier ecosystem in India and nurture strong partnerships aligned with the government’s vision of ‘Aatmanirbhar Bharat’ and Make in India,” said Remi Maillard, President Airbus India & South Asia.

Airbus is eyeing the Indian Air Force’s C295 programme under which a final assembly line is envisaged in India along with the Tata group and the NUH (Naval Utility Helicopter) programme for the Indian Navy for which Airbus has offered a final assembly line of the Panther helicopter in India with the Mahindra group.

This year’s show, which happens to be the first post-pandemic international event comes amidst a 10-month long border standoff with China at the LAC (Line of Actual Control), was held at Yelahanka air force base in southern India’s Bangalore city, and

Photos: Aero India



The “Roaring Metal Birds” on fly-by over Bangalore during the opening ceremony of Aero India 2021.

was watched closely globally. Defence Minister Rajnath Singh stated, “Aero India 2021 promises to be the world’s first hybrid aero and defence exhibition with a concurrent exhibition integrating seminars, business to business events, product displays etc.”

Key Highlights

1. Among the key highlights, on the inaugural day, the ‘Atmanirbhar’ formation flight by indigenous aircraft showcased India’s Government-owned defence PSU (public sector unit), HAL (Hindustan Aeronautics Limited). From the LCA trainer and fighter, basic trainer HTT-40, IJT (intermediate jet trainer), Advanced HAWK Mk 132 and Civil Do-228, the full spectrum of trainer and fighter aircraft were displayed in action thereby signifying self-sufficiency in India’s weapons platforms.
2. The sealing of the biggest indigenous order was the highlight of the show, keenly watched by everyone. The US\$6.7Bn contract to procure 83 LCA (Light Combat Aircraft) TEJAS fighters for the IAF announced last month was formally awarded to HAL on the first day of the show, along with the second production line of LCA TEJAS at HAL inaugurated by the Defence Minister.
3. For the first time, a two-day Conclave of Air Force Chiefs from 75 countries and an IOR (Indian Ocean Region) Defence Ministers’ Conclave was conducted.

4. The US heavy bomber B-1B LANCER, of the 28th Bomb Wing based out of Ellsworth Air Force Base in South Dakota, USA, performed a “fly-by.”

5. The British defence company, BAE Systems showcased a model of the advanced trainer aircraft HAWK, along with a laser guided APKWS rocket at the show.

6. HAL handed over three ALH (Advanced Light Helicopters) Mk III to the Indian Navy and two ALHs to the Indian Coast Guard.

7. The Light Utility Helicopter (LUH) received the IOC (Initial Operational Clearance) for the Indian Army from CEMILAC (Centre for Military Airworthiness and Certification).

8. Sixty start-ups under ‘Defence India Start-up Challenge’ were awarded grants of up to US\$208M each.

9. Forty-five MSMEs (Micro, small, medium enterprises) at Aero India received orders worth US\$28M.

10. A total of 201 MoUs (Memorandum of Understanding), 18 product launches, 19 ToTs (transfer of technology), four Hand Overs and 32 major announcements concluded at the Bandhan ceremony were held on the last day.

Atmanirbhar Bharat

As part of the IAF’s focus on Atmanirbhar Bharat and the Atmanirbhar Bharat mission, impetus is given to the fast-tracking of incorporating indigenous products, as well

as enlarging the scope of involvement of Indian aerospace and defence industry, especially MSMEs. With this in mind, the IAF has already identified approximately 4,000 lines of spares, like aviation grade filters (fuel, hydraulic & pneumatic), aeroengine bearings, hydraulic and pneumatic hoses, multifunction displays, aviation grade circuit breakers, etc, to be made at home.

Air Marshal Vibhas Pande, the IAF's AOM (Air Officer-in-Charge, Maintenance) stated on the issue of 'Self-Reliance', "To date, our dependence on foreign OEMs is to the tune of 85 per cent. The civil aviation sector and the MSMEs can contribute in a large way. There is huge scope, capacity and potential in the country to create an all-new ecosystem as far as defence MRO (Maintenance Repair Overhaul) is concerned."

Salil Gupte, President of Boeing India said that under Atmanirbhar Bharat, India will be an MRO hub for both defence and civil aviation.

Explaining their integration into India's 'Self-Reliance', William Blair, Vice President and Chief Executive of Lockheed Martin India opined, "We have currently integrated more than 70 Indian suppliers into our global supply chain. We have



The President of India, Shri Ram Nath Kovind, giving the opening speech at Aero India 2021 on 5 February 2021

nearly 240 suppliers including MSMEs feed into our two joint ventures and have benefited from the vision of Lockheed Martin and Tata working together."

While Lockheed Martin is showcasing the F-21 fighter for the IAF's 114 fighter jet deal valued at approximately US\$15Bn, Boeing has offered the F-15EX fighter. Currently operational in the US, Israel, Saudi Arabia and Japan, the F15 is highly rated for its combat prowess and agility. F-15EX has been described by Boeing as the most advanced version of the F-15 to date.

Lockheed has teamed up with Tata and formed Tata Lockheed Martin Aerostructures Limited (TLMAL) and Tata Sikorsky Aerospace Limited (TSAL), to manufacture aerostructure components for the C-130J SUPER HERCULES transport aircraft, while Boeing is partnering with HAL and Mahindra Defence.

The Indian Government has taken progressive policy steps like hiking FDI (Foreign Direct Investment) to 74 per cent under the automatic route, to boost defence manufacturing in India.



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Remote Operations and Management: Enabling Advanced, Vehicle-Based Tactical Networks

Charlie Kawasaki, CTO, PacStar, Curtiss-Wright Defense Solutions

Networking on-the-move capabilities are increasingly critical to today's warfighter, as adversaries equip themselves with the latest wireless technology and smartphones while actively moving in ground vehicles. Internet Protocol (IP) networking on-the-move is a necessary response to counter the many foes who have ready access to this technology, and it is making warfighters more agile and prepared. Deploying networking equipment in vehicles (and also in command posts and fly-away kits) has many challenges – including space constraints, power and fuel constraints, and environmental extremes. Yet, increasing requirements to deploy more communications, networking, wireless and cyber capabilities at the edge conflict with goals to reduce the size, weight and power of deployed equipment. To meet these conflicting demands, future programmes are starting to look to small form factor networking and communications equipment – delivering more capability to the edge, while reducing SWaP and improving reliability. This article outlines what programmes should look for in designs and test procedures to ensure that this new generation of equipment is up to the challenge.

Photos: Curtiss Wright



IQ-Core® ROAM's consolidated network dashboard for tactical networks ensures the manageability of distributed networks in challenging environments.

New Technologies

To exploit the potential benefits of new technologies such as artificial intelligence (AI), robotics, video analysis, IoT, AR/VR, and other innovative technologies on mo-

bile platforms at the tactical edge, military communications programmes must effectively deploy advanced IT infrastructure, connectivity and compute resources.

Next generation technology will surely increase bandwidth requirements of the un-



PacStar Secure Wireless Command Post takes advantage of over 14 virtualized network devices, consolidated on servers, providing more capability at the network edge while reducing SWaP.



PacStar 453 delivers high performance GPGPU-accelerated processing at the network edge for video, AI/ML, sensor fusion and IoT applications.

derlying network across battlefield domains, placing additional needs for communication link reliability.

While new technologies hold great promise to deliver increased safety and lethality for the warfighter and offer new options for manoeuvre for commanders, integrating a vast suite of rapidly advancing technologies presents a daunting challenge. Current methods of technology integration are reaching the end of their usefulness, do not scale, are unaffordable, and require too much space, weight and power in the future – especially as the array of new technologies needs to be deployed. In order to “future proof” new generations of vehicles, as well as to make existing platforms upgradable as technology continues to advance, modular architectures must be adopted. This allows for incremental upgrades of individual technologies while maintaining interoperability, functionality and cybersecurity.

Modularity

Programmes must adopt a system of modular electronics and software components that reduce size, weight and power, enable multiple industry partners to interoperate, enable incremental modernisation of components, reduce cost, and deploy new advanced technologies without requiring entire system redesigns. This modular electronics approach is designed to transition vehicles from using discrete “stove-piped boxes” to integrated, high density chassis with standardised interfaces improving maintainability. Additionally, software defined networking and the availability of most software technologies in the form of virtual machines enable programmes to take advantage of ever-increasing computing power while maintaining or reducing SWaP. Multiple functions and virtual network devices can be consolidated on single servers, providing more capability at the network edge.

Growing Complexity

As technology advances enable organisations to deploy more technology on to smaller platforms, a critical side effect will be added complexity, and increased requirements for maintenance and training. The introduction of new technologies, combined with an already increasingly difficult-to-manage IT infrastructure at the tactical edge, increases the risk of the network infrastructure becoming unusable simply due to its complexity. This dynamic is well understood in enterprise IT organisations which

work hard to centralise, standardise and automate complex management, monitoring, and configuration tasks. These challenges are much more difficult in ad-hoc, distributed, intermittently or poorly connected networks in dynamic environments.

Additionally, the burden of maintainability never gets “cheaper” as prototypes and proof-of-concepts transition to production networks. As the innovation-lifecycle continues to introduce more capability, the maintenance-tail requires more training, more configuration management, more testing, and requires additional processes to manage.

Remote Operations and Management

A solution to sustain modernisation efforts is to consolidate and simplify network visualisation, device integration, and configuration management, on vehicles, using open standard software and network management interfaces, into a single user interface that provides tailorable access to the configuration items and information appropriate for the types of operators using the systems. Support for Remote Operations And Management (ROAM) on relevant tactical networks will ensure the manageability of these systems at real world scale. Remote management of multiple platforms requires network visualisation, node status and management, support for cybersecurity administration, configuration management, and aggregated node reporting. This will enable robust operational support from upper echelons, and aid in situational awareness while driving down complexity, downtime, and configuration errors.

This type of solution can consolidate dozens, or even hundreds, of diverse screens that would otherwise be presented to operators and administrators, by underlying technologies each developed by a different vendor. It can also enable programmes to experiment with new technologies while maintaining a consistent user interface, even across upgrades. Distributed software management technology – running locally on each node – is necessary to efficiently achieve ROAM functionality and consolidate the management plane of the network. This awareness must extend from upper echelons to the edge of the tactical networks, and must operate seamlessly in disconnected, intermittent, and limited (DIL) environments. A robust ROAM solution deployed on each node can support collaborative management between local on-platform, lightly-trained or untrained crew members, on-platform

administrators, and remote highly trained administrators.

An example of a ROAM solution available today is provided by PacStar’s IQ-Core ROAM software, which operates at multiple tiers in a distributed network, including the NOC, at remote sites, and on every network node at the edge of the network. IQ-Core ROAM enables the entire network to be viewed through a single pane of glass, while sharing views and access to deployed operators at any echelon, to create a collaborative,



U.S. Marine Corps NOTM vehicle mounted modular architecture allow for incremental upgrades of individual technologies while maintaining interoperability, functionality and cybersecurity – while enabling mobility.

hierarchical, network operations and management structure. System administrators in the NOC have the same view and features as system operators. Network nodes can be remote offices or sites, tent-based command posts, vehicle-mobile command posts, or small fly-away-kits – frequently connected via SATCOM or unreliable WAN links.

While moving forward on increasing technical capabilities at the edge by reducing SWaP of networking and computing hardware, it is simultaneously necessary to consider a robust communications management software solution for remote operations and management to maximise the effectiveness of networks. This will consolidate the management plane of networks onto a unified interface regardless of the type of technology or vendor. It will be capable of providing distributed, hierarchical, and efficient management of network-attached nodes.

EDGE: Advanced Technology Priorities That Are Defining Us

H.E. Faisal Al Bannai,
CEO & Managing Director, EDGE Group

Just over a year ago, the UAE consolidated all its sovereign defence capabilities under EDGE, allowing us to modernise our national capabilities systematically and comprehensively, making it fit a new type of conflict – a new era of hybrid warfare. Since the inauguration by HH Sheikh Mohamed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces in November 2019, we have been able to leverage greater synergies between our subsidiary companies, better focus collaborative R&D investments in advanced technologies, upgrade our capabilities more consistently, and progress at a speed that meets the needs of the fast-evolving market.

These changes have already meant that we are now considered among the top 25 military suppliers in the world, and though this is quite a milestone in itself - being the first from the Middle East to be ranked among the likes of Rolls Royce, General Electric and Honeywell, our ambitions on export have only just begun.

While we are building on the capacities of our past efforts, unlike before, we are looking ahead and planning for the next 20 years with extensive investments – relying on advanced technology breakthroughs to spearhead our progression. We are rethinking our defence industry and combining it with the latest in technology R&D, trends and projections, disrupting across critical areas in autonomous capabilities, directed energy, cyber-physical systems, advanced propulsion systems, robotics, and smart materials – with artificial intelligence embedded across core platforms.

Our strategic priorities at EDGE revolve around three critical areas:

Drones, with a specific focus on unmanned aerial vehicles (UAVs) and unmanned ground vehicles (UGVs). Leveraging the benefits of autonomous capabilities, we are

looking to modularity, AI integration and swarm capability among key areas of near-term exploration.

The electromagnetic spectrum (EMS). With modern defence and sophisticated security systems being developed to operate the complex multi-domain environments of today, our key objective is being resilient to deception and disruption, converging cyber and electronic warfare for battlespace superiority.

And armament that will see the development of next generation munitions technology, air defence systems, and smart weapons, while also serving soldiers of the future through high-performance and high precision.

While we understand the level of investment required to be on the leading-edge of technology, we also appreciate that those technologies must ultimately be sparked and leveraged by **industry innovations, partnerships, and a new talent strategy.**

For that reason, EDGE is also focussed on converging commercial market innovations with defence capacities to shake up the industry. It is collaborating with partners big and small – from defence conglomerates to start-ups, because true innovation takes place at the nexus of public-private-partnerships (PPPs). Being at the crossroads of the world and now with the clout of 25+ companies that spans offerings and capabilities from design and manufacturing all the way to MRO and systems integration, we have been developing more strategic relationships with business hubs and partners than ever before.

Building local defence capabilities is a priority for every country, but building strategic partnerships is what will distinguish us as we bring a greater focus on commercial

Photo: EDGE



H.E. Faisal Al Bannai

viability and value across the defence and security supply chain. We will import where it is necessary – or where it makes the most business sense. And, crucially, we will also build new export capabilities with our global partners, wherever we can offer a distinct competitive advantage.

Further to this, new technology means acquiring new skill sets, and it is because of this that we are reshape a more relevant talent strategy for the defence industry. To enable a more secure future, successful workforce planning revolves around training current personnel, hiring the best and brightest both locally and globally across a broad range of different skills, and understanding the new ways of working in this dynamic technology-led landscape.

As a nation, we look ahead with confidence to the tremendous opportunities that advanced technology offers us. It gives a country like ours the chance to compete on a level playing field, leveraging technologies as force multipliers, and a way to differentiate ourselves in the global market. While EDGE starts with R&D in the high-investment and explorative defence sector, it ultimately intends to transform a cross-section of industries in the UAE and beyond through 'spin-off' innovations, positioning itself as a notable global player in advanced technology.



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Outcome-Based Contracting

New Ways of Contracting for Multinational Defence Programmes and Projects

Peter Janatschek, Joe Spruill, Gustavo Scotti di Uccio

Commercial entities such as airlines and various countries' military organisations have employed outcome-based contracting (OBC) with varying degrees of success. The initial stages of outcome-based contracting have been attributed to the commercial aviation industry. The Rolls-Royce company pioneered the concept of selling propulsion units to aircraft, rather than selling engines, spare parts and repairs – known as 'Power by the Hour' – and has since expanded its concept to a number of countries' military forces. Furthermore, other similar arrangements have been concluded between industry and countries in order to provide logistics as an outcome-based service. Some examples include aerial refuelling in the UK, and pilot training in Singapore. In both cases, the governments have avoided the cost of investing in infrastructure, training and operations, by having industry provide the desired outcome (refuelled aircraft or trained pilots), at a cost less than the respective governments could have achieved organically.

The NATO Industrial Advisory Group

The NATO Industrial Advisory Group (NIAG) is a high-level consultative and advisory body of senior industrialists of NATO Mem-

ber and partner countries, acting under NATO's Conference of National Armaments Directors (CNAD). Its aims are:

- To provide a forum for exchange of views on industrial, technological, economic, management and other relevant aspects of research, development and production of armaments equipment within the Alliance, based on current and updated information provided by relevant NATO bodies;
- To provide industry advice to the CNAD, and other NATO bodies as appropriate, on how to foster government-to-industry and industry-to-industry armaments co-operation within the Alliance.

One of NIAG's tasks is to consider and comment on NATO planning and acquisition procedures and practices, in so far as they affect industry.

In this context, industry has proposed and NIAG has initiated, two "High Level Ad-

vice" studies, both sponsored by the CNAD's Life Cycle Management Group (LCMG):

NIAG Study 1:

"Concepts and Rationale for Contracting for Logistics Capability on NATO Armaments and Support Programmes"

Many nations engage in outcome-based contracting for weapon systems support and other logistics requirements. Many different terms are used to describe these arrangements, e.g. the US uses the term "Performance-Based Logistics" (PBL).

Background

In traditional procedures, the government ('customer') would procure the required support and services through transactional

NIAG Studies OBL/OBC and Metrics

"Concepts and Rationale for Contracting for Logistics Capability on NATO Armaments and Support Programs" (2017 - 2018)

"Metrics/Metrics data and analytical tools in the life cycle of NATO systems and in contracting for logistics capability in NATO armaments and support programs" (2019 - 2020)

Authors

Peter Janatschek is Managing Director CALS Forum Germany (CFD) and Chair for the NIAG Studies "Contracting" and "Metrics".

Joe Spruill is Senior Consultant at the Logistics Management Institute (LMI) and Team Leader of the NIAG Study "Contracting"; Vice Chair for the NIAG Study "Metrics" and Vice Chair of ACT-NIAG Logistics & Sustainment Community of Interest.

Gustavo Scotti di Uccio is President and General Manager of the Atlantic Organization for Security (AOS) and Chair of the ACT-NIAG Logistics & Sustainment Community of Interest.

vice (HLA)" studies, both sponsored by the CNAD's Life Cycle Management Group (LCMG):

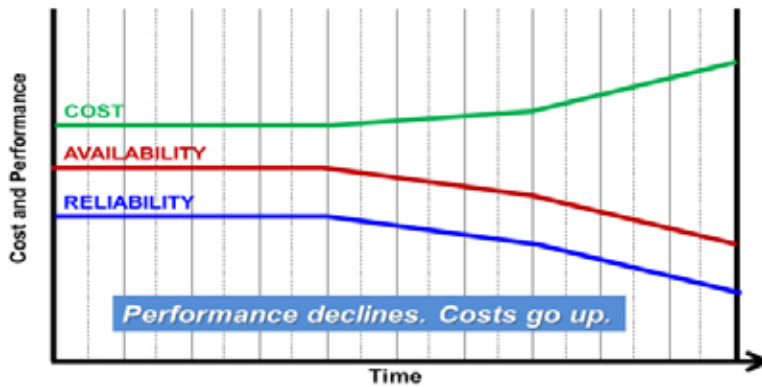
1. "Concepts and Rationale for Contracting for Logistics Capability on NATO Armaments and Support Programmes" (2017-2018);
2. "Metrics /Metrics data and analytical tools in the life cycle of NATO systems and in contracting for logistics capability in NATO armaments and support programmes" (2019-2020).

Both Study Groups were supported by more than 60 experts – some of whom participated in both studies – bringing the

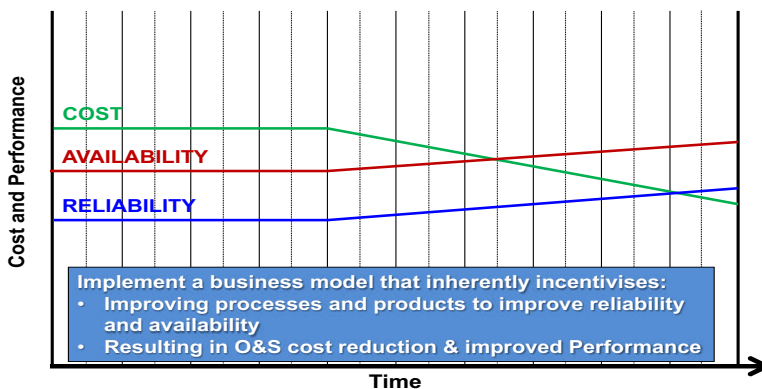
contractual arrangements. In OBC, the government procures an outcome, whereby industry takes on the responsibility, and associated risk, to deliver those required outcomes. Industry prime contractors include original equipment manufacturers (OEM), non-OEM competitors, or joint ventures of interested parties.

OBC arrangements have common characteristics and generally seek to achieve similar results, i.e. optimised performance and cost. By moving to OBC arrangements, governments have recognised that, by shifting the responsibility and risk, contractors were incentivised to make improvements, thus pro-

Transactional Support Strategies



OBC Support Results



Traditional vs. OBC support strategies

viding better outcomes at lower cost.

Increasingly, national military organisations (e.g. from UK, DE, NL, US) are leveraging the defence technological and industrial base (DTIB) to provide operational support, and are contracting for that support, based on the delivery of performance outcomes. Contracting for capability includes bringing outcome-based, commercially-provided solutions to logistics and sustainment to increase user-defined availability and capability, for the same or even reduced costs. Examples of outcome-based services can also be called performance-based logistics, fleet management, turn-key solutions, or total life cycle management, and OBC has become a method of obtaining an operational armament support that purchases "performance" (i.e. outcomes) rather than materiel, maintenance and/or repair services (i.e. outputs). OBC generally expresses requirements in terms of a desired end-state, rather than providing for prescriptive or specification-based work statements. Simply put, OBC is more about the "what", than the "how" in delivering the desired product. The approach is aimed at decreasing overall programme risk, improving reliability and maintainability, and driving down life cycle costs.

Aim of Study 1

The study had the objective to provide analysis, recommendations, and tools for NATO to effectively exploit outcome-based contracting.

The Study Group was tasked to analyse armament programmes that have been conducted using outcome-based contracting to achieve logistics or sustainment related missions. The evaluation of the respective programmes using outcome-based contracting had to include a comparative cost-benefit analysis between the outcome-based contracting and results that would have been expected using traditional contracting methods. The study included comparisons of other countries' efforts and results. Of particular value were the results from the US Department of Defense's report on Project Proof Point. This project assessed outcome-based support programmes, and found that 25 out of 26 of those realised, improved readiness at the same or less cost.

Relevant NATO policy and doctrine had to be identified and updated, to include the concepts of outcome-based contracting; sample language for consideration by the document custodian also had to be provided.

Furthermore, the Study Group was tasked to develop a decision tree type of tool that can be used by NATO programme managers to determine whether, and to what extent, outcome-based contracting might be appropriate given the programme parameters.

Study 1 – Outcome, Findings and Recommendations

The evidence observed during the study demonstrates that well-structured and well-defined OBCs will reduce total cost, increase system availability, and optimise industry performance (investments and costs) to deliver an improved outcome, i.e., a real win-win situation for government and industry.

The most important finding of the study is that OBC processes have the same value for NATO as traditional contracting processes. The overarching recommendation is that NATO should fully adopt and implement OBC processes. From that, more detailed recommendations are derived on a possible way ahead for such an implementation by the Alliance.

The final NIAG Study Report also includes recommendations on how NATO doctrine and policy might be enhanced to encourage consideration of outcome-based contracting. Sample language for inclusion in NATO documents is included.

Furthermore, the required tool is provided in the final Study Report. The tool is designed to support programme managers in determining which support solution is most favourable.

NIAG Study 2:

"Metrics / Metrics data and analytical tools in the life cycle of NATO systems and in contracting for logistics capability in NATO armaments and support programmes"

Background

OBC will not work without metrics. It is important that they are precisely defined, properly established and well used. OBC without metrics is highly ineffective.

Metrics are defined as a quantifiable entity that allow the measurement of the achievement of a process goal. Metrics can be measured and reported in order to help manage a process, service or activity. Metrics and metric data form an integral and essential part of contracting for systems, whether it is OBC-based or traditional.

In the context of the management of the life cycle of systems and of contracting for logistics capability, metrics and metric data should be identified as early as possible and feasible in strategy development and docu-

mented in the relevant plans and refined as the programme progresses towards implementation of the contracting arrangements. A metric normally has a threshold value, representing the minimum required value, and an objective value, representing the desired maximum value. These values, for example, can be tied to the incentive strategies in outcome-based product support arrangements and contracts and can serve as a powerful way to achieve desired support goals.

One of the most critical elements of any contracting strategy is the tailoring of metrics to the operational role of the system and ensuring synchronisation of the metrics with the scope of responsibility of the support provider. The level (system, subsystem or component) and specifics of the arrangement will dictate whether to use top-level outcome metrics, lower-tier metrics or both. The US Department of Defense (DoD) for example has identified the following four so-called Life Cycle Sustainment Outcome Metrics:

1. Availability (Materiel & Operational Availability)

A key data element used in maintenance and logistics planning.

2. Materiel Reliability

Provides a measure of how often the system fails/requires maintenance. Another key data element in forecasting maintenance/logistics needs.

3. Ownership Cost

They are focused on the sustainment aspects of the system and represent an essential metric for sustainment planning and execution and are useful for trend analyses. Furthermore, they support design improvements/modifications.

4. Plus Mean Downtime

A measure of how long a system will be unavailable after a failure. Another key piece used in the maintenance and logistics planning process.

Photo: NATO



Multi-Role Tanker Transport

These four Life Cycle Sustainment Outcome Metrics are universal across all programmes and are essential to effective sustainment and logistics planning.

Aim of Study 2

The aim of the study is to provide analysis, recommendations, and requirements for tools (e.g. a box of utilities, a set of mechanisms, best practices, a decision support tool) for the NATO community to effectively use metrics and respective data and analytical tools throughout the management of the life cycle of systems and in contracting for logistics capability.

This study is the direct follow-up activity to Study 1.

This NIAG Study concentrated on three focus areas:

1. The study should contain performance metrics and metrics data relevant to OBC contracting which, if this methodology is adopted, could be used and experienced in NATO contracting agencies such as the NATO Support and Procurement Agency (NSPA) and the NATO Eurofighter and Tornado Management Agency (NETMA), national contracting (e.g. US, DE) and industries (best practices);
2. The study was to provide a refined decision support model, which is based on the model developed by the previous NIAG study;

3. The study was to contain a training concept related to the outcomes of the study, including the use of the decision support tool.

The evidence observed during the study demonstrates that only well-structured and well-defined metrics and analytical data will enable efficient OBC processes.

OBC arrangements, and the implementation and use of metrics and analytical data are inseparably linked; they will not function alone.

Findings and Recommendations

The overarching recommendation is that NATO should fully adopt and implement the concept of using and implementing metrics, metrics data, and analytical tools throughout the management of the Life Cycle of Systems and in contracting for logistics capability.

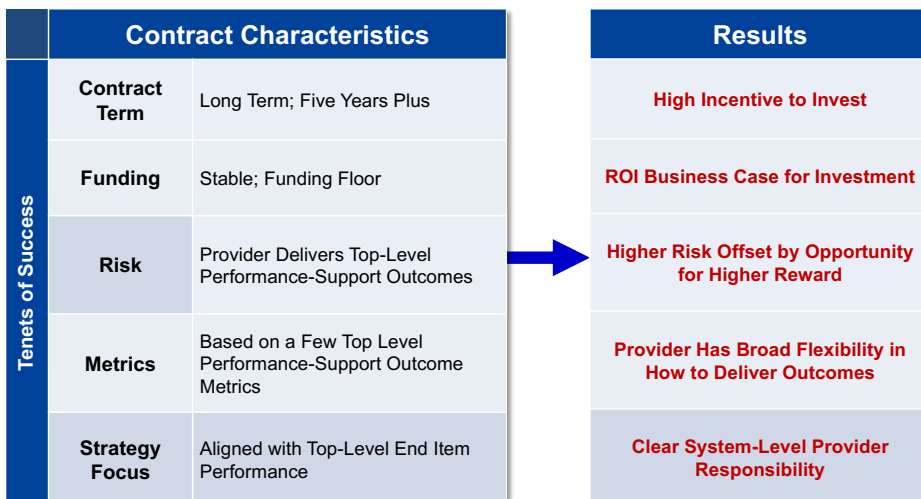
Conclusions

The logistic support for multinational defence programmes within the Alliance has always been an enormous challenge for all nations and industries involved. The contracting for their support and the relevant services have very often led to costly and ineffective solutions.

OBC processes have the same value for NATO as traditional contracting processes. The overarching recommendation is that NATO fully adopts and implements these processes, especially for new projects such as the Multi-Role Tanker Transport (MRTT), a High Visibility Project (HVP) establishing a multinationalally owned and operated fleet of MRTT aircraft.

In combination with the implementation and use of well-structured and well-defined metrics, total costs will be reduced, system availability increased, and industry performance (investments and costs) - to deliver an improved outcome - will be optimised, leading to a real win-win situation for NATO governments, agencies and industries.

OBC CONTRACTS CHARACTERISTICS



Viewpoint from New Delhi

Photo: Suman Sharma



India to Engage in UN Multilateral Reforms through Political Engagement

Suman Sharma

As India assumes its seat on the United Nations Security Council (UNSC) for the eighth time as an elected non-permanent member beginning 1 January 2021, with its agenda to push for reformed multilateralism, one is reminded of former US Ambassador to the UN Jeane Kirkpatrick's comment: "What takes place in the Security Council more closely resembles a mugging than either a political debate or an effort at problem-solving."

Seeking inclusiveness, accountability and striving for a structure which can accommodate multipolarity in a multilateral framework seems to be the driving force that India will aim to work towards during its time in the UNSC. India's Permanent Representative to the UN, Ambassador T S Tirumurti recently stated, "We will be a country which will reinforce multilateralism."

"India needs to have a proactive political engagement at the UN for incremental progress", stated India's former deputy permanent representative to the UN, Manjeev Singh Puri, adding that "Across the Atlantic, nations have given a fillip to multilateralism. The new Biden administration will work the traditional alliances like the World Bank and the IMF to make them more effective, which will work as a counterweight to China. China needs to be part of the game and play accordingly, keeping its large population in mind, and shed its hegemonistic designs."

Indian Prime Minister Narendra Modi laid out the blueprint last year in his address at the 75th anniversary of the founding of the UN for 'reformed multilateralism' in a post-COVID-19 world, which reflects the realities of the contemporary world, addresses contemporary challenges, focuses on human welfare and gives voice to all stakeholders. New Delhi plans to push for the finalisation of the Comprehensive Convention on International Terrorism which it had proposed in 1996 to augment global action against terrorism, their sympathisers and supporters seeking streamlining of the process of sanctioning of the terrorists and terrorist entities. Other priorities for India during its tenure include counter-terrorism, peacekeeping, maritime security, reformed multilateralism, technology for the people, women and youth and developmental issues, especially in the context of peace building. External Affairs Minister Dr. S Jaishankar reiterates that "Multilateralism is needed to reflect contemporary realities and adopt a comprehensive approach to peace and security and technology with a human

touch, which in turn will be guided by dialogue, mutual respect and commitment to international law. Global institutions needed to be reformed and adequately represented, in order to be able to deliver." To recall, India is presently represented in 22 UN Bodies. The country has previously served on the UN Security Council seven times as a non-permanent member (1950-51, 1967-68, 1972-73, 1977-78, 1984-85, 1991-92 and 2011-12), and India was one of the founding members of the UN.

Multilateral UN bodies like WHO, WTO, World Bank, IMF require active participation by India which has so far been passive and obstructionist, leading to global recognition of India's rise. This is possible only when India, like others, decides to work with other powers. One Ministry of External Affairs diplomat stresses that "We should also participate actively in the regional economic integration through trade and investment linkages or else no one will take us seriously. For example, our role in the Indo-Pacific will have no strength without a strong economic component to it", adding that "Security alliances have an aggressive posturing but there is a cost to be paid. This is an old model of the Cold War. Cooperation through alliance is needed for world peace and stability. More importantly for taking on China."

Ambassador Manjeev Puri differs slightly, explaining that "India has jumped up to being the fifth largest economy in the world. Security issues geographically speaking are not locational. It is more a question of shadow boxing among powerful nations. India is becoming important. The PM himself pushed for political engagement at his BRICS address, as well as his address at the 75th anniversary of UN foundation."

However, it is interesting to note that a multilateral UN body like the WHO, even after one year, has not yet come out with any concrete information regarding the origin of the COVID-19 pandemic and its real cause, thereby displaying its failure to function as a multilateral body.

During its two-year tenure at the UNSC, India aims to work collectively towards accountability from bodies like the WHO, in a bid to ensure prompt responses from them. The WHO's handling of the pandemic is an example of how important reforms of multilateral bodies are.

The Dutch Defence Sector on the Way towards a European Defence Market

Ron Nulkes

To date, no common European defence market has been created. This article considers five strategic recommendations for the successful development of the Dutch defence sector.

Geopolitical relations are hardening, and threats are increasing in number, variety and complexity, according to the Netherlands' Ministry of Defence "Defence Vision 2035" paper, published in 2019. That is why the Dutch government is committed to a strengthened Europe becoming an independent geopolitical player. NATO remains the cornerstone of Dutch security policy and one of the instruments to achieve this is participation in the European Defence Fund (EDF), for which the EU is making €7Bn available for the period 2021-2027. With the EDF, the European Commission intends to strengthen the existing defence capabilities in Europe with the aim of encouraging Member States and companies to increase cooperation in the field of research and development and in the acquisition of new defence capabilities. Additionally, the EC wants to strengthen the European Defence Technological and Industrial Base (DTIB) through the EDF. Until now, the European DTIB has been formed by relatively closed value chains. There is no level playing field since no open defence market exists in Europe. Not only do Member States want to keep sovereign control over the deployment and equipment of their troops for national security reasons, but they also want to protect their national value production chains. This has become particularly evident during the COVID-19 pandemic. Dutch security and de-

fence policy remain matters of national concern within the European and transatlantic context. This article looks at five strategic recommendations regarding the successful development of the Dutch defence sector en route to the European market. First, we will examine the Dutch approach to the EDF and national instruments.

The Netherlands' Commitment and Governance for the EDF

The Netherlands' Government has an expressed ambition to be among the top 10 countries with regard to the resources allocated from the EDF. In addition to its own national interest, it is in the future interest of Dutch companies to position themselves via-à-vis the EDF. In the first instance, the EDF focuses on research and development projects. It is not yet clear whether Member States will also obtain the results of these projects. The EDF requires at least three entities (such as companies, knowledge institutions, universities) from at least three different countries to participate in projects. Cooperation between governments and the private sector is therefore essential because Member States must express the intention to use the results of a project, with or without other Member States, for their equipment. Successful participation in the EDF therefore requires intensive coordination between the government and the defence sectors, as well as with foreign governments. In the Netherlands, the involvement of various national policy areas is essential in this respect. The Ministers of Defence and of Economic Affairs and Climate (EZK) have established the Interdepartmental Coordination Group (ICG) for European Defence Cooperation (EDS) and appointed a Special Representative (General [ret.] Tom Midden-dorp). The Defence sector is represented by NIDV (Nederlandse Industrie voor Defensie en Veiligheid) which is a member of the ICG EDS. Industry, ministries and knowledge institutions are thus working closely together to achieve the best possible result.

Photo: Ron Nulkes



Ron Nulkes, Director of NIDV

The National Defence Industry Policy

However, the Dutch Government is not focussing solely on the EDF. It allows new knowledge and technology to be incorporated into the value chain of the defence sector, thereby enabling new companies to enter the sector. However, there is no level playing field and an open defence market in Europe does not (yet) exist. Member States require not only sovereign control over the deployment and equipment of their troops for national security reasons, but also for the protection of their national production. A recent government policy document therefore stipulates a sovereign Dutch approach to be an instrument for strengthening the defence sector. To improve the position of the defence sector, the government deems customisation necessary. It states that the In-

Author

Ron Nulkes (colonel ret.) is Director of the Netherlands Industries for Defence and Security Foundation (NIDV). After various posts with the Koninklijke Marechaussee (Royal Military Police) and Royal Netherlands Air Force (RNLAf), he took up the position of division head project procurement of the Defence Materiel Organization of Dutch MoD in 2006. NIDV represents 180+ companies and knowledge institutes based in The Netherlands.

dustrial Participation (IP) policy, in addition to strengthening the DTIB, contributes to the international positioning of the Dutch DTIB and improvement of levelling the playing field. This Dutch hybrid course is steadfast.

A Hybrid Course for the European Security and Defence Policy

Most European countries are following a hybrid course in the development of a Common Security and Defence Policy. For the defence industry, this is essentially about strengthening international cooperation, such as the EDF, and a sovereign approach, with or without intergovernmental cooperation. The Permanent Structured Cooperation (PESCO) is an example of such cooperation.

The hybrid course of most Member States complicates the strengthening of European defence capabilities and breaking open the value chains. This approach transcends various policy areas within the Netherlands, so that the ICG has a crucial role to play. To properly position the Dutch defence sector for the EDF, strategic decision-making is needed on the following five points:

Funding Opportunities for EDF projects

Companies wishing to participate in EDF projects need financing of their long-term investments since not all the costs of participation are reimbursed by the EU and financing through financial institutions is problematic. Because of NGO pressure, most Dutch banks do not finance companies in the defence sector. Even the European Investment Bank (EIB) invests little or nothing in military programmes. The banks value the contribution of NGOs over security interests although the EIB now offers openings for loans to Member States for dual-use projects. The defence sector is a sector in which investments can be made, and not just in dual-use projects for Member States. The companies affiliated with the NIDV and ASD adhere to the integrity statute and therefore do not participate in prohibited weapons or unauthorised exports.

In addition, supplementary financial support from the government is necessary. A good start has been made with the reserve of €20M on the budget of EZK. According to the 'juste retour' principle (whereby the Dutch financial contribution to Europe flows back into the Dutch economy), which I would also welcome for the EDF, three to four times more is needed each year. I also note a positive general attitude towards achieving this volume. The Minister of Fi-



Photo: Koninklijke Landmacht

The Dutch Government is committed to a strengthened Europe becoming an independent geopolitical player.

nance must ensure that banks finance the defence sector. There must be clarity about additional financial support from the government.

The Netherlands Government should guarantee that financial instruments are made available to the defence and security industry. It has made a good start by reserving €20M for co-financing EDF projects.

The Relationship between PESCO and EDF

There are now 47 PESCO projects. The Dutch Government participates in 11 of these. These intergovernmental projects can also be registered for the EDF, including the prospect of a financial bonus. However, when a company is interested in an EDF/PESCO project, problems arise if the Member State of residence does not participate in that PESCO project, as two Dutch companies found out last year when they were excluded as consortium members. The European Commission was unable to intervene; here the PESCO and EDF regimes collide.

It should not matter whether a company is from a country participating in a PESCO project. If participation in such a project is refused for this reason, the Netherlands would have to join the PESCO project not only for operational but also industrial reasons, so that the company can still participate.

A European Implementation of Export Policy

Whilst Member States adhere to the EU Common Position on Arms Exports, controlling the export of military goods and technology is a sovereign affair. Moreover, it is unlikely that this will change anytime soon. With the Common Position (intergovernmental), a decision is tested against eight criteria, including a mechanism for information exchange. Unfortunately, these criteria suffer from significant differences

in interpretation. Compared to most other countries, the Netherlands has adopted a stricter interpretation of these criteria, something that enjoys strong political support nationally.

Although the Netherlands sets an example on reporting export control decisions, not all Member States make it clear why they grant a licence, while other Member States openly refuse to do so. This puts industry operating under more restrictive governments at a serious disadvantage. One of the first study projects of a preparatory programme of the EDF with a Dutch contribution has now been granted a licence. However, the Dutch EDF ambition will be limited if Dutch companies want to lead an EDF consortium with the goal of entering the market. Companies from countries with a less restrictive policy will think twice about participating in a consortium led by a company from a country with a restrictive export policy. Then, access to markets to recoup investments is, to put it mildly, unclear.

The export of military equipment outside Europe is essential for the European DTIB. For this reason, even non-restrictive France and the equally restrictive Germany have concluded bilateral agreements such as the 'Toulouse Treaty'. This means that if one of the countries participates less than 20% in a cooperative project, the leading country decides on exports. However, this agreement only addresses a symptomatic issue of large differences in interpretation of the Common Position. The success of the EDF therefore depends on the successful further harmonisation on the European Export policy.

Commitment to unambiguous interpretation of the Common Position is necessary. The Dutch Government should transfer the granting of export licences for the EDF to the Member State in which the consortium leader is located. The Netherlands will not be able to become a consortium leader for EDF projects if it remains more restrictive than the other participants in the consortium.

A Good Starting Position for the EDF

The Dutch DTIB is internationally renowned for its high-quality technological knowledge industry and competitiveness. However, the Dutch defence sector is under pressure due to increasing international consolidation, limited scale in the Netherlands and possibly due to protectionism from EU countries, which seem to make much more use of Article 346 of the Treaty on the Functioning of the European Union (TFEU). By focusing on Dutch design, development and construction, Dutch earning capacity will be created for decades to come.

Born a Decade too Early

With European Directive 81/2009, implemented in the Public Procurement Act for Defence and Security (ADV), the EU and the national governments have committed to an open and transparent European market for defence and security equipment. The directive, and therefore also the ADV, should contribute to achieving a level playing field in the European defence market with space for production and sales and the innovative industry. Although all Member States have implemented the Directive, they continue to exercise their sovereign powers through Article 346 (TFEU). In many cases, a defence assignment remains within the national value chain. Ten years after its introduction, it can be argued that the objective of Directive 81 has not been achieved. Less than 20% of the financial volume of European defence projects has been put out to European tender, though cross-border integration in the value chain based on the directive has hardly taken place. Directive 81 was born a decade too early, and instruments such as the EDF a decade too late to facilitate consolidation and integration of the European defence market. A different order might have directed the market more favourably. Large Member States actively encourage their industries to intervene in the defence markets of other Member States. And if Dutch assignments go abroad, the Netherlands will no longer play a role in the European value chain, even if it was established based on this EDF in the next decade. The IP policy has certainly benefited the Dutch defence sector in recent years with the focus on early participation in development programmes in line with the view that 'military off-the-shelf' projects are generally less technologically interesting. Joining a project with the American DTIB at an early stage has given several Dutch companies a permanent position in

Source: NL MoD



Like most European countries, the Netherlands takes a hybrid approach to its defence policy, relying on both European cooperation and sovereign decision-making.

the defence sector; as a result, the sector has regularly been able to develop and market components for weapon systems with interesting spin-offs and spillovers. Partly because of the transatlantic context of European cooperation, it is recommended to continue to apply the IP instrument explicitly in Dutch assignments to transatlantic and European suppliers. This is in line with the strategic objective to further develop this IP policy.

The use of Article 346 (TFEU) by the Netherlands is essential. The report on procurement law versus national security, in this case relating to the ecosystem for Dutch military-logistical capabilities, offers interesting starting points for legitimising this.

The Dutch government needs to continue using its national instruments. With the application of Industrial Participation and the use of Article 346 (TFEU), customisation can be applied for the Dutch defence sector. If a capacity is not available in the Netherlands, research should be conducted into the desirability to build it up.

A Choice of European Cooperation Partners

For the Netherlands, European cooperation offers the greatest opportunities if it is joined by German and French-led programmes. The Netherlands is accustomed to cooperation with both countries. But the Netherlands can also play a leading role where German and French companies can join. The NIDV has a partnership with several associations from like-minded countries, which meets at the Associates consultation. The countries of this Associates consultation and the preferences of the Ministry of Defence could be juxtaposed. It is recommended that the Netherlands decides with which countries it wishes to cooperate in the European defence dossier.

In the coming years, the Netherlands will not only be able to look back on an increase in the number of defence projects that flow into the market, but also on a realistic policy

for the defence sector. The execution, where possible, will be achieved based on intergovernmental cooperation (such as PESCO), but also through the EDF. The objective of the EDF is the development of military capabilities, whereby the European DTIB is strengthened through international cooperation in the value chain.

The Netherlands' Government focuses on two horses: the reinforcement of the European defence sector and the application of Industrial Participation whilst providing the essential pillars of co-financing of EDF projects and close coordination with industry and knowledge institutions. The Ministries of Defence and of Economic Affairs and Climate Policy actively support the Dutch defence sector to join the first EDF projects. Dutch ambition is well-suited to apply a *juste retour* principle in the implementation of the EDF.

Dutch security and defence policy will remain a sovereign matter for the time being. The intended strengthening of the geopolitical role of the EU requires that the Member States also cooperate in the field of defence equipment in a NATO context. Therefore, a focus is not only needed on European industrial cooperation, but also on transatlantic industrial cooperation. For our safety, it continues to be vital to pay attention to national industrial capabilities. It is legally tenable for the Dutch Government to acquire national projects, such as other Member States, with reference to Article 346 (TFEU), which applies customisation to the Dutch defence sector. This is not only about existing industrial capacities, but also about the question of whether these can be built up in the Netherlands.

In addition to its commitment to the EDF, the high-tech defence sector deserves such an approach for start-ups, scale-ups, small and medium-sized businesses and larger companies. It is up to the players of the Triple Helix of government, industry and knowledge institutions to help this policy on its way to the European defence market. ■

The Royal Saudi Air Force – Confronting Multi-Dimensional Threats

David Saw

The Royal Saudi Air Force (RSAF) finds itself in an incredibly challenging operational environment having to deal with both conventional and asymmetric threats. It is forced to do so at a time when the strategic realities in the Middle East are rapidly changing. What's more, the new US administration will pursue a new Middle Eastern policy signifying yet more change and uncertainty.

The Kingdom of Saudi Arabia (KSA) sees itself as being at the centre of the Islamic world. Islam's two holiest places, Mecca and Medina, are in the KSA and the King is known as the 'Custodian of the Two Holy Mosques'. The Saudi Kingdom's geographical position, together with its religious significance, especially in terms of Sunni Islam, and its wealth, also make the KSA the leading state in the Arab World.

Threat Perceptions

The strategic centrality of the KSA in the Middle East inevitably makes it a target for hostile actors, thus the KSA faces both conventional and asymmetric threats. While the KSA looks for strategic stability across the Middle East, its competitors look to spread instability, attack the Kingdom's allies and destabilise the country itself. Ensuring stability and confronting those who would encourage instability is particularly vital at this time, as the KSA embarks on an ambitious agenda of internal reform.

The Iranian Threat

The obvious primary threat to the KSA is Iran. While the KSA sees itself as the champion of Sunni Islam, Iran portrays itself as the champion of Shia Islam resulting in a long history of conflict between Iran and much of the Arab World. A significant element to consider is that the theocratic regime in Iran wishes to alter the political shape of the Middle East, thereby fundamentally challenging the KSA and its interests.

Evidence of Iran's intentions can be seen in the 'Shia crescent' that now extends from Tehran through Iraq and Syria into Lebanon where Hezbollah, Iran's proxy, holds the real power. The KSA and the United Arab Emirates (UAE) acting under the auspices of the Gulf Cooperation Council



Photo: US Air Force

In December 2020, Royal Saudi Air Force (RSAF) F-15s taxi at King Faisal Air Base during joint missions with US Air Force aircraft. The RSAF is a major user of F-15 aircraft, acquiring the F-15C/D under the Peace Sun programme, then the F-15S and more recently the F-15SA.

(UAE), helped the Bahraini government put down the 2011 revolution, where the Bahraini Shia were the dominant opposition force, amidst suggestions of possible Iranian interference. Since 2014, Iranian-supported Houthi forces battle Saudi-supported Yemeni government forces in the Yemeni Civil War, a brutal conflict on the southern border of the KSA that has often spilled over into Saudi territory and has seen direct Saudi military involvement and that of some of its GCC partners. Furthermore, there is the strategically and economically important Eastern Province of the KSA where the majority of the Saudi Shia population reside; there is plenty of scope here for Iran to foment trouble and look to destabilise the situation.

Any discussion of the Iranian threat is incomplete without mentioning the nuclear issue. It is well known that Iran intends to acquire a nuclear weapons capability. This is, of course, an existential threat to the

KSA, and once Iran is demonstrably nuclear-armed, we enter uncharted territory. At that point, Saudi Arabia will need a verifiable deterrent capability. Just how they are going to achieve that will be a critical factor for the future strategic stability of the region.

Disputes with Qatar

Qatar represents another threat to the KSA, although it might be more accurately described as a strategic competitor, or perhaps even an irritant. In June 2017, the KSA and many other Arab States severed diplomatic relations with Qatar, and blocked Qatari aircraft, ships and other forms of transport from crossing their territory by land, sea or air. As of January 2021, the Arab boycott of Qatar appears to have ended, but full diplomatic relations have yet to be restored. If anybody thought this meant a return to normal service, that Qatar had



Photo: Copyright Eurofighter - Jamie Hunter

The RSAF acquired 72 TYPHOON aircraft under the £4.43Bn SALAM project signed in 2007 between Saudi Arabia and the UK. The relationship goes back to the MAGIC CARPET programme of the 1960s and the AL YAMAMAH programmes of the 1980s and 1990s.

somehow been forgiven, and welcomed back into the Arab fold, then they have not been paying attention. The boycott was proving embarrassing and that is why it was ended. The fundamental problems between Qatar and many of the other Arab states continue to exist and are not going to disappear.

Despite Qatar being a relatively small country, it is nevertheless an incredibly wealthy one and has proven to be highly skilled at projecting soft power. Al Jazeera news channel, based in Doha, in both its Arab and international versions, is a classic soft power tool. Qatar's political lobbying network is also well connected and effective from Washington DC through to Berlin, London and Paris. Furthermore, Qatar continues to cause disquiet due to its funding -

both overt and covert - of extremist groups in the Middle East, especially the Muslim Brotherhood. This grouping is considered to be an anathema by the KSA, the UAE, Egypt and other Arab states.

The KSA has had border disputes with Qatar in the past which have turned violent, however, armed clashes between the two countries are now deemed unlikely. The presence of a major US base at Al Udeid in Qatar further reduces the possibility of conflict. That being said, since 2015, Qatar has significantly boosted its airpower via the acquisition of 36 Dassault RAFALE DQ/EQ, 24 EUROFIGHTER TYPHOON and 36 Boeing F-15QA, all arriving with extensive air weapons packages. Undoubtedly, an unwelcome development for the KSA was the fact that Turkey was invited to establish a major base in Qatar, which could eventually accommodate a brigade-sized unit. Suspicion of Turkish intentions is widespread across the Arab world at present.

Saudi Airpower

In terms of combat aircraft, the RSAF has traditionally turned to Great Britain and the US to meet its needs. Back in 1966, the KSA was forced to upgrade RSAF combat capabilities in the face of a conflict in Yemen. This resulted in a programme known as "Magic Carpet" under which an initial batch of six HUNTER aircraft were acquired as an interim measure, followed by six LIGHTNING F.52 and two LIGHTNING T.54 aircraft. This was later followed by the arrival of 34 LIGHTNING F.53K, six LIGHTNING T.55K and 25 STRIKEMASTER Mk 80 trainer/light attack aircraft.

In 1985, the first in a series of arms sales with Britain was agreed. Known as Al Yamamah, the first sale covered the supply of 24 TORNADO ADV, 48 TORNADO IDS aircraft and 30 HAWK 65 trainers. In 1993, the second Al Yamamah contract was agreed, covering the sale of 48 TORNADO

IDS and 20 HAWK 65A trainers. Following this,, the Tornado Sustainment Programme would see an upgrade in the capabilities of the RSAF TORNADO IDS fleet.

All of this led to the Salam Project, a £4.43Bn programme signed in September 2007, covering the acquisition of 72 TYPHOON aircraft, 48 Tranche 2 and 24 Tranche 3 variants. Subsequently, HAWK 165 trainers were also acquired. An option remains for a second purchase of 48 TYPHOON aircraft, which has long been discussed but has been slowly fading into the background.

Regarding RSAF programmes with the US, at the end of the 1970s, the RSAF embarked on the "Peace Sun" programme which was followed by the eventual acquisition of 72 F-15C and 22 F-15D aircraft through to the early 1990s. The RSAF then acquired 72 F-15S aircraft, the Saudi variant of the F-15E, from the mid-1990s onwards. The last major US purchase, according to the 2010 Defense Security Cooperation Agency notification to Congress, valued at over US\$29Bn, covered the acquisition of 84 Boeing F-15SA aircraft, with APG-63(v)3 AESA radars, plus the upgrade of 70 F-15S aircraft to the F-15SA configuration, as well as air weapons, training and support.

The future of the RSAF obviously rests with the F-15SA and the TYPHOON. However, should the Joint Strike Fighter (JSF) arrive in the Gulf as seems likely via a UAE acquisition, then the KSA would also look to acquire that kind of capability. In the meantime, the key considerations for the RSAF include enhanced target detection and engagement capabilities allowing the effective use of stand-off weapons to suppress ground targets and reduce the threat to attacking aircraft. Operations over Yemen have shown the risks to aircraft in ground attack missions and thus far, UAV systems have failed to adequately replace/supplement manned aircraft in these missions.

There is also a need to improve capabilities in terms of air defence missions, and not just against manned aircraft. Iran and its surrogates have used UAV systems to attack critical infrastructure targets, such as the oil industry and airports. Attacks have already been at multi-UAV level and will inevitably expand to UAV swarms in the future.

Fundamentally, the challenge for the RSAF is to continue to improve the quality of its effectiveness. Simply acquiring more aircraft is not a measure of success. Unfortunately, for both the KSA and the RSAF, the future in the Gulf region is one of strategic uncertainty, challenging the soft power capabilities of the KSA and the deterrent capabilities of the RSAF. ■



Photo: US Air Force

A RSAF Boeing F-15SA is tanked by a KC-135 during a training mission in September 2020. The RSAF acquired 84 F-15SA aircraft and has upgraded its existing fleet of 70 F-15S aircraft to the F-15SA configuration.

INTELLIGENCE FOR THE INTELLIGENT

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Advances in Naval Mine Countermeasures

Luca Peruzzi

Mine Countermeasure (MCM) operations have always been time, manpower and equipment consuming. The technological developments offered by the unmanned and increasingly autonomous systems are allowing the industries and navies to look to modular equipment ‘toolboxes’ being operated by motherships standing off from the minefield, increasing safety levels and speed of operations.

The ‘toolboxes’ include unmanned surface vehicles (USVs) able to autonomously launch, recover, search and identify autonomous underwater vehicles (AUVs), towed side-scan sonar and mine neutraliser vehicles, in addition to aerial systems from the mothership, all connected and managed through a command and control system. Technological and operational challenges, including autonomous target recognition, communications and unmanned platform power management, however, need to be overcome.

Photo: US Navy / Bill Mesta



The Textron Systems 12.7-metre long Common Unmanned Surface Vessel (CUSV) will deploy from LCS and vessels of opportunity carrying alternatively the same company UISS (Unmanned Influence Sweep System) or the remote minehunting mission equipment.

US Programmes

After many years of operations with AVENGER class (and previously also OS-PREY class) mine countermeasures vessels (MCMVs) and Sikorsky MH-53E SEA DRAGON helicopters equipped with dedicated towed systems, the US Navy's future surface MCM warfare requirements are planned to be fulfilled by a mix of unmanned and manned systems deployed from the Littoral Combat Ship (LCS) class of ships and vessels of opportunity (VOO), while the airborne MCM capability is being evaluated for post-2025 operations. Developed to counter deep, shallow, and tethered mines in the littoral environment, in addition to the Northrop Grumman MQ-8B FIRE SCOUT Vertical Take-off and Landing UAV equipped with dedicated payloads, the LCS MCM Mission Package's (MP) latest configuration includes the Unmanned Minesweeping System (UMS), Remote Mine-Hunting (RMH) and Buried Mine-Hunting (BMH) capability modules. Both the UMS and RMH packages are based on the same 12.7-metre long Common Unmanned Surface Vessel (CUSV) supplied by Textron Systems, towing the UISS (Unmanned Influence Sweep System) or the remote mine-hunting mission equipment. The

Photo: US Navy / John Green



The Raytheon AN/AQS-20C towed minehunting sonar together with the future BARRACUDA mine neutralisation system will provide the US Navy a full-cycle semi-autonomous MCM capability.



capability supporting clandestine mine detection against volume, bottom, and buried mines, with Block 1 IOC planned for Q3 FY 2022.

The MMCM Joint French-UK Programme

Last November, on behalf of the French and UK MoDs, the OCCAR agency awarded Thales Defence Mission Systems a contract for the delivery of unmanned-based MCM packages under the Phase 2 of the so-called Maritime Mine Counter-Measures (MMCM) pro-

Photo: Thales

As part of the MMCM programme's unmanned systems package, the 12-metre USV by L3Harris ASV & Thales will operate the Thales T-SAM towed sonar with SAMDIS high-resolution single-path antenna system for detection, classification and localisation of mines.

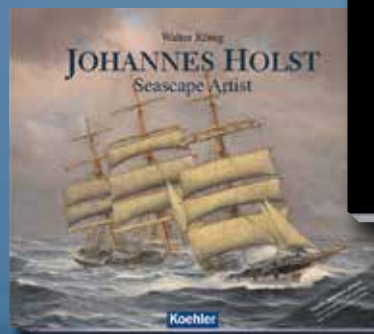
Textron Systems-provided UISS towed system consists of a magnetic/acoustic sweep system which low-rate production was launched in the Q2 2020 and is planned to reach the initial operational capability (IOC) in 2021.

The RMH module includes the under-delivery towed Raytheon AN/AQS-20C (or the Northrop Grumman AN/AQS-24B towed by RHIB-based USV used by the US Navy in the Gulf) mine-hunting sonar, in addition to the future BARRACUDA mine neutralisation system. Capable of single-pass detection, classification and localisation (DCL functions) and an IOC planned for Q4 FY 2021, the AN/AQS-20C, together with the BARRACUDA mine neutralisation system, will provide the US Navy a full-cycle semi-autonomous mine countermeasures capability. The BARRACUDA is an expendable, modular, mine neutraliser with an A-size sonobuoy diameter intended for employment from a surface platform (initially the CUSV together with the towed sonar) to autonomously reacquire, transmit data with a communication buoy to the MCM MP operator and neutralise previously detected near-surface mines. With a detailed design and development contract awarded to Raytheon in April 2018, the BARRACUDA is set to achieve IOC in 2026. The General Dynamics KNIFE-FISH medium class UUV provides the Buried Mine-Hunting

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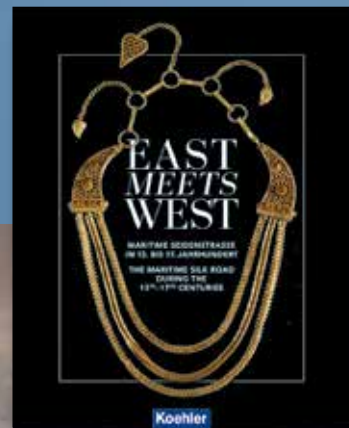
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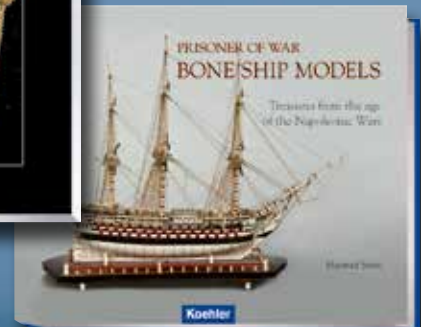


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The Atlas Elektronik UK (AEUK) autonomous ARCIMS USV will be used by the Royal Navy for minehunting applications, hydrographic and mine-sweeping operations, in the latter case with a system developed by AEUK.

gramme. Following the successful completion of previous phases awarded by OCCAR in 2015 and 2016 in which two identical system demonstrators have been procured and successfully proved their capabilities at sea for each country, the procurement phase launched last

November sees the acquisition of three so-called 'primary systems' for France and the upgrade of the demonstrator system, in addition to a new Shore Operation Centre (SOC) and a training centre, the latter two facilities also provided by Thales. Two new 'primary systems'



The French/UK MMCM mission package will use the Saab MuMNS (Multi-Shot Mine Neutralisation System) ROV to-relocate and neutralise the threat. The MuMNS is equipped with three reloadable munitions to accomplish multiple neutralisations in one mission.

and the upgrade demonstrator were acquired in November 2020, while the third 'primary system' will follow in 2021 and an additional four are planned by 2025. Each primary system is made up of two 12-metres USVs by L3Harris ASV & Thales, one accommodating the Thales T-SAM towed sonar with SAMDIS high-resolution and single-path multi-view capable system for detection, classification and localisation (DCL functions) of the threats and the other the Saab MuMNS (Multi-Shot Mine Neutralisation System) ROV able to-relocate and neutralise the threat. The MuMNS is equipped with three reloadable munitions to accomplish multiple neutralisations in one mission. The upgraded demonstrator (primary system) is made of one Portable Operations Centre (POC) by Thales including a Mission Management System and MiMap software for post-mission analysis, one USV L3Harris ASV & Thales with one MuMNS and one TSAM, in addition to three ECA Group ESPADON AUVs with a Thales SAMDIS payload. The latter systems were included into the package to conduct clandestine longer reconnaissance missions and DCL functions.

The UK acquired three 'primary systems' with identical systems, but with each including one Thales POC, one USV with one TSAM and MuMNS each and the upgraded demonstrator 'primary system' made up of one POC, including the same MMS and MiMap post-analysis software package, one USV and one TSAM and MuMNS each. Concerning the AUV/UUVs for the primary systems, ESD understood that the French MoD will first evaluate systems as part of MMCM before deciding which type/size of AUV/UUVs to procure between the large (ECA Group A27-M) or medium (ECA Group A18-M). Thales SAMDIS sonar and communication systems are compatible with both types of UUVs, as well as the MMCM operational centre, said the French Group. The UK MoD has launched a AUV/UUV market survey to which Thales will participate with other suppliers.

French SLM-F

The French MMCM programme segment is part of the wider Marine Nationale's SLAM-F (Système de Lutte Anti-Mines Futur) programme. The containerised MMCM systems can be quickly deployed by air and vessels of opportunity, but in addition to being controlled by onshore C2, they will be embarked and operated by four-to-six new Bâtiments de Guerre

des Mines (BGDM) to be procured by the French DGA to replace the current fleet of ten TRIPARTITE type MCMVs. The new large-size 80-90 metres and 3,000/3,500 tonne BGDMs will have the capability to operate two USVs with AUV/UUVs, as well as UAVs to be delivered from 2025. The programme also regards the procurement of three new generation Bâtiments Bases de Plongeurs Démineur (BBPD NG) or dedicated MCM/EOD diver support vessels to replace the current fleet of four dedicated platforms.

The UK MHC Programme

The Royal Navy's Mine countermeasures and Hydrographic Capability (MHC) programme was established with the goal of procuring a capability that will, over time, replace the HUNT class, SANDOWN class MCMVs and hydrographic vessels with unmanned vehicles suites controlled from onshore or at-sea not-dedicated platforms. However, in the meantime, the two MCMV classes are being upgraded to extend their life-service and be retired between 2023-2031. Under the 'Project Wilton' initiative of the MHC programme, in 2020 the service established a UK peacetime route survey capability putting together USVs, AUVs, portable operations centre (POC) and associated communications. Two Atlas Elektronik UK (AEUK) autonomous 11 metre ARCIMS (Atlas Remote Capability Integrated Mission Suite) USVs which will be joined in 2021 by a 15-metre SEA class platform, also provided by AEUK, and fitted with an advanced autonomy controller for launch and recovery of mission systems or alternatively the C2 of smaller ARCIMSs. 'Project Wilton' will initially manage a fleet of AUVs, including the Hydroid REMUS 600 and 100, L3Harris upgraded Iver3 platforms, as well as M500 ROVs, together with hydrographic and off-the-shelf mine-hunting sonars. The follow-on step will see the UK MMCM system addition, while the UK MoD launched a survey to acquire three sets of new UUVs, launch and recovery systems, C2 and different payloads in 2021. The other initiative called 'MCM in a Box' regards the development of a portable and modular mine-hunting and disposal capability to be forward-deployed in the Gulf. Last January, the UK MoD awarded AEUK an additional contract for the supply of the new combined influence minesweeping systems as part for the MHC programme. The contract covers the supply



Photo: ECA Group

The ECA Group A18-M AUV has more recently been acquired in Europe for the BE/INL offboard MCM programme and by the Latvian MoD, together with other ECA Group equipment.



Photo: ECA Group

The Belgian and Dutch MoDs have acquired from Belgian Naval & Robotics, a JV of Naval Group and ECA Group a complete offboard MCM suite, including 12 motherships and a pool of circa 100 MCM drones called toolbox, shared by the two navies.



The German Abeking & Rasmussen shipbuilder announced last November the steel cutting for two new platforms based on an evolved Type 332 FRANKENTHAL class non-magnetic steel MCMV design for the Indonesian Navy.



The second EL KASSEH class MCMV has been delivered to the Algerian Navy by Orizzonte Sistemi Navali (OSN), a JV of Fincantieri and Leonardo, while a third one is under construction.



Last January, Elbit Systems announced the award of a contract from an Asian-Pacific country for supplying an undisclosed number of SEAGULL USVs equipped with a MCM equipment package.

of three 11-metre ARCIMS USVs configured with a power-generation module and towed magnetic, acoustic, and electrical influences.

The Future Offboard MCM Programme

The BE/NL stand-off MCM capability based on motherships employing a 'toolbox' of offboard unmanned MCM systems will be fulfilled by the Belgium Naval & Robotics, the consortium of Naval Group and ECA Group, which was contracted in May 2019 by Belgian Defence, also on behalf of the Netherlands' MoD, for the supply of twelve 2,700-tonne displacement motherships, six for each navy, plus a pool of about 100 MCM drones called 'toolbox', shared by the two navies and supplied by ECA Group. Each mothership is equipped with two lateral stations to launch and recover 12.3-metre INSPECTOR 125 USVs in two different models. The USV family will deploy the A18-M AUVs equipped with the UMISAS synthetic aperture sonar, the towed vehicle with the T18-M towed sonar, the mine identification and disposal systems (MIDS) comprising the SEASCAN Mk2 and the K-ster C ROVs, all provided by ECA Robotics, and the minesweeping suite, towing magnetic/acoustic influence systems to be provided by Polish CTM. The motherships will be equipped with ECA Robotics UMISOFT software with the Naval Group's Multi-Drone Mission System (SMMD, Système de Mission Multi-Drones) for unmanned mission planning, execution and data analysis, as well as the integration with the Naval Group's Polaris Command Management System (CMS) and the supply of the UMS SKELDAR V-200 unmanned aerial vehicles. In charge of the ship's preliminary design, Naval Group works in close collaboration with the Kership JV between Piriou and Naval Group, which will carry out the detailed design of the ships and their construction. Kership's activities will start after crossing the preliminary design review milestone, which was scheduled for last December. The ECA Robotics Belgium will take delivery of all unmanned systems carried by the 12 motherships under a contract awarded last September. Spanning a 10-year period, after a design period of three years, Belgium Naval & Robotics will move into the production phase of these drones, while Kership will begin construction of the first-of-class mothership, which together with its mission and drones suite, will be delivered to the Belgian Navy in 2024.

Other European Programmes

Last September, the ECA Group announced that it had been awarded a €20M contract by the Latvian MoD to modernise three ex-ALKAMAAR class (Tripartite type) MCMVs acquired from the Netherlands in 2006, opening the way for the French Group to upgrade these programmes. The modernisation carried out with ECA Group's Mauric naval design bureau subsidiary and Latvian companies, will see the adoption of a UMIS integrated system with A18-M AUVs and SEASCAN Mk2 and K-Ster C mine identification and disposal systems, allowing for out-of-minefield MCM operations. Together with a new Mine Warfare Data Centre, the platforms will be delivered in 2021, 2023 and 2024.

The Polish Remontowa shipbuilder announced last December the launch of the third KORMORAN II class MCMVs for the Polish Navy. The latter will be equipped with Teledyne Marine GAVIA AUVs and Saab Deutschland Double Eagle Sarov hybrid ROV/AUV systems together with KATFISH 180 towed high-resolution side-scan sonar from Canadian company's Kraken Robotic. This system is also at the centre of the Danish Navy's upgrading of MSF class manned/unmanned remote-controlled platforms to be delivered in 2022-2023.

Looking to exports, last December, the second EL KASSEH class MCMV for the Algerian Navy delivered by Orizzonte Sistemi Navali (OSN) JV between Fincantieri and Leonardo, reached the North African country, while a third vessel is under construction. The vessels are built by Intermarine (IMMSI Group) and based on the worldwide known family of MCMV based on monocoque single skin glass reinforced plastic, equipped with a combat system provided by Leonardo and MCM suite including Atlas Elektronik hull-mounted sonar, Gaymarine PLUTO PLUS ROVs and a Klein Marine Systems side-scan sonar. In late November, the German Abeking & Rasmussen shipbuilder announced the steel cutting

for two new platforms based on an evolved Type 332 FRANKENTHAL class non-magnetic steel MCMV design for the Indonesian Navy to be delivered by mid-2023. No further information has been released, but the new platforms are likely to be equipped with a mission suite, including MCM drones belonging to the SeaFox family.

Israeli Developments

Last January, Elbit Systems announced the award of a contract from an Asian-

Pacific country for the supply of an undisclosed number of SEAGULL USVs equipped with a MCM equipment package. This includes integrated side-scan and forward-looking sonars, mine identification and destruction ROVs. The USVs also will be equipped with the company's autonomous suite, combat management system and satellite communication capability. Thanks to the suite, according to Elbit Systems, the SEAGULL USVs will be able to execute end-to-end MCM operations, handling bottom, moored and drifting sea mines. ■

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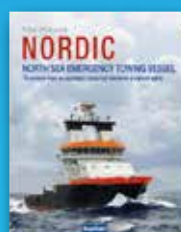
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Indian Naval Aviation Considering Major Reforms in 2021

Suman Sharma

The Indian Navy has ambitious plans for its air arm and has outlined some major purchases in 2021

Hideki Tojo, the man reported to have ordered the Pearl Harbor attack in December 1940, a General in the Imperial Japanese Army and later prime minister, proved the importance of the naval air arm in wars. He later remembered: "The main American naval forces were shifted to the Pacific region and an American Admiral made a strong declaration to the effect that if war were to break out between Japan and the United States, the Japanese Navy could be sunk in a matter of weeks." During World War II, the world witnessed what was soon to become the future of wars. Japanese naval air power launched 353 aircraft from six heavy aircraft carriers in a surprise military strike destroying or crippling 19 US ships.

Indian Naval aviation has come a long way from pitting its sole aircraft carrier, INS VIKRANT in 1961's "Operation Vijay" liberating Goa from Portuguese colonial rule, to gearing up for modernisation through some of its major programmes in 2021.

The gravity of having a strong naval air arm recently took centre stage when the Indian Naval Chief Admiral Karambir Singh stated that "Air operations are integral to naval operations. Airpower at sea is required here and now. If you have an aspiration to become a US\$5TN economy and have one-fifth of the world's population, you would have to go outward and seek the world. For that, air power is required at a longer range and is absolutely necessary." Naval Chief Singh, who is himself a helicopter pilot, stressed that "We have not yet gone to the government (seeking approval and funds) for the third carrier as we first want to get certain parameters right. But we don't want to be a Navy tethered to the shore." And Vice Admiral (ret.) Shekhar Sinha of the Indian Navy, a former SEA HARRIER pilot says, "Since the 1960s, the naval aviation doctrine has been about operating three carriers, one on the eastern seaboard and one on the western seaboard. The Indian Navy's maritime domain awareness is robust. Naval air assets have a larger reach and can find targets much faster and destroy them."

Photo: via author / CC



INS VIKRAMADITYA is the Indian Navy's first aircraft carrier.

The Indian Navy currently operates its sole aircraft carrier INS VIKRAMADITYA whereas a second carrier – an indigenous battleship, to be christened INS VIKRANT post-induction – is undergoing sea trials.

The Indian Navy has ambitious plans for its air arm and has outlined some major purchases for 2021. The big push this year will be the launch of India's first indigenous aircraft carrier - INS VIKRANT - and the finalisation of the long pending RFP (Request for Proposal) for the 111 NUH (Naval Utility Helicopter) deal.

VIKRANT, with its length of over 260 metres and a 60-metre breadth, capable of operating STOBAR (short take-off but arrested recovery) aircraft, including the indigenous LCA (Light Combat Aircraft) TEJAS, has two take-off runways and a landing strip with three arrestor wires. The basic design for the indigenous VIKRANT was the responsibility of the Indian Navy's Directorate of Naval Design with the detailed design done by the design team of CSL (Cochin Shipyard Limited). Scheduled for commissioning in early 2021, VIKRANT will be fully operational by 2022.

There is some foreign assistance in the VIKRANT project in the form of consultation and integration. The Italian Fincantieri

has assisted in the streamlining of supplies, systems, components and training. Vice Admiral (ret.) Anup Singh of the Indian Navy says, "The contract with Fincantieri is about propulsion system integration. Fincantieri was chosen after an open selection process as the oversight contractor for integration of the entire propulsion system." Former Indian Naval Chief, Admiral Sureesh Mehta, himself a former SEA HAWK pilot lauds the present Naval Chief's remarks, "All three aircraft carriers are not operational at any one point of time, two are operational and one is always under refit, therefore the decision to have three carriers is a wise one."

Helicopters

The long pending US\$3Bn deal proposal to acquire 111 NUH for the Indian Navy to replace the ageing vintage CHETAK helicopters has been shelved due to a lack of consensus over involving government-owned Indian PSU (public sector unit) HAL (Hindustan Aeronautics Limited). These choppers are mandatory for search and rescue operations, casualty evacuation, low-intensity marine operations and torpedo drops. This proposal was

first initiated in 2008 with the aim to buy the entire lot from foreign manufacturers, but in 2014, changes were made in the proposal to buy just 16 and build the remaining 95 in India. In 2018, the Government of the day decided to involve private Indian manufacturers. In May 2020, the DAC (Defence Acquisition Council) went ahead with its decision to involve the Indian PSU HAL as the partner with the selected foreign firm, thereby inviting opposition from the Indian Navy.

The 111 NUH is Indian Navy's first programme under the new Strategic Partnership model. The Strategic Partnership is aimed at boosting domestic manufacturing in collaboration with foreign firms and reducing defence imports that currently account for 60 per cent of military acquisitions. Under this model, a foreign vendor teams up with an Indian partner. It can include either a private Indian manufacturer or a Government-owned PSU. The foreign chopper giants identified for the 111 NUH programme are Lockheed Martin, Airbus Helicopters, Bell Helicopters and Russian export agency, Rosoboronexport, while the Indian private players are TASL (Tata Advanced Systems Ltd), Mahindra Defence, Adani Defence, Larsen & Toubro and Bharat Forge.

Six KAMOV-31 AEW (airborne early warning) helicopters worth US\$295M from Russia under a single vendor purchase are high on the priority list this year. These choppers will be on board the IAC-1 VIKRANT performing the role of an extra set of eyes. Radars on board Indian naval ships are unable to track low-flying targets owing to their limited 'horizon', which is where the KAMOVs come in as they have a rotating radar. The KAMOV-31 has a radar system capable of detecting aerial targets up to a distance



Photo: Airbus

The Indian Navy uses HERON TP UAVs to patrol the innermost layer of India's three-tier maritime surveillance network

of 200 kilometres away and also scanning targets on sea and land.

The US\$905M deal for 24 multirole helicopters to replace the SEA KING 42/42A ASW fleet was inked in February 2020 during US President Donald Trump's visit, under the fast track mode, between Sikorsky and the Indian Government; deliveries will commence in early 2021.

The MH60Rs were envisaged to operate from frontline ships and aircraft carriers providing them with the critical attributes of enhanced surveillance and attack capability. They will be employed in offensive and defensive roles including anti-submarine warfare, anti-ship strike, low intensity maritime operations, and search and rescue. Their delivery comes at a time when the Indian Ocean region is witnessing an increased security threat due to the proliferation of Chinese submarines.

Fighter Jets

For its aircraft carriers, the Indian Navy is eyeing 57 multirole carrier-borne fighter

jets to replace the existing MiG-29K fleet in a mega deal worth US\$25Bn. The envisaged roles for these 57 fighters include shipborne air defence, air-to-surface attack, aerial refuelling, reconnaissance and electronic warfare. Boeing F/A-18E/F SUPER HORNET and Dassault RAFALE-M have emerged as the main contenders for this deal. Vice Admiral Sinha explains, "As for the 57 fighter aircraft required for the carriers, unlike other nations, India first selects a carrier then finalises an aircraft for it, whereas it should be the other way round." With the deal clearly in mind, Boeing recently demonstrated the compatibility of its F/A-18 SUPER HORNET fighter jets with the Indian Navy's aircraft carriers, at a shore-based facility, Naval Air Station Patuxent River, Maryland, US, demonstrating that the F/A-18 SUPER HORNET could synchronize well with the Indian Navy's STOBAR system. INS VIKRAMADITYA and the under-construction indigenous aircraft carrier (IAC)-I VIKRANT both have a ski-jump with a STOBAR mechanism.

Armaments for the 57 twin-engine deck-based fighters include a gun, plus four beyond-visual-range air-to-air missiles and two all-aspect air-to-air missiles. Overtures by the Indian Government-owned defence research agency DRDO (Defence Research and Development Organisation) has however, provided a ray of hope to the Government's recent clarion call for a 'Self Reliant India' when it proposed developing a twin-engine deck based jet, modelled on the indigenous Naval LCA, due to enter service by 2030. The need for an indigenous fighter was felt following three MiG-29K accidents in the past year, raising questions about their safety record.

The Naval LCA programme which began in 2009, achieved a milestone in January 2020 as it successfully demonstrated its first ever arrested landing on board INS VIKRAMADITYA on completion of extensive trials



Photo: Airbus

The Indian Navy wants to purchase another six Russian-made KAMOV-31 helicopters.

Photo: via author / CC



India wants to buy another six Boeing P8I aircraft for US\$1.8Bn.

on the SBTf (Shore Based Test Facility). The Naval LCA jointly being developed by ADA (Aeronautical Development Agency), DRDO and the Indian Navy, has a strengthened landing gear and other necessary modifications for a carrier. The Indian Navy has plans to acquire 40-50 LCAs for both INS VIKRAMADITYA and VIKRANT.

Vice Admiral (ret.) Sinha adds: "The air arm of the Navy has long been neglected, but now it's moving ahead rapidly, as we have seen in the recent past with INS VIKRAMADITYA, P8is, MiG-29Ks coming in. As for maritime surveillance, a total of 31 aircraft are required. P8is are also performing an ASW role. The first draft proposal for anti-submarine warfare helicopters was initiated in 1995, but the deal for 24 MH60R was inked during President Trump's visit to India in February 2020."

Surveillance

Surveillance capability is paramount in maritime aviation. After acquiring eight LRMR (long-range maritime reconnaissance) aircraft P8i worth US\$2.1Bn, the Indian Navy placed an order for four more under the optional clause, worth US\$1.1Bn, followed by a recent announcement for six more.

Former Naval Chief Adm. Mehta says, "Surveillance is required as a large area has to be covered. Air assets give a larger reach. More numbers are required as the oceans are huge. From the east coast to the west coast, the entire area concerns India and it is only through surveillance that these waters can be kept cleared. The P8i induction was a major step as these planes are performing well."

Also referred to as 'submarine hunters' for their anti-submarine warfare role, the Boeing P8is, based in southern India

at INS RAJALI, Arakkonam, are known for their snooping and anti-submarine warfare capabilities. These patrol planes are being extensively used in the Indian Ocean and eastern Ladakh ever since the border standoff with China kicked off in May 2020. The ninth P8i was commissioned in July 2020, while the last three are poised to enter service in 2021. The P8is are packed with radars, electro-optic sensors, HARPOON Block-II missiles and MK-54 lightweight torpedoes.

Following China's increasingly aggressive posturing, India is moving ahead with an additional order for six P8is in July 2020 worth US\$1.8Bn. The deal is high on the list to be signed this year.

With an operating range of over 350 nautical miles, MRMR (medium range reconnaissance aircraft) touted as the Navy's 'eyes and ears' over the Indian Ocean in the medium range. The RFP for the nine MRMR worth over US\$1.5Bn was sent to Alenia (ATR 72 MPA), Airbus Military (C-295 MPA), Antonov (An-70), Boeing; Elta, Lockheed Martin (SC-130 version of the HERCULES), Saab (340 or 2000 MSAs) and Embraer (EMB-145-based MPA). The deal is likely to see conclusion in 2021. The deal for MRMR aircraft, poised to replace the ageing vintage ISLANDERS, is likely to be concluded in 2021. These surveillance planes will join Dornier-228s and IL-38s of the Indian Navy and the Coast Guard to secure the 7,516 kilometre long Indian coastline. With 350 nautical miles as the operating range the MRMR planes will act as the Navy's eyes and ears over the Indian Ocean region in the medium range, whereas the P-8Is with their 1,200 nautical miles operating range, patrol the outermost layer of India's three-tier maritime surveillance network. Israeli HERON and SEARCHER-

II UAVs teamed with Dornier-228s make up the inner most layer.

To buttress its lethal unmanned strike capability, the Indian Navy is also keen on armed SEA GUARDIAN, worth more than US\$1Bn. The 'hunter-killer' SEA GUARDIANs, with their advanced ground control stations, air to ground missiles, smart bombs, launch and recovery elements, all of which was augmented with the signing of the Indo-US bilateral military pact COMCASA (Communications, Compatibility and Security Arrangement) in 2018, thereby paving the way for greater access to advanced military technologies which the SEA GUARDIANs possess.

The original deal was for 22 armed drones, reduced later to 12. In 2021, this proposal is expected to move ahead with the new US administration under the Pentagon's FMS (Foreign Military Sales) and see the light of the day.

Meanwhile, the Indian Navy has leased two non-weaponised MQ-9B SEA GUARDIAN drones for a period of one year for surveillance over the Indian Ocean region and eastern Ladakh sector, from the American drone giant General Atomics Aeronautical Systems, with a clause of extending the period for another year.

Also noteworthy is the Government-approved acquisition of 10 Naval Shipborne Unmanned Aerial Systems worth around US\$178M for surveillance on board large warships.

Also to watch out for in 2021 will be the US\$400M worth upgrade of the Israeli unarmed HERON UAVs (Unmanned Aerial Vehicle). The Indian Navy has been operating UAVs since 2006. The upgrade includes equipping the 30 naval UAVs with air to ground and air-launched anti-tank guided missiles and laser-guided bombs. Earlier these UAVs were acquired only for surveillance purpose and the offensive role was not envisaged, until the recent Chinese incursions.

Retired Vice Adm. Sinha says that "The Chinese threat is real and one has to be ready for it. During the previous regimes, there was "sea blindness", as threat perception was limited to just continental India, till 26/11 happened. The Chinese have become frequent visitors in the Indian Ocean region and aggressive in the South China Sea hence these acquisitions ought to be expedited."

Former Naval Chief Adm. Mehta adds, "The present Government has handled purchases well, as is evident from the modernisation of the IAF (Indian Air Force). The more you delay procurements, the more expensive they become." ■

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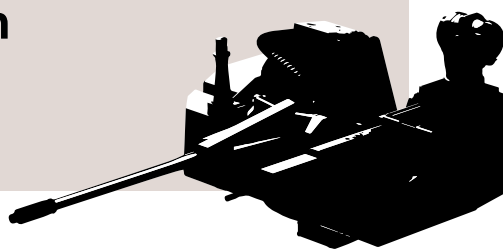
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