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### **Editorial**

# Afghanistan Needs More Support



At the present time all eyes are on the war in Syria, and the despairing efforts to achieve at least a temporary ceasefire. This is causing another war zone almost to disappear from public notice: Afghanistan. Since the end of the ISAF mission in 2014, the security situation in Afghanistan has deteriorated horrendously. Best estimates are that Afghan government troops control no more than two-thirds of the country. The Taliban are as wellestablished there as they have ever been since being toppled in 2001. Despite the billions which the West has pumped into rebuilding the country, the end result is plain to see.

Certainly, some rays of hope should not be overlooked. There has been good progress in the education sector. Ten million children are now going to school, more than ten times as many as in 2001. Infant mortality has been cut by a quarter, and life expectancy in Afghanistan has risen from 42 to 62 years. But the Taliban insurgents now control more regions than ever before, the number of civilian casualties of the conflict has reached new record levels, and the losses which the Afghan army has had to incur are so high that its military capacity in the long term is under threat. The recent terrorist attacks in the capital Kabul have clearly brought it home that the Taliban have only lost a little of their combat capability.

The latest attacks on the northern Afghan city of Kunduz occurred only one day before a donor conference for Afghanistan was held in Brussels, at which Afghan president Aschraf Ghani participated. The aim of the two-day event in Brussels was to agree on promises of billions in aid. The EU and its member states want to support Afghanistan with €1.2bn annually up until 2020, precisely because the security situation continues to be extremely unstable. At the last major donor conference in Tokyo in 2012, US\$16bn (€14.3bn) was committed for a comparable period of time. The Brussels gathering was attended by representatives from 70 countries and 20 organisations. UN General Secretary

Ban Ki Moon called for "a strong message of support for the people and the government of Afghanistan".

On 16 October 2016 the EU and the government in Kabul agreed to speed up the return of Afghan refugees who have been unable to obtain asylum in Europe. This could affect tens of thousands of refugees. Aid organisations, however, are accusing the EU of using the development aid as a means of applying pressure. The "Save the Children" organisation has called the forced returns "extremely worrying", since "violence and conflict in Afghanistan have increased over the past two years". The EU Representative for Foreign Affairs, however, Federica Mogherini, maintains that the EU has kept development aid independent of the relocation agreement. "There is no connection between them", she said.

NATO Secretary General Jens Stoltenberg emphasises that the Alliance will continue to support Afghanistan despite handing over responsibility for security to the Afghan army and police two years ago. The need for development and an improvement in the security situation go hand in hand, he said. US Secretary of State John Kerry has called upon the Taliban to join in peace discussions with Kabul. "There is a way to end the conflict with honour", he said. The Afghan president Ghani maintained that the Afghans are in a position to secure peace. His government sees itself as "committed to a constructive policy, not destructive"

Whether the billions in aid will bring about stability and an upturn in the Hindu Kush is by no means certain. Afghanistan has to this day been a country which is exploited by its elites. The billions in aid from the West, too, often becomes the booty of the clans. Improving the lives of the 33 million Afghans will take more than pumping billions into the country. To tackle the causes of the refugee crisis, donors will have to monitor the implementation of the projects very closely on the spot, and create a new administration. **Henning Bartels** 

### Content



- Security Policy
- Armed Forces
- Procurement
- Defence Industry

Pages 14-32

#### SECURITY POLICY

- 7 Security Issues in the Mediterranean Giulia Tilenni
- 11 Ukraine's Energy Security and Energy Foreign Policies on the Way to Europe Frank Umbach

#### COUNTRY FOCUS: SPAIN

- 14 **Ready to Adapt** The Spanish Defence and Security Alignment Nuria Fernández
- 18 **The Spanish Armed Forces in the 21st Century** Fernando García Sánchez
- 25 **"Most programmes managed by DGAM involve significant challenges in the long term."** Interview with Lieutenant General Juan Manuel García Montaño, Director General of Armament and Material, Spanish Ministry of Defence
- 28 Spanish Perspective, Global Vision The Spanish Defence Industry Adolfo Menéndez
- 30 "Navantia has the clear objective to increase its presence in the international market." Interview with Gonzalo Mateo-Guerrero, Commercial Director, Navantia

#### ARMED FORCES

34 **Keeping NATO Connected** Interview with RAdm. Thomas Daum, Ph.D., Chief of Staff, NCI Agency

#### **Space-Based Reconnaissance Systems**



The Space Strategy for Europe points out that EU spacebased applications can provide additional operational capacity for the implementation of the European Common Security and Defence Policy. Page 52

#### ARMAMENT & TECHNOLOGY

- 37 Aspects of International Armoured Vehicle Development Rolf Hilmes
- 41 **Training and Simulation Developments** William Carter
- 48 F-35 LIGHTNING II: A Fighter for the Information Age Doug Richardson
- 52 Space-Based Reconnaissance Systems Technological Trends and Current European Programmes Nicholas Fiorenza
- 55 Defence Procurement in Denmark Current Programmes J. Bo Leimand
- 57 Close-In Ship Defence Confronting Missile Threats David Saw
- 62 **Russia's Hypersonic Cruise Missile** Debalina Ghoshal

#### INDUSTRY & MARKETS

- 63 **Russian Defence Industry in the Era of Putin** Eugene Kogan
- 67 Turkey: Maritime Strength and the Naval Industry Korhan Özkilinc
- 72 Meggitt on the Export Trail Interview with Winn Hines and Darren Shavers, Meggitt Training Systems (MTS)

#### **VIEWPOINT FROM ...**

10 Edinburgh: To Stay or not to Stay – Scotland Considering Brexit John Cooke

#### COLUMNS

- 1 Editorial
- 4 Periscope
- 66 Masthead
- 75 Firms & Faces
- 76 Preview

#### **Index of Advertisers**

Bren-Tronics, Inc.	45
Enforce Tac	5
EXPAL	17
General Dynamics European Land Systems	27
HOMSEC	31
IDEX	2nd cover
ISDEF 17	61
LAAD	3rd cover
Meggitt Training Systems	4th cover
RUAG Defence	43
Shield Africa	35
Theissen Training Systems GmbH	47
U.T. SEC	3



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## French Naval Aerial Drone Programme

(df) Airbus Helicopters and DCNS are joining forces to design the future tactical component of France's Naval Aerial Drone (Système de Drones Aériens de la Marine – SDAM) programme. DCNS's role in the partnership will be to design and supply the entire warship-integrated VTOL drone system. DCNS will design and develop the solutions for the ship-based operation and integration of the drone, including the specification and validation of the payloads and mission data links. DCNS will also produce the drone's mission system, which will enable real-time



management and allow payloads to be controlled through the combat management system. Under the terms of the partnership, Airbus Helicopters will be responsible for designing and developing the VSR700 drone as well as the various technologies needed for drones to perform aerial missions, such as data liaison, payload and a "see and avoid" capability enabling the drone's integration into airspace. The VSR700 is derived from a light civil helicopter, the CABRI G2 (developed by Hélicoptères Guimbal).

#### Improved Vibration Control for the CHINOOK

(df) Delivery of the first Improved Vibration Control System (IVCS) for the CH-47 CHINOOK helicopter to Boeing took place early November. The IVCS technology uses accelerometers that measure

Photo: LORD



aircraft vibration levels. These signals are processes via a centralised computer through a software algorithm that interprets the data and sends commands to force generators located under the pilot seats. These force generators create "anti-vibration" that stops the progression of vibration due to the main rotor, and creates a more comfortable vibration environment for the aircrew. The product made by LORD Corporation is a direct/ drop-in replacement for the previously used passive tuned vibration absorber. According to Mike Janowski, Manager of Electromechanical Design at LORD, the IVCS is easily installed using existing mounts on the CHINOOK aircraft and outperforms the legacy system.

#### Advanced Training for UAS

(df) Simlat has delivered an advanced Simulation and Training System for the Altavian NOVA Unmanned Aerial System



(UAS) platform. For this solution the Integrated Training Simulator (INTER) was customised and integrated to the NOVA's control station named FLARE. "This is the first time that Altavian has had access to professional quality simulation for training," said Thomas Rambo, COO of Altavian. "We have a long-standing partnership with Sinclair as our National OEM Training Partner to provide the most modern and complete solution to our customers. This simulation capability is unparalleled in the commercial market, and will truly set Sinclair's training program apart." The new INTER-NOVA training system is fully integrated and capable of producing sophisticated virtual training scenarios with high-fidelity visuals, realistic environments, and interactive situations.

#### New Zealand's Network Enabled Army Programme

(df) Systematic announces the award of a contract to assist New Zealand Defence Forces to complete Tranche 1 of the Network Enabled Army (NEA) Programme."



Systematic will provide an Enterprise License for the full SitaWare Suite including Headquarters, Frontline and Edge products," explains Mike Magill, President Systematic Asia-Pacific. "This enables interoperable C4I capabilities at all levels of command including not just static headquarters units, but also vehicles and dismounted commanders. In addition to the COTS based software at the heart of the C4ISR capability, we will also assist the NZDF team in providing architecture and system design services, along with implementation and integration support. A key feature of the support services is that they will take account of evolving and maturing requirements through the set-up of an 'Agile' project environment managed by Systematic." The New Zealand NEA programme is one of the most important for the NZ Army in the coming years. It will modernise the C4ISR capabilities in four tranches through the coming 12 years.

#### Tank Commander Visual System Supported by Augmented Reality

(df) Augmented reality has been in the focus of military from the very beginning. The advantages are clear: Bringing even complex information direct to the eye of



the soldier, like fire control, an outside view from inside a tank or pictures of the surrounding that might come from a drone. But still, the existing disadvantages – high cost, unclear reliability, interoperability challenges, possible security risks and an information overload of the soldier - have until now prevented an introduction to the armed forces. The Ukrainian Army is now introducing LimpidArmor, a circular review system for armoured vehicles consisting of a helmet with integrated Microsoft HoloLens glasses, into their tank troops. This helmet with integrated augmented reality will allow the commander a 360 degree thermal and optical view around the tank in an area up to 300 metres around the vehicle. LimpidArmor made its debut in October at the Arms and Security show held in Ukraine's capital city of Kiev. The introduction to the Ukrainian Armed Forces is planned for 2017.

## Successfull Tests of the CH-53K KING STALLION

(df) Lockheed Martin announced that the CH-53K KING STALLION successfully completed initial operational testing by the US Marine Corps to verify the key capabilities of the heavy lift helicopter. The week-long operational assessment by Marine Corps pilots, aircrew and maintainers marked an important step in support of a Low Rate Initial Production (LRIP) Milestone C decision early next year. The



US Marine Corps' initial operational testing included external lift scenarios of 12,200 kg in hover and a 5,422 kg 110 nautical mile radius mission. Ground events included embarkation/debarkation of combat equipped troops, internal and external cargo rigging, tactical bulk fuel delivery system (TBFDS) operation and medevac litter configuration. Flyby-wire flight controls facilitate reduced pilot workload for all heavy lift missions including external loads, maritime operations, and operation in degraded visual environments. With more than triple the payload capability of the predecessor CH-53E, the KING STALLION's increased capability can take the form of a variety of relevant payloads ranging from an internally loaded High Mobility Multipurpose Wheeled Vehicle (HMMWV) to up to three independent external loads at

once which provides outstanding mission flexibility and system efficiency. A locking, US Air Force pallet compatible cargo rail system reduces both effort and time to load and unload palletised cargo.

#### South Korea Buys TAURUS

(df) TAURUS Systems GmbH, a joint venture of MBDA Deutschland GmbH (67%) and SAAB Dynamics AB (33%), handed over the first lot of TAURUS KEPD 350K stand-off missiles to the Republic of Korea Air Force (RoKAF). The TAURUS KEPD 350K is an enhanced and upgraded version of the TAURUS KEPD 350, which



has been in service with the German Air Force since 2005 and with the Spanish Air Force since 2009. The TAURUS KEPD 350K is a cruise missile for precision strikes with a range excess of 500 kilometres at speed of Mach 0.80 to 0.95. The missile has been designed and devel-

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### Periscope

oped to fly through dense air defences at a very low terrain-following level and for the engagement of high-value targets. The missile contains a highly effective dual stage warhead system, with the double 500-kilogramme warhead featuring a precharge and initial penetrating charge to enter a bunker together with blastand-fragmentation capabilities against point and area targets.

#### SYNTACS

(cf) At Euronaval 2016, the German bridge system integrator Raytheon Anschütz announced its Synapsis Tactical Command System (SYNTACS). The capabilities of SYNTACS are enhanced through the integration of ballistic modules, weapon computer and additional shipborne surveillance equipment, enabling it to provide a complete fire control solution. SYNTACS currently combines command and control, situational awareness capabilities and navigation features. With the integration of the ballistic modules, SYNTACS offers the entire chain from surveillance, situation analysis and detection, to engagement and fire control. The system is also fully compliant



with IMO standards and type approvals for high-speed operation. Ballistic modules can be operated on multifunctional workstations simultaneously with other applications, such as tactical navigation on ECDIS.

#### Counter-Microdrone Solution Shown at INDO DEFENCE

(df) Rohde & Schwarz presented their counter-microdrone solution, the R&S ARDRONIS, for the first time in Asia at the 7th INDO DEFENCE in Jakarta. The R&S ARDRONIS enables users to identify microdrone control signals early on, and locate the drone's operator and disrupt the control link. In addition to effectively counteracting microdrones, the system also offers the capability of integration into higher-order networked systems or flexible security systems. The threats arising from drones affect, for example, critical infrastructures, political and public events. They range from industrial espionage to severe attacks. For example, drones can interfere with air traffic control signals, jeopardising airport safety. The R&S ARDRONIS is optimised for countering the threats arising from radio-controlled microdrones. Another highlight to be showcased at INDO DE-FENCE is R&S NAVICS, a new, VoIP-based switching system for naval communications that offers innovative technology and a state-of-the-art, intuitive user interface



# (Photo: Rohde & Schwarz)

### Marketing Report: EXPAL Systems

EXPAL Systems, from Madrid, Spain, is a leading company in the defence and security sector. With its global operations, EXPAL aims to provide the armies with products, systems and services for sustaining and improving their operational capabilities and for the defence and protection of their troops. The company offers a wide range of solutions and technological developments appropriate to the nature of their missions. EXPAL's portfolio includes weapon systems, munitions and propellants, technological systems and applications, as well as vehicles and aeronautical systems maintenance and demilitarisation and EOD services.

EXPAL is a leader in ammunition and explosives, as well as in demilitarisation and EOD services, managing the entire life cycle of munitions and explosives, from design, development, manufacture and maintenance, until end-of-service destruction.

EXPAL's products and services are employed by over 60 countries all over the world. Its clients are Ministries of Defence and armed forces, international organisations and other leading defence companies.

Knowledge, experience and capabilities: Development of the range of EXPAL products is based on continual improvement, a strong commitment to technology and a clear focus on the customers and their needs. This customer orientation, together with the company's capabilities, experience and know-how in the development and manufacture of weapon systems, ammunition and explosives, allows EXPAL to provide a wide offer of services and solutions in the defence field.

EXPAL is responsible for the design and development of new products and also for the improvement and adequacy of the existing products in meeting the specific requirements of the customer. The great number of successful EXPAL development programmes stems in part from close collaboration with Ministries of Defence, armed forces and with leading companies within the defence and security sectors from the earliest possible programme stages. EXPAL also collaborates in international programmes of research and development with official organisations and top-level companies to achieve the technological developments demanded by the armies across – principally – European programmes of cooperation.

Some of the highlights of EXPAL's product lines include its own family of extendedrange 105 mm and 155 mm artillery ammunition; its mortar systems that include 60 mm, 81 mm and 120 mm mortars, complete with munitions of various natures; fire control systems; tactical training simulators; its experienced and complete knowledge of propellants; and its innovative solutions for demilitarisation and EOD services.

The EIMOS Mortar system from EXPAL, mounted on a URO Vamtac 4x4, fires different calibres and natures of EXPAL mortar ammunition and is controlled by an EXPAL fire control system.



# Security Issues in the Mediterranean

#### Giulia Tilenni

The Mediterranean Sea has become an area of key strategic interest for an ever-growing number of actors, some of which belong to the area, and some are from external regions. Its pre-eminent geographical position makes it a nodal point for commercial routes with choke points such as Suez, Bab el-Mandeb and the Straits of Hormuz.

n addition, the region is relevant in terms of energy exploitation, especially for underwater oil and gas resources. Today, the Mediterranean Sea is a geopolitical domain within which endogenous complexity is paired with a high level of immediate and future uncertainty.

The unstable geopolitical environment created within several Mediterranean countries (from Libya to Yemen and Syria) shapes current security issues concerning this area. With the exception of Tunisia (which is eruption in Africa. Civil conflicts in Yemen and Syria, and the consequent international military interventions, represent additional drivers of instability across the whole area, as a number of regional and international actors have been dragged into military action by events – and by their political stakes. Mass migration from African countries and illicit traffic (people, drugs, fuel and arms) seem to be the most widely known consequences of instability, although they represent just superficial examples of the





USS PORTER (DDG 78) transiting the Suez Canal en route to the Red Sea in May 2016 during a routine patrol in the US 6th Fleet area of operations in support of US national security interests in Europe

facing political problems anyway), the socalled Arab Springs, expected to stimulate a democratic transition from within, have merely created instability in most of the concerned states, Egypt amongst others. Furthermore, Qadafi's death left a political vacuum in another key country, Libya – one of the most relevant oil producers – creating the preconditions for Islamic State's

#### Author

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issues concerning the region. Tensions are spreading both at the political and the military level. At the political level, local and international instability has been spreading to the point that even the most solid alliances have experienced some impact. Some new alliances are rising, while some of the existing ones are changing or failing, thus feeding further unpredictability and turmoil. Hence, on the one hand, ongoing military action comes from the stakeholders' widespread need to better protect their multiple economic interests, while on the other, such struggles lead to further militarisation in the region, therefore raising the tones and the risks of politicalmilitary confrontation.

#### **Rising Tensions among Relevant Actors**

Following the Russian annexation of Crimea, tension between Brussels and Moscow had risen considerably, leading to the imposition of economic sanctions. The current situation in Syria worsens relations between these actors, with the EU evaluating the approval of stronger sanctions– to date not agreed – to condemn the siege of Aleppo, and Russia pledging more support to the Bashar al Assad regime. EU states are not cohesive in their resolve to implement sanctions – Italy and France amongst others.

But Russia is not the only state whose relationship with the EU is deteriorating. After the rapprochement aimed at reducing the flux of migrants reaching Greek coasts, cooperation between the EU and Turkey has become more problematic, especially after the attempted coup in July 2016.

Such dynamics do have an impact "on the ground", namely the Mediterranean. For instance, circumstances pushed Russia and Turkey to resume their political ties. Russian-Turkish political relations have been complicated for decades, and the 2015 Sukhoi incident represented their lowest point. Despite the mutual convenience that has led to consistent economic ties especially after post-Ukraine EU sanctions - Turkey did not hesitate to shoot down the Russian interloper, and Moscow launched economic retaliation promptly. The international response to the attempt to overthrow Erdogan (condemned by all Western states, but not as firmly as Russia), together with the ongoing and growing "Islamisation" of the country, has represented a turning point - a positive one - for relations between Ankara and Moscow.

The immediate consequence of such renewed cooperation has been Turkey's intervention in the Syrian conflict to support the international counter-ISIS operations next to the Syrian-Turkish border. Never-

7

theless, the political-military implications of these revived ties could be particularly problematic if Turkey decided to pursue an autonomous agenda, detaching from Western countries to get closer to Moscow. This notwithstanding, Ankara would keep the power to veto Western military undertakings at the NATO level, therefore favouring Russia's proactive approach to the Middle East.

Should this worrying scenario turn into reality it would open to a new wave of potentially disrupting geopolitical reshapes, as Russian presence in the area builds up.

#### Controlling the (Rising) Military Traffic

Instability brought by the trends highlighted above is leading to the increase of military traffic in the Mediterranean.

Following the intervention in the Syrian civil conflict and in the anti-ISIS campaign, the number of Russian units sailing across the Mediterranean is increasing considerably. Several (and a growing number of) vessels belonging to the Third fleet, originally deployed in the Black Sea, have been recently redeployed in the Mediterranean: for instance, the fast-attack guided missile craft MIRAGE and the two BUYAN-M series missile corvettes SERPUKHOV and ZELENY DOL, armed with KALIBR NK cruise missiles. The naval group deployed to the Mediterranean reportedly includes the NANUCHKA-III Class missile corvette MIRAZH, the ADMIRAL GRIGOROVICH Class frigate ADMIRAL GRIGOROVICH, the KRIVAK Class frigate PYTLIVY, the minesweeper IVAN GOLUBETS, the battle cruiser PYOTR VELIKIY, the anti-submarine ships SEVEROMORSK and VICE ADMIRAL KULAKOV and support vessels. In addition, the only Russian active aircraft carrier, ADMIRAL KUZNETSOV, has recently completed its redeployment in the Eastern Mediterranean.

According to Russian military spokespersons, the deployment of the whole battle group is aimed at protecting Russian interests from international terrorism and piracy, even if a number of vessels have reportedly been involved in operations in Syria.

The formal operating base for operations in Syria is the Humaymim Air Base in Latakia. At the same time, Tartus naval facility (Syria), already in use as a logistic base for vessels crossing the Mediterranean sea, is now serving as Forward Operating Base for operations – previously beefed up through the Sevastopol base (the closest Russian naval base to the Mediterranean before Tartus was restored). Some recent statements from Russian senior officers



ADMIRAL KUZNETSOV, for the time being the only active Russian aircraft carrier, has recently completed her redeployment to the Eastern Mediterranean.

speculate on the idea that the Tartus base should be transformed into the first active fleet infrastructure in the Mediterranean. The relevance given to the Tartus base and the whole naval group is underlined by the recent redeployment of one S-300 air defence system in the area.

The massive presence of Russian vessels in the Mediterranean requires better situational awareness, from and for Western assets, including the need to track ongoing activities in this crucial area.

Missions like shadowing vessels or intelligence gathering could prove increasingly difficult to perform safely, given the unprecedented security architecture around the Syrian theatre amongst Turkey, NATO, and Russia. Despite the period of budget constraints and political tensions, the worrying reliance on Turkish assets (considering that Turkey is also the closest NATO member to the Syrian front) obliges NATO to take additional measures, so adding to the complexity.

In the meantime, Turkey's interest in enhancing its amphibious capabilities stresses once again Ankara's key role in any future military undertaking in the region. For instance, the MILGEM programme, started in 2000 and then blocked for some years, is currently revived, and new bids are under discussion. The programme is aimed at modernising the Turkish fleet through the purchase of corvettes and frigates locally produced, to give Turkey strategic independence from foreign products. So, in the future, Turkey can be viewed as a key player with more military autonomy.

Furthermore, surface vessels represent only a part of the traffic (even if the most significant), as submarines are increasingly coming back to the Mediterranean. With stealth and long endurance as main features, submarines can accomplish both combat missions and intelligence gathering – namely SIGINT, ELINT and COMINT. Israel represents an interesting example in the Mediterranean submarine domain, as the country is supposed to base its nuclear deterrent on submarines as a second



The DOLPHIN Class submarine LEVIATHAN, built by HDW, Germany, has been in service with the Israeli Navy since 2000.

strike capability. The country owns five (one more to be delivered by 2017) German produced DOLPHIN 2 submarines; according to various sources, the most recent units should be refitted to carry submarine launched cruise missiles (SLCM) with nu-



Paris reaffirmed its ties with Cairo through the sale of 24 RAFALEs to the Egyptian armed forces.

clear warheads - probably the Israeli built POPEYE TURBO. Furthermore, a number of countries - the US, the UK, the Baltics and Sweden – are reporting a growing number of Russian submarines moving back and forth across the Mediterranean, therefore crossing the Channel and the Baltic Sea. Worse still, US analysts believe the Russian submarine fleet has reached a remarkable availability and enhanced technological level thanks to deep maintenance processes. Keeping in mind present and future scenarios, increasing submarine traffic in the Mediterranean is crucial for a number of reasons.

First is the inadequacy of Western assets (especially those of Southern EU countries) to counter submarine threats. Following a period of decreasing submarine traffic in the Mediterranean, different countries, Italy among them, have been replacing their ASW capabilities with MP ones. Also, northern Mediterranean submarine fleets are shrinking while southern Mediterranean ones expand. This could have negative consequences in the short- and midterm. Looking at the latest technological developments in the naval sector, submarine warfare is entering a new developing phase - not only in terms of submarines themselves, but also concerning underwater robotic technologies, very probably enhancing submarine threat capabilities in the area in the near future.

Second, the majority of Mediterranean states (namely Portugal, Spain, France, Italy, Greece, Turkey, Israel, Algeria and Egypt), already have a submarine "fleet": regardless of the efficiency rate of these fleets, what is interesting is that an eventual deployment of submarines as a consequence of the aforementioned tensions is not excluded. A sample scenario serves well to describe a potential evolution of the ongoing situation. A small sub-area of the Mediterranean is currently "hosting" a relevant amount of traffic, in terms of surface vessels - the ones involved in the Syrian crisis, plus

the commercial traffic - and submarines. As a consequence of the need to gather intelligence and keep potential enemies under control, submarines enter and exit the area without coordination, because of the different tasks they have within a system of fluid alliances. In detail, we can figure out that at least seven submarines could currently operate in the Eastern Mediterranean at the same time: a Russian one, in support of the fleet's activities in the area; a US one, to track Russian activities; an Israeli one, to gather intelligence and to prevent illicit arms traffic from Syria to its coasts; a Turkish one, to observe what is happening next to its maritime border and in Syria; an Egyptian one, to control eventual threats to its strategic interests; a French and an Italian one, with intelligence gathering as main tasks, and the opportunity to support their troops in Lebanon or as part of NATO activities. Lots of assets with multiple tasks and caveats actually raise the likelihood of escalation, and add to a geopolitical theatre which is difficult to handle for all.

#### Conclusion

A number of critical security issues have affected the entire Mediterranean Sea, and instability in the MENA region drives Mediterranean instability further.

Considering the strategic importance of the Mediterranean, several countries want to play a role in the area, both physically (see the military presence) and politically (with the creation or renewal of alliances, especially among MENA and non-MENA states). Sometimes even schizophrenic scenarios arise. For instance, France and Russia are seeking to strengthen their military cooperation with those African countries deemed relevant in countering terrorism. Paris is reaffirming its ties with Egypt through defence procurement: the sale of 24 RAFALEs to Cairo (the first foreign buyer) has been followed by the hand-over of the helicopter carrier MISTRAL, with a

second to follow. Russia is also enhancing its relationship with Egypt, (as demonstrated by the joint counter-terrorism exercise "Defenders of Friendship-2016" and the sale of equipment operating from MIS-TRAL) namely technological platforms and, probably, helicopters. Furthermore, military and economic cooperation remain strong with Algeria, which sees in Russia its first arms provider – and it is also expanding its submarines fleet. Meanwhile, Algiers purchases from France and Italy as well.

Concerning geopolitical stakes among local actors, omitting Libya for its peculiarities, Egypt could represent a major threat in the near future. Willing to protect its major economic interests - namely offshore gas and oil deposits (Egypt is a candidate as a gas hub for the Eastern Mediterranean), and the security of the Suez canal, especially after its doubling - Cairo is enhancing its naval fleet, and taking advantage of its political ties with the US, EU countries (France, but also Italy) and Russia. Here the critical part lies in the political ambiguity of the al-Sisi government, both at the domestic and the international level.

So, while the Eastern Mediterranean represents the hottest spot in today's world, the unclear and unstable political situation in relevant North African countries, together with ongoing "militarisation" fed by eastern turmoil, create the necessary conditions to spread crises westwards, thus inflaming the whole Mediterranean region.

The main vulnerability for international security is that, despite multiple stakeholders' growing efforts, no-one has truly comprehensive situational awareness (the reasons to be found in the capability gaps and political/military variables described above) nor command of the bigger picture. Alliances' fluidity has a negative effect on politicalmilitary reliability, as recent incidents like the Sukhoi affair demonstrate, and in these conditions increased traffic and mounting tension cause the smallest incident to lead to the most unpredictable consequences.



# Viewpoint from Edinburgh



# To Stay or not to Stay Scotland Considering Brexit

John Cooke Marshall Cooke Consulting

With its ubiquitous kilted pipers, Edinburgh can give the impression that it embodies the Scotland portrayed by Sir Walter Scott. But that impression is misleading: Scotland's capital is a modern, cosmopolitan city with an international outlook. So it is no surprise that the issue causing most concern for Edinburgh folk just now is the UK's vote to leave the EU – and the potential for that to trigger another referendum on Scottish independence.

The reasons for Edinburgh's internationalist attitudes are fairly obvious. The Festivals attract artists and thousands of visitors from across the globe each August. The locals are a cosmopolitan bunch, too, including a significant minority of people born outwith Scotland: it's as easy to find pierogi or sauerkraut as haggis in the supermarkets. Many Scots have relatives living abroad – if this correspondent's experience is anything to go by, half Edinburgh's taxi drivers have an auntie in Toronto.

Edinburgh has four universities, with many staff and students from outside the UK. What happens to them, post-Brexit, is an obvious concern, as is the prospect of losing EU research funding.

The city is the largest financial services centre in the UK, outside London, and also has a thriving digital industry. Firms in both sectors tend to have a global outlook. The prospect of much less favourable trading terms with Europe is causing them to worry, as is the risk that they may not be able to hire skilled staff from abroad. So while 62 percent of Scots voted to remain in the EU, the "remain" vote in Edinburgh was even higher, at 74.5 percent.

Some of Edinburgh's concerns over Brexit are similar to those felt elsewhere in the UK. However, there is a specifically Scottish dimension: the possibility that there will be a further independence referendum.

Scotland's First Minister, Nicola Sturgeon, leader of the proindependence Scottish National Party (SNP), has been careful to stress that she is exploring "all options", of which independence is merely one, to keep Scotland in the Single Market. But she has also indicated that a so-called "hard Brexit" would lead her to trigger another independence referendum. And the signs are that "hard Brexit" is probable. Restricting immigration appears to be one of the "red lines" in the likely negotiating position of the UK Conservative government. One minister even suggested recently that firms would have to register how many of their staff were foreign, with those employing too many being "named and shamed". Conversely, the indications from elsewhere in Europe are that the principle of free movement of people is sacrosanct: no free movement, no Single Market.

How Edinburgh might vote in another independence referendum is hard to predict. In the 2014 referendum, when Scotland voted 55 percent to 45 percent to remain within the UK, the city was more solidly for remaining than Scotland as a whole. A key argument of the pro-UK case then was that independence would see Scotland forced to leave the EU. That argument no longer applies. Polling evidence suggests that Brexit hasn't yet significantly changed attitudes to independence across Scotland as a whole. But in Edinburgh, EU nationals and many in the business and academic communities may now prefer independence within the EU to isolation within the UK.

That does not guarantee a majority for independence: around a third of those who voted for it in 2014 also voted to leave the EU in June. How they'd vote in another independence referendum is anybody's guess – there are certainly some who prefer the UK to the EU, if forced to choose.

If Scotland did vote for independence, the defence and security implications should not cause undue alarm amongst NATO members. The SNP is firmly against the possession of nuclear weapons, but it wants an independent Scotland to be a NATO member – a position that appears to command a majority of Scottish public opinion. The SNP will also say that its position is no different from that of other members, such as Canada or Norway, both of which have a similar strategic interest in the North Atlantic.

Ms Sturgeon has campaigned for Scottish independence all her adult life. But there are only two circumstances in which she will call a second referendum: if she's sure she can win; or if she feels she has no choice. She may conclude she is in the latter position within the next two years.

# Ukraine's Energy Security and Energy Foreign Policies on the Way to Europe

#### Frank Umbach

After the end of the Euromaidan revolution, the ouster of the Ukrainian President Viktor Yanukovych on 22 February 2014 and Russia's annexation of Crimea, many Western commentators have uncritically adopted the Russian propaganda that Ukraine has no alternative to Russian gas imports.

Since these events, it has often been overlooked that the previous Ukrainian government under the presumed pro-Russian President Yanukovych had already worked out a gas diversification and gas independence strategy in 2012, which wanted to reduce largely or even entirely all Russian gas imports.

Indeed, Ukraine had no alternative gas import options to Russia's state company Gazprom until 2012. It gave the Kremlin the opportunity to pressure Kiev into fixing the gas price and – as in the case of Belarus – to take over the entire control of the Ukrainian gas pipeline network. But until today, all Ukrainian governments have resisted such a takeover as it would have given Russia extensive control over the Ukrainian economy and the directions of its future foreign and security policies.

On the other side, Russia has also been dependent on a stable and cooperative Ukraine in regard to its transit status for Russian gas exports to Europe - though this interest has been gradually decreased by building the Nord Stream 1 gas pipeline through the Baltic Sea. Against the background of the insufficient diversification of its gas imports, Ukraine's gas independence strategy of 2012 and its energy strategy of July 2013 have favoured the saving of gas, an increase of its own conventional (offshore gas reserves at Crimea's coast) and unconventional gas production (shale gas) as well as an expansion of coal and nuclear energy consumption in Ukraine's energy mix. Its recoverable gas reserves of 2.98 tril-

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lion cubic meters (tcm) belong to the largest in Europe. Under President Yanukovych it was already possible to reduce Ukraine's gas imports from Russia of around 45 billion cubic meters (bcm) in 2011 to 26 bcm in 2013. Alongside its first gas reforms, energy saving and potential gas imports from Europe, the Yanukovych government favoured initially a closer cooperation with the EU and its European neighbouring countries as well as US energy companies in regard to shale gas exploration projects. This also explains the interest of the Yanukovych government to sign the planned comprehensive free trade and association agreement with the EU.

If the gas independence strategy of Ukraine's President Yanukovych and his Prime Minister Mykola Azarov would have been successfully implemented by 2020, Russia would have lost its most important instrument to influence Ukraine's energy and foreign policies. Following severe Russian pressure, President Yanukovych resisted signing the comprehensive free trade and association agreement with the EU, which finally triggered the Euromaidan revolution in November 2013.

#### The Overlooked Energy Dimensions of Russia's Annexation of Crimea

Following the annexation of Crimea and Russia's policy to freeze the conflict in Ukraine's eastern regions, the Kremlin has deprived Ukraine of any chance to develop its huge offshore oil and gas reserves at Crimea's coast and, therewith, to implement Kiev's original gas independence strategy. In addition, the control of Ukraine's major coal mines in its eastern regions (where 45.6% of its national coal reserves are located) by the Russian supported separatists has prevented Kiev from enhancing its coal share in its national energy mix in order to reduce its gas share.

According to the Ukrainian energy strategy of July 2013, its conventional and unconventional gas reserves should increase the country's annual domestic production level from 20 bcm today up to 47 bcm and, thus, reduce its gas imports to less than 5 bcm per year by 2030.

In addition to its large offshore-gas resources of Crimea with an estimated volume of 4-13 tcm, Crimea has also the highest potential for solar power and one of the biggest European solar parks. Its mountainous coast also offers a promising potential for wind power. After the Russian annexation of Crimea, the energy company Chornomor Naftogaz, a subsidiary of the Ukrainian state-owned gas company Naftogaz, was immediately transferred to and integrated into Gazprom.

Until 2014, energy forecasts indicated that Ukraine – having the third-largest shale gas reserves (after France and Norway) - might be able to produce 8-10 bcm of shale gas in 10 years and 20 bcm in 15 years. But after the occupation of its Eastern regions by separatists, Royal Dutch Shell and ExxonMobil gave up their plans to invest US\$10Bn in the eastern shale gas field Yuzivska (with estimated gas reserves of 4 tcm). Chevron had also agreed to shale gas exploration in Ukraine's western region at Olesska with 2.98 tcm reserves, with a planned production target of 5-10 bcm per year. But confronted with the resistance of local environmental groups and insufficiently investor-friendly taxation, Chevron also abandoned its shale gas engagement in Ukraine – although this was also the result of the dramatic collapse of international oil and gas prices, which have forced major oil and gas companies to reduce dramatically their investments in new exploration and production projects.

Ukraine had begun still in the era Yanukovych to import 2 bcm gas in 2013 from the EU member countries Hungary (in November 2012) and Poland (April 2013) via its Russian-European gas pipeline network and gas reverse flows.

#### Unstable Coal Supplies by Ukraine's Eastern Regions

Ukraine's 300 coal mines, most of which are old and inefficient, are a considerable burden

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Gas Consumption (bcm)	71.1	67.5	53.1	59	61.9	54.6	50.3	42.6	33.8
Gas Imports from Russia (bcm)	50.59	54.6	26.95	36.47	44.8	32.94	25.8	14.5	6.1 (7.8) <sup>1</sup>

Ukrainian gas consumption and its gas imports from Russia (2007-2015)

for its economy as they had been subsidised with €1.3Bn (3.8% of the state budget) in 2012. But coal - in addition to nuclear power - is the most important energy source for the Ukrainian power plants, which generate 35.8% of the national electricity supply and meet 13% of the country's heat demand. As a result of the occupation of the eastern regions and the control of many coal mines by the separatists, in the autumn of 2014 only 24 of its major 93 mines remained in operation. It forced Ukraine to import 2.293 million tonnes (mt) – including 1.839 mt from Russia. With the frozen conflict in its eastern region, Kiev has limited prospects for a short-term stabilisation of its coal supplies. In the mid-term future, it will be decisive, whether the country can open up new coal mines in other regions, and until then it will remain dependent on higher coal imports.

# New Diversification Efforts of Gas Imports since 2014

Potentially, Ukraine could import much higher gas supplies from Slovakia. It began in September 2014 to export annually 3.2 bcm via gas reverse flows through its Vojany-Uzhgorod gas pipeline, which had been inoperative for the previous 15 years. The Russian gas export pipeline capacities at the Uzhgorod-Velke Kapusany gas transit points on the Ukrainian-Slovak border have even an entire capacity of 115 bcm, of which more than 30 bcm are unused and could be made available for gas reverse flows from Slovakia back to Ukraine.

The Russian energy giant Gazprom, however, resisted the use of these free pipeline capacities for diversifying the Ukrainian gas imports. But in the view of Ukraine and the European Commission, those Russian policies contradict the rules and regulations of the EU's Internal Energy Market ("Third Energy Package").

In 2015, Ukraine could increase its imports from Poland and Hungary up to 7 bcm. Meanwhile, Russia had also reduced its gas price for Ukraine. But the Russian gas price was still higher than the one for Western Europe. Hence Kiev did not accept the Russian gas price offer and opted for cheaper gas imports from the EU. As a result, Ukraine's gas imports from Russia decreased further from 26 bcm in 2013 to just 6.1 bcm in 2015. Accordingly, Russia's market share of Ukraine's gas imports declined from 92% in 2013 to 18% in 2015. By way of contrast, Ukraine imported in 2015 a total of 10.1 bcm (63% of all Ukrainian gas imports) from neighbouring EU member countries. At the same time, its national gas consumption has been halved in comparison with 2008 down to 33.8 bcm by a combination of considerable gas savings, an increase of gas prices, disruption of gas supplies in its eastern regions and the overall economic crisis.

In the mid-term future, Ukraine will receive new gas import options by the commissioning of the new Liquefied Natural Gas (LNG) import terminals in Lithuania and Poland (Swinoujscie) and another planned one in Croatia (island of Krek). They will be connected with new gas interconnectors as part of the EU's "North-South Gas Corridor". Lithuania will provide some of its imported LNG via a new Polish-Lithuanian gas interconnector and an additional 110 km long new gas interconnector between Poland and Ukraine (costs: US\$245M). The lat-



The European-Ukrainian gas transit pipeline network

ter will also have a reverse-flow capability and an annual capacity of 8.3 bcm. It will be built in 2017 and become operational by 2020 and connected with two Ukrainian gas storage sites with a capacity of almost 19 bcm. Then the Polish gas pipeline exports to Ukraine could increase up to 15 bcm per year.

#### The Gas Infrastructure of Ukraine and its Transit Status for Russian Gas Exports to Europe

Alongside Russia's plan to build two additional Nord Stream pipelines (Nord Stream 2) through the Baltic Sea and the doubling of its capacity up to 110 bcm per year, the Kremlin and Gazprom have repeatedly declared that they are no longer interested in maintaining Ukraine's transit status for future Russian gas exports to Europe. However, in the short-term it is hardly realistic for Gazprom to stop all gas exports to Ukraine by 2019, when the gas transit contract with Kiev will expire. Thus even Russia's President Putin declared in the summer of 2015 the beginning of negotiations with Kiev to extend the transit contract by a few years. But at the same time, Russia remains interested in circumventing Ukraine with new bypass gas pipelines as highlighted by the recent agreement between the Kremlin and Turkey to resume the suspended Turkish Stream gas pipeline project (with an annual capacity of 63 bcm) to Turkey through the Black Sea. It will make future Russian gas exports redundant via its existing Russian Balkan pipeline through Ukraine, Romania and Bulgaria to Turkey.

In 2015, Russia's gas exports through Ukraine increased slightly to 64 bcm (in comparison with 60 bcm in 2014). But the share of Russian gas exports through Ukraine decreased from 65 percent in 2007 to around 50 percent in 2015. Hence Ukraine's transit revenues decreased from US\$4Bn in 2013 to around US\$2Bn in 2015.

Nonetheless, the 28 EU member states agreed at their European Council summit in the spring of 2015 that Ukraine's transit status for Russian gas exports to Europe shall also be maintained beyond 2019. The EU has not only an interest that Ukraine will continue to receive transit fees in the future, but also in Ukraine's integration into the EU energy and gas market. In this context, Ukraine's 13 underground storage sites – the largest ones in Europe with an annual operational capacity of 32.5 bcm – are of special interest for the EU. During cold



Sources of imported gas, %

winter months, Ukraine stores around 16-18 bcm for Europe's gas supply security. In contrast to other European countries, which have hardly any free gas storage capacities available, Ukraine's large gas storage sites in the vicinity of its EU borders are operating at just 50% of their total capacity. With this option, the EU does not need to build additional costly storage sites. Instead it could use Ukraine's gas storage sites as transit points for gas supplies from Central Europe to Southeastern Europe as the most exposed region of Russia's gas monopoly in Europe.

## Ukraine's Gas Reforms and the Strategic Perspectives

Meanwhile, Ukraine under President Petro Poroshenko and the new management of Naftogaz has initiated far-reaching reforms in its energy and gas sector. But it needs to fully implement them against the resistance of some oligarchs and vested interests groups. In order to increase trust and confidence in its gas transit status and to oppose Russian accusations of illegally extracting gas from the Russian gas transit pipelines, Naftogaz has enhanced its transparency by publishing daily the level of its gas volumes in its storage sites as one of the first European countries on the website of "Gas Infrastructure Europe". It also transfers, as the first non-EU member, daily reports to the European Network of Transmission System Operators for Gas (ENTSOG) about the volumes and the transit of Russian gas supplies via its gas transit pipeline network from its eastern to its western borders. Moreover, Ukraine has also invited EU experts to constantly monitor and control its gas inflows and outflows at its Russian and EU borders. While the strategic perspective of Ukraine's gas supply has been significantly improved, its coal supply remains challenging and problematic due to the occupation of the coal mines in the Donbass and Luhansk regions. In light of this, Ukraine needs in the mid-term perspective to accelerate energy savings, a constant expansion of renewables (from the present level of 4% to 11% of its primary energy mix by 2020) and maintain its reliance on nuclear power, which increased to 57% of its electricity supply in

2015 and guaranteed 22% of its primary energy supply in 2014. In the past, the nuclear sector with its 15 reactors and electricity generation of 13.8 gigawatts was, with regard to nuclear fuel, dependent on Russia in a similar way to the gas sector. Kiev is currently also trying to reduce its dependence on Russia by expanding its cooperation with Westinghouse, including building two new reactors with estimated costs of around US\$4Bn. The building of these new reactors would also allow its electricity industry to reduce its greenhouse gas emissions of annually 24 mt. But given the dramatically declining oil and gas prices, the building of new nuclear reactors appears at present commercially rather less profitable, whilst other existing nuclear reactors will be modernised by enhancing their capacities. The lifecycles of four reactors have already been extended by an additional 20 years - with two others planned to follow. As one of the least energy efficient countries

in the world, Ukraine has still a considerable potential for further energy savings, especially considering that the public costs of its domestic subsidies for its energy consumption increased to 10% of its GDP in 2014. For Ukraine, it remains highly important that the far-reaching introduced reforms of its gas market "as the mother of all reforms" and the adoption of all EU guidelines and regulations in Kiev's energy policies will be fully implemented. This is particularly important with respect to the gas market law, adopted by the Ukrainian Parliament in April 2015, as well as regarding the unbundling law for Naftogaz's gas transport and storage the government agreed on last July as part of the adopted EU "Third Energy Package". To summarise: Ukraine has made undoubtedly significant progress with unprecedented reforms of its energy and gas sectors - though those reforms are also the result of direct and indirect pressure of international finance institutions against all kinds of still existing resistance in Ukraine, which is and will remain dependent on its cooperation with those international financiers and investors. The biggest loser of the conflict with Russia, however, is not Ukraine and Naftogaz, but Gazprom as it has lost with Ukraine its traditionally second-largest gas export market (after Germany).

#### Footnotes

1 The higher figure includes 1.7 bcm of Russian gas supplies to occupied eastern regions of Ukraine.



The planned North-South gas corridor of the EU and the integration of the Polish-Ukrainian gas interconnector.

# Ready to Adapt The Spanish Defence and Security Alignment

#### Nuria Fernández

In the last few years Spain has had to face two important challenges: new threats and conflicts within and outside its borders, and the financial crisis. From a defence viewpoint, this has spawned the need for flexibility and adaptation.

As stated in the National Defence Directive, adopted in July 2012, Spain must have a defence system prepared to respond to different threats, risks and challenges at the lowest possible social cost. The country must also have good and reliable allies and, at the same time, it must behave as a loyal and supportive actor of collective security.

Cyber attacks, proliferation of weapons of mass destruction, human trafficing, piracy, increase of fanatic groups and breakdown of airspace safety are global threats that can only be faced as part of a force coalition, which, in the case of Spain, will have to have a NATO and/ or EU mandate. Against this background, Spain has to find the right formula to reinforce its international projection within the Alliance and in the framework of the Common Security and Defence Policy.

On the other hand, the strategic geographic location of Spain confers the responsibility to ensure safety, especially in the Mediterranean Sea. But the security of Spain and Mediterranean stability can only be achieved if the Middle East and Sahel as neighbouring regions move in the right direction and become subject of stability, too.

Taking these assumptions as a reference, the Spanish defence policy is currently based on five main pillars. The first is to ensure a strong Spain that allows keeping the necessary influence in the international context. The second is aimed at coordinating the means and resources of the different ministries to reach the most effective response to threats to national security. The third is to maintain a credible and sufficient level of deterrence in

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order to prevent the risk scenarios from becoming threats and keep the necessary reaction capabilities to ensure the defence of the territory, population and interests of Spain. Fourth is the need to ducted. In this regard, a new National Security Strategy was approved in 2013. In the document, after analysing the relations of Spain with the rest of the world in terms of security, the Government ad-



Final assembly of the Airbus A400M airlifter is carried out at the production line in Seville. Spain has 27 A400M on order, the last of which is to enter service in 2024.

transform the Armed Forces to meet the growing strategic challenges of Spain at a time of limited resources. Finally, there is the development of a strategic defence communication intended to further an awareness of defence in Spain and, in more depth, a culture of defence.

In order to meet these objectives, the Spanish Government introduced a series of actions as part of the National Defence Directive 2012; these are also grouped in five categories.

First, it is noted that, to streamline structures related to security, the National Security Strategy will be reviewed and a Strategic Defence Review will be condresses the main current risks and threats to Spain and marks the strategic lines of action. Among these lines, there are, for example, the national defence, fight against terrorism and organised crime, cybersecurity, economic and financial security, management of migration flows, maritime security, protection against emergencies and disasters or critical infrastructure protection.

Secondly, to maintain a credible level of deterrence, it will be a priority to maintain the necessary military capabilities to defend the national territory, monitor maritime and air spaces, project forces to defend our interests abroad and support

-**1** 

civil authorities in case of emergency. The third point is the participation in international security and defence organisations. The Spanish Government stresses that these organisations, above all NATO, are essential in a scenario in which the variety of threats cannot be encountered by a single country alone. Consequently, to Spain the active participation in the NATO initiatives which promote national and collective interests are priority matters. Likewise, our country contributes to the configuration and further development of the Common Security and Defence Policy and the Permanent Structured Cooperation. And there are the bilateral relations with the nations which share our interests and/or threats, since they can provide stability to the country's environment or improve the position of Spain in the field of strategic relations

The fourth point is the necessary reorganisation of the Armed Forces; on the one hand, in order to make them more effective and, on the other hand, because of the limitations imposed by the current economic context.

Finally, the defence of Spain requires boosting the permanence and growth of the domestic defence and security industry as an ideal way to meet the armament and material requirements of the Armed Forces.

#### **Role in NATO**

For Spain, NATO is decisive in the Euro-Atlantic area and represents an essential dimension of Spanish defence. However, the National Security Strategy published in 2013 highlights that NATO must continue to adapt to a changing reality, in which the risks and threats continuously increase and diversify, to preserve its effectiveness. Moreover, it must develop, in a balanced manner and with a wide view on security, the three main tasks established at its new strategic concept: collective defence, crisis management and cooperative security.

Spain has traditionally been a major player in the international operations carried out under NATO. In the 90s, the Spanish forces took an essential role in the peace-keeping operations in Bosnia-Herzegovina and Kosovo, and in this new millennium, their participation in Iraq and, especially, Afghanistan has also been important.

Currently, the Spanish Armed Forces participate in four operations led by NATO: "Resolute Support" in Afghanistan, "Active Endeavour" in the Mediterranean



The BAM (Buques de Acción Marítima) are new modular offshore patrol vessels adapted to different purposes from a common base, and built by Navantia. Shown here is the FoC METEORO, which was commissioned in 2012. Four of these OPVs are in service with the Spanish Navy, two more were laid down in April of this year.

Sea, "Active Fence" in Turkey, and Baltic Air Policing in Lithuania and Estonia.

Air Policing in Litruania and Estonia. In January 2015 the "Resolute Support" mission has replaced ISAF (International Security Assistance Force). It is focused on training and advising Afghan forces to provide them with sufficient capacity to take care of their own security. The Spanish Army contributed 485 personnel in Herat from January to October 2015 to develop training missions, security and the participation at the airport management. In addition, the Army kept the Role 2 Hospital deployed from 2005. Today, 20 personnel remain in the headquarters of the operation in Kabul.

"Active Endeavour" is aimed at demonstrating the solidarity and determination of the Alliance in the fight against international terrorism, establishing measures to help deter and prevent any terrorist activity in the Mediterranean. Spain generally contributes naval assets to the zone around the Straits of Gibraltar, although it has deployed to other areas. The Spanish Navy's contribution to the operation is updated each year and often takes place when Spanish naval vessels are serving with a Standing NATO Maritime Group (SNMG). The deployed ships usually embark a helicopter and a Marine Corps security team and are often supported by the CANTABRIA, a replenishment ship.

"Active Fence" – the Allied Defence Plan was decided in 2013 to give support to Turkey against missile threats from Syria. In August 2014 the NATO Supreme Commander Europe (SACEUR) asked Spain to assess the possibility of contributing in 2015 to one of the PATRIOT units deployed in Turkey in order to continue efforts of the Alliance in this task. Spain decided to meet the request of the Headquarters of the Allied Forces in Europe (SHAPE) in January 2015 by deploying a reinforced battery with six PATRIOT launchers. It is in charge of the defence of Adana city and will stay deployed at least until June 2017.

Finally, the mission of the Baltic Air Policing is part of NATO's collective effort to defend the integrity of the airspace of its members. Spain took over responsibility as lead nation for BAP in January 2016. Four Spanish TYPHOONs from No.14 Wing at Albacete operated from Siauliai in Lithuania for four months, returning home at the end of April 2016. This was the third time that Spain has supported the policing mission. Previous deployments included three MIRAGE F1s at Siauliai in 2006 and four TYPHOONs at Ämari, Estonia, in 2014-15.

#### Reorganisation of the Armed Forces

In January 2014 the Chief of Defence Staff, General Admiral Fernando García Sánchez, presented the so-called "Transformation Process of Force", by which the Armed Forces remain enrolled and with full operational capacity to 67,000 troops of the approximate 120,000 that are available now.

These 67,000 troops from the Army, Navy and Air Force will feed the so-called Joint Force. In turn this Joint Force will be divided into 12,000 troops for permanent tasks of the Armed Forces in Spain (surveillance and maritime security, defence and national air operations, cyber de-

tegic Defence Review: "The Army must continue its transformation toward units that permit easier projection, have greater deployment capability and are modularly organised ad hoc for the specific mission". These units are the so-called Multivalent Organic Brigades (BOP: Brigadas Orgánicas Polivalentes), the formation of which commenced in 2015 and which will be able to respond to international obligations



In the scope of operation ACTIVE FENCE Spain has deployed a battery of six PATRIOT launchers near the Turkish/Syrian border.

fence or intelligence); 15,000 rapid reaction forces of the three branches will carry out missions alone or combined with allies abroad (e.g. foreign missions such as Afghanistan or Lebanon, humanitarian disasters, participation in NATO monitoring missions, evacuation of civilians elsewhere on the globe...), and other 40,000 troops who will form the rotary reserve of the other 27,000 troops.

Meanwhile, the remaining 53,000 troops will provide support to the force and in the headquarters and will become a remnant force which could suffer a progressive reduction, according to the budget scenarios.

The Ministerial Order DEF/166/2015, by which the basic organisation of the Armed Forces is prescribed, takes another step and states that the structure of the Army will be flexible and adaptable, allowing a rapid and effective response to the use of ground forces in complex and uncertain scenarios. The fundamental characteristic that will define this structure is the versatility of its brigade level units, which will be able to respond to the operational requirements across the full spectrum of conflicts.

Against this background, the Army is currently undergoing a process of reorganisation which is also in line with the ambitions set out in the April 2003 Straand the main security threats: terrorism, organised crime, proliferation of weapons of mass destruction, rogue and/or failed states, persistent regional conflicts, illegal immigration, and natural disasters.

So, the Army will have eight multivalent brigades: four chained brigades and four wheeled brigades. The first one will bring together all the specialties (light and armoured infantry, cavalry, artillery...) and will be able to act throughout the spectrum of conflict. The wheeled brigades will lack of armoured units, so they will have a bivalence reduced to operations of low and medium intensity.

According to the figures provided by the Chief of Defence Staff, the core reaction will have a BOP trained permanently to intervene immediately in the national field. In the international field, two BOPs will form the embryo of a division that could be supplemented by other brigades and/ or support units from allied countries.

However, the evolution towards this structure will be conditioned by the current restrictive economic scenario. Therefore the Army Staff has faced the whole process with a "realistic, flexible and coherent approach". The change has not started from scratch, but from the current means and the experience gained by the Army over recent years. In this sense, following the basic principle of adaptability to preside over this new transformation, during the transition period, the multivalent brigades will keep the armament systems currently in inventory grouped by families for easy maintenance and use of existing infrastructures.

#### **National Industry**

As already mentioned above, one of the five main points established in the National Defence Directive of 2012 is boosting the growth of the domestic defence and security industry as an appropriate means to meet the armament and material requirements of the Armed Forces. In recent years, the Ministry of Defence

has come a long way in this direction, both in regard to its own organisation and with regard to support actions and defence of strategic capacities.

As a first point, the Directive raises the need to adapt structures to increase resource efficiency. The management model based on the principle of "centralised management, decentralised execution", which had fulfilled its function in the circumstances under it was conceived, needed to evolve to adapt itself to new conditions. The need to define responsibilities, eliminate interferences in the decision-making process, and create a dynamic of exigency between internal suppliers and users were identified as main requirements in the new scenario.

Consequently, the Ministry decided to replace the model of "centralised management, decentralised execution" by the model "centralised management, centralised execution" in 2014. As a result, the Directorate General of Armament and Material (DGAM in Spanish) had to start the necessary reorganisation to assume responsibility not only for the management, monitoring and control of the armament and material programmes, but also for the execution of those programmes. The core criterion of this reorganisation was to guarantee efficiency in resource management, with the lowest possible cost, preventing overlaps and duplication and obtaining simple and standardised procedures.

In addition, other actions have taken place parallel to the DGAM reorganisation. Firstly, the strengthening of the Foreign Support Office, targeted at fostering the international presence of national defence companies. Secondly, and within the framework of the CORA plan concerning the reform of the Administration, the Ministry decided the integration of the "La Marañosa" Institute of Technology and the autonomous "Canal de Experiencias Hidrodinámicas" centre



During the NATO exercise "Trident Juncture 2015" US Marine Corps (USMC) Bell Boeing MV-22 OSPREY tilt rotor aircraft embarked on board the Spanish Navy's landing helicopter dock (LHD) JUAN CARLOS I.

in the National Airspace Technology Institute (INTA in Spanish) to concentrate the Department's technological capacity. Another important step for the defence industrial base was the tabling of the "Strategic Industrial Capabilities" and the "Defence Industrial Strategy" documents in 2015. In the first one, the Spanish Government identifies the nine strategic capabilities that Spain can protect from foreign competition by affecting essential interests of defence and national security, a key road map for companies in the sector. Meanwhile, the Defence Industrial Strategy aims to establish, within the framework of the policy of armament and equipment, lines of action and instruments that enable the development and strengthening of the defence industrial and technological base and obtaining or enhancing those considered strategic industrial capabilities.

All these actions have been accompanied by a certain recovery of the budgetary capacity and the possibility of opening a new 'investment cycle', as the Secretary of State for Defence, Pedro Argüelles, said at a meeting of the Defence Commission in the Congress in 2015.

This new investment cycle has resulted in two new major armament programmes: 8x8 wheeled armoured vehicles and F-110 frigates. At the end of 2015, the Ministry of Defence launched R&D projects to start

#### **COUNTRY FOCUS: SPAIN**

these two programmes and all the projects were awarded to the domestic industry, mainly Navantia, Indra and GDELS Santa Bárbara Sistemas. In this regard, the Minister of Defence, Pedro Morenés (recently succeeded by María Dolores de Cospedal), said that these two programmes are the basis for a restructuring of the defence industrial sector, because they promote partnerships and cooperation in order to develop the aforementioned technological projects.

#### Outlook

Defence policy, however, must be backed by a political consensus to ensure its continuity over a certain time and stability of the actions implemented. In Spain, the current government has just begun to walk after a year 'in office', a low support from voters and a political opposition more unstructured than ever.

To have effective and well trained Armed Forces, equipped with high-tech systems to face the new risks and threats, we need political and financial stability, an efficient decision and management structure and a strong defence and security industry. The first steps have been taken, but a long way remains to be gone.



# The Spanish Armed Forces in the 21st Century

#### Fernando García Sánchez

During the last decade the security framework has undergone profound changes inside and outside Spain which have had important implications for the nature and the use of military power, causing changes in the capabilities, organisation and modes of action of our Armed Forces.

hus, the global geo-strategic situation has been changing around three fundamental realities:

- Globalisation and its complexity, the growing role of non-governmental actors, the variety of conflicts, terrorism, the impact of mass migration, climate change, the importance of cyberspace as a new security environment, and other factors shape an environment of "operational uncertainty".
- 2. Changes in the global geo-economic and geopolitical order, translated into a substantial increase in military budgets in many emerging or recovering countries, in some regions have laid the foundation of a worrying arms race.
- 3. The persistence of internal crises and conflicts, the disintegration of traditional power structures in some areas, the growing strategic importance of areas without government control as a logistical base or safe haven of hostile non-state actors and the spread of urban areas as essential elements of a zone or theatre of operations have led to the birth of a new and complex type of threat.

From there, Western countries have developed, since the beginning of the 90s, successive military strategic models that have been separating the dynamics of the Cold War to enter a scenario that is first marked by the deployment of a large number of troops during long periods of time, leading to more selective operations and an easily sustainable and more discreet footprint.

Meanwhile, the operating environment

#### <u>Author</u>

#### Admiral Fernando García Sánchez,

is the Chief of the Defence Staff (Spanish: Jefe del Estado Mayor de la Defensa, JEMAD) of the Spanish Armed Forces



has continued its transformation, showing an innovative side with the growing recourse to military tools for carrying out tasks of internal security or law enforcement for external security work, while on the other hand, still maintaining more traditional approaches but ones that are used against threats of various kinds, capable of combining procedures of regular and irregular combat and making the most of the easy access to new technologies.

Therefore Western armed forces have to face two types of scenarios that require different strategies and approaches:

- Those where superiority is essential in confrontation and ability to deny or open access to common areas not subject to sovereignty, such as maritime and international air routes, outer space or cyberspace;
- Those where irregular operating environments, mostly urban, take precedence, with no defined battle fronts and with a civilian population that will be unintentionally involved in the conflict.

Not least due to the pressure of public opinion both will definitively determine the planning and conduct of operations.



Major sensor and weapon elements of the F-110 design. The multimission bay can accommodate unmanned vehicles, special operations vessels or containers for different use.

Given this profusion of instabilities, risks and threats that are difficult to categorise and the great extent of connectivity, the introduction of new models of security and defence is inevitable, both national and collective, shared or cooperative.

As a result of the role of Spain in the Euro-Atlantic framework, its geographical situation (between Europe and Africa, the Mediterranean and the Atlantic) and its own territorial management (which includes island territories and autonomous cities), which provide a special dimension to its defence, there are risks involved which cannot always be shared with our partners and allies.

The so-called Southern Arc, ranging from Afghanistan to North Africa through the Middle East, is home to four wars (Iraq, Libya, Syria and Yemen), emerging internal conflicts (Egypt) and strained relations between states (Iran – Saudi-Arabia). It is a permanent source of instability affecting European security due to its connection with terrorist attacks in European cities or mass migration flows amid dire humanitarian conditions.

Thus, the existence of weak or failed states in North Africa, the Sahel, the Gulf of Guinea and the Horn of Africa, along with the vulnerability of the maritime areas of the Mediterranean and their avenues of approach, make these areas vital to the interests and security of Spain. Moreover, on the eastern flank of the Euro-Atlantic cooperation, Russia has violated the rules of the international system with the annexation of Crimea and the destabilisation of Ukraine. Thus, it is trying to regain its superpower status, rebuilding its former sphere of influence and strengthening the capabilities of its armed forces.

#### Implications for the Development of Spain's Defence Policy

The National Security Strategy 2013 establishes Spain's commitment to the system of collective security based on its integration in international organisations in which it participates and through its active contribution to operations abroad, carrying out actions that contribute to the development of the external action of the state and improving Spain's international position.

Today, the establishment of strong, while flexible, collaborative relationships is essential at the multinational level. Thus, Spain firmly believes that its defence policy must be of a shared and cooperative nature, so that this collective effort must primarily be implemented through international organisations, mainly the Atlantic Alliance (NATO) and the European Union (EU), without forgetting the importance of the UN as the most important organisation for global cooperation and source of international law.

With the possible departure of the United Kingdom from the EU (Brexit) a new stage has opened that will require greater cooperation between NATO and the EU, as submitted this October in the letter sent by the defence ministers of France, Germany, Italy and Spain to their European counterparts. It is necessary to implement a package of measures to revitalise European defence, to make it stronger, realistic and credible, giving it ficient forces with high availability that respond, and give guarantees, to the necessary political will. The most significant milestone in this process is to design a Joint Force<sup>1</sup> that is balanced to carry out the tasks assigned to the armed forces for the purpose of:

- Providing an active and effective deterrent;
- Defending the national territory;
- Monitoring the airspace, territorial waters and cyberspace;
- Projecting military power to defend our values and national interests and that of our allies on a global scale;
- Supporting civil authorities to ensure the welfare and safety of Spanish citizens inside and outside our borders.



A Spanish PATRIOT launcher protecting the city of Adana, Turkey

a strategic autonomy in the operational and industrial field. This leap forward in building European security and defence will in turn mean a stronger NATO with which the EU can complement efforts to strengthen cooperation and avoid duplication whilst seeking balanced burdensharing.

The situation in North Africa obliges Spain to promote, coordinate and support any measures undertaken by states in that region in their fight against threats such as terrorism, organised crime, illegal migration, illegal trafficking and piracy. Promoting our security starts from working with our partners and allies in this area to achieving those objectives.

Finally, to operate in future scenarios the main effort focuses on building a core of qualified, powerful, effective, and ef-

All of these present and future scenarios, the required effort on the part of the armed forces, objectives and strategic lines of action, the operational use of the Joint Force and its areas of action arising from the National Defence Directive (NDD) and Defence Policy Directive (DPD) are set out in the documents issued by the Chief of Defence Staff (CDS): Concept of Employment of the Armed Forces and Military Policy Planning, strategic documents which are the baseline for the start of the planning cycle for which the necessary capabilities for the Armed Forces are determined and

<sup>1</sup> Within this Joint Force, a Core Joint Force (CJF) is established, defined as a set of units, headquarters/control elements and supporters with high availability and adequate combat autonomy, assigned to the operating structure or prepared to be deployed and employed quickly by the Chief of Defence Staff (CDS).

whose definition process and materialisation will be discussed later in this article.

#### The Current Role of Spain in the International Security Environment

In response to the strategic approaches previously set out, Spain responds with considerable effort, manifested in its participation in a series of overseas missions as well as certain initiatives contributing to Allied Security and Defence:

#### NATO

#### RESOLUTE SUPPORT Mission (RSM)-Afghanistan

Spain has been present in Afghanistan since 2004 and currently contributes personnel to the Headquarters (HQ) of the operation, maintaining its commitment and support to the common allied position, taking into account that the situation in this country is key to international security.

#### **Operation SEA GUARDIAN**

After the transformation of the Article 5 Operation ACTIVE ENDEAVOR to a maritime security operation, Spain maintains its commitment to actively contributing to security in the Mediterranean through the fight against terrorism, collaborating in marine environment knowledge and through capability-building activities especially in North Africa.

The national contribution to this operation has been ongoing since its inception, transferring maritime patrol aircraft, submarine and ship deployments, which remain under national command; they are ready to be deployed, if necessary, to inspect merchant traffic.

#### NATO Air Defence

Photo: EEAS

Spain meets its commitment of being host nation and providing the command

of the Air Operations Centre of the Southern Zone. It also participates with vessels of the ÁLVARO DE BAZÁN Class in the theatre of operation with the deployment of theatre anti-ballistic missile destroyers, and participates in anti-ballistic missile defence, deploying a PATRIOT battery in Adana (Turkey).

#### Air Defence of the Baltic Countries

In the scope of the airborne mission of the Baltic Air Police, Spain has led two combat fighter deployments.

#### NATO Response Force

After the NATO summit in Wales and in light of the objectives of the Readiness Action Plan (RAP), Spain makes a significant contribution to the implementation of the new Enhanced NATO Response Force (ENHANCE NRF) as one of the six framework nations that will rotate annually to form the Very High Readiness Joint Task Force (VJTF).

This year, 2016, Spain has been a pioneer leading the first multinational brigade and has performed the land component command of the VJTF with NATO's Rapid Deployable Corps of Spain (NRDC-ESP). For the following years, Spain will continue to make significant contributions, leading the Special Operations Component Command (SOCC) of eNRF-18, and in 2019 it will lead in the Joint Force Air Command (JFAC) of eNRF-19.

#### Standing NATO Maritime Groups

As a multinational maritime force, the usual Spanish contribution has personnel in the Maritime Allied Command Headquarters (MARCOM), deploying frigates and supply ships in the two escort groups (SNMG 1 and 2). As for the group of minesweepers, it supports one ship for several months a year in the SNMCMG2. In 2016 Spain took control of the SNMG1 and is expected to do so once again in 2024, and will assume responsibility for the SNMG2 in 2020.

#### Enhanced Forward Presence

After the last summit of the Alliance in Warsaw and with a view to strengthening the position of deterrence and defence against dedicated threats, Spain intends to contribute with an S/GT mechanised multinational battalion led by Canada in Latvia.

#### **European Union**

#### EUTM Mali

Spain provides military assistance, education and training to Mali's army and security forces under the control of the legitimate civilian political authorities. In the medium term, it is intended to slightly increase the level of current contribution and it is the intention of Spain, together with France, that the core of the mission headquarters will be provided by the CG of the Eurocorps from the second half of 2017.

#### EUTM RCA

With a national contribution of around 20 forces, generated within the framework of the General Staff Headquarters EUROCORPS (EC), it contributes to the reform process of the Security Sector coordinated by MINUSCA and to the development of the capacities of the African Armed Forces Centre (AAFC). Spain will continue with the mission while continuing the participation of the EC, which is scheduled to be completed in the summer of 2017.

#### EUTM Somalia and ATALANTA

Spain contributes with personnel to both the staff and training teams. The mission will enter its 5th mandate with a more focused guidance on the "Train-Equip-Maintain" methodology.



During her participation in EUNAVFOR MED operation SOPHIA in 2016 the Spanish frigate REINA SOFIA directly rescued 3,762 migrants at sea.

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In the ATALANTA Operation, the personnel assigned include a maritime patrol aircraft, a surface vessel, special operations team and staff in the OHQ at Northwood (UK). In 2017, Spain will assume command of the forces deployed from February to July.

#### EUNAVFOR MED SOPHIA

Since the start of the operation, Spain has contributed with naval and air assets

Spain, in order to maintain peace and security in the Middle East.

#### Peace Mission in Colombia

Spain is ready to deploy the first group of observers once deployment to the EU countries is authorised.

The historical ties with Colombia, the bonds of friendship between the two nations and the fact that we speak the same language gives this mission a spe-



in support of the main task; interrupting the business model of human smuggling networks and people traffickers in the central and southern Mediterranean off the coast of Libya. In addition it has personnel deployed in their HQs.

#### EUFOR ALTHEA in Bosnia-Herzegovina (BiH)

Through the provision of two forces at the Force Headquarters in Sarajevo and one in the Operational Headquarters in SHAPE, the efforts of BiH to maintain a secure environment are supported, creating capability for the building and training of the armed forces.

#### Battle Groups (BGs) in the EU

Spain has participated regularly in the BGs of the EU and has its next commitment in the contribution of the BG during the second half of 2017, which will mean a major effort in terms of preparation and certification during the first half of next year.

#### **United Nations**

#### UNIFIL (Lebanon)

The contribution to UNIFIL, leading one of the two multinational brigades from the start of the mission, reflects the willingness to collaborate on the part of cial character as far as our country is concerned.

#### **International Coalitions**

Support for Iraq and the Fight against DAESH

As an active member of the international coalition led by the United States in the fight against DAESH in Iraq, Spain offers around 300 military personnel. Our participation is integrated into the official CGs of the Coalition, training units for brigades of the Iraqi armed forces and special operations units, besides support units and force protection. In the near future, we want to expand the spectrum of training for police forces, which will require an increase in the contribution of personnel.

#### **Activities of Cooperative Security**

Senegal, Cape Verde, Gulf of Guinea and Mauretania

Spain regularly conducts cooperative security activities in countries of West Africa, the Sahel and the Gulf of Guinea. In particular, with the armed forces of Senegal, Cape Verde and Mauretania it is in the process of extending this collaboration to other countries of the region. They are aimed at strengthening the military capabilities of these forces in the areas of land, sea, air and special operations, in order to cope with risks and threats such as Jihadi terrorism, illegal immigration, organised crime (illicit trafficking of arms, drugs and people), as well as piracy.

# Functional Areas of the Industry

It is the responsibility of the Chief of Defence to set out the military capabilities of our Armed Forces considered to be necessary to the Minister of Defence. Prior to the development of the processes of planning and procurement, it is necessary to understand the tasks faced by the Armed Forces and the strategic framework in which they have to operate. It is important to bear in mind that from conceiving the idea of having a capability, until the associated systems are available and operational, there is still an important way to go that affects very diverse actors; both within the scope of the Ministry of Defence (MINISDEF), other governmental

agencies, and industry, etc.



At the national level, the document that has led to the convergence of efforts at the level of the general administrations of the state has been the National Security Strategy (NSS) signed by the President of the Government in 2013, which integrates all the tools in the hands of the is delved into, in the concurrency of the different planning authorities (Chief of Defence (CHOD), Secretary of State for Defence (SEDEF) and the Assistant Secretary of State for Defence (SUBDEF)), and the support of the Army, Navy, Air Force and subordinate agencies.



State to ensure security, with the Armed Forces (FAS) being another actor, but with direct involvement in the National Defence Line of Action.

The fundamental reference of the process at a political level (President of the Government) is the National Defence Directive (NDD), as an expression of the general lines of action and of the guidelines for the development of the Defence Policy.

Meanwhile, the Defence Minister promulgates the Defence Policy Directive (DPD). The Defence Policy sets the framework under which, holistically, the organisational, functional and employment aspects of the FAS need to be dealt with.

As a result of the need to contribute to a number of measures to overcome the economic crisis, an objective defined from the political level and which has affected all of the general state administration, it has been necessary to adapt the previous ministerial order regulating the planning process of the MINISDEF (37/2005) to a new order that is still in its implementation phase (60/2015).

In this new order, and based on lessons learned from previous planning cycles, the joint character of the process The process described in this new planning order involves, among other issues, the definition of objectives, the establishment of priorities and the allocation of resources, and the implementation of activities necessary to achieve the military capabilities required by the FAS, establishing the broad lines of action and the precise guidelines for planning which will be reflected later in the process of obtaining the systems that cover these capabilities.

Hence the need to establish efficient planning that can respond to any type of threat, which is not limited to a particular physical space or to a defined type of conflict, which must adapt to the evolution of the changing strategic scenarios and even the type of threat and its symmetry. These constant changes offer great opportunities, not only from the conceptual point of view, but also from the point of view of industrial development. As with the risks and threats, these developments and concepts have to be globalised in line with our partners and allies in order to be interoperable, so that we can act together and contribute to enable the security of their countries, states and hence that of their citizens, as cited

in the policies referred to above.

The necessary capabilities will be reflected in the document entitled "Military Capabilities Objective (MCO)" which will integrate the military planning and the resources from the very beginning of the conceptual phase, with continuous coordination and synchronisation of activities among all the planning authorities through meetings of the Working Group in support of the Planning Committee.

So far the word "capability" has been mentioned, but what is military capability?

Military capability is the set of various elements (weapon systems, infrastructure, staff and logistical support) established on the basis of doctrinal principles and procedures which are intended to achieve a certain military effect at strategic, operational or tactical level, in order to fulfil the tasks assigned.

As can be deduced from the definition, planning goes beyond the mere acquisition of a unit, system or computer, since it involves analysing each of the capabilities with a holistic approach, so that all the requirements can be established for achieving them, and associating them with the following factors: Material, Infrastructure, Human Resources, Training, Doctrine and Organisation (MIRADO in Spanish).

In this process we cannot ignore other fundamental components which can significantly set out their viability: interoperability, financial availability and the state of technological development.

Given the fundamental components mentioned above, in particular the financial availability and the broad spectrum of necessary skills, there is a need to establish prioritisation on the basis of a valuation assigned to two types of factors:

- Qualitative: taking into consideration the expected date on which to reach full operational capability and operational risk;
- Quantitative: taking into consideration the frequency of scenarios with operational risk and the number of tasks assigned to the Armed Forces.

And in addition to all this, the notice required for its development and implementation must always be taken into account.

Once the capabilities have been identified, they must be contrasted with the existing resources and the "military necessity" that will allow the development of the proper process of obtaining the systems to be identified.

The process governing the obtaining stage is referred to in the instruction of the SEDEF

67/2011 which regulates the process of obtaining material resources, according to the process described in the chart.

Although the process of obtaining assets itself is developed among various authorities of MINISDEF, we can observe that all of the conceptual phase, as well as the phase of defining the systems' requirements, are the sole responsibility of the Chief of Defence with respect to the needs that arise from "Military Planning".

For the development of this "process", the Chief of Defence has the Armament and Materials Programme Board (JUPROAM in Spanish), which is responsible for harmonising the different needs that may be requested (by the Army, Navy, Air Force or the Defence Staff itself), as well as for submitting for validation the documentary milestones that will define them and serve as a basis for the SEDEF to start the subsequent feasibility process (technological, infrastructure and economic) of the needs requested and the subsequent obtaining of assets on the market and/or development via R&D. If the entity of the necessity so requires, and provided certain conditions are met, the acquisition will be conducted through a programme. The DGAM has assumed, by delegation of the Minister, both the approval of provisions for which management and contracting of the weapon and material programmes are centralised. To do this, we proceeded to centralise, in the DGAM, the management and contracting of the armament and material programmes, as well as that of modernisation and common support and the offices of the existing programmes in the various armies/navy and the Chief of Defence; with the latter remaining as a "single interlocutor" between the Ministry and industry.

As a result of the foregoing, and as with the planning, for the process of obtaining an industrial policy there is an industrial defence policy and an industrial defence strategy which establish the guidelines and future of the existing industrial interests in order to foster, define areas of, and maintain, the reverse cycle; the ultimate goal being that the needs of the Armed Forces are met in the best way possible, and that it will materialise mainly in an Armament and Material Policy, which includes R+D initiatives and which is coordinated with the industrial policies of the EU and our allies. From a sectoral point of view, and comparing it with the civil industrial activity, we could speak of seven defence sectors: Auxiliary, Electronics and IT, Naval and Land Vehicles, Aeronautics, Armament, Space (very much booming lately with regard to research and monitoring) and Raw Materials, as well as Missiles.

The national developed industrial capacity, taking into account all the sectors, is quite large in terms of subsystems or components (since it relies mainly on SMEs) and is somewhat reduced in terms of the capability for integration and development of major systems.

The market limitations/restrictions favour the creation of consortia and partnerships between SMEs in the same sector which will facilitate not only the necessary financial capacity or technology itself, but also the possible participation in other markets that makes the survival of the companies themselves more feasible. We cannot forget that another fundamental point of convergence is that rapprochement between some of the systems in the military field and the civil sector has gradually been taking place in recent years given the growing potential "dual" use thereof. of technology and knowledge, applicable to the sectors of land, sea, air and space:

- a. Command and control, communications, information (C4i);
- b. Cyber defence;
- c. Surveillance and reconnaissance, intelligence and targeting (ISTAR in Spanish);d. Critical systems on platforms;
- e. Space systems for mission and data processing;
- f. Simulation of equipment and weapons systems, for advanced training;
- g. Navigation systems, guidance control and payload, missiles and complex munitions;
- h. Complex systems composed of other advanced weapons systems, the integration requirements of which are linked to essential interests of defence and security.
- i. Traffic control and navigation aids.



The ASCOD AIFV is the result of a Joint Austrian-Spanish development and production effort. Shown here the ASCOD PIZARRO, as the Spanish variant, in Austria referred to as ASCOD ULAN or within the UK referred to as AJAX.

All this effort is necessary to try to identify those industrial areas of interest in order to be able to direct the efforts of all the parties involved and, with appropriate optimisation of resources, to be able to obtain the systems.

With regard to the determination of the industrial capacities and areas of knowledge that affect the essential interests of defence and national security, Law 24/2011, on public sector contracts in its ninth additional provision, establishes that it is the Government that will undertake the task. On this basis, the Council of Ministers approved, by means of the agreement adopted on 29 May 2015, in the following areas This means that the fundamental activities of maintenance, supply, engineering and integration that these systems require for operation throughout their useful life will be considered equally.

These areas of technology and knowledge will seek to comply with the three major strategic objectives of the Industrial Defence Policy:

- Equip the Armed Forces with the best possible systems according to their needs.
- 2. Enhance industrial capacities to conform to what is required in the planning and acquisition process for the financial and material resources.

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METEOR is a ramjet-powered, beyond-visual-range, air-to-air missile from MBDA and intended to arm – among others – the EUROFIGHTER/TYPHOON fleets of Germany, Italy, Spain, the UK, and Saudi Arabia, as well as the British and Italian F-35s, and Swedish and Czech GRIPENs.

3. Consolidate an industrial and technological base adapted to the new forms and market conditions.

From these three goals, seven main axes are defined that will be developed transversally and will facilitate the definition of the lines of action required for each one of them, and will subsequently be evaluated annually by the indicators that are determined in order to verify the degree of compliance and effectiveness of the planning performed:

- a. Feasibility and budgetary stability;
- b. Orientation of the investments in industrial capabilities;
- c. Intelligent management of industrial knowledge;
- d. Interlocutor and institutional collaboration;
- e. Quality, competitiveness and sustainability;
- f. Innovation and technological training;
- g. International cooperation and external support.

In addition to these areas of capability, some sectoral master plans have been promulgated (helicopters, RPAS and space systems), the objective of which is to provide a strategic vision of these systems, which serve as elements of support in decision-making and which will deal with both the present situation, as well as international needs and commitments.

The following can be referred to as examples of current programmes:

#### **Terrestrial Systems:**

a. ASCOD PIZARRO combat vehicle: Combat vehicle with treads that allow manoeuvre units to operate in cooperation with the natural formations of tanks.

- b. TIGER combat helicopter: Combat helicopter with the capability to undertake diverse missions, at all times, with a high rate of survival, equipped with real-time information systems and a firepower and deterrent capability greater than those of the current ones.
- c. "SPIKE-LR" anti-tank missile: Midrange anti-tank missile, and firing positions, to replace the DRAGON system (marine infantry) and MILAN (Army).
- d. VCR 8x8 combat vehicle PIRANHA: Wheeled combat vehicle to replace the armoured wheeled vehicles (BMR) which incorporate the new technical solutions to cope with the evolving threats and that are adaptable to the new organisation based on organic multi-purpose brigades.
- e. PIRANHA combat vehicle: Amphibious wheeled combat vehicle that provides the marines of a mechanised tactical group with elements of manoeuvre and limited means of support.

#### **Naval Systems:**

- a. S-80 submarine: Submarine with an airindependent propulsion (AIP) system and the capability to launch missiles to engage land targets.
- b. F-110 frigate: Multi-purpose escort frigate for high-intensity scenarios, with an important combat capability in all the main areas, enabling it to carry out its tasks, especially in the profiles of force protection and in the projection of naval power; as well as to be able to carry out tasks associated with the profiles of maritime safety and support to civil authorities, if so required and determined.

#### Air Systems:

- a. EUROFIGHTER combat aircraft: Fighter aircraft developed in the scope of an international programme with the aim of achieving a latest-generation European plane.
- b. A400M transport aircraft: Transport aircraft developed in the scope of an international programme that can replace the fleets of HERCULES and TRANSALL aircraft.
- c. NH-90 helicopter: Multi-purpose average-load helicopter developed in the scope of an international programme to replace various models currently used by the Army, Air Force and the Navy.
- d. EC-135 training helicopter: Training helicopter to complete the army fleet, which provides the pilots with the ability to operate in visual flight with and without navigation aids, as well as tactical and night flying with and without night vision goggles.
- e. METEOR missile: Air-to-air mediumrange missile developed in the scope of an international programme to equip the combat aircraft with a capability beyond the visual range.
- f. AB-212 Helicopter Life Extension: Life extension programme for the AB-212 helicopters, which also includes the modernisation of their capabilities, enabling their employment from a BAM Class patrol ship.

#### **C4ISRyE Systems:**

Satellite Observation and Communication System (SPAINSAT-XTAR, SECOMSAT and PAZ).

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# "Most programmes managed by DGAM involve significant challenges in the long term."

Interview with Lieutenant General Juan Manuel García Montaño, Director General of Armament and Material, Spanish Ministry of Defence

ieutenant General (Army) Juan Manuel García Montaño was assigned the position of Director General of the Spanish Directorate General of Armament and Material (DGAM) in September 2012. In this interview, he explains the activities of this procurement organisation and comments on the main programmes carried out by the Spanish Ministry of Defence.

**ESD:** Can you briefly elaborate on the role, organisation and duties of the DGAM? **LtGen García Montaño:** The Directorate General of Armament and Material [Spanish abbreviation: DGAM] is the authoritative organisation for planning and scheduling the Armament and Equipment and Research, Development and Innovation Policies, as well as the command and control of their execution.

The Armament and Equipment Policy is the set of actions associated with the planning and execution of procurement in the Ministry of Defence in the short, medium and long terms, as well as the key aspects related to the procurement process, such as logistics integration and the financing of new weapon systems.

The main purpose of the Armament and Equipment Policy is to meet the needs of the armed forces providing them with the best weapon systems and equipment in line with the resources that the nation makes available. In addition, this policy contributes to setting up an industrial policy that allows the strengthening of the defence technological and industrial base.

**ESD:** Is DGAM comparable to other defence procurement organisations like the French DGA or the Swedish FMV? Are there other organisations involved in defence procurement in Spain?

**LtGen García Montaño:** Although there are some differences among the three or-



ganisations in what refers to organic and missions, there are similarities in terms of tasks, since the DGA is responsible for the definition, procurement and evaluation of the French armed forces systems, and the FMV is the armament and material procurement agency of the Swedish armed forces.

The Spanish DGAM centralises all the current and future acquisition, mod-

ernisation and common maintenance programmes, including the purchase, management, quality inspection, financial control and the industrial cooperation agreements. Meanwhile, the armed forces, as origin of the need and future users of the systems, are responsible for defining requirements. In addition, they have to meet their permanent needs of armament and equipment with the replacement of existing resources and consumables, as well as the resources associated with specific support.

**ESD:** To what extent does the DGAM assume responsibility for the R&D share of armament programmes? Do you have your own R&D personnel?

**LtGen García Montaño:** Specifically in R&D&i, the DGAM is responsible for proposing and directing the plans and programmes of weapon systems and equipment of interest to national defence, in coordination with the relevant national and international organisations.

DGAM is the only interlocutor of the Ministry of Defence with regard to R&D activities. It plans and programmes the R&D Armament and Equipment policies of the Ministry and manages and controls its execution.



PIRANHA VCR 8x8 during load into an A400M

#### **COUNTRY FOCUS: SPAIN**



Along with Germany, Italy and the UK Spain is among the primary users of the Eurofighter EF-2000. Shown here are aircraft of six user nations in formation flight.

Specifically, the National Institute for Aerospace Technology (INTA), subordinate to the Secretary of State for Defence, carries out activities of scientific and technical research, as well as technological services, since it is specialised in research and technological development, dual character, in the fields of aerospace, aeronautics, hydrodynamics and defence and security technologies.

DGAM has technical personnel who plan and manage the R&D&i policy, and controls the execution of programmes funded by the Ministry, although the development of the R&D&i is carried out by different entities of the technological and industrial base (large companies, SMEs, Universities...).

**ESD:** What are the most important defence programmes currently executed by DGAM? What is the annual budget available for defence materiel investments in Spain?

**LtGen García Montaño:** Each programme managed by DGAM responds to specific needs of the armed forces; therefore, all of them are considered really important.

After the reorganisation of the Ministry of Defence held in 2014, DGAM started to manage the procurement, modernisation and common maintenance of weapon systems and equipment of interest to national defence until the stage of initial logistical support (ILS). Among these programmes we can highlight, in the naval field, the F-110 frigate and S-80 submarine; in the aviation field, the A400M new generation transport aircraft, the Eurofighter EF-2000 and the TIGER and NH-90 helicopters, and in the land arena the 8x8 armoured fighting vehicle, without forgetting the remotely piloted aerial systems, such as EUROMALE 2025. In this regard it should be emphasised that the management of some of these programmes is certainly demanding in terms of workload and cost, as in the case of the EF2000 aircraft or our F-110 frigates.

As regards the annual budget for defence material investments, in general terms, it is about €1,000 million.

**ESD:** Which of your current programmes are carried out in international partnerships with other national or multinational procurement organisations?

**LtGen García Montaño:** Today, it is virtually impossible to find an initiative in the field of armament and material policy that does not have, in one way or another, an international component. And in most cases, this international aspect will not only be relevant but also decisive and determining. Like other European countries, Spain has chosen to develop jointly, through international organisations and cooperation agencies, such as OCCAR, and the NATO agencies, several armament and material programmes which I have already mentioned above and which include:

- A400M transport aircraft.
- Eurofighter EF-2000 aircraft.
- Remotely pilot aerial system EURO-MALE 2025.
- TIGER combat helicopter.
- NH-90 multipurpose helicopter.
- METEOR medium-range air-to-air missile.

With these programmes, we try to boost the defence industry as well as facilitat-

ing their integration and internationalisation.

**ESD:** Are there defence procurement efforts executed in the scope of public-private partnerships?

LtGen García Montaño: In 2015 the Secretary of State for Defence approved the Defence Industrial Strategy, a document aimed at establishing, within the framework of the armament and equipment policy, lines of action and instruments that allow the development and empowerment of the defence-related technological and industrial base and the procurement or enhancement of those industrial capabilities considered as strategic capabilities. With the document the Government proposes the achievement of three strategic objectives that contribute to the crossdefinition of a total of seven strategic priorities that will set a model of defence industrial and technological base. In this scenario, the public-private partnership plays an important role and it is collected in the strategic axis of Viability and Budgetary Stability and the axis of Institutional Collaboration and Dialogue.

As regards the axis of Viability and Budgetary Stability, we have identified concrete actions such as the promotion of new mechanisms of public-private partnerships with industry that allow a sharing of cost and financial risks associated with the development of new systems, establishing new forms and alternative sources of funding.

Meanwhile, the axis of Institutional Collaboration and Dialogue devotes a specific line of action for the promotion of public-private collaboration mechanisms. For DGAM, and in general for the Ministry of Defence, the public-private partnership allows new opportunities for investment contribution by the Defence Technological and Industrial Base. In this sense, we will encourage the expansion of the current business model of public-private partnership beyond the traditional areas of maintenance and operation of systems, so as to allow providing the Ministry of assets and capabilities considered of interest to national defence.

In order to get this new model of partnership, we will promote the creation of forums for interaction between the General Administration and the defence industry sector to rigorously define potential needs and future demand forecasts, as well as analysing possibilities of mutual collaboration. The associated regulatory constraints will also be evaluated, providing legal certainty for both parties and limiting the risk of collaboration.

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In short, the Directorate General of Armament and Material is fully sensitive to publicprivate partnerships and will carry out the actions which are considered relevant in the context presented by the Defence Industrial Strategy.

**ESD:** What advice can you give to a foreign defence contractor who wants to enter into a business relationship with DGAM and the Spanish Armed Forces?

LtGen García Montaño: As you know, Spain is subject to EU regulations regarding defence contracts, so most of our tenders are posted on public official sites. Any contractor can access them and contact the DGAM to offer their products or services anytime. As a matter of interest, since the acquisition of defence weapons and materials in Spain is largely done through international cooperation, DGAM has recently published a directory of defence industry in Spain (Edition 2016), accessible on the Internet at the following link: *http://www. defensa.gob.es/portalservicios/servicios/ industriadefensa/catalogoindustria* 

**ESD:** Are there any materiel requirements from the Spanish Armed Forces that constitute long-term future challenges for DGAM?



Spain's original order for 45 NH90 TTHs was later reduced to 22 featuring customised communications suite and Indra-developed electronic warning systems.

**LtGen García Montaño:** As it is for other nations in our environment, large parts of the programmes managed by DGAM involve significant challenges in the long term. These challenges are primarily related to the need to make compatible the available budget with the operational needs of the armed forces for high-technology systems. In this sense, I can mention some particular programmes, such as the new F-110 frigate, the 8x8 fighting vehicle or the NH-90 helicopter.

The interview was conducted by Nuria Fernández.

### Highest Survivability and Combat Proven Technology



# **Defense Solutions for the Future**



GENERAL DYNAMICS European Land Systems

# Spanish Perspective, Global Vision The Spanish Defence Industry

#### Adolfo Menéndez

This year, 2016, has been more unstable than expected for the security and defence community. Brutal Islamist-inspired terrorist attacks; a large geographical area – from North Africa to Afghanistan – in a state of permanent alert for ISIS; expansionary policies of strong powers causing tension and confrontation with neighbouring countries and other parts of the world, growing concerns about cyber security and the vulnerability of strategic infrastructure, the need and the duty for a fair and balanced response to migration problems.

All of this draws a complex global scenario, in which efforts to provide oneself with the defensive capabilities in line with the risks and threats have become an absolute priority.

The Spanish defence and security industry is prepared to act as an ally of reference in the described context. Our companies are determined to continue to grow, to become more competitive and

Photo: Wikiped

#### Main Magnitudes

The Spanish defence and security industry has learned important lessons in these years of shrinking domestic de-





The rules of the game evolve: globalisation, emerging countries, the financial crisis, the course of the conflicts which adds space and cyberspace to the traditional areas (land, sea and air), the renewed demand for innovation, strategic decisions about the future direction of the Common Security and Defence Policy, etc. require adaptation.

#### Author

Adolfo Menéndez is the President of the Spanish Association of the Defence, Aerospace and Security Industry TEDAE (Asociación Española de Empresas Tecnológicas de Defensa, Aeronáutica, Seguridad y Espacio)



75% of the Spanish defence industry's turnover is generated in export programmes, among them the Royal Norwegian Navy's FRIDTJOF NANSEN Class programme based on Navantia's ÁLVARO DE BAZÁN frigates and featuring Lockheed Martin's AEGIS combat management system.

efficient. Not coincidentally they invest around 10% of their turnover in research and development. They know that the competitive edge and spearhead to break into new markets is in the innovation and development of technologies and own products. mand and cost containment in new programmes. In particular, we have learned that we are capable of doing good things and do not want to give up the relevant technological position we occupy and have achieved with hard effort. The fact that best expresses the strength

#### **COUNTRY FOCUS: SPAIN**

of defence and security firms associated in TEDAE is that the evolution of the turnover of these sectors has almost doubled their contribution to the industrial GDP in the 2007-2015 period. They are effective economic accelerators since each euro invested has generated €2.5 of economic activity. Last year they reached a turnover of €4,900 million, employed 20,800 people and exported 75% of their turnover. And as an example of the effort to gain technological leadership, more than 40% of these companies have innovated continuously and 25% are patent applicants. Spain is one of the few nations the industrial base of which can handle the entire industrial process: innovation, production, deployment, maintenance, etc. We have products, capabilities and competitive technologies in the area of ground, naval and air platforms, electronics and communication, weapons and ammunition, space, etc. The sectorial structure, distributed among primes, subcontractors and SMEs with own products, allows us to lead complex projects, participate in international programmes and have competitive specialist areas.

We have reached an important position in markets, a position which we want to maintain and strengthen since our companies have achieved it after investing many resources, much effort and a great deal of enthusiasm. There are the major international programmes in which our industry is involved, and our products providing advanced services at a high technological level in the UK, Australia, Brazil, France, Saudi Arabia and Germany, among other countries.

#### Looking to Europe

It is evident that much of our industrial future lies in Europe. Our possible success depends on our capacity, reliability and technological advantage to lead the changes towards a European industrial base which ensures supply efficiently and with guarantees.

The defence cooperation, specifically in R&D&i, has acquired a very important role in Europe. Following the European Councils of December 2013 and June 2015, and at the initiative of the European Commission, the possible integration of a defence research programme with the next Framework Programme of the European Union is being promoted. To this end, it is proposed to structure preparatory actions to validate the possibility of such a programme. These actions will be, along with the Action Plan on Defence, the possible White Paper on

Defence and the Global Security Strategy, the key elements in this field for Europe over the next years.

#### **Conquering Markets**

All indicators point to the start of the economic recovery, and we want to contribute to the extent of our possibilities, which are many. We see the progress of state as regulator and significant client. We have solid experience in various forms of strategic alliances and commercial agreements among companies from different nations. These agreements frequently end up becoming bilateral cooperation agreements between states, transcending the field of defence and security, and covering areas such as infrastructure and telecommunication. These



As the Spanish variant of the LEOPARD 2A6 MBT, the LEOPARDO 2E was procured with GDELS' Santa Bárbara Sistemas as the industrial prime contractor. The programme represents another impressive example of industrial cooperation between the Spanish and international industries.

European regulation and we want to participate in decisions and in the collective effort. Moreover, we want to participate in the opportunities that are emerging: innovation funds, the Horizon 2020, potential growth in demand for security applications or civilian research, development and innovation.

And, of course, we want to compete in global markets with excellent products and on equal terms. It is essential to compete with equal game rules for everyone, because industrial relations based on reciprocity and mutual trust will make us all grow.

Our industry is preparing for it. The Spanish defence and security industry is aware that it is essential to prioritise and specialise, since shooting in all directions is a guarantee of missing the shot. And the industry also knows that any future strategy should consider the role of the are cooperation agreements in which the transfer of technology has been managed very effectively. In fact, 75% of defence and security industry revenue comes from international markets.

In addition, this experience is linked to the support of our Government and the Ministry of Defence, which have encouraged the development of cooperation and export tools such as government-togovernment agreements that facilitate transactions of certain products.

The Spanish defence and security companies are prepared to solve the challenges in the defence and security field and face the future threats. They are committed to adapting themselves to changes that are currently taking place, and are also demonstrably qualified to work with governments in the search for answers to ensure stable environments where economies and societies can thrive in peace.

November 2016 · European Security & Defence 29

# "Navantia has the clear objective to increase its presence in the international market."

Operating under different names, today's Navantia has been a pillar of the Spanish defence industry for decades and is believed to constitute an industrial asset of strategic relevance for the Spanish Government. ESD spoke with Gonzalo Mateo-Guerrero, Navantia's Commercial Director.



**ESD:** Can you give us a "spotlight" on Navantia today? How many people do you employ at how many facilities – and where – and what major programmes are you currently working on?

**Mateo-Guerrero:** At present Navantia has more than 5,400 employees distributed in different locations in Spain and Australia. Navantia's engineering and production facilities are located in several coastal areas of Spain: Ría de Ferrol (with facilities in Ferrol and Fene), Bay of Cadiz (with centres in Cadiz, Puerto Real and San Fernando) and in Cartagena. Navantia Australia has four centres throughout the country: Adelaide, Sydney, Canberra and Melbourne.

Navantia develops different lines of activity that are distributed in the different centres:

- Shipbuilding in Cartagena, Fene, Ferrol, Puerto Real and San Fernando;
- Ship repairs in Cartagena, Cádiz, Fene, Ferrol and San Fernando;
- Systems in Cartagena (control systems) and San Fernando (combat systems);

 Propulsion and Energy in Cartagena (Diesel engines and generators) and Ferrol (gearboxes and steam turbines); and • Through Life Support (TLS) which we undertake directly with the customer.

Navantia continues to work very closely with the Spanish Navy both in new build products (BAM, F-110) and in the TLS, Systems and Propulsion and Energy business areas.

Regarding the international naval market I would like to highlight the following programmes that we are currently developing: AWD, LHD and AOR in Australia, SCORPENE submarine in India, OPVs in Venezuela, corvette combat system modernisation in Indonesia, TLS of Norwegian frigates and transfer of technology (ToT) for the new Turkish LHD.

The most important opportunities in the naval field that Navantia is currently pursuing are the SEA 5000 in Australia, corvettes and OPVs in the Middle East, frigates and OPVs in South America, frigates in Canada and LHDs in India. In the civil market, Navantia also enjoys



HMAS ADELAIDE (L01), shown here at launch in 2012, is the second of two CANBERRA Class landing helicopter dock (LHD) ships under contract to the Royal Australian Navy (RAN).

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the trust of its clients in both the domestic and international markets, for example: four Suezmax tankers for the Spanish Ibaizabal Group, and an offshore support vessel for the Mexican state-owned company Pemex are being built. And more recently Navantia has ventured into the offshore wind sector and has signed contracts for the construction of jackets and substations for different wind farms in different European countries.

**ESD:** We understand that there are 13 technology projects in several technology sectors associated with the F-110 programme for the Spanish Navy. Can you elaborate on those and the role of Navantia?

**Mateo-Guerrero:** Technological Projects are initiatives promoted by the Spanish Navy that allow incorporating the innovative character to the ship. They are essential in developing sensors (radars, electronic warfare, electro-optical systems, etc.), the combat system and the integrated mast of the future F-110 Frigate.

In this sense, one of the Technological Projects includes the development by Navantia of an evolved SCOMBA version that includes the operational integration of F-110 new development sensors. With this Technological Project Navantia, keeping the same line followed in previous constructions for the Spanish Navy, plays a key role ensuring the functional and physical integration of the combat system on board.

It is important to mention that Navantia, supported by Indra, will complete the design and construction of a Combat System Shore Integration Facility in one of the Technological Projects, which will include all the real systems developed in the remaining programmes.

**ESD:** According to an earlier statement of a Spanish Government official frigates based on the F-110 design could replace about 65 frigates and corvettes on the international market until 2035. Do you share this opinion and, if so, which are the markets to be addressed?

**Mateo-Guerrero:** The demand in the international market in this segment, frigates and corvettes, for the next years is focused on products that could be adapted for blue and littoral water operation with a multi-mission capability, that provides enough flexibility to support from low intensity to medium-high intensity scenarios. From the combat system perspective, a combat suit covering all warfare areas including AAW area defence, complete ASW sensor suite, land attack missile capability, electronic warfare operations and asymmetric defence is a key requirement. Furthermore, another relevant requirement will be low operating costs.

The new F-110 frigate for the Spanish Navy is designed according to these needs and will therefore be an excellent candidate for future programmes in the international market. Navantia has the clear objective to in-

crease its presence in the international

market and the F-110 project is an excellent opportunity to achieve this objective.

**ESD:** We understand there is ongoing competition between Navantia, BAE Systems and Fincantieri in Australia. What is the status of the Future Frigate Programme of the RAN and what are Navantia's perspectives downunder?

**Mateo-Guerrero:** The SEA 5000 program (Future Frigate) is currently subject to a competitive process, in the scope of

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#### **COUNTRY FOCUS: SPAIN**

which the three candidates are performing engineering studies to analyse the requirements of the CoA with respect to the respective reference ship of each candidate. The RfT is expected in February/ March and offers should be submitted in July 2017. The final selection is scheduled for early 2018 and a contract signature is expected in mid-2018.

Navantia has been operating in Australia since 2007 as the designer of major surface ships of the RAN. In this regard, Navantia has significantly increased its local capability, with shipbuilding management, support and engineering activities focused to service the Capability Acquisition and Sustainment Group (CASG) and the RAN as required.

Navantia Australia will maintain its commitment to the Commonwealth of Australia (CoA), increasing capability and presence in-country, and expects to keep contributing in the delivery of state-ofthe-art designs and helping mature the shipbuilding industry in Australia in line with the CoA's continuous build approach.

**ESD:** A number of years ago there was intense cooperation between Navantia and DCNS in the area of conventional submarines. Who is the owner of the SCORPÈNE design, and are there still cooperation perspectives? Is the S-80 design offered on the export market?



The BAM (Buque de Acción Marítima) METEORO is the First-of-Class of the Spanish Navy's six new 3,000 ton patrol ships, two of which are still under construction.

future, Navantia is focused on the S-80 submarine, a 100% Navantia design.

**ESD:** What is the background and content and what are the objectives of your I+C+i agreement with the Corporación de Alta Tecnología (Codaltec) in Colombia?

**Mateo-Guerrero:** Navantia has been developing its commercial activities in South America, and one of the countries which we are concentrating on is Colombia.

Colombia has clearly identified the objective of taking advantage of large defence projects to strengthen the capacities of its local industry through cooperation agreements with other countries and/or companies that are in a position to support that goal. From Navantia's perspective, we



Navantia's construction site for the Spanish Navy's Class S-80 submarines

**Mateo-Guerrero:** Currently, the SCOR-PÈNE submarine is property of DCNS, although Navantia is still co-participating with DCNS in the construction of the submarines for India. For the present and consider that Spain is one of those countries and ours one of those companies. We have been developing a series of alliances with some Colombian companies, of which COTECMAR and CODALTEC are the most important. CODALTEC has been developing its activity for a few years now and its growth potential is very important as it has been demonstrating with the products it is supplying to the Armed Forces, and to other sectors of the Colombian authorities.

We have identified some areas in which we could collaborate in the future by providing from Navantia the technology and knowledge to support the development of CODALTEC's current capabilities. This collaboration could be extended to other Colombian companies that could complement CODALTEC's activity, in a similar manner as in Spain with Navantia and the supporting auxiliary industry.

The objective of Navantia and this agreement is simple: to find areas of collaboration that allow Navantia to help Colombia in the development of its industry, and in this particular example with CODALTEC, and the strengthening of its capabilities due to our technology.

**ESD:** If you take a look into the future ten years from now – what will be the status and perspectives of Navantia?

**Mateo-Guerrero:** Looking into the future, Navantia's strategy is to consolidate and strengthen its position in the naval marketplace as a leading shipbuilding company, based on three levers: Continuing its internationalisation process, entering into new markets diversifying its portfolio of products and developing new line of business focusing in ToT, TLS and engineering services in general. Regarding geographical areas and in

addition to meeting the needs of our domestic market, building the most advanced ships for the Spanish Navy, the main geographic areas on which Navantia will focus are Australia, South America and the Middle East.

#### The questions were asked by Jürgen Hensel.

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### ARMED FORCES

# **Keeping NATO Connected**

As Chief of Staff RAdm. Thomas Daum, Ph.D., is responsible for the administration and staff of one of NATO's largest organisations – the NATO Communications and Information (NCI) Agency, the mission of which is to design, procure and operate NATO's IT infrastructure in partnership with Industry, including advanced systems such as air, missile and cyber defence. He also holds the function of Chief Operating Officer, responsible for overall programme and project performance. He acts as Deputy and as Senior Military Adviser to the General Manager, Maj. Gen. (ret'd) Koen Gijsbers.

**ESD:** The NCI Agency started in 2012, how has it positioned itself in NATO in these years?

**Daum:** We are NATO's ICT and advanced technology provider and operator. I stress the word operator. We have some 2,900 staff (both civilian and military) located across 30+ locations – basically wherever NATO is– from Norfolk to Afghanistan, from Stavanger to Naples operating and defending NATO's networks. Our personnel is also regularly deployed in support of operations and exercises, in partnership with the NATO CIS Group. Our work is done in very close partnership with industry. Over 80% is done through contracts with national industries. In the next three years, we will be bringing





"My 'operational understanding' of interoperability was built on the use of NATO's Tactical Data Link Systems, NATO's Maritime Broadcast and NATO's ship-shore and tactical communication systems. However, already for some decades, military off-the-shelf solutions have been no longer the pace-maker of technological innovation."



NATO Communications and Information Agency Agence OTAN d'information et de communication

some €3Bn worth of business opportunities to the market.

**ESD:** What role and importance has the NCI Agency for the NATO nations respectively what impulses or programmes can it create?

Daum: While our primary responsibility is to support the Alliance's institutions - the NATO HQ, the military command structure and NATO's Agencies – under our charter we can and do provide services directly to nations. This includes both NATO members and - when approved by the North Atlantic Council - partner countries. There are two advantages to this: first, nations can re-use solutions they already paid for in NATO for their own national use. This allows nations to save money Several nations are doing this, for example, with advanced, combat-proven command and control software that was developed for use in Afghanistan and is an excellent platform for coalition operations. This is the second advantage: by re-using solutions that were developed in NATO - and therefore were "born interoperable" we boost interoperability.

**ESD:** Does the NCI Agency fill more the role of a standardisation organisation or does it deliver more practical and technical solutions?

**Daum:** We perform both. We work together with the NATO C3 Board and NATO's Allied Command Transformation to define standards for interoperability. For example, any industry selling C4ISR
software or hardware to NATO or a member country should be familiar with a document called ADatP-34 – otherwise known as NISP, NATO Interoperability Standards Profile v8, released in 2014. It outlines the interoperability requirements that C4ISR solutions must meet.

But we also deliver practical solutions like hardware and software – for instance the command and control system for NATO's ballistic missile defence, which achieved initial operational capability at the Warsaw Summit, or the connections to NA-TO's six new Force Integration Units in Eastern Europe.

**ESD:** What budget does the NCI Agency have annually and what sectors are financed?

**Daum:** Our annual budget is approximately  $\in$ 800M, the majority of which, about  $\in$ 600M, goes to industry as contracts and some  $\in$ 200M are the Agency's operating costs.

### **ESD:** What are the main current programmes?

**Daum:** There are several large efforts currently underway: a major refresh of NATO's overall IT infrastructure, air and missile defence, cyber defence. A strong priority is also efficiency. We are about to embark on a major effort to further reduce the cost of NATO's IT. There are always important projects, such as connecting NATO's six new Force Integration Units in Eastern Europe ahead of the Warsaw Summit. It is challenging, fast-paced but highly rewarding work, enabled by a superbly talented multinational staff of experts.

ESD: Somehow every single system has a cyber aspect, how do you define NCI Agency's functions towards the other branches, like army, air force or navy? Daum: We see ourselves as the glue. We are a critical enabler for NATO's command and control function – connecting the forces and units provided by nations into one multinational force. Again, missile defence is a good example. The command and control system delivered by the Agency links national sensors and national effectors (land based or seaborne) into a cohesive system that allows the NA-

TOs Air Commander in Ramstein to plan and execute a missile defence battle.

**ESD:** In your former position as Commander of the German 2nd Fast Patrol Boat Squadron you know about the existing IT infrastructure. How can all these different systems possibly be integrated into a NATO-standardised communication and information structure?

**Daum:** Indeed, my "operational understanding" of interoperability was built on the use of NATO's Tactical Data Link Systems, NATO's Maritime Broadcast and NATO's ship-shore and tactical communication systems. However, already for some decades, military off-the-shelf solutions have been no longer the pacemaker of technological innovation. Thus, we must and should seek to use open, industry standards as much as possible. We should also do more multinational capability development so that our solutions are "born interoperable". The more we customise, the more difficult – and expensive – interoperability becomes. My message to industry: design your solutions to be interoperable because every nation now understands they will operate in a multinational coalition – with





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individual ships, planes or units cooperating directly with ships, planes or units from other nations. Take for example NATO's freshly launched operation in the central Mediterranean – Italian, Bulgarian and Turkish frigates, Greek and Spanish submarines conducting joint patrols under NATO's maritime command in Northwood, United Kingdom. This is well established for NATO's nations' navies and air forces, but we should also recognise the increased requirement for multinational interoperability on the tactical level of land forces, including the dismounted soldier.

**ESD:** Nations have a very broad variety of systems for communication and visualisation in their armed forces, how will the NCI Agency create interoperability?

**Daum:** The principal driver is NATO's Federated Mission Networking (FMN) implementation plan. I would encourage all our industry to inform themselves about this plan. It is a very specific and

exchange, with FMN as the planned successor. What is the current status of FMN? **Daum:** We are now in the implementation phase. Every rotation of the NATO Response Force is used as a vehicle to achieve the next spiral or phase of the plan. For example, forces that will make up the NRF17 rotation are using FMN standards and joining procedure for the so-called "human to human services", for example voice chat. The next phase will see more interaction at the application level. So it is a very much a real programme with specific deadlines and targets, and not just an abstract vision for a better future. Again, I encourage all our Industry readers to familiarise themselves with this plan, including by reaching out to experts in our Agency.

**ESD:** Missile defence is not only of high importance but also shows the problems arising from integrating so called blackbox-systems. What solution has the NCI Agency found to resolve these problems?



A session at NITEC16 in Tallinn, Estonia; NITEC17 will be held from 24-26 April 2017 in Ottawa, Canada.

detailed roadmap to achieving what we call "day 1" connectivity. In today's unpredictable environment we will not know what the next mission will be or which partners we'll need to connect to. The FMN, which is fully aligned with the US-led Mission Partner Environment, is our roadmap for ensuring that we can connect – in fact rapidly connect – to our mission partners, whatever the mission may be.

**ESD:** AMN has been an enormous step forward in the area of international data

**Daum:** Close dialogue and practical, reallife cooperation with nations and again, use of agreed interoperability standards. You do not achieve interoperability on paper. You achieve it through testing and exercising.

**ESD:** How can it be guaranteed, that an important system like missile defence has and will not be compromised, especially regarding the variety of embedded systems? **Daum:** Rigorous testing and exercises. A key asset in this regard are our advanced laboratories located in The Hague, the

Netherlands. For example, our missile defence test bed allows us to connect to national facilities, sensors and weapons systems to see if data flows as it should. This also allows industry to test and derisk new software solutions without having to deploy massive hardware to a specific location. In addition, apart from our defence of NATO's networks we rely on the nations' responsibility to secure their connected entities.

**ESD:** Germany has established a cyber branch in the MoD and is going to establish a Cyber Command in the near future, do you think this has any benefits for the future cooperation between Germany and the NCI Agency?

**Daum:** The cooperation between NATO and Germany in the Cyber Domain is very well established and will for sure further benefit from such national concentration of effort. For the Cyber Command, Major General Ludwig Leinhos as the assigned Commander is a good friend, a former NATO HQ C3 Staff Director and a recognised expert in NATO's C4ISR. So we at the Agency look forward to good cooperation with him. No one can face today's rapidly evolving cyber threats individually. We must collaborate, including with Industry.

**ESD:** In your opinion, what are the main tasks and what are the (IT-)areas NATO should focus on not to lose the connection with future trends?

**Daum:** The main challenge is ensuring we can rapidly innovate. First, this is a matter of improved capability development processes to allow rapid prototyping, agile software development and spiral system development. Second, this means a strong partnership with industry, because industry is the driver of innovation. In the cyber domain, the NATO Industry Cyber Partnership is a good example and the threat information-sharing agreements that we have with industry partners are a core benefit for both sides. Third, I also foresee we will continue to see more and early engagement with industry, ahead of formal acquisition or competition, to ensure that industry has a good understanding of NATO's C4ISR requirements and that we understand where industry is heading. Let me take the opportunity and encourage industry to join us from 24-26 April 2017 in Ottawa, Canada, for our NITEC conference, where we will be previewing what we see as major upcoming business opportunities.

#### The questions were asked by Dorothee Frank.

# Aspects of International Armoured Vehicle Development

#### **Rolf Hilmes**

The presentation of a considerable number of new armoured vehicles at last year's Victory Parade in Moscow has led many countries to reconsider the status and strength of the armoured elements of their own national armed forces.

Superimposed on this scenario is Russian aggression in the Crimea and the massive Russian support for rebel forces in the Ukraine, as well as the realisation that terrorist militias (such as in Iraq) now have access to modern armoured fighting vehicles.

#### **New Developments**

Apart from Russia, the focus for new developments in AFVs has been the Asian sphere. In Europe, the most important development projects are represented within the framework of the French SCORPION programme, the British Future Rapid Effect System (FRES) and the modernisation of the WARRIOR MCV, as well as the Turkish AL-TAY main battle tank (MBT).

#### Turkey

The development of the new Turkish ALTAY MBT began in 2007, and by 2012 a firing demonstration unit (FTR) and a mobility demonstrator had already been produced and tested. The results from the tests were integrated into two demonstrators – one firepower test rig and one mobility test rig which were produced in 2011/2012. In 2014 two further prototypes were produced

(PV-1 for mobility and survivability tests, and PV-2 for firepower tests). Plans are for an initial 250 units to be introduced from 2017. The vehicle is said to have a combat weight of just over 65 tonnes, and is fitted with the 120 mm smooth bore Rh 120 L/55 gun. A tube-discharged guided projectile has apparently been developed for the weapon. Despite drawing on the concept of the South Korean K2 MBT, Turkey has not opted for the installation of an automatic loading system. At least the prototypes and the first series vehicles will still be fitted with the Euro Power Pack (the MTU 883 Ka 501 with common-rail fuel injection system and Renk HSWL 295 TM). It is planned that later vehicles will get an engine by the company Tumosan. A hydropneumatic suspension system has been selected for the running gear, which will undoubtedly require greater effort and expenditure in use than torsion bar technology.

With regard to fire control and protection, the latest available technology has been drawn on, with mine protection taken into account. Ballistic protection is in a modular format; in principle, it will be possible in future for reactive armour elements also to be mounted on selected parts. In the

Photo: Otokar



One of two prototypes of the Turkish ALTAY MBT; the size of the optics is striking.

future it is planned to equip the vehicles with a hard-kill-system (active defence system; ADS) from ASELSAN. ASELSAN is developing not only the elements of the fire control system for the ALTAY MBT, but also a guidance and weapon deployment system. Overall, the ALTAY does not comprise any technologies which were not already present, or could have been installed, in the Leopard 2 PSO-VT, presented in 2009. The Turkish army could have acquired that vehicle for a fraction of the cost of the ALTAY programme, but the government was keen to carry through a national MBT development. In favour of this, too, were considerations of prestige and the hope of freedom in future export decisions. As well as the ALTAY, under development in Turkey, for the Turkish Land Forces Programme there is also the TULPAR-S IFV, from Otokar, and, in competition with this, from FNSS, the KAPLAN 20 IFV. Overall, Turkey is very active in the field of military vehicle development.

#### France

In France, the SCORPION programme has been under way since 2006, within the framework of which a number of new armoured vehicles are being developed, as well as a combat value enhancement for the LECLERC MBT. The intention is that the AMX 10 RC and Sagaie wheeled armoured units, which have been in service for many years, should be replaced by the new EBRC JAGUAR ARV. The VAB armoured transporter, which has also been in use for many years, is also to be replaced by the new VBMR GRIFFON.

The JAGUAR appears to be a 6x6 wheeled unit in the 25-tonne class, with a three-man crew. Mounted in the two-man turret, as the main weapon, is the 40 mm CT 40 machine cannon (MC). This is a joint development by Nexter (GIAT) and BAE Systems. The body of the JAGUAR is made in the traditional manner of a light metal alloy, and is said to provide protection against 14.5 mm



Left: 6x6 GRIFFON armoured transporter from the French SCORPION programme. Compared with the predecessor VAB model, the GRIFFON is perceptibly heavier and larger. Right: 6x6 JAGUAR armoured reconnaissance vehicle from the French SCORPION programme. The two-men turret is equipped with the CT 40 machine cannon.

AP rounds. It also appears that a certain degree of mine protection is provided within the weight limit. Series manufacture seems set to start around 2020. In the first batch, 110 vehicles will be taken under contract, with a total requirement of 248 units.

The GRIFFON 6x6 wheeled vehicle is also assumed to be in the 25 tonne class. As well as the basic two-man crew, the personnel carrier variant can accommodate a further eight soldiers. The series is set to run from 2018, and the first batch appears to be of 780 vehicles. Total requirement is thought to be 1,732 units. As well as the personnel carrier configuration, other variants are planned, among them ambulance, mortar carrier, combat engineer vehicle, and control/communications unit. Both vehicles are being developed and manufactured by a consortium (Nexter: body and final assembly; Renault Trucks Defense: power plant and transmission, wheels, and brakes; Thales: electronics). A first prototype of the GRIFFON was shown at EUROSATORY 2016. France is also hoping for substantial export orders for both vehicles in the future.

#### The United Kingdom

Following a considerable number of unsuccessful and interrupted AFV programmes (FFLAV, Tracer, MRAV, FRES-UV), the UK has at last produced the first prototypes of the FRES Special Vehicle (SV). It needs to be borne in mind in this context that the FRES programme started out in 1998, and the production of the first vehicles has now come about 14 years down the line, due to modifications, reorientations, cancellations, delays, etc. in the interim.

The first mobility test unit of the FRES-SV version has now been around since 2012, built by General Dynamics United Kingdom (GDUK) at the former Steyr plant in Vienna. The vehicle has served in the meantime for tests of the drive system and running gear. In summer 2014 a total system test carrier unit (PMRS) was built by General Dynamics European Land Systems (GDELS) in the plant at Santa Barbara in Spain. In total

there are now seven further prototypes (in three versions) under construction, which should be produced by the end of 2016. The core of the FRES-SV is based on the Austrian-Spanish ASCOD MICV dating from 1988. To fulfil the British requirements, however, the vehicle concept has been entirely revised, and provided with more modern and more efficient elements for the drive, running gear, and protection. This has also increased the combat weight from an original 22.5 tonnes to a present 38 tonnes, with further growth potential up to 42 tonnes. The FRES-SV and its different versions are intended to replace the vehicles from the CVRT family (manufactured by Alvis), some of which have been in use since 1972. At present, plans are to introduce 589 FRES-SV units during the period 2017-2024. The first 100 of the 589 SCOUT SVs will be built in Spain at the GDELS-SBS facility; the remaining vehicles will be produced at GDUK at the facility near Oakdale in Wales. The vehicles are being given a performance-boosted MTU engine (8V 199) with a rated capacity of 600 kW (70 kW more than in the Boxer) and the Renk HSWL 256 B transmission (a modified form of the PUMA transmission).



*Prototype of the British FRES Special Vehicle; the high flank protection is noteworthy.* 



The British WARRIOR AFV with new turret from LMUK and the CT 40 machine cannon



Clockwise (from top-left): the ARMATA MBT with apex-mounted 125 mm weapon system, the T-15 AFV with the EPOCH turret, the amphibious BOOMERANG AFV, and the KURGANETZ with noteworthy side armour.

An entirely new development from Lockheed Martin UK (LMUK) for the FRES-SV is the two-man turret with the CTC 40 mm automatic cannon. The turret development also involved Rheinmetall as subcontractors, who produced 245 turret housings. The particular features of the CTC 40 (a joint development between Nexter and BAE Systems) are the rotary tilt breech mechanism and the compact telescopic munitions. Both elements included a high degree of development risk, meaning that it has taken just on 20 years before the weapons system could be assured of series readiness.

As well as the new development of the FRES-SV, the modernisation of the WARRIOR IFV is the British Army's second major AFV upgrade programme. Of the 789 WARRIOR units, 380 are to undergo modernisation, of which, in turn, 285 are to be fitted with new turrets. This programme has been running since 2011, and is being carried out by BAE Systems. The original planning allowed for the previous turret of the WARRIOR to be retained and for the new 40 mm CTC MC to be integrated into it. In the course of the design work, however, it became evident that retaining the old turret structure would have led to space problems with the installation of the weapon and with the space for the crew. LMUK accordingly decided on a new design for the turret.

The measures for upgrading the combat value of the 380 units are assumed to include, among others, modernisation of the crew positions (such as mine-proof seats) and the adaption of various additional armour elements. The combat space is to be given cladding with an anti-spall liner. Introduction of the modernised vehicles is planned from 2020. These measures are intended to allow the vehicles to remain in use until the 2035/2040 period.

#### Russia

At this year's traditional Victory Parade, Russia set out to demostrate its military might by showing off a considerable number of new AFVs. The parade accordingly included the new ARMATA T-14 MBT. With this unit, Russia aims to complete the transition from the conventional turret concept to an MBT with an apex-mounted 125 mm weapon system. Their second heavy AFV is the ARMATA T-15, which exhibits a certain logistics-relevant similarity with the T-14 in the chassis area, although the T-15 has a front-mounted power plant in order to allow access to the rear combat space (presumably for six soldiers). Installed in the EPOCH unmanned turret is the 30 mm MC 2A42, as well as 2x2 launchers for the KO-RNET EM guided projectile and a 7.62 mm machine gun. With the high level of protection and the weapons mix described, the T-15 is predestined for operations in urban environments.

In the medium AFV family, the new KUR-GANETZ-25 APC was likewise shown in a variant with the EPOCH unmanned turret. A second variant with a smaller turret with the 12.7 mm machine gun was on display, which presumably has allowed the complement to be increased to eight soldiers. Both variants are amphibious and are fitted with a water jet drive at the rear.

Another vehicle presented was the new 8x8 BOOMERANG wheeled AFV. Here too, a variant was shown with the unmanned EPOCH turret. In contrast with the vehicles from the earlier BTR family, the BOO-MERANG now comprises a front-mounted power plant, allowing tailgate access. This means that Russia, after about 55 years, has at last corrected the error of having a rearmounted power plant in wheeled APCs.

#### People's Republic of China

Outside Europe, in addition to Russia, the People's Republic of China (PRC) has been highly active for years in the development and production of a wide range of armoured vehicles. At this juncture, consideration should be given briefly to the new MBT 3000 (VT-4). The vehicle was developed especially for export and is said to be the most modern Chinese MBT, equipped with a highly-developed fire control system, a new power plant (V12 Diesel engine with a rated capacity of 883 kW) with automatic transmission (CH 1000 B, an independent Chinese development) and a guidance and weapons operational system.

The MBT 3000 is fitted with a 125 mm smooth bore gun, which, among other munitions, can discharge a guided projectile of Chinese design (range up to 5,000 m). Combat weight has been indicated as 52 tonnes. Thanks to the automatic loading system, the crew consists of three men. Protection in the fighting compartment consists of a modern composite armour system with adapted reactive armour elements, and the ballistic protection is supplemented by a soft-kill system.

The MBT 3000 must be regarded as direct competition for the Russian T-90 MS. Over the next few years, both countries will be engaged in a bitter competitive battle in the Asian region in particular, to cater for a shrinking market for AFVs. China has high hopes of selling the MBT 3000 to Pakistan.

#### USA

For many national armed forces, the problem is arising that their M113s, which are in use throughout the world (since 1960 more than 100,000 M113s in different variants have been produced), will have to be replaced in the next few years by a modern successor. In the USA, the M113 is a core part of the complement of the Armored Brigade Combat Teams (ABCT). Due to its low level of protection, and its restricted mobility, it has already for many years been unable to meet military requirements. As well as this, the age of the vehicles and occasional problems with upkeep, have resulted in unfavourable availability rates in tactical operations. Of a total of some 6,000 M113 units in the US Army, today only about 2,900 are in active use. As early as 2010, the US Army first gave consideration to replacing the M113 fleet with a future Armored Multi-Purpose Vehicle (AMPV).

For reasons of costs, an entirely new development was never in consideration from the outset; instead, the AMPV was to be based on existing vehicle types. The conversion costs were planned at a maximum of US\$1.8M (2012) per vehicle.

As a first step, the intention is for five variants of the AMPV to be developed: an armoured transporter (522 units), command/ control vehicle (993 units), mortar carrier (386 units), mobile medical team (216 units), and ambulance (790 units). One major re-



Chinese MBT 3000 with a 125 mm smooth bore gun; the vehicle was developed especially for export.



Ambulance variant of the US AMPV programme; the vehicles are based on the M2 BRADLEY chassis and are intended to replace the M113 fleet.

guirement from the US Army is that the AMPV must be able to take on the equipment systems of the M113 variants. As early as 2011 BAE Systems, as the manufacturers of the M2 BRADLEY, and General Dynamics Land Systems (GDLS) as manufacturers of the STRYKER, began to come up with appropriate solutions. The advantages of the BRADLEY variants lie in their high cross-country and off-road capabilities, and the relatively high level of protection. This means that these variants would be in a position to follow the M1 ABRAMS and M2 BRADLEY of the ABCT on the battlefield. By contrast, GDLS makes the STRYKER a contender as a wheeled vehicle, due to noticeably lower utilization costs.

At the beginning of 2015 BAE Systems received an advance from the US Army for the development and supply of the AMPV. During the period from 2015 to 2017, plans are for 29 prototypes of the different variants to be built and tested. Following this, between 2018 and 2020, 289 pre-series vehicles are to be manufactured. From 2020 to 2030, the actual series (2,618 vehicles) should then follow. The variants required of the AMPV are based on the chassis of the M2 BRADLEY, with the turret removed and the pan roof in the rear area raised, in order to accommodate the various systems.

Due to the interruption of the Future Combat Vehicle Program, and also of the Ground Combat Vehicle Program (GCV), the US Army is faced with the challenge that there will not be a successor for either the M109 armoured howitzer (first introduced into the US Army in 1962) or for the M2 BRADLEY. Instead, a seventh modernisation programme had to be embarked upon for the M109, the M109A7, formerly designated as the M109A6 PALADIN PIM, in order for the service life of the vehicle to be extended until 2050. After the abandonment of the GCV programme, the M2 BRADLEY, which was introduced in 1982, must now also remain in service for longer than planned. For these reasons, the vehicles are scheduled to be modernised in two phases over the next few years.

#### **Upgrading Combat Value**

Apart from those in Russia, China, and Turkey, there are at present no new MBTs under development. For the most important Western AFVs, all that is planned are combat value upgrades.

For the Federal German Armed Forces (Bundeswehr), the intention is that, from 2016, 100 Leopard 2 A4 units will be bought back from industry. Of these, 68 vehicles will be converted at least to the standard of the Leopard 2 A7 version. With these 68 units, and 16 Leopard 2 A6 units from the Netherlands and a further 19 from the Bundeswehr, a total of 103 units will be available to form two additional tank battalions. It is also intended that from 2030 the Leopard 2 will be replaced by a version of the Main Ground Combat System. By then, the Leopard 2 will have been in service for more than 50 years.

In the United Kingdom, of the 386 Challenger 2 MBTs (CR 2) originally introduced from 1998, at present 227 units are still in service - a further reduction to 150-160 MBTs is planned in the future - so the UK will have fewer tanks than Germany or France. For operations in Kosovo (2000) and in the Second Gulf War (2003), protection in particular was strengthened, as well as other improvements introduced. As part of the CSP/CLIP modernisation programme, in 2005 a test conversion to the 120 mm L/55 smooth bore gun from Rheinmetall was carried out. Field tests proved successful, but there was nevertheless no series conversion of the units, due to large stocks of spare barrels and munitions for the L30A1 120 mm rifled barrel still being available. From 2013 a further modernisation programme (CHALLENGER 2 - Life Extension Project; CR 2-LEP) was put in hand, which essentially involved dealing with issues of obsolescence with regard to electronic and optronic modules. Nevertheless, the technology in the chassis of the CR 2 still dates back to 1983. The aim of these measures is to keep the CR 2 in service until 2035. This is interesting, because on this date also the

new German-French – project MGCS is to be introduced – thus, it is conceivable, that in the future the UK might participate in this project. The following companies will participate as suppliers in the tender: BAE Systems UK; GDUK; Lockheed Martin UK; KMW; Rheinmetall and CMI together with Ricardo and RUAG. While the protection is still relatively good, and mobility can still be assessed as acceptable, the lack of further munitions development for the 120 mm rifled gun will present a serious problem in the future. Unfortunately, the CR2-LEP has a relatively low priority - in comparison to the other military programmes of an 8x8 wheeled APC (Mechanised Infantry Vehicle; MIV) and the AJAX-programme.

In France, of the 406 LECLERC MBTs introduced in 1992, 254 units are still in service today. From 2020 a modernisation programme is planned for 200 units, within the framework of which, among other things, the protection is to be improved (against IED and hand-held anti-tank weapons), as well as the guidance capability. The intention is to extend the LECLERC's service until 2040.

#### No Revolutionary Leaps

Overall, it can be seen that, apart from the new Russian T-14 and T-15 heavy AFVs, there are no revolutionary leaps identifiable in international armoured vehicle construction. Likewise, to date there have been no major strides in technology either. It has not proved possible, in the period under consideration, for the Diesel-electric drive, electromagnetic weapons, unmanned combat systems, or electric armoured units to be introduced. Instances of incremental progress have been achieved in the sector of guidance systems, with digital on-board networks, and in the field of optronics (introduction of third-generation thermal imaging equipment, such as ATTICA). Perceptible progress has been achieved in a number of states in the series introduction of active protection systems (Hard Kill) and with regard to protection against mines and IEDs.

# **Training and Simulation Developments**

#### William Carter

The most significant annual global training and simulation event takes place in Orlando, Florida, under the rather uncharismatic title of I/ITSEC, standing for the Inter-service & Industry Training, Simulation and Education Conference and exhibition. The scale of the event is shown by the number of exhibition attendees, which last year exceeded 14,000. Over 4,000 of these were in the conference sessions that run outside the exhibition hall, wherein 470 companies were represented on the exhibition floor.

The 2016 theme is "Pushing the Live, Virtual and Constructive Training Envelope" and as we go to press, 8% more exhibitors have registered compared with last year. As well as the conference sessions, another event that runs within I/ ITSEC is Operation Blended Warrior year, and in many cases will be referred to during I/ITSEC.

#### **Coalition Virtual Flag**

Coalition Virtual Flag (CVF) is probably the world's largest air combat exercise



The Combined Air and Space Operations Center in Nellis, Nevada (CAOC-N)

that uses simulation. Hosted by the US Air Force, CVF 2016 took place in August with teams from Australia, Canada, the UK and the USA. It was coordinated by the US Air Force Distributed Mission Operations Center (DMOC) at Kirtland AFB, Albuquerque through their Distributed Mission Operations Network (DMON). This is able to link simulators for exercise purposes, in this case including US and coalition forces over network links over many thousands of kilometres. In the future, the mission simulators for the F-35 Joint Strike Fighter (JSF) will be on DMON through a programme coordinated by Lockheed Martin. The US Air Force contribution to CVF 2016 included units at Nellis AFB in Nevada, conducting operations from the Combined Air and Space Operations Center - Nellis (CAOC-N) which develops new tactics, techniques and procedures.

In the UK, the Air Battlespace Training Centre (ABTC) at RAF Waddington, near Lincoln, has a suite of simulators that can be linked to others worldwide. For many years ABTC has used long range network

(OBW), which this year is to include some 8 hours of Live, Virtual and Constructive (LVC) scenarios and currently includes 55 organisations - a large increase over last year. OBW will include the latest image generators, realistic simulation programmes, games-based training, the ability to select different levels of security, and training systems for the sea, land, air and cyber domains. There will also be another "Black Swan" event, in which a panel of Subject Matter Experts (SMEs) will cover challenges in Modelling and Simulation (M&S), including big data, interactions and modelling. The Serious Games Showcase and Challenge (SGS&C) has been running for ten years, and results will be shown in the SGS&C booth. The rest of this article reviews some of the significant training and simulation events that have happened this



C-130H Full Mission Simulator from CAE featuring Rockwell Collins' Flight2 glass cockpit avionics system

links for exercises with units in the USA such as the Air Force Research Laboratory (AFRL) and the DMOC in Albuquerque. In CVF 2016, E-3D Airborne Warning and Control System (AWACS) crews from 8 Squadron of the RAF took part in the exercise, together with other entities from the ABTC.

Canada had responsibility in CVF 2016 for a range of air landing and air-drop missions, including the insertion of Special Operations Forces (SOF), co-ordinated by the Canadian Forces Aerospace Warfare Centre (CFAWC). The CAE company, headquartered in Montreal, provided over 2,000 computer-generated entities to the exercise. A particular example was where 426 Squadron at Trenton, east of Toronto, used a CAE-built C-130J full-mission simulator in exercise scenarios. CAE computer-generated software was used to insert enemy threats, such as enemy fighters, ground-based missiles, and a range of friendly forces.

Australia contributed simulations of the C-130 HERCULES and the E-7A WEDGE-TAIL airborne early warning and control (AEW&C) aircraft that is based on the Boeing 737. These included a C-130 full flight mission simulator (FFMS) and a C-130J tactical airlift crew trainer (TACT) at RAAF Base Richmond NW of Sydney. WEDGETAIL simulators at RAAF base Williamtown provided an airspace picture to all exercise participants.

#### **UK Defence Innovation**

In September 2016 the UK launched a new defence initiative for future technologies. This covers areas such as virtual reality, drones, laser weapons, robots, and simulation. The project includes an Innovation and Research Insights Unit (IRIS) to study technology trends and analyse how UK defence and security can be developed in order to stay ahead of adversaries. The UK MoD has said that the initiative is intended to change the way defence does business, to collaborate



F-22 Full Mission Trainer

be improved. Invitations will be made to individuals and companies to present to a "dragon's den" type panel that has about GBP 800M available for the most promising projects. There will be a fast-track system for novel ideas and projects will be encouraged that have "reasonable" risk, particularly in the case of smaller firms. The intention is to form a dedicated hub to act as a "defence and security accelerator" so that innovative solutions can better with industry, academia and allies, and target new providers.

#### Live and Virtual Networked Training

In the recent Distant Frontier exercise at the Joint Pacific Alaska Range, simulators for the F-22 RAPTOR were combined with live flying F-16 Falcons. The F-22 element used simulators from the 90th Fighter Squadron at Elmendorf AFB near Anchorage, Alaska, and the F-16s were from the 80th Fighter Squadron at Kunsan Air Base, South Korea. It has been said for fifth-generation aircraft such as the F-22 and F-35 JSF, the only way of providing realistic training is through networked simulation. In the Distant Frontier exercise, the live F-16s and F-22 simulators were connected by the Northrop Grumman LVC Experimentation, Integration and Operations Suite (LEXIOS), and it was reported that full security levels were maintained. Systems such as this enable completely simulated forces to be added to other simulations with human operators, also with live participants that can be added to the exercise. It should be noted that Northrop Grumman is also the prime contractor for the US Air Force Distributed Mission Operations Network (DMON) mentioned earlier.



F-35 Full Mission Simulator from Lockheed Martin

#### **Civil Aviation Training**

In flight simulation, civil aviation has led the way in simulator design and realism of cues to such an extent that for airliners almost all training is on high guality Full Flight Simulators (FFS). The FFS design and performance is regulated and tested to a common world standard. This is a great advantage compared to the widely different specifications for training aids produced by the many different military organisations across the world. There is useful spin-off for the military because the FFS design can be applied directly in areas such as military transport aircraft and helicopters. All that is necessary is to add appropriate geographic databases and network capabilities for linking with other military simulators. This trend is likely to increase because the civil sector is set to greatly expand in the future and improved FFS designs will be available at reasonable cost. These will benefit from economies of scale and the higher fidelity now being mandated by the International Civil Aviation Organisation (ICAO) and regulatory authorities such as the Federal Aviation Administration (FAA) in the USA and the European Aviation Safety Agency (EASA). After airliner stall and upset ac-



The latest International Training Equipment Conference and exhibition (ITEC) was held in London in May 2016. The next will follow in Rotterdam, The Netherlands, on 16-18 May 2017.

cidents such as Air France 447, Colgan 3407 and others, ICAO and civil aviation regulatory authorities have required a higher level of modelling fidelity across the whole flight envelope including stall and upset events. This will benefit military simulator training because the military fly in more challenging conditions than airlin-

ers, and these conditions will be better modelled in the future. The scale of the increase in civil aviation is shown by this year's Boeing Current Market Outlook (CMO) which forecasts that world airliner numbers will increase to over 45,000 by 2035, double those of today. For new airline pilots, Boeing forecasts that no less

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## Together ahead. **RUAG**



The German Army Combat Training Centre (Gefechtsübungszentrum – GÜZ) will be updated by Rheinmetall Defence including new capabilities for training for Military Operations in Urban Terrain (MOUT).

than 30,850 per year will be needed, a total of 617,000 over the 20 year period. All will have to be trained, first for initial qualification, followed by regular recurrency checks in FFS for the rest of their careers. The future of the FFS is assured and the military can benefit from its technology.

#### **Military Flight Simulation**

Unlike the standard civil FFS design, military simulators have a very wide variety of characteristics and layouts, so the MS&T annual census lists all those with a full size cockpit and any type of external visual system. This year there was an increase of some 150 compared to last year for an overall world total of over 2,800. Indeed, over the last five years, the average increase has been more than 7% per year. Over 1,600 are in the USA, followed by the UK with 140, France with 135, Russia with 90, South Korea with 70, and about 55 each in Germany, Italy, Japan, Saudi Arabia and Turkey. China is well down the list, due to a combination of secrecy and the fact that a major re-organisation of Chinese forces is taking place to take advantage of technical progress which will undoubtedly include increased use of simulation, as it has with Chinese airlines with their use of the Full Flight Simulator design mentioned earlier. Within the USA the US Air Force is well in the lead with 620 flight simulators, followed by the Army with 323 (mainly for helicopters), the US Navy with 278, Marine Corps with 93 and about 50 from other organisations including private training suppliers to the military. An important future programme is the F-35 JSF that is being built for 12 nations. F-35 simulators are forecast to increase to over 50 by the end of 2016 and production of the Full Mission Simulators at Lockheed Martin's plant in Orlando is running at two units per month. The total build of F-35 Mission Simulators is expected to be about 240 for all of the operating nations, with many other training devices below the FMS level, for maintainers as well as pilots. The simulator-to-live training ratio is forecast to be about 50:50 overall. As there is no two-seat version

of the F-35, there will be many simulator rides before a pilot's first flights, particularly for the B version with its vertical takeoff and landing capability.

Turning to manufacturers, L-3 Link with its factory in Arlington, Texas, is well in the lead with over 500 military flight simulators in service, followed by CAE of Montreal, then Thales which produces simulators in France and the UK, Boeing Defense at St Louis, FlightSafety Simulation at Broken Arrow near Tulsa, Lockheed Martin's simulator plant in Orlando, and Frasca of Urbana, Illinois. With regard to other manufacturers, CSTS Dinamika of Zhukovsky, Moscow region, has increased its military simulator numbers by 50% to 75 this year. Other increases come from CAE USA at Tampa, Korean Aerospace of Sacheon, west of Busan in South Korea, and AeroSim and Veraxx in the USA. Over 40 other manufacturers come from countries including China, Israel, Japan, Hungary, Romania, Russia, South Africa and Taiwan. Looking at aircraft roles, some 1,200 simulators are for fighter aircraft, 850 for helicopters, 440 for large multi-



#### 13<sup>th</sup> NATO LCM Conference Life Cycle Management – The Way To Provide Integrated And Cost-Effective Solutions Visions - Concepts - Reality

**Parker Hotel Brussels Airport (formerly: Golden Tulip), 24/25 January 2017** In cooperation with the NATO Life Cycle Management Group (AC/327) Supported by the NATO Industrial Advisory Group (NIAG) and the German CALS Forum (CFD)

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#### **CONFERENCE & EXHIBITION**

#### **OBJECTIVES**

In combination with a small but dedicated exhibition showcasing industrial capabilities in the area of logistics the conference will provide a forum for the exchange of information and ideas between and among decision makers, programme executives and experts in all segments of Integrated Logistic Support (ILS), Life Cycle Costing (LCC), Configuration and Quality Management, Performance-Based Logistics (PBL) and Unique Asset Identification.

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engined aircraft, 260 for basic trainers, and about 40 each for UAVs and generic or multi-role simulators.

The most popular layout is the three-channel visual which is fitted to 870 military simulators, followed by 580 with 1 or 2 channels for basic or refresher training before using more advanced devices. At the high end, 240 have 10 or more channels, giving almost complete visual cover inside a dome or where the pilot is surrounded by backprojected visual "facets". Motion platforms are generally fitted to simulators for transport aircraft and many helicopters. There are 640 military simulators with all 6 axes, similar to the civil Full Flight Simulator design, and some have Roll-on Roll-off (RoRo) interchangeable cockpits that allow the same simulator base and visual system to be used for different aircraft types. Most simulator motion platforms now have electric actuators with guicker reaction times than earlier hydraulic systems. For fighter simulators, visuals with very wide-view are preferred, which generally means that they are too large to mount on motion platforms. However, fixed-base fighter simulators can have so-called simulator "motion seats" that give seat-of-the-pants cues through inflatable seat cushions, and pressure pads on the back that simulate longitudinal acceleration. In addition, G-suit inflation is a strong cue of high G and pilots can use their own G-suit in a simulator, inflated through an air valve that operates in response to the G calculated by the simulator computer. For helicopters, vibration is a major cue and can easily be produced through a vibrator unit placed under the pilot's seat, triggered in parts of a sortie where vibration would occur in the aircraft. Network links have already been mentioned, and this year the military simulator world total with network capability has increased to nearly 50%. Of these, 30% have a Wide Area Network (WAN) capability so that exercises can take place with WAN-equipped devices at other locations, even other continents via the long range links mentioned earlier. The other 20% have a Local Area Network (LAN) to link simulators at the same location. This trend will continue and all new-build military mission simulators should have WAN links.

#### **European Training Equipment Conference**

Networked training was mentioned in the keynote address given by Vice Admiral Duncan Potts of the UK Defence Academy to the International Training Equipment Conference and exhibition (ITEC) held in London in May 2016. He said that exercises using real equipment no longer create the required realism because of the constraints of live training, and higher level training almost exclusively uses simulation technology. On the live/synthetic balance, he continued, both types of training are needed, but networked simulation is capable of more realism. The UK has recently opened a Joint Force HQ with a Director General for Joint Force Development (DG-JFD). Full spectrum training includes industry and government as well as the military, he said, intelligence and cyber data need to be taken into account, and training should include other nations as well as own forces. He summarised by saying that live exercises no longer have the realism that we require, the higher the level of activity the more simulation is needed, and we must be able to undertake effective joint training.

General Karl Engelbrektson, head of training for the Swedish armed forces, said that simulators must be able to talk to each other so that training exercises can be realistic. He particularly valued multi-service exercises and those with other nations, and wished to develop simulators at all different levels.

Air Commodore Lincoln Taylor is UK Assistant Chief of Staff for Combat Air, and spoke of the work of the Air Battlespace Training Centre (ABTC) at RAF Waddington, Lincoln, mentioned earlier under the Coalition Virtual Flag exercise. We can now train for conflict in simulators, he said, including force packages complete with ground attack, fighter cover, air refuelling, recce and surveillance. On the F-35 Joint Strike Fighter, he pointed out that UK pilots are currently flying the



### UNIVERSAL CHARGERS AND MILITARY BATTERIES





B version in the USA and working up to initial operational capability (IOC) of the first UK squadron.

Air Commodore Harvey Smyth is UK Air Force JSF Force Commander based at RAF Marham, about 100 miles north of London. This is the site of the UK F-35B Operational Conversion Unit (OCU), and some 500 million UK pounds are being spent at Marham on F-35 infrastructure. The first RAF squadron will form in the USA and arrive at Marham in 2018. Meanwhile, the Royal Navy will fly the F-35B from its new Queen Elizabeth class 70,000 ton aircraft carriers. Airspace in the UK available to a working group called Force for the Future, to study acquisition and handling of data, cyber aspects, and personnel management. Our personnel and promotion system has not changed from that of the 1940s, he said, and needs to be more agile, similar to modern industry. Rank may not be as important as other features such as fluency in languages, knowledge of technical detail, and personality. We should not be reluctant to take people from outside the DoD if they have the knowledge required, so that expertise from academia, industry and defence can be combined. On training, he said that



The Bulgarian Naval Academy acquired VSTEP simulators for its new simulation centre.

the military is not big enough for systems like the F-35, he said, and if live weapons were to be regularly used in training, evidence on their characteristics and performance could be acquired by a future enemy. Therefore, simulation is needed that includes all weapon characteristics and simulators need to be able to be networked to allow multi-unit training. The UK F-35 live/synthetic balance is intended to be about 50:50, including in aircraft carriers on which small simulators will be on board. Significantly, combat readiness checks are scheduled for the simulator rather than the aircraft. This is because the simulator is better, he said, in training critical combat situations - but to do this it is essential that such simulators are always kept current with the real aircraft state. Frank DiGiovanni is Director for Force Readiness and Training for the US Department of Defense (DoD), and said that lower classification data are adequate for most multi-role training exercises, and some 85% of information for military exercises is already public. He announced

the traditional classroom model is outdated, and individuals had different abilities to learn and develop skills. On Cyber, he said that this is a gap that needs fixing, and to do it we should use experts without limits of rank and age.

# Other Training and Simulation News

Some other news as we go to press includes the following in the Land, Sea and Air systems areas, listed in alphabetical order of country or region:

#### Land Systems

 Austria. CAE of Montreal, Canada, and CAE Elektronik of Stolberg, near Aachen, Germany, are to upgrade the GESI command and staff training system for the Austrian Armed Forces. GESI stands for GEfechts-SImulation and is for joint exercises from company up to division level. It can be used for computer assisted exercises (CAX) and also for classroom training. In CAX mode, commanders and their staff can run exercises from their normal work places using live command and control systems.

- Finland. Saab Security and Defence, headquartered in Järfälla, Sweden, is to upgrade BT46 laser-based training systems of the Finnish Army. In 2015 Finland purchased 100 LEOPARD 2A6 main battle tanks (MBTs) from the Dutch Army, which included earlier models of the BT46 system. The upgraded systems will be at the armour brigade centre at Parolannummi and the KASI mobile Combat Training Centre in Säkylä.
- Germany. Rheinmetall Defence, • headquartered in Düsseldorf, has contracts worth €24M for updates at the German Army Combat Training Centre (Gefechts Übungs Zentrum – GÜZ). This is at the Altmark Training Grounds in the Colbitz-Letzlinger Heath area north of Magdeburg. Amongst other things, this will expand software for training for Military Operations in Urban Terrain (MOUT) in the so-called "Schnöggersburg" urban environment, plus a general update of communications. Also included will be Future Soldier (IdZ) equipment, whose GLADIUS/IdZ-ES system is also made by Rheinmetall.
- Middle East/North Africa. Rheinmetall Defence is to produce a training system for Military Operations in Urban Terrain (MOUT) for a customer in the Middle East-North Africa (MENA) region. A "training city" will be built in the customer country with laser and live fire systems, wireless tracking and a control and evaluation centre. Where live firing takes place, real-time video monitoring will be used.
- NATO. The NATO Science and Technology Organization (STO) Collaboration Support Office (CSO) in Neuilly-sur-Seine, France, has developed the MSG-147 project for crisis management and disaster response (CMDR). The aim is to provide distributed simulation, automated data collection and modelling for CMDR. Examples include reinforcing civilian authorities in conditions of terrorist alert, maintaining law and security after disaster events, providing services if peacetime infrastructure breaks down, and so forth.
- Poland. The Polish Army is to build an instrumented combat training centre (CTC) with laser-based tactical simulation, live-fire shoot-houses, IED training devices, and after action review (AAR). Companies responding to the

Request for Proposal (RfP) include Cubic Defense, Elbit Systems, Rheinmetall Defence, RUAG and Saab. This follows the procurement in November 2015 of a CTC for Polish special operations forces (SOF), being built by Elbit Systems, RUAG Defence, and Autocomp Management of Poland, to train for urban, rural and indoor environments. Also, Saab is to deliver a laser-based tactical engagement simulation system (TESS) to the Polish Army, for the General Tadeusz Kosciuszko Military Academy of Land Forces in Wroclaw (WSOWL).

#### **Maritime Systems**

- Bulgaria. VSTEP bv of Rotterdam, the Netherlands, has delivered several simulators to a new training centre at the Nikola Vaptsarov Naval Academy (NVNA) in Varna. These include two NAUTIS bridge simulators, two NAU-TIS DNV Class C desktop simulators and two NAUTIS Class C DP simulators. The Full Mission Bridge Simulators (FMBS) have 240° and 180° visuals. VS-TEP also supplied its Live Data Module (LDM) that visualises the movements of real ships with data from their Automatic Identification Systems (AIS) and can insert other training aspects such as oil spill, Man Overboard (MOB) and real weather situations.
- Sweden. The Saab Underwater Systems business unit of Saab Dynamics, Karlskrona, Sweden, has developed the AUV62-AT autonomous underwater vehicle for anti-submarine training. Launched from ships, it simulates different submarine characteristics so that crews can practise anti-submarine drills.

 USA – Cyber. Metova Inc of Franklin, S of Nashville, Tennessee, USA, is to provide a Persistent Training Environment (PTE) for the US Navy Cyber Operations Training Simulator (NCOTS) programme. This will use Metova's Cyber operations Enhanced Network and Training Simulator (CENTS®) to simulate Navy networks. This will include cyber ranges for the Navy Cyber Defense Operations Command (NC-DOC), the Network Operations Center (NOC), and ships.

#### **Aviation Systems**

- Germany. Airbus Defence and Space, headquartered in Munich, has delivered a Eurofighter Maintenance Simulator Trainer (MST) to the German Air Force. It can train maintenance and repair, troubleshooting, fault detection, system tests, and some 400 fault scenarios. The MST can be operated in the workplace and also in a classroom.
- Spain. Indra Sistemas, headquartered in Madrid, is to produce a full flight simulator (FFS) for the A330 Multi Role Tanker Transport (MRTT). This is for the Airbus Defence and Space International Training Centre in Seville, and is to be Ready for Training (RfT) in Q2/2018. As well as the usual FFS functions, it will be optimised to train pilots in Air to Air Refuelling (AAR), using both boom and probe-and-drogue systems.
- Poland. Virtual Reality Media (VRM) of Trencin, Slovakia, has delivered a MiG-29 flight simulator to the Polish Air Force 23rd Air Base near Mińsk Mazowiecki, east of Warsaw, in co-operation with the Polish company KenBIT

of Gdynia. It is fixed-base with six projectors and a 180 x 80 degree dome display. The US\$6M contract includes spares, maintenance and support. The Polish MiG-29 fleet has recently been upgraded with new avionics from IAI, a Rockwell Collins communication suite, and a Saab EW package.

UK. BAE Systems has upgraded simulator software for the Eurofighter TY-PHOON. This was carried out by the company's Air Service team based at Warton, Lancashire, for the Emulated Deployable Cockpit Trainers (EDCT) at RAF stations Coningsby and Lossiemouth. Amongst other things, the upgrades extended the geographic database to current operating areas. Thales UK of Crawley, South of London Gatwick airport, has a GBP80M contract for support of the British Army's WATCHKEEPER Unmanned Aircraft System (UAS). This includes management of the WATCHKEEPER Training Facility, updates to courseware, and additional instructors for pilots, mission system operators, maintainers and support crew.

#### Conclusion

All of the above shows that the value of simulation has been recognised, not only for its training value but also to save large amounts of money by replacing a significant proportion of live training, typically a 50:50 live:simulator ratio. It is also recognised that simulation can be more realistic, because it can be used to inject training scenarios including enemy responses that cannot be reproduced in training with the real equipment.



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# F-35 LIGHTNING II: A Fighter for the Information Age

#### **Doug Richardson**

With estimated acquisition costs of nearly US\$400bn, the F-35 acquisition programme is the most costly ever tackled by the US Department of Defense (DoD). By the end of last year, more than 150 aircraft were operating, along with 18 developmental test examples, and this combined fleet had flown more than 48,000 hours.

A total of 10 countries – all either NATO members or close US allies – joined the F-35 development programme. The United Kingdom is classified as a Level 1 partner; Italy and the Netherlands are Level 2 partners; Australia, Canada, Denmark, Norway, and Turkey are Level 3 partners; while Israel and Singapore joined as Security Co-operative Participants. (The higher the level, the greater is a country's financial stake in the programme, and the greater is its potential for technology transfer and subcontract work).

In addition to being responsible for final assembly Lockheed Martin manufactures

the forward fuselage, cockpit, and wing edges, while Northrop Grumman builds the mid-fuselage and wing box. BAE Systems produces the tail and aft fuselage sections, while Tusas Aerospace Industries (TAI) will manufacture composites parts and sub-assemblies for the centre fuselage section, and act as a second source for centre fuselage sections. Two non-US Final Assembly and Checkout Facilities (FACOs) are located in Italy and Japan.

Three variants of the F-35 are being fielded. The F-35A is an aircraft that operates in conventional take-off and landing



*F-35A* LIGHTNING II Joint Strike Fighters from the 58th Fighter Squadron, 33rd Fighter Wing, performing a mission off the coast of Northwest Florida in May 2013. The F-35A variant operates in conventional take off and landing (CTOL) modes.

#### <u>Author</u>

Following an earlier career in engineering, **Doug Richardson** is a defence journalist specialising in topics such as aircraft, missiles, and military electronics. (CTOL) modes, while the F-35B is the version for short-take off and vertical-landing (STOVL) operation. The F-35C is the catapult-compatible (CATOBAR) model for use on US Navy aircraft carriers.

There is no twin-seat version of the F-35, so much of the training of an F-35 pilot will take place in the simulator. Al-



A Marine Corps F-35B LIGHTNING II taking off at Hill Air Force Base, Utah, on 18 June 2015. The F-35B is the version for short-take off and verticallanding (STOVL) operation.

though these simulators lack the fullmotion capabilities of older designs, in other respects they will be more realistic. They can be linked together in a single scenario, allowing several pilots to "fly" a joint mission, and can simulate latestgeneration threats and allow simulated EW operations.

Planned procurement of the F-35 is currently as follows, (but all figures are liable to be altered).

- US: 1,763 F-35A (USAF), 260 F-35C (USN), 353 F-35B and 67 F-35C (USMC)
- Australia: c.100 planned
- Canada: planned procurement of 65 F-35A has been shelved
- Denmark: 27 F-35A
- Israel: 77 F-35I
- Italy: 60 F-35A and 30 F-35B
- Japan: 38 F-35A
- South Korea: 40 F-35A
- Netherlands: 37 F-35A

- Norway: 52 F-35A
- Turkey: 100 F-35A
- UK: 138 F-35B

The programme is currently running about six years behind its original schedule and well over budget. According to the US Government Accountability Office (GAO), the F-35 programme's cost, schedule, and performance problems can largely be traced to what they describe as "decisions made at key junctures without adequate product knowledge", as well as a highly concurrent acquisition strategy in which development activities, flight testing, and production would significantly overlap.

Highly-publicised technical problems have included the failure of the F-35C tailhook to reliably engage the arrester cable on a carrier flight deck. This was solved by reprofiling the hook, and giving it additional damping.

When it became obvious that the F-35B version was about 1,500 kg (3,300 lb) overweight, and engineering task force was set up in 2004 to tackle the problem. Structural measures taken included repositioning the wing spars and increasing their number in order to allow the use of a thinner wing skin. While these and other modifications eliminated much of the unwanted weight, design improvements increased the engine performance. The Auxiliary Air Inlet (AAI) that provides additional air flow to the main engine of the F-35B during STOVL operations had to be modified when it became clear that this component faced higher dynamic loads that had been anticipated.

Problems have also been experienced with the aircraft's Pratt & Whitney F135 engine. An engine fire at Eglin Air Force Base on June 2014 lead to a temporary fleet-wide grounding. Found to be the result of excessive rubbing of an air seal between two stages of engine blades against a surrounding rub strip under some flight conditions, this was solved by modifying the rub strip to provide increased clearance.

These and other problems are regularly reported, the most recent being crumbling of the insulation of coolant lines within the wing fuel tanks of the F-35A. In this case, the problem was linked to tubes from one specific manufacturer, but these had only been fitted to a small number of delivered aircraft.

In January of this year, Lt. General Chris Bogdan, the F-35 Program Executive Officer, stated: "While the development program is 80% complete, we recognise there are known deficiencies that must be corrected and there remains the potential for future findings.... The Joint Program Office will continue to work with the F-35 enterprise to make corrections and improvements as quickly as possible."

Development flight testing is due to be completed by October 2017, but Michael Gilmore, director of the US DoD's Operational Test and Evaluation Directorate, has suggested that late 2018 is a more realistic date. The F-35 programme office is reported to have asked for up to US\$530 million of additional funding in order to finish this work.

In late October, five F-35B LIGHTNING II aircraft landed on the amphibious assault ship USS America as part of a planned shipboard deployment of seven aircraft. Two are earmarked to begin the third shipboard phase of developmental test (DT-III), while the remaining five will be used for operational testing.

The principal components of F-35's integrated avionics suite are:

- the Northrop Grumman AN/APG-81 Active Electronically Scanned Array (AESA) radar
- the Northrop Grumman AN/AAQ-37 Distributed Aperture System (DAS)
- the Lockheed Martin AAQ-40 Electro-Optical Targeting System (EOTS)
- the BAE Systems' AN/ASQ-239 Barracuda EW system

In most fighters, the pilot is essentially a sensor manager who must decide how to task his aircraft's active sensors, and cope with track data from several sources. This workload can lead to task-saturation during air combat. With the F-35, the data from all on-board sensors, and from offboard sources, will be automatically fused to give the pilot a single view of the battlespace, and allowing him to focus on the mission and tactics.

The level of data fusion implemented in the F-35 is a formidable data processing task, so it is hardly surprising that the aircraft uses around 8.3 million lines of software code – more than four times the amount used by the F-22 RAPTOR. The Block 3i software was released for flight test in May 2015. Finalised by May of the following year, it supported the US Air Force declaration of initial operational capability (IOC) in 2016. This version of the software was

not trouble-free; initially, instability problems required actions

> AAQ-40 Electro-Optical Targeting System (EOTS) from Lockheed Martin

such as an automatic shutdown, or a manual sensor restart every three to four hours. By April 2016, the situation was much better, with instability problems were being noted about once every 15 hours.

The final development software block is build standard 3F. Coding was completed in June 2015, allowing this version to be released for flight testing. A series of updates is planned; these are due to be completed by the autumn of 2017, and will support the planned USN IOC in 2018 and the start of IOT&E.

Using the Block 3F software, the F-35 completed 12 weapons-delivery accuracy



AN/APG-81 Active Electronically Scanned Array (AESA) radar from Northrop Grumman

and 13 weapon-separation events during a month-long series of tests conducted this summer. Earlier tests have involved



An F-35C LIGHTNING II arriving at Hill Force Base, Utah, on 15 April 2016. The F-35C is the catapult-compatible (CATOBAR) model for use on US Navy aircraft carriers.

30 different weapons including the Raytheon AIM-9X SIDEWINDER, Raytheon AIM-120 AMRAAM, Boeing JOINT DI-RECT ATTACK MUNITION, and Boeing **GPS-guided SMALL DIAMETER BOMB** The current development programme is expected to end next year, when Block 3F developmental flight testing is complete. Expected to cost around US\$3bn over the next 6 years, the follow-on F-35 Block 4 programme is intended to give the aircraft new capabilities, and correct deficiencies in nine capabilities. This upgrade is expected to add a wide-area high-resolution synthetic aperture radar (SAR) mode to the AN/APG-81 radar, and to improve the Electro-Optical Targeting System (EOTS) with features such as higher-definition video, longer-range target detection and identification, a video datalink, and an infrared marker and pointer.

US weapons due to be integrated as part of Block 4 upgrade include the AIM-9X Block II, JSOW, GBU-54/38, SMALL DI-AMETER BOMB II, and the B61-12 nuclear bomb. Block 4 will also make the aircraft compatible with several non-US weapons such as the MBDA METEOR, the Kongsberg JOINT STRIKE MISSILE (JSM), and Turkey's Tübitak Sage SOM cruise missile. Israel has its own unique weapon-integration requirements, so its F-35I (known as the "ADIR") will incorporate a plugand-play feature that facilitates use of Israeli-designed electronic equipment such as EW hardware, and allow the use of indigenously-developed air-to-air missiles and guided munitions.

The Autonomic Logistics Information System (ALIS) – a complex system of systems that supports operations, mission planning, supply-chain management, and maintenance – remains an area of concern. In October 2015, the US Congress was told ALIS is one of the most significant technical and schedule risks to the F-35 programme.

According to a GAO report published early in 2016, ALIS does not have redundant infrastructure, but depends on all F-35 data produced by US users being routed to a Central Point of Entry and then to the ALIS main operating unit. These have no backup system or redundancy, says the GAO; if either fails, it could take the entire F-35 fleet offline. There are also concerns that the system may not be deployable at the sort of austere locations often used by the USMC.

The Marine Corps declared IOC with the F-35 in July of last year, and since then the USAF has been working to groom its version for entry into service. In February, F-35As from the USAF's 388th and 419th Fighter Wings dropped laser-guided bombs at the Utah Test and Training Range during the first weapons release conducted by a combat unit.

The first successful air-to-air engagement was conducted on 28 July when USAF test pilot, Major fired an AIM-9X missile from the wing pylon on an F-35A.The aircraft's sensors identified and targeted the target drone, and passed the target "track" information to the missile. The pilot was able to verify targeting information using the high off-boresight capability of his helmet mounted display (HMD), and then launched the missile, which successfully destroyed the drone. Just before launching the AIM-9X, the pilot fired an internally-carried AIM-120C missile at another target drone that was flying at beyond visual range. The AMRAAM guided successfully, but was given a self-destruct signal just before it was due to reach its target.

On 2 August of this year, General Hawk Carlisle, commander of Air Combat Command, formally declared the F-35A to be "combat ready". The first unit to have achieved IOC was the 34th Fighter Squadron of the 388th Fighter Wing, based at Hill Air Force Base, Utah. The aircraft was cleared to conduct basic close air support, interdiction, and limited suppression/destruction of enemy air defences in a contested environment.

Following the IOC announcement, the 33rd Fighter Wing participated in Exercise NORTHERN LIGHTNING on 31 August. In what was the largest F-35A deployment to date, the unit recorded more than 110 kills against "enemy aircraft," supported a surge of 138 sorties and dropped 24 GBU-12 laser-guided bombs.

Denmark, Norway, and the Netherlands all plan to operate their F-35 force from hardened aircraft shelters, so two Dutch F-35A that arrived in the Netherlands on 23 May were used to demonstrate this basing mode and to assess the increased sound and vibration levels experienced by the aircraft when it is operated in such small enclosures. The F-35 is the first aircraft incorporating stealth technology that the US is prepared to export. Previous stealth aircraft such as the F-22 and B-2 used radar-absorbing skin materials that were far from robust, and required significant maintenance work in order to maintain the required stealth characteristics. For the F-35, the radar-absorbent material is not a surface treatment, but is incorporated into the skin material itself. As a result, the aircraft's low radar cross section (RCS) characteristics should be much easier to maintain. RCS testing of both flight test and operational aircraft has verified the aircraft's low-observability characteristics. There has been speculation that the level of stealth built into the aircraft delivered to the US services (and perhaps to some selected customers) might be better than that built into most export examples, but there is as yet no evidence to support this. The ability to penetrate enemy air defences is not the only advantage that the F-35 will offer in combat. In a paper published by the Mitchell Institute in June 2016, Maj General Jeff Harrigian and Col Max Marosko (both from the USAF), explained how the fused sensor information gener-

ated by the F-35 will have to be passed

via datalinks to the USAF's much larger legacy aircraft forces, and to selected command and control nodes.

"By linking this information to the entire force, an actionable common operating and targeting picture can be created for commanders and decision makers. As sensors, communication protocols, and data links improve, all friendly forces should be able to share the multi-domain situational awareness fifth generation aircraft can generate, in co-operation with other assets."

In a future conflict against an opponent equipped with large numbers of mobile advanced surface-to-air missile systems (SAMs), only stealth aircraft like the F-35 would be able to operate over contested territory, Harrigian and Marosko stated. But they predict that the F-35 force would be able to "use advanced geo-location capabilities, combining with their stealth signature and electronic warfare (EW) tools, to neutralize many of these SAMs, allowing joint force operations to steadily increase their freedom of action."

They also predicted that the F-35 will be able to use their onboard sensors to find the runway during landing operations in inclement weather, stating that this capability will reduce the number of personnel and equipment required for deployment, and allow the use of airfields that lack modern navigation or air traffic control facilities.

The potential of the F-35 to integrate with other weapon systems and to support the US Naval Integrated Fire Control-Counter Air (NIFC-CA) concept was demonstrated on 12 September when an F-35B from the Marine Operational Test and Evaluation Squadron 1 acted as an elevated sensor and detected a simulated threat that was over the horizon from an AEGIS Weapon System on the USS Desert Ship (LLS-1), a land-based test site. The aircraft used its Multi-Function Advanced Data Link (MADL) to send threat data to a ground station that was connected to LLS-1, which responded by launching a Standard Missile 6 which engaged and intercepted the threat.

For the moment, the last word can perhaps best be left to F-35A integration office director General Scott Pleus. "In terms of lethality and survivability, the aircraft is absolutely head and shoulders above our legacy fleet of fighters currently fielded... This is a formidable airplane and one our adversaries should fear."



F-35A LIGHTNING IIs from the 33rd Fighter Wing taxi down the flightline at Volk Field, Wisconsin, during the tactical-level, joint training exercise NORTHERN LIGHTNING on 22 August 2016.

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# Space-Based Reconnaissance Systems Technological Trends and Current European Programmes

#### Nicholas Fiorenza

Ten years after the first satellite of Germany's SAR-Lupe radar satellite reconnaissance system was launched on 19 December 2006, the next generation, SARah, is in the process of being developed.

Germany and France have an agreement dating from the beginning of 2008 to share data between SAR-Lupe and the French Helios-2 optical satellite reconnaissance system, which will be replaced by the

time, Rudolf Scharping, concluded that he could not obtain from outside sources the imagery required fast enough for national decision-making. The present defence minister, Ursula von der Leyen, does not have





SAR-Lupe, Germany's current satellite-based reconnaissance system, consists of five identical small satellites and a ground segment.

MUSIS (MUltinational Space-based Imaging System for surveillance, reconnaissance and observation), whose data will be exchanged with that of SARah, the follow-on to SAR-Lupe. The two systems are the only European space-based satellite reconnaissance systems designed purely for military purposes, with various dual-use satellites providing data for defence and security applications.

#### From SAR-Lupe to SARah

Germany decided to develop SAR-Lupe after NATO's 1999 Kosovo air campaign, when the German defence minister at the

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this problem. For over a year now, SAR-Lupe satellites operating in a constellation with Helios 2 have been providing reconnaissance support to coalition forces operating against the so-called Islamic State (IS). The resulting increased situational awareness helps protect civilians and civil infrastructure, track cross-border movements, and gauge the size of the IS operational area, according to the German Ministry of Defence. The imagery provided by SAR-Lupe also supports civil applications: environmental protection and exploration of natural resources, disaster management, monitoring plants and recording geodetic data.

SAR-Lupe is part of the trend towards using several small satellites, with the total programme cost kept relatively low at  $\in$ 348 million, including the five satellites, launches, a satellite control and user ground segment from EADS (before it was renamed Airbus) and 10 years of operations by using commercial off-the-shelf technology and Russian launch boosters. Five satellites measuring  $4 \times 3 \times 2$  metres and weighing 770 kilogrammes each provide quicker response and more images of a mission area, as well as redundancy in case one is disabled or damaged by space debris or micro-asteroids.

The 10-year contract with OHB System to operate SAR-Lupe will end in November 2017 and the Bundesamt für Ausrüstung, Informationstechnik und Nutzung der Bundeswehr (BAAINBw), Germany's Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support, on July 2013 awarded the company an €816 million contract to develop and build the follow-on system, SARah, for operation until 2029. SARah will use synthetic aperture radar, like SAR-Lupe, and be even more capable.

OHB will design and build two satellites based on SAR-Lupe reflector technology and components of the ground station equipment in Gelsdorf, Germany, while Airbus Defence and Space will build a third satellite fitted with phased-array antennas. Phased-array antennas on the TerraSAR-X and Tandem-X civil satellites flying in tandem generate detailed threedimensional structures of the Earth's surface. They are phase-controlled antennas comprising many individual transmission/ reception modules and can be interconnected, bundled and variably controlled, allowing image sequences to facilitate mechanical alignment. Combining reflector and phased-array technologies for the first time, as well as the establishment of a second reception station in Kiruna, northern Sweden, will make SARah more powerful than SAR-Lupe. This will mean higher resolution radar images, faster data dumps from the satellites and shorter system response times.

The SARah satellites are planned to be launched from Vandenberg Air Force Base in California on a SpaceX Falcon 9 reusable rocket in late 2018 and early 2019, including a dual launch of the two OHB satellites. A contract for the continued operation of SAR-Lupe is planned for the transition period between the end of nominal SAR-Lupe operations and the full operating capability of SARah. It still has to be decided what to do with SAR-Lupe after it is replaced by SARah, with one of the possibilities being



SARah, the successor to SAR-Lupe, will provide higher resolution radar images, faster data dumps from the satellites and shorter system response times.

reentry into the Earth's atmosphere, where it would burn up.

#### From Helios 2 to MUSIS

Unlike Germany, France was not a newcomer to military space-based reconnaissance when it launched the Helios 2A satellite on 18 December 2004, followed exactly five years later by Helios 2B, to replace Helios 1. Helios 2 has two instruments: an Airbus Defence and Space medium-resolution instrument like that of the SPOT 5 civilian Earth observation satellite with a wide field of view in the visible and low infrared spectrum and a very high-resolution instrument with an infrared channel from Thales Alenia Space.

Compared to the dozens of images a day provided by Helios 1, Helios 2 delivers

around 100 of higher quality in terms of resolution, contrast, and electronic noise, according to the Direction Générale pour l'Armement (DGA), the French procurement agency. It can be used for surveillance of nuclear facilities, mission preparation and mapping, including for cruise missiles, to prevent collateral damage, and for bomb damage, according to French officials. Its ground resolution is classified but is high enough not only to be able to photograph targets, but also identify activity such as whether a nuclear reactor or the engines of a tank column have been turned on through infrared imagery.

The total cost of the Helios 2 programme is  $\in$  2Bn, with the two satellites accounting for half this amount, the design 20 percent, the launches 15 percent, and the ground segment 10 percent.

Helios 2 will be replaced by MUSIS and its Composante Spatiale Optique (CSO) optical space component satellites. At the end of 2013, the DGA awarded Airbus Defence and Space the contract to build and provide 12 years of through-life support for the user ground segment (UGS) of MUSIS, which will progressively replace Helios. This followed the signature by Astrium with the Centre National d'Etudes Spatiales (CNES), the French space agency, in December 2010 of the contract to build three CSO satellites, to be launched starting in 2018. The MUSIS ground segment will programme commands to be sent to the CSO satellites and receive, generate, distribute and store the images they acquire. The UGS will also allow the French armed forces to access existing and future satellite observation sensors.

As prime contractor for the CSO programme, Airbus Defence and Space will provide the platform and avionics and is responsible for the integration, testing and delivery of the satellites to CNES, acting on behalf of the DGA. The CSO satellites will be highly manoeuvrable and built around a bus architecture drawn partly from the Pleiades dual-use optical system, providing great autonomy and agility despite weighing 3.5 tonnes each. Thales Alenia Space will provide the very-high-resolution visible and infrared optical instrument.

The latest generation of gyroscopic actuators, fibre optic gyroscopes, on-board electronics and control software will optimise the satellites' weight and inertia and significantly increase pointing speed. The satellites will also carry a Galileo navigator developed by Airbus Defence and Space. MUSIS was initiated by France in 2005 to create a European satellite reconnaissance system and to replace Helios 2 and



Three MUSIS optical space component satellites are to be launched starting in 2018.

Cosmo-SkyMed is a dual use Earth observation programme consisting of four satellites equipped with high-resolution X-band radars.

initially included Belgium, France, Germany, Greece, Italy and Spain. By the time Poland and Sweden announced their intention to join in 2010, MUSIS had evolved into a programme aimed at federating some of the next generation European military or dualuse Earth observation satellites, such as the replacements for Helios 2, SAR-Lupe and the Italian CosmoSkyMed, and assuring access to space by the participating states through a common ground segment. The programme's level of ambition has since tractor for the CSG programme, in charge of building the two CSG satellites, while Telespazio is responsible for developing the ground segment and integrated logistics for operations. To guarantee service continuity with Cosmo-SkyMed first generation satellites, the first second generation satellite will have to be launched and operational by the first half of 2018, and the second satellite by the first half of 2019.

Cosmo-Skymed is the radar component of the Franco-Italian Optical and Radar



The EU Satellite Centre (EU SATCEN) is located in Torrejon, Spain.

been reduced to an interoperable ground segment for CSO, SARah and CosmoSkyMed Second Generation (CSG).

#### From Cosmo-SkyMed to CSG

Cosmo-SkyMed is a dual-use Earth observation programme funded by the Agenzia Spaziale Italiana (ASI), the Italian space agency, the Italian Ministry of Defence, the Italian Ministry of Education, Universities and Scientific Research. The Cosmo-SkyMed system consists of four satellites equipped with high-resolution X-band radars that can operate in all weather and visibility with a very high revisit frequency. The system's military applications take priority over civil requirements such as environmental monitoring, civil protection, oil and gas. Thales Alenia Space built the four satellites, launched in June 2007, December 2007, October 2008 and November 2010, respectively. Telespazio built the ground segment. The Fucino Space Centre houses the control centre for the constellation, managed the phases of acquisition of the satellites after launch and their placement into orbit, and carries out command and control activities and the scheduling of requests for the acquisition of images. The Matera Space Centre, managed by e-GEOS, is responsible for the acquisition, processing and distribution of satellite data for civil applications.

Thales Alenia Space is also the prime con-

Federated Earth Observation (ORFEO) programme, for which the French Pleiades dual use system is the optical component. Pleiades has been observing and mapping Earth's surface at a resolution of 70 centimetres since Pleiades 1A was launched on 17 December 2011. Pleiades complements the capabilities of the SPOT satellites, which have a wider field of view than Pleiades but lower spatial resolution. Pleiades 1A and Pleiades 1B, launched on 1 December 2012, share the same orbit and together can take images anywhere on Earth in less than 24 hours.

Pleiades' extremely sensitive optical instrument from Thales Alenia Space reduces the exposure time needed for each image, giving each satellite the ability to acquire up to 500 images a day. Its imagery is used for both military applications like locating adversaries' military installations for mission planning and civil applications like tracking urban expansion, monitoring active volcanoes, and assisting road and railway routing.

#### **Planning for the Future**

The Space Strategy for Europe presented by the European Commission on 26 October 2016 points out that EU space-based applications can provide additional operational capacity for the implementation of the European Common Security and Defence Policy (ESDP). In the area of Earth observation, surveillance through the Copernicus programme and situational awareness are included as contributors to European strategic autonomy and non-dependence. The Commission is considering using Copernicus for security applications like border control and migration surveillance.

Under the October 2016 Franco-German initiative to reinforce the ESDP, the two countries are examining using CSO and SARah to increase the European Union's situational awareness, including the maritime picture in the context of implementing the EU Maritime Security Strategy (EUMSS). France and Germany intend to propose a cooperation framework to the relevant EU institutions, facilities and agencies allowing better access to satellite images from SARah through the EU Satellite Centre (EU SATCEN) in Torrejon, Spain. This initiative could also support Frontex, the European border protection agency. Institutions and agencies like the European Commission, the European Maritime Security Agency, Frontex, the EU Intelligence Analysis Centre, the EU SATCEN and the European Defence Agency (EDA) will contribute to the creation of a specific maritime picture, as called for by the EUMSS.

The EDA is looking further into the future, to 2025-2030, given that it takes 10 years from conception to launch of a satellite. An agency working group on high level requirements for future systems just began activities, which are considered an important step towards building a business case for Earth observation systems.

An important consideration is the need for very high resolution, with the 30 centimetres of Digital Globe as a reference. One way of achieving this is through the use of wide swath technology. Effectiveness, both in cost and image analysis, are also important. Other considerations are image quality, default colours, the ability to take a picture whenever it is needed, and the proper algorithms so image analysts can make effective use of the imagery.

Six EDA member states invested almost €100 million through the agency to achieve independence in gallium nitride technology and build a European value chain. This technology is necessary to develop the smaller components with higher performance necessary for smaller satellites.

Some of the challenges facing satellite technology are the management of crosscutting cyber threats to both the space and ground segments, improving signal processing building blocks for quick dissemination, and making sure that satellites, antennas and signal processing all work seamlessly at both the component and application levels.

# Defence Procurement in Denmark – Current Programmes

#### J. Bo Leimand

In continuation of last year's report on the Danish Defence Procurement Plan 2015-2030 (see ESD 06/15) this article considers the fact that the plan should actually be revised annually and amended in accordance with the political situation, both territorial and abroad.

owever, as this issue goes to print, no amendments have been published. Nonetheless, the Danish Ministry of Defence has released individual information to serve as an objective basis for this contribution.

Comparing last year's with this article, one might argue that the procurement efforts referred to are in part different. That is because this article only focuses on capital procurements programmes. On an annual basis, the Danish Armed Forces procure and maintain equipment for more than 6 billion Danish crowns. personnel carriers (APC). The vehicles are expected to reach FOC (Full Operational Capability) in the Royal Danish Army in 2018.

#### **Royal Danish Air Force**

In summer the Danish Government decided to buy the F-35 Joint Strike Fighter from Lockheed Martin as a replacement for the Royal Danish Air Force's F-16 fighter aircraft fleet. This procurement valued more than 20 billion Danish crowns is the biggest of the past few years and the initial agreement covers 27 airplanes to



The Danish Army's ageing M-113 fleet will be replaced by PIRANHA V type vehicles. The picture shows the PIRANHA V during trials in 2013.

The considerations hereafter cover procurement efforts executed in 2016 and future plans.

#### **Procurement in 2016**

#### **Royal Danish Army**

The Danish Armed Forces and GDELS-Mowag from Switzerland signed a contract for 309 PIRANHA 5 8x8 armoured be delivered in 2021. The funds are to be taken from the defence budget, and the other services are now following this procurement closely to make sure that their share of the budget will be maintained to the best possible extent. However, some cuts and savings are to be foreseen. The Minister of Defence has announced that he does not expect that the price tag on the aircraft will change. This was announced during a meeting with the political parties that have signed the current Defence Agreement.

#### **Royal Danish Navy**

In September the third and last Danish inspection vessel of the KNUD RASMUS-SEN Class was named LAUGE KOCH. Currently, the ship is being equipped with different systems in order to declare FOC in 2017.

The first MH -60R SEAHAWK helicopters were delivered to the Royal Danish Navy in 2016. From 2019 the Royal Danish Navy will have 9 helicopters in its inventory. An update of the vessels planned to operate the SEAHAWKs are ongoing. The helicopters are procured under a US Foreign Military Sales (FMS) contract.

The THETIS class is both undergoing an update for the Seahawk helicopters as well as an update of sensors and the command, control and information systems.

#### Future Procurement Programmes

In continuation of the procurement plan referred to in the article in ESD 06/15 it has been decided to procure new lorries in the coming years. It is expected that the Danish Armed Forces will procure more than 700 lorries of different variants. The companies participating in the competition are Scania Danmark A/S, Rheinmetall MAN Military Vehicles GmbH and Iveco Magirus AG.

In the vehicle area the Danish Armed Forces are working on alternative methods of acquiring those assets. Instead of the traditional ownership, leasing of materiel could be a possibility in the future. This should be seen in the light of the JSF buy, which requires from the Armed Forces to improve their efficiency even more than they already have achieved under this Defence Agreement.

Besides, a number of the Danish LEO-PARD 2 A5 DK MBTs will undergo a mid



In the scope of a contract for 27 F-35A LIGHTNING II valued at €2.7bn Denmark is replacing its F-16 fleet by 2024.

life-update in the coming years, thus taking advantage of latest developments in this important area.

Currently, the Royal Danish Army is in the middle of the procurement of a new artillery system to replace the American M109 155mm self-propelled howitzer, which have reached the end of their service life. Companies in this competition are Elbit Systems, Hanwha Techwin and Nexter Systems. A contract is expected to be signed during 2017.

Also under procurement is a number of armed patrol vehicles for the Royal Danish Army. The companies taking part in this competition are GDELS-Mowag from Switzerland and Force Protection Europe – both are General Dynamics subsidiaries. A contract is expected to be signed in 2017. In order for the Danish Armed Forces to fulfil maritime surveillance obligations the plan is to procure four vessels for environmental use in the coming years. The vessels are expected to be declared FOC in 2019. A list of planned investments and maintenance requirements can be found at http://forsvaret.dk/FMI/nytMateriel/planlagte-investeringer-og-driftsopgaver/ Pages/default.aspx

#### Conclusion

It is quite clear that the Danish Armed Forces have completed a lot of procurement efforts in order to be ready for the fighter procurement, which in the coming year will put a heavy burden on the defence budget. It is obvious that the procurements for the Royal Danish Army will be assets that can be used in international operations, should the requirement arise. Likewise has the procurement for the Royal Danish Navy been necessary in order to fulfil our international obligations in securing our sovereignty.



The South Korean K9 THUNDER is among the three contenders for the Danish SP howitzer requirement.



# Close-In Ship Defence – Confronting Missile Threats

#### **David Saw**

The age of the modern anti-ship missile can truly be said to have commenced on 21 October 1967 with the sinking of the Israeli destroyer INS EILAT. EILAT (the former HMS ZEALOUS, commissioned in the Royal Navy on 15 July 1944, sold to Israel on 15 October 1955 and commissioned into the Israeli Navy in July 1956) was on patrol in international waters off Port Said, Egypt when she was engaged by Project 183R KOMAR Class missile boats of the Egyptian Navy located within Port Said harbour.

KOMAR Class boat engaged EILAT, with the first P-15 TERMIT (SS-N-2 STYX) anti-ship missile hitting EILAT at 17:32, and a second hitting two minutes later. EILAT had not detected the launch of the missiles and when they finally detected

er hit and that was the end of the EILAT. The Indian Navy successfully used the P-15 TERMIT in the 1971 India-Pakistan War. On 5 December 1971, during Operation Trident, Indian Navy Project 205 OSA Class missile boats engaged targets around and



On 17 May 1987 the USS STARK (FFG 31), an FFG 7 Class frigate of the US Navy on patrol off the Saudi coast was attacked by an Iraqi aircraft that launched two EXOCET missiles at the US ship. Although the frigate had both "hard kill" and "soft kill" defences against such threats misunderstandings led to them not being used. Two EXOCETs struck the STARK, killing 37 and wounding 21 of her crew.

the incoming missiles it was too late to do anything. The crew of the EILAT struggled to save their ship while they awaited help from other Israeli Navy units. Then another KOMAR boat in Port Said launched two more P-15s, one missed, but the oth-

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within the port of Karachi in Pakistan. The Pakistani destroyer PNS KHAIBAR was hit by two P-15s and sunk, another destroyer was severely damaged, with a minesweeper and a cargo vessel sunk. A P-15 was used in a land attack mode to attack port facilities in Karachi. Three nights later the Indian Navy returned to conduct Operation Python, here a single OSA boat launched its four P-15 missiles at Karachi. The result was two merchant ships hit, with one sunk, a Pakistani Navy oiler hit and an oil tank in the port destroyed. Amidst the chaos of the attack defensive fires sunk another merchant ship by mistake.

The P-15 TERMIT was developed during the 1950s and first entered service in 1960. It was big and even by the standards of the time was not the smartest of missiles. By the October 1973 War, the Israeli Navy had developed effective countermeasures, including jamming and decoy systems such as chaff, thus neutralising the P-15 threat. Other more effective threats were on the horizon though, including the EXOCET.

In 1967 Nord Aviation in France (later Aerospatiale and today MBDA) started work on a sea-skimming anti-ship missile that would result in the EXOCET family of weapons, including the ship-launched MM38, the air-launched AM39 and the submarinelaunched SM39. The current version of the weapon is the MM40 Block 3, available in a ship-launched version, as well as in the EXOCET Mobile Coastal Defence System. It was the 1982 Falklands War between Britain and Argentina that brought the EXOCET missile into the public consciousness. On 4 May 1982, Dassault SUPERT ETENDARD aircraft of the Argentinian Navy launched two AM39 EXOCET missiles at the British destroyer HMS SHEFFIELD, with one missile hitting the target. This caused immense damage forcing the ship to be abandoned, although it did not sink until 10 May. The merchant ship ATLANTIC CONVEYOR, a critical logistics asset for the British Task Force, was hit by two AM39 missiles on 25 May, heavily damaged, it eventually sunk under tow three days afterwards. The Argentinian Navy removed some MM38 missiles from one of its destroyers to provide the basis for an improvised shore battery on the Falklands. On 12 June this battery detected and fired on the destroyer HMS GLAMORGAN. GLAMORGAN detected the incoming EXOCET and was able to manoeuvre and avoid the missile hitting side on, instead the missile hit the hangar area



The USS STOUT (DDG 55), a Flight I ARLEIGH BURKE Class destroyer of the US Navy, conducts a firing exercise with its PHALANX Close-in Weapon System (CIWS) in the Arabian Gulf in September 2016. Manufactured by Raytheon, the first PHALANX CIWS entered service with the US Navy in 1980 and is now in service with 19 other navies around the world.

causing casualties. Although damaged, less than three and a half hours later the destroyer was underway with fires caused by the missile extinguished.

The Royal Navy was by no means ignorant about the EXOCET, after all they operated the missile themselves, yet there seemed to be no institutional awareness about antiship missiles. Everybody knew about what happened to the EILAT, they also knew that the Israeli Navy had developed a counter to the missile threat and had also successfully used their own GABRIEL 1 missiles in the October 1973 war. Even so nobody seemed to anticipate what the EXOCET could do, had Argentina been able to obtain more AM39 EXOCETs for its SUPER ÉTENDARD then history might have been very different.



A new type of missile threat is the DF-21D Anti-Ship Ballistic Missile (ASBM), shown here during a parade in China. The objective of the DF-21D ASBM is to target US Navy aircraft carriers in the Western Pacific. Hitting a moving target, even one as big as an aircraft carrier, at extended range is not an easy proposition, but get it right and China has an anti-ship weapon of strategic importance.

#### Learning Lessons

The fact of the matter was that suitable hard kill and soft kill countermeasures to the anti-ship missile already existed or were coming into service at that point. There was nothing new in navies facing guided-weapon attacks while at sea. In August 1943 the Luftwaffe employed the FX 1400 FRITZ X guided anti-ship glide bomb and the Henschel Hs 293 anti-ship glide bomb based on the SC500 500 kg bomb, with an attached rocket engine as a booster. Both weapons used manual command-to-line-of-sight (MCLOS) guidance via radio link to control the weapon, and initially both systems were very successful. Yet by April 1944 their utility was at an end as a jamming system had been developed that blocked all frequencies used by the weapons rendering them useless.

As previously noted, the Israelis had discovered how to effectively use jamming against the P-15 TERMIT, they had also used decoy systems, initially chaff, but over time more complex concoctions were employed. Others followed this lead, with decoy launchers becoming commonplace on most surface units. Electronic warfare and other sensor developments allowed earlier detection of missile threats and, depending on the threat system, suitable jamming options were available.

Early detection of the missile also allows the ship being targeted to manoeuvre, potentially this might, in conjunction with decoys and other measures, allow missile lock to be broken. The case of HMS GLAMORGAN is worth referring to once more, if she had been hit side-on the missile would have penetrated deep into her innards potentially causing far higher levels of damage.

Another option to reduce vulnerability is to present a smaller target. The Israeli destroyer INS EILAT, the first victim of the modern anti-ship missile, was a 1,730 tonne displacement unit, with a length of 110.6 metres and a beam of 10.9 metres, in addition it required a crew of 199. Even before the sinking of the EILAT, the Israeli Navy had come to the conclusion that large units such as EILAT were a thing of the past, they would rely on smaller missile-armed fast attack craft. These were the SA'AR 2 and SA'AR 3 Classes, with a 250 ton displacement, a length of 45 metres, beam of 7.62 metres and a crew of 40. Equipped with the GABRIEL missile system and effective electronic warfare capabilities these SA'AR Class units totally transformed the regional naval picture in favour of Israel.

Obviously the objective is to avoid being hit by an anti-ship missile, but it happens. In general the missile is designed to pen-



Initially China purchased the Russian AK-630 Close-in Weapon System (CIWS) to meet its defensive needs, although the two Project 956EM destroyers acquired from Russia had the KASHTAN combined gun/missile CIWS. Then China developed an indigenous CIWS in the form of the Type 730, now succeeded by the Type 1130 (shown here), as mounted on the Chinese carrier and other high value units.

etrate deep into the interior of the target, a process that in itself causes tremendous damage, at which point the warhead detonates and carnage ensues. Another threat is unburnt fuel in the missile which ignites and this adds fire into the damage mix. The ship has been hit, its structure is compromised, there is blast damage plus fire and smoke. One of the lessons of the Falklands was having robust damage control capabilities, getting the fires under control and evacuating the wounded. Recognising the enormity of the anti-ship missile threat led to an understanding of the need to prepare for and train realistically to confront this threat. Efficient damage control practices can only do so much, however; at the design stage emphasis must be put on system redundancy to ensure the power, light and water remain available to allow damage control teams to have a chance of saving the ship. Equally, without power the ship becomes a sitting duck with weapons and sensors offline. There is nothing particularly intellectually challenging in all of this, the problem was that the lessons of the past had been forgotten. For the Royal Navy the Falklands was a hard school to re-learn these lessons, other navies were also quick to digest and act on them as well. There were basic problems to put right, such as having uniforms that had fire retarding properties and wiring insulation that did not burn so readily and give off noxious fumes. More technically demanding areas such as fire suppression systems that reacted rapidly, but did not turn any crew in the area of fire being suppressed into casualties due to the suppression agent used also had to be investigated. There was more that could be done to increase ship survivability, with naval designers putting new emphasis on the subject for future construction. Key areas included new materials, either adding additional protection or avoiding the weaknesses of older materials such as flammability. All of

a sudden it was acceptable to think along the lines that ships can and do get hit, and therefore also to ask what can be done to minimise and recover from damage. Another area of importance was signature

### **Rolling Airframe Missile**

(ck) The Rolling Airframe Missile (RAM) is a sophisticated naval self-defence system against anti-ship missiles, helicopters, aircraft and surface targets. RAM is currently deployed on more than 165 ships in eight countries, ranging from 500-ton fast attack craft to 95.000-ton aircraft carriers. It is capable of effectively coping with multiple and high density raids.

RAM is a supersonic fire-and-forget weapon. Its autonomous dual-mode passive RF and infrared guidance design provide high-firepower capability for the simultaneous engagement of multiple threats. The RAM missile owes its name to its rolling around its longitudinal axis to stabilise its flight path similar to a bullet fired from a rifled barrel. After launch, the passive RF seeker homes on the incoming missile's radar emission. Because of the rolling airframe, only two RF antennas and two forward steering fins are necessary instead of the usual four in a non-spinning missile. When the missile is close enough to the target or the latter stops its emitter, it switches to IR terminal homing. RAM has been subject to continuous improvements to stay ahead of the ever-evolving threat of anti-ship missiles, helicopters, aircraft and surface craft. The German and the US Navy have successfully performed more than 350 flight tests and operational firings under real threat scenarios against a variety of targets including HARPOON, EXOCET and supersonic M2.5 VANDAL achieving a kill-performance of above 95%. RAM has proven first-shot kills on every target in self-defence scenarios such as lowest level sea-skimming, diving and highly manoeuvring profiles in single, stream and wave attacks.

The RAM Block 2 variant is a kinematic and RF receiver upgrade of Block 1/1A. A larger, more powerful rocket motor and advanced control section make the missile two and a half times more manoeuvrable with one and a half times the effective intercept range. This provides the Block 2 missile with the capability to defeat high-manoeuvring threats,

increasing the survivability of the defended ship. An RF receiver allows detection of anti-ship missiles that employ low probability of intercept receivers.

The Mk 44 Guided Missile Round Pack (GMRP) and the Mk49 Guided Missile Launching System, which hold 21 missiles, comprise the Mk 31 guided missile weapon system. The system is designed for flexibility in ships' integration, with no dedicated sensors required. A variety of existing ship sensors can readily provide the target and pointing information required to engage the anti-ship threat.



RAM is the result of more than 30 years of successful US-German cooperation. Development costs are shared among Raytheon Company in the United States and the German companies MBDA Germany, Diehl Defence and RAMSYS. The Diehl Group and MBDA Germany are shareholders of RAMSYS.

#### ARMAMENT & TECHNOLOGY 🗖

management, making detection harder had obvious benefits. The use of "stealth" materials and technologies, shaping for example, had tremendous utility. This is reflected in changes in all areas of ship design from the mast to the forward gun. Emphasis on reducing radar, heat and noise signatures all offered significant benefits.

#### Active Measures

While electronic warfare, countermeasures, and ship and crew survivability enhancements all play key roles in dealing with the anti-ship missile threat, more active "hard kill" systems are a fundamental requirement. This led to the development of the Close-in Weapon System (CIWS), the logic of such a system was inescapable, what was harder to understand is why it took so long for many navies to field this capability. The most significant western CIWS system is the PHALANX (originally developed by General Dynamics but now a Raytheon product). This was first offered to the US Navy in the early 1970s, at that point more work was needed and it took until 1977 until the system fully met evaluation criteria, after which, in 1978, it was approved for production. The first US Navy installation was in 1980, with widespread deployment thereafter. The system was also supplied to numerous export customers. Consistently upgraded, PHALANX is now in the Block 1B configuration.

Elsewhere others were developing their own CIWS solutions, in the 1970s Signaal in the Netherlands (now Thales Netherlands) started work on a system that became known as the GOALKEEPER. Unlike PHALANX with its 20 mm M61 cannon, GOALKEEPER employed the GAU-8 30 mm cannon, as used in the A-10. The system entered service in the 1980s with the Royal Netherlands Navy, with its most significant export customer being the Republic of Korea Navy who use the system on three destroyer classes (KDX) and on the DOKDO Class LPD. Another European CIWS solution was the Oerlikon Contraves (now Rheinmetall) SEA ZENITH - this was a unique guad 25x184 mm system, but was only adopted by the Turkish Navy on its four YAVUZ (MEKO 200TN) and four BARBAROS (MEKO 200TN Track II) Class frigates.

The former Soviet Union also developed its own CIWS system in the form of the AK-630 which uses a 30x165 mm rotary cannon. This system came into service during the 1970s and was widely deployed by the Soviet Navy and export customers. Manufactured by Tulamashzavod and continuously upgraded, the AK-630 system continues to be extremely successful, both with the Russian Navy and with export customers such as India, who



In support of littoral combat the People's Liberation Army Navy (PLAN) has built more than 80 Type 022 HOUBEI Class missile attack craft. Small, fast and stealthy, they can carry up to eight anti-ship missiles. A mass missile attack from craft of this nature offers the possibility of simply overwhelming ship missile defences.

use it on their latest indigenous construction. Another Russian CIWS solution was the KASHTAN which is used on the carrier ADMIRAL KUZNETSOV and offers a combined gun and missile solution. Interestingly combined gun/missile CIWS systems have not gained much traction in the CIWS marketplace.

The AK-630 has also been purchased by China, but more recently Chinese destroyers and frigates have been equipped with indigenous Type 730 CIWS. Currently the Chinese Navy is deploying the Type 1130, another 30 mm calibre CIWS, which is used on the carrier LIAONING and is replacing the earlier Type 730 on new build Type 52D destroyers and Type 54A frigates.

Although the CIWS plays a critical role in defending against the missile threat in tandem with "soft kill" systems, the best defence is to provide a layered defence and engage missile targets at extended ranges. Naval air defence systems now offer the ability to detect and target missile threats at these extended ranges. Furthermore systems such as AEGIS offer the ability to target ballistic missile threats, this now has significant implications in defeating a new anti-ship threat in the form of the Anti-Ship Ballistic Missile (ASBM).



The USS MASON (DDG 87), a Flight IIA ARLEIGH BURKE Class destroyer of the US Navy, shown here in the Gulf of Oman in September 2016, fought off two anti-ship missile attacks in October. On 9 October she was targeted by two missiles launched by Houthi rebels, who are supported by Iran, then on 12 October she was attacked by two more missiles. In both cases the missile threat was defeated.

As to the future laser and directed energy weapons offer great potential as the defence of last resort against incoming anti-ship missiles. The key issues will be effective targeting, power requirements, reaction times and reliability. If these weapons can deliver in this regard then they might become part of the antidote to the increasing speed of the current and future projected missile threat.

#### **New Threats**

China has developed an ASBM in the form of the DF-21D which is aimed at US aircraft carriers operating in the Western Pacific, think of it as the ultimate access denial weapon. Initial DF-21D deployment is said to have started in 2010, and since then China has invested in support infrastructure for and refinement of the system. Using the weapon is no easy process, firstly one has to detect a moving target, certainly a carrier is a very big target, and then track it probably via overthe-horizon radar. In parallel with this target data must be passed to satellites to provide increased tracking information, additionally robust communications links are necessary to provide mid-course targeting updates to the missile and finally the missile must have an effective seeker to lock on to the target. Potentially the DF-21D might also employ decoys to defeat systems looking to intercept it.

Hitting a mobile naval target at extended ranges is an incredibly difficult task, but China obviously feels that it can achieve this, and if it has developed a counter to the US Navy aircraft carrier then it has changed the strategic calculus in the Western Pacific. However, possibilities to counter the DF-21D exist, radars used to detect targets for the system can be found and neutralised, satellites can be fooled through the use of obscurants and other measures, mid-course targeting updates can be subjected to electronic attack, as can the DF-21D seeker. Then of course there are active defence measures that can be taken using the AEGIS/ Standard missile combination. The fact that there are a lot of steps necessary to allow the DF-21D to make a successful attack creates a window of opportunity for countermeasures. Nonetheless, the DF-21D represents a new level of threat complexity for ship defence.

The threat is evolving in other ways as well, one way to cope with improved defences is to saturate them. An option that China has come up with is a littoral warfare solution in the form of the Type 022 missile craft, these small and stealthy 220 ton displacement units are capable of 36

knots and carry eight anti-ship missiles. Operating in large numbers these missile boats could potentially overwhelm an antimissile defence with the number of missiles they could generate. On an individual level the antiship missile threat has grown in sophistication and capability as well, a classic example being the Russo-Indian BrahMos. This is a big missile with a large warhead that comes in at extremely high speed and is capable of causing tremendous damage. Future anti-ship missiles will feature higher speeds further reducing defensive reaction times, making early detection critical to allow for an incoming target to be classified and engaged.

To conclude it is worth talking about a new development in the context of anti-ship missiles and that is an asymmetric threat. On 14 July 2006, INS HANIT, a SA'AR 5 Class corvette of the Israeli Navy, was on patrol some 18.5 kilometres off the Lebanese coast. The SA'AR 5 is a modern corvette of 1,275 tonnes displacement, with a length of 85.64 metres, having the BARAK 1 air defence system and the PHALANX CIWS, in addition it had a full range of electronic warfare and countermeasures systems. And yet it was struck by a single missile from a Hezbollah coastal battery equipped, most probably, with an Iranian version of the Chinese C-802 missile. HANIT did not expect to be attacked and her defensive systems had, unknown to the Captain, been placed in standby mode and could not be reactivated in time. More recently on 1 October, off the Red Sea port city of Mokha in the Yemen, a 1,695 tonne displacement highspeed catamaran built by Incat in Australia that was leased to the United Arab Emirates (UAE) military and engaged in delivering aid to Aden, was hit by an antiship missile fired from a shore-battery operated by Iranian-supported Houthi rebels. The UAE operated vessel was severely damaged. Then on 9 October, the US destroyer USS MASON was targeted by two Houthi-launched missiles off Yemen, the missiles were successfully nullified. On 12 October, USS MASON was targeted by two more missiles, countermeasures were deployed and the missiles missed their target.

The USS MASON, as an ARLEIGH BURKE Class destroyer, had all the tools necessary to defeat an incoming missile threat as proven by her experiences off Yemen on October 9 and 12. More importantly they were aware that there was a threat, unlike HANIT, and were prepared to react. You can equip a naval unit with all of the "hard kill" and "soft kill" tools necessary to defeat the anti-ship missile threat, but in the end it is awareness of the threat and an ability to react, provided by an effective training regime, that is critical.



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# **Russia's Hypersonic Cruise Missile**

#### **Debalina Ghoshal**

In March 2016, reports confirmed that Russia had test-fired a hypersonic cruise missile called the 3M22 ZIRCON missile.

his missile is a member of the 3K22 ZIRCON family of missile systems. Serial production of the missile system is expected to start in 2018, while throughout 2017 the system will complete its test regime. Hypersonic speeds of Mach 5 to Mach 6 could render opposing missile defence systems ineffective: intercepting hypersonic cruise missiles turns out to be a complex task.

This missile is reported to have been testfired from a sea-based launcher, completBoth the PYOTR VELIKIY and the ADMIRAL NAKHIMOV cruisers of the KIROV Class are being upgraded with this new hypersonic weapon. ADMIRAL NAKHIMOV will reenter operational service in 2018. There are also reports that the PYOTR VELIKIY and ADMIRAL NAKHIMOV will receive a naval version of the long-range S-400 and the mid-range POLIMENT-REDUT missile systems, and speculation that they might also be equipped with the S-500 missile system. risov, stated that Russia would also develop similar weapon systems as a component of its rearmament programme for the decade of 2016-2025. It is self-evident that hypersonic systems would be Russia's choice in developing similar global strike systems. Russia is developing the BRAHMOS hypersonic missile system in collaboration with India, and Moscow is also working on the Yu-17 hypersonic glide vehicle (HGV) which is reported to be nuclear-capable. Moreover, since the days of the Cold War, the Soviet Union has applied an "anti-ac-

cess/area denial" (A2/AD) strategy to deny the United States and other NATO powers naval supremacy and unhindered influence





The KIROV Class cruisers, which include the depicted PYOTR VELIKIY, are being upgraded with a new hypersonic weapon.

ing the first trials of the sea-based version. It is destined to equip the nuclear-powered HUSKY submarines currently under development, and also the Project 11442 nuclear-powered KIROV Class battle-cruisers. The HUSKY nuclear submarines are considered to be a fifth-generation submarine. According to reports, the KIROV Class cruisers will be fitted with the multi-role 3S-14 vertical launch systems (VLS). The cruiser already carries the 130 mm AK-130 gun, surface-to-air missile (SAM) systems, KORTIK close-in weapons systems and the VODOPAD antisubmarine missile/torpedo system.

#### Author

**Debalina Ghoshal** is an independent consultant specialising on nuclear, missile and missile defence related topics. She was previously associated with the Centre for Air Power Studies and the Delhi Policy Group. The ZIRCON anti-ship cruise missile system is expected to replace the P-700 supersonic GRANIT anti-ship missile system, and will probably also replace the supersonic P-800 ONYX and KALIBR NK anti-ship missiles. Though the ZIRCON's features are not yet known, reports have suggested that the range of the missile is around 400 km. According to Igor Korotchenko, editor-in-chief of National Defence, the ZIRCONs would "improve the ship's combat characteristics, survivability and firing capabilities as well as expand its combat mission scope in various theatres of naval operations".

States such as China and the US are working on hypersonic missiles for greater swiftness and for the timely engagement of time-sensitive and mobile targets. The US is already working on its strategy of Conventional Prompt Global Strike (CPGS) whereby it plans to develop a family of weapon systems that could reach any part of the world in sixty minutes or less. In 2014 the then Russian Deputy Defence Minister, Yuri Boin a particular region. Strategising A2/AD capability is a common practice by revisionist states, amongst which Russia is only one. Another is China, that pursues an A2/AD capability to deny the United States any naval supremacy and to check Washington's growing influence, especially in the Asia Pacific region. In Moscow's and Beijing's view, an A2/AD strategy is even more crucial as the United States implements the Air Sea Battle concept and the CPGS.

Anti-ship cruise missiles, especially hypersonic systems, would strengthen Moscow's A2/AD capability. In the light of Russia's own pivot to Asia (as the conclusion to the Ukrainian crisis) Moscow has to deal with US naval supremacy in the Far East region. Russian anti-ship missiles would enable Moscow to exert its own naval influence and become a maritime power again. It is therefore obvious that Russia will continue to develop sophisticated weapon systems, both offensive and defensive, to counter US domination in Asia.

# Russian Defence Industry in the Era of Putin

#### Eugene Kogan

There is a preconceived and very inaccurate perception in the West at large that the Russian Military-Industrial Complex (MIC) has and will continue to have difficulties in the coming years because Russia faces domestic economic challenges caused by the low price of oil, continuing economic sanctions imposed by the EU and the US and the breakdown of defence industrial relations with Ukraine.



KURGANETS-25 armoured personnel carriers with medium-category caterpillar chassis at the military parade in Moscow on 9 May 2016

#### Author

**Dr Eugene Kogan** is a defence and security expert affiliated to the Tbilisibased Georgian Foundation for Strategic and International Studies (GFSIS). The author would like to thank Ilya Zhitomirsky, USC Communications Director, for assistance in the preparation of this article. There is very little understanding in and by the West at large that for President Vladimir Putin the issue of rearmament and, as a result, the correctly-functioning MIC enabling the planned delivery of weapons systems to the armed forces are of crucial importance, and that the Russian president is not ready to yield an inch in tenaciously pursuing his ambitious domestic agenda. What is more, as Alexandra Suslina, an economic analyst said: "The economy is far from the government's priority. They do not even pretend it is". Putin is also ready to back up a properly functioning

MIC financially even if Anton Siluanov, Minister of Finance, continues to baulk. Furthermore, Putin and his ambitious agenda are tacitly supported by the Russian population, that perceives the West at large as its major adversary. And the Russian population is ready to tighten its belt further and at the same time financially to support MIC operations. To a Western audience the sacrifices made by Russians for the sake of the MIC operations may sound like a paradox: however, for Russian patriots sacrifice and support are one and the same thing. It also needs to be remembered that the MIC employs four million workers, who pay taxes, get subsequently a monthly wage, and, as a result, support a stable purchasing power of the population and at the same time stimulate trade and services. Not surprisingly, on 5 March 2016 Tatyana Shevtsova, Deputy Minister of Defence for Defence Expenditure, said that: "The Russian president agreed that cuts in the rearmament programme may undermine national security and must be approved by the Security Council, taking into consideration existing threats". On 21 September 2016 Nezavisimaya Gazeta online published an article entitled "[Defence] Expenditure for Rearmament is not Going to Suffer a Cutback". On 31 October 2016 Nezavisimaya Gazeta online published an article entitled "The Budget 2017 in the Regime of Demilitarisation", stating clearly that the allocations for na-

#### Russian Defence Industry is not Floundering but Prospering

Despite domestic economic challenges, the Russian defence industry is prospering since the government financially supports a massive (re)armaments programme that has escaped state spending cuts, while at the same time Russian defence companies are exporting a large quantity of weapons. The national defence export agency, Rosoboronexport (RoE), supports the current trend and is also interested in attracting a number of new customers for Russian arms worldwide. For instance, while in 2015 RoE sold arms worth US\$14.5Bn, during the first eight months of 2016 RoE sold arms worth US\$8Bn and plans to sell arms for additional US\$5Bn before the year end.



Rosoboronexport (RoE) as the national defence export agency supports the acquisition of new customers for Russian arms worldwide.

tional security will be maintained at the same level as before. Siluanov said that: "Despite (mounting) difficulties we will continue modernisation of the armed forces". Thus, both recent articles reinforce Putin's preferences loud and clear, so any discussions pertaining to revision of the rearmament programme are aimed towards the Western audience that should be reassured that Russian economy cannot sustain its high military spending for long, and that the MIC is unable to cope with the procurement targets. The reality as presented below is indeed very different, and on this point other experts in the field may disagree with the author.

In addition, reforms to Russia's (arms) export laws, enacted in mid-2014, have also allowed a small group of defence equipment manufacturers to engage directly in pursuing service and support contracts without having to go through the RoE. As a result, a number of companies ranging from Russian Helicopters to the Russian Concern for Radio-Electronic Technologies (KRET) – are currently able to lower their overheads and pursue direct contracts with equipment operators. By way of example, in 2013, KRET made US\$2.4Bn in revenue. In 2015, KRET's consolidated revenues were US\$1.9Bn, including US\$1.6Bn from the sale of military goods. According to Igor Nasenkov, First Deputy Director-General of KRET, "The current 22% of its US\$1.9Bn revenues will be increased to 37% by the end of 2017".

The United Shipbuilding Corporation (USC) is the world's largest exporter of ship hulls, exporting US\$900M worth of submarines and US\$400M worth of surface vessels in 2014. On 4 October 2016, in an e-mail to the author, Ilva Zhitomirsky, USC Communications Director, wrote that: "The corporation's net profit in 2014 stood at RUB11.4Bn (about US\$165.6M), with revenues of RUB260.7Bn" - about US\$3.6Bn. On 29 September 2016, in an e-mail to the author, Zhitomirsky wrote that: "The company revenues in 2015 were RUB304.3Bn, of which RUB20.7Bn was net profit." Financial data for 2016 is not yet available.

The United Aircraft Corporation (UAC) saw revenues rise 7% to US\$6.2Bn in 2014, while in 2015 the revenues slightly decreased to US\$5.8Bn. In the first six months of 2016, the corporation's revenues increased by 24.3% to RUB128.6Bn (US\$2Bn). The RAC MIG, part of UAC, saw revenue increase by 13% to RUB44Bn in 2015.

Russian Helicopters saw revenues rise 16% to US\$3.96Bn in 2014 and slightly decrease to US\$3.6Bn in 2015. The net profit of the company in the first six months of 2016 was RUB9.8Bn (US\$150.5M). It can be said that Russian Helicopters remains successful. According to the Rostvertol report, the net profit of the company, one of Russia's largest helicopter manufacturing and repair facilities, part of Russian Helicopters, for 2014 increased by 83% to RUB5.6Bn from RUB3.1Bn in 2013. Net profit for the first half of 2016 has reached RUB17.9Bn (US\$275.3M).

The United Engine Corporation (UEC) saw a 25% increase over 2013 revenues to US\$3.3Bn in 2014. The company's net profit for the first half of 2016 has reached RUB7.7Bn (US\$118.4M). The Radio Technical Engineering and Information Systems' (RTI) revenues saw a 15% increase to US\$947M in 2014. In 2015, RTI's consolidated revenues were US\$1.050Bn, including US\$660M from the sale of military goods. The aforementioned companies represent the crème de la crème of the Russian MIC.

In the words of Alexander Scherbinin, Deputy Director-General of Russian Helicopters, "In the next two years (namely 2016-17) the company plans to keep the order book at the current level and sell between 230 and 280 helicopters annually". Besides the order book, Russian Helicopters began actively to develop post-sales service centres and opened two such centres in Egypt and Iran in 2015, in addition to six centres already operating around the world. It should be remembered that over many years the Russian Achilles heel was the lack of a proper maintenance base and timely delivery of helicopter spare parts to customers worldwide. Apparently, Russian Helicopters learned the right lesson. Although the Russian annexation of Crimea and the ensuing war in the Eastern Ukraine has contributed to the breakdown of ties between the Russian and the Ukrainian MIC the performance of the Russian MIC as presented above was not affected and the necessary production units were moved back to Russia. As General Yuri Borisov, Russian Deputy Minister of Defence for Procurement, said on 29 December 2014: "Production of main propulsion units for frigates was moved from Zarya-Mashproekt in Ukraine to the NPO Saturn plant of the Russian UEC in 2014. Diversification efforts have included moving Mi-8/17 engine production from Motor Sich in Zaporozhye to Klimov in Saint Petersburg, shifting the production of low-value components to Belarus and China and also moving naval turbine production from Zarya-Mashproekt to the Zvezda plant of the USC". The production of these items in Russia is likely to pick up pace from 2017 onward,

likely to pick up pace from 2017 onward, while according to General Borisov defence industry imports from Ukraine will be completed by the end of 2017. The General further said that: "The import replacement programme is being carried out, and all activities with Ukraine should be completed by 2018".

#### **Current Critical Problems** and the Way Ahead

It should be emphasised that in the post-Soviet era the MoD has made very few investments in the defence electronics sector, which has been unable to keep up with the rest of the world. The defence electronics companies became too dependent upon sourcing many electronic components from outside Russia. The case of RTI presented below supports the author's assertion. Sergey Boev, Director-General of RTI, said: "Electronics of all Russian-made radars will be free of imported components in the near future, but it will be hard to substitute VHF microchips". In mid-August 2015 Boev further reiterated his company's dependency on imported electronic components by saying that: "In 2016 the situation



Russian Helicopters military aircraft participating in the "Victory Parade" on 9 May 2015

compared with 2015 will be more difficult, because 70% of our equipment consists of imported components". The Russian Ministry of Industry and Trade plan shows the proportion of imported components in the electronics industry should be halved by 2020. In several areas, such as integrated microchips, imported components are supposed to be reduced from the current 85% of the total to 45% by 2020. In the case presented above, solutions are not immediately available and require more time to be mastered compared with other branches of the MIC.

Despite the full support that the government provides to its armaments programme and to arms export success, the personnel profile of the MIC is ageing; the average age is above 55 and that of the scientific research institutes is 60. However, over the last several years the government has begun to provide financial incentives to attract younger em-

ployees. For instance, according to (nonidentified) government data, about one thousand MIC personnel, most of them young specialists, were awarded grants for their contribution in developing a technological breakthrough and the development of modern weapons systems. In mid-August 2015 Boev said that: "The Company implemented a new system for training and retaining prospective employees from the secondary school level, rather than only universities as it was in the past". As a result, RTI moved from 99th place on the Defense News top 100 companies in 2014 to 69th place in 2015. However, the above-mentioned trend is not observed, for instance, at the RAC MIG where the average monthly wage increased to RUB43,000 and the number of workers including young personnel and engineers are sufficient to maintain the company's growth.

In another example, despite a steady increase in revenues, in early November



*Vladmir Putin's support for the domestic Military-Industrial Complex* (*MIC*) seems to be backed by a large part of the Russian population.

#### Masthead

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Annual subscription rate (6 issues): €49.80 incl. postage 2015 Russian Helicopters began to restructure one of its plants based in Kumertau, Bashkorstan. The plant did not have a sufficient workload and, as a result, accumulated losses of about RUB2.5Bn in 2014. As a consequence, Kazan Helicopter Plant and Kumertau Aviation Production Enterprise are to merge and from 2018 a merged facility will manufacture a variety of civilian and military helicopters such as ANSAT, Ka-31/32/226 and Mi-8/17/38.

Following a decision by the Russian government, on 29 April 2016 NAZ Sokol in Nizhny Novgorod was merged with RAC MIG. According to Aleksey Beskibalov, Deputy Director-General for Corporate Finances, "The merger will have a synergy effect". In an interview with Vedomosti online on 22 December 2015 Sergei Korotkov, Director-General of RAC MIG, said: "The merger will lead to dismissal of between 5% and 10% of the company (managerial and administrative) staff, however, the dismissals will not affect workers and engineers".

The powerful Rostec industrial holding company, that controls about 700 companies in machine-building and MIC sectors, including RoE, is to eliminate about 40,000 employees from its corporate staff over the next two years. One of the follow-on effects of this downsizing is the liquidation of intermediary entity Oboronprom. This company originally controlled both Russian Helicopters and UEC, which were subsequently taken over by Rostec.

In other words, in order to infuse fresh blood into the MIC the government began to provide financial incentives, and also, as was highlighted in the case of RTI, expanded the pool of new employees for the company. In order to make the performance of the MIC enterprises efficient and profitable, ongoing mergers and restructuring are the way ahead out of the current difficulties.

Finally, the current rearmament programme foresees that the MIC will continue to deliver weapon systems to the armed forces up to 2020, when 70% or slightly more of the armed forces will be equipped with modern (and not modernised) weapons. According to Putin, "By 2020 the large-scale rearmament will be completed and the peak in deliveries will be over. Nonetheless, we will continue to improve the state of the armed forces, even though such a large-scale order for the MIC will be over". What the scale of orders will be for the MIC post-2020 is not yet known. As a result of that uncertainty, Putin suggested paying attention to the manufacture of civilian goods by the MIC. We need to remember, however, that the current Russian MIC, just as its Soviet predecessor, is not wellsuited to the production of civilian goods. Past experience shows that Russian consumers were and still are not eager to buy domestic appliances. Whether or not directors of the MIC will heed Putin's orders is not clear at the moment. Furthermore, even the Russian civil aviation facilities have difficulty in manufacturing first-rate commercial aircraft such as the touted Sukhoi SUPERJET 100 (SSJ100) and the planned MS-21: domestic air carriers somehow prefer purchasing Airbus and Boeing craft despite the government imploring them to buy Superjets. Thus, the effort to diversify production for the needs of the civilian sector may not pay off even if Putin prods the directors of the MIC.

To conclude, until 2020 the MIC remains busier than ever before, delivering weapon systems to the armed forces and exporting military goods worldwide. Thus far this mixed strategy has proven to be successful. As for the era after 2020, it is too early to make a prudent forecast. One thing is certain: at the moment the blueprint for the MIC enterprises post-2020 is not ready. The talk about diversification of MIC products for the civilian market is cheap and useless. Russian patriotism preached by Putin to buy domestic civilian goods has a low appeal and the Russian population living in the larger cities has become used to foreign civilian support for the domestic MIC is real and beyond any doubt.

# Turkey: Maritime Strength and the Naval Industry

#### Korhan Özkilinc

The geopolitical surroundings of Turkey are characterised by a complex mesh of relations, and with its 8,400 km coastline the country has a very intense interest in the maritime affairs of the Middle East.

urkey also has a strategic advantage at the interface of the Danube, Euphrates and Tigris – the "Blue Gold" – and accords special attention here: Turkey is rich in maritime policy combined with foreign policy.

#### **The Maritime Surroundings**

The Russian invasion of the Ukraine and annexation of the strategic Crimean peninsula, and the escalating crises in the Middle East, relegated many territorial developments to the background. Russia is trying with all its multi-polar influence to impose policies in the Middle East through massive expansion in the strategic naval base of Tartus and the air base of Latakia in Syria. Recently, Russian warships "ran up" the Cypriot ports of Paphos, Limassol and Larnaca, while concurrently the Russian and Egyptian forces carried out joint military exercises, the "Defenders of Friendship in 2016". All these are strategic chess moves trying to enmesh Turkey and its western allies in the maritime politics of the Middle East while simultaneously cooperating with both countries in a variety of ways – for example, securing resources and expansion of the "Turkish Stream" energy corridors. In response, Turkey has good relations with Ukraine and cooperation in different aviation and defence projects.

Therefore Turkey must maintain, in spite of many maritime discrepancies and spatial developments, her interests through the balancing act of policy.

Nonetheless, very discreetly for the last decade China has purchased trans-shipment ports, for example Piraeus (Greece) in the Aegean sea, as part of its aim to gain worldwide control over the shipping lanes. In contrast, Turkey is considering whether the port of Çandarlı (Izmir) should be expanded under the direction of China to become a deep-water port. A cooperative collaboration with China would be wise so that Turkey could emphasise her strategic position on the silk road: but the flip side of the coin is that



The guided-missile frigate USS TAYLOR (FFG 50) and the Turkish frigate TCG TURGUTRIES (F-241) conducting a tactical manoeuvring exercise in the Black Sea in May 2012

we have to expect, in the near future, massive traffic of the Chinese Navy in the Aegean and in the Mediterranean Sea, and these developments could generate new conflict situations in this region.

After General Al-Sisi seized power, the Egyptian Naval Forces – in a short time and through massive procurement – acquired two LHDs (MISTRAL-class), one multi-purpose frigate (FREMM-class) and four corvettes (GOWIND 2500-class, under construction) from France. Additionally, four Type U-209 submarines are under construction in Germany. These developments show that Egypt wishes to exert more influence in the Near East.

Then, last but not least, Israel strengthened her submarine fleet with six DOL-PHIN-class (heavily-modified U-209s) from Germany, which are able to fire nuclear missiles. Additionally, four German corvettes (K 130 BRAUNSCHWEIG Class) are under construction, and the consignments shall probably be delivered in the near future.

Spheres of interest in the Mediterranean, Aegean and Black Sea focus primarily on securing resources, energy corridors and sea crossing routes, but these can be massively impacted by international terrorism and illegal immigration.

The current status of fragile states in the Middle East and the Balkans requires a sophisticated security architecture and the increased presence of the Turkish Navy on the high seas. Strategically, Turkey is strengthening the perception of its military through the establishment of bases in Albania, Azerbaijan, Iraq, Qatar and Somalia, underlining the mindset of the State by the transfer of its peacekeeping security-political role into world policy.

# Maritime Alliance Capability and NATO

The political forces of Turkey within NATO are very significant, especially regarding maritime capability: the geo-strategic position and maritime strength of Turkey are hugely important for the transatlantic Alliance. The involvement of the Turkish Navy in Standing NATO Maritime Group 2 (SNMG 2), the Standing NATO Mine Countermeasures Group 2 (SNMCMG 2) and NATO Response Force (NRF) is considered to be an important contribution. Some examples of completed and ongoing operations are; Operation OCEAN SHIELD, Operation ALLIED PROVIDER and the upcoming Operation SEA GUARDIAN. In addition, Turkey's participation in multi-national tasks is impressive. For example, as the initiator of the Black Sea



The Standing NATO Maritime Group 2 (SNMG2) trained with the Turkish Navy in the Eastern Mediterranean in February 2016.

Naval Cooperation Task Group (BLACK-SEAFOR) Turkey will ensure security in the Black Sea. Turkey is also an important partner in the Proliferation Security Initiative. Turkish missions under UN mandate are significant, such as UNIFIL, which monitors the peace agreement between Lebanon and Israel. Furthermore, worthy of mention is Turkish involvement in the multinational coalition naval task force, Combined Task Force 150 (CTF-150).

The Turkish Navy also conducts intensive naval exercises with friendly countries such as the UAE, Pakistan, South Korea and Japan; also, the provision of humanitarian support in Africa in 2014, the BARBAROS Turkish Maritime Task Group. Unfortunately the naval exercise between Turkey and Egypt ("Sea of Friendship 2011"), which had been conducted regularly, was discontinued due to continuing negative political developments.

Due to today's frequent crises, many conflicts are incalculable and endanger the security and economies of many states, so the Turkish Naval Forces and also NA-TO partners will demand even more in order to keep the balance between police tasks and conventional tasks. These can only be tackled and solved in joint forces.

#### **Turkish Shipyards**

The origins of modern military ship-building in Turkey were established from 1960 onwards, with foreign assistance for 30-35 years. In this time many ships were delivered from the USA as used, but new vessels were delivered from Germany or built in an alliance in Turkey. The turning point was the development of the "MILGEM" project, which emerged confidently in early 1996 but really only started in 2004, and this was the resurrection of Turkish shipyards. In Turkey there are a lot of shipyards with significant expertise: until five years ago the goal was that not more than a handful of shipyards should be involved in naval projects, but it seems that the other shipyards want their piece of this lucrative cake. Although the leases of the shipyards have recently been extended to 49 years, each of them must constantly stand against brutal competi-



TCG BÜYÜKADA, the second ship of the ADA Class ASW corvettes of the Turkish Navy, was constructed at Istanbul Naval Shipyard.

tion with regard to prices, costs and especially deadlines.

#### Naval Shipyards

Istanbul Naval Shipyard:

INS is located in Istanbul Pendik and specialises in naval shipbuilding and repair of all types. The Naval Research Center Command is also domiciled in INS. The area is bigger than 1 million m<sup>2</sup> and includes many docks between 100 m and 300 m.

#### Gölcük Naval Shipyard:

GNS is located at the Gölcük Naval Base and is very well-equipped. The area is almost 400,000 m<sup>2</sup>. GNS is also the main

#### Desan Shipyard

Desan dates back to the 1950s. The company has the capacity to build large ships and tankers at its 200 metre long docks.

#### DÜZGIT Shipyard

Düzgit's origins can be traced back over 40 years and the shipyard specialises in tankers and small patrol boats.

#### Istanbul Shipyard

The company was founded in 1980 and builds various sizes of oil and chemical tankers. The trio of one submarine rescue and two towing ships was delivered by Istanbul Shipyard.



LCT C-151 was delivered to the Turkish Navy in 2012 as the first of eight fast amphibious ships from Anadolu Shipyard (ADIK).

address for submarine construction and repair – the U 214TN will be built in GNS. Both competitors – GNS and INS – can build vessels up to 40,000 tons.

#### Izmir Naval Shipyard:

IzNS is an important part of the Turkish Navy in the Aegean, with an area of 200,000  $m^2$ ; its main task is the support and repair of vessels.

#### **Commercial Shipyards**

Anadolu Deniz Insaat Kizaklari ADIK Shipyard

ADIK was founded in 1950 and has built ships in sizes up to 20,000 DWT. Their competence is more towards logistic vessels.

#### ARES Shipyard

ARES is a highly-skilled, new and dynamic company with plans to construct coast guard boats, patrol boats and small attack boats.

#### DEARSAN Shipyard

The company is skilled in the construction of various types of ship, including: corvette class ships, multi-purpose search and rescue (SAR) ships, fast intervention boats, attack boats and fast patrol boats boats. Special attention should be paid to their TUZLA Class 57-metre patrol boats.

#### RMK Marine Shipyard

RMK is one of the largest shipbuilding companies in Turkey and has outstanding expertise in the construction of modern ships, super-yachts and warships.

#### SEDEF Shipyard

The company is the largest private shipyard in Turkey. The Turkish LPD TCG AN-ADOLU will be built by SEDEF.

#### Sefine Shipyard

Sefine was founded in 2005, and its expertise is found in cargo ships, ferry vessels and rescue boats.

#### Selah Shipyard

Selah was founded in Istanbul in 1982, and has been building special vessels like logistic support ships.

#### Yonca-Onuk JV

The company has been building fast attack boats and fast patrol boats up to 40 m in length for domestic and international customers since 1986. These types of boats are held in particularly high regard by the Turkish Special Forces.

Upon closer observation of the projects, all the vessels will be built the first time in Naval Shipyards with the involvement of the private sector, and then the follow-on ships will be built by private shipyards. This procedure has been applied since 2004, and has an important purpose: the transfer of military shipbuilding expertise will lead to increased competitiveness of the commercial shipyards.

#### **Turkish Naval Projects**

Turkey is trying to increase its own naval forces through domestic production. In this respect the SSM owns slightly more than 30 naval programmes, with an estimated value of US\$8-10Bn. The projects listed below are mostly in the development process or currently about to start; some of them have recently been completed. The goal of these strategic procurements is to transfer the Force Projection of the Turkish Navy to Medium Global Forces and this will be achieved not later than five to seven years hence.

#### Coast Guard Search and Rescue Ship

The contract was signed between RMK Marine and SSM at beginning of 2007. The four Coast Guard Ships were supplied between 2009 and 2014, TCSG DOST (SG 701), TCSG GÜVEN (SG 702), TCSG UMUT (SG 703) and TCSG YASAM (SG 704). The ships have a length of 89 m and, displacing nearly 1,700 tonnes, can also undertake in defined tasks the role of the corvettes.

#### New Type of Patrol Boats (NTPB)

The contract for the construction of 16 Patrol Boats was signed in August 2007, between SSM and DEARSAN Shipyard. The 57-metre Patrol Boats have a complement of 34 and will be used for reconnaissance, surveillance and protection in coastal zones. They are also able to hunt submarines with effective weapons systems. Some 70% of the systems were integrated from the domestic industry. DEARSAN was able to sell 10 boats to Turkmenistan.

#### Landing Craft Tank (LCT)

In 2013 ADIK Shipyard delivered eight landing ships. The length of the ships is almost 80 m, they have a range of 400 nm with 330 tons of freight embarked, and will be supported by a 20-man crew.

#### Landing Ship Tank (LST)

The contract for two LST ships was signed with ADIK Shipyard in June 2011. The 140 m long and almost 7,300-ton LST ships are able to transport 1,200 tons of cargo to an operating range of 5,000 nm. On the deck is a landing place for a 15-tonne helicopter and the propulsion system consists of four 2,880 kW

diesel engines. Aselsan has delivered all the communication and electronic systems; the Command and Control System has been integrated by Havelsan. Both LSTs – TCG BAYRAKTAR (L-402) and TCG SANCAKTAR (L-403) – are in the testing phase and will be delivered to the Turkish Navy in 2017.

#### MoShip & RaTShip

The SSM has built for €170M three ultramodern submarine rescue ships through Istanbul Shipyard. The project consists of a Submarine Rescue Mother Ship (Mo-Ship 4000) and two Rescue & Towing Ships (RaTShip 2000). The MoShip is 91 m long, has an operating range of



TCG HEYBELIADA (F-511) was launched in 2011 as the first ship of the MILGEM project.

#### Logistic Support Ship (LSS)

By the end of 2014 Selah Shipyard won the contract to build two LSS for the Turkish Navy and these are under construction. The 105 m long vessels weigh a little more than 6,200 tonnes and should be able to transport 4,000 tonnes of marine diesel fuel, 330 tonnes of Helicopter Fuel, and 550 tonnes of fresh water. The armament is two independent 12.7 mm calibre turrets.

#### Seismic Research Vessel 87 (SRV87)

The General Directorate of Mineral Research and Exploration (MTA) was for a long time reliant on foreign marine companies for research and analysis of the bottom of the sea. The order for the special ship SRV87 was signed in 2012 between Istanbul Shipyard and SSM. The MTA TURKUAZ SRV 87 with a hull length of 87 metres includes many sensor systems for 2D/3D seismic research and sampling for hydrographic, hydro-acoustic and geological studies. Currently, the MTA TURKUAZ is in the testing phase and will be delivered in the near future. 4,300 nm and is equipped with multibeam sonar, remotely operated underwater vehicles (ROV) and atmospheric diving suits (ADS) which can operate down to a depth of 3 km. The two RaTShips have a length of 69 m and operating ranges are 4,000 nm. They are equipped with the most modern technologies. Both have a helicopter landing platform. The MoShip TCG ALEMDAR (A-582), and the two RaTShips TCG ISIN (A-583) and TCG AKIN (A-584) were launched in 2014 and are expected into service at the end of 2016 or beginning of 2017. The vessels are highly complex systems and confer an enormous amount of prestige on the Turkish Naval Industry.

### MİLGEM (ADA-class Corvette & I-class (F-100 Frigate)

The MILGEM (national ship) is a class of Turkish corvettes and frigates that are designed so that they can also operate in coastal waters (Littoral Combat Ships) and should be stealthy. The project began in 2004 and the first ship, TCG HEYBELIADA (F-511), was launched in 2011; the second, TCG BÜYÜKADA (F-512), in 2013; the third, TCG BUR-GAZADA (F-513), is in the testing phase and will be in service at the end of 2018; and the fourth in the class, TCG KINA-LIADA (F-514), is planned for 2019. All the corvettes in this class were or will be planned and built in Istanbul Naval Shipyard. The skills acquired from this ADA-class project should be included into the four planned I-class frigates (F-100-class). The planned 120-metre frigates are larger and are equipped with different weapon systems like the Mk.41 VLS, as well as a lighter ESSM system. The first frigate, TCG ISTANBUL (F-515), will be completed by Istanbul Naval Shipyard and the following frigates, TCG IZMIR (F-516), TCG IZMIT (F-517) and TCG ICEL (F-518), will be com-



Successful test of the ATMAKA missile
pleted by the private shipyards. Seven private Turkish shipyards have bid for this tender. Deliveries should take place between the years 2021-2024.

#### Landing Platform Dock (LPD)

The LPD (TCG ANADOLU) is the largest defence project of the Turkish marine industry and is a component of an ambitious and comprehensive project. Additionally, the LPD will get 27 Amphibious Armed Vehicles (AAV), four Landing Craft Mechanics (LCM), two Landing Craft Personnel Vehicles (LCVP), one Commander Boat and one Rubber Hull Inflated Boat (RHIB). The decision for the procurement was taken at the end of 2013 by the Defence Industry Executive Committee and in June 2015, Sedef Shipyard was commissioned to deliver the LPD to the Turkish Navy in 2021. The Turkish LPD TCG ANADOLU is based on the Spanish LPD JUAN CARLOS I; the Spanish company Navantia will provide design, technology transfer and more to Sedef Shipyard. The

layed due to "disagreements", and started on 28 September 2015. The commissioning of the first submarine (REIS-class) is expected in 2020. The U-214 TN is a healthy mix of the submarine types U-209 and U-212A of ThyssenKrupp Marine Systems (TKMS). The U-214 TN is, in comparison (65 m long and with a 27-man crew) with ballistic and nuclear hunting submarines, quite small, but it is equipped with sophisticated systems. As a "sensor", it is able independently to perform complex tasks in different operations and also can operate in networked structures; its superiority is pronounced. The U-214TN is equipped with an air-independent fuel-cell-based propulsion system and is one of the world's quietest conventional submarines.

#### TF 2000

The gained competitiveness from the two MILGEM projects (ADA-class corvettes and I-class frigates) will be transferred to the Air Defence and Command frigate TF-2000. In total four (+2 optional) frigates



*The Landing Ship Tank (LST) TCG BAYRAKTAR (L-402) was launched in October 2015.* 

LPD is approximately 230 m long and displaces almost 28,000 tons. The powertrain will propel this colossus with a full load up to 21 knots and the operational range is almost 9,000 nm. TCG ANADO-LU is designed for carrying some 1,200 persons, thereof 900 infantrymen. The deck itself might be used for 10-12 F-35 B STOVL aircraft (not yet decided) or it can embark 12 helicopters.

#### U-214 TN

Turkey decided in July 2008 to procure six submarines of the type U-214TN, and these should be built in Gölcük Naval Shipyard. The signing of the contract was in July 2009 but the start of the project was deare planned. The hull of the ship is almost 150 m long, displacement over 7,000 t, and the weaponry is classified but it is expected that the ship will receive a 32 Cell Mk41 VLS, ESSM, SM2, Anti-Ship Missile ATMACA (Roketsan), torpedo launcher, a Goalkeeper CIWS Gun System and a large calibre gun. The two local heroes, Aselsan and Havelsan, are working hard on the domestic ÇAFRAD radar system. ÇAFRAD (Çok Amaçlı Faz Dizili Radar) consists of a variety of different modular systems, such as multifunction, 3D long range surveillance radar, illumination/fire control radar, EO Surveillance. Havelsan is working on the highly advanced Combat Management System, GENESIS Advent (Gemi Entegre Savas Idare System). The mission ability should be adapted into different usage scenarios:

- Anti-Air Warfare (AAW)
- Amphibious Warfare (AMW)
- Anti-Surface Ship Warfare (ASU)
- Anti-Submarine Warfare (ASW)
- Command, Control and Communications (C3)
- Command and Control Warfare (C2W)
- Strike Warfare (STW).

As always, the first frigates will be built by Istanbul Naval Shipyard and the first service entry is expected in 2023. The following three other ships will be built by private Turkish shipyards. These battleships will play a strategic role in the Turkish Navy; in addition to monitoring their own airspace they will also defend the southeast flank of NATO, meaning that they will be integrated into the NATO BMD Network.

In addition to all the intentions outlined above, there are two large and two smaller tenders on the way. The first of them, for eight "600-Type Coast Guard Ships", has attracted the attention of almost all of the eight companies (ADIK, DEARSAN, Desan, Istanbul Shipyard, RMK Marine, SEDEF, Sefine, Selah). The second, for the project to build one "Fleet Replenishment" ship, has only attracted bids from SEDEF and Sefine. The decisions for smaller projects - eight fast patrol boats and two high speed special warfare (special operation craft) boats - will be announced at the end of 2016 or in the first guarter of 2017. There are only two candidates for these procurements: ARES and Yonca Onuk Adi co-partnership. The decisions of the SSM are awaited with great excitement.

#### Conclusion

The maritime strategy of Turkey builds on the historical naval power, and the geographical identity of the country. But the roles and presence of the Turkish Navy go beyond the limitations of the "multiple identities", and reflect the ambitions of long-range foreign policy. Turkey's maritime expertise is expected not only in the Aegean Sea, the Black Sea, and Mediterranean but also, strongly, in the Atlantic and Indian oceans.

The Turkish naval industry is highly competent but still operates more in the domestic rather than in international markets. The aim would be to achieve strong consolidation by mergers or JVs within the Turkish Naval Industry. This development would not only promote growth, but also the desired internationalisation would be accelerated.

# **Meggitt on the Export Trail**

During the AUSA Annual Expo and Meeting in October 2016 ESD had a brief opportunity to speak with two senior Meggitt Training Systems (MTS) executives, Winn Hines (WH) and Darren Shavers (DS).

**ESD:** Meggitt Training Systems has enjoyed some great successes recently, and you have some significant export plans; please talk us through recent events.

WH: For one thing, a lot of countries bought EST 2000 through FMS have EST as the validated system of record. All those countries can upgrade to EST II through FMS, and all their weapons will work. We will be going to some smaller countries that use the FMS acquisition programme to get our product out there. Additionally, we had a lot of companies and publicity traction out of ITEC 2016 because we showed the FATS 100E, that is really the baseline for the investment that Meggitt made to win EST II for the US Army and ISMT-U with the US Marine Corps. So all of that system is now much closer to its initial building, and we will see, as a result of the flexibility of FATS 100E, the FMS opportunities for the EST to be upgraded will be in a lot more countries than the "big five". We are already providing quotes to those customers who may only have four systems around the world due to their smaller military – nothing that I can talk about right now, but we already see the fruits of those opportunities coming to fruition.

DS: A final couple of things have happened here in the last few months. In July we went to a SVT which is a System Verification Test, where we took the system into the field and said: "Okay, does this system meet all the US Army requirements?" That is when you bring all the soldiers down, all the experts and say: "Yes, it is documented and correct. Yes, the weapon works as it is supposed to. Yes, all the capability that was required on the system works. Yes, the upgrade from the old system to the new system actually works." We went through all that process during that time period to prove that the EST II will be now the Army programme of record.

Some of the things over and above what used to be on the old system are things that we upgraded. For example, we upgraded to tablet. Everyone is doing a tablet, but our tablet can really add auto-coaching – basically "You did this wrong, this is how you fix it." The tablet can be used in Instructor Mode, multiplying the knowledge of the instructor by spreading out that knowledge



Winn Hines, Director of Virtual Systems Sales at Meggitt Training Systems, Inc.

in the tablet. The ability to have multiple weapons being used per shooter - in the past you could not have done that, you had to have separate lanes. Also, what we have been doing for the last 10 years: most soldiers have more than one weapon, so weapon drill going through your primary to your secondary now can be done in the system and scored on the system:"You engaged this target with this weapon, which is your primary, and engaged this target with your secondary, and here is your combined score." That wasn't required ten years ago and now is. It is a requirement to have all the weapons that are currently fielded work on our system - part of the validation was those weapons can be plugand-play; just show up and automatically work on our system, seamlessly, like they did on the old system. We have a moving eye point capability that wasn't available in the past because we were always in defence. Now we need to be able to do defence or offence depending on tactics at our unit. Now we have the moving eye point in Move and Shoot and a moving eye point in our collective allows a capability you didn't have before. Now you can be offence or defence depending on what the unit commander wants to train at the time, and that something you definitely couldn't have had in the past.



Darren Shavers, Director Business Development at Meggitt Training Systems, Inc.

ESD: Can I go and coach myself?

DS: The instructor tablet will flag everything you are doing wrong; as long as you can run the system, it flags it and then you don't need an instructor because now the tablet says: "You jerked your trigger." I hit the button on the tablet that says video, and it actually gives me a video "This is what you did wrong; this is how you fix it." WH: You have access to the system. We have three tablet modes: operator, instructor, and trainee. So the individual who has access to the facility and knows how to turn everything on- he can get a tablet, put it in instructor mode and he runs it himself. Now whether or not that is going to be allowed, we don't control that. Is that possible? Yes.

**ESD:** Back in the 1980s, we would let people do that: we would have appreciated the fact that they were doing that.

**DS:** Speaking of back in the 1980s, we used to have something we called hippocket training: you're sitting doing nothing, so you pull out your notebook and practise something, right? Well now you can have 15 student tablets, 3 instructor tablets and 1 operator tablet on one 15-lane system. So let's say I have 5 guys with problems breathing; they need to fix that. That information is on the tab-



US Army soldiers from the 316th Cavalry Brigade training on the first delivered Engagement Skills Trainer (EST) II at Fort Benning, Georgia, in August 2016. As an official system of record for the Army, EST II delivers best value through 3D marksmanship, automatic coaching, a tablet interface, enhanced graphics and compatibility with existing Army simulated weapons. Meggitt Training Systems was originally awarded the US\$99M, five-year Indefinite Delivery/Indefinite Quantity contract in 2014.

let. You say "Ok, I want to go to training materials and I want to go just to breathing". The Instructor and you will know the instruction you need to be doing, so now you need to beef up on what you are going to train tomorrow: you pull the tablet out, look at your training material and look at the fundamentals you will be working on next day. That is what the tablet also gives; an opportunity to do hip-pocket training – "Hey, we are sitting here, we have time, so just pull the tablet out and do the training".

**ESD:** OK. A question about the distance between a policeman and a suspect. If the policeman is trained to close that distance the chance of a person actually being shot diminishes because you have a gun there. Would that be correct?

WH: As a police officer, you want distance. Distance is safety; edged weapons are sometimes more deadly... Right now we are going through the phenomenon of social media, of partial facts getting "out there". A lot of partial facts are correct; people made mistakes and people died as result of those mistakes. And in some of the cases the officers' actions were justified. People who have not been in law enforcement in some of those cases have a hard time accepting that. A lot of that has to do with the tensions in the United States and all of that, but... Our system here has three modes of training, and in this show and at ITEC we really only focus on two of those modes. We focus on marksmanship, in which I think we are the premier marksmanship and simulation provider in the world. We invented it and I think we have got it near perfection. And we focus on collective training. We focus on CGI. Now we are with VBS and integrating their latest, which shows flexibility in our system because we're integrating what Army, Marine Corps and other customers have invested in – VBS- and we're

integrating that into EST. But the system is Video Judgemental Training; we don't really focus on that at the shows. Now, we are going to IACP (International Association of Chiefs of Police) and we will be focusing heavily on the judgmental aspect of this system in after-action review, understanding use of force, understanding case law; we will have a big focus on that. But: we have been talking to other people: there are MPs, security forces at military bases performing that law-enforcement role, whether it is at the Post-Exchange, whether it is at the hospital, whether it is responding to a "domestic" in a residential area. They are making that same decisions that law enforcement is making, and our system allows you to have scenarios where you can escalate and where you can work on verbal de-escalation skills. Or on our commercial law enforcement system we have Taser. It was not a requirement for the EST programme, but was something that could be integrated. Chemical spray could be integrated. And another thing law enforcement is doing is the use of flashlights and weapon lights. All that could be integrated into the system for military training.

**ESD:** In terms of multiple weapons, are we also talking about the physical drill of changing from one to the other?

**WH:** This is a difficult thing because once you pull a weapon out it is very difficult to



Deliveries of almost 900 EST II systems will continue during the next 18 months for all active-duty Army installations worldwide, plus most National Guard and Reserve sites. As a system of record, the programme will train new and experienced soldiers in marksmanship, collective scenarios and judgmental video scenarios. Each mode provides critical training based on the skill level of the soldier or unit. The company expects significant interest from allied military forces that may have similar training requirements.

put a weapon away, but... We build liveaction video - I am going to be aggressive; I am going to be passive-aggressive; I am going to be physically non-compliant; I am going to use deadly force; I am going to make a threat. We film all that live action. We give the instructor options for what he wants to select, based on what the students are doing - whether they are making use of cover, whether they are using verbal means. You go in a domestic scene, you are in a kitchen, someone says: "Let's get out of the kitchen!" But: someone has a kitchen knife, and you are not getting distance from that weapon... The instructor can pause the students to see their mistakes. The use of force has changed: "What is reasonable, to stop the action, that requires the use of force?"- with the principle of minimum force, based on the circumstances then, not two days later when everybody watched the clip 30 times, but based on what is going on right then at that moment. Obviously, a person's experience and training, background, their physical condition - all of those things go into what device they are going to decide to use. If you think deadly force is a possibility you don't go to a Taser unless you have someone else there to cover you; if I am going to a Taser, he has a knife, say

the Taser doesn't work and he charges at me... I probably won't be able to get rid of my Taser and get my weapon out and stop a knife attack. You know, there is a lot that goes into it: What is the person doing? What are they holding? What is my physical skill? What is my athletic skill? They can train all of that on our commercial system and it could be added if necessary to any military system.

**ESD:** You have had a lot of sales through FMS. Will the follow-on sales for EST II be FMS or are we looking at countries starting to buy with their own money?

**WH:** We think it will be a mix. Some especially will be FMS: there will be some where they have very sophisticated requirements that call for more than just simulation, and they go into some of Meggitt's core expertise, both in live fire and virtual, and those opportunities will go outside of that path.

**ESD:** What are you going do and what are we going to find at I/ITSEC?

**DS:** We are taking a step up because budgets are getting reduced; less money, less travel, but you still have to make all these things happen. How do we start taking your EST II platform and multiplying that training? How do we get the training to coalition forces? How do we have somebody in Atlanta train with somebody in San Diego? How do we do all that kind of stuff? So now we look into the future and say, the Army wants to do this live virtual instructor training, they want to do this: everybody training different training systems, different locations, same battlespace. Now with EST II you can start plugging into that via VBS and train the same battlespace at separate locations. So that is the next step, where you can take someone flying a helicopter, someone over here doing dismount patrol, someone over there doing a call for fire – at completely different locations and it all happens in the same battlespace. That is when you start seeing EST II, where militaries are going. Because we always have to fight with a coalition, we all fight right now the same war, the war on terror, we are required to understand each other's tactics and the only way to do that is train it. The budgets are going to be reduced. So, if you can't travel, we have EST II right here: Go run in there and practise.

ESD: Thank you.

The interview was conducted by Stephen Barnard.



### Firms & Faces

#### GOFA Establishes Business Unit "Tank Systems for Military and Civil Use"



(pb) The German tank trailer and container specialist GOFA is an internationally established and marketleading manufacturer of mobile tank equipment. The company combines the strengths of a German medium-sized enter-

prise and the worldwide corporate network of the Chart Industries Group. In its 55th year of business GOFA develops and manufactures mobile tank systems in premium quality. Besides its standard product range GOFA has always been focusing on customised special solutions. In the 1970s GOFA realised the first potable water and fuel applications for military and civil use and has manufactured hundreds of such special tanks until now. But now the tank specialist from the Lower Rhine has decided to become even more committed in these product and market segments by creating a dedicated business unit for its activities in the range of potable water and fuel tanks. In order to expand this business unit worldwide in the next years, GOFA hired Jan Gerhard-de Vries, who is a well-known and established expert in tank containers for defence applications, looking back on several thousands of manufactured units.

## Cyber Security Training Centre for IT and SCADA

(df) CYBERBIT, a subsidiary of Elbit Systems, has been awarded a contract to supply its CYBERBIT Range platform to the Cyber Security Training Range (CSTR)







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of Maryland, which will then become the first hands-on cyber-security training centre for IT and SCADA security professionals in the US. Work is to be done during 2017.

Leveraging the capabilities of the CYBER-BIT Range, the CSTR of Maryland provides a unique approach to cyber-security training, enabling the entire security and business team to practice the incidentresponse workflow in hyper-realistic settings that mimic the trainee's actual work environment. Thus, it allows teams to respond faster and more effectively to complex and advanced attacks and to perform better as a team. Centrally located in Baltimore, close to the federal government's cyber-related activities, CSTR of Maryland will offer cyber-security professionals in both private and public sectors training the most current cyber warfare strategies.

The training and simulation platform will serve as the launching capability of the CSTR, instructing cyber-security professionals how to protect national assets and infrastructure against cyber attacks.

#### Navies in the 21st Century

(ih) What is the purpose of Navies in the modern world, and what types of warship does this require? "Navies in the 21st Century", the new book edited by Conrad Waters, tackles these questions by looking at naval developments, both technological and operational, in the quarter century since the end of the Cold War. It provides the overall political and economic context, assesses significant naval operations from the first Gulf War to Russia's annexation of Crimea, reviews changes in the objectives and composition of the principal fleets, describes major design developments amongst the main warship types, and examines wider



technological and operational developments including naval aviation, shipbuilding and manning.

It follows the successful approach and format of Seaforth's annual "World Naval Review" with individual sections by internationally acknowledged expert authors, each generously illustrated in a similar style. As a succinct, single-volume overview of how contemporary navies have evolved to meet today's challenges it is unrivalled, and will prove invaluable to defence professionals and interested enthusiasts alike.

Seaforth Publishing, ISBN 978-1-4738-4991-4, 256 pages, £35.00 / €44.10

#### Lifeboat Training to Prevent Accidents

(df) A report by academics at the Seafarers International Research Centre found that tight vessel schedules often did not allow sufficient time for drills, and crews were often too frightened to take part as they had not been properly trained in using the equipment. "A lifeboat is your last chance to evacuate a vessel, when it is not safe to be onboard or use other means of evacuation so it is vital that the crew members are properly trained and know what they have to do," said Endre Eidsvik, SVP of Service for Norsafe. To Photo: Norsafe)



face these problems, Norsafe has now also set up two modern, STCW approved, full-scale training centres for training seafarers, in Norway and Greece.

#### **40th Anniversary of Peli**

(df) The 40th anniversary of Pelican Products marks the actual highlight of a true American Dream. Dave Parker started Pelican 1976 in a simple garage in Torrance, California and created the very first of the still successful Pelican Protector cases just two years later. Another major step followed 1997 by really entering the European market and setting up the EMEA headquarters in Barcelona. In buying several other companies Peli was able to enlarged the portfolio – from cases over package solutions to robust lights – significantly and to get the better of rival producers.

"Pelican has been on an amazing journey from its beginnings in a garage in 1976 to becoming the global power in the design and manufacture of the toughest products in their categories," said Lyndon Faulkner, Pelican's President and CEO. "Our continued success is a testament to the people who have contributed their ideas, vision, enthusiasm and hard work over the years."

#### Saab Acquires Nordic Defence Industries

(gwh) Defence and security company Saab has acquired the Danish naval company Nordic Defence Industries (NDI). NDI, designs and manufactures mine disposal charge systems for the naval defence industry.

The acquisition of NDI develops Saab's market leadership in the unmanned underwater domain when it comes to

regional reach, technology and innovative solutions. This means customers can come to Saab for an end-to-end solution to meet their Mine Counter Measures (MCM) needs to detect, classify, identify and dispose maritime mines.

One of NDI's products is DAMDIC, a mine disposal charge, carried to the mine by a remotely operated vehicle such as Saab's Double Eagle – the first choice for many navies when it comes to Mine Counter Measures.



# **Preview**

- Regional Focus: United Arab Emirates
- Technology Focus: Personal Weapons & Equipment
- NSPA
- Military Aircraft Requirements in India
- Tactical Navigation Options
- Close / Tactical Surveillance
- In-Theatre Water Management
- Energy Generation & Storage
- Training Ranges / Shooters
- Indirect Fire Infantry Weapons
- Parachute Developments
- Anti-Submarine Warfare
- Decontamination Technologies
- **Supplement: Armoured Vehicles** (already available at the International Armoured Vehicle Conference, London, in January)

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Shots Fired: 5 Fotal Hits: 5 Friendly Hits: 0 Foe Hits: 5: 19 Fotal Score: 19 Fotal Score: 5 Max Possible Score: 25 Max Possible Score: 2

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