

Domain growth and new threats set agenda at AOC EW Europe



Photo: Clarion Events

Cyber, sensors, RF and decoys are just some of the technological solutions that are forming the narrative at the AOC EW Europe 2019 event in Stockholm.

With more than 1,000 industry attendees and 20 new companies exhibiting, this year's conference and exhibition will be covering future operations, cyber and AI, EW data and information, EM and information manoeuvre, and technical challenges and opportunities, amongst other areas, across a wide range of sessions today and tomorrow at Stockholmsmässan.

Over 75 companies and sponsors are to participate in the event and it continues to grow by 10% year on year as industry, military, government and academia come together to collaborate, share information and knowledge on the EW market and battlespace.

With a total of 45 countries represented, this year's event is set to be the biggest in AOC EW Europe's history with attendance expected to be 35-40% up on previous years.

On this, Tracy Bebbington, event director at Clarion Defence & Security, shared with *AOC EW Europe Daily News*: 'As EW Europe continues to grow, this will be the biggest AOC EW Europe to date. We have had excellent engagement from the Swedish Armed Forces for this year's event, and attendees will gain valuable insight into the operational and technological experiences of the

Swedish defence forces in the wider European EW landscape.'

The two conference streams will be focussed on the future of EW and EM operations in this ever-evolving theatre and the threats posed there from hybrid warfare, information operations/warfare, the multi-domain battle, cyber and anti-access/area denial.

The keynote address is being presented by Brig Gen Fredrik Bergman, head of the test and evaluation division at the Defence Materiel Administration - Sweden. This will be followed by an opening address on 'new threats and future EW systems' from Johan Falk, head of department, radio EW systems, at the Swedish Defence Research Agency.

John Clifford OBE, Wg Cdr RAF (Ret'd), director global conferences at AOC, commented on the event: 'AOC EW Europe continues to be the most relevant EW event in Europe and is the second largest such event in the world. It plays a central role across industry, academia, the military and government, helping us to raise awareness of issues facing the EW sector as it grapples with its new multi-domain reality.'

'The EM environment/domain is a huge growth area, and leadership and investment from the brightest minds in the sector is exactly what the AOC exhibition and conference offers to delegates, visitors and exhibitors,' he added.

By Helen Haxell

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14 May 2019

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Leonardo's BriteCloud squares up to US testing

STAND B4

Jon McCullagh, head of strategic campaigns (EW) at Leonardo Electronics, sat down with AOC EW Europe Daily News to discuss the company's latest achievement with its BriteCloud decoy in the US, where it is under test and evaluation as part of the Office of the Secretary of Defense's (OSD) Foreign Comparative Testing (FCT) programme.

Announced on 13 May at AOC EW Europe, the US DoD has selected Leonardo's BriteCloud expendable active decoy (EAD) to be assessed under the FCT initiative.

Of the BriteCloud portfolio of EADs, the 218 variant was specifically developed with the US market in mind for integration, as generally the dispensers used for decoys in this market are in a square format.

'In order for us to have a product that would be easily fitted and integrated into a wider part of the world that uses American-style aircraft

or across American aircraft and American dispenser systems, we went down the road of making the BriteCloud 218,' McCullagh noted.

The system decoys RF-seeking missiles and fire control radars, with the 218 model fitting into a 2x8x1in form factor, rather than the 55mm flare dispenser fit of the original version, BriteCloud 55.

In June 2018, at EW Europe, Leonardo launched the BriteCloud 55-T which is designed to protect wide-body aircraft from modern radar-guided missiles. In addition, it offers a significant power increase on previous decoys to deliver a bigger radar return required to protect large transports.

Returning to the 218 variant and its evolution, McCullagh shared: 'Having shrunk what effectively was a full-size jamming pod into something the size of a Coke can, we had to shrink it again by around 30 to 50% to fit it all into the smaller format.

'But in terms of the state of performance, the performance is

the same with the 218 as with the 55. So really to the end user and to the customer, the only changes are the shape and the format of how it fits in the dispenser,' he added.

The US Air National Guard will lead the charge on the FCT as the 218 will be launched from countermeasure dispensers installed on its F-16s. The trials aim to show the heightened survivability of the aircraft with the EAD.

As the global battlespace evolves and the proliferation of surface-to-air missiles poses a wider aggressive threat, this emphasises the role of decoys such as BriteCloud 218 and the role they can play in such contentious airspace and hostile theatres.

McCullagh commented: 'What we did with BriteCloud is we designed it to defeat the latest systems that are being fielded, and because it's reprogrammable and programmable by the user, that means we have, to an extent, future-proofed it so that we can program new

and different countermeasures into it throughout its lifetime.'

He shared further that the BriteCloud 218 provides an offboard jamming capability, as it falls away from the aircraft at a rapid rate. Therefore, the radar or radar-homing seeker on the missile is being lured away from the aircraft.

Further to the original trials of BriteCloud, the US has been in talks with Leonardo for a number of years about the system. Interest from the DoD goes back about half a decade, although McCullagh said that the Pentagon was keen to see the product mature and for it to be used in service.

In April 2018, the first deliveries of BriteCloud by Leonardo to the UK MoD were completed and it went into service on board RAF Tornado jets.

However, it was at the end of 2018 that Leonardo was selected as one of the providers under the FCT programme. The Leonardo technology, which is not yet available in the US, will be compared against existing DoD systems so it can be evaluated for adoption onto US aircraft.

The FCT programme is likely to take between two to three years. On what is going to occur during that timeframe, McCullagh said: 'The programme itself will be split into a number of phases, but the evaluation of the products will be in a laboratory and a ground environment first. It's always more efficient and cheaper to do a lot of the evaluation there, where you can easily measure outputs and inputs against the number of variables and do thousands of different permutations in the lab.

'They will effectively build a model of how they think BriteCloud works and how they think that means it will perform in the air, and then they move on to airborne trials where they'll release it from an F-16 and see how it performs there.'

Following extensive testing, in Q4 2017 the UK MoD approved the BriteCloud 55 for operations.

By Helen Haxell



Image: Leonardo

Plath Intelligence Workshop celebrates tenth anniversary

STAND A16

The tenth edition of the Intelligence Workshop hosted by Plath on 13 May kicked off proceedings for attendees at AOC EW Europe 2019 in Stockholm.

Nico Scharfe, CEO of Plath, commented how this iteration of Intelligence Workshop was the 'opening act' for AOC EW Europe.

Scharfe has been in his role for the last 20 years and explained to delegates that this event and the wider sessions were about the community, and that these discussions are integral to realising opportunities and prospects, with the sharing of information and knowledge being a crucial part of technology trends.

He went on further that the five points that form the basis of the Intelligence Workshop comprise: dedication to the intelligence

community; open discussions; talking about requirements and trends; inspiration; and cooperation between industry partners.

The conference is a forum to discuss and find technological solutions to enable customers to choose the technology right for them.

Participation over the years at the event has grown and delegates from 48 countries have been in attendance from Algeria and China to Italy.

A major focus of this year's event is cyber defence and AI. Brig Gen Armin Fleischmann, director plans and policy directorate, Cyber and Information Domain Service HQ, at the German MoD and Lt Col Holger Schmör, senior German national officer, Joint Electronic Warfare Core Staff at NATO kicked off proceedings.

With the latter focussing on 'knowledge versus vulnerabilities – intelligence requirements in the modern battlespace', this set the



Photo: US DoD

in particular the technologies presenting themselves in this arena, with the contributions from international speakers spanning academia and research, the

tone for the rest of the week in the closed forum.

The day's sessions covered a wealth of topics ranging from cyber defence, artificial (signal) intelligence – can a machine learn to think? to multi-domain intelligence – catch me if you can, featuring a range of industry and military speakers.

The collaborative platform seeks to address topics surrounding COMINT,

public sector, military, and industry.

According to Plath literature, essentially, about a decade ago COMINT requirements focused on the capturing of multiple electromagnetic signals, then over time, became more about software then a drive towards digitalisation.

'This challenge of increasing quantities of data pursues us to this day. Systems are required that can process enormous quantities of data, fuse information from different sources and conflate them into a single intelligence report.

'The focus is on the still-important signal of interest. But also the event the user is searching for is more and more important: who does what, when, where and why?' it stated.

Enter the field of automation and the significance of its positioning in the field to meet the threats, tasks and challenges posed to security.

Over the course of the last ten years, the Intelligence Workshop has travelled the globe from Europe to Asia. The event has been hosted in Berlin, Singapore, Rome, Cologne, Edinburgh, Stockholm, Rotterdam, London and Lausanne.

'It's all about the community, the exchange, the networking, the people,' Scharfe stated. This will continue at the next iteration of the Intelligence Workshop in 2020 which will be take place in Liverpool.

By the Shephard News Team



Photo:
Beth Maundrill

CM Labs releases latest Vortex Studio

Montreal-based CM Labs Simulations has announced the release of the latest version of its Vortex Studio product. Known as Vortex Studio 2019a, this software suite has been developed for real-time simulation and virtual prototyping of complex mechanical systems.

The company has said that Vortex Studio 2019a 'adds an upgraded simulation engine, enhanced graphics, and additional sensor extensions, as well as revised software packages and subscription terms'.

One key element of the latest version of Vortex Studio is what the company refers to as 'solver enhancements' that are designed to enhance performance and reduce development time.

'The new solver produces significant improvements to simulations; in some cases, we're seeing a 50% reduction in

processing time,' explained Marc-Alexandre Vezina, CM Labs' product manager for Vortex Studio.

'Users will notice this in large scenes with many rigid bodies. For example, in a port with hundreds of simulated shipping containers, you can dedicate computing resources to keeping vehicles running smoothly without the slowdowns typically caused by complex scene interactions.'

Another benefit from the solver solution is a reduction in system memory that leads to improved dynamics performance. Improvements have also been made to the product's sensor library.

'The era of autonomous machines is being driven by the ability to capture, analyse and act on data from the outside world,' said Lisa Barbieri, VP of marketing and customer experience at CM Labs. 'For teams looking to develop, test, and refine automated systems

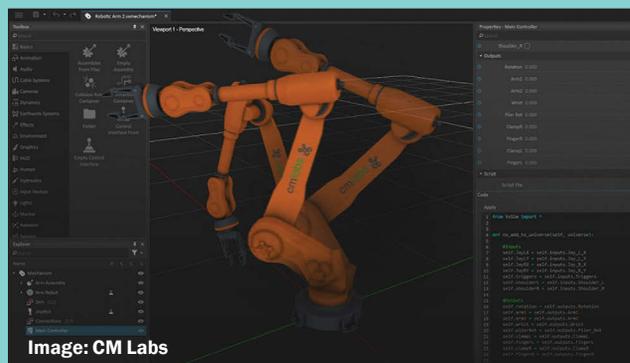


Image: CM Labs

through simulation, a diverse range of sensors is crucial.'

Graphics enhancements are also included in Vortex Studio 2019a to provide more realistic scenario development. These include enhanced lighting halos, improved fog replication and more realistic vehicle tracks caused by movement across terrain.

In addition, the company commented, 'in an effort to make the process of adding Vortex Studio

to workflow as seamless as possible, Vortex Studio's pricing and packaging models have been revised to more flexible, workflow-focused packages on an annual subscription model, providing teams with the option to add tools as needed, with room to scale capabilities as required'.

Previous Vortex Studio customers include BAE Systems, CAE and Lockheed Martin.

By Trevor Nash

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TECHNOLOGIES

DiSTI unveils GL Studio 6.3

STAND IB41

DiSTI's human-machine interface (HMI) and embedded user interface (UI) development tool kit for safety-critical applications, GL Studio, has just been enhanced through the release of version 6.3.

GL Studio allows developers to create high-fidelity, feature-rich 2D and 3D graphical user interfaces for embedded automotive and aviation systems, as well as HMIs. It supports industry-standard 2D and 3D file formats and is compatible with modern 3D graphics hardware.

This latest release encompasses several new GL Studio features and GLS-Map Toolkit enhancements, and 50 additional GL Studio improvements that, said the company, allow 'designers and developers to create 2D and 3D HMI/UI without compromise for the aerospace, automotive, defence and medical markets.

'The features and enhancements save designer/developer time and maintain high-quality design while saving significant production costs.'

Some of the key enhancements found in the latest version of GL Studio include: an improved package management system that adds searchable/sorting functionality to the UI; a new conditional rendering system that frees up processing power for other tasks enabling stronger multitask functionality; and more text readability and control, to improve legibility and give better readability with designer fonts.

'Our team continues to respond to our rapidly expanding customer base to enhance technology in our industry with the development of a solid GL Studio user experience,' explained DiSTI's CEO, Joe Swinski.

'DiSTI with GL Studio continues to be the developer's choice for design without compromise. Developers and designers conceptualise, develop and deliver faster with GL Studio than any other tool in the market.'

The company said that customers under current maintenance and support contracts for GL Studio can log into DiSTI's customer support portal to download this latest version.

By Trevor Nash

ATAC goes on the offensive for TACT

US Naval Air Systems Command (NAVAIR) has selected a team led by Airborne Tactical Advantage Company (ATAC), part of Textron Airborne Solutions, to provide contracted offensive air support services for its Terminal Attack Controller Trainer (TACT) programme.

This programme sees ATAC and its partners Textron Aviation Defense and Valkyrie Defense deliver live airborne training to ground and airborne forward air controllers (FACs) and joint terminal attack controllers (JTACs) using a fleet of L-39 Albatros, AT-6 Wolverine and A-27 Tucano aircraft.

The planned period of performance will include one base year ordering period, and four one-year options.

'TACT is a marked increase in both the quality and quantity of JTAC training services demanded by the US Navy and marine corps,' said Russ Bartlett, CEO of Textron Airborne Solutions.

'ATAC's world-class team is pleased to provide the most mission-representative JTAC training solutions available.'

ATAC has a fleet of over 90 aircraft, and has been operating for nearly 25 years, in which time it has amassed over 57,000 flight hours.

For the past 15 years, the company has provided a wide range of contracted close air support capabilities to US DoD JTAC communities in Europe, the continental US, Hawaii and the western Pacific region.

This is a significant win for ATAC given that the USAF has a similar but much larger FAC/JTAC training requirement under consideration.

Although no value has been disclosed, ATAC was bundled together with two other offensive air support contracts for Draken International and Coastal Defense by NAVAIR. The total value of all three contracts is over \$124.5 million.

By Trevor Nash

Kongsberg builds bridges to RAN



Photo: RAN

This is the latest in a series of contracts between the RAN and Kongsberg that cover ship handling and engine room simulators delivered to training facilities across the country.

Kongsberg Digital has signed a contract for two new K-Sim Full Mission Bridge (FMB) simulators for delivery to the Royal Australian Navy's (RAN) HMAS Watson Bridge Simulator Facility, part of the Maritime Warfare Training Establishment, in Watsons Bay, New South Wales.

The requirement for expansion and intensification of the RAN's training programme is the result of an increasing capability enhancement for the navy. The expansion includes construction of new *Hunter*-class anti-submarine Future Frigates and *Arafura*-class offshore patrol vessels, while the navy is also taking delivery of two

AOR (Auxiliary Oiler Replenishment) vessels.

The new FMB simulators will be used for the ongoing training of RAN officers and sailors undertaking all levels of ship handling, navigation, warfare and bridge management courses.

'Our simulator training requirements continue to grow and Kongsberg has shown the flexibility to support our requirements, even in a compressed timeframe,' said Cdr Chris Doherty, head of command and navigation, RAN.

'This latest delivery reflects the depth of our partnership as well as the importance of high-quality simulator training to the safety and operational performance of our people and fleet.'

By Trevor Nash

RSi completes KC-390 sim work

RSi's Epic-View visual display system for Rheinmetall Defence's Embraer KC-390 flight simulator has completed acceptance testing at RSi's headquarters facility in Coppell, Texas.

The Epic-View features a 220x60° field of view provided by a 3.5m radius collimated optical display system. Seven Norxe P1 IR projectors provide an edge-matched cross-cockpit image driven by the company's RS200 image generator.

The WQXGA Norxe P1 LED projector weighs 17kg and has a maximum brightness of nearly 4,000lm.

The KC-390 Flight Simulator is to be installed in 2020 at Embraer's facility in Brazil. Rheinmetall was selected to provide training for the aircraft in 2016 and subcontracted visual system elements to RSi.

By Helen Haxell

Swedish navy re-equips to face future challenges

In his keynote address on the opening day of UDT 2019 in Stockholm, the Chief of the Royal Swedish Navy, RAdm Jens Nykvist, focused on the unique maritime position the country holds in the Baltic Sea as well as challenges, namely from a resurgent Russia, that the Scandinavian nation must contend with both now and in the near future.

As noted by Nykvist, Sweden can be 'considered an island' as the country has 2,400km of coastline with 90% of national trade being delivered by sea.

'The main task of the Swedish Navy is to protect our territorial waters. To do that we need to be able to be at a threshold to deter an adversary,' Nykvist said. He added that this is achieved through strength in preparedness as well as cooperation with other nations. 'We have a high [level of] readiness and in general good equipment.'

With an average depth of 65m the Baltic Sea represents the perfect playground for submarines, but also presents the historical challenge of mines left over from both world wars. Another concern for Sweden is the increased presence from Russia in the Baltic, with numerous exercises by the resurgent nation taking place in these waters.

Nykvist noted that since the annexation of Crimea in 2014 there has been more attention devoted to defence in Sweden and both political and public realisation that perhaps in the past the numbers within the armed forces may have been lowered too much. To this end it appears that there is now a revival in spending within defence.

The Swedish Navy is now focusing on a variety of modernisation programmes including the midlife upgrade (MLU) of its *Gotland*-class submarines, investment in two new A26 submarines, the MLU of the two *Gävle*-class corvettes as well as acquisition of missiles and torpedoes.

The first of the upgraded *Gotland* submarines is already undergoing sea trials, with the second set to enter the waters in June 2019, according to Nykvist. The MLU programme has set the stage for development of the A26 submarines with most of the newest technologies being integrated onto the *Gotlands* forming part of the upgrade.

This essentially sees the class emerge from refit as near-new submarines. Nykvist said this upgrade path towards acquisition is a strategy that the navy seeks to explore regarding its surface fleet.

'I want to develop our new corvettes, use the same philosophy [that we are] using in the underwater domain and continue that with the



Photo: Clarion Events

stealth *Visby*-class corvettes into the next generation of the next *Visby* generation two,' Nykvist said.

In addition, in April 2019, the Shiprepair Yard Nauta, in Poland, completed the next milestone in the construction of a SIGINT ship for the Royal Swedish Navy with the vessel's initial launch.

He also highlighted that it is not just new platforms that remain a priority for the service but the integration of additional high-end sensors.

'We need to push our technology and the desire to protect our crews and ships [so that they can] continue to operate undetected in stealth mode but also use new technology. To be stealthy is very important, the fact that we don't have the number of ships... for that and to be able to operate

unseen and undetected will increase the deterrence factor... because you never know where or what to expect,' he commented.

For Sweden it appears the situation has been acknowledged and the defence budget has indeed increased, covering 2021 to 2025, although Nykvist noted that his priority is now focused on the future post-2025.

'My main challenge is the period 2026 to 2030, when a lot of our current fleet needs to be replaced, but this replacement needs to start right now. [We need] to remember flexibility is one of the keys to be able to continue to build and remain a deterrent. We need to remain agile and adjust everything from tactics to how we buy things if necessary,' Nykvist said.

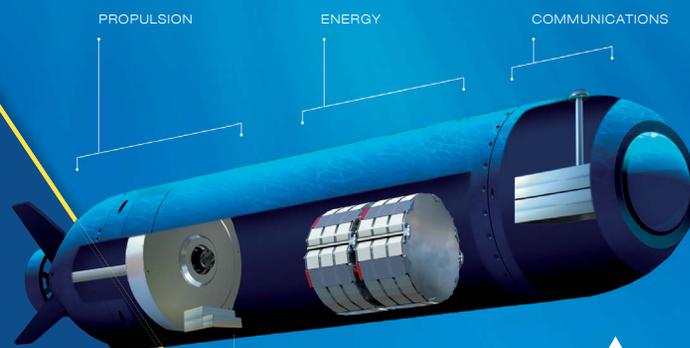
By Beth Maundrill

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STAND B38

As the first upgraded Royal Swedish Navy Gotland-class submarine continues sea trials following its launch in mid-2018, the nation continues to move forward on its effort to develop two new submarines with Saab Kockums.

Dr Fredrik Hellström, project manager for the A26 programme with Sweden's Defence Materiel Administration (FMV), provided an update during UDT 2019 in Stockholm.

The first A26 is currently under construction and Saab Kockums will perform verification on both boats before final assessment by the FMV.

It is expected that sea trials of the first submarine, HMS *Blekinge*, will begin in 2022 and the second, HMS *Skåne*, will start the following year in 2023.

Hellström also said that the FMV was beginning to look at the training and education of the crews who will man the boats. Saab Kockums will train and familiarise the first two such

crews and these submariners will ultimately bring the knowledge inside the Royal Swedish Navy and train future complements.

The contract for the two submarines was awarded in 2015; subsequently, it was decided by the Swedish government that it needed a total of four submarines, the other two to be made up from the A19 *Gotland* class. These are currently being modified to A26 standard through their mid-life upgrade. More than 20 systems onboard the new *Gotland* will be implemented in the A26.

During UDT 2019 Hellström was asked why it was decided to acquire only two new submarines, and while he said this was a government decision, he did point out that it was not necessarily optimal to procure just two: 'Three or four would be optimal for the size of a country like Sweden,' he commented.

Whether Stockholm will look to acquire more boats is unknown, but Hellström said that if that was the case future submarines could be additional A26 types or another new class altogether.



Photo: author

The A26 houses various new capabilities, including covert mine countermeasures (MCM). However, Hellström noted that the subs would not be used as a primary MCM asset as they are 'too expensive' to send into a minefield. Alternatively, they would be used as a launch platform for smaller MCM assets.

Other new features include the addition of a flexible payload lock and integration of the T47 lightweight torpedo system, which is being designed in conjunction with the A26 by Saab.

In 2022, the torpedo system will be installed and ready for corvettes and submarines of the Swedish Armed Forces. The A26 will also house the T62 torpedo which is already in service.

Another key factor that Hellström highlighted in his programme update was the importance of operational availability for the submarines. He noted that the A26 will have an eight-year period between general overhauls while the older A19s require a six-year period.

By Beth Maundrill

Open Safety for open waters

Dr Alex Deas, CEO at Open Safety Equipment, spoke with UDT Daily News about the role the company plays in the military diving community, the challenges being met and the technology which is seeking to be the answer.

Over the last decade, Open Safety Equipment has been specialising in respiratory systems for diving, in particular rebreathers, full face masks and gas protection.

'We focus on areas where Functional Safety (FS) has application. As well as the safety role, this reduces equipment cost while improving performance,' Deas commented.

On key technology limitations within the diving arena, Deas shared that battery safety was a significant area. He said: 'Currently it is necessary to reduce battery capacity

Photo: Open Safety



by 30% to have a safe battery – one that can pass ATEX [Apparatus for use in ATmosphere Explosives] requirements and [FS] requirements.

'Lithium batteries are available in both LiFePo and LiMn technologies that can be short-circuited with a temperature rise of less than 50°C, and housings are available such that total failure of battery and thermal runaway does not present a hazard to the user, even in body worn applications,' Deas added.

In response to this he shared further that Open Safety Equipment has lithium battery packs that have passed ATEX and International Electrotechnical Commission Explosive (IECEx) as well as FS audits. Deas commented: 'But they do have a 30% lower capacity than the non-ATEX and non-FS alternative.'

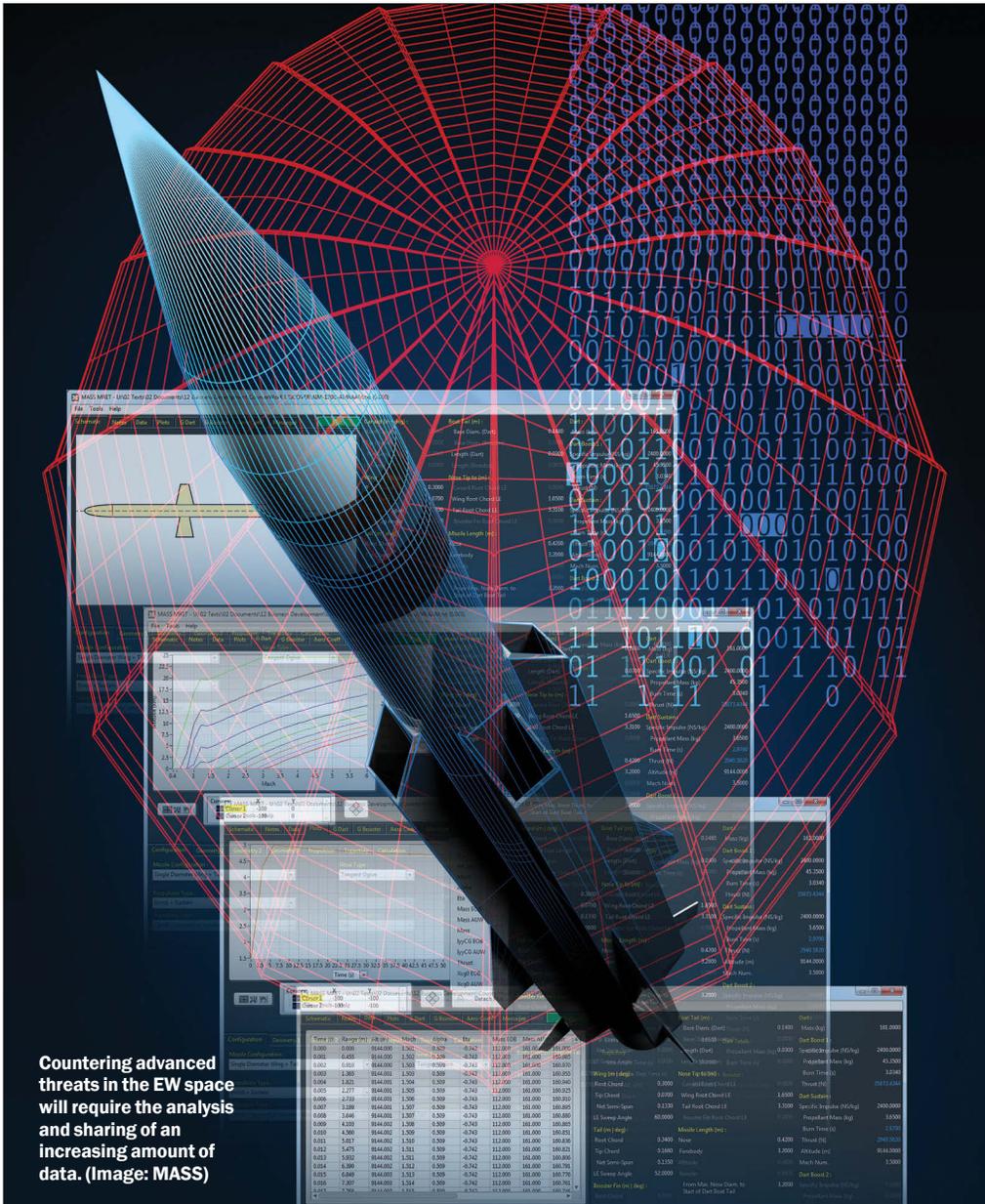
On this he observed that to see a continuation in improvement of the safety and capabilities of military divers, it is paramount to 'grow awareness of the need for Functional Safety and the benefits [of this] to both diver and procurement [processes]'.

When asked by *UDT Daily News* if he thought a collective approach was the best way forward, Deas commented: 'It depends on exactly what is meant by "collective". [However,] in some regards collective approaches can result in the lowest common denominator being adopted. Competition is healthy and procurement requirements can encourage companies to cooperate even where they compete directly in other areas.'

By Helen Haxell

Strength in numbers

In the EW arena, cooperation between NATO and other allied nations is coming to the fore, among both militaries and their industry partners. **By Gerrard Cowan**



Countering advanced threats in the EW space will require the analysis and sharing of an increasing amount of data. (Image: MASS)

A key theme of AOC EW Europe 2019 is the need for free-world allies to increase their collaboration in the area of EW. This could bring a range of benefits, according to speakers at the event, ranging from technological innovation to improved efficiencies.

The subject is a key focus for Athanasios Chouliaras, a retired colonel in the Hellenic Air Force, who will present on concepts of

operations (CONOPs) for optimising joint ISR/EW missions, interoperability and effectiveness through integrated, network-centric C2 and battle management systems.

Joint information

By working together in EW and information operations, joint forces from various NATO and allied nations can 'effectively harness the true potential

and power of the contemporary battlespace', Chouliaras told AOC EW Europe Daily News.

For this to happen, allied nations must improve their cooperation, in order to participate effectively in common operations. There are a number of technological domains that could benefit, he added, provided that the work complies with the necessary international standards and NATO Standardised

Agreements, and meets a number of other requirements.

Chouliaras pointed to joint ISR/EW tasks, intelligence production, threat detection and assessment, and both soft-kill (through electronic countermeasures) and hard-kill operations as areas of potential benefit.

He also referenced a range of other advantages, such as saving resources through finding synergies between organisational and technical infrastructures.

Additionally, increased commonality among EW assets could boost real-time decision-making and C2 within the multinational battlespace, minimising misunderstanding and confusion, which may boost capabilities and reduce the risk of collateral damage.

Critical MASS

Shaun Vickers, EW business development manager at MASS, a UK company that specialises in EW and cyber, is presenting on how data can be exploited to achieve an operational advantage against the backdrop of a changing EM spectrum.

Increasingly advanced threats in the EW space and the congested and contested nature of the EM environment (EME) present a number of challenges to operators and analysts, he told AOC EW Europe Daily News, challenges that are exacerbated by the volume, variety, velocity and veracity of data that is either required by equipment to operate in the domain, or that it produces from the domain.

'The primary challenge is faced by the analysts who need to be able to make sense of and make use of the volumes of data that are being created,' he said.

'As the operational space becomes increasingly complex,



Thales is working on methods of completely securing data transmission with little impact on network performance. (Photo: Thales)

we must not allow it to become chaotic. Assistance, therefore, must be delivered to the analysts to allow them to operate effectively and efficiently, and enable them to continue to support the decision-maker.'

There are also indirect challenges, Vickers said. For example, the growth of data must be met by the availability of qualified, experienced people who can make use of it. The provision of training will be essential to build this capacity, and will, in turn, help mitigate the broader challenges associated with data growth.

'Information overload will prove to be a significant challenge for the operational commander and decision-makers thanks to increased levels of data,' he added.

'If we can control, understand and manage the data, we can manoeuvre in the operating space with increasing amounts of freedom. Determining the best manner in which we manage the data from all the different sources is a significant challenge that operators in the EME face,' he said.

Vickers said that in the near future, AI will be a game-changer in terms of boosting the ability to analyse the vast amount of data being generated and supporting effective decision-making.

'It can help identify the presence of the abnormal and absence of the norm, providing indicators and warnings that give decision-makers an operational advantage. In short, AI can provide the operator with vital time to conduct critical thinking, as opposed to reacting to demands.'

Vickers also emphasised the conference theme of collaboration between allied governments, companies and other organisations. The answer to the data problem is not always provided by new (and often expensive) equipment, he said.

Instead, operators need to make better use of existing technology and data that can enhance current capabilities, which 'of course means sharing between domains and collaborative nations'.

Successful solutions to the data problem will require closer integration and development in concepts and policies, as well as the procurement and employment of relevant technologies plus increasing the numbers of relevant skilled personnel, he said.

While sharing data may not always be preferred by nations due to the sensitivities involved, it needs to be considered as more operations are undertaken on a collaborative basis, Vickers added.

'Sharing data will ensure that platforms are better protected [through all parties] being aware of the threats they face,' he said.

Getting wired

Joseph Warren, global product line manager for network security at Thales, will present on hard-wired data transmission security and performance in a virtual world, focusing on innovative methods of completely securing data transmission at almost no impact to network performance.

While there could be security concerns over collaborating with different nations, this need not be the case on the transmission side, Warren said.

Each nation can use its own method to securing data, in terms of the particular algorithms used or other standards employed. However, it could then be transmitted through a shared encrypted link, meaning the data would be doubly encrypted against those outside the link. Effectively the link acts as a transportation method that is agnostic to the type of security a particular nation might wish to use.

'You can actually add security with very little impact on performance,' he said.

Crossing boundaries

Spectrum does not abide by international boundaries

or arbitrary delineations between different domains, said Dustan Hellwig, CEO and CTO of Chesapeake Technology International, who will present on multi-domain and multinational use of spectrum and its related capabilities (EW, cyber, navigation, etc).

The nature of the domain must be placed into the correct context for operational decision-making, he said. His paper will propose essentially an open-architecture system that facilitates the sharing of data, analytics and visualisation capabilities on spectrum usage across nations and domains, in line with concepts associated with joint EM spectrum operations.

It would deploy open-source and open software platforms to facilitate the required sharing, he said.

As things stand there is a degree of bilateral cooperation, where certain partners agree to share data on their use of spectrum, Hellwig added. There is also a limited amount of multilateral participation through international organisations, such as the International Telecommunication Union.

However, there is little operating-level sharing, through, potentially, a global database of usage that would inform users of who is operating in a spectrum at any one time anywhere in the world, 'so that people can rapidly get a picture of what is happening and how it might impact what they're trying to do'.

There are security issues that need to be addressed, with limits to the details that can be shared, while there is certain information that would not be shared because it could refer to systems that are not readily detectable anyway or are difficult to interfere with, meaning they would not impact upon other users.

'But there's no reason why providers can't post all the frequency channels they're currently utilising in a global database,' he added.



A screen capture from MetaVR's VRSG IG depicting a geo-specific area at Camp Pendleton, California. (Image: MetaVR)

Seeing it all

Ensuring that the three core elements of a simulator's visual system work together in harmony to provide a seamless experience is a key objective for developers. **By Peter Matthews**

The visual systems that are used in virtual simulators comprise three elements: the image generator (IG) – in some applications referred to as the rendering engine; the visual database that feeds the IG; and the display system.

The latter itself can be divided into two elements, the projector and the screen. CAE's director of global military business development, Phil Perey, has described the holistic visual system as a 'three-legged stool' in that if one element malfunctions, the whole will come crashing to the ground.

On cue

The role of the visual system is to display cues to the operator – a pilot, vehicle gunner or ship's bridge navigator – and these cues can represent the natural 'out-of-the-window'

(OOTW) scene or heads-up (NVG) and heads-down (EO/IR/LLTV) sensor presentations.

Clearly, the two scenes must be correlated and when it comes to the sensor views these must also accurately match the real-world physics of materials in all types of weather conditions and times of day or night.

When IGs transitioned from analogue to digital in the late 1980s, the fidelity compared to today's devices was crude. Shading was non-existent, moving models absent, and terrain and cultural objects were built using faceted sides, giving an unreal feel to the whole OOTW scene.

Due to relatively low computational power, update or iteration rates were slow. When considering the displays, the CRT collimated display or direct-view CRT projector predominated; these were

expensive, prone to failure and difficult to edge-match – the process where adjacent display channels seamlessly blend together.

Today then, much has changed. The conventional IG remains, although the power of COTS technology, particularly in terms of computational power, means many are driven by PCs and therefore the 1990-vintage IG that filled an air-conditioned computer room, nowadays can be contained in a single rack.

Market challengers

Modern IGs, especially those from companies such as FlightSafety International (Vital 1150), CAE (Medallion-6000), Link Training & Simulation (SimuView) and Collins Aerospace (EP-8100), are able to support high-end simulator requirements, but increasingly these companies are being

challenged by small- to medium-size enterprises.

Such companies include MetaVR (VRSG), Diamond Visionics (Genesis) and Aechelon (pC-Nova); all now have significant market share.

The other challenge is coming from the so-called serious games sector through companies like Bohemia Interactive Simulations with products such as its VBS Blue IG and Calytrix Technologies with its Vanguard CSE (Common Synthetic Environment).

As the computational power at the heart of the IG has mushroomed, iteration rates – the speed at which the image is updated – have increased to typically 120Hz.

Like the major simulator companies, BISim and Calytrix are offering 'whole-earth' solutions with high resolution inserts representing areas of training significance. These could include airfields or urbanised operational areas.

No matter what type of IG, and its associated database, two key discussions prevail: whether to use geo-typical or geo-specific terrain; and whether databases should be portable for use by different IGs.

The latter boils down to common standards that are

specified to enhance database re-use. However, Geo-specific data is more costly to acquire, although its proponents argue that it provides more realistic training and is therefore worth the additional cost.

Many believe that the best option is to use geo-typical data and save geo-specific data for particular areas of interest.

That said, visual systems are no longer just used for generic training tasks but are frequently exploited for mission rehearsal. For this application, OOTW and sensor images must be as realistic as possible to provide an accurate representation of the operational area.

The phrase 'train as you fight' has a particular resonance when talking about using virtual simulation for mission rehearsal.

Standard procedure

As to standards, this discussion has been ongoing since the fielding of the first digital visual systems in the late 1980s. Various have been suggested and all have failed to achieve the Holy Grail of true transportability between different IGs.

There have been many reasons for this: proprietary protectionism, the difficulty of encompassing legacy technologies and a general malaise, whereby the status quo is seen as good enough.

In terms of the visual database, the major trend to occur over the past decade has been the availability of a plethora of raw data from sources as diverse as Google Earth to satellites.

The modern world is awash with digital data and in parallel with this availability, tools to create the perfect visual database have multiplied. These tools are far more intuitive and easier to use than hitherto and as a result, the time needed to construct a high-resolution visual database has significantly reduced.

In theory, the concept of modelling and simulation as a service, or MSaaS, should continue the vector to provide 'streaming' visual databases from the cloud. Security issues aside, this could well be the preferred approach in the future.

Like the visual database and IG, the display system has seen major improvements over the years. In simple terms, the visual display comprises a device to emit the image and a surface to view the image.

The emitter is normally some form of projection device, and the surface can vary from a flatscreen monitor to a large dome device or even an HMD.

In terms of projectors, system integrators have a wide choice of technologies to select from that

include the relatively simple digital light processing and liquid-crystal-on-silicon devices to the more capable laser phosphor and LED, or even hybrid models.

A classic example of a modern projector is the Barco F70-4K6, a laser phosphor projector with native WQXGA and up to 4K UHD resolution.

The device has been designed to withstand the simulator motion platform's rapid and sudden movements. The F70 has a projected lifetime of up to 60,000h with a maximum brightness of 5,000lm. The system also has IR output to allow it to be used with NVG.

Resolution continues to improve with 8K projectors that make use of LED technology now beginning to appear.

Like the IG market, the projection market is highly competitive with companies such as 3DPerception, Canon, Collins Aerospace, Digital Projection, Esterline, JVC and Sony all vying for business.

Higher resolution

One of the most high-resolution display systems on the market at the present time is Boeing's Constant Resolution Visual System or CRVS, which was launched in 2012. The system uses JVC's Direct Drive Image Light Amplifier – D-ILA –

projectors to provide a 120Hz update rate over the CRVS 360° dome surface to provide 20/20 eye limited resolution.

CRVS is in use in the US (F-15), Saudi Arabia (F-15SA) and in Australia where it is integrated with two CAE-built Hawk Mk127 LIFCAP simulators.

The Boeing integrated visual solution that is CRVS is also mirrored by devices from FlightSafety International and CAE that were launched in late 2018, the latter's Medallion MR e-Series and the former's Evolution 360. CAE currently offers the baseline Medallion MR e-Series with either Barco or JVC laser projectors, although the solution can be offered with other high-end models depending on specific customer needs.

The Evolution 360 rear projection dome also provides a new option for training the single fast-jet pilot. The product showcases the company's display system optical design and manufacture, IG and system integration technologies.

Evolution 360 features an array of 4K projectors, driven at 120Hz by Vital 1100/1150, and managed by its integrated display management system that provides edge blending and colour matching.

As we have seen, the visual system comprises three main

elements: the IG, database and display system to form a holistic whole.

These systems need to be fully integrated to get the best out of the simulator and to provide the maximum in training value.

With technology racing ahead, the modern visual system continues on its upwards trajectory of improvement with 240Hz update rates and 8K projectors set to be the norm in the not too distant future.



CAE's Medallion MR e-Series integrated display system was launched in late 2018. (Image: CAE)

New combinations

The AUV62-MR can be used for MCM.
(Photo: Saab)

One of the major themes of this year's UDT is the potential exploitation of commercial innovations in the military domain. This can bring a number of benefits, according to speakers at the event, from harnessing technological advances to cutting costs.

The subject will be the focus of a talk by Matthew Gleed, consultant technologist at BAE Systems Submarines, and Darryl Newborough, technical director at Sonardyne International, who are presenting on 'future underwater enablers: learning from other operators within the marine sector'.

Speaking to *UDT Daily News*, Gleed said it can often take time for novel technologies to be adapted into the underwater domain, notably in the application of autonomous systems, but more broadly in terms of the use of automation to enhance the way operational capability is delivered.

This type of technological inertia is certainly prevalent in the defence sector, he said, and although it is advancing fast, there is utility in looking outside of it.

To help address this, BAE Systems has partnered with

The transfer of underwater technologies and operating concepts from the civil to the defence sphere (and vice versa) is an increasingly fertile source of innovation.

By Gerrard Cowan

Sonardyne – as a major player in the wider marine sector – in an effort to understand how the industry is dealing with the speed of the rate of technological development and innovation.

Similar solutions

While defence manufacturers operate under particular pressures – such as the need to develop products for a more hostile environment, or to put more emphasis on information security or the signatures of platforms – there are a number of areas in which defence and the wider marine market are attempting to solve similar problems through similar solutions, Gleed said.

'They are similar, though they're not precisely the same: defence has very particular constraints, in particular around the way that we tend to operate a lot more covertly, and that we are operating in more of

a threat-based environment,' he said.

'That's not to say that the non-defence sector does not have threats it is trying to deal with, but those threats are different in the way they might apply to technology.'

Although some commercial technology cannot transfer into defence, 'there are obvious areas where we could develop things between the two sectors without constraint', Gleed noted.

For example, he pointed to energy harvesting in the underwater environment, seabed infrastructure or methods for docking an AUV. Sonardyne has developed technologies in this area that BAE Systems is keen to adapt, he said.

Gleed noted that many of the autonomous systems being used in defence were originally developed for the commercial domain, so there is already a degree of overlap, although he

noted that there are a number of other areas of potential development that BAE hopes to exploit through working with Sonardyne and other partners across the sector.

While Sonardyne has its own focus on the defence and security market, it also is involved in a wider array of marine sectors, from ocean science to marine resources.

Two-way street

There are various areas within the non-defence marine domain from which companies like BAE Systems can learn, said Newborough, pointing to technological developments in areas like oil and gas and oceanography.

However, this works both ways, with strong potential for these areas to learn from the defence business as well, he said. For example, Sonardyne designed a diver detection sonar system suitable for the defence business that can also be used to secure harbours, ports and mega yachts.

Similarly, the company has taken technology developed for defence and used it to detect leaks and seepages of hydrocarbons on the seabed,



Sabertooth, fitted with the Blue Logic charger, is the world's first system capable of remote docking operations. (Image: Saab)

which has obvious applications in oil and gas.

Dr Ioseba Tena, global business manager at Sonardyne, will also present at UDT, speaking on covert communication using free-space optical modems, a technology that Sonardyne believes could provide a more covert means of communication than traditional acoustic signals.

Sonardyne has developed its BlueComm system to exploit this technology; this is a through-water wireless optical communication system designed to transmit subsea data, stream video and perform tetherless vehicle control at high speeds, according to the company.

It enables data rates of up to 10Mbps to be transmitted over distances of up to 150m, according to Sonardyne.

While Sonardyne has identified a number of niches for the technology in the commercial domain, there is a range of possibilities in defence, Tena said, pointing in particular to the development of covert communications between large AUVs, as well as between submarines or between submarines and AUVs.

'This new technology enables commanders to act on intelligence, talk to their unmanned assets, and remotely control them if they need to, while remaining covert,' said Tena.

Cost-cutting COTS

Cost is a key driver of the military focus on COTS products, said Chris Lade, engineering and

defence sales manager for Saab Seaeye UK, who will present at the conference on 'the marriage of commercial and military underwater systems for the good of defence', which focuses on how exposing military hardware to commercial operators can encourage the latter to understand what the armed forces are trying to achieve, allowing commercial companies the opportunity to help defence operators with technical and procedural inputs.

Lade said that in general terms 'the cost is going to be lower than it is for a military-spec product', although he cautioned that this depends on the individual technology type.

An area where the commercial and military worlds often differ is in the modularity of commercial ROVs versus the specificity of military equivalents. Pointing to a particular example of introducing a modular system to the military, Lade said the Multi-Shot Mine Neutralisation System (MuMNS), which is based on a commercial ROV concept, was selected for the UK and France's OCCAR programme; Saab is part of the team behind the project.

While cost is a big driver, Lade also pointed to usage. Commercial systems 'have really been tried and tested', he said, being frequently used over extensive time periods. Potential military operators can therefore often be certain that the systems have undergone rigorous use ahead of adapting them into the defence domain.

Additionally, the commercial sector is good at getting new technology to market very quickly, Lade added, as companies look to obtain commercial benefit.

The fact that systems are being developed with private funds means that the products can be placed into market at speed, 'and they don't have to jump through the procurement hoops, because it's not public funds'.

In defence, this can be a more challenging process for understandable reasons, due to the various challenges associated with introducing a new system into the market.

'In the commercial domain they can try and test things and if it works then they can use it, but if it doesn't work then they'll discard it and move onto the next one,' Lade said, meaning that in some areas the commercial domain can actually be ahead of its military counterpart.

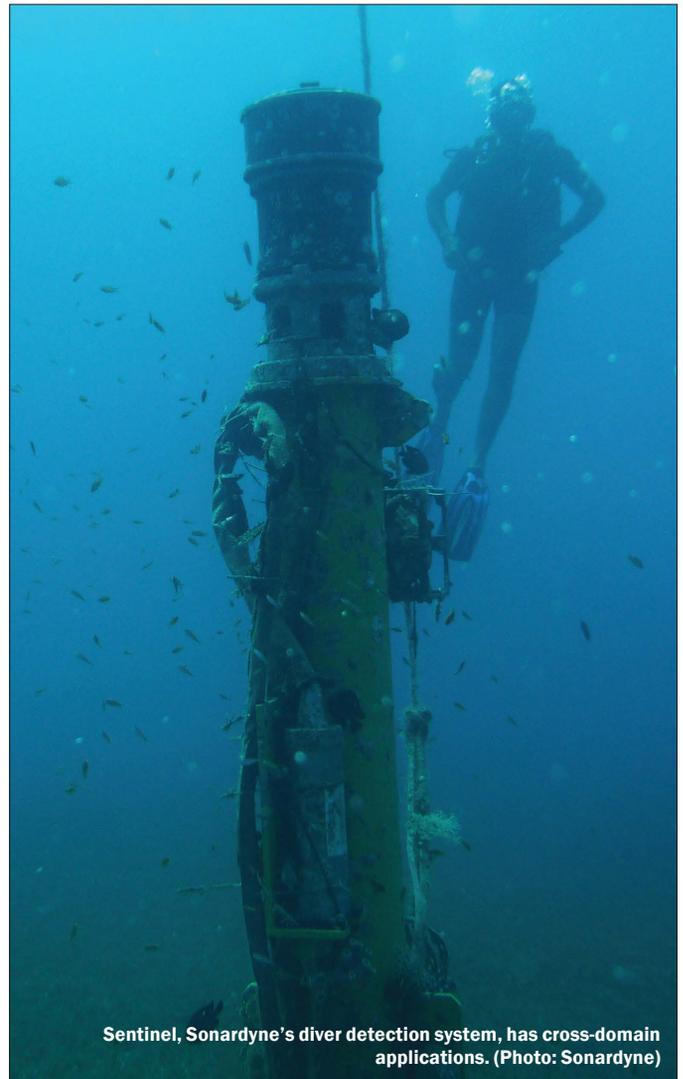
Autonomy is perhaps the key area of potential crossover between military and commercial sectors underwater, said Lade, with navigation systems being a particular area of potential.

Both sectors are pushing rapidly ahead with development in this area, he said, driven both by cost and safety factors.

'If you can remove the need for expensive, manned platforms then you've got the advantage of reducing your costs,' he said. 'And if you can take the person out of the loop, that's also beneficial from both a military and commercial point of view.'

This means there are parallels between the commercial and military domains that could be exploited to the benefit of both.

'While there are different reasons [motivating] each, there are similarities in what they are trying to achieve,' he said.



Sentinel, Sonardyne's diver detection system, has cross-domain applications. (Photo: Sonardyne)

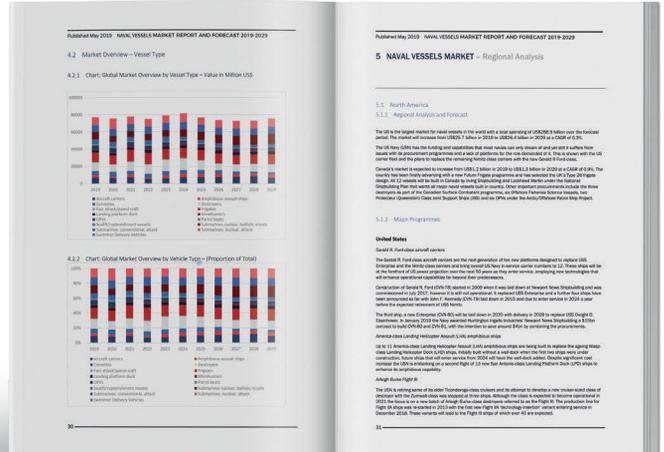
A selection of some of the items on display at UDT 2019.

Photos by Beth Maundrill



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