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– the Scandinavian Military Magazine –

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POISON AND POLITICS

While the Russian opposition politician Aleksej Navalnyi is now on the road to recovery, it has been confirmed by German, French and Swedish laboratories that Navalny was poisoned by the neurotoxin Novitsjok.

This is the same poison that the British authorities concluded had been used to poison the Russian / British former spy Sergej Skripal and his daughter in Salisbury in the UK in 2018.

Novitsjok is a series of neurotoxins, which were developed in the Soviet Union and Russia in the period of 1971-1993. Unlike many other war gases and nerve poisons, Novitsjok is lethal even at very low concentrations.

Western countries have accused the Russian government of being behind the poison attacks. This is not so surprising. The poison Novitsjok is not something that just any criminal cohort can get hold of. The Russian state is probably one of very few states, if not the only one, that has Novitsjok available. At the same time, the victims of the Novitsjok attacks, both in the UK in 2018 and today, are people whom the Russian authorities have had an interest in getting rid of.

Out of all the different types of poison found on the planet, the poison that has been used is one with clear links to the Russian authorities. It is hard to believe this can be a coincidence. By their use of this poison, Russian intelligence wants to demonstrate to the world just what they are both capable of and willing to do to their opponents. This in frightening in itself. And when one also knows that Novitsjok causes a very painful death for the victims, the Russian attitude takes on an even more frightening hue. Until today, only Russian citizens have been subjected to Novitsjok attacks. But the signal is clear. The Kremlin regime, which is steadily evolving in the direction of dictatorship, is making the statement that they can target anyone who fails to do as the Kremlin says.

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Combat Boat 90
US Marines and Norwegian Coastal Rangers training together outside Harstad during exercise Platinum Ren 19. Norwegian Costal Rangers is currently using the "Combat Boat 90". This class of vessels is due for either comprehensive upgrades or renewal.

Photo: Jakob Østheim/ FMS

NORWEGIAN COSTAL RANGERS DEPLOYING A HELLFIRE MISSILE BATTERY DURING EXERCISE JOINT VIKING IN 2017.

For years, the Hellfire missile has been the main armament for the Costal Rangers, giving small units on shore the capability of attacking enemy vessels in littoral waters.
Within few years, the Hellfire missile system will have reached the end of its technological lifespan, and the missile system will not be upgraded or replaced by any other weapons system per se. The Costal Rangers units will be equipped with sensors and drones providing target data and information for the armed forces long range precisions weapons, like the Naval Strike Missile and the Joint Strike Missile. *Photo: FMS / Jonny Karlsen*

THE COASTAL RANGER COMMAND UNDER FURTHER DEVELOPMENT

Trondenes: The Coastal Ranger Command (CRC) will be developed in a more sea-operational direction and tied up closer to maritime security operations while collaborating more closely with the units of the Navy. The focus will be on developing the Navy's ability to perform ISTAR operations (Intelligence, Surveillance, Target Acquisition and Reconnaissance), enhancing the capability for intelligence-driven operations and further develop the Navy´s ability to perform Maritime Interdiction Operation.

Text and photo: Tor Husby

The Coastal Ranger Command (CRCDO) will employ flying drones, develop robust and relevant boarding capacity, as well as develop the force protecting abilities. The task of supporting the Norwegian Special Forces (FS) will continue at the current level. The Navy will be phasing out the Hellfire missile from about 2023, and the CRCDO will focus on the introduction of drones and new sensors while developing the ability to gather decision-supporting information and target data for the Armed Forces' long-range precision weaponry. This is a natural further development of the Coastal Ranger Command, where the main focus will be on putting new technology to use, such as

drones and advanced sensors, and becoming more integrated with the maritime operations. The organic sea mobility of the CRCDO will remain and be further developed. The goal of the Navy is to develop its abilities within intelligence-driven operations, while increasing the range of its sensors in order to produce target data for its long-range precision weapons. This will entail that the CRCDO will be making use of the newest technology to develop further its abilities of situation understanding in the coastal, littoral and blue water areas.

The Coastal Rangers' abilities regarding organic sea mobility will be maintained and developed further. The CRCDO is currently using the "Combat Boat 90", which is due for either comprehensive upgrades or renewal. The unit, located at Trondenes near the city of Harstad, has procured smaller drones of the PUMA type in order to develop competence in drone operations. The drones are held and launched by operators and are of all-weather type with day and night capabilities. The "Puma" has a range of 20 kms, can stay aloft for 2.5 hours, and flies to an elevation of 10,500 feet. It is possible to mount new sensors on to the units. The same type of drone is also used by other units of the Armed Forces.

Tactical drones are coming

- For now, we are in the start-up phase with a limited number of PUMA-type drones, but as soon as we have built up the necessary competence, we will start the development towards the use of tactical drones with longer range. Exactly which types of drones we will then choose to use, will be decided in accordance with the needs we have identified. We are also eagerly studying laws and regulations governing the use of drones; we are attending courses with the Air Force, and we have entered into co-operation with the University of Tromsø and other civilian entities, says the Chief of CRCDO, Commander Sten Richard Larsen, to "MilitærTeknikk".

An initial pair of new RHIB-type boarding craft have been procured for the purpose of increasing the ability for boarding of vessels. The Coastal Ranger Command will be developing its boarding abilities in accordance with NATO requirements. This is an exacting process, calling for a great deal of specialised competence and equipment. In step with the development of competencies, more boarding craft will be procured, along with more specialised equipment. The competence will be built up gradually.

- We are currently practising our boarding skills against military vessels, cargo vessels, civilian ferries and other available boats. It is not up to the CRCDO to decide what vessels are to be boarded. Assignments of this kind happen through the line of command, whereby the Norwegian Joint Headquarter (NJHQ) gives the Navy the order to execute boarding, says Commander Larsen.

When it comes to force protection, the CRCDO will, based on information gathered from both "Puma" and "CB 90", contribute to the early detection of threats to our own and allied units. Sten Richard Larsen is confident that the CRCDO comprises of competent personnel that are fully capable of meeting the Navy's needs in this respect.

Chief of CRC, Commander Sten Rikard Larsen. *Photo: Tor Husby*

COASTAL RANGER BOARDING A CIVILIAN VESSEL

The Coastal Ranger Command is developing its boarding abilities in accordance with NATO requirements. *Photo: CRCDO*

PUMA LAUNCH FROM A STRIDSBÅT 90

In order to build drone competencies, the Coastal Ranger Command has acquired a limited number of PUMA UAV's. The type and numbers of drones to be finally chosen has yet to be decided. *Photo: CRCDO*

Support to the Special Forces is a important task for the Navy. The Navy declines to comment on missions related to Special Operations but confirms that the CRCDO has personnel present in Afghanistan in order to support the Special Forces. The Coastal Ranger Command has no helicopters of its own, but the Navy uses NH90 helicopters. Looking ahead, this can become a valuable tool for deploying boarding forces to a vessel. The CRCDO has acquired good competence in collaboration with helicopter capacities and holds regular exercises with the Air Force's own as well as allied helicopters.

The development of the Coastal Ranger Command will drive the need for enhancements regarding infrastructure and assets at Trondenes. This applies particularly to new workshop and maintenance facilities.

RUSSIA SNIFFING AROUND LOFOTEN AND VESTERÅLEN

The strategic development in North Norway has been given a new element which is characterized by Russia conducting maritime surveys of the Lofoten and Vesterålen islands and waterways. The Moscow interest is not confined to just Finnmark, states Ståle Ulriksen, head lecturer at the Naval Academy in Bergen.

The Russian Navy appears to have ceased building bigger warships, focusing instead on smaller vessels like corvettes and conventional submarines that can be surreptitiously shifted between the Northern Fleet and the Baltic Fleet by way of the Russian canals. Both the movements internally in Russia and operations along the Norwegian coast with these smaller vessels will be harder to detect.

The bigger warships are showing signs of wear and tear, and inadequate maintenance, and they are not sailing as much as they used to. The ageing aircraft carrier "Admiral Kutznetsov" – Russia's only such – can only be seen on rare occasions. And when it does, it is always accompanied by a tugboat. Speculations are that it will be scrapped.

- The motivation for the Russian interest in our coast, according to the way the Naval Academy views the project "Naval Force 2040", is either to prepare operations to disturb or delay Norwegian and allied operations that are dependent on using the protected inner sea routes, or to prepare for using our coast in order to compensate for a lack of resources to establish the classic bastion defence, says Ståle Ulriksen.

The ageing aircraft carrier "Admiral Kutznetsov" sails along the coast of Norway in October 2016. "Admiral Kutznetsov" is the only Russian aircraft carrier and can only be seen on rare occasions. And when it does, it is always accompanied by a tugboat. Speculations are that it will be scrapped. *Photo: FMS*

Stronger along the Norwegian coast

He contends that while the Russians are losing strength at sea, they are gaining in force along the coast of Norway, where they can also establish land-based "denial bubbles" based on mobile radars and missile batteries for use against both air and sea targets.

Ståle Ulriksen is not prepared to delve further into the Norwegian reaction, or lack thereof, to the interest that the Russians are showing in Lofoten and Vesterålen.

Christian Tybring Gjedde, member of the Foreign Policy and Defence Committee at the Stortinget, says in general terms that there is nothing new about Russia showing increased interest in North Norway. A great deal has been written on the subject, but exactly what the Russian intentions are, will be pure speculation.

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Norwegian Defence and Security Industries Association (FSi)

THE LEADING ASSOCIATION IN NORWAY ADVOCATING THE INTERESTS OF ITS SECTOR, AND THE PRIMARY INTERLOCUTOR FOR THE GOVERNMENT IN MATTERS OF IMPORTANCE TO THE INDUSTRY. AFFILIATED WITH THE CONFEDERATION OF NORWEGIAN ENTERPRISE (NHO) AND REPRESENTING MORE THAN 100 COMPANIES

HVORFOR VIL IKKE REGJERINGEN DELTA I DET EUROPEISKE FORSVARSFONDET?

I forslaget til statsbudsjett for 2021 foreslår regjeringen at Norge ikke deltar i Det europeiske forsvarsfondet (EDF). Det vil svekke forsvarsevnen og forsvarsindustrien, sette arbeidsplasser i hele landet i fare og medføre betydelig bortfall av verdiskapning og eksportinntekter. Forslaget strider mot regjeringens egen Europapolitikk og vil, dersom det får tilslutning i Stortinget, innebære at Norge avslår EUs invitasjon til å delta i det mest omfattende og viktigste tiltaket Europa har iverksatt for å styrke den europeiske pilaren i NATO. Det innebærer også at Norge gir avkall på muligheten til å være med å påvirke krav, spesifikasjoner og ytelser for å sikre at løsninger som utvikles i europeiske samarbeidsprosjekter er best mulig tilpasset Forsvarets behov.

Det er bred politisk enighet om at Norge har behov for en forsvarsindustri. Likeledes er det erkjent at eksport av forsvarsmateriell er en forutsetning for å kunne opprettholde en nasjonal forsvarsindustri. Det forutsetter at forsvarsindustrien sikres markedsadgang hos våre nærmeste allierte. FoU samarbeid på tvers av landegrensene er et viktig tiltak for å bryte ned handelshindringer og sikre bedre utnyttelse av FoU-midlene på forsvarsområdet. Videre er det erkjent at dersom Norge skal kunne opprettholde den industrielle kompetansen Forsvaret, av hensynet til nasjonens vesentlige sikkerhetsinteresser har behov for i Norge, må vi i enda større grad enn før samarbeide med andre nasjoner om utvikling av materiell, slik vi nå gjør med Tyskland om ubåter og missiler. Bilateralt samarbeid vil ikke kunne kompensere for de negative konsekvensene av å ikke delta i EDF. Å stå utenfor EDF innebærer at norsk forsvarsindustri blir en vesentlig mindre attraktiv samarbeidspartner også i bi- og multilaterale samarbeidsprosjekter i Europa som gjennomføres utenfor EDF.

Koronapandemien har fått vidtrekkende konsekvenser for norsk næringsliv. Som følge av dette har regjeringen brukt enorme beløp på å begrense de økonomiske skadevirkningene. I denne perioden har store deler av forsvarsindustrien kunnet bidra til å holde hjulene i gang. Det har vært svært viktig for å sikre overlevelsen til mange små og mellomstore underleverandører i hele landet i en svært krevende tid. Det har også har bidratt til å gjøre statens utgifter til tiltak for dempe konsekvensene av pandemien mindre enn de ellers ville ha vært. Dette illustrerer godt betydningen av å legge til rette for å kunne opprettholde næringer som sikrer langsiktig og stabil verdiskapning og store eksportinntekter for landet. Når det også er dokumentert at å delta i EDF over tid vil ha lavere kostnader for Norge enn å ikke delta, blir det svært vanskelig å forstå regjeringens begrunnelse som er at den ikke finner rom for å delta i EDF.

Norge har gjennom EØS-avtalen valgt å være en del av EUs indre marked. Derfor har EU og medlemsstatene gitt Norge et eksklusivt tilbud om å delta i EDF. EU-kommisjonen har vært en pådriver for dette på tross av betydelig motstand i enkelte medlemsstater. Etter omfattende lobbyvirksomhet fra norske myndigheter i Brussel og øvrige europeiske hovedsteder gjennom flere år fikk Norge så sent som 28. september i år, som eneste ikke-medlem, anledning til å delta i EDF. Det innebærer i praksis at både norske myndigheter og industri kan delta med tilnærmet fulle rettigheter i gjennomføringen av programmet. Å si nei til EDF nå sender et sterkt signal til Europa om at Norge nedprioriterer samarbeidet med EU på forsvars- og sikkerhetsområdet og at regjeringen ikke følger opp sin egen politikk på dette området.

For et par uker siden lanserte EU-kommisjonen et helt nytt initiativ: «Action Plan on synergies and cross-fertilisation between the civil, defence and space industries. Formålet er bl.a. å hente ut synergier på tvers av EUs FoU-programmer. Derfor kan det å ikke delta i EDF også få skadevirkninger for norsk deltagelse i andre EU-programmer, som f. eks. romprogrammene. En betydelig del av EDF vil bli brukt på militære romrelaterte prosjekter, her vil norsk romindustri ikke få delta. Det kan på sikt også få konsekvenser for norsk industris muligheter i de sivile romfartsprogrammene, når disse i økende grad ses i sammenheng ned fra EDF-finansierte romprosjekter. På lengre sikt kan EUs ambisjoner om å ta ut synergier fra de industrirelaterte FoU-programmene innebære at også norsk deltagelse i øvrige programmer som f.eks. Horizon Europe blir negativt påvirket av at vi ikke deltar i EDF.

Dersom regjeringens forslag om at Norge ikke skal delta i det Europeiske forsvarsfondet blir stående, vil forsvarsevnen og forsvarsindustrien bli svekket, arbeidsplasser i hele landet blir satt i fare og det vil medføre betydelig bortfall av verdiskapning og eksportinntekter. Vi setter vår lit til at Stortinget forstår de vidtrekkende negative konsekvensene av regjeringens forslag og sørger for at behandlingen av forsvarsbudsjettet sikrer for at Norge kommer med i det europeiske forsvarsfondet fra 2021.

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YGGDRASIL: AREA CONTROL FOR THE LAND FORCES

The Norwegian Army`s project for area control, named Yggdrasil, reached out to the FSi (Forsvars- og Sikkerhetsindustriens Forening/ The Defence and Security Industries Association) for the purpose of informing industry an early phase to allow industry to prepare for a future programme. It was therefore very gratifying on the part of the FSi when the management of Project 5065 got in touch and wanted FSi to arrange a meeting place for the industry and the Armed Forces' project management.

Major Per Kleiven is the Project Manager from the Army side for the Yggdrasil project. *Photo: MilitærTeknikk*

The meeting took place at the beginning of September in the Oslo Military Society, and all 53 registered participants were given seats within safe corona distance to the neighbouring chair.

Project 5065, also known as "Yggdrasil: Area Control", has the purpose of acquiring a modern, efficient and deployable area control system. The system will be based on the NATO concept for Area Access Control (AAC). When the system is available, the goal is for even a small number of soldiers to have the most efficient and flexible capacity possible for controlling, monitoring and possibly also denying access to the area.

The Yggdrasil project for area control came about as a project idea in 2015-2017 and is a Land Force project chiefly intended for the Army and the Home Guard. According to the FAF (Future Acquisitions for the Norwegian Defence Sector 2019 - 2026), the project carries a cost estimation of between 400 and 600 million NOK, or 40 to 60 million Euro.

- The project involves the development of a system consisting of different types of sensors that are connected to a command and control system through a secure network When the system is deployed to an area, its sensors will send information to military command centres, relevant military units, etc. about, for example, enemy troop movements that are picked up by the sensors. On the basis of this information, own forces can be disposed of in a far more efficient way.

- We envision that the system is based on the NATO concept for Area Access Control, but it must be emphasized that as of today this is only a concept. There is as far as we know, no NATO country that has such a system in operation, says project manager Major Per Kleiven. Our project will accordingly involve significant innovation and development work, Kleiven explains, and adds that innovation with public funds is a relatively demanding process.

- The area we regard as particularly relevant to cover includes the northern part of Norway. These are of course the areas that are also the most exposed due to their location. Within this area, Finnmark is particularly demanding, as the warning time will be particularly short in the event of a pending attack.

As of today, we are working on the development of requirement specifications for the project, continues Major Kleiven. - We basically have a little more leeway than in other projects to alter the project requirements as the project proceeds, giving us a lot of opportunity to incorporate good input from the industry.

- On the sensor side, we see that there is a virtual jungle of different sensor types out there, not least when it comes to civilian sensors such as drones and wild game cameras. These sensors are also quite inexpensive, which means that a large number can be deployed, and if some of the sensors are lost, it will not be critical, neither operationally nor financially. Limitations include such factors as many of these sensors having been made by China, or incorporate technology manufactured in China. Further to this, the civilian sensors are based on the 4G communications network, and this network is nowhere near secure enough for use in a crisis or war.

- So, what we are looking for, could perhaps be pointedly described as consumer electronics adapted to defence use, says Kleiven in conclusion.

FACTS AND FIGURES:

According to Norse mythology, Yggdrasil is the name of the world tree, probably an ash, which spans across the sky and spreads its branches all over the world. Yggdrasil is always green, and from it comes dew that drips to the ground.

UBIQ AEROSPACE, A DEEP-TECH COMPANY, ENJOYS STRONG GROWTH

UBIQ Aerospace is a young tech startup that develops autonomous technology systems. The company is part of a mutually beneficial collaboration with the Armed Forces and FFI (the Norwegian Defence Research Establishment) and is a member of FSi.

History

UBIQ Aerospace was founded in Trondheim, Norway, in November 2017. The company is the commercial platform for a technology developed as part of a Ph.D. project at NTNU (the Norwegian University of Science and Technology), pitched by a contact from the US Coast Guard.

The company's technology and products

UBIQ Aerospace creates systems and solutions for autonomous and unmanned aircraft that enables technological autonomy for a future of increasingly complex and self-governing systems. This objective is achieved by building solutions to critical problems limiting unmanned aircraft and urban air mobility industries from reaching their full potential.

The first solution developed by UBIQ Aerospace is D•ICE, an autonomous icing protection solution for unmanned aircraft (often referred to as unmanned aerial vehicles, UAVs). In-flight icing is one of the most significant weather hazards to aviation and especially to the UAVs. In-flight icing is experienced in freezing conditions when liquid water droplets impinge on exposed aircraft surfaces. Upon impact, the droplets freeze and drastically reduce aircraft capabilities with potentially devastating consequences, e.g., the tragic outcome of Air France Flight 447. Current mitigation strategies for UAVs include delaying or sometimes canceling critical operations. D•ICE was initially developed at NTNU and NASA Ames Research Center. Fully autonomous, the D•ICE solution provides the robustness required to operate in harsh and cold conditions, without any requirement for human interaction. With this capability, UAVs can operate reliably and efficiently for critical operations such as search and rescue, disaster mitigation, and medicine supply deliveries.

In May this year [2020], the Norwegian Armed Forces awarded UBIQ Aerospace a development contract to complete the D•ICE solution. The contract will see the completion of D•ICE by the end of 2022 when the Norwegian Tactical Unmanned Aircraft Systems acquisition program begins.

The corporate organization

UBIQ Aerospace is growing rapidly and will have a total of 11 employees by January 1st, 2021. The company is wholly owned by a quartet of founders, four employees, New York-based Lupa Investment Holding, and 6AM.

How is the company involved in the defense market?

"We produce dual-use technologies, but the defense market is unquestionably the most established part of the UAV market and early adopters of new technologies, such as ours. It is, therefore, only natural to focus on the defense market initially. Also, this is a constructive environment for developing new technology alongside, for instance, FFI" –, said Kasper Trolle Borup, CTO, UBIQ Aerospace.

A member of FSi?

UBIQ Aerospace became a member of FSI in 2018 because of the many benefits of such membership. "We joined because of the networking opportunities, the events, and the strong engagement between industry and defense. We are delighted with the opportunities that have arisen due to our membership in FSi" –, said Kasper Trolle Borup, CTO, UBIQ Aerospace.

The D•ICE solution uses sensor data to detect and eliminate ice. Here shown on the Maritime Robotics PX-31 Falk. *Image: TYD*

The leading edge of a UAV wing with glaze ice accretion on it. *Photo: Richard Hann*

"THUNDER" CANNONS FOR THE NORTH BRIGADE

In September, the North Brigade took delivery of the initial 12 units of "Thunder" self-propelled 155 mm artillery (K9) and three ammunition vehicles (K10) from the Hanhwa factory in South Korea. The K10 transfers the grenades automatically every few seconds to the artillery. The K9 weighs in at 48 tonnes, and the K10 almost as much.

The K9 "Thunder" self propelled artillery (left) and the K10 ammunition vehicle (right) during trials at Rena in 2019. *Photo: Fredrik Ringnes/FMS*

Text: Tor Husby

A further two deliveries are expected from the factory this autumn. In total, the Artillery Battalion in the North Brigade will then be furnished with 24 units of K9 cannons and six K10 ammunition vehicles. The contract value amounts to 1.8 billion NOK, or some 168 million Euro. The Armed Forces hold an option for a further 24 units of K9 and K10. The new artillery will be replacing the old M109 cannons, following 50 years of service with the Artillery Battalion. The gun crews, who

henceforth will enjoy air cleaning while also wearing gas masks, will be protected against nuclear, bacteriological and chemical warfare, as well as 155 mm fragmentation grenades, 14,5 mm armour piercing grenades and anti-personnel mines, according to Hanhwa.

The major military advantages are related to the range of the "Thunder", which at 40 kms is almost twice as far as that of the M109, while it also offers a higher rate of fire with greater accuracy, topped with better mobility. With a full tank of diesel, the cannons can drive up to 480 kms, or 300 miles. The artillery battalion will not be using the "Thunder" in a stationary role. The cannons are intended to move from one firing site to another as quickly as possible, according to the so-called "Shoot and Scoot" principle. Indeed, the "Thunder" can be on the move to its next firing location before one minute has passed. This modernisation is expected to give the Armed Forces in the Inner Troms region a considerable lift when the new system is fully operational in a few months.

The Defence Workshop at Bjerkvik will also be considerably enhanced. Its role will be to function as a permanent technical support to the South Korean cannon system of the Artillery Battalion at the Setermoen camp. Hanwha has been building up the technical competence of the workshop as a n integral part of the offset purchase commitments. Furthermore, Norway and Finland, who has also procured the same cannon system, are pursuing close military co-operation in this field.

The first four units of the Norwegian army´s new K9 Thunder artillery arriving at Artillery Battalion at Setermoen camp in Northern Norway. *Photo: Jens Inge Furu/FMS*

Embarking two squadrons of F-35B Lightning IIs – one British, one American – HMS Queen Elizabeth's participation in Exercise Joint Warrior in October marks the largest number of the type at sea at one time – ever. *Photo: UK MoD*

A QUEEN BY ANY OTHER NAME...

HMS Queen Elizabeth is one of the two largest warships ever built in or operated by the United Kingdom. But will such a gigantic vessel stand a chance in a battlespace in which cruise missiles are the dominant threat?

Text: Tim Mahon

As these words are written, Britain's Royal Navy is a week away from opening another chapter in its long and distinguished history – a chapter that will, to a certain extent, reprise an earlier one.

The last time British aircraft carriers – the Invincible class just about qualified for the name, but they were really 'through-deck cruisers' rather than true carriers – were used in active operations was during the Falklands/Malvinas conflict in 1982. In early October this year, HMS Queen Elizabeth – one of the two largest warships ever built in or operated by the United Kingdom (the other being her consort and classmate HMS Prince of Wales) – will take part in Exercise Joint Warrior in and around Britain's shores, taking her place for the first time as the flagship of a UK-led NATO Carrier Strike Group (CSG). Some 6,000 troops from 11 nations will take part in the exercise, together with 81 aircraft, 28 surface warships and two submarines. Notable will be the contribution made by F-35B Lightning II combat aircraft operating from the carrier – both British and US Marine Corps aircraft, training together in British skies for the first time and marking the largest number of F-35Bs at sea ever. They will also constitute the largest number of aircraft embarked on a Royal Navy vessel since 1983.

Quite apart from all these 'firsts,' the exercise, which is aimed at showcasing NATO's collective force and capability to potential adversaries – particularly the resurgent and increasingly intractable Russian Federation – will present a series of challenges for the carrier and her crew. This marks the first major exercise of carrier-based strike power for the UK in almost four decades, during which time two complete generations of naval officers and the entire leadership of the service have grown up with no experience of carrier strike operations.

That does not belittle the vast efforts – intellectual, organisational and physical – that the Royal Navy has made in the years since commissioning the class of two aircraft carriers. But the development of theory and extensive wargaming, while offering significant benefits, is absolutely no substitute for the opportunity to practice in a far more realistic environment – one in which the vagaries of weather and the capricious nature of the sea will combine with the more-than-likely wickedly disruptive antics of the exercise controllers to inject uncertainty, chaos and challenge into the mix. It will be interesting to read some of the after-action reviews and reports from Joint Warrior, should they ever become available in suitably sanitized form.

The most interesting aspect of the decision to build the two carriers – a decision that has included huge elements of political concern and controversy, professional debate and public confusion, mostly over the financial aspects – is doctrinal in nature. Aircraft carriers have traditionally been seen as instruments of power projection. The message sent to a potential enemy in saying "we can park a powerful air group several hundred miles off your coast and thereby hold your industrial, military, political and even societal assets at peril," is a powerful one. But is it necessarily still as persuasive a rationale as it once was for committing to the massive resource and financial investment required?

The US Navy, for example, appears to think not. Learning lessons from the spiralling costs and delays in the construction of the approx. $13.5 billion Gerald R Ford, the service has recently suggested to Secretary of Defense Mark T Esper that it will downsize the carrier fleet from 13 to nine vessels, using the cash and operational resources thus saved to build a numerically superior navy that will feature a large number of unmanned and smaller crewed vessels. This is in response to the perceived threat from China which, among other moves, has invested heavily in anti-ship missile technologies and capabilities.

What, then, might this mean for the Queen Elizabeth class? Are the most expensive warships ever commissioned in Britain doomed to impotence from the outset? Some would say yes – pointing to the virtual impossibility of protecting so high-value an asset against swarming attacks of scores, perhaps even hundreds, of so-called 'carrier killer' cruise missiles such as the Chinese DF-21D (CSS-5 Mod 4), which has a reputed range around 1,500 kilometres. Such a point of view, while legitimate, does not really tell the whole story.

National defence is essentially an insurance policy. Government and the defence authorities that enact developed policy gamble that the assets they fund, procure, man and operate will be sufficient to defeat the vast majority of threats the nation faces. The equations that they must resolve in deciding how best to achieve that challenging task are many, varied and fiendishly complex. More distressingly, they are always changing. When weighed against the gestation period of designing, developing and commissioning as complex a machine as an aircraft carrier – and adding to the mix the expected 40-year or more life span of the vessel – it may well be that building an aircraft carrier may be considered as not having been in Britain's best interests in the light of current threats.

And that would be a mistaken conclusion. Quite apart from the considerable

The carrier embarks a total of 40 aircraft, split between fixed- and rotary-wing platforms as operational circumstances demand. *Photo: UK MoD*

flag-waving and political power projection aspects inevitable in the two carriers' expected future – especially in the post-Brexit world rapidly approaching – the question of the most likely operational deployment needs to be considered. Strategic strike operations against land targets in the Middle East, Southeast Asia or elsewhere are less likely to attract the type of attacks envisaged by those who believe the carrier is outdated. Limited conflict in the North Atlantic or the Arctic is possible – particularly in an anti-submarine warfare context – but is unlikely to cross an escalation threshold that would put the carriers at severe risk. At least, that is the current thinking in Whitehall, according to recent off-the-record conversations with observers both in and out of uniform.

At 65,000 tonnes, driven by two 33-tonne propellers at speeds of up to 25 knots, the 280-metre long vessel embarks 40 aircraft. Her powerplant could provide power for a town the size of Swindon (approx. 200,000) and her air traffic control capabilities would be able to cover national requirements if, for example, a cyber attack took down the existing civilian network. Queen Elizabeth – and her consort – are national assets. They reaffirm all sorts of commitments – overt and subliminal – and provide a focal point for the continued evolution of cohesive, compelling and effective defence strategies. Which is the message one hopes will be taken on board by the Kremlin as it watches Exercise Joint Warrior unfold in October.

MARITIME DOMAIN AWARENESS

The underwater domain is becoming increasingly important internationally in all conceivable conflict scenarios - symmetrical and asymmetrical. In April this year the Netherlands became the first European country to select the Sea Wasp underwater robot system from Saab. Due to their geographical location, such underwater systems may also be relevant for Norway.

Text: Communication Manager Christian Trottmann, Saab

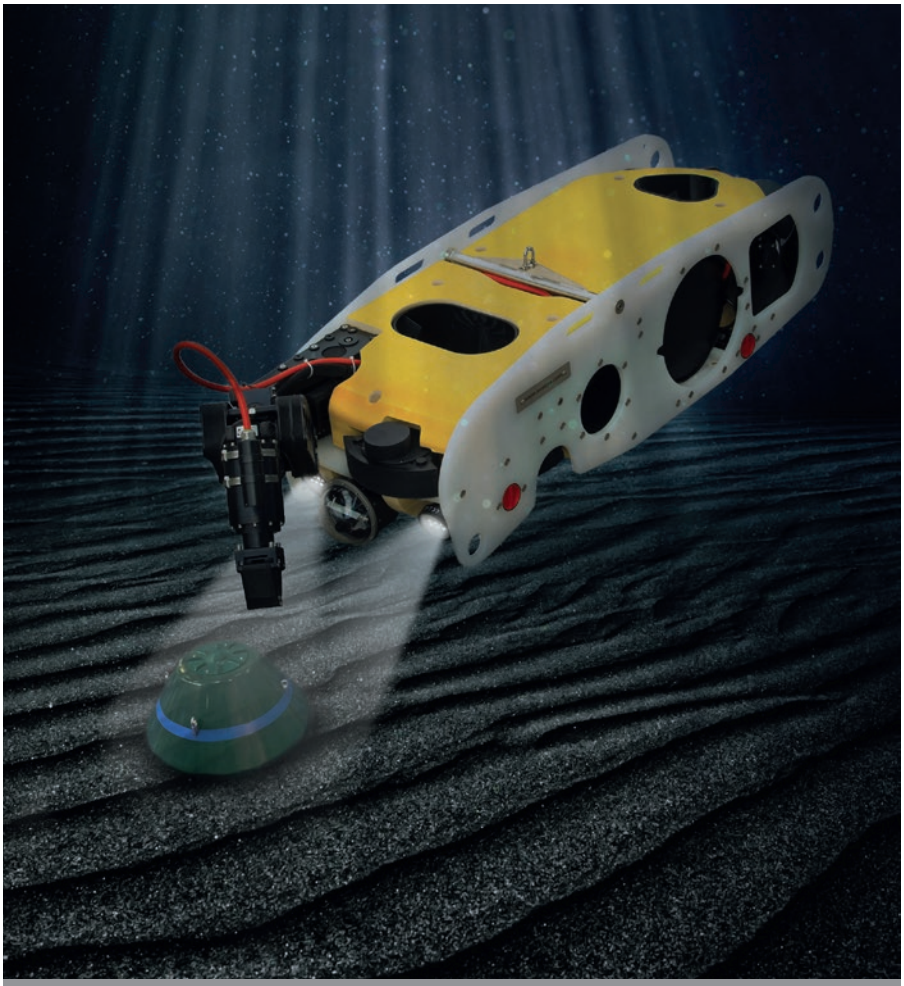
Until today sea mines dating from the Second World War are still regularly found in Norwegian waters. These are detected and neutralized by naval mine divers - a costly and often dangerous operation. This work can be done more efficiently and without risk by unmanned underwater systems. Operational safety is perhaps one of the most important advantages of using such underwater systems.

System capabilities

Saab's Sea Wasp underwater vehicle is designed as a fully mobile system that can operate in harbors, lakes, rivers and other waterways. Underwater orientation is performed by video cameras, LED lights and wideband sonar, primarily to locate targets that may have been placed on a ship's hull, harbour wall or the seabed. When ready, the operator uses the thrusters to lock into position and using the five-function manipulator arm to position a tool kit beside the target - ready for detonation.

The operating range varies and depends on the integrated sonar, with a maximum range of 100 meters. The operator is connected to the Remotely Operated Vehicle (ROV) by a 160-meter electrical/optical cable for power and communication. With a basic weight of 75 kilograms and a speed of just over 2.5 knots, the underwater vehicle navigates to the pre-defined location using waypoints in a chart interface. Sea Wasp's onboard Doppler Velocity Log (DVL) and Internal Measurement Unit (IMU) deliver navigational capability, allowing it to save, import and export specific waypoints. Obstacles under water are automatically detected and avoided. The six degrees of freedom allow for manoeuvring and operating with maximum freedom of movement under water. Experience has shown that Sea Wasp can reliably locate, identify and neutralize underwater mines, even in confined spaces and under difficult conditions such as strong currents.

Decisive advantages are provided by those systems which offer variable application possibilities and ensure the uncomplicated exchange of a mission module. One of the most important arguments in the development of the Swedish underwater robot was therefore the modularity of the system. Here, the basic configuration is tailored and efficiently adapted to the requirements of each mission, for instance by adding payloads.



Saab's Sea Wasp underwater vehicle neutralizing an underwater mine. *Ill: Saab*

Civil and military use

ROVs are not only suitable for military operations by Naval Forces, but also for law enforcement agencies for anti-IED (Improvised Explosive Device) and other underwater missions. Due to its small dimensions and footprint, manoeuvrability and relatively low weight, Sea Wasp is perfectly suited for counter IED operations in ports and also for possible self-defence of the own ship. Such unconventional explosive devices are usually well camouflaged and difficult to detect.

Due to its geographical location, long coastlines and close proximity to the Arctic, Norway has a specific interest in "Maritime Domain Awareness" - the knowledge of maritime spaces and the safeguarding of such interests. In addition to traditional means such as Maritime Patrol Aircraft (MPA) - manned or unmanned - underwater systems are likely to become increasingly important for Norwegian security precautions.

– Bulletin Board for Defence, Industry and Trade –

Procurement of new training aircraft suspended

The schooling aircraft SK 60, which has grown to a ripe old age, is to be replaced by a comprehensive so-called Basic Trainer Aircraft system. The FMV has initiated the procurement process, and invited offers.

Now, however, the procurement has been stopped, and the FMV has advised all bidders accordingly.

- We aborted the procurement in August. We had at that time not received any proposals that met with all our "must have" requirements, says Andreas Säf Pernselius, Project Manager for the FMV.

At his time, the situation is undergoing analysis with the FMV as well as the Armed Forces, where a preparatory work is in progress.

The need for a replacement for the SK 60 remains. The schooling aircraft in question, the SK60, took to its wings for the first time in 1963. The goal is for the pilot education system to be ready at Malmen in Linköping for the first batch of pilot candidates in the summer of 2023.

Before the Armed Force pilots enter the hot seat in Gripen, they will have spent many hours side by side with an instructor in the SK 60, or the Saab 105 which is the civilian designation of the aircraft. The twin-engine trainer plane has been the mainstay of all flight training for pilots since the 1960's. *Photo: Saab*

Taiwan conducts anti-landing drill

Taiwan has conducted anti-landing drills on one of its islands closer to the Chinese mainland amid increasing cross-strait tensions.

The exercise to push back landing attempts was held on the Matsu archipelago, according to a statement by Taiwan's Defence Ministry.

Accompanied by pictures of the drill, the statement said that it involved the use of cannons and machine guns.

In a social media post, Taiwan's Defence Ministry said: "Whether the engine of a fighter plane or the rumbling of artillery, it is a reassuring sound for the national army that is defending the homeland."

Taiwan has controlled Matsu and Kinmen island since the end of the civil war between nationalist and communist forces.

China claims sovereignty over democratic Taiwan and in recent months, tensions has escalated after Beijing ramped up military activities in the region.

Recently, Taiwan scrambled fighter jets after Chinese aircraft breached the unofficial mid-line of the sensitive Taiwan Strait.

China also conducted large-scale air and naval drills near the island this month.

This comes after Taiwan allied with the US for armaments and support, a move denounced by mainland China.

The Northrop Grumman E-2d Hawkeye is an American all-weather, carrier-capable tactical airborne early warning (AEW) aircraft. *Photo: US Navy / G.R. Kusner*

E-2D Hawkeye Aircraft for France

The State Department has made a determination approving a possible Foreign Military Sale to the Government of France of three E-2D Advanced Hawkeye Aircraft and related equipment for an estimated cost of $2 billion.

Czech Republic to buy Israeli air defence system SPYDER

The Czech Republic has selected the Israeli SPYDER system after assessing nine air defence systems from seven producers.

Developed by Rafael Advanced Defense Systems, SPYDER is a low to high-altitude surface-to-air missile system designed to protect against fighter aircraft, helicopter, other missiles and unmanned aerial vehicles.

According to the company website, the missile system incorporates advanced air-to-air-missiles called PYTHON-5 dual waveband IIR missile, the I-DERBY active radar BVR and the I-DERBY ER long-range missile. These missiles can also be used for ground-to-air operations.

Valued at around $430m, the deal is slated to be finalised early next year with deliveries expected two years later.

Once delivered, the SPYDER system will replace the ageing Soviet-era 2K12 KUB system and will be used to protect industrial hubs, nuclear plants and airports.

SPYDER air defence missile system on a Tatra truck. *Photo: Ereshkigal1*

A Swiss Air Force F-18 Hornet. By a margin of just 9,000 votes, Swiss citizens have given a cautious all-clear for a multi-billion purchase of new fighter jets for the air force.In general terms, French- and Italian-speaking cantons voted against, and German-speaking cantons voted for. Analysts consider the high turnout of urban voters, who are generally more critical of the army, may have driven the close result. Also the cost of the plan and the current "pandemic effect" may have been decisive. *Photo: VBS / DDPS / Alexander Kühni*

Wafer-Thin Majority Approves New Fighter Jets

By a margin of just 9,000 votes, Swiss citizens have given a cautious all-clear for a multi-billion purchase of new fighter jets for the air force. In the end, 50.2% of voters approved the CHF6 billion ($6.49 billion) funding package after a surprising afternoon that left pollsters unable to call the result until the last minute. Turnout was 59.4%.

Projections over the past weeks had shown clear acceptance for the government-backed plan, which will see the army replace its ageing fleet of F-5 Tigers and F/A-18 jets by 2030.

The government would now proceed with the evaluation of four fighter models bidding for the contract: the Lockheed-Martin F-35, Boeing's Super Hornet, Dassault's Rafale, and Airbus's Eurofighter Typhoon, and during the first quarter of 2021, a choice will be made among the different types of combat aircraft. In addition a choice of long-range surface-to-air defence will be made. The candidates for the long-range surface-to-air defence systems are the SAMP / T (Eurosam, France) and Patriot (Raytheon, United States).

The planned financial limit for aircraft is 6 billion francs and for ground-to-air defence 2 billion francs.

The new fighter jets as well as the long-range surface-to-air defence system will likely be delivered between 2025 and 2030.

USAF to upgrade Keflavik airfield infrastructure

The Detachment 4 of the US Air Force (USAF) Installation and Mission Support Center has awarded three contracts with a total value of $38m to upgrade the airfield infrastructure at Naval Air Station Keflavik in Iceland.

The projects support the European Deterrence Initiative (EDI) which is implemented by the US European Command.

It aims to boost the US Air Forces, Nato member state forces and European allies' responsiveness and readiness.

The initiative is a partnership between the Air Force Civil Engineer Center, Detachment 4, US Air Forces in Europe and Air Forces Africa, the Naval Facilities Engineering Command Europe Africa Central, the Icelandic Coast Guard and the Icelandic Airport & Air Navigation Authority.

The design and construction manager, Detachment 4, will carry out the project with aid from NAVFAC EURACENT.

Iceland Prime Contractors will execute the work, which includes three major initiatives, parking aprons expansion, preparation of the bed-down site to aid personnel in an expeditionary environment and to upgrade the hazardous cargo pad of the airfield for the loading and unloading of explosives.

AFCEC Facility Engineering Directorate director Col David Norton said: -The air force depends on the technical expertise of the professionals from AFCEC and Det. 4 to deliver mission-ready infrastructure. We are upgrading infrastructure at Naval Air Station Keflavik to provide a high level of readiness for US Air Forces in Europe. We have incorporated innovative design and construction techniques to build resilient facilities to ensure the longest lifespan at the overall lowest lifecycle cost.

In a separate development, the Department of the Air Force has chosen 15 additional companies to participate to develop new capabilities for Advanced Battle Management System (ABMS).

Two P-8A Poseidon maritime patrol and reconnaissance aircraft on the apron of Keflavik Air Base, Iceland on 2 January 2020 *Photo: US Navy / Amariv Perez*

First search and rescue aircraft for Canada

The first CC-295 lands at 19 Wing, Canadian Forces Base Comox, in British Columbia. *Photo: Garry Walker – CNW Group/Airbus*

The Royal Canadian Air Force (RCAF) has taken delivery of the first future fixed-wing search and rescue CC-295 aircraft from Airbus.

This is part of the government's plans to equip the RCAF with modern aircraft to carry out search and rescue missions across the country.

The new fleet will be named Kingfisher, after the kingfisher bird, which is known for agility, speed and searching and hunting skills.

The aircraft features integrated sensors, which are expected to detect persons or objects from over 40km away.

Worth C$2.4bn ($1.86bn), the Kingfisher fleet will consist of 16 aircraft, which will replace the current CC-115 Buffalo and CC-130H Hercules fleets at four locations in the country.

New combat vests for Norwegian soldiers

The Norwegian Defence Materiel Agency Forsvarsmateriell (FMA) has entered into a contract with the company Equipnor AS for delivery of a new combat vest system for the Norwegian Armed Forces. The vest system will be supplied by Equipnor AS, and has been developed by the Norwegian NFM Group AS. The system also includes new ballistic (bullet-proof) protection. The contract will run for five years, with an option to extend up to 10 years. The scope of delivery has an estimated value of just under 500 MNOK, or 45 MEUR. The combat vest systems will eventually replace existing battle vests and load carrying systems currently in use by the Norwegian Armed Forces.

"The contract contributes to giving the Armed Forces increased operational capacity and predictability," explains project manager Navy Captain Tor Inge Thun. With this system, the Armed Forces will have a complete, modular vest system that draws on the best from operational experience as well as all the experience the supplier possesses. At the same time, the modularity of the Combat Vest system ensures that the vest can be easily adjusted and adapted to different areas of use.

Start of production is planned for the first quarter of 2021, with the first deliveries to the Armed Forces early in the same year.

In connection with the delivery contract, a Research and Development (R&D) contract was also signed between the Defence Research Institute (Forsvarets Forskningsinstitutt FFI) and NFM Technologies AS, a subsidiary of NFM Group AS, for the establishing of a development effort related to ballistic protection. The agreement will run over five years with the option of extension. The goal is to bring out the next generation of ballistic protection with lower weight and greater performance.

New battle vests for Norwegian soldiers. *Photo: Equipnor*

Squadron 2020 and HX Fighter programs to drive Finland's defence expenditure

Finland plans to raise its defence spending to EUR3.16bn (US$3.74bn) to modernize the capabilities of its naval and air forces through the Squadron 2020 and HX Fighter programs. The Finnish capital defence budget accounted for 24.9% of country's total defence budget in 2020, an increase of 0.2% from 2019.

Military tensions in the Baltic have been on the rise and heightened with Russia's Ocean Shield 2020 naval exercises. This has helped Finland to push for the modernization of its naval and air fleets through the Squadron 2020 and HX Fighter programs.

The Squadron 2020 program aims to replace seven vessels of the Finnish navy with four multi-role corvettes, which are projected to cost around EUR1.3bn (US$1.53bn); the construction of new vessels is expected to begin in 2022. The new multi-role corvettes will have surface warfare, maritime mine-laying and anti-submarine warfare capabilities.

Finland has an aging fleet of 62 F/A-18C and F/A-18D, which will be replaced by new multi-role fighters under the HX Fighter Program to secure and monitor the territorial integrity of the country. This program is estimated to cost EUR7-10bn (US$8-12bn) and the final decision on the procurement of fighters is expected to be made in 2021.

KAPLAN ANTI-TANK Vehicle

The KAPLAN ANTI-TANK vehicle has been developed specifically for an anti-tank role, and has successfully completed firing tests performed using KORNET and OMTAS missiles launched from the FNSS' Anti-Tank Remote Controlled Turret (ARCT).

KAPLAN ANTI-TANK is the smallest member of the KAPLAN new-generation armoured combat vehicle family of FNSS. The vehicle can execute a broad variety of missions with the integration of different subsystems. The vehicle also features mine and armoured protection, and offers high mobility under different geographical conditions thanks to its low-weight hull and five road wheels. As an amphibious vehicle, KAPLAN ANTI-TANK stands out as one of the few vehicles in its class possessing this ability. With two water propulsion systems located at the rear, the vehicle allows its users to carry out operations even in deep and turbulent waters. The hatches and lids on the vehicle's hull have all been fitted with water-tight gaskets, and the vehicle allows its users to enter the water without prior preparation.

For its firepower, KAPLAN ANTI-TANK relies on ARTC, which was developed to feature modern firing and command & control capabilities. In addition to the ready-to-fire missiles, the turret is also fitted with a 7.62 mm co-axial machine gun.

Following the completion of qualification tests, serial production of the KAPLAN ANTI-TANK will begin soon afterwards, and deliveries are expected to be completed in 2021.

KAPLAN ANTI-TANK vehicle. *Photo: Turkish Army*

The A330 MRTT combines the advanced technology of a new generation tanker with the operational experience recorded during more than 200,000 FH in service. The A330 MRTT is interoperable with receivers worldwide and delivers true multi-role capabilities as proven during the recent MEDEVAC and strategic transport missions related to the COVID-19 pandemic. *Photo: Airbus*

Additional Airbus A330 MRTT

Airbus has received a firm order for an Airbus A330 MRTT Multi-Role Tanker Transport from OCCAR, Europe's organisation for the management of cooperative armament programmes.

The order, which OCCAR has placed on behalf of NATO's Support & Procurement Agency (NSPA), follows the decision from Luxembourg to maximize its participation into the Multinational MRTT Fleet (MMF) programme with a significant increase from 200 to 1,200 the number of flight hours contracted. The aircraft is part of the three additional options originally included in the contract and will increase the MMF fleet to nine aircraft.

This new order comes after the delivery of the first two aircraft, with training and operational activities already in place.

The MMF programme is funded by the Netherlands, Luxembourg, Norway, Germany, Belgium and Czech Republic who have the exclusive right to operate the NATO–owned aircraft in a pooling arrangement, a prime example of European operational defence collaboration. The aircraft will be configured for in-flight refuelling, the transport of passengers and cargo, and medical evacuation operations.

Carl-Gustaf order from U.S. Army

Saab has received an order for Carl-Gustaf ammunition and AT4 systems from the U.S. Army. The order value is approximately USD 100 million (930 MSEK) and deliveries will take place in 2021.

The order was placed within an indefinite delivery and quantity agreement signed in 2019, enabling the customer to place orders for Carl-Gustaf ammunition and AT4 systems during a five-year period to a value of up to USD 445 million. The AT4 systems and the Carl-Gustaf munitions in this order will be operated by the U.S. Army, Marine Corps, and Special Forces Command.

Since 1987, Saab has delivered more than 600,000 AT4s, both directly and under license, to the U.S. Armed Forces. The Carl-Gustaf system has been a program of record in the U.S. since 2013 and in 2018 the U.S. Army announced it would acquire the latest version of the system – the Carl-Gustaf M4 (designated M3E1 in the U.S.) with a reduced weight of less than 15 pounds (7 kilos).

Patria AMV for Bulgaria?

Patria's armoured combat vehicle AMV has been selected for the second phase of Bulgarian vehicle acquisition program based on a tender phase. The final decision on the actual acquisition will be made after field tests and negotiations. Also, General Dynamics has proceeded to the second phase.

Patria AMV is a modular, powerful and robust armoured wheeled vehicle. Patria AMV is also available with amphibious capability for amphibious and landing operations. The capabilities of the platform allow the integration of any weapon system.

US Air Force to replace ageing ICBMs

The US Air Force (USAF) has awarded Northrop Grumman a $13.3bn to modernise the US ageing intercontinental ballistic missile (ICBM) system, marking the next phase of the Ground Based Strategic Deterrent (GBSD) programme.

The contract covers the engineering and manufacturing development (EMD) phase of the GBSD programme. Spanning over eight years it will cover 'weapon system design, qualification, test and evaluation and nuclear certification.'

Northrop Grumman became the lone bidder for the GBSD programme after Boeing dropped out last year, following Northrop Grumman's acquisition of Orbital ATK. Boeing said that Northrop Grumman's acquisition of Orbital ATK meant that the company would be able to offer a cheaper system and had earlier signalled its intention to not bid for the competition.

The resultant missile developed under the GBSD programme will replace the LGM-30G Minuteman III ICBM that first entered service in the 1970s. The GBSD ICBM is designed to offer 'increased accuracy, enhanced security and improved reliability' broadening the US array of strategic nuclear options.

The finished missile is due to be deployed in the late 2020s. Northrop Grumman said it is aiming to achieve initial operating capability by 2029.

Air Force Technology understands that over its lifetime the contract to update the USAF's ICBM force could be worth up to $85bn.

An unarmed Minuteman III intercontinental ballistic missile launches during an operational test. *Photo: USAF*

RBS15 Anti-Ship Missiles from Germany

Saab has received an order from its German partner Diehl Defence for the RBS15 anti-ship missile for provision to the German Navy. The order value is approximately 1.7 BSEK with deliveries between 2022 and 2026.

This order is part of a framework agreement between Saab and Diehl Defence, which offers the possibility for additional procurement in the future, where Saab's share is up to approximately 1.5 BSEK. The agreement allows orders to be placed until the end of 2024.

The RBS15 missiles and laun-cher systems provided in this order will be placed on the German Navy's Braunschweig Class Corvettes. In addition to the missile systems, the order also includes associated equipment and services. The German Navy has been a user of RBS15 since 2011.

RBS15 in flight. RBS15 has a range of more than 200km, a total in flight weight of 660 kg, and a 200 kg warhead. The missile has all weather anti-ship and sea denial capability and is designed to overcome the challenges of the modern naval battlespace. Built for deployment on multiple platforms, the RBS15 missile system currently serves with the armed forces of several nations around the world. The RBS15 anti-ship missile solution is jointly produced by Saab and Diehl Defence. *Ill.: Saab*

The AN/TPS-80 Ground/Air Task Oriented Radar (G/ATOR) provides the U.S. Marine Corps with capabilities for air surveillance, air defence, and ground weapon locating missions in one single ground-based radar solution. *Photo: : Saab/ Northrop Grumman*

Radar components for the U.S. Marine Corps

Saab has received a 36.7 million USD order for the U.S. Marine Corps' AN/TPS-80 Ground/Air Task Oriented Radar G/ATOR. Saab received the order from Northrop Grumman Systems Corporation, the prime contractor for G/ATOR.

The order includes components and subsystems in support of the Full Rate Production phase. Saab's deliveries relating to this contract will take place between 2020 and 2021 from its facility in Syracuse, New York, USA.

First Surface Ship and Submarine Firings of Saab Lightweight Torpedo

Saab has together with the Swedish Defence Materiel Administration (FMV) and Swedish Armed Forces conducted the first tests with the Saab Lightweight Torpedo (SLWT) from a corvette and a submarine.

The tests are the first of its kind for the new torpedo and were undertaken during February and March 2020 at sea ranges outside Karlskrona, on Sweden's east coast in the Baltic Sea. The tests were conducted from a Gotland-class submarine and from a Visby-class corvette. The purpose of the firings was to verify that the torpedo can be safely launched from the vessels, which also included verification of the integration on the vessels as well as SLWT's target seeker.

The development of the torpedo commenced with an order from the Swedish Defence Materiel Administration (FMV) in 2016, and is to be deployed on Sweden's submarine fleet and corvettes. In January 2018, the Finnish Navy placed an order for the SLWT, as a part of the Squadron 2000 Mid-Life Upgrade Programme. The Finnish Navy will operate the system on-board the upgraded Hamina-class vessels as well as the new Pohjanmaa-class corvettes of the Squadron 2020 Programme.

The SLWT is unique in the way that it is adapted for difficult littoral underwater conditions such as those found in the Baltic Sea while also being designed for operations in deeper seas. It incorporates a fully digital homing system, which offers both fire-and-forget and wire-guided operation to pursue the target. It is a flexible system that can be launched from multiple platforms, including surface ships, helicopters, fixed-wing aircraft and submarines.

First tests with the Saab Lightweight Torpedo. *Photo: Saab*

Photo: Airbus

First Five-bladed Airbus H145 Helicopter

Airbus Helicopters has delivered the first five-bladed H145 to the Norwegian Air Ambulance Foundation. This new version of its best-selling H145 light twin-engine helicopter brings a new, innovative five-bladed rotor to the multi-mission helicopter, increasing the useful load by 150 kg while delivering new levels of comfort, simplicity, and connectivity.

Norwegian Air Ambulance operates all 13 HEMS (Helicopter Emergency Medical Services) bases in Norway and all 4 bases in Denmark using a fleet of H135s and H145s.

Life time extension for Skjold-class coastal corvettes

UMOE Mandal AS and Kongsberg Defence & Aerospace have agreed to cooperate on the life time extension of Skjold-class coastal corvettes.

On May 29th, the Norwegian Government presented a proposal to speed up the life time extension of the Royal Norwegian Navy's coastal corvettes. This is an initiative that will enable increased activity in the Norwegian maritime industry.

The life time extension of the coastal corvettes will take place at the ship yard in Mandal, Norway in close cooperation with KONGSBERG and other suppliers.

UMOE Mandal has constructed and built the Skjold-class coastal corvettes for the Norwegian Armed Forces, and KONGSBERG has been a key supplier of the combat system, and the integration of sub-systems.

Costal corvette KNM Storm during exercise Cold Response 2014. Photo: FMS

India tests extended range BrahMos supersonic missile

India has tested the extended-range variant of BrahMos surface-to-surface supersonic cruise missile.

The test was conducted at Integrated Test Range (ITR), Balasore, in the state of Odisha, where the BrahMos Land-Attack Cruise Missile (LACM) achieved a top speed of Mach 2.8.

The extended range variant is equipped with Booster and Airframe Section, as well as other locally made sub-systems.

India has tested the extended range version of BrahMos supersonic missile. The variant has a range of more than 400km. The photo displays the original version of the BrahMos missile, with a range around 290km. . Photo: Indian MoD

This is the second time that the extended range version of BrahMos supersonic missile was tested. The variant has a range of more than 400km.

BrahMos missile was jointly developed by India and Russia. The original version has a range of around 290km and has already been inducted in the armed forces.

According to The Times of India, the BrahMos missiles have been deployed in Ladakh and in Arunachal Pradesh as India is engaged in a military confrontation with China for the past few months.

India has also moved 800km-range Nirbhay cruise missiles, as well as Akash surface-to-air missile (SAM) systems to the front.

Recently, India also tested the laser-guided anti-tank missile from MBT Arjun Tank.

US keeps buying F-35 Parts from Turkey

The U.S. will continue to buy parts for the F-35 Joint Strike Fighter from Turkey through 2022, despite Ankara's purchase of the Russian S-400 air defence system.

The Trump administration in July 2019 banned Turkey from participation in the multinational F-35 program. But the Defense Department continues buying Turkish-made parts to maintain production, according to a statement from the US MoD.

Turkish factories currently make more than 900 parts for the F-35's centre fuselage, cockpit display systems and other components. A complete cut-off in December as planned would result in about $1 billion in replacement costs that would slow down production of the aircraft.

Tactical Power Pack for Field Use

Bittium launches Bittium Tactical Power Pack for portable tactical communication devices. The Tactical Power Pack has been designed to be used for example with Bittium Tough SDR Handheld radio and Bittium Tough Comnode device, but it can also be easily used with normal tablets and smartphones through USB connection. The Tactical Power Pack enables uninterrupted field use for the devices.

Bittium Tactical Power Pack has been designed especially for tactical communication use cases. It includes two 70 Wh, 6.7 Ah batteries that are attached as one with an adapter. This way the Tactical Power Pack can also be used as a charger for the two batteries. The small size and light weight of the Tactical Power Pack enables also its easy attachment to soldier gear together with the device being charged.

Bittium is a Finnish company with over 35 years of experience in advanced radio communication technologies.

Russian Navy's Black Sea Fleet (BSF) frigate Admiral Makarov. *Photo: Russian MoD*

Russian air defence training

Air defence (AD) crews on the Russian Navy's Black Sea Fleet (BSF) frigate Admiral Makarov have carried out training to repel the mock enemy air attack.

The exercise is carried out by the frigate as a part of the permanent group of ships that are allocated to the Mediterranean Sea. During the exercise, the mock enemy aircraft relayed information regarding the location of the frigate and headed for an airstrike using guided missiles on the target.

The weapons control system of the ship electronically simulated the mock enemy with the specified characteristics. The crew of the combat information post identified and classified the target, and the approaching 'plane' was then destroyed by the air defence crews before it entered the target range.

The enemy target was destroyed by electronic launches of anti-aircraft missiles, which prevented it from striking the ship.

The Indian Navy reportedly took part in exercises with Russia on 4-5 September.

In July, the Russian Navy took delivery of a new generation of hypersonic nuclear strike weapons and underwater nuclear drones.

During the same month, the Russian Navy accepted its newest Admiral Gorshkov-class of Project 22350 frigate, Admiral Kasatonov. The new frigates feature stealth capabilities and carry high-precision weapons. They are being built by Severnaya Verf (United Shipbuilding Corporation).

Photo: UK MOD

Thales and Leonardo to Support Polish Navy's Anti-submarine Warfare Capability

The Polish Navy will equip its AW101 helicopters with four FLASH SONICS (Folding Light Acoustic System for Helicopters) from Thales. The FLASH is a dipping sonar, and is operated by a large number of naval forces, including the US Navy, the UK Royal Navy, the French Navy, the Royal Australian Navy and the navies of the United Arab Emirates, Norway, Sweden, South Korea, the Philippines and now Poland. To date, over 400 Flash systems have been delivered to about a dozen navies around the world.

The key benefits of this low-frequency wideband sonar include long-range detection with broad sector coverage and low false alarm rates in open ocean as well as littoral waters. Initially designed for heavy helicopters such as the Merlin AW101 from Leonardo chosen by the Polish Navy, the system is also available in a compact version equipped with an electric motor for lighter helicopters like the AW159.

Second GlobalEye for UAE

The United Arab Emirates (UAE) has taken delivery of the second GlobalEye Swing Role Surveillance System from Saab. In 2015, Saab signed a $1.27bn contract with the UAE to expand and improve the airborne surveillance capabilities, with the delivery of new airborne swing-role surveillance system (SRSS).

The first GlobalEye aircraft was delivered to the UAE in April this year. The UAE has so far ordered three GlobalEye aircraft.

In November 2019, the UAE Ministry of Defence expressed interest in buying two additional GlobalEye Airborne Early Warning and Control (AEW&C) aircraft from Saab.

GlobalEye is designed to provide air, maritime and ground surveillance capabilities. It integrates the Saab Erieye Extended Range Radar with Bombardier Global 6000 aircraft. *Photo: Saab*

Patria NEMO on a AMV 8x8. *Photo: Patria*

Teaming up for U.S. turreted mortar programs

Patria and Kongsberg Defence & Aerospace have teamed up for the future U.S. turreted mortar programs. The teaming will provide to the U.S. market an unrivalled combination of Patria's world-leading mortar systems together with Kongsberg's U.S. remote weapons systems (RWS) manufacturing capabilities and experience in the U.S. market.

Patria Nemo is a remote-controlled 120mm mortar system capable of both direct and indirect fire on the move. Nemo can also execute multiple rounds simultaneous impact (MRSI) fire missions with up to 6 rounds per MRSI mission. In addition to being highly protected, Patria Nemo is light, compact and easily installable on light, tracked chassis, wheeled armoured vehicles or navy vessels.

Having an eye on upcoming turreted mortar programs for the U.S. armed forces, Patria and Kongsberg have agreed to leverage Kongsberg's existing RWS manufacturing facilities in Johnstown, Pennsylvania for Nemo's production to the U.S. market.

Sonars for Coastguard vessels

Kongsberg Maritime has signed contract with Vard to deliver sonars to the Norwegian Coastguard. The sonars will be used on board three new craft planned for launch between 2022 and 2024, replacing the existing Nordkapp-class vessels.

KONGSBERG will equip the new 136-metre, ice-strengthened vessels with its SS1221 sonars, which boast acoustic properties which make them ideally suited for multiple operations safeguarding Norwegian territorial waters, especially those requiring deployment in shallow-water environments.

The SS1221, principally devised for ASW operations and capable of detecting torpedoes or other small objects in the water column, is an active hull-mounted sonar which utilises sophisticated tracking algorithms. Its electronically-stabilised transmitting and receiving beams can be tilted to adjust to challenging sound speed profiles, with its integrated Sound Propagation Model determining the optimal tilt settings and enhancing the Probability of Detection (PoD) ratio. The SS1221 sonars will be delivered to the Coastguard complete with retractable hull units and gate valves for ice protection, ensuring safe and efficient operation.

Art impression of the new Norwegian Coastguard vessels. *Ill. Vard Group*

Air defence capability under development

FMV is in the final phase of the tests with the Fire Unit 98 system. Robot 98 (IRIS-T missile), which is fired from Fire Unit 98, will defend Sweden against, for example, combat aircraft and cruise robots. *Photo: FMV*

During the summer, the FMV carried out test firings with parts of what is known as the Air Force Operational Capability. The goal is to hand over all system units of Fire Unit 98 this year.

Some verification tests are always performed when new systems are developed. The technical ability is tested in relation to the requirements set out in the procurement that FMV has made. Air defence systems are technically complex and require high precision.

The Fire Unit 98 system will defend Sweden against enemy air targets at short distances, such as fighter bombers and cruise missiles. With radar information from Intelligence Unit 23, the fire master on Fire Unit 98 fires the robot at the aircraft.

The robot fired from Fire Unit 98 is also included as an armament on the JAS 39 Gripen fighter aircraft. The flight-based robot has also become ground-based after adjustments in the software.

SkyRaider UAS to US Marine Corps

FLIR Systems has won a contract with the US Marine Corps (USMC) for the delivery of its R80D SkyRaider Unmanned Aerial Systems (UAS).

Under the $10m contract, the company will supply an undisclosed number of its advanced military UAS. FLIR R80D SkyRaider has been developed for the US defence and other federal government clients.

Fitted with long-range and high-resolution EO/IR imaging sensors, the unmanned system is capable of offering situational awareness both during the day and at night.

SkyRaider holds the capacity to carry up to 2kg external loads for specialised missions, such as forward resupply, asset extraction and more.

SkyRaider Unmanned Aerial Systems (UAS). *Photo: FLIR*

Composite components for F-35

Northrop Grumman Corporation has awarded Kongsberg Defence & Aerospace AS (KONGSBERG) a contract worth 800 MNOK, where 426 Million NOK has been incrementally ordered in previous quarters.

The agreement covers production lots 12-14 for supply of composite fuselage panels and hatches for all variants of the F-35 Joint Strike Fighter.

Australia to invest $186bn in defence

The Australian Government is set to invest A$270bn ($186bn) in the Australian Defence Force (ADF) capability and infrastructure over the next ten years.

The investment has been detailed in the 2020 Defence Strategic Update 2020 and Force Structure Plan. Once implemented, the strategic update will invest to directly benefit 11,000 Australian companies in the defence industry.

NATO infrastructure in Estonia

NATO has announced the opening of its infrastructure facility for allied troops at the Tapa Base in Estonia.

Built with a €20m ($22.5m) investment, the project received majority funding through the NATO Security Investment Programme (NSIP).

The new facility will serve as a base for allied troops to take part in short-notice exercises and deployments quickly and effectively.

In order to facilitate the Readiness Action Plan, NATO Allies have launched a programme to construct more than 200 similar projects. Currently, the infrastructure to support the prepositioning of military supplies, staging and training is under construction in eight NATO nations.

The US Navy is planning to acquire a total of 19 Independence class vessels. The photo displays the USS Gabrielle Giffords. *Photo: U.S. Navy/ J. J. Kunkle*

US Navy's 12th Independence-class littoral combat ship

Austal USA has delivered the US Navy's 12th Independence-class littoral combat ship (LCS), the future USS Oakland (LCS 24).

Designed to operate in near-shore environments, the vessel will be deployed to conduct maritime security, sea control and deterrence, and protect coastal threats, including submarines, mines and swarming small craft.

Russian Jets for India

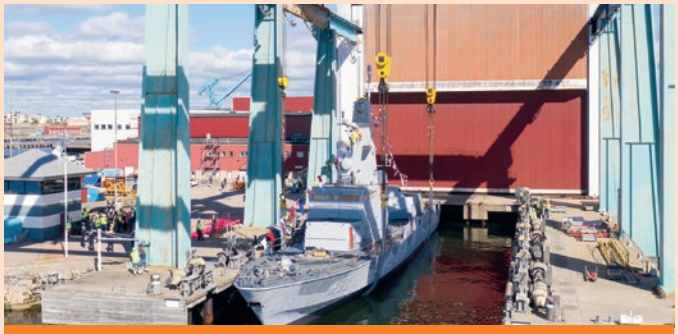
India has green-lighted the purchase of 33 Russian fighter jets and upgrades to 59 others worth $2.4 billion at a time of rising border tensions with China.

The government also approved the procurement of 12 Russian Su-30 MKI aircraft to be built under license by Hindustan Aeronautics Limited.

In 2019, India was the third-largest military spender in the world at $71.1 billion, according to the Stockholm International Peace Research Institute (SIPRI).

Most of India's arms imports still come from Russia. The United States and Israel are also major providers of high-tech military hardware.

Despite serious serviceability issues with its MiG-29s (photo) and Su-30s, India has decided to buy 33 more Mig-29s for $2.4 billion. *Photo: Aktug Ates*



Facts and figures, HMS "Gävle". Built at the Karlskronavarvet AB, and sea launched 1990. The vessel is 57 m long, 8 m abeam, its draft is some 2,5 m, and the displacement is about 400 tonnes. *Photo: Swedish Navy*

HMS "Gävle" at sea after the first stage of the modifications

When the first of the two corvettes to be modified now takes to sea, the project for half time modifications enters the next phase, with the completion of installations and integration of various systems.

The half time modification is the most extensive upgrade that the Gothenburg class corvettes will undergo during their life span. The hull itself has a life expectancy of 30 years, while the usable technical life span of several part systems is shorter. In some cases, the problem is difficulty of maintenance, while in other cases the technical development has surged so far ahead that entire systems need to be replaced in order to keep up the operative ability.

At the time when the first corvette now takes to sea, the second corvette lies in the hull hall for the completion of corresponding modification efforts.

First A330 aircraft to NATO fleet

Airbus has delivered the first Airbus A330 Multi Role Tanker Transport (MRTT) aircraft to the NATO Multinational MRTT Fleet (MMF) in Spain.

During the ceremony at the Airbus Getafe site in Spain, the first of eight aircraft was delivered.

The MRTT aircraft's official acceptance marks a milestone towards its entry to service of the multinational unit formed by the Netherlands, Luxembourg, Norway, Germany, Belgium and the Czech Republic.

The aircraft's main operating base is located in Eindhoven, the Netherlands. It will also operate from the Forward Operating Base in Cologne, Germany.

Funded by the six nations, the MMF programme will permit them to operate the NATO–owned aircraft in a pooling arrangement.

Airbus A330 Multi Role Tanker Transport (MRTT) aircraft will perform in-flight refuelling, transport passengers and cargo and carry out medical evacuation operations. *Photo: Airbus*

New surveillance boat for the West Coast

The FMV (Swedish Defence Materiel Administration) has delivered the surveillance boat HMS "Ärlig" to the 17th patrol boat company at the Amphibious Regiment in Gothenburg. With this delivery, the fifth and last patrol boat has been delivered to the company.

The five surveillance boats that FMV has now delivered have undergone a service life extension program during which, among other tasks, the command bridge has been rebuilt and engines and sonar have been replaced.

In Sweden's latest defence policy paper for 2016–2020, national defence was prioritized, including submarine hunting capability. The patrol boats have a special role of participating in the protection of shipping and Sweden's territorial waters from intrusion, especially in and around Gothenburg, where 30 percent of Sweden's foreign trade passes through every year.

The Swedish archipelago constitutes a complex environment which means that the Swedish Navy needs short reaction times. The patrol boats must be able to carry out several different tasks such as maritime surveillance, protection of shipping, submarine hunting and reacting in the event of an attack. This requires both sensors and equipment that are adapted to the environment to achieve optimal effect.

HMS "Ärlig" together with two other patrol boats at the Gothenburg naval base. *Photo: Joakim Nilsson/ Swedish Armed Forces)*

Norwegian company Aristeia AS signs agreement with the US Navy

Following promising results from initial tests in Norway, Aristeia AS has engaged the Naval Medical Research Unit – San Antonio as an independent test and evaluation agency to further develop its novel emergency tourniquet. The Collaborative Research and Development Agreement (CRADA) will see the tourniquet undergo multiple phases of testing, granting the company access to world-leading expertise and facilities in prehospital medicine.

Aristeia has been developing a tourniquet to stop lethal hemorrhage in the extremities since 2016. The design is based on a pull cord mechanism, utilizing a similar movement to that found in outboard engines and lawnmowers to build up pressure. The company has worked closely with the Norwegian Defence Research Establishment through its Innovation and Industrial Development and Comprehensive Defence divisions on prototyping and testing. In addition, testing and evaluation has been performed through a collaboration with the Norwegian Armed Forces. To reach these milestones, Aristeia has received backing from the Royal Norwegian Ministry of Defence, Innovation Norway, SIVA and the Research Council of Norway.

Aristeia is developing a new tourniquet system for use in the military and civilian trauma care.

Kongsberg acquires Patria Helicopters AS

Kongsberg Aviation Maintenance Services AS, a company in Kongsberg Gruppen ASA (KONGSBERG), has entered into agreement to acquire Patria Helicopters AS in Bardufoss from Patria Aviation Oy, a subsidiary of Patria Oyj. The formal takeover date was 1st. July 2020.

"This acquisition strengthens our presence in and commitment to Bardufoss and this region and makes us more able to support the NH-90 helicopters," says Eirik Lie, the President of Kongsberg Defence & Aerospace AS.

The acquisition is part of KONGSBERG's long-term commitment to the operation and maintenance of the Norwegian Armed Forces' systems and platforms. The company bought a minority shareholding in Patria Oyj in 2016 and in 2019 a majority shareholding in the former AIM Norway AS, now Kongsberg Aviation Maintenance Services AS, where Patria is the minority shareholder. Since then, KONGSBERG has entered into strategic cooperation agreements with the Norwegian Armed Forces relating to the NH-90 helicopter and some of the Royal Norwegian Navy's systems.

In addition, KONGSBERG signed a letter of intent with Boeing regarding the maintenance of the Norwegian Armed Forces' newly acquired P-8 maritime patrol aircraft on 18 June and signed a letter of intent with the Norwegian Defence Logistics Organisation regarding a strategic partnership on the P-8.

The acquired company, Patria Helicopters, will be renamed Kongsberg Aviation Maintenance Services Bardufoss AS. It has operations at Bardufoss Airport with special responsibility for maintaining NH-90 helicopters.

There are plans to grow the company's activities, which means hiring new personnel and increasing the workforce to around 50-60 jobs over time. That involves a greater need for aircraft technicians, for instance. Troms and Finnmark County has recently decided to establish an additional aircraft mechanics class at Bardufoss High School, and the first three apprentices will join Kongsberg Aviation Maintenance Services Bardufoss in August 2020.

In addition, Kongsberg Technology Training Centre AS (K-Tech), which is partly owned by KONGSBERG, will establish operations at Bardufoss in the autumn of 2020. K-Tech is a centre of education dedicated to technology and industrial subjects and, with its total of 64 apprentices, plays a very important role in the efforts to recruit people to this industry. The first three apprentices will start to work for Kongsberg Aviation Maintenance Services Bardufoss as early as in August 2020.

The one hundredth vehicle in the massive rebuilding project Combat Vehicle 90 RENO, encompassing the integration of a new command support system as well as renovation and upgrading of subsystems. *Photo: FMV*

Upgrading the Combat Vehicle 90

This week, the FMV took delivery of serial number 100 of the total 288 units of Combat Vehicle 90 that are undergoing renovation and upgrading. BAE Systems Bofors and BAE Systems Hägglunds are carrying out the assignment jointly.

The contract for rebuilding 288 Combat Vehicles 90 in six different variants was concluded by FMV in 2016 with the company jointly owned by BAE Systems Bofors and BAE Systems Hägglund, H-B Utveckling. This includes the integration of a new command support system as well as renovation and upgrading of subsystems in the Combat Vehicle 90.

Bofors is responsible for turrets and system integration and Hägglunds oversees chassis. Development, verification and production take place at each company, with final integration and delivery at Bofors for all variants, except the salvage variant delivered from Hägglunds in Örnsköldsvik.

Serial production began in 2019 and will continue up to and including 2022. Instructor and technician courses have been completed, and now in August 2020, the Armed Forces have started unit training on rebuilt Combat Vehicles 90, where Boden is the first to go.

Remote controlled AMV 8x8

The development of Patria's Heavy Unmanned Ground Vehicles has reached a level where the Patria AMV 8x8 vehicle can be operated remotely beyond visual line of sight utilizing 5G and 4G networks. This enables vehicles operation even from longer distances with higher reliability.

Patria´s unmanned solution can be integrated to new Patria AMV, Patria 6x6 vehicles and to all already delivered AMV 8x8´s without any major changes in the vehicle configuration.

Photo: Patria

The new STIM277H Gyro module from Sensonor. *Photo: Sensonor*

Sensonor Launches Space-Dedicated Gyro and IMU Modules

The high-accuracy tactical-grade STIM277H Gyro module and STIM377H Inertial Measurement Unit are based on experiences and requirements from serving customers in the space segment during the last decade.

The modules have a hermetic aluminum enclosure with a glass-to-metal sealed electrical micro-d connector and a laser-welded lid to secure long-term hermetic operation. The hermetic enclosure protects the system from the external environment and ensures long-term reliability to meet requirements within the space segment and other applications needing exceptional long-term reliability. The design is tested for a 20+ years' operating life through high-temperature operating life (HTOL) testing.

STIM277H and STIM377H are electrically and mechanically backward-compatible with Sensonor's other IMU and gyro modules, and provide users with an easy implementation into an existing design.

The parts are a good fit for satellite attitude & orbit control systems (AOCS), launchers, portable target acquisition systems, UAV payloads, land navigation systems, turret stabilization, missile stability and GNSS-supported navigation systems.

Sensonor designs and manufactures advanced tactical-grade gyro sensors, gyro modules and IMUs for high-precision applications.

Sonars for Mine CounterMeasures

ECA GROUP and iXblue strengthen their partnership and sign a contract for navigation, underwater positioning systems and obstacle avoidance sonars for Mine CounterMeasures replacement program for the Belgian and Royal Netherlands Navies.

As part of the program to replace the naval Mine Counter Measures capability of the Belgian and Dutch navies, which includes the supply of twelve minehunters equipped with drones (Toolbox), ECA GROUP has signed an agreement with iXblue for the supply of Forward Looking Sonars (FLS), as well as inertial navigation and subsea positioning and communication systems.

The Toolbox developed by ECA GROUP consists of a variety of drones to be deployed by operators to perform autonomous mine clearance missions at sea. It contains USV INSPECTOR125 surface drone, SKEDAR V-200 aerial drones, AUV A18-M underwater drones, T18 towed sonars for mine detection, as well as SEASCAN and K-STER C MIDS (Mine Identification and Disposal System) for mine identification and neutralization.

These drones must perform navigation, obstacle detection and avoidance, vehicle tracking and underwater communication between UAVs with a high level of performance. So, through this 10-year agreement, iXblue is committed to provide equipment adapted to the high level of performance specified by ECA GROUP.

Art illustration of the naval Mine Counter Measures Toolbox developed by ECA GROUP for the Belgian and Dutch navies. *Ill: iXblue*

T1 N234MQ (s/n 00001) on its first wheels-up flight from MidAmerica Airport. The shadow cast shows the air vehicle's chine, the longitudinal line of sharp change in the cross-section profile of the fuselage. *Photo: Boeing Phantom Works*

STINGRAY: NO BARB OR VENOM FOR NOW

The US Navy's nascent MQ-25 Stingray unmanned aerial vehicle

Text: Mark Ayton

Naval Air Systems Command and Boeing's Phantom Works is currently developing the MQ-25A Stingray. This 15.5m (51-foot) long unmanned air vehicle is the world's first designed for carrier-based operations. In addition to catapult launch and arrested landing capabilities, the Stingray will perform autonomous aerial refuelling in support of all fixed wing aircraft assigned to the Carrier Air Wing (CVW).

Secondary to that, the MQ-25A has an intelligence, surveillance and reconnaissance (ISR) role afforded by an electro-optical and infrared sensor. Data will be transmitted to other aircraft, naval vessels, ground forces, etc.

As the first carrier-based, Group 5 unmanned aircraft system (UAS), the MQ-25 will pioneer the integration of manned and unmanned flight operations, demonstrate sea-based UAS command, control, communications, computers, and intelligence (C4I) technologies, and pave the way for future multi-mission unmanned air vehicles.

The latter is a pointer to follow-on roles for the MQ-25. Certainly the air vehicle's low-observable stealthy configuration points to the air vehicle being used to drag aircraft in CVW strike packages further from the carrier than ever before: most importantly supporting F-35C Lightning IIs into non-permissive environments.

A likelihood not denied by Captain Chad Reed, MQ-25 Program Manager, Unmanned Carrier Aviation with PMA-268 (PMA =Program Manager, Air) who said: *"Right now, even though its configuration is stealthy, there is no low-observable requirement for the MQ-25. Our requirement was for Boeing to use mature technologies in accordance with the accelerated programme goals. It is designed to operate in permissive environments when it enters the fleet, while concepts of operation are explored, and it's meshed with manned operations. Manned-unmanned teaming is a notable aspect of the programme, one that's on*

the cutting-edge simply because other aircraft are not designed to operate in such close proximity to and with manned aircraft: Stingray has a configuration and a new capability unmatched in a current air wing."

The US Navy has highlighted the current requirements for the MQ-25A as carrier-based refueling and persistent ISR capabilities.

Major architectural segments

Designed to be sustainable on board an aircraft carrier and from shore bases, the MQ-25 system is comprised of three major architectural segments.

- the air segment includes the MQ-25A air vehicle and associated support and handling equipment including the deck handling system, spares and repair materials.
- *the control system and connectivity (CS&C) segment includes the Unmanned carrier aviation Mission Control System (UMCS) and its associated communication equipment. Mission support functionality of the Distributed Common Ground Station-Navy (DCGS-N), the Navy's primary intelligence, surveillance, reconnaissance and targeting system. All network based interfaces and routing equipment required to control the Stingray; and all required modifications to existing networks and C4I system infrastructure.*
- the CVN (aircraft carrier) segment comprises the ships' spaces allocated to unmanned carrier aviation, installed ship systems and modifications necessary for interface with the air and CS&C segments. CVN systems important to the MQ-25 include aircraft launch and recovery systems, data dissemination systems (including radio terminals and antennas), and deck operations systems. Ship installation requires considerable work to re-model nearly 900ft² (84m²) of space on board the carrier to house the UMCS.

Systems specific to carrier flight deck operations include a tail hook for arrested landings; foldable wings to minimise the air vehicle's parking footprint on the flight deck; design features that ease maintenance; and on-deck control systems that integrate with systems currently used on Nimitz and Ford-class carriers.

CBARS Competition

In 2016 PMA-268 issues a plus-up award for four contractors capable of developing an UAS suitable for the CBARS requirements; Boeing, General Atomics, Lockheed Martin and Northrop Grumman.

Each contractor presented PMA-268 with ideas about how they were to mature their own technologies and concepts.

PMA-268 released the draft air system Engineering, Manufacturing, and Development (EMD) Request for Proposal (RFP) in July 2017. In August 2018 PMA-268 awarded the EMD contract to The Boeing Company.

Under the EMD contract, the first seven aircraft procured by the Navy are four Engineering Development Model (EDM) test air vehicles (AV-1, AV-2, AV-3 and AV-4), and three System Demonstration Test Articles (SDTA). In addition, Boeing will also build two more airframes – one for fatigue testing and one for static loads testing.

Boeing's bid was determined to offer the best value for the government, first and foremost because of its ability to meet the schedule, and the ability to meet the key performance parameters (KPPs). It's notable that the MQ-25 had just two KPPs; the capability to give away a set amount of fuel to a CVW strike package hundreds of miles away from the carrier, and full integration with Nimitz and Ford-class carriers as they currently operate.

The US Navy saw the importance of getting the system to the fleet quickly. More specifically to reduce the amount of flight time used up by F/A-18 Super Hornets when conducting the aerial refuelling role.

The 6,000-hour Super Hornet service life is being depleted at much faster rates than anticipated. This has forced the Navy to devise and develop a new weapon system to conduct its tanker mission and save Super Hornet service life. This is a primary reason why the Navy switched its plan for a carrier-borne UAS from one programme, UCLASS, to another; CBARS (see below).

The CBARS concept also addresses other tactical aspects of carrier aviation; it helps to counter emerging threats now fielded by potential adversaries. That capability almost certainly points to a need for the MQ-25's stealthy, low- observable configuration.

T1 and Phase One Testing

Phantom Works, Boeing's advanced prototyping division, started building air vehicle T1 in 2012.

The design features a blended wing-body-tail air foil with folding, high-aspect-ratio wings and a V-tail. Its configuration reflects the long-endurance mission requirements of the UCLASS programme, particularly the long thin wings. Phantom Works finished the first iteration in 2014 as part of its design proposal for the UCLASS programme.

Air vehicle T1 has the same outer mould line and the same engine to nascent production standard MQ-25s. Consequently, some aspects of testing already undertaken with T1 will not require repeating with a production standard air vehicle.

The objective of the MQ-25 test programme is to evaluate system maturity and technical performance of the aerial refuelling role; both mission and recovery tanking.

T1's maiden flight took place there on September 19, 2019.

As of March 20, T1 had flown 12 flights and amassed nearly 30 hours.

T1 is currently undergoing a planned modification for the installation of an aerial refuelling store underneath the left wing.

Testing with T1 will continue over the next few years to include envelope expansion, engine testing, aerial refuelling store operations, and Joint Precision Approach Landing System (JPALS) functionality testing.

Another top down shot shows the fuselage plan form, the engine intake's curved articulation, and the flaperons' position on the wings. *Photo: Boeing*

T1's involvement in the test programme will culminate with its hoisting aboard an aircraft carrier to test the deck handling and control station systems.

Risk Reducer and Later Test Phases

T1 has already proven beneficial as a risk reducer during initial ground and flight testing. Having T1 available for testing years before the first EDM vehicles are produced, supports early learning and the discovery of any issues much earlier than is typical. For example, an icing susceptibility issue with the air data probe system has already been identified and a different air data probe has been designed and will be fitted to all four EDM air vehicles AV-1, AV-2, AV-3 and AV-4, during their production.

Without T1, the test team would not have been able to identify the air data probe problem for several years.

AV-1 and AV-2 will be dedicated to flight sciences testing and fitted with similar instrumentation to T1. AV-3 and AV-4 will be dedicated to mission systems and carrier suitability testing, and the air vehicle's effectiveness to the aerial refueling role, all planned for the second phase.

The air vehicle's all-up weight is an incredibly important design parameter for carrier suitability. The MQ-25 must be capable of fulfilling its tanking role despite the constraints imposed by maximum catapult shot weights and arrested recoveries from Nimitz- and Ford-class carriers. All-up weight was also constrained by the requirement for a fuel giveaway of 16,000lb (7,257kg) at 500 nautical miles (925km) from the carrier. By comparison, a Super Hornet holds a giveaway fuel load of 12,000lb (5,443kg) on a two-hour cycle, 15,000lb (6,803kg) on a normal cycle and 25,000lb (11,339kg) on a short cycle.

The MQ-25 will also be tasked with recovery tanking, which involves having a tanker airborne in orbit close to the carrier while aircraft recover. A critical capability at night or when the weather conditions are bad with a pitching deck in heavy seas, such that pilots need to top up the tanks to afford further attempts to land on the flight deck.

Control System

Designated the MD-5 A/B (ship/shore), the Unmanned Carrier Aviation Mission Control System (UMCS).

An MD-5 A/B control station comprises open architecture software, six OJ-845 common display systems, two UYQ-122 common processing systems, one network processing group, one integrated communication system, and network connectivity.

An artist impression of General Atomics' proposal for the CBARS programme, shown aerial refuelling an F/A-18 Super Hornet from the single ARS mounted under the left wing. *Photo: General Atomics*

During demos, the UMCS communicated with a Surface Mobile Aviation Interoperability Lab truck, simulating an air vehicle, and verifying command and control. Connectivity between the UMCS and shipboard network systems was tested and voice trunking (internet protocol to serial) between the air vehicle operator (AVO) and the simulated UAV was verified.

Limited control and data dissemination between the UMCS and simulated air vehicle to include automatic identification system detection, electro-optical/infrared camera operation, and full motion video, preplanned and dynamic mission re-planning, was also performed.

Air Vehicle Control

The air vehicle operator (AVO) commands the air vehicle where it needs to go and what it's required to do: the system determines how to get there in the most safe and efficient way.

Typical operation involves the AVO maintaining positive control of the air vehicle, including the ability to change speed, direction and altitude, and continuously monitor the machine while in flight.

Flight control software is designed to handle unexpected events such as bad weather or when a change to altitude or the position of its tanking pattern is required.

The AVO will use the MD-5 control station housed within the carrier's Unmanned Carrier Aviation Warfare Center throughout all stages of the mission from the catapult launch to the arrested landing.

During aerial refuelling ops, the AVO will have the ability to communicate with the receiver aircraft's pilot.

Milestone C and Beyond

PMA-268 is pursuing a Milestone C decision for low rate initial production in 2023 to procure up to 12 MQ-25A air vehicles. Following successful tests and evaluations, PMA-268 will pursue a full rate production decision for an estimated total of 76 air vehicles.

Stingray is expected to achieve its initial operational capability with the fleet in 2024. ■

MQ-25 STINGRAY CHARACTERISTICS

Wingspan	75ft (22.86m)
Wingspan folded	31ft 3in (9.54m)
Length	51ft (15.54m)
Height	15ft 8in (4.78m)
Flight deck footprint	No greater than a Super Hornet

SPECIALLY ADAPTED SNOWMOBILES FOR THE RANGERS

Lynx BoonDocker Army 4100 850 E-TEC
Sweden is procuring two types of snowmobiles, the Lynx 69 Ranger Army 900 ACE and the Lynx BoonDocker Army 4100 850 E-TEC, both adapted to meet the requirements set forth in the agreement. *Photo: FMV*

The FMV (Swedish Defence Materiel Administration) has signed an agreement for the supply of 100 specially adapted snowmobiles for the Armed Forces' rangers, with the possibility of exercising options for a further 200 snowmobiles with attendant spare parts. The contract value including options and systems materiel amounts to approximately 80 MSEK, or 8 MEUR.

The FMV has contracted with BRP Finland Oy for the delivery of one hundred new snowmobiles adapted and intended for the Army Ranger Battalion at the Norrbotten regiment in Arvidsjaur, and the Paratrooper Squadron at the Intelligence Battalion by the Life Regiment Hussars in Karlsborg.

The contract is for two models of snowmobile: one wide-tracked snowmobile, and one snowmobile with high agility in alpine snow conditions.

BRP Finland Oy will be delivering the snowmobile models Lynx 69 Ranger Army 900 ACE and Lynx BoonDocker Army 4100 850 E-TEC, both adapted to meet the requirements set forth in the agreement.

The delivery of the new snowmobile system with snow scooters and attendant tools, spare parts and training will be made before the winter of 2021/2022.

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