The prevalence of VTOL UAVs in ship-based operations is on the rise as ongoing de-risking work has reached the point at which these systems are deemed safe enough for vessel integration, and the appetite from customers for this eyes-on capability increases. By Beth Stevenson

Creation and integration

While VTOL systems can also be used within land-based environments, arguably one of their real benefits comes from ship-based operations, during which the lower amount of real estate that comes with a vertically launched and recovered system is truly realised.

Space on board any type of vessel is valuable, and prioritising the preferred use of this space is an ongoing issue. However, the need for an unmanned capability is becoming more prevalent in naval operational doctrine, so minimising the space that these systems take up is going to make their integration even more appealing.

Improved features

Generally speaking, the endurance of most VTOL UAVs now largely satisfies the requirements under which they are being used, providing a picture of goings-on within a certain radius of the ship and reporting back to the vessel with an up-to-date operational picture, although work is constantly under way to increase the efficiency of the platforms' powerplants and to ensure that they are more reliable.

The capability of these vehicles is also advancing, transitioning away from a rather straightforward surveillance mission set to one that comprises enhanced features – for example, multi-sensor operations that utilise radar integration, the addition of Link 16 connectivity and added targeting acquisition capability.

One of the more advanced systems in this category is the USN’s Northrop Grumman MQ-8C Fire Scout unmanned helicopter, 23 of which are operational in the B-model configuration, with a further 26 out of an expected 38 C-model variants having been delivered to the service. The OEM has recently been contracted for the final five air vehicles, which are scheduled to be delivered by early 2022.

The MQ-8C is operated on board the USN’s littoral combat ship (LCS) alongside Lockheed Martin MH-6OS rotorcraft, and it will be sent on new deployments this coming year in the US Central Command and Western Pacific areas of operations, which Capt Eric Soderberg, programme manager at the Multi-Mission Tactical Unmanned Aerial Systems office, said is a “big milestone” that the service is crossing. “Where I really expect us to get the operational value added out of these units going forward is with that; those deployments are the original CONOPS for the Fire Scout, and that should be happening this summer,” he told Shephard.

The UAV is undergoing modifications to its sensing capability in parallel to increasing its operational presence,
Over the past year, the V-200 Skeldar has secured contracts with the German Navy and the ENSA. (Image: UMS Skeldar)

capability (IOC) in 2019, and the first deployment and parallel IOC for the radar capability is expected to be achieved towards the end of 2021. ‘There’s testing and development work going on right now on the platform, and we expect it to be on the aircraft this summer for flight tests,’ he confirmed.

Complementary assets
While Leonardo cannot comment on the progress of the navy’s programme, the company noted that Osprey was designed from the offset with SWaP considerations in mind, utilising the latest processing technologies to ensure that the throughput is maximised within a small form factor.

‘For the larger UAVs, Osprey provides a flexible solution that allows the customer to tailor the configuration appropriately for their platform or operational needs, be it performance or angular coverage,’ stated Alberto Pietra, director of marketing and sales for Leonardo Electronics.

He told Shephard that the company’s Sage ELINT system can be integrated onto platforms such as Leonardo’s own Hero unmanned helicopter or the Schiebel S-100 Camcopter, as well as the larger end of the rotary spectrum in the form of the Leonardo SW-4 Solo or the Fire Scout.

The current lack of radar capability on the MQ-8C means that the USN will rely on the MQ-8B variant for the coming years, particularly as the earlier variant integrates the Cobra mine countermeasures pod that the C model currently cannot carry. The B model is expected to remain in service throughout the 2020s, and there is currently no scheduled end-of-service date for the variant, Soderberg said.

‘We are looking at potential options [for] a single-type model series, and that’s going to be [based on] projections for LCS and fleet requirements that tend to be a little bit variable at this point,’ he continued.

‘It is very hard to project out past 2030 as to what that requirement will actually be.’

Soderberg noted that there are associated economies with operating a single-type model series, although the requirements for sensors that are currently only available on the B model are balancing this out.

Furthermore, while there is no operational requirement as such for the weaponisation of Fire Scout at present, it was reported in March 2019 that the Naval Air Systems Command is funding assessments for the arming of the platform.

‘We have done some of the preliminary work in terms of storage stations and avionics buses, but there has been no weapon selected and no programme of record to do that. It is a complementary asset to the H-60, which is perfectly capable of carrying a large variety of armaments, which can be directed by the Fire Scout,’ Soderberg explained.

‘We did that during a demo last year where we utilised the Fire Scout for targeting for the Hellfire missile, in which it was integrated with the LCS,’ Packwood said.

including the introduction of a new active electronically scanned array radar for the C model, namely via Leonardo’s multi-aperture Osprey system. This, alongside the introduction of a Link 16 capability, will enable the platform to carry out more mission types in the future. ‘With things like Link 16, it really does give the opportunity for Fire Scout to demonstrate the possibility that the platform has,’ said Melissa Packwood, programme director for Fire Scout at Northrop Grumman.

‘It really can adapt to any of the capabilities that the navy requires, both with the current and the planned sensors that are aboard. With the endurance that the portfolio has, and with the opportunity for the sensor and payload capacity, it enables the Fire Scout to adjust, then execute with that increased flexibility,’ she added.

According to Soderberg, the MQ-8C is scheduled to achieve initial operational
added, highlighting the evolution of the UAV as a target designator for other assets.

Leonardo added that since it demonstrated the capability of its Sage system on board the SW-4 platform during the UK RN's Unmanned Warrior experiment in Scotland in 2016, the company has received interest from additional customers wishing to explore the possible integration of the sensor on various manned and unmanned platforms.

'To date, there have yet to be further demonstrations, but we are exploring options for testing smaller RF [radio frequency] capabilities in the near future, which we hope to be able to publicise as soon as the trial has taken place,' Pietra said. 'We are also developing sense-and-avoid solutions and can offer a complete ground segment [ground control station, data links].'

While no further testing is planned for the SW-4 Solo with Sage, Pietra noted that the concept has proven that this type of capability can be utilised on a rotary unmanned platform. 'Leonardo pursues a policy of continuous product development to ensure we offer leading-edge ISR capabilities to the marketplace. As such, we have regular flight tests to develop and verify new product capabilities,' he highlighted.

As for the Camcopter, it is a regular competitor for maritime-based VTOL UAV programmes, including most recently having been contracted by the European Maritime Safety Agency (EMSA) to provide surveillance at various locations across the continent using the onboard L3 Wescam MX-10 EO/IR payload, Overwatch imaging PT.8 sensor and an automatic identification system capability.

On trial
Elsewhere, Schiebel announced in February 2019 that it had carried out a demonstration in Nigeria to the oil and gas industry, showcasing the Camcopter’s ability to perform in this sector. Conducted in Rivers State, the demonstration was carried out in the presence of the Nigerian Air Force, Army, Civil Aviation Authority and Navy, as well as Kongsberg Geospatial and local UAV service provider Aerial Robotics.

'The international oil and gas industry has shown increasing interest in employing UAS to effectively monitor and control oil and gas infrastructure, both onshore and offshore,' the company said. 'Therefore, the latest flight trials with the Camcopter S-100 around the coast of Rivers State were designed to further investigate the implementation and potential advantages of UAS technology.'

A company spokesperson told Shepherd that Camcopter has not been used in a routine oil and gas monitoring role, although it has previously taken part in similar R&D trials. ‘The S-100 successfully completed a number of day and night flights monitoring pipeline rights of way [ROW], inspecting oil and gas wellheads/facilities and performing first-line maintenance checks, including detection of leaks and fluid levels of storage tanks,’ Schiebel clarified. ‘The Camcopter was also able to detect various third-party illegal activities on the client’s pipeline ROW. Kongsberg Geospatial’s IRIS UAS situational awareness application supported the safe conduct of this beyond-visual-line-of-sight operation.’

This is the first time that IRIS has been integrated onto the Camcopter. The application is derived from software developed by Kongsberg that was originally provided for missile defence systems. It aids in visualising airspace and utilises the company’s experience in developing GCS for the USN’s MQ-4C Triton fixed-wing UAV.

'The system integrates data from a variety of sensors and combines it with aeronautical navigation data – like aerodrome locations, obstacles and airspace restrictions – and then displays it along with 2D and 3D terrain data in a single picture that gives drone operators a very clear picture of everything around their drone,’ explained Paige Cutland, VP of sales and marketing and programme director for IRIS at Kongsberg Geospatial. ‘The IRIS system includes some hardware for connecting to sensor input, but is primarily a software platform designed to handle and coordinate inputs from a lot of sources at once, and then display it accurately on a high-resolution 3D terrain map.’

Cutland noted that the energy industry is interested in using UAVs for surveying pipelines, but in places like North America, this has not been possible due to BVLOS airspace restrictions. ‘Nigeria has been suffering terrible fallout from oil pirates sabotaging pipelines – environmental damage, fires and explosions as the direct result of sabotage have killed hundreds of people,’ he emphasised, adding that ‘IRIS is a tool that is hopefully going to help combat that problem.’

In development
As far as African industry is concerned, South Africa’s ALTI has developed the VTOL Transition fixed-wing system and is now introducing the new Reach version.
The Transition can be used for agricultural applications, carrying out multispectral data collection using sensors like the MicaSense RedEdge, mapping using the Sony A6000 camera with the Emlid Reach post-processed kinematic geotagging systems and surveillance using the Trillium HD25 or NightHawk2 EO/IR cameras for day and night missions.

The ATL Transition is a class-leading VTOL fixed-wing unmanned aircraft, developed as an ultra-compact, efficient and affordable system with the ability to take off and land vertically almost anywhere, with real-world endurance of up to 12h and unmatched performance,' the OEM said. 'ATL has been shipping the Transition since early 2017. We're certainly not one of the “new kids on the block”, with seven-plus years of unmanned development and manufacturing experience [and] over 1,000 systems shipped out of various models, shapes and sizes.'

The ATL Reach, meanwhile, has been in development for 12 months, and the company expects to start testing the final product in the first half of 2019, said Ian Share, sales technician at the OEM. He added that the system has an endurance of over 20h, noting that there has been a ‘massive amount of interest’ in the platform, and a number of examples have already been sold before the system is even completed.

Also in development is the VSR700, an unmanned rotorcraft that is being developed by Airbus Helicopters and Naval Group. The platform is based on the Guimbal Cabri G2 twin-seat rotorcraft, but although based on a civil-certified helicopter, the naval market is currently leading the requirement.

'The VSR700 is currently the only viable UAS [vertical UAS] in the 500-1,000kg MTOW [maximum take-off weight] class,’ an Airbus spokesperson commented. 'It will perform more effectively than larger helicopter-based UAS at a fraction of the cost, while providing similar payload/endurance capabilities. Equally, it has a low logistic footprint, which in the case of naval applications eases ship operations/integration.'

The partnership was formed in 2017 to respond to French Navy requirements for a future UAS capability dubbed SDAM (Navy Airborne Drone System), which resulted in a de-risking, pre-development contract being signed in December of that year. This is expected to lead on to a development and industrialisation contract ultimately being signed with the French DGA procurement agency.

Alongside this, Airbus is working on the baseline system that forms this requirement, the spokesperson said, developing the aircraft, flight control element and the GCS, which will ultimately feed into the navy's requirement while also preparing the system for export.

The company announced in December 2018 that the platform had conducted its first fully autonomous flight during a 30min sortie in Istres, France, which Airbus said demonstrated compliance with the regulatory and safety system requirements in the country.

'The VSR700 team is now concentrated on the VSR700 prototype, with a first flight foreseen this year,' the spokesperson confirmed. 'In parallel to this first flight, the team continues to work on the risk-reduction contract for the French DGA. The risk-reduction studies enable certain technological capabilities to be investigated and thus choices made for the development phase. The spokesperson added that these initial studies will run until 2021 and will include a demonstrator carrying out flight tests at sea from a frigate.'

The initial mission set for the platform will be maritime ISR, comprising multi-sensor configurations including EO/IR and tactical radar. The VSR700 has a 100kg payload capacity with 10h endurance, and should the target market for the UAV expand into parapublic domains, cargo-carrying is one identified area, Airbus noted.

Maritime focus

Another key player in the unmanned rotary-wing market is UMS Skeldar, which has received recent success from the German Navy. The service selected the V-200 UAV for integration onto its K130 corvette. The OEM has also been contracted by the EMSA to operate the V-200 Skeldar in support of risk-reduction maritime surveillance missions over a two-year period, which kicked off on 1 April 2019.

Two systems and two crews will be available under the terms of the contract, with different sensors on each system. Skeldar will be operated from the shore and used to carry out pollution and gas-emission detection, particularly sulphur emissions, for which there is an aim to reduce tenfold over the coming years.

David Willems, business development director at UMS Skeldar, said that the company is focusing on the maritime surveillance capability of the platform, which will help position it as ‘the platform of choice for navies across the world’. He noted that the success with Germany will...
Leonardo’s Osprey radar is being delivered for integration on board the USN’s MQ-8C Fire Scout. (Photo: Leonardo)

New player
A relative newcomer to the VTOL market, meanwhile, is FLIR Systems, which is a traditional sensor manufacturer that has transitioned into the unmanned platform market. The company acquired Proximitics and its Black Hornet nano unmanned helicopter in 2016, which was its first move into the VTOL market. FLIR subsequently acquired Aeryon Labs and its SkyRanger reconnaissance multicopter family in January 2019. It also announced in 2019 that it had acquired Endeavour Robotics, a UGV manufacturer.

Black Hornet is a handheld reconnaissance system that provides an organic sensor capability for dismounted soldiers. It has been operated by the British Army, and since being rolled into FLIR’s operations, the product is now in its third iteration.

In January 2019, it was announced that France had also selected the nano UAV for its French Operational Pocket Drone programme, and a contract with a maximum value of $89 million was awarded to the company for the newest Black Hornet 3. During the same month, FLIR also announced that the US Army had ordered Black Hornet for its Soldier Borne Sensor programme under a $39.6 million contract award, building on a first-phase contract award in June 2018 that has resulted in an initial batch of the systems being delivered to the US DoD.

On 15 April, FLIR was awarded a $1.8 million contract by the British Army to deliver the FLIR Black Hornet 3 Personal Reconnaissance System. Deliveries of the systems are now taking place and are anticipated to be completed by October this year. The number of units delivered has not been released.

The SkyRanger system, meanwhile, comes in both the R60 and R70 configurations, and it was unveiled in the new R80D SkyRaider configuration in 2018, which Aeryon literature describes as a Group 1 VTOL UAV with capabilities of a larger Group 2-3-sized system. This can carry payloads up to 2kg, has an open architecture and includes embedded AI computing capability, all of which the company said is ‘redefining what’s possible with a man-packable drone’.

“We view the acquisitions of Prox Dynamics, Aeryon Labs and Endeavor Robotics holistically as part of our strategy to move FLIR beyond providing sensors to the development of complete solutions,” said Roger Wells, general manager of FLIR Unmanned Systems and Integrated Solutions. “Today, the systems that we sell as part of all three acquisitions are disparate, and we see tremendous opportunity to create integrated, unmanned-unmanned teaming solutions that both meet the needs of the customers but also greatly expand their capabilities.

‘In the battlefield of the future, these systems will need to work together, and today we’re investing to help us advance toward true integration such as building a common architecture that will help us integrate ground and aerial systems,’ he continued.

FLIR is focusing on offering solutions that meet military demands and are distinguishable from the more commercially available and lower-cost variants that are readily available, as the company works to offer durability, power efficiency and sensor capabilities that meet their requirements, Wells said.

Growth potential
Concerning the recent acquisitions, Wells added that both Aeryon and Endeavour are former FLIR customers, noting that the company has recognised ‘tremendous opportunity for improvement’ across the manufacturing of all of its unmanned products. ‘Regarding future markets, we see significant growth potential in existing markets, with more integrated solutions such as border security. We also see opportunities for growth in other markets like public safety and critical infrastructure,’ he highlighted.

Wells added that FLIR is continually investing in technology, and enhancements to the SkyRanger are expected to be revealed in the future, while further acquisitions could be made. ‘Acquisitions remain a key aspect of our long-term strategy to drive business growth across the three business units at FLIR. So, watch this space,’ he said.