SENSING CHANGE

A prevalent trend is emerging in the commercial rotary sector towards the adoption of more sophisticated radar and sensor technology, but how are major manufacturers of imaging payloads responding? **By Beth Stevenson**

A Wescam MX-15i multi-sensor, multispectral imaging system on board a Slovenian Police H145 helicopter. (Photo: Airborne Technologies)

The integration of sensors onto rotorcraft serves a variety of roles according to the capabilities offered by each technology, from weather radar to aiding pilot visibility and crew safety to surveillance cameras for search and track applications.

More dependence is now placed on digitisation, but bespoke helicopter sensor suites that fulfil these functions are costly and may carry integration challenges. Instead, payload developers are offering alternative solutions that they claim are suitable for incorporation on numerous types of rotary-wing aircraft.

However, the SWaP characteristics of the sensors may be a development limitation, as these constraints are particularly sensitive on helicopters, and must be balanced with a widespread industry requirement for increased levels of performance, including more sensitivity, longer detection ranges and the ability to operate in challenging environmental conditions.

Sensor technology for commercial rotorcraft tends to roll over from the military sphere, where government investment has gone towards addressing common operational considerations during the development of payloads. Commercial applications that require sophisticated sensor suites include SAR, law enforcement and border security, all of which also benefit from the ruggedisation of military systems.

Electronic signatures

Typically, weather radar for commercial rotorcraft are mechanical, low-cost and easily certified. However, there may be an emerging trend to adapt active electronically scanned array (AESA) radar for certain parapublic applications – technology that has previously been exclusive to the military domain, primarily in support of fighter fire control.

Although not currently commonplace due to its cost and sophistication, AESA radar has a number of attributes that are beginning to appeal to the civil market. It can switch between modes and carry out multiple tasks simultaneously, for example, including terrain clearance, collecting weather information and performing ►

search functions. 'As soon as you move away from [looking at a] single task, AESA will slowly start to come in, I think,' said Brendan Nolan, VP of sales for radar and advanced targeting at Leonardo.

Unlike mechanically scanned (m-scan) radar, AESA is electronically controlled, so there are no moving parts, which reduces the mean time between failure of the sensor. While it may be more expensive to initially acquire, the through-life cost of supporting AESA is expected to be reduced overall.

'I think it is rare, but it is becoming less rare [for commercial operators to use AESA],' Nolan added. 'We're certainly starting to see that the awareness in the market is starting to rise, and people are starting to enquire, so this is absolutely the way forward. There is no doubt that in a period of time – be it ten or 20 years – nobody will be making m-scan radars.'

In December 2013, the Norwegian Ministry of Justice contracted Leonardo Helicopters to provide 16 AW101s to replace its Sea King rotorcraft under the All-Weather SAR Helicopter (NAWSARH) programme. The aircraft feature the company's newest Osprey distributed-antenna AESA radar.

Despite being operated by the air force, the AW101s will be used in a non-military role, so are a good example of this type of technology being introduced into the commercial sector.

'That's been a good programme, and that non-military user is absolutely ideal for Osprey, because they are able to exploit all of the advantages of an AESA radar over a more traditional m-scan, or even over a gimballed AESA,' Nolan told *Shephard*.

'It's interesting, because it's not a military task... in this case, we're using the benefits and flexibility of an AESA in a parapublic task,' he continued. '[Operators] like coast guards to SAR agencies I think will move to AESA very quickly, because they've got a difficult job. The operational benefits of the radar are that it can do lots of different tasks at the same time.'

Osprey can be distributed over four different apertures across the aircraft to achieve an extensive FOV, which is typically provided by a belly-mounted sensor. 'There has always been an issue with fitting radars to get a 360° coverage. Underneath is fine, except [with] a helicopter that [must] be able to land anywhere,' Nolan said.

'The radar is a very expensive, high-tech piece of equipment, and even behind a radome there is always a danger you'll damage it when landing anywhere other than on a ship or on a runway, and of course, that is not what happens in a search and rescue operation – you might be landing anywhere.'

Given that Norway is prone to snow, landing on an unprepared runway could put a belly-mounted sensor at risk of damage by hitting undetected obstacles such as rocks that are hidden from view.

The country has also contracted a short-range awareness mode, whereby terrain clearance can be provided at a distance to provide situational awareness in advance, while also carrying out maritime search or weather checks.

The first SAR-configured AW101 has been delivered under the agreement, and the second is scheduled for delivery in early 2018, with five more examples expected to be handed over throughout the year. Five more will follow in 2019, and the remainder in 2020. Once three have been received, the fleet will begin operations.

'The Norwegian Ministry of Justice is very happy with the radar, and the Helicopter Division has done a good job of integrating the radar into the systems on the aircraft, which is key for us,' Nolan confirmed. 'This is how the data we are able to generate with the radar is displayed to the crew, and what makes it work or not.'

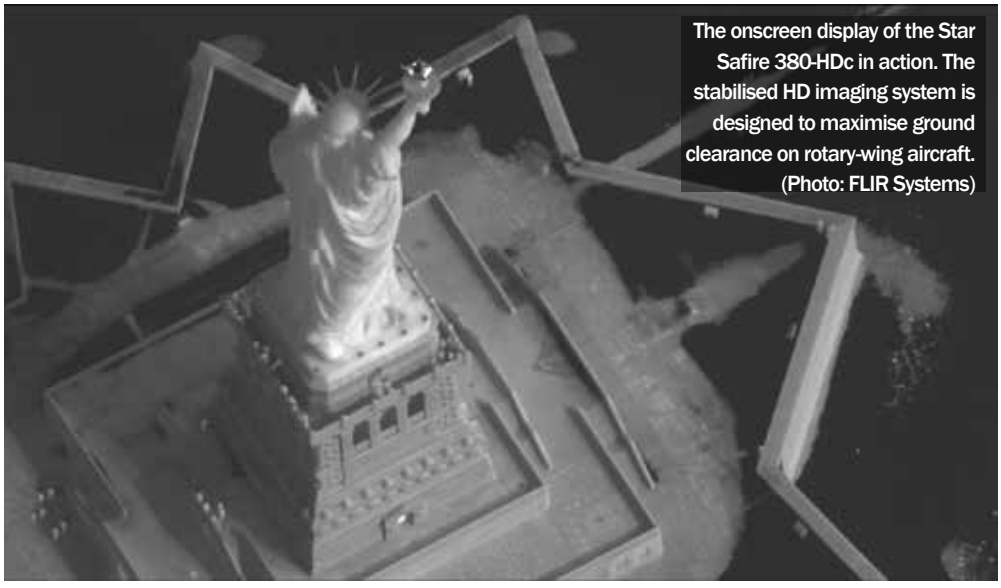
Pivotal performance

EO/IR sensors are also widely used for lots of different military applications, but have become relied upon for government and parapublic rotorcraft for use in SAR and law enforcement roles and by intelligence agencies.

Onboard imaging systems can be installed standalone or as part of a larger, integrated sensor suite, depending on the requirements and budgets of the operator. Many offerings are provided as gimballed sensors that fit to the underneath of the helicopter, and the SWaP implications of carrying them are constantly being evaluated.

FLIR Systems is a supplier of both military and commercial EO/IR payloads. 'Most customers tend to have legacy mission systems or existing OEM equipment that we need to integrate our EO/IR sensors with,' said Adam DeAngelis, director of marketing for FLIR's Surveillance Group. 'For those customers that do not have legacy systems or OEM equipment, we are able to offer our Merlin mission system.'

The Star Safire 380-HDc is one of the manufacturer's key offerings for commercial rotorcraft, although it has a larger 15in (380mm) form factor than competing systems. 'While there are 10in systems available on the market, it is impossible to fit in the optical capability, and customers



The onscreen display of the Star Safire 380-HDc in action. The stabilised HD imaging system is designed to maximise ground clearance on rotary-wing aircraft. (Photo: FLIR Systems)

are prioritising the need for longer stand-off ranges,' DeAngelis explained.

'Our systems are very power-efficient, therefore the demand for size and weight tends to outweigh any power issues. We like to say "performance" instead of "power", since it tends to have much more relevancy in today's mission requirements.'

He noted that while the company has a strong traditional customer base, it is also seeing increasing demand in emerging markets, and there are a number of developments under way that it is planning on unveiling in this sector later in 2018.

Similarly, L3 Wescam has also reported receiving interest from government markets, both domestically and internationally, including intelligence, customs and border patrol and law enforcement agencies, claiming that purely commercial markets do not require the level of sophistication that its MX series of EO/IR gimbals offers.

In addition to the standard visible and thermal (midwave IR) cameras found in a Wescam payload, options also include near IR and shortwave IR (SWIR), plus lasers for rangefinding, marking and targeting, alongside an inertial navigation system.

> ***"Technology usually reserved for the military domain is beginning to roll into markets with less available budget, but ones that often have just as demanding requirements."***

The company is seeing increasing demand for a complete operator's console package, as opposed to just the sensor. 'In addition to monitors and a hand controller, the console would include a moving map system that provides the customer with a state-of-the-art touchscreen operator interface with advanced sensor management functions, video recorders, microwave downlink and other related equipment,' explained Paul Jennison, senior VP of strategy and business development at Wescam.

Products in the ubiquitous MX series share common features such as imager types and HD resolution, but vary in optics, with the larger turrets having larger apertures and longer focal lengths, which magnifies the target that is being tracked. This equates to longer target detection, recognition and identification (DRI) distances for superior operational performance. ▶

Further emphasising the strong correlation between SWaP and performance, Jennison said: 'So, sensor choice comes down to a trade-off between the mission DRI requirements and the payload SWaP constraints of the platform.'

The Euroflir 410 features standard interfaces, enabling it to be integrated with other mission systems. (Photo: Safran)

Likely prospects

While other manufacturers take the view that one system type can serve a number of applications, L3 is instead finding that each product has its own niche market. 'Wescam has found that the MX-10 is a good fit for light to medium-lift rotorcraft with nominal mission altitudes around 5,000ft, and the MX-15 is a good fit for medium- to heavy-lift rotorcraft with nominal mission altitudes around 15,000ft,' Jennison said.

'We expect that the introduction of a new product, such as the MX-8, will open up a new market segment to us in terms of platform and mission addressability,' he added. 'Specifically, that product is appropriate for the very light helicopter market, which may otherwise not employ a sensor.'

As imaging technology continues to advance, L3 expects to introduce new features into its products. 'For example, Wescam has taken advantage of a new generation of compact HD midwave IR detectors to bring that capability to our small MX-10 family of sensors,' Jennison said.

'We have leveraged state-of-the-art high sensitivity and high dynamic-range colour CMOS detectors to bring an unprecedented level of colour performance under challenging illumination conditions,' he continued.

Full HD is being added to low-light sensors through CMOS technology, while SWIR is being introduced to enable the sensor to perform in harsh weather conditions. The newest MX sensors are also utilising new processing architecture, which offer improvements in internal computing.

The maturation of processing technology means that L3 can provide advanced video tracking and embedded moving target indication, according to the company.

In addition to leveraging developments in software to increase its presence in the commercial sector, the manufacturer has its eye on future regional growth. 'We forecast that the next high-growth region will be Southeast Asia, which is not surprising given the ongoing geopolitical tensions in that part of the world,' Jennison told *Shephard*, although he did concede that opportunities are not anticipated to be quite so forthcoming elsewhere. 'The Middle East has been a strong market for the past seven years, and we expect that to continue but without the same levels of high growth,' he said.

France-based manufacturer Safran is also looking to the SAR and civil security markets for its Euroflir family of sensors. 'Our EO/IR systems are designed to fit any rotorcraft application requiring performant systems to [provide] suitable information in a complex situation, where the lives or security of people – on the ground or on board – are at stake,' a company representative stated.

As with competing systems, Euroflir can be used within a wider, full sensor suite or as a standalone product, depending on customers' mission and aircraft configuration requirements. Furthermore, Safran offers its EO/IR payloads directly to the aircraft manufacturer or integrator or as part of a complete ISR system for an operator's rotorcraft modernisation efforts alongside C2 systems (which include a mission system, console and ground data links).

Reiterating the industry-wide stress on the importance of SWaP, the spokesperson said: 'In airborne applications, SWaP and performance are of equal importance, as the life of the crew is often at stake and light [weight] is crucial. Safran, capitalising on all its experience in various optronics including handheld goggles, can combine high performance and light SWaP.'

There are clearly commonalities across the marketplace in terms of SWaP challenges and the requirement for increased performance, recognised by multiple manufacturers to be particularly salient for commercial and parapublic users requiring EO/IR and radar systems. However, while some companies are offering common systems to the whole marketplace, others are seeing appeal for specific products for different types of helicopter.

The introduction of AESA radar is likely to disrupt the commercial rotary sector, as technology usually reserved for the military domain begins to roll into markets with less available budget, but ones that often have just as demanding requirements, such as for SAR missions. ■