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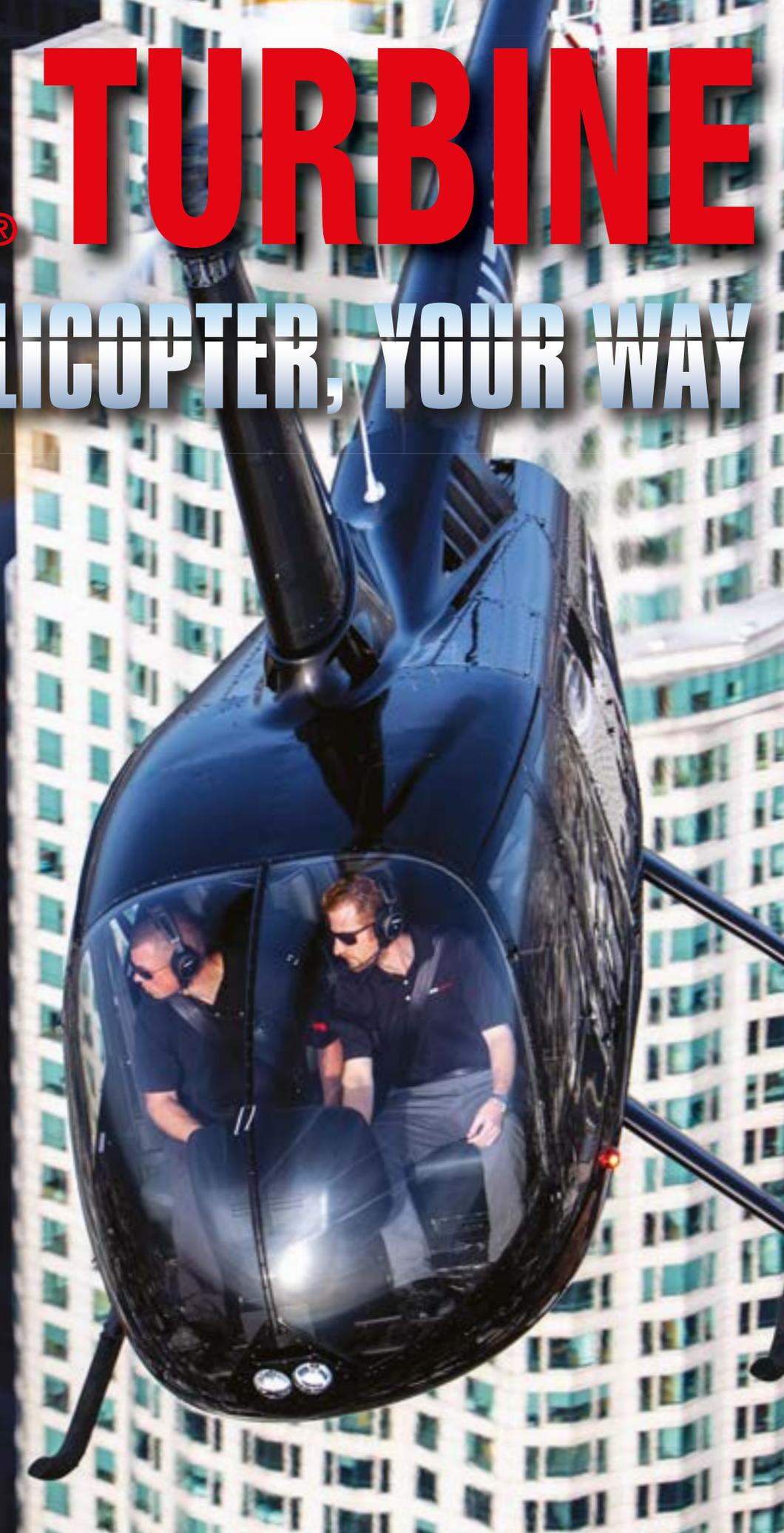
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Front cover: The lion's share of power line inspection work continues to be completed by rotary-wing aircraft. (Photo: Airbus Helicopters)

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Helen Haxell, Air Editor

Highs and lows

Peaks, troughs, highs, lows, climbs and dips – all part of the lexicon we heavily associate with the civil helicopter sector. The industry – which is constantly having to look at itself in the mirror to consider whether the state of the oil and gas market is resulting in an abundance of idle aircraft – is self-aware, self-conscious and always going through therapy.

One thing I have learnt as Air Editor, covering this sector for the last few years, is that you can never be too certain – the rotors of change quite literally shift with the wind. However, since it is important to continuously take stock, I cautiously review the status quo for the market's modus operandi into the second half of 2019.

Following the money

Almost a year ago, I was adamant that the leasing market would plug the gap of orders that had arisen due to the oil and gas downturn. However, we are now seeing lessors and rotorcraft providers filing Chapter 11.

One such company is the Bristow Group, which has recently been given approval by the US Bankruptcy Court for the Southern District of Texas to move forward with its Chapter 11 restructuring process (see p6).

After also filing in November 2018, Waypoint Leasing entered into an agreement the following month to sell its assets to Macquarie Rotorcraft Leasing. It was confirmed in March this year that the acquisition of Waypoint's helicopter portfolio has been completed. This news could be construed as decreasing the size

of the leasing market, with a smaller contingent of lessors now in business.

Whilst the West streamlines its leasing sector, Asia is instead continuing to expand in this arena. Throughout aerospace and defence, the market share that China is taking away from the wider world is being observed with bated breath. Will the dragon eat away the greater proportion of competition? For the leasing segment, I highly doubt it, as operators tend to prefer a local touch, but if Beijing proves successful in getting its claws into Western industry, then it could present a very real challenge to regional companies.

Chinese lessors reportedly own around one eighth of the world's fleet, and this number may be on the rise.

Targeting growth

However, the potential for business in the Asia-Pacific market is also not going unnoticed, and lessors are making efforts to get their footprint well and truly cemented in the region.

Considering China in particular, Lease Corporation International (LCI) already has 40% of its Asia-Pacific fleet operating in the nation, and this is only going to grow as older machines are replaced. Indeed, the lessor is targeting strong growth, and is expecting up to half of its fleet to be active in the region as a whole in the coming years.

A deal with Shanghai Kingwing Aviation was secured in summer 2018, whereby LCI leased three new Leonardo AW139 platforms to the operator for EMS work.

In the next issue

- SAR
- HUMS
- EO/IR
- Finance and leasing

The lessor has also said that it is seeing increased demand from China's offshore oil and gas companies, which are looking to upgrade their domestic fleets and expand their international presence.

Internal affairs

The other mighty power, Russia, has indigenously maintained its leasing business through government-owned enterprises – GTLK is the state-owned leasing company – so it is not likely to see any penetration from international players.

At the end of last year, the Russian Ministry of Health announced that it is set to extend its state-sponsored HEMS programme until 2025 while gradually expanding the scope to cover the entire territory of the huge country. The project now covers 49 regions, and a further 21 will be added in 2020, with the whole nation covered by 2021. A total of over 120 aircraft will conduct operations on lease.

With Russia focussing internally on its leasing affairs and China looking to continue its exponential growth domestically, interested parties will naturally want to invest there and reap the economic awards.

Hiccups from the oil and gas downturn are still having rippling effects across the Western world, so whether the global leasing market remains represented by a plethora of global companies is dubious. Instead, it is highly likely that one overarching body will cut through the competition and spread its base across the world through the acquisition of multiple lessors. ■

End in sight for certifying AW609

The push to achieve FAA certification for Leonardo's AW609 tiltrotor is building momentum as the company looks forward to the programme's final prototype (AC4) flying later this year.

Once certified – before the end of 2019 – the aircraft is set to become the first powered-lift civil platform to enter the market and is positioned as a significant proposition for EMS, offshore energy, SAR and VIP/corporate operators.

Current flight test developments include the AC1 undergoing load-level survey certification flights and the AC3 conducting in-flight engine performance certification operations, a Leonardo spokesperson explained to *Shephard*.

In 2015, the AC2 was involved in a fatal crash in Northern Italy.

Alongside the forthcoming AC4 flight operations, the company also expects to have a number of training devices – notably a virtual interactive procedural trainer and

full flight simulator – introduced to the market shortly.

The development of the AC4 is of particular importance to the overall certification effort as it is looked upon as 'production representative' and includes major components of assembly-ready AW609 aircraft. It is also set to be the first prototype equipped with the Collins Aerospace Pro Line Fusion avionics suite. The spokesperson confirmed that the platform will be 'focused on flying avionics tests'.

Once FAA certification is achieved, a plan for EASA approval will be requested, but no firm or estimated timeline for this has yet been disclosed by Leonardo.

However, the spokesperson did confirm that serial production of the aircraft started at the company's Philadelphia final assembly line in March 2019.



Image: Leonardo

Interest in the AW609 has been underscored by a number of agreements to this point, including a February 2018 announcement by Leonardo that helicopter transport operator Era Group will become the civil launch customer of the tiltrotor.

Era has ordered two of the aircraft in a nine-passenger utility configuration, with both scheduled for delivery in 2020 and to be reserved for multi-mission services, including EMS, offshore, SAR and VIP missions across the US.

Leonardo and Japan-based Nakanihon Air Service signed an MoU in March 2019 to establish a joint working group set to study requirements for introducing the AW609 into service with civil and government users in the region.

In November 2018, Leonardo shared with *Shephard* that it has received interest for orders of 'over 50 aircraft' worldwide. 'Users are intrigued by the significant time savings enabled by eliminating the slow ground transportation to and from an airport with the AW609's true point-to-point transit,' the spokesperson explained. 'Likewise, numerous mixed-fleet operators see significant savings by having a homogenous AW609 fleet instead of having separate helicopter [and] fixed-wing aircraft fleets and the duplicity in their associated logistics.'

Subject to customer demand, the military variant of the AW609 is expected to be certified in 2021.

The spokesperson said that the OEM 'is looking into' how it could potentially play a role in Future Vertical Lift programmes through the use of tiltrotor technology, adding that it is 'too early to say' for the US Future Long-Range Assault Aircraft project.

By Tim Martin, London

North Dakota builds up R44 training fleet

Robinson Helicopter Company has delivered another two R44 Cadets to the University of North Dakota, adding to the two in-service Cadets that were obtained by the customer in 2017 and 2018.

Although the R44 is a four-seat light helicopter, the Cadet variant swaps out the two rear seats for cargo space and has a more efficient muffler and a Lycoming O-540-series engine, which is suitable for training purposes. The examples delivered to the university were also equipped for IFR and VFR training, with a fully integrated glass cockpit that features Garmin's G500H

1060 TXi touchscreen flight display and a GTX 345 transponder with ADS-B In/Out.

With this additional purchase, the University of North Dakota seems committed to the idea of transitioning to an all-R44 training fleet. Chief helicopter instructor Wes Van Dell said that 'by the fall of 2019, all incoming students will train in Cadets'. The fleet is based at the Grand Forks, North Dakota, campus, alongside the university's helicopter division, which in 2018 logged more than 1,200h in Cadets.

The type has also been used by Southern Utah University (SUU). Richard Cannon, director of flight operations at SUU,

stated that the Cadet is a 'very safe and capable training aircraft'.

In production since 1992, the R44 series (at first made up of the Raven, then the Raven II and then the Cadet in 2016) has globally reached 40 million flight hours, with Robinson reporting increases in deliveries year on year.

By Helen Haxell, London

Photo: Robinson





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Ka-32 set for significant upgrade

Russian Helicopters is set to launch a programme to upgrade the Ka-32 coaxial utility transport helicopter with new avionics and engines for improved performance.

According to the Ka-32's chief designer Shamil Suleymanov, the type will be offered as a new-build platform and as a modular upgrade package for existing customers.

Dubbed the Ka-32A11M, this new derivative of the proven 11t helicopter – with coaxial rotors and a 5t payload – is tentatively set for the launch of its flight testing and certification programme in spring 2020, with serial production expected to commence by the end of that year. The first customer deliveries are slated for 2021.

The development is being funded by Russian Helicopters (75%) and VSK, a subsidiary of the former that specialises in the fleet's logistic support operations.

The new integrated avionics suite, provided by Russian avionics specialist KRET, is based on the system already developed and certified on the Mi-38

15.6t civil helicopter and which is also used in a simplified form on the 3.6t Ka-226T. It has a modular open architecture, including three large multi-function colour displays in the cockpit.

The new Klimov VK-2500PS-02 engine is a derivative of the civil-certified VK-2500 family, rated at 2,500shp in one-engine-inoperative mode and 2,200shp in take-off mode. The powerplant also features FADEC controls and an extended service life, and its design has been improved to sustain increased loading during high-cycle external cargo operations. The new engine promises to boost flight performance in hot and high conditions, enabling the Ka-32A11M to boast better productivity in the external cargo transport and fire-fighting roles.

The Ka-32 upgrade programme is available to existing customers, mainly in China and South Korea, presumably covering all existing versions in service.

For use in the fire-fighting role, the Ka-32A11M is offered with a 4t fire attack



system, using a tank accommodated in the underfloor bay and under the fuselage. Developed by Kumertau Aviation Production Enterprise, the new system has four separate compartments and comes equipped with a built-in pump and hose, allowing filling in 1min in hover mode.

In addition, the system has adjustable discharge rates, and thanks to the retractable refilling hose, the Ka-32A11M's maximum permitted speed is 220km/h. First flight tests of the new fire attack system are slated for August 2019.

The Ka-32A11M can also be equipped with a telescopic water cannon with a 35-40m range and 800l/min discharge rate, which is advertised as being useful for extinguishing fires in high-rise buildings.

By Alexander Mladenov, Moscow



Bristow Group operates in the offshore oil and gas sector. (Photo: Airbus Helicopters)

Bristow Group has been given approval by the US Bankruptcy Court for the Southern District of Texas to take forward its Chapter 11 restructuring process.

The outcome of the process is expected to leave the helicopter services provider in a better financial position as a stronger balance sheet and a 'lower and more sustainable debt level' will be established. 'All of Bristow's businesses are operating in the ordinary course and are anticipated to continue to do so for the duration of the Chapter 11 process,' the company stressed in a statement on 15 May.

In recent months, the financial fortunes of Bristow have seen a drop in share prices,

Bristow puts faith in Chapter 11 restructure

following disappointing performance from oil and gas-related business, as well as the termination in February of a \$560 million acquisition of Columbia Helicopters.

As part of a legal declaration supporting the company's position, Brian Allman, chief financial officer of Bristow Group, summarised the nature and gravity of market issues. 'Oversupply of oil, together with weakening demand, have greatly impacted capital expenditures for exploration and production activities. These factors have led to a substantial number of oil and gas-related bankruptcies over the last four years,' he said.

The impact of such volatility – with clients subsequently reducing offshore exploration activities – led to a fall in revenue of approximately 40% between FY2015-2019.

'Depressed revenues' were also a direct result of greater competition in Australia, the Gulf of Mexico and the North Sea, according to Allman. 'In sum, the scope and volume of helicopter services demanded by the market has greatly contracted, while the overall level of competition has increased,' Allman stated.

The Chapter 11 case covers six of Bristow's legal entities in the US and two of its Cayman Islands subsidiaries. However, the company claims that outstanding legal matters should have 'no impact at all' on its UK operations, including a key SAR contract held with the government-ran Maritime and Coastguard Agency (MCA). 'The debtors have kept Bristow Aviation Holdings Limited and their other non-debtor UK affiliates, key customers like the MCA and regulators like the UK Civil Aviation Authority appropriately apprised of the debtors' situation and the financial objectives of these Chapter 11 cases,' Allman noted.

Bristow currently operates from ten UK coastguard bases and is responsible for carrying out SAR-related activities across the region, having originally taken over the role from the Royal Air Force and Royal Navy in 2015 and 2016.

By Tim Martin, London

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An H135 operated by Canada-based Finnair conducts a power line inspection mission. (Photo: Airbus Helicopters)

A HIGH-WIRE ACT

The use of helicopters to carry out aerial work, look for and assess faults with power lines, support high-voltage cable construction and transport critical equipment to support these kinds of missions continues to be a highly valued role, not least in underdeveloped countries where such work often provides manufacturers with new customer opportunities. Railway lines and utility inspections are also covered within the aerial services market.

EO/IR sensors are an essential part of these operations, with camera imagery and photographs giving operators clear indications of how to address and manage issues such as pipeline leaks or the cracking of a pipe itself.

It is worth mentioning the full array of sensor and camera capabilities that ultimately underpin the efficacy of these types of missions, with items including temperature measurement, thermal hot spots, corona detection, enhanced zoom for increased visibility and wide-angle field of view all contributing to the overall operation at hand.

Shephard looks at how the civil rotary sector is adapting to coexist with UAVs across the aerial services and power line inspection sector and questions how the helicopter industry can best support itself and ensure that competition with unmanned platforms does not disrupt business interests.

By Tim Martin

Strong competitor

Up to a certain point, the rotorcraft industry had a fairly strong claim to the entire aerial services market, with companies including Kaman Aerospace and Robinson Helicopter Company well known for their expertise in the field.

The use of UAVs across the commercial aviation scene has been increasing over the past few years. Within the aerial services market, the striking similarities between what helicopter and drone operators can offer has given credence to the idea that unmanned systems could yet steal market share in an unprecedented manner.

The contest might seem almost unfair when the manufacturing costs of basic,

lightweight drones are ranked against single- or twin-engine rotary-wing assets. However, at the other end of the debate stands the fact that rotorcraft regulations are well established, and their implementation goes so far beyond the limited progress of the commercial unmanned industry that the pendulum begins to swing back towards a helicopter industry advantage.

Some of the major territories where investment in power line infrastructure is most in need and where operators sense opportunity are Africa, India, Saudi Arabia and South America, according to Roger Wassmuth, senior director of business development for air vehicles at Kaman

Aerospace. ‘The California power line system, [which is around] 40-50 years-old, requires major replacements and upgrades for hundreds of miles. That does not even address the areas damaged by fires that will [also] require full replacement,’ he said.

Kaman manufactures the single-engine, single-seat K-Max helicopter, which is best known for its thin airframe, counter-rotating rotor system as well as being developed for external load carrying – the platform can lift 2,700kg.

‘It is the only designed vertical reference helicopter with a narrow fuselage with an unobstructed view that helps the pilot see and place the loads with exacting precision and control,’ Wassmuth said. ‘In addition, the low noise and low rotor wash provides safety and efficiency to the workers below. The aircraft cargo hook trolley system enhances stability and load placement.’

Kaman’s position on UAVs disrupting the market is fairly straightforward in that it points out that UAVs simply cannot match the K-Max’s load-carrying capabilities. That said, the company has invested in developing optionally piloted vehicles for commercial purposes and plans to provide this capability as an option for new and existing aircraft, according to Wassmuth.

‘We have also identified a number of missions that will benefit from unmanned capabilities, including forest fire-fighting and humanitarian relief, and are looking forward to aligning with domestic and international commercial operators in need of these capabilities,’ he explained.

Support work

Rotak Helicopter Services, an Alaska-based K-Max operator, used two of its fleet to support power line work for nine months following the destruction of hurricane Maria in Puerto Rico. The work of the operator included over 1,000 flight hours to set 220 transmission towers, move conductor lines and the transport and placement of concrete foundations, Wassmuth detailed.

The support effort also saw Rotak carry critical supplies to remote areas across the country, with the operator performing human external cargo operations, moving crews in and out of inaccessible areas.

Kaman restarted production of the K-Max in 2015 and has since delivered ten of the newly made aircraft, with five to six scheduled to be built on a yearly basis ‘for the foreseeable future’, Wassmuth said.

Washington, DC-based Rainier Heli International will also purchase and lease K-Max helicopters, with St Louis Helicopters, for example, agreeing to use one for construction work in December 2018.

In terms of recent news within the market, one key aerial services delivery took place in April, with China’s State Grid General Aviation Company (SGGAC) taking receipt of an Airbus H215 heavy-lift helicopter, making the operator the launch customer of the type in China.

The SGGAC is a leading international utility company responsible for aerial construction and maintenance of domestic power lines and associated networks. The H215 is set to ‘perform cable repair, cable laying, cargo transportation and power line

pylon construction in difficult-to-reach areas,’ according to an Airbus statement.

To support these missions, the aircraft will be equipped with a 4.5t cargo sling, hoists, weather radar and a wire-strike protection system. The platform is configured to accommodate 17 passengers while also housing oxygen jackets for high-altitude operations.

In April 2018, Airbus delivered an H145 to San Diego Gas & Electric (SDG&E) to support the company’s electric transmission and distribution network. SDG&E is a regulated electricity and natural gas utility company that provides a service to San Diego County and southern Orange County in southwestern California. The company reserves the helicopter for stringing power lines, setting poles, transporting maintenance crews to remote locations and patrolling its significant power line network.

Effective partnerships

Efforts began in 2015 by Airbus Helicopters UK and French utility company RTE to develop, certify and produce a live-line system for use on the operator’s H135 aircraft. During HAI Heli-Expo 2019, the two companies agreed to formally collaborate in an industrial partnership to offer the equipment to the international power market through RTE’s aerial works subsidiary Airtelis.

The agreement follows entry into service of the live-line system, which also included aircraft modifications undertaken by Airbus and certificated by EASA. ‘The full system includes a series of aircraft-mounted

Table: The scope of work that helicopters perform across the power line and construction market. (Source: Airbus Helicopters)

Phase	Sub-phase	Purpose	Classes
Building	Pylon assembly	To pile up power line pylon parts	Heavy
	Cable stringing	To uncoil electric cable	
Maintenance	Power line survey	To monitor ‘hot points’ along power lines prior to repair	Single
	Insulator cleaning	To remove dirt which hampers insulation effectiveness	
	Livewire repair	To repair damaged wires w/o having to cut off power	
	Tree sawing	To prevent growing vegetation to enter in contact with wires	Single

elements and a number of underslung live-line basket configurations to carry the line-men to the power lines,' an Airbus spokesperson said. 'The aircraft-mounted modifications include a dual cargo hook, anti-spin system, extended mirrors, camera system, dedicated cockpit-mounted mission displays and communication equipment.'

RTE's breadth of work covers the largest electricity network in Europe, with 100,000km of lines in France, some of which carry currents up to 400kV.

In addition to its five H135s that were purchased specifically for power line surveillance and maintenance work, RTE currently operates an H215 and two H225s for heavy-duty work, such as moving pylons. Five H125s are used for inspection duties in mountainous areas, and an AS355N conducts human external cargo missions with heli-baskets. The live-line system is designed to address the 500kV requirement of networks in countries such as China and the US.

Addressing the evolution of the power line market and its maturity, the Airbus spokesperson explained that aspects like inspection, maintenance and repair are primary areas that continue to be most important, with operators having to make sure their work does not cut electricity or stop service to local populations.

'Countries in Asia, Latin America and Africa have recently started building their networks from scratch and are focused on quick and sustained construction growth. So, different parts of world have different development issues requiring different solutions,' the spokesperson noted.

Although the OEM did not disclose exact numbers of its power line operator base, it claimed to be 'well represented' across the light single-engine (H125), light twin-engine (H135 and H145) and heavy segments (H215 and H225).

In particular, the H135 is becoming a more attractive option for operators, based on the fact that regulators in regions like Europe and North America are 'leaning towards' dual engines as they offer enhanced safety in the event of an engine failure, according to the spokesperson.

Besides platform developments, Airbus views drones and helicopters as 'being complementary' rather than competing entities, as each provides 'real added



The K-Max is well known in the power line inspection market. It has a maximum lifting capacity of 2,700kg. (Photo: Kaman Aerospace)

value in the end-to-end process'. Clarifying that summation, the spokesperson added that UAVs are important for inspection, while rotorcraft and people are key to performing diagnostics and repairs.

'The emergence of drones in this market is a positive evolution, because drones enable us to perform a greater number of inspections in as safe a manner as

possible,' they explained. For example, when unmanned systems are used to elevate a camera, the operator on the ground can get a view without having to go up on the line themselves.

Staying prepared

As a means to sharing best practices and focusing on safety enhancements across

the sector, Airbus hosts the annual International Power line Symposium for rotary professionals, with the 2019 event due to take place in November at a venue in Boise, Idaho. 'The agenda is co-created with customers,' the Airbus spokesperson said.

The Tennessee Valley Authority (TVA), a federally ran organisation tasked with overseeing utility management throughout the US state, has a fleet of nine helicopters all reserved for transmission line infrastructure duties. A variety of missions fall under TVA's remit, including 'scheduled line patrols, emergency line patrols (eg damage from storms or tornadoes), lidar, infrared, line maintenance, line construction and insulator washing,' Adam Hammond, helicopter operations manager at the agency, told *Shepherd*.

As data collection and sensor-based capabilities are critical to these activities, Airbus H120 light single and Bell 407 single utility aircraft conduct 12 to 15 weeks of lidar inspections and six to ten weeks of IR inspections annually. 'The data received from these flights helps plan preventative maintenance on our system,' Hammond explained, adding that 'lidar and infrared

are important tools for maintaining TVA's 99.99% reliability rating'.

A third MD 530F manufactured by MD Helicopters was also added to the TVA fleet in November 2018 and has since been carrying out maintenance and construction missions, having covered nearly 250 flight hours since delivery.

In a brief summary of how TVA plans for power line missions, Hammond explained that this relies on 'effective communication' across key agencies like maintenance departments, flight schedules, flight followers, pilots and line crews.

Additionally, safety is supported by a thorough in-house programme of work that includes technical training covering weather, charts and scheduling, 'human performance' and professional development, referred to by Hammond simply as 'any specific courses our aviation staff finds that will help make them a more effective employee'.

In missions as critical and dangerous as power line inspection, it is clear then that TVA is committed to addressing safety and supporting its pilots and aircrew to carry out their work effectively and successfully.

Similarly, on the subject of how difficult and challenging these flights can be for pilots, the Airbus spokesperson explained that flying usually takes place at low altitudes and low speed, close to obstacles, meaning that the pilot is required to pay particular attention to the location of wires. These can 'sometimes appear invisible to the human eye against the landscape in certain weather conditions due to the sun's reflection', the spokesperson noted, adding that 'proper preparation by experienced pilots is the best way to mitigate risk'.

Working together

Hammond also pointed to some of the major advantages of using helicopters compared to UAVs, specifically their greater range and payload capabilities.

'We are able to move very quickly from one job site to the next, where the UAS operator will have to redeploy to each location because of the line-of-site regulations they must follow,' he said.

'However, there is a great advantage of UAS operations for missions where only a few transmission structures or components require inspection; using an unmanned system for smaller jobs is definitely the right tool for the right price,' Hammond noted.

Asked how TVA is currently positioned to compete with the commercial unmanned sector taking market share from the rotorcraft industry, Hammond responded that both 'helicopter and UAS operations complement each other by leveraging the unique strengths of each platform'.

In a diplomatic hint about how the organisation would address and determine future procurement decisions, he added that TVA would continue to evaluate those issues based on which platform is determined to be the 'safest, most effective and cost-efficient method of accomplishing our mission'.

The rotary industry clearly remains an indispensable part of the aerial services and power line sector, with payload and range marking helicopters out as superior to their drone platform counterparts. However, UAVs certainly contribute to the market overall, and it would be wrong to suggest otherwise, with their ability to assess hard-to-reach locations and perform underground work, arguably their most unique selling point compared to rotorcraft. ■

An H145 operated by San Diego Gas & Electric carries out a power line inspection mission. (Photo: Airbus Helicopters)





A medical worker on board the Children's Healthcare of Atlanta's EC145. (Photo: Metro Aviation)

Equipping a helicopter for the EMS role is a bespoke process that must cater to the needs of each customer. There is no one specific set of medical interior designs for rotorcraft, because each one has to find a balance of meeting the specific requirements of the platform and type of EMS application that the operator wants to provide within the SWaP restrictions that are inherent in the outfitting of rotorcraft. **By Tim Fish**

AN INSIDE JOB

The challenge for the EMS helicopter interior industry is that there is no one-size-fits-all capability. Every aircraft is different, every operator has a specific role and level of EMS they want to deliver, and this means that there is no standard cabin design or even standard set of equipment that can be applied.

Alan Stewart, senior design manager at Heli-One – a subsidiary of CHC Helicopter that designs EMS cabin interiors – told *Shepherd* that the company has developed different designs for customers around the world. 'No two proposals are alike. Each operator has different requirements, which makes it a dynamic but interesting challenge for our design teams,' he noted.

Making compromises

EMS rotorcraft can be specially designed from scratch, fitting equipment according to

the aircraft type specifically to provide a full airborne medical service, which may include a balloon pump, defibrillator, electrical systems, incubators, IV pumps, medical wall, oxygen tanks, radios, seats, storage units, stretcher, suction units and vital signs monitor.

For multirole helicopters that will not conduct EMS all of the time, modular detachable equipment is preferred, which can be installed or removed quickly to adapt the platform to the role when required.

Rolf Kraus, director of sales and programmes at Bucher Group, an EMS interior design solution company, told *Shepherd* that design requirements come from the customers. He said that the European market mostly comprises dedicated EMS helicopters, with a full range of equipment directly installed into the cabin, whereas in other segments like

Asia – a growing market area – new operators are showing a preference for detachable solutions.

‘EMS is not established [in these regions], and it is less necessary to perform the EMS missions, so you need time to collect experience. Therefore, it is less risky and costly to start with an aircraft where you change the equipment quickly,’ Kraus explained.

However, he pointed out that the advantage of a dedicated EMS platform is that it is easier to clean and is also lighter, because it is weight-optimised. ‘For example, in a dedicated H135 EMS helicopter, we don’t use an extra floor and this saves weight. If you want a quick-change aircraft, you need the same equipment, but it cannot be fixed into the airframe, so all the loads need to come down to a fixed point, usually a detachable floor, which adds to the weight,’ he said.

Therefore, the decision about capability is always a compromise for operators – a fixed equipment installation is lighter and therefore more medical equipment can be carried, although it lacks flexibility, whereas a detachable/modular solution will be heavier, so less equipment can be carried, but it offers the ability to re-role the helicopter at short notice.

Stretching capability

The main piece of equipment that is a requirement for an EMS helicopter is the stretcher, which is the largest item that needs to be fitted and is where the patient will be laid out and treated. There are various configurations for this device, and it can make a difference between a civilian medical helicopter and a military one.

Ricky Reno, VP of military and government initiatives at Spectrum Aeromed, told *Shephard*: ‘When I was a Black Hawk medevac pilot in theatre flying to pick up a patient, they’d just throw them on the floor and away we go, they don’t even strap them down or anything like that. We just need to get them out of there.’ So, whilst a stretcher is a luxury item for the military, it is essential for patients in a civilian platform. The operator will ultimately have the decision about the kind of stretcher to be installed in the aircraft, but there are a range of options.

According to Reno, the stretcher can be just a backboard or a roll-on/roll-off

gurney, one that attaches to the floor or one that can attach to a pivoting base. This decision depends largely on the size of the helicopter – the larger the rotorcraft, the larger the stretcher can be. It also comes down to the size of the patient, as weight is the main consideration in any helicopter operation.

Stewart noted: ‘The hardest part is usually the stretcher, or two, which might have 300lb [136kg] of patient and equipment loading it down. This has to be manoeuvred through the cabin door and usually rotated into a defined lock-down position. For cardio-pulmonary distress patients, this will ideally be accomplished with the torso raised, making it more complicated and top heavy. Some stretcher and helicopter combinations just can’t fit.’

Reno agreed with this assertion. ‘It is not just the weight of the patient but the girth of the patient... You are looking at different types of straps and fittings needed to secure each patient to the stretcher, and that is something you have to think about when designing and building equipment.’

Spectrum Aeromed builds stretchers for the EMS market and has to take into account heavy or large patients, using extra fittings and robust materials. Reno said that the company also considers customer requirements for rear-loading or side-loading stretchers as well as meeting medical requirements to have a raised back and head, using double air shock cylinders, so that a patient with breathing

problems can remain upright instead of having to be laid flat.

There are constant changes and modifications required to stretcher systems that start as a unique solution and can spread as other operators find them useful. Amy McMullen, customer configuration coordinator at Metro Aviation – an aircraft completions company – commented: ‘A couple years ago, Metro developed a loading ramp for the [Airbus] H135. An overseas customer was having trouble loading the stretcher into the aircraft, so we developed a system for it. It’s now available to all customers. We’ve seen an increase in requests for it.’

Customised options

Another key piece of equipment for a basic medical capability is a special retainer system for storing oxygen bottles, including outlet pipes around the helicopter to connect the oxygen to the ventilator where it is needed.

Electrical power also needs to be distributed around the aircraft, with power from the platform used for the working lights around the patient and 12V or 24V outlets for the loading of medical devices.

Kraus highlighted that even when it comes to seats, special medical models are needed, so that they can be cleaned and moved around. ‘If a patient is on board and bleeding, if you get this on a standard seat with fabric, it cannot be cleaned hygienically. Therefore, ▶

Modular medical walls are available for bigger aircraft such as the Airbus H215, Leonardo AW101 and Sikorsky S-92. (Photo: Spectrum Aeromed)





The configuration of medical equipment in an EMS interior is specific to each customer. (Photo: Heli-One)

you need medical seats that can be properly sanitised,' he pointed out.

'Then you need a seat to swivel and move in the cabin, because when the doctor is treating the patient, he needs to change position sometimes at the head or sometimes at the chest. The seat needs to be flexible, so that the doctor can treat the patient with his safety belt on. A fixed seat means the doctor has to take off the safety belt and climb around the cabin to treat the patient, but that is not a safe operation,' Kraus explained.

Other basic equipment includes cabinets that can be different in terms of size and storage, depending on what is needed on board. If an EMS helicopter is being used as an airborne taxi service, then less medical equipment will need to be stored, but with a doctor on the flight, more medical consumables will be required. These can be fitted to a medical wall installation.

'A flexible medical equipment wall allows for on-the-fly changes to provisioning. The modular concept allows for crews to customise positioning and equipment choice. Some provisioning is specific [such as oxygen tanks] but placement is flexible [can be attached to various parts of the wall structure],' said Stewart. He noted that this offers toolless installation/reconfiguration for increased efficiency.

Practical solutions

Reno said that Spectrum Aeromed produces medical walls for bigger aircraft such as the Airbus H215 (formerly Eurocopter AS332 Super Puma), Leonardo AW101 and Sikorsky S-92 for a modular fit and quick change.

'Offshore operators for search and rescue groups have options for suction and air pumps. We also have medical walls that – instead of going in and modifying the walls and putting medical equipment on that – attach to the module itself.

'The modular base normally has a 3,500l bottle of oxygen in it, inverters in there to convert the DC power to AC power, and there are electrical outlets, suction pumps and air pumps in there that can be changed in less than ten minutes. You can convert an aircraft from an offshore utility, VIP or other role into EMS once the seats are out and put all this equipment in that time with no tools required,' Reno explained.

Heli-One has also developed a multi-mission medical equipment wall for EMS and SAR purposes for the AS332, AW169, H225 and S-92 helicopters. Stewart stressed that the secure wall infrastructure is lightweight, tailored to crew requirements and has toolless installation.

'We take into account different EMS equipment, such as Corpuls 3, Braun Perfusor, oxygen bottles, etc. We want to empower crews to change up the equipment configuration to meet their mission needs – this could be removing excess or adding additional pieces,' he said.

Bucher Group also offers a complete cabin interior solution for EMS helicopters. According to Kraus, the company will sit down and talk with the medical teams, pilots and operators/owners to make a decision on the role and best equipment fit.

However, this approach is not suitable for operators seeking detachable equipment,



Heli-One has developed a multi-mission medical equipment wall for a range of platforms. (Photo: Heli-One)

as there are fewer options for customisation. Kraus insisted that this only makes sense with experienced EMS operators like those in Europe that 'know exactly what the opportunities are for a new platform, and they give us the requirements for how the cabin should be equipped'.

He added: 'We have the view from the paramedics/medical team – they focus on medical operations and want to be well equipped. Then there is the view from the pilot, who wants everything to be safely stored and also that the weight is reduced as much as possible, because this affects the performance of the helicopter. If the medical crew wants new equipment, the pilot will ask if it is necessary and agree or find another solution, because he wants to keep the weight down.'

According to McMullen, Metro Aviation partners with OEMs to keep ahead of developments and meet the needs of the medical community. 'Currently, we're working with Airbus, Leonardo and Kopter to develop medical interiors for the H160, AW169 and SH09,' she confirmed.



Medical ruling

Interior designs are driven by regulations, which means that although some requests for equipment can be fulfilled, others cannot. Devices cannot just be bought from a local store and installed in a helicopter – they must be certified under EASA in Europe and FAA in the US with an STC.

Reno said that there are no specific regulations that interior designers have to adhere to other than what the local civil aviation authority (CAA) requires for a country or region. ‘All of our equipment [that Spectrum Aeromed] designs and builds meets PMA [Parts Manufacturer Approval] rules and has STCs for that particular CAA, depending on the operator and their requirements. There is nothing that states how to design and build or install medical equipment, as long as it is maintained to federal air regulations,’ he noted.

‘There are burn tests and destruction tests – they have to meet certain requirements – but that is standard aviation, per the CAA or FAA or whoever. If we build the equipment and it meets the US FAA [requirements], most of the other countries

have bilateral agreements with the CAA, so they will accept our STCs,’ Reno explained.

He cited airworthiness regulations such as FAA Part 29 Regulations, ‘which require a minimum safety standard for the helicopter, crew, passengers and installed equipment’ and that some medical devices and standard stretchers ‘simply cannot meet these rules’.

Reno highlighted: ‘This is a grey area where often it is acknowledged that the rules cannot fit the problem and FAA can ignore it. An example is battery-powered medical devices, which do not meet battery safety requirements for aviation. These are not unsafe, but they weren’t aviation qualified either.’

According to Stewart, ‘crashworthiness rules will often dictate stretcher orientation and the ability to raise a patient’s head during take-off and landing. Attachment to floor can be a structural challenge particularly with newer helicopters with higher crash load requirements.

‘Medical device regulations are written in a completely different context. Generally, they are extremely demanding regulations,

which will ensure patient and aircraft safety, but comparing these regulations and the equipment qualifications is not for the faint-hearted,’ he continued.

Role dependence

According to both Kraus and Reno, the Airbus H135 and H145 are the most popular rotorcraft used by operators for the dedicated EMS role. Kraus said that these two platforms take a market share of ‘60% or more’.

The main benefits of these helicopters are that they are dual-engine models and have more power and therefore can take more weight. Reno noted that in terms of single-engine aircraft, the Bell 206 and 407 are popular options alongside A-Star and Twin Star helicopters in the US, and the AW109 and AW119 series are also becoming more popular.

‘For the H135 and H145, you are really able to have a lot of different options,’ Reno insisted. ‘The 145 has quite a large cabin, a nice-size area to work with – you can transport dual patients, you can do a quick-change modular type of system that is self-contained with the oxygen, suction pumps, air pumps and inverters in it that Spectrum offers or you can use the roll-on/roll-off gurney or use a pivoting stretcher with those aircraft and do a side load or aft load, so it depends on the operation,’ he explained.

Kraus concurred that if a medical crew has more space, it can put more equipment on board, but the type of aircraft chosen depends on the role. Due to the size of the platform, operators who use a very large helicopter like the H145 will have problems when they need to land next to an accident scene in a city. ‘Then an H135 is better, because if the maximum take-off weight is not that high, then the downwash of the helicopter is also not that much when compared to a big helicopter. If you want to fly with a Super Puma into a city, then you risk damage to windows in a narrow area or other stuff flying through the garden and streets.

‘With a heavy helicopter, it is always a compromise, and you need to know what you want to transport [and] how long to fly: If it is only short distances for mostly primary rescue, a smaller helicopter is better; if you have to do long-distance



Spectrum Aeromed manufactures stretchers for HEMS. (Photo: Spectrum Aeromed)

transport, you need a bigger helicopter,' he added.

'You really have to look at the operations,' Reno agreed. 'There is an operator that is a local sheriff's office. They have a big helicopter with lots of power and capabilities, but they are limited in what they have for EMS in the aircraft, with a rescue hoist and a stretcher, but just one that attaches to the floor – it is really not outfitted with equipment in that aircraft, because they carry that on with them.'

'Then we have other operators that have small aircraft and are able to do hoist operations, have dual-patient capability and [can carry out] a lot of roles with that one small aircraft – baby transport, scene work, hospital-to-hospital transport – a lot of capability in there. So, it is really up to the operator and the missions they want to accomplish,' he noted.

Trends ahead

Looking to the future, one of the challenges for the helicopter interior industry is the lack of solutions for new types of platform being introduced to the EMS market.

Stewart said that Heli-One is keen to meet this challenge and mentioned the Leonardo AW169 as an example. 'We

developed a stretcher solution for Babcock Scandinavian AirAmbulance that meets patient transfer best practices and also works within the constraints of the cabin. We were able to provide this solution within a month after initial proposal. We are also currently developing a medical wall solution for this aircraft type for EMS purposes,' he explained.

McMullen said that Metro Aviation has seen a growing trend for innovative technology and increased safety. The company has provided its IRIS satellite communication and aircraft voice and data recording system. 'We're ensuring all aircraft in the Metro fleet are outfitted with IRIS moving forward,' she confirmed.

According to Kraus, Bucher has found that operators using dedicated HEMS helicopters are adding more special treatment capabilities. 'Hospitals are focusing more on special treatments, and in the future, cities will have the A-level hospitals, but in the countryside, hospitals are closing or only providing a lower service. So, the demand for inter-hospital transport will increase, with special treatments during the flights as well,' he noted.

Kraus added that the ability to conduct operations in adverse conditions is another

emerging requirement, as this would give operators the potential to earn more money with the platform, responding to calls at night, for example.

The market for EMS helicopters was previously dominated by dedicated platforms, with established operators in Europe, but this is now changing as the market is growing in China and other Asian countries that are requesting detachable multirole solutions.

Reno said that the market is currently steady, but the less-developed world is taking time to adopt 'the EMS life-saving mindset'. He emphasised that Spectrum Aeromed is working with OEMs to deliver more cost-effective solutions where there are lower budgets available.

'There are lot of older aircraft in these areas, and we are trying to use modular systems to help those operators to be able to use their aircraft for multi-mission [operations] – for instance, to be able to haul passengers in the utility version, then do an EMS medevac transition by pulling the seats out and installing a medical module with the suction, air and electrical components in just ten minutes or just install a stretcher to secure a patient to the floor,' he explained.

Elsewhere, Reno believes that UAVs are the future, and we could see unmanned air ambulances that will be able to install more equipment or take more staff in the cabin than is possible with manned helicopters, because there is less weight without the pilots. 'The pilots would be on the ground as remote operators and when there is a call to a scene. The UAV would dispatch with a medical team, pick them up and fly to the treatment facility,' he noted, adding that tiltrotor aircraft could also offer a new EMS capability.

As new technologies are brought to the market, the capability of EMS helicopters will improve as the equipment that fits in the cabin interior becomes more advanced. Meanwhile, countries new to the market are starting to use modular equipment for a basic capability. As these nations gain experience in operating rotorcraft in these roles, it is likely that requirements could develop towards more permanently fitted EMS interiors, with customers demanding more enhanced features and dedicated designs. ■

There are over 900 Bell aircraft currently working on law enforcement missions around the world. (Photo: Bell)

SKYWAY PATROL

Law enforcement is one of the most demanding applications in the helicopter industry. In recent years, there have been a range of technical developments that are aimed at enhancing the ability of police operators to carry out their missions.

By Gerrard Cowan

As the role of law enforcement is evolving, the platforms used to carry out operations need to keep up with growing demands – modern law enforcement agencies require aircraft that have multirole capabilities and can be reconfigured quickly in order to fulfil different missions.

Multi-mission approach

Carl Crenshaw, segment specialist at Bell, noted that like other parapublic operators

(EMS, for instance), law enforcement users often adopt a dual approach as they have to quickly reconfigure an aircraft for use in other missions when needed.

‘Bell focuses on a multi-mission approach, allowing for reconfiguration based on the needs of the customer,’ he explained. ‘Bell looks at the total support package throughout the lifecycle of the aircraft. What Bell is providing is more than an aircraft – we are providing a total solution.’

There are more than 900 Bell aircraft currently working on law enforcement missions around the world, he said, with the parapublic market as a whole holding steady over the past two years. The company is expecting law enforcement to show significant opportunities over the next year or so, and is ‘excited about the Bell 505 beginning fielding by Sacramento Police Department as well as Stockton Police Department’, according to Crenshaw.

The Sacramento Police Department signed a deal to purchase the first law enforcement-configured Bell 505 Jet

Ranger X in February 2018. Speaking at the time of the deal, Sgt Greg Brown of the Sacramento Police Department’s Air Operations Unit said that the platform was the choice aircraft for its operations, supplying enhanced visibility, manoeuvrability and advanced avionics.

He noted that the 505 would be invaluable in reducing the number of man hours spent as well as response times in critical, routine calls of service. Anthony Moreland, Bell’s managing director in North America, said that the deal came after several successful demonstration flights earlier in 2018. Brown added that Bell has seen ‘incredible interest for the Bell 505 Jet Ranger X from law enforcement agencies around the world’.

The aircraft was delivered at the end of the year, with Bell outfitting the platform with a range of equipment. The OEM said at the time that in addition to high skid gear, this included forward/aft hardpoints for mounting equipment as well as a 15in display monitor with moving map system, loudhailer, MX-10 EO/IR sensor and TrakkaBeam Searchlight. ▶

'The ergonomic seats allow the pilot and tactical flight officer to fly for hours comfortably, and the large windows allow for greater visibility that makes searching for suspects and missing persons easier,' explained Sgt Randy Van Dusen of the Sacramento Police Department's Air Operations Team.

Mission equipment in the law enforcement sector continues to be improved, Crenshaw added, with Bell working internally with its Aeronautical Accessories brand and third-party vendors to provide solutions. He noted that the 505's integrated glass cockpit provides enhanced situational awareness and integration of mission equipment, along with a number of other benefits.

Latest equipment

While the market itself has not changed, the role of law enforcement has evolved to encompass a broader idea of 'public safety', said Crenshaw. 'The name changed because the mission has changed – law enforcement is now driven by public safety commands.'

As with all technologies in the domain, equipment is becoming lighter and less expensive. 'Bell sees more of a multi-tool approach and continues to see the demand of these operations grow,' Crenshaw noted, adding that the company 'anticipates a healthy market – with even possible growth – around the world'.

Monica Campos, who is in charge of law enforcement and government sales at Robinson Helicopter Company, emphasised that 'police helicopters are all about providing an on-site communications centre'. She explained that this means providing radios that can communicate with multiple agencies, both aviation and police, and allowing handoffs to highway patrol, fire departments and other users.

In addition, FLIR systems, HD cameras and searchlights are providing better night-time visibility, while Robinson's R66 police helicopter has an auxiliary fuel tank, allowing it to remain in position for up to 5h if necessary.

The OEM has delivered over 55 police rotorcraft to countries around the world, Campos confirmed, including four of the R66. Robinson's focus is on 'helping law enforcement agencies keep their

programmes running efficiently and reliably in the long term', she said.

Customers include the Sky Knight helicopter programme in Lakewood, California, which uses the Robinson R44, as well as the Fontana Police Department (also in California), which has been using the R66 since 2012 and is currently completing its first overhaul.

Campos noted that the biggest development with the R66 is the use of the Genesys HeliSAS Helicopter Autopilot and Stability Augmentation System, which 'assists the officers in reducing workload fatigue, especially when the pilot needs to assist the tactical flight officer [TFO] in mission-specific tasks or must remain over an active police area for an extended time'.

Campos also highlighted the use of more advanced equipment like cameras with increased magnification and resolution, as well as the new 163l auxiliary fuel tank. She pointed out that the Garmin 1060 TXi touchscreen multi-function displays in the company's police helicopters 'is the latest in touchscreen displays'.

Other trends in the law enforcement market include the use of gimbal camera systems with HD capabilities, while mapping systems are continually improving and becoming more integrated. 'Now you can link a searchlight with the mapping system and gimbal all at once, also assisting the TFO,' Campos said.

She expects to see autopilots and stability augmentation systems continue to develop and play a pivotal role in assisting flight missions, allowing officers greater freedom to focus on ground activities. However, while there are growing uses being made of UAVs, 'you can't do all jobs with the drone – you need someone in the aircraft to communicate and make decisions'.

A spokesperson for Airbus also pointed to the use of drones, saying that they 'are definitely on the rise in police work'. Manned-unmanned teaming (MUM-T) concepts are of high interest for the company's helicopter customers, with Airbus demonstrating its MUM-T capacity in 2018. 'Combined with high-speed networking and powerful algorithms for real-time content analysis, it will lift police missions to the next level,' the spokesperson asserted.

Increased capability

Police forces are some of Airbus' most demanding customers, the spokesperson said, as they need their equipment to function perfectly at all times.

The spokesperson also highlighted the multifaceted roles that law enforcement agencies perform. 'Multirole capability is essential for them. An EMS operator does EMS purely, but modern police squadrons have to cover a whole variety of missions in parallel, like EOS [EO systems security operations], direction finding, IMSI

The H145 is one of Airbus' major offerings in the law enforcement market. (Photo: Airbus Helicopters)





Police forces are some of Airbus' most demanding customers as they need their equipment to function perfectly at all times. (Photo: Airbus Helicopters)

[international mobile subscriber identity] catching, special forces transport, winching, fast rappelling, fire-fighting, etc. This results in very complex integrations and certifications.'

In terms of Airbus' own platforms, the spokesperson highlighted a new version of the H145 with a five-blade rotor, 'which is very attractive to serve law enforcement missions'. The platform combines a number of benefits from the previous H145 (D2) suitable to police users, such as compactness, which is 'a huge asset to operating safely in confined areas without sacrificing transport capacity'.

The spokesperson also emphasised low operating costs, increased crew mission efficiency and safety, stemming from the Helionix glass cockpit, and the ability to quickly change roles from surveillance to Special Weapons and Tactics (SWAT) transportation or SAR/secondary rescue missions, along with other improvements.

The new H145 brings a number of additional features that could be beneficial for law enforcement, such as additional load capacity, a smoother flight experience and increased comfort, which 'improves the focus on the mission from crew and pilots'. The spokesperson also pointed to boosted connectivity and simplified maintenance.

Airbus has had a range of recent successes in the police market beyond

the launch of the H145. For example, it delivered the first two H135 platforms with Helionix in police configuration to Brazil's Integrated Air Operations Coordination (CIOPAER) in late 2018. The procurement of these aircraft was aimed at reinforcing public security in the state of Ceará and providing support for aeromedical operations in other parts of the state, Airbus said at the time.

The H135s joined two AS350s and four twin-engine helicopters of the H135 and H145 families in CIOPAER's fleet. The cockpit layout boosts situational awareness for operators, Airbus emphasised, with up to three large electronic displays. It is NVG-compatible, among other features.

'The pilot's workload is facilitated by the stability of the aircraft, which helps to maintain a constant altitude,' said CIOPAER's Lt Col Marcus Costa. 'It can transport two pilots and five crew members, has flight autonomy of more than three hours and has special equipment such as a searchlight, electric winch, rescue kit and infrared camera,' he noted.

Securing contracts

The H215 has also had success on the international law enforcement market in recent years. For example, in June 2017 the Tokyo Metropolitan Police Department signed a deal for one platform, making it the

first Japanese operator of the aircraft, which is scheduled for delivery next year ahead of the Tokyo 2020 Summer Olympics.

The type is dedicated to a variety of missions, including personnel and VIP transportation, material transport and wide-area support missions, according to Airbus. It is capable of covering the entire Tokyo region and will be involved in missions conducted across Japan, joining H135 and H155 helicopters in operation in Tokyo patrol and rescue missions.

Furthermore, the company has had traction on the support and maintenance side, winning a deal to provide these services for the National Police Air Service (NPAS) of the UK in March 2019. The deal will see Airbus Helicopters UK support the operation of 15 H135s and four H145s flown by NPAS in support of the 43 regional police forces of England and Wales.

The aircraft are based in 14 locations and are among the most intensively used police helicopters in the world, the company stated. Under the contract, Airbus will provide a package of services comprising maintenance of aircraft and mission system equipment, airworthiness management, supply of spare parts and engine support.

The agreement also includes options for modifications to the aircraft and mission systems. Steph McKenzie, head of technical services at NPAS, said the deal will last for five years, with the aircraft collectively being used for about 20,000 tasks annually upon request.

Great expectations

Police equipment is becoming more sophisticated, the Airbus spokesperson said, with high-definition surveillance camera systems and software tools for analysing video content in real time, achieving maximum performance in every phase of the mission.

In addition, it is possible to significantly reduce workload compared to the systems available a decade ago, thanks to technical advances like the Helionix cockpit. 'This guarantees that the crew can really concentrate on the mission,' the spokesperson said.

In some regions, there is a requirement for law enforcement agencies to carry more and do more for their communities, said Dave Peterson, director of US sales at ▶



Fontana Police Department operates Robinson R44 and R66 platforms.
(Photo: Robinson Helicopter Company)

Sikorsky. He noted that this had prompted increased interest in the company's offerings, 'which are generally larger than most police helicopters'. Additionally, many law enforcement personnel previously served in the armed forces and are familiar with the company's platforms.

According to Peterson, law enforcement agencies have always required mission flexibility, but recent developments include even greater adaptability and broader capability. There are increasing expectations that require larger cabins for team transports and special equipment pallets relating to humanitarian response, high-rise rescue, maritime rescue and other areas. 'This often also comes with an expectation to supplement other agencies with HEMS and fire-fighting capabilities,' he said.

Peterson highlighted that Sikorsky has been involved in the law enforcement market for decades. He pointed to an increased demand for multi-mission platforms, which 'are preferred when efficiency of cash spent and ease of quickly adapting to various missions are the priority to get the most out of the aircraft and the investment in that aircraft'.

Sikorsky's focus on reducing maintenance cost and maintenance man hours while maximising aircraft availability are critical elements for law enforcement

agencies, he added. 'Law enforcement is a tough business. Sikorsky helicopters, known for their toughness, excel at nimbly adapting as the circumstances change from minute to minute and hour to hour, often under the harshest circumstances,' Peterson said.

Facilitating development

Peterson highlighted a number of areas of technical development with implications for law enforcement, such as leveraging the data from HUMS. 'Sikorsky teams work around the clock to analyse HUMS data from collaborating operators that our teams then compare with worldwide fleet trends,' he said.

This results in dramatically reduced unscheduled maintenance and a number of other benefits such as increased operational availability and reduced operating costs. Survivability is also expected by law enforcement customers, which is also the case in the military sphere.

Peterson also pointed to Sikorsky's focus on smoother flight characteristics, with the S-76D being a good example. This is part of an effort to make the flying experience more pleasant, which also helps to reduce wear and tear on the machine and the crew by minimising vibration.

'Sikorsky helicopters fly fast and efficiently, carrying more while using less fuel and making less noise while doing so, and most importantly flying smoothly,' he noted, adding that 'the smoother flight characteristics of Sikorsky's commercial products exemplify the significance of this capability, resulting in reduced crew fatigue due to reduced sound and reduced vibration'.

Like other OEMs, Sikorsky works across the parapublic sphere. Peterson said that there are more similarities than differences between law enforcement and HEMS in terms of helicopter design. 'Safety, survivability, speed, reliability, durability, cost-effectiveness and aircraft availability are critical to both,' he commented. 'Having a quiet and smooth ride also plays a role in a positive outcome for the patient as well as the operator. World-class anti-corrosion is another often-shared requirement.'

In many cases, airborne law enforcement (ALE) and HEMS missions are frequently carried out by the same aircraft. 'The same cabin size advantageous to transporting a SWAT team, or rescuing multiple individuals, is the same cabin size that is beneficial for positive patient outcomes requiring multiple patient transports or complex advanced life support mission requirements,' Peterson said.

Additionally, he pointed to NVG capability, wire-strike protection and the ability to have EO/IR, searchlights and other systems as all being shared requirements of ALE, HEMS, SAR and other applications.

'Onboard Wi-Fi data transmit and roll-on litters are becoming more critical for HEMS, while microwave transmission of real-time video for command and control, cargo hook, ballistic protection and a hoist are more important for multi-mission law enforcement,' Peterson explained.

In the coming years, Sikorsky expects to see the inclusion of greater autonomy in ALE platforms, allowing for optionally piloted vehicles (OPVs), rotorcraft that can perform with a single pilot or reduced crews or enable two-person crews to focus on mission-critical tasks.

Peterson added that the same sensors and software that enable OPV flight also increase the reliability and safety of the aircraft. He pointed to Sikorsky's work with the US Defense Advanced Research Project

“ Modern police squadrons have to cover a whole variety of missions in parallel. ”

Agency on the Aircrew Labor In-Cockpit Automation System (ALIAS) programme, which is developing a tailorable, drop-in, removable kit that would enable the addition of high levels of automation to an existing aircraft.

This builds on the work of Sikorsky's MATRIX technology programme, which covers a range of autonomous technologies and has applications for law enforcement users. 'Under the ALIAS programme, Sikorsky has developed a perception system that identifies safe landing zones for autonomous landing should the aircraft or pilots become disabled, but also vigilantly assisting a flight crew in ways that have not previously been possible. We continue to advance our MATRIX technology autonomy system to support the operator,' Peterson told *Shephard*.

New offerings

There has been an evolving demand for sensors used on board police helicopters, according to Dr Amela Wilson, general manager of the FLIR Surveillance division at FLIR Systems, a major supplier of airborne IR camera systems to law enforcement operators in Canada and the US.

'More and more, airborne police agencies are requesting cameras with the ability to integrate multiple solutions,' Wilson confirmed. 'They would like the "mission suite" – including the camera, moving map, downlink and touchscreen displays – to be integrated and work seamlessly.'

The range of missions has also increased, Wilson explained, with the company adapting its offerings to meet these needs. She also pointed to an increase in the use of UAVs by state and local departments, mainly as an enhancement to their mission. FLIR Systems now offers airborne and unmanned solutions through its recent acquisition of Aeryon Labs.

There is a wide range of uses for the company's products among its customers, Wilson added, with operators involved in patrol, surveillance, border security, fire support and SAR missions. FLIR Systems also works with federal law enforcement customers such as the USCG and US Customs and Border Protection.

FLIR's major offering into the ALE market is its Star SAFIRE 380-HDc. This provides many of the capabilities of the full-size Star SAFIRE 380-HD turret, but in a package that is about half the weight of the previous version.

The Aeryon Labs acquisition also sees the company provide Group 1 UAS, imaging and delivery payloads and flight management software for public safety departments as well as for militaries. The Aeryon SkyRanger product line is now a core part of its UAS offerings, Wilson added, saying that this 'will complement our history in manned systems'.

FLIR works across a range of parapublic markets, including EMS and police. The needs of these two markets are similar, Wilson noted, as ALE and EMS both have a need for long-range visibility. 'ALE will be able to spot a criminal suspect sooner than they could ground, while EMS can spot a missing hiker or a capsized boat from miles away. At longer ranges, you can see and effectively be on the scene and take action sooner,' she explained.

An example of a specific sensor type used in both markets in different ways is shortwave IR (SWIR), which allows ALE pilots to look through glass. This can be useful when searching for suspects. SWIR 'also sees through smoke or other airborne particulates that might be common where fires are present, making it particularly useful for fire-fighting', she added.

According to Wilson, there is a continuing need for a higher level of automation to provide assistance in decision-making and workload reduction. She also pointed to a desire for miniaturisation of cameras, without sacrificing capabilities. 'Customers want lighter and more capable payloads, because it enables them to add other sensors and capabilities in support of their mission sets,' she commented.

In the future, FLIR expects to see more integration of technologies like moving map systems, as well as multiple download streams that can be accessed simultaneously, including from aircraft and drones. Wilson said that at some point FLIR expects to see downlinks direct to mobile phones, which would help to eliminate the need for towers. 'We expect to see technological advancements that will result in size and weight reduction for the same or better operating capabilities and features. Customers continue to request greater range with higher resolution, and we continue to invest in research and development to advance our sensors,' she concluded. ■

Robinson's customers include the Sky Knight helicopter programme in Lakewood, California. (Photo: Robinson Helicopter Company)





Airbus offers three types of HCare service packages to its customers. (Photo: Airbus Helicopters)

MAKING PREDICTIONS

Airbus Helicopters offers a wide range of support services to its customers, notably through its HCare range. This covers material management, helicopter maintenance, training and flight operations, connected services and technical support among other services. Operators can choose a particular package to suit their needs.

Standards of care

As a bare minimum, customers require spare parts and training for their pilots and technicians, said Matthieu Louvot, executive VP for customer support and services at Airbus Helicopters. These types of services generally come as part of the acquisition package for the aircraft, along

with some technical assistance. Operators can then opt to take out an HCare contract on top of this that is tailored to their specific needs.

For example, there are three types of HCare material management packages available, depending on the extent of services required – HCare Easy, HCare Smart and HCare Infinite – some of which include pay-by-the-hour contracts that cover component maintenance, scheduled and unscheduled events and more.

The widest-ranging package – HCare Infinite – involves Airbus taking responsibility for full line maintenance, inventory planning, airworthiness follow-up and workshop management, which it either performs directly or through a service centre and

Helicopter operators demand a range of support services from OEMs after acquiring their platforms, from maintenance to training. These services have evolved in recent years, with manufacturers increasingly turning to technology like predictive maintenance to widen the scope of their offerings. **By Gerrard Cowan**

sees the OEM make an availability commitment to the operator's fleet.

The type of package selected depends on a number of factors, Louvot told *Shepherd*, from the region of the world in question to the size of the fleet involved. In general, all of the offshore oil and gas operators of Airbus platforms choose an HCare package, he confirmed. The same

is true for multiple EMS operators, particularly in Asia and Europe.

The OEM has seen a growing demand for performance-based contracts like HCare, Louvot noted. Although this has been the case on the military side for some time, it is now developing strongly in the commercial domain as 'customers want to be more secure in their logistics chain; they want more performance commitments', Louvot explained.

He said that larger operators will very often opt for HCare packages because they provide 'the capability to plan budgets and benefit from greater availability'.

According to Louvot, there have been a range of changes in the sector in recent years, particularly when it comes to technical development. For example, he pointed to the use of predictive maintenance through technologies such as HUMS.

One step ahead

In 2018, Airbus introduced its FlyScan service, a form of predictive maintenance that can 'detect a trend in the platform that may not be an issue by itself, but is highly likely to create a challenge over time'. This means that operators and the OEM can identify a part that may need to be removed 50h or 100h in advance, which is a major benefit, Louvot said.

'We can anticipate that need for removal, and we can help the customers do it during a planned event, making it a planned maintenance, instead of having it turn into an issue at the last minute, causing the helicopter to be grounded,' he explained.

Airbus currently provides this service to 12 operators and 68 helicopters. 'Customers are definitely interested in the benefits of connectivity and connected services and predictive maintenance, which is why FlyScan was well received,' Louvot added.

However, he conceded that there are some limits to services like FlyScan. For example, they are dependent on utilising 'helicopters equipped with the right sensors, which are by far not a majority in the fleet today'.

The platform manufacturer has thus developed a number of partnerships with companies like Safran which can equip a rotorcraft with data monitoring devices through an STC. Airbus is developing versions of FlyScan that are based on this

data (from the flight management system, for instance), rather than from vibration sensors. Such services would be more widely applicable to a greater number of helicopters. 'That would enable us to provide these services to a much larger part of the global fleet,' Louvot noted.

The company has also sought to deepen its work on the digital side. For example, it announced at HAI Heli-Expo 2019 that CHC Helicopter's newest H175 would be the first Airbus rotorcraft to be delivered with digital log cards. This makes Airbus the first helicopter OEM to turn paper-based log cards into digital data, the company confirmed. Speaking at the time of the announcement, Louvot said that a log card is used to track the entire history of critical helicopter parts from manufacture, with about 2.5 million in circulation throughout the world.

'Over time, the paper log card ages, gets misplaced, becomes hard to read and more difficult to use,' he explained. 'Our new digital version stores the content in a secured cloud while preserving the existing template, using the same process and stakeholder roles and responsibilities as the paper version, meaning no additional workload.'

Stephanie Bonnefoy-Fourie, who heads up Airbus' connected services business, said that 'the feedback we received from pilot users indicates that digital log cards

meet our objectives of delivering better data quality, smoother processes, time savings, reliability and data confidentiality'.

New functionalities not available with the paper variants include the ability to attach documents, archive, search and immediately transfer a selection of log cards, according to Airbus. A range of other applications could also be applied in the future, such as the ability to build new analytics around the data that is collected.

New customers taking delivery of a civil Airbus platform can now receive digital log cards, the company stated, while those with existing log cards can convert these to the digital format.

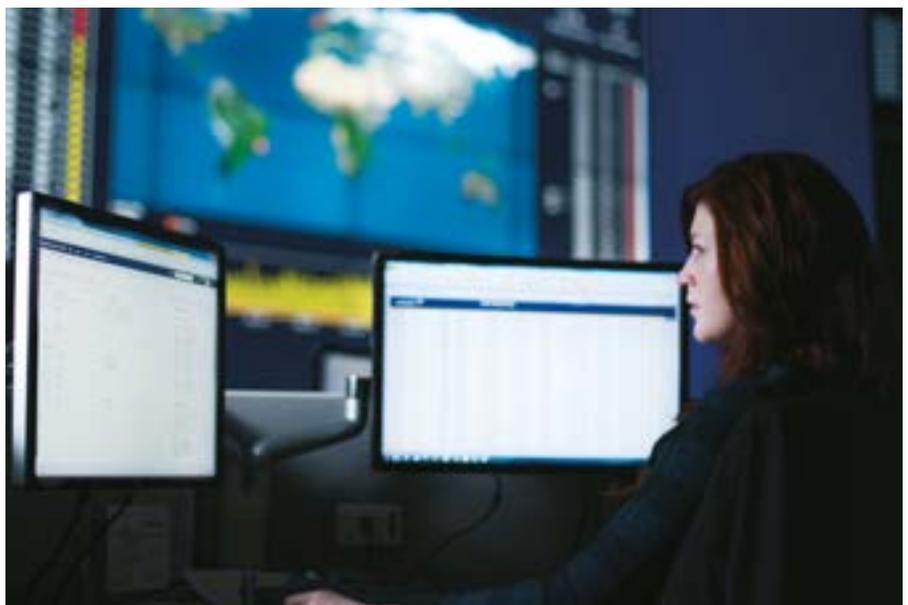
The OEM also announced the signing of a letter of intent with Skytrac at HAI Heli-Expo 2019 in March. This will allow Airbus helicopters equipped with Skytrac data processing and communications hardware to transmit flight data directly to servers on the ground. The data collected will also be used for analytics, Airbus added.

Outsourcing work

Customers' predominant requirements have not changed significantly in recent years, although technology has improved the speed and ability of OEMs like Bell to meet those requirements, said Chad Nimrick, director of customer support and services at Textron.

He highlighted that some of the larger operators have moved away from what ▶

Sikorsky operates a Customer Care Center that provides various types of services. (Photo: Sikorsky)





Bell's support network conducts an array of services for customers from basic maintenance to complete aircraft refurbishment. (Photo: Bell)

were once considered 'core maintenance activities', instead choosing to outsource this work to suppliers like Bell or to specialist providers.

'There has been movement within several of our larger operators to outsource their major component maintenance and overhaul work,' Nimrick explained. 'In some instances, these organisations have even eliminated their overhaul capabilities for some models.'

Bell's support network conducts an array of services for customers, from basic maintenance to complete aircraft refurbishment. 'The basics for these services revolve around spare parts replenishment and distribution, aircraft inspections/maintenance and overhaul of all major components,' said Nimrick.

The company employs a network of field service engineers in order to 'offer our customers a single contact point for all their technical needs', he added. 'Bell's field service engineers can access contacts within Bell or help guide our customers through the proper channels to assist them in all their operational needs.'

The OEM's major focuses are safety, quality, reliability and support availability, along with a strong focus on 'detail to exceed the customer's expectations'. Bell recently opened a service centre in Fort Lauderdale, Florida, to 'allow for better efficiency and increased capabilities', Nimrick added.

The precise package of services offered is affected by the operational tempo – the annual flight hours – and the size and complexity of the needs of each operator, Nimrick emphasised. Larger organisations may acquire additional assets – such as more parts or service engineers – to allow for increased flexibility, meaning that maintenance activities will have less overall impact on flight operations. Smaller operations might not have this degree of flexibility, 'which may necessitate a completely different maintenance philosophy'.

Heavy rotorcraft tend to be more complex and therefore often require a greater amount of maintenance. 'In some cases, the OEMs have restricted the data used in the overhaul of major components, [so there is] a requirement to send work back to the manufacturer or an approved affiliate,' Nimrick explained.

Customised support

Alan Walling, Sikorsky's director of commercial helicopter programmes, reiterated that there are natural differences between larger and smaller operators in terms of services required.

A large multi-aircraft operator typically has an established maintenance programme along with spare parts and training, whereas an owner of a single VIP helicopter or a small EMS operator may not

have access to such resources. The aim is 'to customise the level of support based on the individual customer's needs', he noted.

Sikorsky operates a Customer Care Center (CCC) that provides various types of services. The company offers an aircraft-on-ground (AOG) resolution, Walling stated, which represents 'a relentless drive to return aircraft to service'.

He also highlighted the company's Fleet Management Center, 'which leverages data and analytics for the long-term benefit of our customers and their aircraft'. The Sikorsky360 portal provides an ability to place orders, check parts and AOG status, as well as access services and financial information, view aircraft data and contact the OEM for additional support.

Furthermore, Sikorsky provides a worldwide support network for the S-76 and S-92 fleets, which provides each customer with an account service manager, access to a field service representative, product technical support, four forward-stocking locations (FSLs), 22 worldwide customer support centres and other services. The aim is to 'enable quick access to logistics, spare parts and advanced technical services for our customers', Walling explained.

The OEM's main offerings are in the heavy- and medium-weight class, he added, which fit into the company's offerings 'without having to differentiate the level of support and service between the two. Although the S-76 has been around much longer than the S-92, we still see growth in the aftermarket business'.

According to Walling, Sikorsky's aftermarket offerings have evolved in recent years. While it maintains a centrally located warehouse in the US, it also operates a range of FSLs around the world, near where its customers operate. 'The FSLs provide the capability to get material to our customers in hours or in some cases minutes,' he emphasised.

Walling said that Sikorsky's CCC – which is based in Trumbull, Connecticut – leverages real-time flight data and fleet-wide analytics to return aircraft to flight status and yield long-term benefits for the S-76 and S-92.

The facility has 'played an instrumental role in improving operator customer support and has resolved AOG events in less than 24 hours for the last 18 consecutive months', he noted. ▶



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These services are connected, with the AOG Resolution Center team at the CCC leveraging HUMS aboard the company's helicopters to transmit, view, assess and track mission-critical health data in real time. 'They then analyse this data in collaboration with aircraft operators, crew members and ground support teams and use the data to inform operational and maintenance decisions that will keep the fleet flying,' Walling told *Shephard*.

Big data

According to Walling, Sikorsky's Fleet Management Center similarly leverages data analytics. 'The team monitors the removal rates of component parts, when and why particular parts need to be replaced, and how long they take to be replaced. They then use predictive analytics to develop proactive solutions for scheduled fleet maintenance, which largely reduces the number of AOG events and increases the fleet's availability levels,' he explained.

The use of 'big data' is a major element of Sikorsky's work in improving helicopter reliability. The company highlights its

efforts in combining data analytics technology with its engineering and manufacturing background 'to develop product improvements for customers in oil and gas, VIP transport and search and rescue operations'.

Company literature highlights the impact that big data and products like HUMS can have on safety, minimising the impact of an issue and keeping the community aware of how best to inspect and monitor their aircraft to identify if they are at risk.

Sikorsky can then work with its customers in real time to address any issues; rather than grounding a fleet, pulling parts and finding an improvement, it can examine the data to find a specific issue and fix the problem before it becomes catastrophic, according to the OEM.

'Being able to look at aircraft data immediately is a huge benefit to the industry, and it's something the industry needs in order to ensure the highest level of safety,' said Simon Gharibian, director of fleet management at Sikorsky. 'HUMS data turns unplanned events into planned events for our operators.'

As an example, Gharibian mentioned that in one case, the company's use of data flagged that operators were replacing landing gear more often than anticipated; Sikorsky was able to then look at the data and find that the issue was related to leakage and corrosion on the landing gear piston. 'At this point, our engineering and manufacturing teams came in and developed on-aircraft repairs to address the corrosion and resulting leakage, thus reducing the number of times the landing gear needed to be removed and replaced,' he explained.

Facilitating availability

Outlining one major market trend, Pat Cox, director of technical support at Robinson Helicopter Company (RHC), said that a bigger fleet typically results in increased aftermarket activity and support.

He pointed to a number of areas of recent change in the aftermarket support sector. For example, many aftermarket vendors now offer an increased range of products that can be used for maintenance purposes by integrating accessories like tablet computers in the cockpit. 'Augmented reality, as a maintenance aid, is already being tested in the industry and will likely reduce maintenance costs in the future,' Cox added.

He told *Shephard* that Robinson has about 480 service centres, of which 133 are dealerships. The company prefers to sell its aircraft via dealerships, 'because they are familiar with their respective territories, speak the language and are familiar with the airspace and regulatory environment', according to Cox.

Service centres are required to have an excellent facility that has the necessary tools and spare parts to maintain the company's helicopters and provide scheduled and unscheduled maintenance. All of them employ at least one full-time aircraft and powerplant mechanic (approved in the local country), who must attend the Robinson maintenance course.

'Regarding spares and components availability, many service centres carry inventory which allows them to perform immediate maintenance,' Cox noted. 'At RHC we maintain a steady production line of new aircraft and a large inventory of parts and components ready for immediate shipment. The availability of spare parts and the

Customers' predominant requirements have not changed significantly in recent years, although technology has improved the ability of OEMs like Bell to meet those requirements. (Photo: Bell)





HCare covers material management, helicopter maintenance, training and flight operations, connected services and technical support, among other services. (Photo: Airbus Helicopters)

opportunity for field overhauls allows for shorter downtimes and avoids the necessity of returning the aircraft to RHC.'

Robinson has a team of customer service and technical support personnel. The former focus on processing customer orders and coordinating with production to ensure that spares are shipped in a timely manner, while the latter handle calls and emails from aircraft owners and mechanics in the field. Cox added that the company provides operating and maintenance manuals to pilots and mechanics at no cost.

Clear expectations

Lease Corporation International (LCI) operates a fleet of helicopters sourced from Airbus, Leonardo and Sikorsky. If the lessor acquires a new platform, it expects a number of services from the manufacturer, said Crispin Maunder, the company's executive chairman. This naturally includes training on the particular aircraft type for pilots and technical staff, something that is embedded in LCI's purchase agreements.

On a longer-term basis, 'we are very much focused on the technical condition of the aircraft as they are being operated' by customers around the world, Maunder added. All LCI lease agreements require the helicopters to be placed on power-by-the-

hour deals with OEMs, while the lessor operates its own standby contracts with the manufacturer as well.

'Essentially, if there's a part that needs to be replaced either on a scheduled basis or an unscheduled basis, then the manufacturer will provide those parts to the operator. So, it's really a cost assurance plan, and that's very important to us,' he told *Shephard*.

This type of plan typically falls into two or potentially three contracts. One will cover the airframe and associated systems and will be agreed with the OEM. Another will cover the engine and is agreed with the engine manufacturer. There may also be a separate contract with the OEM for the avionics if this is not already covered by the airframe arrangement.

'For an owner, as opposed to an operator, these life programmes give us assurance that the helicopters are in "full life" condition,' Maunder said. This essentially means that the lessor can transfer the aircraft from one operator to another and that the next operator will simply have to pay the relevant amount required per hour to keep the rotorcraft in optimum condition, no matter what sector they are operating in. 'This is very important for the lessor, but it also gives peace of mind to the operator,

“ **Augmented reality, as a maintenance aid, is already being tested in the industry and will likely reduce maintenance costs in the future.** ”

because they know they can budget accurately for the operational costs of the aircraft,' he noted.

While the service programmes involved are essentially the same no matter what sector the helicopter is operating in – EMS, offshore, etc – the operational parameters are likely to change. For example, offshore platforms will most likely be exposed to a harsher climate than those in EMS. This filters through to the hourly rate, Maunder explained, 'but as a lessor, we would just be anxious to ensure that all the components are covered'.

He highlighted the impact being effected by technical developments in a number of areas, such as HUMS. 'The maintenance organisation of a helicopter operator now knows full well when a part needs to be attended to or replaced or worked on, and now – by linking the output to Skytrac [data acquisition systems] – it should be possible shortly to download this directly to the maintenance team even while the helicopter is still on its way back to the main base,' Maunder said. 'That is improving the efficiency of the maintenance organisation and therefore improving the availability of the helicopters as well.'

According to Nimrick, the industry is still in the early days of the evolution of aftermarket support services, with huge potential for the use of technology. 'Today, we are just beginning to see the added benefits of technology in our industry. Bell believes that the technology leap will continue at an exponential pace,' he emphasised. 'The type of data captured and monitored, real-time reporting, trending and forecasting will improve the overall market safety and drive down maintenance costs,' Nimrick concluded. ■

HORIZON OF CHANGE

Lighter weight, greater intelligence, higher energy efficiency and wireless features are emerging requirements in the development of headset technology, with an eyeglass for visual aid also on the horizon. *Shephard* assesses industry efforts in advancing these trends.

By Rob Coppinger

Lightspeed Aviation's Tango headset seen here with its panel interface. (Photo: Lightspeed Aviation)

Helicopters can be rather noisy and pilots would have a tricky time trying to operate the aircraft if not for the headset that provides a space to focus on the job at hand, rather than having to concentrate through a horrendous cacophony. While the basic functions of communication and noise reduction have been delivered for some time, improvements are ongoing, and an entirely new facet to the headset – the eyeglass – could be an important advance.

Improving functionality

One offering on the market is the Thales TopMax heads-up vision system. 'The system is still in development, but it is very much specific to civil pilots, both on fixed- and rotor-wing. I don't have a specific roadmap unfortunately. We are still fine-tuning the system to make a viable commercial product,' said a company spokesperson.

Demonstrated for the first time at the Paris Air Show in 2015, TopMax has been developed from the company's experience

with military helmet-mounted sight displays and civilian head-up displays (HUD).

Using ideas from the consumer technology world and its own knowledge of military systems, Thales has designed a product that can be worn by civilian pilots and does not require a large fixed mount that a helmet provides. TopMax gives low-visibility take-off and landing functions, enhanced flight vision and synthetic vision capabilities of a fixed HUD, but as with a military version, it also provides a 360° field of view.

TopMax is 'especially suited to mission management for things like EMS, policing and exploration', said the spokesperson, adding that 'it helps pilots and ground controllers share data from the headsets and therefore enables quicker target acquisition and waypoint selection'.

The device also has head tracking to allow a civilian pilot to look at objects such as 3D traffic to better understand their position and in some cases select them like waypoints for inclusion in the flight management system. So far, Thales has tested TopMax with fixed-wing aircraft.



However, the company also sees helicopter pilots as potential users since they also need high levels of situational awareness for flight in low-visibility conditions around airports.

In other developments, a bone-conduction microphone – like the eyeglass – could significantly change the appearance of the headset as the microphone would no longer be located just before the lips. ‘We have made a new microphone that... is actually sampling from your skull,’ explained Par Akradi, director of engineering at Pilot Communications USA.

The benefit of this is that ‘you don’t get wind noise [or] exceptional noise’, he said. ‘All the time it’s touching your skull, and you just talk normally. That voice is transmitted.’ Pilots will still have to push to talk, but the voice detection will radically change. The project was launched three years ago.

Wireless objectives

Akradi noted that Pilot Communications has simultaneously been working on improving wireless capability, adding that the function is mainly aimed at the crew and not necessarily the pilot. ‘We have a transmitter that is plugged into the communication ports of the aircraft,’ he told *Shephard*. This enables a medic or a load master, for instance, to communicate with the pilot when they need to get something off the aircraft.

Akradi said that a wireless headset can have a 2km range, but that is reduced by using less power. The product that should emerge from the company’s R&D is expected to be available in 2020.

Another manufacturer that is offering a wireless headset is US-based Lightspeed Aviation, with a product called Tango. Teresa De Mers, the company’s executive VP of marketing and corporate development, stressed that many rotorcraft pilots like the freedom that a wireless headset gives.

‘One thing that some people get confused about at the outset is that the headset is not connected by a wire to the part that plugs into the panel,’ De Mers noted. Instead, there are two pieces to the system: the panel interface, which plugs into the panel, and the headset that is being worn.

‘That connection then between the two pieces is something that we call Lightspeed Link. It’s a proprietary blend of analogue



Thales’ TopMax headset, which has a head-up vision system, is being developed for civil helicopters. (Image: Thales)

and digital signals that we’ve patented. That’s what creates that communication link,’ she explained.

Such a link is regulated by the US government’s Federal Communications Commission. De Mers emphasised that in order to ensure that the mixed analogue and digital link was approved by the agency, ‘we did test extensively before we released the product to make sure that it didn’t interfere with any of the other avionics or electronics in the cockpit, and it’s fine there as well. We tested it with numerous systems’.

That feature has now been available for four years, and De Mers explained that pilots use it when they are boarding and leaving the aircraft. ‘They’re trying to be in and out of the aircraft more, so not having to unplug or take the headset off [is helpful],’ she said.

De Mers noted that tour operators also like the feature because passengers are often not used to having cables and cabin plug sockets. With wireless headsets, tourists can exit the aircraft without having to take the sets off first.

Although it is sometimes assumed that the connection is either Bluetooth- or Wi-Fi-based, De Mers confirmed that this is not the case as these services are too slow for voice communications.

Navigation applications such as Garmin Pilot or ForeFlight use the A2DP (Advanced

Audio Distribution Profile) protocol for alerts, and the headset needs to have that built in, which Lightspeed’s does. ‘We meet a lot of pilots who fly in helicopters that are talking to ATC on their intercom radio, but they might be talking to someone on the ground or some central coordinator on the ground. They’re on the phone too,’ De Mers added.

Obstacles to overcome

Patrick Schutterop, Bose Aviation’s EMEA and India category business manager, pointed out that a fully wireless headset has substantial certification obstacles. ‘To make a wireless headset, which is going to fulfil the requirements of the FAA’s TSO [Technical Standard Order] or EASA’s ETSO requirements is extremely difficult, so you need fail-safes,’ he said.

‘A wireless product is more prone to issues than a wired [product] which you can actually see is plugged into your system, into your aircraft. A helicopter, just like the cockpit of an aircraft, is very sensitive to EMI [electromagnetic interference],’ he highlighted.

Dennis Buzzell, aviation market manager at David Clark Company, agreed. ‘Wireless headsets may be several years away, because headsets should be FAA TSO approved for use in both commercial and general aviation cockpit applications,’ he said, emphasising that ‘all aviation

headsets manufactured by the David Clark Company are FAA TSO-approved’.

Schutterop noted that there are a lot of big fuses in aircraft and high-voltage windscreen heaters, so EMI is a problematic issue that cannot be ignored. He stressed: ‘Not a single one [with headsets] has been approved by the FAA or the EASA. They’re, generally speaking, used for general aviation purposes, so the people go out to the airfields and fly for fun in the weekend, not in commercial aviation.’

Schutterop also sees a great challenge in taking all of the technology in the cable system and incorporating it into a headset. ‘Basically, all of the technology is in the control module in the cable. Now, you’re going to get rid of your cable. That means that everything that’s in that control module now needs to go into the ear cups,’ he explained. None of the wireless headset ear cups currently available on the market have been certified.

Batteries have to be included in addition to the control electronics. ‘Those ear cups are big, and all that technology out of that control module goes into the ear cups, including the batteries. They’re big, they’re heavy, they’re uncomfortable and they’re very susceptible to EMI,’ Schutterop pointed out.

There are other practical considerations with the use of batteries. De Mers said: ‘I don’t know if I would call it a trade-off, but why wouldn’t everyone just buy a wireless headset? Well, the other side is that it has lithium-ion batteries in it that have to be recharged. There is one more maintenance step there, where other headsets and our Zulu 3 take AA batteries and they’ll last 40 to 50 hours.’ In her view, people who really want wirelessness are happy with recharging the batteries.

Despite Schutterop’s misgivings, he does not rule out wireless headsets completely. ‘A wireless headset is going to be very susceptible in that cockpit in that very high EMI environment, but will there in the future be wireless headsets? I think there will be,’ he asserted.

Reducing noise

Another aspect to consider is noise cancellation, which has a long history in

this field. In 1975, David Clark Company introduced its noise-attenuating headset, designed to provide hearing protection for pilots.



Lightspeed Aviation’s Tango headset is a product with wireless features. (Photo: Lightspeed Aviation)

‘Trends in the future should include enhanced audio performance, increased comfort by reducing the size and weight of headsets, and increased use of active noise-cancelling headset technology,’ said Buzzell.

Bose Aviation also has a noise attenuation heritage going back to the 1970s. ‘In 1978, [Dr Amar Bose] was on a flight with electronic headphones and he was quite excited about that, got on that flight from Zurich to Boston and very quickly during the flight found out that he needed to turn up the volume so high to basically get rid of the aircraft noise that the music or the sound he was listening completely distorted,’ explained Schutterop. It was this experience that then led to Bose’s first product that came out in 1989.

Since then, noise cancellation has ‘evolved [as] companies learned how – we learned how – to make it more effective’, noted De Mers. Lightspeed has been making active noise-reduction headsets for aviation since 1996. According to De Mers,

23 years of experience has enabled Lightspeed to develop a mature technology.

She has seen the band of frequencies that active noise reduction can counter expanding over the years. ‘Active noise reduction is a technology that is particularly good at low frequencies. The passive protection is what starts to take over as you move up in the frequencies,’ she emphasised.

Passive headsets essentially clamp on the head and block any noise from reaching the ears. ‘[We] want to have as little clamping force as possible to make the flight experience as comfortable as possible. We need a little bit of force, otherwise the thing falls off your head. Active noise-reduction headsets are lighter and have less clamping force,’ Schutterop explained.

The goal is to have a headset that clamps enough to counter those higher frequencies while the active measures cancel the lower frequencies. Active noise cancellation involves sending a signal into the earphone that is the same as the noise, thereby cancelling it out.

De Mers noted that this has other benefits in addition to noise reduction. ‘It also helps to really reduce fatigue, improve situational awareness and improve intelligibility when we don’t have all that low, droning noise coming into your environment,’ she clarified.

There is even an added benefit for monitoring how your aircraft is doing. ‘You can actually also hear anomalies with the engine more clearly when you’ve got all that low-frequency noise masked out’, she said, adding that Lightspeed’s research has found that there is still a large component of low-frequency noise in both piston and turbine aircraft.

Digital format

Pilot Communications also has a headset undergoing testing now with pilots. ‘We have some units already in the market, not in the market as a sold unit, we’re just giving it to pilots so that they’re doing the testing for us,’ said Akradi.

The company is testing a digital noise-cancellation product. The pilots that have been given the headsets are working in a variety of services (eg lifting air conditioner

units and rescue operations) where the doors are open and a lot of noise is coming into the helicopter.

'We have been working on this digital format for a while right now,' Akradi disclosed. In the past, digital headsets have had much higher battery power consumption compared to analogue headsets as a lot of power is consumed listening to the ambient noise and sampling it digitally to then recreate the sounds, which uses more power again to cancel the incoming noise out. Pilot Communications' solution is to change the method of the sampling to overcome the power consumption, Akradi explained.

The more energy-efficient sampling system works by monitoring the take-off and then automatically going into the sampling mode. Instead of sampling on a continuous basis, it listens for noise frequency changes and knows when it needs to do sampling. 'Basically, you take off in the beginning, the engine is really in full power and the frequency of the sound is

different than when you go to cruise, then when you go to the landing again, the frequency changes,' said Akradi. The technology also remembers an engine and its frequencies. Its capability enables it to retain the memory of the engine and its levels and refer back to it.

Pilot Communications focuses on a dynamic testing process. 'We're getting some testing done inside of the helicopter, so we know what the [headset] unit is doing,' Akradi confirmed. The process aims to refine the product for the users. The feedback from the pilot enables the OEM to 'refine it before we give it to the market, because otherwise you would have a headset or a device that is having some issues that you could not find on the [testing laboratory] bench when you're doing that testing', he added.

Viable options

Schutterop sees headsets as very personal items that depend on the pilot's preferences. That choice is expanding with

variations of wirelessness from Bluetooth to digital and analogue radio and panel plug-in modules or pure cable-only options. The microphone is also changing with the prospect of bone conduction removing the need for one in front of the mouth.

The headset system would appear to be shrinking with no cable and no microphone, and the eyeglass HUD with synthetic vision, waypoint selection and other vision-enabled functions will significantly change both the way headsets look and their functionality.

However, there is another great challenge for headsets. Buzzell sees helmet requirements as a significant factor for the market. 'Since the requirement for helmets to be worn by pilots in the law enforcement, medical life flight industry and related markets, these regulations have reduced the size of the helicopter headset market considerably.'

Finally, battery technology is improving, and the issue surrounding time between recharges could therefore become a hindrance of the past. ■

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The in-development Bell 525 Relentless is one of a handful of new commercial helicopters set for certification in 2019. **Susan Griffin**, executive VP of commercial business at the OEM, spoke to *Shephard* about the latest developments in flight testing and certification of the super-medium aircraft.



Relentless progress

Once approved by the FAA, certification of Relentless will represent seven years of hard work on behalf of its programme team and suppliers to offer the civil helicopter market a clean-sheet super-medium aircraft with fly-by-wire capabilities – a first for the sector.

Advanced testing

Looked upon as a multi-mission aircraft for EMS, oil and gas, SAR and VIP markets, the 525 programme has now reached a stage where Bell is completely focused on 'flight, component testing and submitting deliverables' to the FAA, according to Griffin.

Four test helicopters are involved in the campaign – known as aircraft two, three, 14 and 15 – with one based at Bell's Amarillo, Texas, facility and the others residing at the company's flight test and research centre in Fort Worth, Texas.

In March 2019, the 525's General Electric-made CT7-2F1 engine also received type certification from the FAA. The powerplant hosts a new, improved-life high-pressure turbine, an engine electronic control unit and HUMS.

Programme matters more directly relating to Bell include the forthcoming 525 handling qualities testing at the company's Fort Worth flight research centre. Griffin explained that this will cover the evaluation of fly-by-wire technology, and added that

the FAA continues to review the OEM's flight test plans as part of the certification process. 'The FAA also looks at which specific test points they want to see flown by the aircraft,' she noted.

While the end of certification is in sight, confronting challenges such as weather disruptions to flight test schedules has proven to be a burden at times. 'Certain atmospheric conditions are needed for specific tests, and at Fort Worth the inability of flying when raining [has been a problem],' Griffin confirmed.

Similarly, the vast distances involved in transporting flight test aircraft to various locations has also been taxing from a logistics and operational point of view: cold-weather testing was completed in January 2019 at Yellowknife, Canada; snow test certification was conducted in Rome, New York; and hot-and-high testing took place in Yuma, Arizona.

Process management

At the other end of the scale, certification and flight test developments have been made easier to manage due to the flight research centre being in the same site as the 525 engineering team, Griffin said.

'The centre also includes integration labs where simulation technology has been used to test software applications. Assembly tooling fixtures and 3D-defined parts [made at Amarillo] have enabled the construction of three different components to then be built as one single fuselage,' she explained.

Amarillo is where serial production of the 525 takes place, having originally started in the summer of 2018. While Bell previously disclosed that a 'very low number' of the helicopters would be built this year, Griffin did not reveal any exact

order figures, but told *Shephard* that the company had received 'a lot of requests' from potential customers.

For those customers wanting to learn about the aircraft and its capabilities, Bell has been typically visiting 'operator locations' and providing programme briefings to each, with the Fort Worth flight test centre being used for other operators to see the 525 assembly line and in-flight demonstrations first hand.

Furthermore, while aircraft 15 is not instrumented, it will be used as a customer demonstrator after certification, while two of the four test aircraft are also due to be involved in icing-condition trials post certification. 'No location has been determined [yet],' Griffin said of the icing trials.

Initial interest

The manufacturing dilemma of potentially overburdening the offshore market with super-medium helicopters when an excess of heavy-lift aircraft continue to sit idle or inactive remains, as does concern over a volatile oil and gas market.

Despite that assessment, Griffin is clear that there is still a 'significant market' from which the 525 can benefit. 'That's why we have designed the aircraft, and we will keep in touch with [oil and gas] operators and those who have a need to get to and from oil rigs,' she said.

Beyond civil interests, Bell is also set to use 525 technology as part of its US Army-led Future Attack Reconnaissance Aircraft programme proposal. The company is one of five defence contractors currently involved in the competition, having been awarded an initial design review contract in April.

Griffin spoke to Tim Martin



Photo: Bell

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