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# Relentless pressure

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EDITORIAL Tel: +44 1252 545993

Managing Editor Glenn Sands glenn@hmgaerospace.com

Contributors Gordon Arthur, Peter Donaldson, Michael Doran, Emma Kelly

ADVERTISING SALES AND MARKETING Tel: +44 1252 545993

Publisher Mark Howells mark@hmgaerospace.com

Sales Manager Shelley Potts shelley@hmgaerospace.com

Marketing and Communications Manager Emma Walker emma@hmgaerospace.com

PRODUCTION AND DESIGN

**Production Manager** David Rogers Tel: +44 7986 658483 david@hmgaerospace.com

Production and Design Editor Steve Lodewyke Tel: +44 1252 545993 steve@hmgaerospace.com

**Graphic Designer** Paul Firth paul@hmgaerospace.com

CIRCULATION

**Subscription Enquiries** Tel: +44 1252 545993 subscriptions@hmgaerospace.com

MANAGEMENT publishing@hmgaerospace.com

Managing Director Mark Howells

Director **Becky Howells** 

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HMG Aerospace Ltd The Hub, Fowler Avenue, Farnborough Business Park, Farnborough, GU14 7JF, United Kingdom Tel: +44 1252 545993

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Increasing that crossover connection

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Front cover: Bell is confident that the 525 Relentless will finally achieve FAA certification this year. (Photo: Bell)



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# Glenn Sands, Managing Editor Increasing that crossover connection

It might be just outside of RotorHub's regular coverage, but I can't help keeping an eye on the US Army's Future Vertical Lift programme and wondering how long it will be until some of the technology involved begins to appear within these pages as it crosses into civilian markets. It is easy to imagine this developing military tech finding its way into commercial HEMS operations, for instance, significantly changing the way these life-saving missions are conducted.

The current testing of Bell's V-280 Valor and the joint Sikorsky-Boeing SB-1 Defiant is demonstrating how far the helicopter's capabilities have come, and the potential that both these programmes are offering looks set to revolutionise the way helicopters and tiltrotors will be operated in the future. The big question for the civil sector is how long it will be before it gets to benefit from the capabilities now being developed for the military.

#### Waiting game

There is no doubting the appeal of this cutting-edge technology, and those commercial and parapublic operators with big enough budgets will most likely be interested in adopting it at some point down the road. With it will come an increased capability that may allow a HEMS platform to attain a speed of 370 km/h while providing the advantages of fly-by-wire, which is only now appearing on a civil production helicopter.

While current commercial platforms are no doubt capable and becoming ever better equipped, the speeds of civil helicopters have not really improved much beyond those first attained back in the 1960s. It's as if all those within the helicopter world have been waiting for the next 'big thing', and the current US Army programmes may well be it.

I recall watching a documentary an awfully long time ago on American helicopter manufacturer Sikorsky. During the programme, Igor Sikorsky was asked: "Will a helicopter ever fly faster than an aeroplane?" His reply was: "Of course not." I wonder what he'd think now as the next generation of rotorcraft begin to take flight.



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#### NEWS

# Airbus reveals new helicopter test bed

Airbus Helicopters has begun in-flight testing on board its Flightlab, a test-bed aircraft that the OEM will use to mature new technologies.

The Flightlab provides an efficient means of quickly testing technologies that could later be introduced on Airbus's helicopter range. It can also play a role in developing solutions for future eVTOL platforms or fixed-wing aircraft.

In particular, Airbus will be looking to test hybrid and electric propulsion technologies on the Flightlab demonstrator. Autonomy is another area it wishes to explore, as well as technologies that reduce helicopter noise levels, simplify maintenance and improve flight safety.

Bruno Even, CEO of Airbus Helicopters, commented: "Investing in the future remains essential, even in times of crisis, especially when those innovations bring added value to our customers by targeting increased safety, reduced pilot workload and reduced sound levels. Having a dedicated platform to test these new technologies brings the future of flight a step closer and is a clear reflection of our priorities."

Flight testing with the demonstrator actually started last April, when it was used

to measure helicopter sound levels in urban areas, focusing on how buildings affect people's perception of the noise. The results suggested that buildings play an important role in masking or amplifying sound levels, and Airbus believes its studies will be instrumental when the time comes for sound modelling and regulation setting, especially in relation to urban air mobility initiatives.

In December 2020, Airbus evaluated a rotor strike alerting system on board the Flightlab aircraft. Technologies due to be tested this year include an image-detection solution with cameras to enable low-altitude navigation. Airbus also wants to investigate the viability of a dedicated health and usage monitoring system for light helicopters, as well as an engine back-up system that will provide emergency electric power in the event of a turbine failure.

Testing on the Flightlab is expected to continue in 2022 with the evaluation of new ergonomic designs for intuitive pilot flight controls that should reduce workload. These designs could be used in traditional helicopters and other platforms such as eVTOLs. **By Glenn Sands, Farnborough** 





Fit for a president: the AW139. (Image: Leonardo)

### Colombia picks AW139 for head-of-state transport

The Leonardo AW139 has been selected to be the Republic of Colombia's new presidential transport helicopter. The aircraft, which will be outfitted in a special VVIP configuration, will be operated by the Colombian Air Force. Delivery is expected to take place this spring.

The Colombian Air Force will be the first military operator of the AW139 in the country, but the type has already had success in civil transport operations for the oil and gas industry, with Helistar operating five of them.

The presidential AW139 will be configured with an eight-seat layout, and in addition to the type's usual safety features, it will be fitted with a self-defence suite like those often found on head-of-state/government transport helicopters.

According to Leonardo, the AW139 has achieved significant success in the VVIP and government transport markets worldwide "thanks to its outstanding reliability, safety, comfort, customisation and versatility". It has also made inroads into the global military market, and the AW139M variant is being proposed by Leonardo to meet the multirole requirements of Colombia's air force, army, navy and national police.

There are nearly 1,100 AW139s in service around the world, with almost 3 million flight hours logged between them. Orders have come from more than 280 customers in over 70 countries.

By Glenn Sands, Farnborough

# AW169 set for VIP operations in Mexico

Leonardo has announced that a twin-engine AW169 light-intermediate helicopter is due to enter service with a private operator in Mexico this year. This acquisition marks the entry of the AW169 into the Mexican VIP/corporate market.

Leonardo indicates that the aircraft will have a "highly customised configuration combining the highest standards of quality and comfort, and leveraging the outstanding cabin space of the model".

This latest deal expands the success of the AW169 among operators across Latin

America and strengthens Leonardo's position in the multi-engine VIP helicopter segment worldwide. Its share of that market is around 40%, according to the OEM.

Commenting on the Mexican order, the company stated: "For more than three decades, Leonardo has been the preferred OEM of Mexican customers for VIP/executive transport operations, with several AW109 variants sold and in service. The AW169 offers existing light-twin operators in Mexico higher payload, more space and greater comfort.



"At the same time, as the lighter brother of the world-class AW139, the AW169 benefits from the AW Family commonalities, delivering similar capabilities on a smaller and lighter scale with distinguished systems and equipment."

The AW169 can comfortably carry up to 10 passengers in its large cabin, along with a range of customised equipment and entertainment systems. It incorporates several new technology features in its rotor system, engines, avionics, transmission, and electric power generation and distribution systems. The aircraft is powered by a pair of Pratt & Whitney PW210A turboshaft engines.

Leonardo notes that a performance improvement package is under development to provide even greater capabilities to customers, including in hot and high conditions like those frequently encountered in Mexico.

Certified in 2015, almost 240 AW169s have been ordered to date for VIP/corporate transport, EMS/SAR, law enforcement, firefighting, electronic news gathering, utility, training and military missions. By the RotorHub team, Farnborough

# Mongolia to create helicopter SAR centre

Mongolia is setting up its first ever helicopter search and rescue centre, which will be located close to Chinggis Khaan International Airport in Ulaanbaatar. The project, which is expected to include the construction of a training facility, maintenance hangar and fuelling station, has been enabled by a concessional loan from the French government to the landlocked country.

French firm Héli-Union will manage the centre for Mongolia's National Emergency Management Agency (NEMA) and will operate four helicopters from there. The fleet will consist of three Airbus H145 aircraft and a single Guimbal Cabri light helicopter that will presumably be used for training.

In addition to search and rescue, the aircraft will be used for a wide variety of

other missions, such as fighting wildfires, deploying emergency personnel and transporting injured people to hospitals.

NEMA signed a financial agreement with France's Directorate of Civil Defence and Security in October 2019. That overall package for civil defence support involved a 30-year €57.9 million soft loan from France. The agreement specified that NEMA, which is generally poorly equipped, would establish a new air unit, and that 12 helicopter pilots and 12 mechanics would be trained.

It is unclear when the SAR centre is scheduled to begin operations. Last June, Héli-Union placed advertisements for qualified H145 pilots to "work as captains for search and rescue missions" on fixed-term contracts in Mongolia. The requirements were for at least 50 hours of flight time on H145s and a minimum of 1,000 flight hours overall.

Héli-Union has already signed a contract with Thales for the provision of training for Mongolian H145 pilots, and RotorHub understands that a simulator will be procured for the facility.

Thales said in a December 2020 press release: "French civil security pilots have trained on the same type of Thales systems since 2006. Héli-Union's instructors will therefore benefit from Thales' specialised expertise in training systems for civil defence missions."

The company added: "The project will build on the long-standing relationship between Thales and Héli-Union to bring Mongolia access to France's helicopter know-how." **By Gordon Arthur, Christchurch** 

#### NEWS

# Volocopter outlines Singapore air taxi plans



Volocopter will launch urban air taxi services in Singapore within the next three years, according to an announcement by the German company in December.

Volocopter has been working with the city state's Economic Development Board and the Civil Aviation Authority of Singapore (CAAS) over the past two years. This ambitious timeline would make Singapore the first Asian country to launch an urban air mobility (UAM) service.

Florian Reuter, the company's CEO, commented: "Singapore is renowned for its leading role in adapting and living new technologies... There is no better place in Asia to launch our electric air taxi services than in Singapore. The city's research institutes conducting R&D play an integral part in this. Topics like route validation for autonomous operations, material science and research regarding battery technology are particularly important for our long-term business success."

To prepare for this inaugural service, Volocopter Asia Holding has been created. Volocopter will employ 50 pilots, engineers, operations specialists and business managers in readiness for the service's launch. By 2026, the company believes it will have more than 200 full-time employees in Singapore.

The very first aerial taxi route will target the tourist market, flying over the southern

waters of Singapore to gain skyline views of Marina Bay. Volocopter revealed that succeeding routes could include "crossborder flights" – presumably to Malaysia – to enhance regional connectivity. However, each electrically powered aircraft can carry a maximum of just two passengers at a time.

Singapore already hosted an air taxi demonstration flight over Marina Bay in October 2019. Before the full UAM service can begin, Volocopter will need to obtain the necessary approvals from the CAAS and EASA.

As a technology and industry still in its infancy, there are numerous legal and regulatory challenges for UAM to overcome, including air traffic control, flight standards, certification, insurance, noise pollution, land use and privacy concerns.

An Urban Mobility Readiness Index produced by the Institute of Transportation Studies at the University of California, Berkeley listed five Asian cities – Singapore, Shanghai, Tokyo, Beijing and Seoul – among the top 10 most prepared cities for UAM worldwide.

With Singapore ranked number one, Asia is expected to be at the centre of this new form of transportation, especially given the overcrowding and traffic congestion that is endemic to the region.

By Gordon Arthur, Christchurch

### NHV leases H145s from Milestone

GECAS unit Milestone Aviation has agreed to lease two Airbus H145 D3 helicopters to NHV. The aircraft will be used by the Belgium-based operator to support a training programme for Germany's Bundeswehr (Federal Armed Forces) at Laupheim in Germany.

The new H145s are the first five-bladed versions to be acquired by Milestone and the first to be operated by NHV. The lessor delivered a four-bladed H145 to NHV in 2020. Milestone now leases eight helicopters to the operator.

Sebastien Moulin, Milestone's head of Europe and the Americas, noted that the helicopters it leases to NHV cover a wide range of missions, including oil and gas transportation, emergency services and windfarm maintenance. "The ability to provide such tailor-made solutions is a key differentiator for Milestone and illustrates the depth of service capability we offer," he said.

By Glenn Sands, Farnborough

#### Babcock continues North Sea SAR

Babcock has been awarded a four-year extension to an existing contract covering the provision of a search and rescue service that supports offshore energy industry operations in the North Sea.

The original contract began in 2015 and initially covered a five-year period. It was subsequently extended by 12 months, meaning it was due to come to an end this April, but will now run until spring 2025.

Babcock will continue to operate two specialist AW139 helicopters from its SAR headquarters at Aberdeen International Airport. The aircraft are fitted with dual-hoist winches and carry hospital-class medical equipment. They are staffed and supported by clinical experts to ensure the availability of high-quality medical care. By the RotorHub team, Farnborough

# **Chinese AW169 aids Antarctic medevac**

When an expedition member at Australia's Davis research station in Antarctica needed to be evacuated in December, it took three aircraft and a collaborative effort involving teams from Australia, China and the United States to get the job done.

A Chinese icebreaker was in waters nearby, and the ship's Leonardo AW169 helicopter was deployed to transfer an Australian team and materials 40 km inland from Davis to build a ski-way. When that was completed, the AW169 transferred the patient from Davis to the ski-way.

Meanwhile, a Basler BT-67 ski-equipped aircraft from US station McMurdo flew 2,200 km to Wilkins Aerodrome to pick up a doctor. It then continued on to the new ski-way, where it collected the patient and returned to Wilkins.

The 3.2 km Wilkins runway is composed of 70% ice cover and 30% snow cover, and is able to handle an Airbus A319 aircraft,



with regular services operated between October and March. To complete the evacuation, an A319 flew from Hobart to Wilkins, picked up the patient and returned to Hobart on Christmas Eve.

According to Australian Antarctic Division director Kim Ellis, Antarctica really brings nations together to support each other, and this operation was in the very best spirit of that multinational cooperation. A Chinese icebreaker's AW169 played a key role in the evacuation. (Photo: Dan Dyer)

"We're extraordinarily grateful to the Chinese and US Antarctic Programmes for the fact they were able to change their operating models and come to our assistance," he commented. "And I'm particularly grateful to the Australian expeditioners, who displayed courage, resilience and skill, deploying to remote airfields and ski-ways in tough conditions.

"The synergy of operating capabilities, incredible expertise and a favourable weather window enabled us to bring the patient back to Australia within a week," Ellis noted.

By Michael Doran, Victoria, Australia

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# RELENTLESS PRESSURE

With a state-of-the-art fly-by-wire system and a cruise speed of 296 km/h, Bell's 525 Relentless is set to turn the offshore and VIP helicopter markets on their heads. It's a design that's based on direct input from a customer panel, using all the expertise out there. RotorHub's **Glenn Sands** couldn't wait to hear more about this impressive-looking helicopter.

The 525 Relentless undergoes cold weather testing in Yellowknife, Canada. (All photos: Bell)

t doesn't matter what you have out on the helipad today, in order to stay ahead of the competition, you need to be looking 10 or even 20 years into the future, particularly when designing and building helicopters. It's a practice that Bell adopted a long time ago, and it appears to have paid

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There's an old aviation adage that 'if it looks right, it flies right', and it couldn't be more appropriate for this super-medium helicopter star!

off with its new 525 Relentless model.

Bell has always been able to predict the helicopter market's future needs, and with the super-medium class gradually gaining more prominence across the helicopter world during the 1990s, particularly in the offshore industry and SAR, it was an ideal opportunity to look at introducing a new player. Recognising there would be an eventual need to replace types such as the Sikorsky S-61N and S-92, as well as Eurocopter's AS332 Super Puma and EC225, Bell predicted that there would be a requirement in the commercial helicopter market for a new model in this class with the latest technology and innovations by the early 2020s.

The inception of an idea was there from Bell. It was now a case of working on a super-medium design that would be able to meet the anticipated future demand.

Josh O'Neil, the chief engineer for the Bell 525 programme, explains how the

Relentless took shape. "I think there's a misunderstanding that aircraft in this class are developed primarily for offshore, but I always thought there would be more scope for the design. Fortunately, I was in the programme from the start and have a lot of experience, and it was unique in that we started with a true clean-sheet development design. So it wasn't being developed or hadn't grown out of any other project we'd had already, in terms of hardware. Obviously, the software technology would be similar to other types, but we were keen to develop this as well.

N525BK

"I think that's what makes us different to our competitors. We didn't see the market in terms of just five to 10 years into the

#### **AIRCRAFT FOCUS**

future, but 20 or even 40 years ahead. We tried to foresee what aircraft would be wanted by Bell operators."

O'Neil continues: "We knew we would be bringing brand-new technology to a market that would be 20 years from when we began. It was a case of knowing how to put an aircraft together when we didn't know completely what it would be doing in the future. But it had to be a capable design."

Even with a clean-sheet design, there's still a basic list of requirements that have to be followed with any helicopter, but Bell's design team took an innovative approach to those basics and included them in entirely different ways, which contributed to the stunning look of the 525 Relentless.

"It's like how we laid out the cockpit to best help the flight crew, so that they can operate the aircraft in a safe manner, be provided with better situational awareness and have a level of comfort that wouldn't induce pilot fatigue on long flights. With this clean-sheet approach, we could design from scratch and think about what it would be like in the aircraft and whether there were any physical constraints due to the dimensions. We worked within these bounds."

#### **Admiring the view**

The 525's cockpit was, from the outset, going to be something special compared to other helicopters out there, and this was demonstrated by the use of sidestick controls and the removal of dedicated pilot and co-pilot doors, adding to the sleek look.

O'Neil explains: "It's a great example of how the development of the 525 occurred. It's one of the earliest things that I started working with on the programme.

"Basically, you work from the inside out. It's about putting a human being into an environment that makes their job easier, makes tasks more straightforward and allows them to operate the aircraft in a way that's ideal. So you start with the individual, their seating posture – what's best?

"Then we look at the sight lines, both inside and out. What are the things the pilot wants to be able to see at all times? Where are they looking during the landing cycle on an offshore oil rig or an elevated helipad? It's working out where they'd like to look. It's a challenging task, as we have to basically interpret what a pilot wants to see if they are going to put it down on a landing spot.



Bell built five aircraft for the 525's flight test programme. Above are numbers four and five.



The Relentless is powered by two GE CT7-2F1 engines with a dual-channel FADEC system.



The 525's flight crew share exits with the first row of passengers. Each crew seat is mounted on a J-track that allows it to rotate inwards.

#### AIRCRAFT FOCUS

"Often, it's not as simple as a pilot just saying: 'I want a big window here and to be able to see in this direction as well,'" O'Neil notes. "But it's not as involved as you might think, where you end up with a multitude of possibilities. You pretty quickly get a general consensus among different pilots, and even some non-pilots have suggestions which may be of use to the design team.

"One of the tools we used very early on in the design process was VR technology. We had a complete lab devoted to the 525 project. It was a case of saying: 'Here's what we are thinking in terms of a cockpit layout,' and then viewing it, before actually having to construct a physical mock-up. Using this method, we were able to get 90% of the configuration to how we wanted it. But you have to keep in mind that there was 10 years of development before we got to this stage.

"The feedback was constant throughout this process, I recall, as simply being able to cater for the tallest pilot to the shortest had to be taken into account. Both have to be able to reach the controls safely. As a team leader, everyone I worked with understood our aims and was keen to develop the ultimate pilot working environment of the future. But there was always tweaking of the design throughout this process." Filtering across from military aviation is fly-by-wire (FBW), a concept that has been readily adopted by the commercial fixed-wing aircraft industry. But for helicopters, it's still relatively new. Bell was keen to get this technology into its 525 model.

"We have a very long history in the development of flight control hardware for military platforms, which is basically an industry in itself, in how to arrange the systems and ensuring redundancies as a safety measure. It's a case of making the platform fly in the way you want by running it through a software network," O'Neil says.

#### **Game-changing capability**

"At Bell, we certainly felt like we had an advantage in what was needed to support an FBW system, which, to be honest, is an enormous undertaking in terms of development. It does take decades to perfect this. We'd done the work already here at Bell, so I could take advantage of that, from a hardware perspective, for the work on the Relentless.

"The software and advanced control laws, when matched with the earlier development work, have been game-changing for this helicopter," he declares. "We are bringing a software interface to the pilots that allows them to have that 'gee whiz' factor in terms

The Relentless will be the first commercially certified helicopter with fly-by-wire flight controls.



of handling capability, while also offering them the latest technical feedback in a safe way.

"It was something that I was keen to see out in the market with the Relentless," O'Neil says. "It was taking the advanced control laws that we had developed for the military market and shifting them to the next level with a civilian helicopter. It involved a lot of tweaking, but we had to for civilian certification.

"The flight control laws are best described as levels of augmentation. The lowest is akin to a normal static stabilised aircraft, basically what a pilot would fly in a non-FBW-equipped platform, but is essentially still a stabilised platform in the air. If you go to what's typical in the development of a brand-new aircraft, it's where you begin, you have most of the advanced features turned off.

"You then walk through the process of adding new control augmentation laws on to what we had installed on the first prototype. Within a few flights, we had all five control laws running. It was completed within a week. We had all the augmentations up and running shortly after the maiden flight. It was a clear testament to the development effort and the confidence that we all had in the programme and what we were doing with the FBW system."

Once the FBW was operating effectively on the prototype, it was a process of ensuring that the software would meet all the necessary certification requirements and regulations for the numerous authorities. This turned into a large technical programme itself within the 525's overall development work.

O'Neil explains: "This process was a great example of really good collaboration between the FAA, EASA and Transport Canada. We had been in tripartite conversations with all three specifically on the FBW issue. It was a perfect framework for close cooperation. We could get together and ask the right questions in terms of safety issues. It was the same for the mechanical flight system.

"The FAA had been on board with the aircraft and had experienced these control laws, they'd done the same simulator work as Bell, before the flight test programme started. It's really been positive in that we have both established independently what





The innovative cockpit features touchscreen Garmin avionics and sidestick controls.

this should look like. It's setting a baseline, and others can follow on from what Bell has accomplished. When the next model with FBW comes along for civil certification, there will be regulations already in place, to benefit the industry as a whole, for helicopters in this class." Flight testing is a critical stage for any new aircraft programme, and Bell has not been slow in getting the prototypes of the 525 out on the road in order to fly them in extreme weather conditions. Three travelled up to Canada – two to Yellowknife and one to Manitoba. "Three of the prototypes went off for cold weather testing, while the fourth remained in the US, although as it turned out we had a severe snowstorm in New York where the aircraft was, with temperatures getting as low as -40°C. This proved a challenge at times," O'Neil recalls.

The off-site testing is the culmination of six months' preparation by a team from Bell. "We send out a team of folks to go and do a site survey and understand what is there, what kind of facilities are available and the airfield they'd be based at. So there's a series of trips that are related to planning, months ahead, so we know what we are dealing with.

"Several weeks prior to the helicopter's departure, a logistical team heads out with telemetry and data monitoring equipment in preparation for the Relentless. When the aircraft arrives, everything is ready to go.

"It's an unbroken, fluid process," O'Neil emphasises. "The team simply pick up the flight research work, but it's just at a different, colder location."



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It's the 525's cockpit that's creating the most interest within the industry, and it's something that Bell's engineers are particularly proud of. O'Neil provides his overview of it. "With the kind of arrangement we have and using FBW, which makes things incredibly easier, we had the ability to put a lot of instruments under glass. The avionics units, which before had been very switch-based, could now be displayed on MFDs. It's one of the things that new pilots remark on, the almost complete lack of switches in the cockpit.

"It sounds great, but there were concerns about accomplishing this in an effective and safe way, and not making things more complicated. So we spent a great deal of time working out how to arrange a lot of information and capabilities that the aircraft provided in ways that are intelligent and easy, and in a logical process – almost to a point where the whole process is as simple as working a cell phone," he says

#### **Customisation possibilities**

"Garmin had all the expertise in this field and were able to deliver the G5000H flight deck, which we coupled with our advanced FBW control system. It provides outstanding crew situational awareness.

"We advised them throughout the process on where we wanted certain switches and so on. It was a new way of setting out requirements for the flight control system. It also means that, over time, we have the ability to expand the capability. It will allow operators to customise the system to what they specifically need."

Those who will simply be using the Relentless to get from A to B can't fail to be

impressed by the cockpit layout, and the comfort and space available. O'Neil discusses the 525's impressive internals. "Comfort was obviously important for those destined to operate the helicopter. The advantage we had with starting from scratch was that by making it more comfortable, there's the knock-on effect of being able to move around more easily.

"There's a natural alignment between feeling safer and feeling comfortable," he observes. "We wanted a cabin whose sight lines and seating wouldn't clash. Passengers feel far safer when they can see where they are going and know where the nearest emergency exit is – in the Relentless, they can literally touch this.

"What we came up with for the cabin was something completely different, which was, I admit, unexpected, but from our perspective was simple. Four rows of four seats with access from each side of the cabin. Looking at it, it appears common sense, but it took some work to achieve, taking into account the structural design of the helicopter. It works great!"

The industry has been itching to get its hands on the Bell 525 Relentless, and there's been a lot already written about the helicopter, but it's the feedback from the pilots who've been invited to fly one of the demonstration models that is the most telling, as O'Neil acknowledges. "Bringing them in and listening to their feedback has been extremely meaningful, I think because it is so direct, and has been positive.

"When you spend this amount of time on a new design, and obviously a lot of work goes into it, and you know the whole team individually, you know we're all doing a good thing. When you get validation from outside the team from those who have worked with helicopters for decades, it definitely lifts the team.

"When the pilots, especially those who have a lot of experience on heavy and super-medium types, are turned loose on the aircraft, they soon have a big smile on their face. They tend to get excited when flying the 525, and many have commented that they wished they'd been part of Bell's development team," O'Neil reports.

#### **Multirole machine**

So where will Bell's 525 Relentless be operating? With the VIP market demanding a new type, it's clear that it won't be too long before 525s are rolling off Bell's production line in a variety of exotic private colour schemes.

However, it's offshore operations that may well benefit most from the capabilities of the new helicopter. Given the ability to operate over water and with a cabin large enough to carry the necessary equipment, it should make an ideal SAR platform. Bell currently has a number of internal suites undergoing certification that will allow the Relentless to be offered for a variety of roles.

O'Neil sums up what the 525 Relentless is bringing to the commercial helicopter market. "The 525 is the next generation for rotorcraft in this class, and it's been designed to adapt to the differing needs of customers we have around the world. It's a clean-sheet design that's been developed so that it can meet a customer's ideal requirements, whatever those are. We intended the Relentless to be this way from the start." Years ago, the greatest obstacle to understanding was getting hold of all the relevant information, making it difficult to connect the dots.

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# HEMS in the HIGHLANDS

Gama Aviation

Providing an aeromedical service in one of the most challenging regions of the UK requires commitment, highly experienced personnel and specialist equipment. Gama Aviation extended its fixed-wing air ambulance support for the Scottish Ambulance Service into HEMS last year and hit the ground running despite the pandemic, as **Glenn Sands** reports.

t's hard to believe that it's almost a year since I was at Gama Aviation's Farnborough presentation where it unveiled its new fleet of three Airbus Helicopters H145 D2s. The aircraft were destined to fulfil its helicopter emergency medical services (HEMS) contract with the Scottish Ambulance Service.

Little did any of us know what a year 2020 would be. It pushed Gama's crews to their limits, and threw multiple and daily challenges at project managers, operations, pilots and medical teams alike.

To support its entry into the UK HEMS market, Gama acquired three Airbus H145s. (Photo: Liner) Despite being new to HEMS operations, Gama rose to the challenge and met all of its targets. Its success so far has been a clear validation of its strategy to focus more on the special missions market, a move that was underlined by the recent reorganisation of the company into three strategic business units – Special Mission, Business Aviation, and Technology and Outsourcing.

Although the presence of COVID-19 still looms large, Gama is already looking towards the future and seeking to expand the three units. It recently announced the acquisition of a US maintenance specialist for \$8.7 million.

#### **Trusted partner**

Dr Scott McVicar oversees Gama's HEMS operations as managing director of its Special Mission strategic business unit. He describes the rationale behind the company's reorganisation.

"As a business, we have been around for nearly four decades, which is a great achievement in a marketplace that doesn't suffer fools gladly. We have always maintained a client focus and have been effective at delivering service to companies that do an important job, but whose own core mission isn't necessarily aviation. Those clients want a partner that is trusted to deliver a robust and resilient solution that fulfils their transportation need without having to worry about the complexities of it.

"This is where the Special Mission team comes in," McVicar declares. "We're able to deliver robust, high-end, high-availability aviation services that are vital to address HEMS, air ambulance, ISTAR [intelligence, surveillance, target acquisition and reconnaissance], law enforcement or any number of specialist applications.

"Our recent strategic shift means that we have been able to re-emphasise that focus with each strategic business unit having a distinct purpose to deliver decisive advantage to our clients. For instance, Technology and Outsourcing focuses on automating and removing low-value manual processes from the aviation value chain with the aim of improving data accuracy, speed and human productivity. We started this capability to make our own business more efficient, but now we are also taking



these systems to the external market as a service.

"But the most important – and the closest to my heart, as I run it – is Special Mission. My team deliver to clients capabilities that are of critical importance, where people's quality of life depends on the service we can deliver. With regard to any of our air ambulance clients, all of the team are keenly aware that if our aircraft are not there to support the service at any time, it can have a serious impact on an individual's medical outcome. It certainly focuses the mind and our determination," McVicar observes.

Gama has a long-standing relationship with the Scottish Ambulance Service. Its existing contract with the organisation already covered the provision of both fixedand rotary-wing aeromedical services, but the HEMS element had been subcontracted to another operator until Gama took over last year.

#### **Team effort**

Gama's process for establishing its own HEMS capability for the Scottish Ambulance Service contract followed its traditional, well-proven procedure of putting the customer's requirements first and then building the service from the ground up. Everyone involved in the initial stages understood they were doing something that really mattered. It was a question of aligning closely with the client and putting in place a range of infrastructure that supported the Scottish Ambulance Service in what it needed to achieve.

In practice, this involved bringing together different elements of the Special Mission team to deliver an effective transition and stand-up of the service, encapsulating things as diverse as pilot training, setting up a new maintenance base and the construction of a new facility in Inverness.

Given the nature of HEMS operations, specific requirements must be met, as McVicar explains. "From an air ambulance side of things, it's all about availability, and this means that we form an increasingly close collaboration during the initial set-up process with the client. Of course, there's a split of responsibilities in managing a transition project, but it's always been about monitoring the entire process and keeping an effective, close alignment – in ►

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An H145 is prepared for its future HEMS role. (Photo: Gama)

terms of what we are bringing, we must make sure that it's right.

"With HEMS, it does tend to be an ongoing process. There's innovation when you look at what impact COVID has had, and we need to learn and adapt to it. This requires a blend of our knowledge of aviation and air ambulance operations, the client's understanding of the clinical requirements, and the OEM's platform and capabilities. When you have all three working together in harmony, as this project had, transition and delivery becomes relatively easy."

As with any new partnership, Gama had a plan in mind for the transition of the

contract, but it needed to be flexible enough to take into account the impact of COVID-19, and guidelines issued by the UK and Scottish governments. Of course, essential workers such as engineers, medics and pilots were not subject to significant restrictions, but measures were rapidly introduced to ensure as little disruption as possible, particularly when building the new facility in Inverness.

There was one small positive in this complicated start for Gama, as Andy Lister, its head of flight operations in Scotland, points out. "In relation to COVID-19, although it was a bit challenging for the



Although Gama's in-house HEMS capability is relatively new, the operator has been providing the Scottish Ambulance Service with aeromedical support for nearly 30 years. (Photo: John MacDonald)

team, as we were setting up the rotary project it was slightly to our advantage, particularly in building our pilot team."

In terms of pilot recruitment and training, early fears that it might be difficult to source pilots proved unfounded. Lister, who took on the responsibility, explains: "Given the rapidly changing situation, we didn't know how many pilots would come across to us. We went out quite early to consult via TUPE [Transfer of Undertakings (Protection of Employment) regulations] and discovered that we were effectively starting with a clean slate, which was probably to our advantage.



#### **OPERATOR PROFILE**



"We looked for pilots who had at least 1,500 hours as pilot in command. In addition, the client had their requirements, and we made sure any potential candidates would meet these.

"As new operators, we were unknown, but I was surprised at how many pilots applied," he recalls. "Being in Scotland, a large pool of pilots from Aberdeen applied, mainly from the offshore network. Some of these wanted a change or saw it as a stepping stone to get into the HEMS role. A few felt as though they wanted to do something a bit more productive.

"We didn't need to advertise, as things like this tend to be word of mouth amongst pilots. In the end, we selected 10 for the initial training phase, three of whom had relevant HEMS experience. Pilots came from all over – one candidate had flown for the United Nations in Sudan."

#### **Eager to fly**

While COVID-19 restrictions were in place, Gama's recruits were able to focus fully on preparing for their new roles.

"We found that once pilots had committed to joining the company, they were incredibly enthusiastic about getting things up and running," Lister says. "They didn't have the distractions of family or girlfriends, and just all came together within the Glasgow area. It gave them all total commitment, so it was very easy to move the training schedules around and adjust flight rosters at short notice – so, strangely, the lockdown helped. Purely from an operational training point of view, it probably made delivery easier than it could have been.

"The first task was to ensure they were all IFR qualified and then to give them an H145 rating," he notes. "It's a super helicopter to fly, and with the Helionix avionics suite and the other modifications we made, they all settled into the programme easily. The IFR elements proved no problem at all. To deliver the service, each pilot had to have at least 25 hours under their belt and had to meet single-pilot operational requirements – they all did.

"Much of the training was out of Glasgow, although we operated out of Oxford for a while with line training. One thing that did help was that most of this took place in June. In my opinion, it's the best time to start a service due to the short nights and long days, plus the weather is benign in Scotland – it all worked in our favour. The pilots all knew they had to hit the ground running, as all the other logistics were being put into place at the same time they were flying."

Pilot training was completed within the anticipated three-month window, and the operator's engineers were qualifying on the type at the same time.





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#### **OPERATOR PROFILE**

When operations began, the flying roster initially involved 12-hour duty periods for the pilots, incorporating a shift change at 7 am and 7 pm, with three days or nights on and then three off. This was later modified slightly, but the roster ensures that all crew members get the rest they need.

The improvements in the service, and the resulting positive feedback, were obvious once Gama and its personnel got into

the routine of HEMS operations, as Lister is keen to point out. "From the feedback we've had, the client has been delighted with the transition.

"For the first few months of lockdown, sortie numbers were down due to the impact of COVID-19. People were simply staying inside, following the Scottish government guidelines. After June, by which time we had taken over the contract, there was a clear jump with the easing of restrictions, with an increase of around 20%, which meant we were out on more sorties than the previous operator.

"It's difficult to see why this occurred," he says. "We were operating to the same operational parameters as the incumbent, but our consideration of the risk profile was different, which together with the deep flying experience of our pilot team allowed



us to get out there and make a difference. This has allowed us to attend, safely, many more incidents that otherwise would have been without helicopter support."

As with many emergency service personnel, asking HEMS crews if they can recall any particularly memorable missions is not guaranteed to evoke a flood of reminiscences. The pressures and the need to focus mean the training takes over and their attention is purely on saving lives. But McVicar mentions one example while highlighting the work of Gama's crews.

"The teams out there are doing a great job. One time, one of our teams had to land on a pier on one of the outlying islands, which sticks in my mind. We've a host of images of our H145s on top of mountains, in fields, on roads, and so on – the typical locations where you'd expect help to

#### **AWARD-WINNING SOLUTIONS** RECOGNIZED BY ERICKSON AS A GOLD KEY SUPPLIER



The views are great, but Scotland's terrain can sometimes make finding a landing spot tricky. (Photo: Gama)

be needed. A picture tells a thousand words, and I think they demonstrate to the rest of the Special Mission team what a valuable job they are doing."

When asked what's next for Gama in terms of HEMS operations in the UK, Lister is quick to comment. "For far too

long, there have been the same players within the industry who have dominated the HEMS market. You can see why not a lot of companies are coming into this business, with its high financial commitment and investment in people, but Gama has evidenced these in fixed-wing operations and now HEMS," he emphasises.

#### **Proven performer**

"At the start, I was selling something I really believed in to a potential pilot, and I had to convince them that it was all going to work. However, across the Gama team, there was a constant belief that we could deliver despite COVID-19 – smoothly transitioning the service and then working hard to improve it. We've achieved just that with three helicopters in service and a team of people to support them.

"Now, Gama Aviation is not having to knock on the doors of potential clients to discuss HEMS operations. Interested parties are coming to us," he declares. "We've demonstrated our credentials, and we want to increase this area of the Special Mission business to match our fixed-wing air ambulance credentials."

McVicar echoes Lister's comments. "It's a key market for us in the future, which aligns with what we do as a business. We have shown that we have a rotary-wing capability. Andy and the guys have done a great job. I think we've brought a fresh thinking and new energy into the market, which had been static for a while.

"We formed the Special Mission business unit precisely to disrupt the market and provide an alternate way of looking at air ambulance and rescue solutions," McVicar stresses. "It is a key market for us, and HEMS falls into this category. It's absolutely the direction we want to go in."

#### INTERVIEW

# **KEEPING BUSY**

The Asia-Pacific civil helicopter market has come through the challenges of the last year in a much better state than many anticipated, according to Asian Sky Group VP Nadav Kessler. He spoke to **Gordon Arthur** about the state of the industry in the region.

he year 2020 was a dramatic and difficult one for many, including helicopter makers and operators. However, there are some who believe that COVID-19 may not have had a hugely detrimental effect on the Asia-Pacific civil helicopter market, which boasted 4,373 turbine-powered helicopters at the end of 2019.

Nadav Kessler, vice-president of sales and business development at aviation consultancy Asian Sky Group (ASG), spoke to RotorHub at the tail end of 2020 about the Asia-Pacific market. Despite doom and gloom expressed in some circles, Kessler had a different outlook: "It's not very different to where it was before COVID-19."

He continued: "I think the civil helicopter industry in Asia-Pacific has not been any different from the rest of the world. What I mean is, and despite what some may think – and this is true for helicopters and even truer for fixed-wing – the market, in terms of demand and activity, is fairly stable. "Yes, in the first few months, we definitely saw a pause or slowdown or whatever you want to call it, but it was less a change in market behaviour and more just a 'wait and see' from the world really, and the region as well, to see what the significance of this crisis would be in the long term. After two or three months, when countries, governments and individuals saw that, yes, things could get worse, but that generally the immediate impact was not as bad as they feared, then things started picking up again, at least in terms of operational demand."

#### **Tourist trap**

Nonetheless, in terms of operations, there was one segment that was impacted immediately: tourism. This accounts for a small proportion of the Asia-Pacific helicopter market, perhaps less than 4%. Kessler estimated that "probably 90% of [helicopter tourism operators] are flying much, much less than they were previously. Tourism for sure was affected."



Asian Sky Group's Nadav Kessler.

Other segments such as private and corporate flights also suffered due to strictures such as lockdowns. While true that there is less activity on those fronts, Kessler noted that private and corporate usage "is ticking up now that people do feel there's more stability". Indeed, "some operators actually have more of a demand than they did previously. I'm talking about corporate and private flights where it's borderline on the need between a commercial flight or actual vehicle transport, so a helicopter is an effective solution where they don't want to travel too long and don't want to fly commercial."

As for the offshore oil and gas market, that was in poor shape well before COVID-19 hit. Kessler commented: "Yes, we know

In the Asia-Pacific region, the demand from government departments and state agencies for helicopter support has largely remained stable during the COVID-19 pandemic. (Photo: Gordon Arthur)





that oil prices took a terrible dip with this crisis, but it didn't really make things worse than they already were for operational utilisation. It's still bad." This segment represents 7% of the Asia-Pacific helicopter fleet, according to ASG's most recent regional report.

He added: "The oil and gas future is looking pretty dire right now because we are not seeing more activity and contracts are being put on hold, and therefore operational demand for oil and gas will probably decrease further."

Utility missions are the largest segment in Asia-Pacific, and Kessler related that activities such as government contracts, powerline patrols, construction, EMS and search and rescue "are pretty stable, and I think we will see that continue".

It is useful to take a holistic view of the Asia-Pacific helicopter market too. Kessler explained: "When one is in one segment, you might think things are terrible, but actually there are opportunities and there is activity and there is demand. Yes, there isn't much left [in some segments] because of lockdowns and the fact that there is no tourism, but other than that, many helicopters continue to work."

#### Impact assessment

On COVID-19's impact, the ASG executive added: "I cannot say that anything positive came out of this, but I also cannot say something extremely negative. On that note, the utility space, which is the largest market share in the helicopter industry, has been stable, primarily because a lot of contracts are government-related and they've not really been affected." Understandably, it has become a lot harder to conduct business in the international helicopter market due to logistical challenges. "Fixed-wing is a different story because they can still move aircraft from one region to another, but moving helicopters between countries or from one region to another is difficult," Kessler shared, in terms of sales or transfers. This is because of the difficulties of doing proper independent inspections of arriving aircraft, for instance. "So, definitely, that has made it more complicated. It doesn't mean it's not happening, but it is more complicated."

Concerning operations, Kessler observed: "Initially, because of safety, there was an impact, but the ones who are operating found solutions to operate safely. But in terms of what happened to the market or to those segments because of COVID-19, it's my view that not too much happened. Things are more difficult, but the demand and operational need are still there."

In East Asia, for example, the market remains "really stable". Within that subregion, though, China is a different story due to other reasons. "China is having its own difficulties and challenges, which are probably a result of the ongoing economic downturn. There actually is less and less utilisation of their helicopter fleet, and more operators that are looking to suspend or downsize their operations. That's something we've been saying is ongoing in China, and I wouldn't say it's a result of COVID-19."

Ironically, with China having emerged relatively unscathed from the pandemic, despite the virus outbreak originating in Wuhan, the country's helicopter passenger and tourism operators are more active than in many other places because of local tourism demand.

As for other markets in the Asia-Pacific region, there were rumours that New Zealand was going to have a surplus of helicopters, especially because so many are involved in the tourism sector. "Initially, there were some [helicopters] that hit the market, but that has levelled out. Things balanced out and settled," Kessler reported. "It will pick up again, and I think there will be repurposing of machines to do other utility work. I know there's been more trading between Australia and New Zealand because of it."

Looking ahead, the ASG representative predicted: "I think it will be a slow rebound, but I don't think the damage has been as severe as some think. Yes, prices have softened, but that's more the result of transacting internationally and the owners' desire to attract someone who is willing to go to the effort of going there. It's not a result of lower demand."

Unfortunately for operators that were borderline successful, they have been put below the red line by the pandemic, Kessler acknowledged.

#### Manufacturing delays

OEMs have clearly been impacted too. "Production has definitely been affected, causing delays in a lot of work and causing difficulties in continuing their production as per normal. I think they've got back on track for future planning and overall production," he noted.

"This crisis did shake up the world and forced multinational conglomerates like that to realise they might have to take a more cautious approach. They don't know how long it will last or what long-term impact it will have."

Kessler concluded: "Although I'm optimistic personally, I think they'll take a cautious approach to see how they get out of this."

Last year, ASG predicted that Asia-Pacific would have a fleet of 4,439 helicopters by the end of 2020, extrapolating compounding growth of 4% over the five preceding years. It will therefore be intriguing to see what the number actually is when ASG releases its 2020 Fleet Report in the coming months. ■

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The load-lifting prowess of helicopters has made them

helicopters has made them essential tools in the construction, energy and utilities sectors, among others. **Michael Doran** talks to OEMs and operators about the types that carry out this vital work.

The precision and payload of the Erickson Air Crane make it an ideal choice for large powerline installation projects. (Photo: Bryan Dundas/Erickson) N163AC

# ERICKSON AIR-CRANE

ith oil and gas operations stagnant, helicopter operators are scrambling to find replacement markets, but growth in offshore wind farms, powerlines and aerial construction is bringing new opportunities. There is a 'horses for courses' feel about which aircraft work best in which sector, with Erickson, Airbus, Leonardo and Kaman all finding niches.

Erickson has a unique perspective on the heavy-lift helicopter sector with its dual role as OEM of the ubiquitous S-64 Air Crane and operator of more than 70 aircraft, flying missions delivering firefighting, oil and gas support, timber harvesting, powerline and aerial construction services globally.

Erickson has been using helicopters for heavy lifting for more than 50 years, and since purchasing the type certificate and manufacturing rights from Sikorsky in 1992, it has made over 4,000 modifications to the S-64 platform.

A core element of its approach is that as new technologies are introduced, they are also made available for retrofitting to older aircraft. Brittany Wise, Erickson's SVP sales, business development and marketing, tells RotorHub that existing operators can bring their aircraft up to the same standard as new S-64s being built.

"The platform is updated in a way that will allow operators to continue to innovate and utilise technology as it advances within the aircraft," she explains. "So it's good for right now, but you also have to be considerate of what's going to happen in 10 years from now as the missions continually change. "As the OEM, Erickson is very conscious of this with its innovation and R&D group," Wise notes, and adds that, with the company being an operator itself, "the Air Crane is supported by a very dedicated OEM that's producing these platforms focused on the civilian market".

Some recent innovations include composite rotor blades, new avionics and glass cockpit displays on a centralised panel. The composite blades improve lift capability up to 25,000 pounds (11.3 tonnes), and Erickson plans to retrofit them to aircraft worldwide as legacy blades reach their service life limit.

"One of the great advantages of the Air Crane is that it was built to lift heavy things and to do it precisely, whereas a lot of platforms are built for different mission profiles but have the performance capability to lift heavy things," Wise says. "It's really this purpose-built approach that makes the Air Crane dominate markets for a variety of applications where payload and precision are needed."

A feature on the S-64 is the glass-enclosed third pilot seat that faces aft of the aircraft and provides an unimpeded view of what is happening below, which makes it easier to lift and place loads precisely.

Aerial construction is a global industry with growing demand coming from the powerline sector, where helicopters can construct and maintain transmission towers while minimising the impact on the landscape.

Building these systems from the ground involves clearing land for roads and

#### **HEAVY LIFT/UTILITIES**



platforms from which cranes are used, whereas a helicopter can do the same task, plus also hang the wires, from the air, leaving the environment virtually untouched.

"In addition to that, where the terrain makes it inaccessible to build roads, the Air Crane allows you to place things and get the mission done where traditional building methods are simply not capable," says Wise. "Utilising helicopters decreases the timeline of any project so you can energise the line sooner, and it just allows you to have accessibility where you previously would not."

The same is true for pipeline construction in remote or sensitive environments where roads are non-existent and options for getting materials to a site are severely limited. Helicopters create efficiencies, be they environmental, timeline or cost, and they enable a way to get the job completed that may be quite different to how it was done previously.

"Every industry is having to adjust to changing environmental regulations, and aerial assets in general, whether that's light, medium or heavy helicopters, are really providing a big tool for that," notes Wise. "So you have to make sure that the technology you're investing in or have is capable of growing and scaling with you for the next two decades."

With its family of helicopters, Airbus provides a wide range of load-lifting capabilities, and the OEM's aircraft are an integral part of operations in the energy and utilities sectors. RotorHub set up a call with two of its experts – Frederic Huin, business development manager at Airbus The H145 has the power and stability needed for safe hoisting and load-lifting missions in offshore environments. (Photo: Airbus)

Helicopters, and Bill Long, head of operational marketing in the UK – to learn more.

"I don't think offshore wind will be as big as oil and gas, but it is growing, and what we're seeing in the North Sea is that the bigger companies like CHC, Bristow and Babcock are getting into that market," says Long.

"One of the things you really need is good power performance

because, in the rare event an engine fails, you need the aircraft to be able to sit firm in the hover, particularly if you have someone on the hoist, and the H135 and H145 can do that," he emphasises. "Also, there's not a lot of money in this field, so putting together competitive contracts is important, and these two are the cheapest to support in their class."

#### Safe at sea

Maintaining wind towers is most crucial in winter, when power demands are greatest and disruptions lead to substantial revenue losses, but the heavy seas make boat trips a slower and often dangerous way to get technicians to a site.

"Both the 135 and 145 are EASA certified to fly in Sea State 6, meaning they can stay upright on a swell of four to six metres, whereas a transfer vessel only operates in waves of about two metres,"

Long says. "When it's really windy, a turbine is making money, so you need to get it back online, and the helicopter has a big advantage when it comes to doing that."

Germany's HTM is the biggest offshore wind operator in the world, and it is often called on to perform load-lifting missions, ferrying tools and equipment to turbines.

"The crew will carry their own personal tools in a bag and carry that down with them when they get to the turbine. The heavier tools will go in an underslung load, and you can get a load-lift kit underneath the 135 and 145 quite happily," Long explains.

For powerlines, the main activity is inspection, using helicopters fitted with high-grade cameras to check the lines quickly and efficiently. This is a mission for which a single-engine aircraft like the H125 is suitable.

A more exacting mission is repairs to lines and towers, which can involve crews working from a basket slung under the helicopter. Typically, the H135 is the Airbus type used for this role. "For this, you tend to use a twin-engine helicopter for safety because you have human external travel and people are working close to the power lines doing repairs," says Huin.

Then there is powerline construction and cable laying, where the heavier payloads needed call for the bigger helicopters, such as the Super Puma H215 and H225, with their external loads of 4.5 to 4.7 tonnes. Huin says Brazil is presenting the best opportunities for helicopter powerline projects, with more than 10,000 km of new lines planned for the next decade to bring power from dams to the cities. He is confident that helicopters will play a big part in that.

"If you construct a new powerline in the Amazonian forest, you tend to stick to the roads, but they may be S-shaped, so you do a longer line or cut a new track across the forest," he explains. "The helicopter allows you to make a straight line and, without the need for cranes and roads, you have much less intrusion and impact on the environment as well."



Airbus's Bill Long says that the H135 and H145 have the lowest support costs in their class, which is important when putting together a competitive tender for offshore wind farm contracts. (Photo: Airbus)

# UNMATCHED POWER & PRECISION

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#### **BUILT TO LIFT**

Unlike many of the helicopter types that perform load-lifting missions today, Kaman's K-MAX was designed specifically to undertake repetitive external lifting.

Having been certified by the FAA in 1994, the K-MAX entered commercial service as a logging helicopter, a role it still frequently performs. It's often employed on powerline and other construction projects, while its firefighting capabilities are utilised by the US Forest Service and others.

Kaman, the K-MAX's US-based manufacturer, has a long history of aerospace innovation, going back to the founding of the company by Charles Kaman in 1945, followed by the first flight of its K-125 helicopter in 1947. By 1954, it had produced the first twin-turbine-powered helicopter, and it pioneered pilotless flight with the HTK-1 in 1957.

Kaman has developed an unmanned version of the K-MAX, which has proven its worth by performing resupply and logistical support missions for the US Marine Corps in Afghanistan.

Today's K-MAX is powered by a Honeywell T53-17A-1 gas turbine engine and can reach a top speed of 185 kph unloaded, while it has the capability to carry an external load of up to 2.7 tonnes. It has an endurance of around three hours, and Kaman asserts that, with fuel consumption in the region of 320 litres per hour, the helicopter has the most efficient lift-to-fuel ratio in its class.

The K-MAX, which has no tail rotor and no hydraulics, requires less than two maintenance man-hours per flight hour. Kaman says it has achieved 99% availability across more than 372,000 flight hours.





Rotex undertakes a wide range of aerial construction work with its K-MAX helicopters, including ski-lift assembly. (Photo: Rotex)

For Leonardo, the offshore wind market is growing, and with installations increasing in size and moving further offshore, the company sees the demands placed on helicopters also growing. Nicolò Daffara, product marketing lead for the AW169, highlights that just operating over the sea brings its own challenges, such as needing to be able to ditch in up to Sea State 6 conditions.

Maintaining wind towers involves winching technicians down to the turbine, so hover stability is vital, and Daffara says the AW169 is the only aircraft in its weight class able to maintain altitude in the unlikely event that one engine fails.

"We designed the 169 specifically for this kind of mission, so even with one engine and winching a person on the wind turbine, it won't lose altitude," he confirms. "You have more than enough time to winch people back inside the helicopter, which is extremely important for this kind of market."

Unsurprisingly, wind farms are built in high-wind environments that present more challenges, but for the AW169 pilot, maintaining stability relies on just pressing the auto-hover button.

"All helicopters are unstable by definition and need an autopilot, and on the 169, the autopilot is designed and made in-house by Leonardo," Daffara explains. "We own the autopilot, and we know the behaviour of the aircraft very well, so we can introduce the features pilots need to perform their job.

"When it's performing hoisting operations, the 169 is capable of withstanding wind gusts of up to 40 knots crosswind, and if the wind is coming from the nose, you can do winching operations in up to 80 knots," he notes.

The AW169 is equipped with an obstacle proximity warning system which uses three LIDAR sensors mounted on the main rotorhead to generate a 360° view showing any obstacles within 25 metres of the blades, alerting the pilot both aurally and visually.

"With this system, you don't need to look outside to be aware of any obstacles around the rotor, which is extremely useful in highworkload situations," he says. "Think of it like the parking assistant in your car."

#### **Larger loads**

With operations moving further offshore, Daffara indicates that aircraft payload is another important factor, and he asserts that, with a maximum gross weight of 4.8 tonnes, the AW169 has the highest power-to-weight ratio in the light intermediate class.

"The 169 is a living programme, and we are extending its capabilities in 2021 with new performance packages which will increase payload by up to 300 kg," he adds. "Such an increase in a small weight class can make a big difference. We will be able to increase the payload by two passengers, which is especially important for offshore operations.

"Speaking about medium- to long-range missions, you need the payload to transport the people and a lot of fuel, plus reserve fuel for contingencies, so you must have a powerful machine," he points out. "Operators buy a helicopter to transport payload, and with a powerful helicopter like

#### **HEAVY LIFT/UTILITIES**

the 169, you can do more jobs in a much safer way than in the past."

The push towards greener energy is driving wind farm development, and there is much symmetry in using a modern and greener aircraft like the AW169, with its lower emissions, reduced noise levels and increased use of composite materials compared to older generation aircraft.

"We had an operator in the energy market who was able to perform the same mission with the 169 that was previously performed by a bigger machine, saving 15% in terms of emissions. And in my view, that's very, very important," concludes Daffara.

Specialising in forestry and heavy-lifting missions, Swiss company Rotex Helicopter started in 1997 with a Kaman K-MAX aircraft, and today, with its fleet of three, it remains the only K-MAX operator in Europe.

Starting out, the company focused on Switzerland, but as it added more aircraft, it spread its wings and now regularly operates in France, Italy and Germany as well. Rotex has bases in Switzerland and Liechtenstein. which gives it the flexibility to work all over Europe, according to project manager Valentin Molk.

"We don't work like a standard company where the helicopter returns to the base at the end of the day, because we always plan the work sites 'on tour' to avoid long overflights," Molk tells RotorHub. "We work in the French-speaking part of Switzerland at the beginning of the week, then go to France and then to northern Italy, before returning to Switzerland. Our crews leave on Monday and return on Friday, and the helicopters return to the base only for maintenance."

#### **Rapid response**

He adds: "With the base in Kägiswil in Switzerland, we can operate really fast in the French parts of the country, in France and in Italy; and from the base in Liechtenstein, we work a lot in the east of Switzerland, and in Austria, Germany and Italy."

Forestry work involves close cooperation with a ground team of cutters, climbers and flight assistants, and Molk explains that because the K-MAX generates very little downwash and is extremely quiet, it is well suited for this mission.

In tight situations around infrastructure or close to buildings, Molk says they attach a line to the tree from the helicopter and hover above while the cutter removes the tree at the base or scales it to take off a section. This solution is clean, with no heavy machinery needed on site or blocking of roads, and what could have taken a day is done in 15 minutes.

A major advantage of the K-MAX for forestry operations is that it can lift up to 2.7 tonnes, and it is one of the few helicopters with a maximum payload that is heavier than its own empty weight, which is 2.3 tonnes.

"A large part of our work is forestry, but we do any type of transport that is too heavy for standard helicopters, like excavators or big compressors," Molk says. "We also do a lot of assembly work for powerlines and ski lifts. With over 40,000 flight hours, we are the K-MAX specialists in Europe."



# ROTORS FOR RENT

elicopter lessors have faced their fair share of challenges over the past couple of years, with the impact of the drastic downturn in the oil and gas sector exacerbated more recently by the ongoing COVID-19 pandemic. Many major lessors, however, are positive in their outlook and believe they are well positioned to weather the storm.

While helicopter values are faring poorly in the current climate, the situation for lessors is "less dire, perhaps, than it has been previously", according to Sharon Desfor, chairman of helicopter appraiser HeliValues. "Some of the small lessors are selling off their portfolios or parts of their portfolios. On the one hand, it's a good business call in most of the cases. On the other, it is one more contributing factor in the glut of available helicopters," she explains.

#### **Risk management**

To ride out the ongoing storm, it is vital for lessors to access capital above all else. "With enough capital, there are terrific deals available on pre-owned helicopters. With enough capital, lessors can withstand downturns," Desfor emphasises. Market sector diversification and geographical diversification are also crucial, helping lessors to spread risk.

Alastair Fallon, helicopter aviation analyst at consultancy IBA, concurs, adding long leases and flexibility to the factors for success. He stresses the importance of having assets that will "keep an income stream up and running during the lean, unpredictable times", and notes that "having platforms that can move from one sector to another reasonably quickly and with little downtime or costly reconfiguration is essential".

"Lessors need a variety of assets to match the marketplace needs. Those who are overexposed to sectors such as offshore oil and gas can feel the bell toll and business opportunities dry up," Fallon warns.

Japanese aircraft leasing company ITC-AeroLeasing believes it has all the factors in place to help it through this difficult period, pointing to strong financial backing from an established group of financiers and investors. It says its unique structure, whereby it sources Japanese equity investors to fund 100% of the aircraft being purchased and leased, as opposed to 20-30% equity from Japanese investors and 70-80% debt from others, means it can provide flexible operating The helicopter leasing sector hasn't had an easy time of it in recent years, with aircraft values hit hard and COVID-19 now having an impact as well. **Emma Kelly** finds out how leading lessors plan to prosper despite the testing market conditions.

Below: Milestone Aviation has a diverse fleet of more than 330 helicopters, including H145s. (Photo: Airbus)



leasing and financing solutions for new and pre-owned aircraft.

Its current portfolio of 60 aircraft – 60% rotary-wing – operate in emergency medical services (EMS), passenger transport, government/special ops and utility roles in the US, Europe, Australasia and Asia. The helicopter types it finances range from light singles, including the Bell 407, H125 and H130, through to heavy twins, such as the AS332L1 and EC225. "We do not order aircraft from OEMs speculatively without having a confirmed end user," ITC explains.

It concedes that the market "remains challenging", but adds that "a certain amount of demand is there, particularly for refinancing and sale/leaseback opportunities". With its financing model, ITC says it has not been negatively impacted when it comes to access to capital. "We



have actually recognised an increase in demand for deals," it notes.

ITC is not currently involved in the offshore market, with its main focus being the EMS sector. While COVID-19 has affected all of its lessees to some extent, most of its customers have been operating with minimal interruption. The company is monitoring other sectors, including power generation, wind farm transportation and firefighting, for future growth.

Continued diversification will be vital going forward, ITC says. "We have always complemented our service offerings with aircraft brokerage, marketing, sales, auctions and advisory services for a wide variety of aircraft models. We remain continually active with all aspects of these services, and we are acutely aware of the importance of diversity, flexibility and adaptability during these challenging times."

#### **Expert opinion**

Similarly, helicopter lessor Milestone Aviation, a subsidiary of GE Capital Aviation Services, has evolved and refined its product offering and expertise in response to changing conditions. "Milestone quickly adopted the mindset that a core competence required in this industry is to be an 'asset manager' and not just a 'financier'," explains its CEO, Pat Sheedy. The company has dramatically improved its technical capabilities, for instance, managing approximately 50 aircraft transitions/deliveries each year and, as a result, developing "deep knowledge in reconfiguration, maintenance and support solutions".

As an example, Sheedy points to the redeployment of its H225 fleet from oil and gas operations to utility roles, working

#### LONG ROAD TO RECOVERY FOR HELICOPTER VALUES

While helicopter lessors are optimistic about the future, those involved with helicopter values are not, as the oil situation and COVID-19 continue to send values on a downward spiral, with little sign of a reversal in direction.

The latest information released by helicopter valuation expert HeliValues provides little cause for optimism in relation to values, with its third-quarter 2020 Blue Book update, released in mid-December, littered with downward arrows.

"Much as we'd all hoped to start seeing some improvement in overall helicopter economics, we're sadly not there yet," states Jason Kmiecik, HeliValues' president, in his commentary. "There is a moderate amount of activity and interest, but values remain stubbornly low and are still falling for the most part."

The few models that have managed to hold their value are those traditionally engaged in EMS, he says, while some newer types with little or no active supply, such as the Leonardo AW169, and the Bell 505, 407GXP and 407GXi, are

with Air Center Helicopters and the OEM. "We successfully reconfigured a large portion of our H225 fleet so it could be operated in utility missions across the world. Back in 2016, not many people believed we could get it done, but we worked hard with

our partners, invested in the platform when others were fire-selling, and we are now seeing increasing demand that confirms our strategy."

Milestone has a fleet of more than 330 rotary-wing aircraft, valued at over US\$5 billion, ranging from light-twin AW169s and H145s to heavy S-92s and H225s, along with a loan portfolio of approximately \$300 million. It supports more than 40 customers in 35-plus countries, with its aircraft operating in offshore transport, SAR, EMS, police surveillance and utility roles. "weathering the storm". AS350 values, which had previously held up, are "starting to collapse under the strain of 2020", Kmiecik observes, and the Sikorsky S-76, one of the workhorses of the offshore transportation business, is continuing its decline.

The past year was particularly brutal for heavy helicopters, according to Alastair Fallon, helicopter aviation analyst at consultancy IBA. "Heavy helicopter values really took a pummelling during the first half of 2020, with oversupply and falling utilisation. The H225, still transitioning from its once major role as an offshore support helicopter on parity with the S-92 to secondary roles such as SAR and heavy lift, took up many of the options for retiring S-92s," he explains.

Medium helicopters have fared better, while light twins in EMS configuration have held their value the best, Fallon confirms.

Sharon Desfor, chairman of HeliValues, paints a gloomy values picture looking ahead. "While there is some activity, some deals closing, some interest in the available inventory of helicopters, we just haven't

Most recently, Milestone announced plans to add six Airbus H160s to its orderbook, for delivery from 2023. The lessor believes that the new type will be a valuable addition to its fleet, capable of use in several missions. seen any real improvement in value," she says.

"This is going to hurt to hear, but I wouldn't necessarily assume normalisation during our professional lives, unless the market finds a brand-new usage for helicopters. Operators and their clients have become very efficient, which means there are far more helicopters in the world than we can actually use.

"With that said, however, remember that investment bankers have a relatively short shelf life, and within the next 20 years there will be a new generation of financiers looking for a place to put money who won't have learned the lessons from today," Desfor adds.

The situation is not helped by the fact that helicopter values continue to be linked to the price of oil. "That link is truly unreasonable in this age and should no longer be the global standard, and yet it still is," she notes. "There is no logical reason why offshore oil support helicopters should determine the values of the other 25,000 turbine helicopters in the world, and yet they do."

Some 60% of its exposure is in the oil and gas industry – its most "challenged" market – with the remaining 40% supporting mission-critical services which are generally backed by governmental contracts. Such diversification has been a

priority for Milestone over the last five years and will continue to be so as the company moves forward.

"There are definitely sectors of the helicopter leasing market that can be considered challenges, and these sectors largely reflect exposure to oil and gas markets. However, there are many segments in the leasing landscape, including EMS

ITC-AeroLeasing's rotary-wing portfolio ranges from light single-engine types, such as the Bell 206L-4 and 407, to heavy twins. (Photo: ITC)



and SAR, which have not faced the same challenges," Sheedy confirms.

While pre-COVID there were positive leading indicators for a recovery in the oil and gas sector, it's too early to be confident about the timing and scale of recovery, he says. On the positive side, flight hours in the sector increased in the third and fourth quarters of 2020 to pre-COVID levels.

#### **Flexible financing**

"Our industry is used to dealing with challenging environments and periods of volatility," he notes, adding that Milestone's response is to be very selective in where it deploys capital.

Sheedy believes that Milestone's biggest advantage in dealing with the current situation is that its business model allows it to support customers with flexible solutions. He highlights as an example the recent delivery of an S-92 to Caverton Helicopters – the first of the type to be operated by Caverton and the first to be operated by a locally owned African company.



"Not only did our solution provide Caverton with the helicopter, but also with full entry-into-service package financing," Sheedy observes.

"It was a really important transaction for both Milestone and the industry, cultivating a new operator for this aircraft type and expanding the global footprint." The past year was an eventful but positive one for LCI, according to its CEO, Jaspal Jandu, with the lessor finalising a number of helicopter leasing partnerships to shore up its position and support further portfolio growth. Its portfolio currently comprises 90 helicopters, owned and managed, valued at nearly \$1 billion.

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in Australia for HEMS and SAR operations. (Photo: LCI)

Around 60% are modern twins such as AW169s and AW139s, with the remainder spread across the weight classes.

In May 2020, LCI announced that it had established a helicopter co-investment vehicle in partnership with Thora Capital and RIVE Private Investment. The agreement covered six AW139s and three Airbus H130s, all of which had long-term, secure debt financing in place. This followed on from the launch of a similar co-investment vehicle with Flexam Tangible Asset Income Fund a few months earlier.

#### Appealing aircraft

Before the year had ended, LCI had also agreed a new joint venture with Sumitomo Mitsui Finance and Leasing that involved an initial acquisition of 19 helicopters valued at \$230 million to be used in EMS, SAR and offshore wind farm transportation. "Our joint ventures with blue-chip business partners highlight the opportunities available in the helicopter leasing marketplace and demonstrate how these aircraft have now become a proven and attractive asset class," says Jandu. Further such partnerships and joint ventures could follow, he adds.

LCI's limited exposure to the oil and gas sector – 35% of its business – means it has come through the last few years better than some of its competitors. The other 65% largely relates to EMS, SAR, offshore wind farm, marine pilot transfer and passenger/ utility operations. "Currently, all of our helicopters are on lease or under LOI [letter of intent], which reflects the rather resilient market," notes Jandu.

While COVID-19 and the oil price developments at the start of 2020 impacted the helicopter business, the effect was relatively minor compared with other sectors, such as commercial fixed-wing aviation, he says, thanks to the variety in the end user base, the nature of helicopter operations and the adaptability of helicopters to different roles.

"The snapshot today is a fairly positive one, with utilisation in most segments we track now back to pre-COVID levels, and in some cases improved. The mission-critical nature of these types of helicopter operations has really been demonstrated over the past year," he adds.

#### **Growth strategy**

Jandu says LCI's business plan has always been based on diversification, "with a primary focus on risk mitigation and a very careful approach to shaping our portfolio". He adds: "This has certainly played to our advantage this year and through the down cycle over the last few years as we successfully navigated a difficult playing field that has been characterised by a number of bankruptcies."

LCl intends to continue with this approach and plans "an aggressive fleet growth strategy" focused on newer, twin-engine types with a large customer base and multiple mission capabilities.

In particular, the offshore wind market is set to feature prominently in the company's plans. LCI was one of the first lessors in this sector, initially in the North Sea, but it is keen to broaden into new markets, especially in Asia, with Taiwan, China and Japan all developing wind energy.

A buoyant Jandu concludes: "In short, we are very much open for business and are keen to grow at this time."



# We may well be on the threshold of a power revolution for the helicopter. The

conventional turbine engine may soon be running on biofuel or be replaced altogether by a hybrid electric powerplant. **Peter Donaldson** talks to engine manufacturers about the possibilities.

ver the last year, turbine engine manufacturers have had to cope with the effects of the pandemic and the oil price slump while delivering engines and support services. At the same time, they have been continuing the research and development activities that aim to meet the need for more power, reduced fuel consumption and lower carbon emissions through advanced technologies, such as biofuels and electrification.

Honeywell has striven to secure engine positions in military and commercial utility helicopters, allowing it to diversify its offerings and sustain levels of support to mitigate the impact of fewer orders for new helicopters, according to Brandon Van Atta, senior technical sales manager for propulsion systems at Honeywell Aerospace.

He cites the repair and overhaul contract for T55-GA-714A engines that power US Army Chinooks awarded last year that enabled Honeywell to double its shop overhaul capacity, which also provides opportunities to support T55 engines in surplus Chinooks in the civilian market.

#### **Remote working**

Nicolas Chabee, vice-president of marketing and sales for helicopter engines at Pratt & Whitney Canada (P&WC), stresses that, besides the need for rapid implementation of COVID safety measures, his company has faced challenges including border restrictions, supply chain issues and logistic



Safran's Aneto engine, in its 2,500 shp Aneto-1K form, powers Leonardo's AW189K. (Photo: Safran)

constraints that have hindered its ability to move engines and people. "But we have found solutions by working with our customers and suppliers," he says.

Although P&WC has had to alter its maintenance, repair and overhaul (MRO) activities to ensure COVID compliance, the company has been able to retain its overall capacity by finding alternative solutions across its network.

"We have deployed mobile customer service solutions to allow our local field support representatives to provide remote support where required by connecting through interactive video with customer mobile devices, having strategic inventory placed locally, including spare parts and rental engines, and working with third-party support providers," Chabee explains.

P&WC has been making extensive use of remote support technologies, in particular the digital inspection tool Onsight by Librestream. Launched in 2017, Onsight is an app that works with customers' iOS and Android devices, and offers features such as remote camera control, on-screen drawing and borescope connectivity, while providing enterprise-grade security.

#### **Open for business**

Safran Helicopter Engines has felt the pandemic's impact through fewer flight hours on its in-service engine fleet and a decline in orders from helicopter manufacturers, but the company has kept its design, production, customer support and MRO facilities open, while strictly observing health protocols, notes Bruno Bellanger, its executive vice-president for programmes. "We have learned to live with the virus while ensuring continuity of service for our customers and their missions, either in person or – with the help of digital tools – remotely."

Bellanger also emphasises that product development has continued. He says: "With our Arrano and Aneto engines now certified, we are ready to support the Airbus H160 and Leonardo AW189K entry into service. We are supporting Airbus in the

first development phase of its Guépard, a military variant of the H160."

In addition, he points out that Safran has continued to invest in new facilities, such as its CAP 2020 industrial campus that opened in February of last year.

In terms of turboshaft engine R&D, Van Atta emphasises Honeywell's work on condition-based maintenance programmes aimed at reducing the need for fixed overhaul intervals, along with modern engine controls and health and usage monitoring systems that together help create the foundation for the next generation of helicopters. For example, the US Army's Future Long Range Assault Aircraft is to be powered by a next-generation derivative of the T55-GA-714A core that incorporates new technologies.

Meanwhile, the company has recently completed the first round of compressor rig tests for the T55-GA-714C upgrade for the CH-47F Chinook helicopter. In these tests, reports Van Atta, the new compressor exceeded predictions for performance and efficiency, and is on its way to increasing power while reducing fuel consumption. The upgrade can be carried out either by installing a new-build engine or by modifying an existing engine.

The US Army's Chinook modernisation programme has resulted in several surplus

aircraft entering the civilian market, where they are now operating on US Forest Service firefighting contracts and flying on a variety of utility missions. "Honeywell is eager to support these operators, and to make sure that they have access to the product improvements and upgrades that we offer," Van Atta emphasises. "We also support these operators with repair and overhaul activities."

#### **Popular choice**

Following the success of Honeywell's HTS900 engine in the Eagle 407HP retrofit programme for Bell 407 helicopters, Van Atta reports growing demand for the 1,021

#### PREPARING FOR FUTURE PROPULSION NEEDS

Rolls-Royce has been a leader in helicopter engine development for many decades, and it is looking to maintain its strong position in the light turbine market, as Don Campbell, director of communications at Rolls-Royce North America, confirms.

"We continue to support our existing fleet and respond to demand for new orders of our M250 and RR300 engines despite the challenges of a global pandemic," Campbell says. "We enjoy positive long-term relationships with airframe OEMs and have experienced growth on a number of platforms."

He adds: "Rolls-Royce engines continue to deliver reliable power and performance – two attributes demanded by our helicopter customers. The low direct operating costs associated with our engines combined with our broad network of product support, through the FIRST Network, are particularly sought after by revenue-generating customers."

With regard to the manufacturer's current products for the helicopter market, Campbell says: "The Rolls-Royce M250-C47E is the latest evolution of our M250 commercial engine family. The engine combines several product improvements and state-of-the-art engine controls into a proven powerplant. The C47E boasts the power and performance improvements of the M250-C47B/8 engine, an additional accessory drive pad and the improved reliability of the new Small Gas Turbine FADEC.

"We are uniquely positioned in the market with our RR300 engine, and discussions are under way with other airframe OEMs



to expand the market reach. We are excited about the future of the RR300 engine, which provides exceptional reliability to customers."

As it looks ahead, much of Rolls-Royce's research is focused on reducing the environmental impact of propulsion systems, with fuel efficiency an obvious area for attention as it also impacts an operator's bottom line. "For our helicopter engine portfolio, our Value Improvement Package kit is one technology introduced to improve fuel economy in our M250 engines," Campbell notes. "With engine core design modifications, we've significantly enhanced air flow through the engine,

> which improves performance and drives fuel efficiency. We're pleased with the technology included in our CTS800 engine product family, which already offers a class-leading powerto-weight ratio and SFC [specific fuel consumption] capability.

> "In addition, we're developing hybrid capability through Rolls-Royce Electrical that will provide performance and fuel economy enhancements. Longer term, we see technology solutions around electrification gaining in market acceptance, leading to the benefits of reduced-to-zero local emissions."

Campbell concludes: "We expect electrification and distributed

propulsion to continue to emerge as revolutionary technologies with the potential to fundamentally change the VTOL and fixed-wing aircraft markets. This next-generation technology will require closer integration between the airframer and the propulsion system provider. Rolls-Royce is partnering with OEMs across the industry to ensure we are well positioned for this future."

shp turboshaft in the light single market, generated by the greater payloads it enables in hot and high conditions, more frugal fuel consumption and lower direct maintenance costs.

"Other platforms include the Kopter SH09 that is currently undergoing flight testing and certification," he adds. "Honeywell has reviewed other possible applications for this lightweight modern engine and continues to provide updated offerings to many aircraft manufacturers."

P&WC's focus for R&D into advanced gas turbine engines is on business, regional and general aviation, and on-board auxiliary power generation, in addition to helicopters, says Chabee. Its efforts have borne fruit most recently with new versions and applications of the PT6 and PW207 families. "In the helicopter market, we continue working with OEMs to understand the future of their business better and adapt



our research and development to them," he comments.

At the Dubai Airshow in 2019, the company announced that the PW207V had been chosen to power the VRT500, a five-seat light single-engine helicopter under development by VR-Technologies, which is part of Russian Helicopters. The new aircraft is being offered with eight basic configurations for roles including passenger transport, urban air mobility (UAM), cargo Honeywell's HTS900 is at the heart of Eagle Copters' 407HP conversion of the Bell 407. AirLife Denver was the first HEMS operator to benefit from the upgrade. (Photo: AirLife Denver)

and medevac, along with other public safety missions.

Chabee tells RotorHub that the VRT500 programme is on schedule despite the effects of the pandemic thanks to rapid implementation of mitigation plans, with final assembly taking

place in Italy.

"Both companies are optimistic that a first flight will take place in late 2021, barring any possible delays caused by COVID-19 in Italy over the coming months," he says. "Three development engines have been produced, with two in the process of being delivered to VR-Technologies."

The PT6 family has found applications in US government orders for military variants of commercial helicopters from Leonardo. ►



#### MAINTAINING MOMENTUM

While engine manufacturers develop the powerplant technology of the future, someone has to ensure that existing engines remain in working order. Euravia is one of the leading helicopter engine overhaul and repair companies currently in the market. Paul Sconce, its international business development manager, offers an insight into the work it regularly undertakes.

"We have the facilities to repair or overhaul at least five engines at any one time, and have additional service areas available for utilisation in peak periods," he explains. "Our core helicopter engine maintenance and associated services are focused on the Bell 212 and 412 models.

"We've a wide and varied customer base who bring their engines to us, which can be a result of in-field failures. Often, for known types, it can be oil leaks from the gearbox or power section failures which are the result of foreign object damage (FOD).

Euravia has extensive experience of working on Pratt & Whitney Canada's PT6 engine family. (Photo: Euravia)

The PT6B-37A will power the single-engined TH-73A (a derivative of the AW119 Koala) for the US Navy Advanced Helicopter Training System, and the PT6C-67C will be on board the twin-engined MH-139A Grey Wolf (an AW139 derivative) for the US Air Force.

#### **Alternative fuels**

All of the engine manufacturers who responded to RotorHub's questions have biofuel programmes aimed at reducing aviation's  $CO_2$  emissions. Honeywell, for example, offers its Green Jet Fuel, which can be made from a variety of sustainable feedstocks. When used as up to 50% of a blend with conventional fuel, it can reduce greenhouse gas emissions by 65% to 85%, says the company.

P&WC has a long-standing involvement with sustainable aviation fuel (SAF) through efforts including the Commercial Aviation Alternative Fuels Initiative, according to Chabee. He says that the company's engineers can design an engine to run on "We can perform all these repairs in accordance with Pratt & Whitney Canada's maintenance and overhaul manuals," he says. "If it happens to be an in-field FOD repair, it can prove a real challenge simply due to the limited access we may have. So we try and get the engine back to the shop if we can. But if we can't, we've a Mobile Repair Team (MRT) that's ready to go 24/7 and can travel internationally, if required.

"The MRT is equipped with a standard tool kit dependent on the repair or service Euravia is offering. Within our team are four technicians who are each fully approved by EASA, the FAA and the UK's CAA for in-field repairs on the PT6 power unit commonly used in several helicopter types," Sconce notes.



nearly any fuel, such as kerosene-like SAF, hydrogen and methane, and that many of its engines are qualified and flying with biofuel blends. He emphasises that the major challenges today are in production, transportation and storage.

"SAF offers great potential as a carbon-neutral source of fuel over its life cycle, provided that alternative fuels are produced using sustainable power sources," Chabee concludes.

Safran has ramped up its SAF efforts over the last year, as Bellanger explains. "All our engines have been certified to run with as much as 50% drop-in alternative fuel, including biofuel. We have just launched a dedicated project, with several other aerospace key players, in order to evaluate the opportunity to burn as much as 100% sustainable alternative fuel in the near future," he says.

"To move towards 100%, we will have to resolve problems concerning the lifespan of seals and pumps, and make sure we have an efficient combustion. Emissions of other pollutants, such as NOx or soot, are also being investigated since the chemistry of the fuel will be modified."

The company is looking to develop large-scale production capacity for SAF. In March 2020, it began working with partners in south-west France to evaluate local capabilities and skills in agriculture, chemicals and energy, and to gauge the feasibility of production and distribution of aviation biofuels.

In addition, Safran is running several research projects to determine the feasibility of using liquid hydrogen as turbine engine fuel, which would eliminate in-flight emissions but is challenging, as Bellanger cautions. "It means tackling a number of complex technical issues, especially in terms of the entire helicopter fuel chain – storage and distribution – and certification."

#### **Hybrid hopes**

Electrification is another major R&D theme for aviation powerplants, and rotorcraft are no exception, particularly for UAM.

Van Atta says that Honeywell has electric power solutions up to the megawatt level and multiple options for mating generators to its existing and developmental engines to power rotorcraft, UAM vehicles and fixedwing aircraft. "The current challenge for OEMs is to accomplish the trade-off studies based on their mission profiles – flight duration, altitude, operating environment, aircraft weight and the electrical power needs," he notes.

"Honeywell has created a state-of-the-art mission analysis tool that can be tailored to unique customer specifications and requirements, and will be ready with hybrid electric power solutions of all ranges. We have engaged with several customers across the industry and are excited to see where this goes."

P&WC is considering hybrid electric power as one of several promising architectures and energy sources. Chabee cautions that helicopters are particularly weight-sensitive, so the added mass of batteries, for example, is a challenge for energy storage, and that retrofits are tough because they also raise centre-of-gravity issues. It is new designs, therefore, that hold the greatest promise of getting the best from new propulsion system architectures.

Hybrid systems offer exciting possibilities for variable antitorque and drag reduction schemes as well as propulsion and flight control, he adds.

Safran's Bellanger is particularly forthright, stating: "We believe that the future of helicopter propulsion lies in the efficient hybridisation of thermal and electrical power sources."

Working with sister companies, Safran has successfully ground-tested a hybrid system that enables a pilot to 'pause' one engine in cruise flight while the other engine supplies full power, a setting at which its specific fuel consumption is better than at half power, for example. Bellanger indicates that a fuel saving of around 15% can be achieved, with a commensurate increase in range. When the paused engine is needed again, it can be rapidly spun up to full power with the aid of an electric motor. The system is due to be tested in flight soon on Airbus Helicopters'



RACER high-speed compound helicopter technology demonstrator.

An option for single-engine helicopters, Bellanger indicates, is an emergency electric power system that, in the event of an engine failure, can provide several minutes of pure electric flight, making it easier for the pilot to make an emergency landing. The system can also supplement the engine on take-off to reduce local emissions at a heliport, for example.

For new classes of aircraft such as multi-rotor UAM vehicles, distributed hybrid

Powered by two Safran Aneto-1X engines, the Airbus RACER demonstrator will feature a hybrid system enabling one engine to be 'paused' in flight to save fuel and then rapidly spooled up by an electric motor. (Image: Airbus)

electric propulsion systems (HEPS) are an option in which a turbo-generator and batteries send current to multiple rotors/propellers as needed for

lift and propulsion, governed by a power management computer. Safran groundtested a 100 kW HEPS in 2018, showing its technical feasibility. Bellanger says that flight tests are due in 2022 aboard the EcoPulse demonstrator developed in partnership with Airbus and Daher with French government funding. Meanwhile, more powerful turbo-generators are under test.

For the first time since the advent of the turboshaft engine, and despite the ongoing pandemic, a revolution in rotorcraft propulsion is brewing. ■

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# CITY HIGH FLYERS

There are still hurdles to overcome, but commercial urban air mobility services no longer seem a distant prospect. **Michael Doran** highlights some of the developers that are looking to turn long-envisioned eVTOL concepts into practical transport solutions very soon.

The Joby S4 received airworthiness approval from the US Air Force towards the end of 2020. (Photo: Joby Aviation)

#### URBAN AIR MOBILITY

he concept of vertical take-off and landing craft was around well before da Vinci's drawings of 1483, but it took until 1907 for French bicycle maker Paul Cornu to get the first man-carrying helicopter off the ground. Now, 114 years later, that elusive goal has morphed into electrically powered vertical take-off and landing (eVTOL) aircraft that can be flown with or without a pilot.

The last decade has seen many slick presentations, beautiful scale models, concept drawings and optimistic predictions, but why has so little concrete progress been made? After all, aren't they just small versions of the helicopters Igor Sikorsky started mass-producing in 1939, albeit with electric motors?

To answer those questions, RotorHub investigated three eVTOL pioneers that are making sustained and measurable progress: Joby Aviation in the US, Volocopter in Europe, and the Austro-Chinese partnership of FACC and EHang.

What they have in common is forming strategic associations with partners that have the resources and presence to drive them through that vital first step of regulatory certification, and thereafter onwards to gain the most important element of all – the social licence for public acceptance of air mobility services.

In the US, what might give eVTOLs a disciplined push towards commercialisation is their role in the United States Air Force (USAF) developmental programme

AFWERX Agility Prime.

The aim of this US\$35 million programme is to ensure that the USAF is involved in the development of eVTOLs so it has direct access to the technology, while also accelerating progress towards eVTOL use in both military and civilian applications.

"Agility Prime leverages unique USAF assets, such as test ranges, safety certifications and military missions capable of logging steady flight hours, to build confidence in the technology, attract investors and hopefully expedite domestic commercialisation," explains Will Roper, Air Force assistant secretary for acquisition, technology and logistics. In December 2020, the Agility Prime team announced that Joby Aviation's fourpassenger S4 eVTOL had been awarded the first airworthiness approval by the USAF, meaning it will be able to fly under a USAF contract in early 2021. These flights will provide an opportunity to assess the utility of the S4 in a range of missions and generate performance data to support the FAA certification process.

In a related development, a 'virtual' ground-breaking ceremony was held at Springfield-Beckley Airport in Ohio for a new urban air mobility facility housing an eVTOL simulator and charging stations to be used by Joby and fellow eVTOL manufacturer BETA Technologies. The facility is envisaged to become part of a network of charging stations in the north-east region that will enable long-distance flights by eVTOLs.

#### **Strong financial backing**

California-based Joby started work on its air taxi project in 2009. By 2017, it had produced and flown its first full-scale prototype, with flight testing of a production prototype beginning two years later.

The developer has attracted more than \$800 million in investment, most notably around \$400 million from Toyota and \$125 million from Uber, and claims to be the best-funded and most valuable company in the air taxi space.

In December, Joby acquired the Uber Elevate programme as part of a deal which also involved Uber investing \$75 million into the eVTOL developer. In addition, the two companies agreed to integrate their respective services into each other's apps in order to provide seamless integration between ground and air travel for their future customers.

Commenting at the time of the deal, Joby's founder and CEO, JoeBen Bevirt, said: "The team at Uber Elevate has not only played an important role in our industry, but they have also developed a remarkable set of software tools that build on more than a decade of experience enabling on-demand mobility. These tools and new team members will be invaluable to us as we accelerate our plans for commercial launch."

The Elevate team numbers around 80 employees, who have been working on the commercialisation of the project and so have knowledge of the other eVTOL manufacturers involved in the Uber Elevate programme, which include Bell, Boeing and Embraer, all direct competitors of Joby. Eric Allison, formerly the head of Uber Elevate, is joining Joby in the head of product role.

Speaking of Uber, at its 2019 Elevate Summit, the company announced that Melbourne, Australia, would be the first city outside the US to get Uber Air services, and indicated that trials would begin in 2020, with a commercial launch in 2023. Melbourne's bid was well supported by local government and tourism bodies, but ►



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Volocopter performed a demonstration flight over Singapore's Marina Bay in 2019. (Photo: Volocopter)

they have been left in the dark as to what will happen with the project following these recent changes.

Joby is planning to operate its own rideshare network and says it won't be selling its eVTOLs to other commercial operators, which will make recovering the significant development costs a longer and more difficult process. It's reported that the app-sharing agreement with Uber is not exclusive, meaning Joby can partner with other mobility platforms and Uber can partner with other aircraft manufacturers on its platform.

#### Quick trip to the beach

The S4 is equipped with six electric propellers, and Joby claims it can carry a pilot and four passengers 150 miles at speeds of up to 200 mph on a single battery charge. It illustrates this on its website by showing a journey from Los Angeles International Airport to Newport Beach taking 15 minutes by air taxi, compared to 76 minutes by road.

Of all the start-ups in the eVTOL space, it seems that Joby is the leader on the pathway to certification and introducing air mobility services. It has formed partnerships with other key players, such as the USAF, Toyota and Uber, and has the funding sources to see the project through.

The company has the opportunity to have its aircraft carrying passengers on services

for the USAF in 2021, and the learnings and experience gained from that will surely help it towards its goal of FAA certification in 2023.

In the meantime, Joby can call on the manufacturing expertise of Toyota to help it design a 'factory of the future' to build its aircraft and, when services begin, it will be able to tap into the millions of customers who use Uber's ride-sharing platform.

In September 2020, German company Volocopter opened bookings for the first sale of tickets for its air taxi service, and the 1,000 tickets quickly sold out. Along with some memorabilia, each ticket covers a 15-minute flight scheduled within the first 12 months after commercial launch.

Announcing the sale, Volocopter's CEO, Florian Reuter, said: "Based on our public test flights and regulatory achievement record, we have paved the way to make electric flight in cities common in just a few years. With the start of reservations, we now invite our supporters and innovators around the world to join us and be amongst the first to experience this new and exciting form of mobility."

For those who managed to get a ticket, their chances of actually flying on the VoloCity were boosted in December when Volocopter made the commitment to begin air taxi services in Singapore by 2023.

Volocopter opened a Singapore office in 2019, and since then it has been

collaborating on the project with the Singapore Economic Development Board and the Civil Aviation Authority of Singapore (CAAS). To show its progress and give locals a taste of what's to come, the company performed a demonstration flight in 2019 over Marina Bay in the heart of Singapore.

While Volocopter has EASA Design Organisation Approval, the only eVTOL start-up to have gained it, the company will need to achieve type certification before it can begin commercial flights. That effort will be simplified by an agreement that enables CAAS to validate EASA type certifications concurrently with the European agency's certification process, rather than after its completion.

In a sign of government support, Tan Kah Han, senior director of the Unmanned Systems Group at CAAS, commented: "In this new area of urban air mobility, we look forward to continuing to work with Volocopter. This gives us the opportunity to co-create regulations and technologies with the industry, facilitating innovation to enable a future mode of transportation for Singapore."

Volocopter will build a team of 50 pilots, engineers, operations specialists and managers, and expects to hire more than 200 employees in Singapore to manage a network of routes by 2026.

#### Japanese cargo carriers

Adding to its Asian presence, Volocopter has also entered into a cooperation agreement with Japan Airlines to bring electric air taxis and cargo drones to the market. In February 2020, the Japan Airlines Innovation Fund invested in Volocopter, and the new agreement will lead to the two companies jointly exploring business opportunities for eVTOL air mobility services in Japan.

Sceptics often say that eVTOLs will be a product without a market, but while the jury is still out on air taxi rides, one vital service provider has done its own study and believes the technology is exactly what it is looking for.

German air rescue organisation ADAC Luftrettung spent two years doing a feasibility study on using piloted multicopters in rescue services and concluded that it "is possible, makes sense and improves the emergency medical care of the population".

#### **URBAN AIR MOBILITY**



German air rescue service ADAC has reserved two VoloCity eVTOLs, which it will use to transport medical personnel to incidents quickly. (Image: ADAC)

ADAC operates a fleet of more than 50 helicopters from 37 bases. The role it has in mind for eVTOLs is the rapid transportation of emergency doctors to a scene. Its study showed that piloted multicopters could get doctors to incidents far faster than ground vehicles, particularly in rural regions, and that their use would enable more efficient tasking of its rescue helicopter fleet.

Initially at least, there is no suggestion that eVTOLs would be used to transport patients, so their role would be to complement the work of rescue helicopters, rather than directly replace them.

In December last year, following on from the study, ADAC reserved two VoloCity eVTOLs for use in emergency medical services. Over the next two years, it will conduct flight tests with Volocopter in preparation for operational testing in 2023.

"After the ground-breaking results of our feasibility study, we are expanding our technological lead with regards to integrating multicopters in rescue services, and Volocopter is the only eVTOL on the market that is advanced enough to reliably plan a test programme with for our purposes," noted Frederic Bruder, ADAC Luftrettung's managing director.

Both Joby and Volocopter are focused on bringing piloted eVTOLs to the market, and although they may see autonomous flight on their horizons, they are not talking about the certification of such technology just yet. However, the strategic partnership between Austrian aerospace company FACC and China's EHang, which describes itself as the world's leading autonomous aerial vehicle (AAV) technology platform company, is moving along a path towards autonomous flight.

In November 2020, at the FACC site in St Martin im Innkreis in Upper Austria, the unmanned EHang 216 AAV took off and flew using automated flight programming, performing well in the severe cold and high-wind conditions, before landing safely.

It was the first test flight of the EHang 216 in open EASA airspace and involved supervision by Austro Control, Austria's air traffic management body. The successful outcome led to the granting of an experimental flight permit by the Austrian authorities. FACC says this will enable it to work with its industry partners, research institutions and aviation authorities to advance its flight test activities.

These efforts complement work already done in China, where, after several thousand manned flight hours, the AAV received the world's first commercial operation approval for logistics purposes from the Civil Aviation Administration of China.

#### Winning public acceptance

Based on what Joby, Volocopter and the FACC/EHang partnership have achieved, it seems quite likely that they will gain regulatory certification for their new aircraft by 2023, but the issue that remains is whether the public will grant the social licence needed for authorities to allow air mobility in their cities.

Most importantly, will public confidence in eVTOL performance and safety be high enough for people to want to use them, and will winning that confidence be a tougher challenge to overcome than any technical issues surmounted in building the aircraft?

There is a place for eVTOLs and air mobility in our transport ecosystem, but the hype around air taxis has not been helpful at this embryonic stage. It will be more effective to prove and certify what eVTOLs can safely do, be it rapid-response medical services, last-mile deliveries or in the military, and then let the applications, like public transport, follow in their own good time.



# A European perspective

In future editions of RotorHub, the European Helicopter Association will be giving regular updates on issues affecting the European rotorcraft community and the organisation's efforts to address them. In this first article, the EHA team provides an introduction to the Association's activities and its priorities for 2021.

he European Helicopter Association (EHA) represents the rotorcraft community in 11 countries across Europe. It is comprised of a large, enthusiastic and committed community of experts in rotorcraft matters.

EHA members include national helicopter associations and operators from Germany, Italy, France, Spain, Austria, Switzerland, Denmark, Luxembourg, Norway, Sweden and the United Kingdom, along with leading OEMs Airbus, Bell, Leonardo, Safran and Kopter. HeliOffshore, the offshore helicopter industry safety organisation, is also among its members. The EHA provides direct access to the political sphere of European and international institutions, networking opportunities with hundreds of experts, and information on the latest events and issues affecting the rotorcraft sector. It also influences the system by providing direct input to the regulatory and political processes. The main areas of activity of the EHA include:

- safety;
- regulation for example, participation in ICAO and EASA advisory boards, EASA's European Plan for Aviation Safety (EPAS), and the SESAR Joint Undertaking;

- financing enabling opportunities for funding and incentives;
- innovation fostering innovation aimed at enhancing the sustainability and safety of the vertical-lift market;
- data collection to inform business intelligence.

The promotion of rotorcraft safety remains of the utmost importance for all the members of the EHA. Together with other stakeholders, they were involved in defining the European Rotorcraft Safety Roadmap and its updates, showing that the industry is continuously supporting the development of the different workstreams within EASA.

#### **Rewriting the rules**

In the past months, the EHA has also supported the EASA survey on the undue administrative burden of small helicopter operators. The results of the survey will hopefully enable the European agency to take the correct measures to reduce the administrative and financial burden on such operators.

By providing voluntary experts, the EHA supports several EASA rulemaking tasks (RMTs), including RMT.0194, 'Modernisation and simplification of the European pilot licensing and training system', which aims to improve the supply of competent flight instructors and extend the principles of threat and error management to all licences and ratings.



#### EHA UPDATE



Within the scope of the training devices workstream, the EHA was able to provide experts for RMT.0196, 'Update of flight simulation training device requirements'.

Independent from the Rotorcraft Safety Roadmap, RMT.0318 concerning the operation of single-engine helicopters is also still on the EHA radar, although in the EPAS 2021-2025 programme, this RMT is indicated to be assessed in the future edition of EASA's Best Intervention Strategy for rotorcraft. Further updates will be given in the next Rotorcraft Committee meeting.

The agency has expressed a willingness to continue working on such tasks, albeit with reduced speed and prioritisation, caused by the limited available resources (both at EASA and member states level) under the current circumstances.

#### **Flight risk**

In this regard, EHA experts are currently involved in the matter of the safety of COVID vaccine transportation, which might occur through helicopters in remote areas. The EHA recently raised with the European legislator the issue of dangerous air cargo applications for vaccine transport.

Some states are indeed planning to use helicopters for some part of the transportation, such as the last leg to a remote island. The vaccines will go to the airport, and the question is how to guarantee their transportation to the destination quickly while maintaining a very low temperature (-80°C). There are several issues that need consideration, such as dry-ice carriage and CO<sub>2</sub> escape. The main questions posed include whether the drug itself will be considered a biohazard and, if that is the case, whether operators will then need a dangerous air cargo approval. EHA experts are working on this subject together with EASA to provide specific answers soon.

The need to change FCL.065, commonly known as the Age 60 rule, is still on the

EHA's agenda too. The positive news is that the rule-change proposal will now be included in RMT.0287, 'Updating Part-MED'. Unfortunately, the impact of the change will not be effective before the end of 2023.

In partnership with EASA, the EHA is behind the wheel of EUROPEAN ROTORS, the VTOL show and safety conference, which will be launched with its first edition in Cologne on 16-18 November 2021. The new event will be a unique platform offering the industry an exhibition where all stakeholders, including OEMs, suppliers and operators, can gather to do business and share knowledge, while also having the opportunity to liaise directly with the European regulator.

Until the pandemic subsides and we can finally meet face to face, the EUROPEAN ROTORS Digital Series has been set up to keep the rotorcraft community connected, provide educational content and offer knowledge transfer on a regular basis. In the form of panels, presentations and interviews, the Digital Series covers topics that are highly relevant to the community, such as eVTOL propulsion systems, funding opportunities for the rotorcraft industry and a rotorcraft market overview.

To watch previous and upcoming videos, visit www.europeanrotors.eu/programme/ european-rotors-digital-series.

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# ... DART Aerospace's Alain Madore

Drawing on its extensive engineering and certification expertise, DART Aerospace has established itself as a leading supplier of mission equipment and replacement parts to the helicopter industry. President and CEO Alain Madore explains how DART keeps hitting the bullseye.

### What does DART Aerospace provide to the helicopter industry?

We provide industry-leading design, manufacturing and market-certified solutions for the helicopter and wider aerospace industry. With an impressive line-up of over 1,100 STCs, we offer a comprehensive portfolio of mission equipment and related services, replacement parts and tooling for civil and military operators, all major rotorcraft OEMs, completion centres and MRO facilities.

DART's key products include flotation systems, landing gears, interior and exterior accessories, cargo expansion, external load equipment, cable cutters and filters. We have extensive engineering capabilities and manufacturing centres that allow us to deliver fast-time-to-market solutions, along with superior customer support in over 120 countries worldwide.

### How has DART's business developed over the years?

DART was founded in 1975 to perform one-off engineering approvals. After a while, we realised there was a growing demand for these approvals, and often demand for approvals of many similar products. In 1993, we started manufacturing our own kits to provide 'off-the-shelf' solutions to customers. We applied directly for STC approvals for these kits, which allowed us to provide a wider range of kits to customers around the world on a recurring basis.

Today, DART continues to define the future of safety-enhancing and cost-effective equipment in various markets such as offshore and aerial firefighting. We offer solutions that increase safety and help operators stay mission-ready.

#### Can you explain the design and certification process for a piece of specialist equipment?

DART excels in two different ways. The first is through design, certification and manufacture of aftermarket STC kits, and the second is working directly with OEMs to help design mission equipment required by operators around the world.

On the aftermarket side, the process starts by designing the modification in accordance with constraints and criteria that are developed based on our own experience or by talking to customers. We then approach the regulator, typically Transport Canada (TCCA) or the FAA, to present a certification plan for the proposed design change.

After the certification basis has been agreed, we complete the required analysis and tests to prove the modification is compliant. When the regulating authority is satisfied, they will issue an STC for the modification. Once that has been issued, DART can then apply for validation of the STC in other countries, based on the bilateral agreements that exist between the different jurisdictions.

Over the years, we have developed strong relationships with the regulatory authorities. Those relationships and the fact that we have several delegates on staff who can make findings of compliance on behalf of TCCA/FAA have helped DART differentiate itself and stand out as a leader in the helicopter aftermarket industry.



### What sort of relationship do you have with helicopter OEMs?

Although the aftermarket is really part of DART's DNA and remains so to this day, we have developed strong relationships with OEMs over the years by providing them with high-performance mission equipment. OEMs appreciate our connections with helicopter owners and operators, and our ability to design, manufacture and certify high-quality products that fit their specific needs.

#### In terms of the future, what areas would DART like to move into within the helicopter market?

Since 2019, we have embarked on a new growth journey through mergers and acquisitions with the aim of broadening our product offering in the helicopter market and expanding into aerospace mission-critical equipment.

With our strengths such as our strong brand, a global commercial force, and a unique design and certification expertise, backed by financially strong new owners, we have already broadened our product portfolio through the acquisition of Simplex and Aero Design. This has allowed us to add not only new, high-quality products to our line, but also the skill and institutional knowledge of the very people who brought these products to market.

We are committed to continuing this accelerated growth through consolidation. By strengthening our product offering, we are reinforcing our leadership position in the helicopter aftermarket mission equipment and replacement part business.





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