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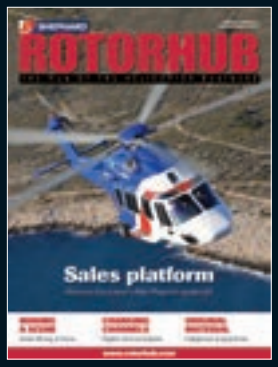
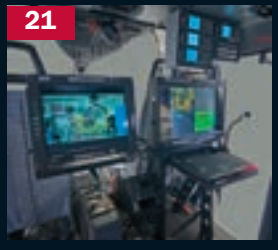


Cover story 8
An EC175 in the colours of launch customer Bristow. (Photo: Eurocopter)



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Report card

Heading over to Paris for Eurocopter's annual courting of the press is usually a good barometer of not only the health of the company itself, but the state of the wider civil helicopter sector.

At this year's event, the OEM reported that it had reached €6.3 billion ($8.4 billion) in sales in 2012, up from the €5.4 billion generated the previous year. While deliveries dropped to 475 aircraft from the 503 handed over in 2011, many of these were larger models purchased by oil and gas customers and the military.

Eurocopter's CEO Lutz Bertling described 2013 as a 'year of execution', with the company targeting a 15% delivery increase as a number of key programmes ramp up. He also noted that particular attention would be paid to shoring up its supply chain, as well as further increasing its services business.

No surprises

When it came to predicted growth areas, there were few surprises, with Bertling expecting the main gains to come from Asia, which is forecast to become the largest market within the next two to four years. The role of China in this remains uncertain, with no firm indication of when the current airspace restrictions will be lifted.

In India, Eurocopter claims a 43% share of registered deliveries and 70% of new civil helicopter bookings – although it should be noted that this is based on orders for only 12 aircraft (including nine EC135s) in 2012, highlighting the fledging nature of the sector there.

Another key market is Brazil, where Eurocopter faces fresh competition from AgustaWestland following its recent partnership announcement with Embraer (see p6).

When asked about the challenge, Bertling predictably pointed to Eurocopter's long history in Brazil. Indeed, AgustaWestland and Embraer have some catching up to do. Speaking at the opening ceremony of the new final assembly line for the EC725 at Itajubá in October, Bertling confirmed that Helibras will design and develop an indigenous helicopter by the mid-2020s.

In the battle to be the biggest, Sikorsky dropped behind somewhat in 2012, seeing its turnover decrease to $6.79 billion, down by 7.7% from $7.35 billion the previous year. The company delivered 243 rotorcraft during this period, with the military Black Hawk and its derivatives comprising the majority of these.

Up close and personal

However, despite its name being synonymous with the history of the helicopter, Sikorsky currently only accounts for 4% of the civil market. Allowing the rotary-wing community to get up close and personal with the long-delayed S-76D may go some way to injecting fresh impetus in the company's pursuit of a wider share of the commercial sector.

As former Sikorsky president Jeff Pino admitted at last year's Heli-Expo, the company also has a gap in its portfolio between the 12-seat S-76D and the 19-seat S-92.

With AgustaWestland, Bell and Eurocopter all pursuing the 'super medium' category, which is considered essential in securing future oil and gas business, he noted that the company was studying the viability of a further aircraft in that weight class.

At the heavier end of the market, Eurocopter's current problems with the EC225 (see p4) may have left the door open for Sikorsky to regain claims to the top spot. Every week that goes by with the type unable to fly offshore further erodes the reputation of the European helicopter giant, and provides an easy sales pitch for reps promoting the S-92.

As usual, we are looking forward to seeing how the heads of the various manufacturers spin these positions during Heli-Expo.

Tony Skinner, Editor

NEXT ISSUE
- Interiors
- Simulators
- Latin American market
- SAR operations

EC225 to return to service in April, says Eurocopter

Operators like CHC could be flying EC225s over the North Sea again by April. (Photo: Eurocopter)

Eurocopter hopes to clear the EC225 for a full return to service in April, after cracks in the aircraft's main gearbox (MGB) caused the ditching of two aircraft in 2012 and the subsequent grounding of the North Sea fleet.

In October, a circumferential crack in the bevel gear vertical shaft resulted in the ditching of a CHC Scotia EC225 (G-CHCN) in the North Sea, some 60km southwest of the Shetland Islands. It followed a similar incident in May, which brought down a Bond EC225 (G-REDW).

Speaking at a press conference in Paris on 24 January, Eurocopter president and CEO Lutz Bertling said getting the EC225 back in service was a key task for the company.

'I expect for those aircraft that are not flying today that we can bring them back to service around April,' he explained. 'The impact for the operators and for the passengers is so severe that it has our full priority.'

In both incidents, the aircraft's MGB emergency lubrication system (EMLUB) was activated and operating as designed, but an alert incorrectly warned that it had failed, resulting in a ditching. There was no loss of life in either case.

While the EASA has introduced operational changes and additional inspection requirements for EC225 operations, UK and Norwegian aviation authorities have issued directives effectively preventing the aircraft being used for oil and gas operations in the North Sea.

The problem of the false indication of EMLUB failure has now been resolved, but Eurocopter has struggled to replicate the conditions that caused the bevel gear vertical shaft to fail.

'We need to try and find the set of parameters again that has led to such an overload of the shaft in that area, which is not easy. What we are doing now is on the one hand, root cause analysis to find a final fix, and on the other hand introduce safety barriers.'

Such safety parameters may include increased inspections of critical components and the monitoring of HUMS data to identify a potential reoccurrence of the issue earlier. Both helicopters were operating within the published HUMS monitoring procedures valid at the time of their accidents.

Bertling acknowledged, however, that customer perception of the safety of the EC225 had been shaken.

'So now, we need to develop additional safety regulations to convince the CAAs in Norway and the UK that we can fly the aircraft in those hostile environments as well. And a large part is confidence, which means safety barriers need to be such that passengers are confident to fly with the aircraft. So this is not only technical, it is about perception and emotions and so on.'

Nevertheless, he denied that the issue had affected the position of the aircraft in the market and claimed that bookings were still being made.

'If you look at the Super Puma fleet, it affects 13% of the Super Pumas flying or less than 1% of the total Eurocopter fleet. So, yes, full priority to fix it because of the very severe impact on one of the most important customer groups we have. But it is nothing that kills the company or which even comes close to it.'

By Tony Skinner, Paris

Azerbaijan Airlines orders ten AW helicopters

AgustaWestland will supply Azerbaijan Airlines with ten new helicopters under a contract signed recently worth approximately €115 million ($154 million). The agreement includes an order for eight AW139 intermediate twins and a preliminary sales contract for two AW189 medium twins.

This deal marks the entrance of AgustaWestland into Azerbaijan's helicopter market. Of the ten helicopters, four AW139s and the two AW189s will be used for offshore transport, two AW139s for EMS, one AW139 for SAR and one AW139 for VIP transport.

Emilio Dalmasso, senior VP of commercial business at AgustaWestland, said: 'We are proud that Azerbaijan Airlines has chosen our products to meet its future rotorcraft requirements. Selecting the best-selling AW139 and the new AW189 to cover such a wide range of missions once more testifies large fleet operators' confidence in the unprecedented combination of capabilities, versatility, high performance and low overall costs offered by our family of new generation helicopters. With this success in Azerbaijan, we believe we can secure further opportunities across the region for our products.'

Deliveries are scheduled to start in the second half of 2013.

By Claire Apthorp, London

Aero Vodochody gets go-ahead for S-76 materials development


(Photo: Aero Vodochody)

Czech company Aero Vodochody has received Nadcap certification for the production of composites, allowing the company to develop its own materials for the S-76 helicopters it manufactures for Sikorsky instead of buying them from foreign suppliers.

'The certificate was given to us on 23 January 2013, the necessary audit having taken place in autumn last year,' a company spokeswoman told *RotorHub*.

Aero Vodochody officially launched manufacture of composite parts in April 2012, but serial production only began in the fourth quarter of last year. They are used primarily for sections of the helicopter such as doors and engine cowlings.

According to company president Ladislav Šimek, gaining the Nadcap certificate is a key milestone in offering composites (whether carbon, glass or Kevlar) combined with metals, especially aluminium alloys.

The company has been making S-76 helicopters for Sikorsky since 2000, first the S-76C+/++ version and latterly the S-76D. 'This year, we expect their production in our plant to reach a total of 350 [since the programme began],' the spokeswoman said.

The S-76 helicopters leave the Czech Republic without any dynamic parts, such as engines, gearboxes and rotors.

'Outside our country, they also receive customised equipment to enable, for instance, rescue flights or transport to and from oil platforms,' the spokeswoman added.

Aero Vodochody also produces cockpits for the UH-60M and S-70i Black Hawk military helicopters.

By Lubomír Sedlák, Prague

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8 February 2013

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7 February 2013

FOURTH AW169 ENTERS FLIGHT TEST PROGRAMME
1 February 2013

RUSSIAN-BUILT AW139 HELICOPTER TAKES FLIGHT
15 January 2013

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Embraer, AgustaWestland sign helicopter MoU

Embraer and AgustaWestland announced the signing of an MoU on 21 January that will see the companies aim to establish a JV to better serve the needs of the Latin American helicopter market.

It is hoped that the arrangement will lead to the production of AgustaWestland helicopters in Brazil to be marketed for both commercial and military use in Latin America.

According to the companies, their preliminary studies 'show strong market potential for twin-engine, medium-lift helicopters, especially to meet the requirements of the offshore oil and gas market'. Other key sectors, such as executive transport and military, 'show promising potential as well'.

Frederico Fleury Curado, Embraer president and CEO, said: 'This is an important step for Embraer as we continue expanding our business. We are certain that the combined skills and competencies of Embraer and AgustaWestland will create great value for customers in the region.'

Bruno Spagnolini, CEO of AgustaWestland, added: 'We are pleased to have signed this MoU with Embraer and look forward to working with them to establish a joint venture company in Brazil to manufacture and market helicopters. Brazil is an important market for AgustaWestland and we believe having an industrial presence in this country will help us to further grow our business in one of the world's fastest growing markets.'

The companies intend to establish the JV within a few months once a final agreement has been reached and the relevant approvals have been obtained.

By Claire Apthorp, London

Chinese company acquires Enstrom

Enstrom Helicopter Corp has been acquired by a Chinese investment company as the US manufacturer looks to expand its reach into Asia.

Chongqing Helicopter Investment Co Ltd (CQHIC) finalised the purchase on 27 December, Enstrom confirmed on 7 January, in a development described as a major step in moving the company 'to a new level'.

'It will provide Enstrom with the needed resources to enhance marketing efforts in China and around the world,' Enstrom president Jerry Mullins said in a statement. 'This strong ownership will allow further growth of our business in Menominee, Michigan to meet the demands of the increasing markets around the world, especially Asia.'

With the recent sales success of its aircraft in Thailand and Japan, the company believes the Enstrom family of helicopters has found a new niche in the training sector. This will be a particularly important area in China, in order to supply pilots for the predicted explosion in demand for helicopters once current airspace restrictions are relaxed – although the timescale of this is still uncertain.

After production levels fell to single figures in 2010, Enstrom plans to expand its Menominee facility to increase its delivery rates. The company told *RotorHub* that it plans to produce 31 helicopters of all types in 2013 and more than 40 in 2014.

With a 50% rise in staff levels over the past 18 months, the injection of capital following the change of ownership is expected to drive further growth.

'This new ownership will provide many opportunities, including continued product improvement, increased marketing support, funding for new product development, and manufacturing support to help control and reduce costs,' the statement said.

In 2010, Enstrom secured a contract to provide 30 Model 480Bs – designated TH-480B – for the Japan Ground Self-Defence Force. The deal followed the sale of 16 examples to the Royal Thai Army, which also purchased 480Bs for training.

In addition, Ukraine is looking to purchase up to 24 of the type for the country's border guard.

By Tony Skinner, London

Enstrom hopes to benefit from future Chinese demand for training helicopters. (Photo: Enstrom)

Helicopter orders placed since 28 November 2012

Aircraft	Operator	Date	Total
EC135	Ghodawat Industries	8 February 2013	1
EC145	Boston MedFlight	17 January 2013	1
EC145	Policía Nacional del Perú	15 January 2013	4
EC145	Geisinger Health System	4 January 2013	1
AW169	Mitsui Bussan Aerospace	1 January 2013	20
Bell 407GX	Air Methods	1 January 2013	20
Bell 429	Turkish General Directorate of Forestry	1 January 2013	5
EC130 T2	Air Methods	21 December 2012	10
EC135 P2e	Air Methods	21 December 2012	4
AS350 B2e	Air Methods	21 December 2012	6
AW139	Azerbaijan Airlines	21 December 2012	8
AW189	Azerbaijan Airlines	21 December 2012	2
AS332 L1e	Finnish Border Guard	20 December 2012	2
EC145	Meravo	20 December 2012	1
Ka-62	Atlas Táxi Aéreo	14 December 2012	7
Bell 429	National Grid	6 December 2012	1
AW139	Kaan Air	4 December 2012	1
AW169	Kaan Air	4 December 2012	1

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Portfolio investment

Scott R Gourley talks to Marc Paganini of American Eurocopter about the challenges and opportunities arising from the company's recent product developments and his market expectations for the next few years.

As the president and CEO of American Eurocopter, Marc Paganini oversees an impressive range of new helicopter platforms, recently introduced upgrades to existing types and technology demonstration aircraft.

One recent milestone was the December 2012 first flight of the first production example of the new EC175 medium twin.

Company descriptions note that the 16-18-seater EC175 combines a 12.2m³ cabin with a large 2,590l standard fuel capacity for extended range. The design features: an advanced avionics suite, including a digital four-axis autopilot; safety features such as energy-attenuating seats and oversized Type IV emergency exits; a rugged aluminium alloy airframe; and an integrated MSG-3 maintenance philosophy.

Paganini explained that the EC175 was developed with the oil and gas market in mind, noting the sector's importance to the company. 'The proportion of business from the oil and gas sector is usually in the range of 15-20% of the units delivered,' he said. 'It should remain about the same [unit percentage] in the coming years.

'But it's more about value, of course. And in this market we sell more medium to heavy aircraft. So when we talk about 15-20% in terms of units, it's actually more about 30% in terms of value.

'We see the helicopter market growing overall and we see oil and gas growing along with that market.'

Growth regions

In terms of regional variations, Paganini noted the expected increase in demand in countries across Asia-Pacific. The region is expected to see growth in the oil and gas market, along with the Gulf of Mexico and Brazil.

'So we see the overall market growing and we expect the oil and gas market to continue to grow in synch with the rest of the market – possibly even a little more. But what is important is what I mentioned before, that in terms of value [the oil and gas rotorcraft] are bigger helicopters. We see more and more deep water operations now, so they need more medium, medium twin, or heavy twin helicopters.'

Asked to compare the performance of the EC175 with some of the other recent platforms that will be likely competitors on the world oil and gas market, he stated: 'I don't know about the others, because they are all paper or concepts. But we believe that the real one, the EC175 that is flying, provides an excellent combination of range, payload, performance and price.

'We developed the aircraft in order to make it extremely competitive in price and cost of operation. It has a very large cabin – I think it is the largest cabin in its class. And we are really working very hard to keep the operating costs at a very low level. And this is why it is one of the very first aircraft to incorporate the MSG-3 maintenance concept.'

Paganini has high hopes for the EC175 in the oil and gas support market. (All photos: Eurocopter)

He continued: 'Because of this large cabin, this is an aircraft that should bring a very high level of comfort with a reasonable cost of production. It also has a nice maximum speed, which will also make the trip out to the platforms very quick. And from the flight tests, we have also achieved a very low level of vibration in this aircraft.'

Subject to delay

Paganini denied that the reported six-month delay in certification of the EC175 would have any adverse programme impact.

'We wanted to go a little bit further in the performance of the aircraft to get it certified at the best performance levels that we were able to witness in flight testing. That's why we pushed it a little bit further, to get it certified at the best operating platform levels. We did not change the delivery of the aircraft though, which is still this fall.'

Supporting his observation on performance levels was Eurocopter's December 2012 announced increase in the EC175's recommended cruise speed to 150kt, which the company identified as '10kt faster than the previous figure without affecting payload range'. Maximum cruise speed exceeds 165kt.

Expanding on the initial development focus on the oil and gas sector, Paganini added: 'For the EC175, we are looking toward the SAR market, which is a very large market growing all over the world. And we are also looking at the VIP/corporate market.'

> 'We see law enforcement business in the US coming back after several years of depressed budgets.'

From a general perspective, he expressed a vision of 'growth in about all of the market segments over the next ten years'.

'For example, we see the EMS market continuing to be a growing market,' he said. 'In the US, it's mainly a replacement market with slow growth. But, because of the age of the EMS fleets, we see that it is going to bring quite a high number of orders every year. That EMS market is also growing a lot in the rest of the world, especially in Asia, the Middle East and South America.

'So we see more and more developments in ministries of health asking helicopter manufacturers to make proposals to build competent aeromedical services in these countries. We did that in Korea with the 175. Now there is some project activity in Turkey. There are some projects in China, India and Brazil. So it's a market that is developing rather quickly.

'We also see law enforcement business in the US coming back after three or four years of depressed budgets,' he noted. 'The corporate/VIP market is also coming back rather strongly in the US. Although the economy may not be growing ➡

The EC130 T2, launched at Heli-Expo 2012, incorporates a large number of improvements over its predecessor.

very fast, it is still growing. And in the European countries we see a lot of opportunities to sell to the VIP/corporate market, either for private use or for transportation of executives for large companies.'

Budgetary constraints

Paganini identified a range of potential challenges as he looked towards the future, ranging from the uncertainties of government budgeting to the introduction of new technologies.

'The main challenge today is to know what is going to happen with the government budgets – both in Europe and in the US,' he said. 'I think that in the commercial market we know more or less where we are going. We know where there are needs. We know what types [of helicopters] are needed.

'But it's a little bit more difficult to assess what could happen on the government side with certainty. In tackling the deficits, we have already seen some decrease in procurement in Europe. We don't know what is going to happen in the US with the budget this year and the coming years. So that's the big question mark.

'Of course, some of the growth in the BRIC countries [Brazil, Russia, India and China] is going to offset a slowdown in Europe or a stalemate in the US,' he acknowledged. 'But we don't know to what extent. That is really an area where we have difficulties in forecasting.'

Paganini also categorised some of the future challenges as 'good challenges'.

'Another challenge that we have – and it is a good challenge – is that we are in the process of developing a new range of products,' he said.

'We are investing about €1.5 billion [$1.8 billion] in new products or product development, to have the next generation of aircraft flying in the 2020s. That's a good challenge, but it's still another challenge.

'Another good challenge, but a very demanding challenge, is to run production to meet market needs. There are many aspects of that, dealing with things like the supply chain.

He continued: 'Those are the types of challenges we see today: ramping up [production]; the development of new aircraft; and the outcomes of government budget crises in the old world. Of course, one other challenge that we always keep in mind, which doesn't change with economic conditions, is to ensure that we deliver a safe aircraft. So we continue to improve on safety.'

Ready to launch

Reflecting on the overall product portfolio, Paganini offered: 'We always say that we would, every year, launch either a new product – a new aircraft, make an upgrade to an existing aircraft – or launch a demonstrator. So already we have launched a new aircraft, which is the 175. And we have also launched the successor of the Dolphin, which we call the X4. It will be available by the end of this decade.'

Along with the new helicopter efforts, he highlighted recent upgrade activities involving the EC130 T2, EC145 and AS350 B3e.

The former, for example, was revealed during last year's Heli-Expo, together with initial orders for 105 helicopters from seven launch customers. It retains the external lines of the existing EC130, but approximately 70% of the airframe structure has been modified.

New and updated features include: the use of a more powerful Arriel 2D turboshaft and upgraded main gearbox; the incorporation of an active vibration control system; improved air ventilation, distribution and demisting systems; a cabin interior structure redesign with a full flat floor; a cockpit update with enhanced man-machine interface; new energy-absorbing seats that improve weight and balance for passenger loading; integration of a crashworthy fuel tank; and increased maintenance accessibility for the electrical and air conditioning systems.

Looking beyond new platforms and upgrades, Paganini highlighted the company's positioning with tomorrow's technologies, offering: 'We have the technology demonstrator of the X3 helicopter that we flew in the US last summer. It's a high-speed concept that we are looking at future applications for by the end of this decade or beginning of the next decade.'

The X3 is equipped with two turboshaft engines that power a five-blade main rotor and two propellers installed on short-span fixed wings. The company visualises a wide range of applications for the hybrid configuration's VTOL performance, including long-distance SAR, coastguard duties, border patrol missions, passenger transport, offshore airlift, inter-city shuttle services and potential military applications.

'So you see there are a lot of things on our plate to make sure that in the 2020s we will have the performance and the competitive aircraft,' Paganini concluded. **RH**

Paganini examines the X3 during its US demonstration tour.

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The KAI Surion will be operated by the Korea National Police as well as the military. (Photo: KAI)

Original material

Despite the number of helicopters in service around the world, few countries have successfully conceptualised, developed and mass-produced them. Anthony J Osborne examines some indigenous helicopter programmes currently making progress.

Until the 1990s, countries that wanted to prove their technological prowess demonstrated aerospace capabilities by building a jet trainer, a supersonic fighter or even a turboprop airliner.

A glance through any aviation reference guide reveals that many of these failed to achieve success, even in their country of origin, and were often consigned to a national aviation museum.

Today, however, it seems that turboprop airliners and fighters have gone out of fashion, and the helicopter has become the project of choice among emerging markets. Many of the programmes have been widely covered in the press, but just as many have slipped past the gaze of helicopter market watchers.

Crowded market

Most of the programmes surround the development of light single or twin-engine types, a market considered saturated and likely to become more so over the next decade as new machines under development by state-owned aircraft manufacturers join those currently produced by the established OEMs.

Before the start of the 21st century, just ten countries had successfully designed, developed and carried out production of a helicopter, an extraordinary statistic when you consider that a similar number of nations have managed to put rockets into orbit.

Since then, more countries have joined the fray, including the People's Republic of China, which has finally begun building indigenous helicopters, rather than simply licence-building Aérospatiale models.

The capability to manufacture a rotary-wing aircraft is a highly recognised and potentially exportable skill, and one that might be seen positively by the public as a way of investing in technology and delivering services such as EMS and law enforcement – something an increasing number of nations are now aspiring to.

Nowhere is this more obvious than in the emerging economies of Brazil, South Korea and Turkey, which all have rapidly progressing rotorcraft programmes. Although the majority of these will produce helicopters for military use, there is a growing realisation that the marketplace will increasingly become dominated by the need for parapublic and private aircraft.

Brazilian boom

Perhaps the most widely covered of these programmes is Brazil's H-XBR programme, which is putting into place the resources and skills to allow the country, through Eurocopter's majority-owned subsidiary Helibras, to begin development of an indigenous helicopter by the 2020s.

The decision was revealed by Eurocopter CEO Lutz Bertling at the 2009 Paris Air Show, who commented at the time that 'Brazil wants to expand its aerospace industry beyond Embraer'. New facilities that opened in October at Itajubá, Minas Gerais, are manufacturing EC725s for the Brazilian armed forces and EC225s for the country's burgeoning oil and gas industry.

Since then, Brazilian engineers and designers have been learning the critical skills required to put the new aircraft together. Helibras has been awarded Eurocopter design authority, and has created a blossoming new supply chain – one that will not only supply Helibras, but potentially those aircraft built in France.

During the opening ceremony, Bertling again reiterated the intention to build a new Eurocopter product designed and developed in Brazil, but distanced himself from comments by Fernando

The AS350 is built under licence in Brazil, but its successor might be designed there as well. (Photo: Eurocopter)

'It makes sense that a replacement for the AS350 Ecureuil family might be built in Brazil.'

Pimentel, Brazilian Minister of Development, Industry and Foreign Trade, who told attendees that Itajubá would eventually go on to work on the 'replacement of the Esquilo' – the name given locally to the AS350 Ecureuil.

Bertling was keen to pour cold water on such a suggestion given that the Ecureuil is still the company's highest-selling aircraft. However, *RotorHub* was previously told by Eurocopter officials that a Squirrel replacement is being considered for the end of this decade, by which time the aircraft will be nearly 50 years old.

It makes sense that a replacement for the AS350 Ecureuil family might be built in Brazil – designing such a machine would be challenging, but not overly complex for the new engineers involved in the project. During its short history, Helibras has assembled and sold more than 600 examples of the AS350 and its military variant, the AS550 Fennec, giving the company a strong idea of the market needs of such a product.

Of course, it is possible the company may look at development of a slightly larger aircraft, as is often demanded by the current parapublic market, with EC135 EMS helicopters being replaced by EC145s, for example.

Making progress

However, while Brazil is considering what sort of rotorcraft it will build, Turkey has already made significant headway into developing its industry. The country's government-owned manufacturer, Turkish Aerospace Industries (TAI), has been working closely with OEMs across the world. For years, it has built components for Bell Helicopter and fuselages for MD Helicopters, but it is now looking at developing an indigenous helicopter.

Huge experience has been gained from ongoing collaboration with AgustaWestland on the T129 attack and tactical reconnaissance helicopter project, and more is expected from the partnership with Sikorsky on the T-70 Black Hawk programme.

For nearly a decade, Turkish industry and universities have been examining the technology and potential benefits that indigenous helicopter development would bring to the country. Since 2005, TAI and researchers from Istanbul Technical University have been working together 'to raise the national knowledge' of helicopter technology.

In May 2011, the researchers and TAI took the covers off their first rotary-wing creation, called the Arikopter. Not to be confused with an unmanned platform of the same name, the Arikopter in its current form is a single-engine 2t-class helicopter capable of carrying up to six passengers.

Pictures of the aircraft on the Internet show a relatively simple design, built with assistance from both Turkish and some private foreign sources, including Triumph and Turbomeca, but key components, such as the main gearbox and rotor blades, were designed and produced in Turkey. However, since its unveiling in 2011, little more has been heard about the Arikopter – despite hopes that the machine might fly during 2012, this does not seem to have occurred.

Assistant professor and project coordinator Basic Belek said at the time of the aircraft's unveiling: 'In recent years, market research and industry shows that there is a gap in this market for light helicopters. Turkey and the world need these kinds of helicopters, so we need to put our products out to market to be the leading country in the region.'

In June 2010, a Turkish government committee appointed TAI as prime contractor for the indigenous helicopter programme, no doubt taking

lessons learned from the Arikopter on board. With this work, the company has been able to invest in new facilities, including a whirl tower to test rotor blades for aircraft weighing up to 4t, while other facilities for transmission development and flight controls are being funded.

An artist's impression on the TAI website shows a single or twin-engined helicopter of advanced design, with a shrouded tail rotor and five-blade main rotor. It features a wide-bodied cabin, which is probably capable of seating between six and nine passengers.

This design is seemingly unrelated to the proposed project being pushed by Sikorsky at the IDEF exhibition in May 2011 following its victory in the Turkish Utility Helicopter programme. Under the project, TAI and Sikorsky will work together to develop a new light twin in the 3.5-4.5t class.

The X factor

Artist's impressions at the time showed an aircraft featuring several of the design features from Sikorsky's X2 high-speed demonstrator, including its low-drag, lightweight composite airframe, but a conventional yet 'high efficiency' main rotor (with four-bladed tail rotor) and fly-by-wire flight controls.

It was reported that TAI would take the lead on the design, engineering, flight testing and production of the new aircraft, with Sikorsky providing support and some assistance with US and European certification. It would then be jointly marketed, sold and supported. However, little news of the programme has emerged since those first tantalising PowerPoint slides.

In South Korea, Korea Aerospace Industries (KAI), the country's largest aerospace company, is now producing the first examples of the Surion, the Korean Utility Helicopter (KUH) produced in conjunction with Eurocopter. As a first helicopter project, the Surion is a complex machine, and it is perhaps no wonder that the new type bears more than a little resemblance to the AS332 Super Puma.

Indeed, Eurocopter provided engineering support for the development of the KUH, and also acts as a direct sub-contractor to KAI for the production of 'kits', which include the drive system, rotor mast and automatic flight controls.

Surions are being purchased for the South Korean armed forces, but the type has also been chosen to support numerous government agencies in the country, in particular the National Police Agency, which will use Surions to replace the fleet of Bell 412s and Mi-17s in the air support role. KAI and Eurocopter have also set up a joint marketing company, which will sell the Surion in civil and military markets outside Korea.

Eurocopter's market outlook for the region suggests that the JV could help secure export sales of as many as 400 Surions over the next 10-15 years. KAI is already planning the next stage of its helicopter development programme.

The Light Armed Helicopter (LAH) and the Light Civil Helicopter (LCH) make up the new family of helicopters currently under development by KAI, although it is unclear how far these programmes have progressed. The LCH is a conventional helicopter, but has some similarities to the Eurocopter Dauphin. The type features a shrouded tail rotor and a four-bladed main rotor system. It is unknown if the civil aircraft will be developed from or into the military LAH, work on which is reportedly scheduled to begin in 2014, with the first examples entering service in 2018, replacing the AH-1 Cobra.

Media reports suggest increasingly strengthening ties between Turkey and South Korea on a number of military programmes, and it is possible that the two could collaborate to pool their resources in the helicopter world too. **RH**

Material benefits

EC145 T2s will feature composite cowling panels produced by Eurocopter Canada. (Photo: Eurocopter)

Once restricted to rotor blades, composites are finding their way into more and more areas of modern helicopter airframes, finds Scott R Gourley.

One increasingly common trend in the design of civil helicopters involves the expanding use of composite structures.

Such structures are increasingly used by airframers as a proven alternative to metal structural parts. Composites add value to the aircraft design by decreasing overall weight and fuel consumption while simultaneously increasing resilience to environmental conditions and inflight stress.

Initially restricted to main and rear rotor blades, the use of composites has dramatically expanded in recent years to encompass an increasing number of airframe structures.

One recent example of the recognised benefits of the material emerged in mid-2010, with the unveiling of the AgustaWestland AW169 helicopter, which the company highlighted as incorporating 'several new technology features', including extensive use of composites.

A more recent example can be seen in the company's October 2012 announcement that highlighted its selection to go forward to the contracting phase for funding from Round 3 of the UK government's Regional Growth Fund (RGF).

Noting that the RGF funding would support 'design and development work for the AW609 and future tiltrotor designs', the announcement added that the company would work with the National Composites Centre in Bristol, the University of Liverpool and a number of key domestic suppliers on this programme.

Civil shift

AgustaWestland is hardly alone in its increasing embrace of composites for rotorcraft structures. At the end of August 2012, Eurocopter Canada (ECL) announced completion of its 300th cowling for the EC145 at its composite manufacturing facility in Fort Erie, Ontario.

'We are very proud of the hard work and dedication displayed by our composites team,' said Guy Joannes, president and CEO of ECL.

'Composite manufacturing at ECL has earned its reputation for producing a high-quality part on time and on cost, which couldn't be achieved without our group of highly skilled engineers and composite technicians.'

Just six weeks prior to the ECL milestone, GKN Aerospace publicly announced its selection to provide Bell Helicopter with 'key metal and composite structures' across the latter's new Model 525 Relentless helicopter fuselage.

The announcement noted that the major work package would include 'composite and aluminium fuselage panels and structural parts installed in the cockpit, cabin and tail boom'. Initial parts deliveries are scheduled for 2013 and will continue through the end of 2015.

'GKN Aerospace engineers have worked closely with the Bell Helicopter team through the structural design phase of this programme,' observed Kevin Cummings, CEO of GKN Aerospace North America.

'Together we have met the demanding weight and performance requirements for structures and assemblies that will equip this airframe from tip to tail – and whose manufacture will exploit our expertise across composite manufacture and metal machining. We are extremely proud to play our part in the creation of this first in a new class of super medium helicopters.'

Constant trend

'There is a trend toward increased use of composites in aircraft,' confirmed Paul Oldroyd, technical fellow for manufacturing and engineering process development at Bell Helicopter.

'Composites are attractive because they offer distinct advantages over traditional metallic construction, including improved strength-to-weight ratios, the ability to tailor structures for optimised performance and improvements in fatigue and corrosion resistance. The desire to exploit these advantages has resulted in the increased use of composite materials in aircraft structures.'

Noting that some military airframes are 'almost all composite', Oldroyd said that the use of composites in the commercial fixed-wing sector 'is now approaching 50% by weight,' but added that 'in commercial rotorcraft, the trend is moving slower'.

'The forcing function for any change is value in the market, and the value metric is performance as a function of cost,' he explained. 'Military aircraft generally prioritise performance, and therefore exploit the mechanical properties advantages of composite material first. Civilian aircraft are much more market-driven, cost is the higher priority, and the use of composites must provide appropriate value.

'In the rotorcraft industry, aircraft tend to be designed around current or near-term engine availability. Once a powerplant is selected, the system is optimised around it. Airframe, rotor and drive, and systems and integration represent the bulk of the remaining cost, with customisation or kits claiming the remainder. Variables affecting cost in these three key areas will influence design decisions accordingly.'

He continued: 'The insertion of new materials or technologies takes time, and carries the burden of proof (ie qualification and certification cost). The cost drivers that must be optimised during the introduction of new aircraft include new materials or process technology insertions that provide a large enough step function change in the value proposition to overcome these insertion costs, namely qualification cost and schedule. In rotorcraft, fatigue is a significant design driver, and as a result, composite materials are finding increased use in rotor and airframe applications.'

Cost reduction

According to Oldroyd: 'For airframe and rotor applications, cost reduction is not only a function of designing a composite part or assembly, but also how and where it is manufactured, assembled and introduced to the market. Initial use of composites emphasised "black aluminium" designs, where traditional metallic components were simply redesigned using composites, fabricated by hand and assembled conventionally.

'One major challenge is the difficulty in certifying bonded primary assemblies.'

'This dilutes many of the fundamental advantages composite designs offer, introduces operator dependence and variation, and renders the airframe less efficient. One major challenge to the increased use of composites is the difficulty in certifying bonded primary assemblies and reducing the need for mechanically fastened assembly. Improvements in non-destructive inspection methods, developing confidence in damage detection and repair, and validation of structural integrity are all necessary to realise an increase in bonded composite primary structures.'

He noted that design for manufacturing (DFM) and design for cost (DFC) concepts will also be necessary, while the increased use of composites will be dependent on the ability of the OEMs to remove the traditional inefficiencies in the design/build process.

'The future application of DFM philosophies will enable digital inspection, electronic work data management, instant access to build and quality data, and the selected and careful use of automation. These improvements will reduce touch labour, shorten fabrication times and reduce variation and scrap,' he added.

'Composites are no longer a novelty; they are now mainstream. The value opportunity for the increased use of composites is not just dependent on design, but optimising the entire process and removing inefficiencies.'

New facilities

Recognition of opportunities for the increased use of composites is also clearly evident in the opening and/or expansion of new facilities by composites suppliers.

One recent example of this trend was the August 2012 grand opening of a new ITT Exelis design and manufacturing centre for composite aerostructures in Salt Lake City, Utah. The new facility added approximately 23,000m^2 to the company's footprint on site.

Company representatives credited the new facilities with providing increased capacity and enhanced automation capability for advanced commercial and military composite aircraft structures and better positioning the company 'to meet customers' growing needs for composites'.

'Strong demand from our domestic and international customers has fuelled this ➡

The Bell 525's cabin and fuselage use composite panels and structural parts. (Image: Bell Helicopter)

expansion,' observed Jim Barber, VP and general manager of Exelis Electronic Systems Integrated Structures. 'This facility leverages our core strengths and capabilities as we invest in new technologies to meet the needs of our customers and the aerospace industry.

'With the addition of automated fibre placement and tape-laying capability combined with high-speed machining, inspection and assembly, Exelis is positioned to provide optimal composite solutions more efficiently.'

According to Mike Blair, VP/general manager of aerostructures for ITT Exelis, the company has more than 40 years of experience in the design and manufacturing of composite structures and assemblies in Utah. Along with producing parts for military applications, such as the F-35 Joint Strike Fighter and the US Marine Corps' heavy-lift helicopter, the CH-53K, Exelis supplies engine parts for General Electric and vacuum tanks for Boeing airliners.

'Our key product at this facility involves building the vacuum waste tanks for Boeing, for example. Those are composite filament wound tanks. I like to say, "our tanks suck" – hopefully,' he laughed. 'That's our core anchor tenant business, if you will.

AgustaWestland has secured UK government funding for development work on the use of composites in the AW609 and future tiltrotor projects. (Photo: AgustaWestland)

Beyond that we also have a braiding capability, where we use a process that's called vacuum resin transfer moulding, or resin transfer moulding. And that has application, we believe, for rotor blades and those types of structures. And then we actually do currently build the tail rotor blades for the S-76C and D helicopters for Sikorsky,' he said.

Supplier space

Blair added that the new facility provides space for both composite fabrication and assembly activities.

'In the rotorcraft market our anchor tenant there is the CH-53K military helicopter, which is also Sikorsky,' he explained. 'We are a tier one [subcontractor] there, where we do design and build and assembly for Sikorsky on the tail rotor pylon and sponsons for the CH-53K.

'But that same space is available [for civilian projects] and we have certainly had discussions with all the big players in rotorcraft, to have them through here to understand our capabilities, because we can do both the [fabrication] and the

assembly. In addition, we have the core capabilities to be able to do integrated assembly within the company as well – within that 250,000ft². Right now, we have allocated about 25% of the 250,000 to assembly operations. And then we've got room to expand beyond that.'

Reiterating many of the advantages of composites in civilian helicopter structures, he offered: 'Certainly the top-level advantages are all in weight, in terms of performance of the helicopter, and then also in life-cycle costs, because of lower maintenance – typically we have a lot lower life-cycle maintenance costs on composites due to lower-corrosion or no-corrosion activities and higher fatigue life on composite parts. At the real top level those are the drivers to composites.'

Blair pointed to two main technology areas that he categorised as main drivers on expanded composite usage in rotorcraft.

'Number one is automation and being able to really produce components using automated processes – whether that be automated fibre placement, automated tape laying, braiding or filament winding – those are all different kinds of automated processes that can increase the throughput and keep the affordability of composites at its highest level,' he said.

> 'We think that braiding and resin transfer moulding has a lot of applicability to rotorcraft.'

'The second thing is what I call out of autoclave processes. Autoclave processes in composites tend to be fairly expensive. So one of the things that we have been focusing on is our braided and resin transfer moulding processes, where today we build a number of engine parts for GE, as an example, using resin transfer moulding. We think that braiding and resin transfer moulding has a lot of applicability to rotorcraft and can give you all the advantages of composites while keeping the costs low.'

Projected demand

Asked how he sees the use of composites in civil aircraft expanding over the next five years, Blair observed: 'It's interesting and, like a lot of our markets, the primes on the helicopters do a number of their own composite efforts. But as we look at it, we think demand will grow in those market segments – especially as the economy improves and goes forward. And it then becomes a lot of "make/buy" decisions for the supply chain.

'And I think that opens up opportunities for the primes to continue to look for ways to improve the weight performance of their helicopters and fuel efficiency. So we see, certainly in rotor blades and in the primary structures, a pretty significant growth prospect.'

Addressing a final message directly to the helicopter primes, he concluded: 'One of the things about composites is that design and processing are much more closely linked than with typical "heritage metallic" structures. And one of the "sales pitches" that we give to customers is to say that we have integrated design capability with our processing capability, and we can really find the best processes and tailor those processes and designs together to produce an optimised part – both from a weight and a cost perspective. We think that is part of the value that we can really bring to the primes, and it's one of the things that they recognise through their internal abilities as well.' **RH**

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Changing channels

The move from analogue to digital radio equipment in the parapublic and offshore sectors has brought new capabilities for helicopter crews, finds Peter Donaldson.

Complex missions and difficult environments drive the evolution of helicopter communications, typified by security and resilience and offshore support.

In the former role, communications fits must evolve alongside those of the police, ambulance and fire services. Offshore, the key drivers today are customer demand for flight following – largely achieved with SATCOM installations – and progress towards Automatic Dependent Surveillance – Broadcast (ADS-B) as the new paradigm in communications for air traffic management.

The greatest change to emergency services communications has been the switch to digital radio. Mostly, this has meant adopting the Terrestrial Trunked Radio (TETRA) standard. Many governments are implementing countrywide TETRA infrastructures, installing networks of base stations plus switching and management equipment, and issuing mobile users with the terminals.

It is worth noting that TETRA is not the only such standard – APCO 25 is used in North America and TETRAPOL dominates in France, for example.

TETRA systems deliver secure and reliable trunked (networked) and direct mode (terminal-to-terminal) voice and data communications. Their support for point-to-point calls, broadcasts to all users on the network and for pre-programmed talk groups provides a major boost for interoperability.

Early adopters

UK police forces were early adopters and provided industry with an opportunity to carve out a world-leading position in the integration of TETRA into helicopters. Airwave is the UK infrastructure provider and Cobham engineers certified packages for airborne applications, while Eurocopter UK focuses on creating, testing and certifying ➡

The Police Service of Northern Ireland has contracted Motorola to provide TETRA network coverage for its helicopters. (Photo: Eurocopter)

The Irish Coast Guard is rolling out TETRA capability across its CHC-operated S-92 fleet. (Photo: L-3 Wescam)

bespoke installations for customers among all the 'blue light' services. It has become the airframer's centre of excellence in 'tactical' communications.

RotorHub paid Eurocopter UK a visit at its Oxford Airport base in January. Richard Atack, director of the company's design and customisation centre, and senior offers manager Nick Goodman provided insights into how the company works with customers in the UK and internationally to turn helicopters into some of the most sophisticated civilian air support assets in the world.

A typical UK police helicopter has four tactical radios, dubbed Tac 1 through Tac 4. In the early days of airborne TETRA, naturally cautious air support units (ASUs) would choose to replace two of the analogue radios with TETRAs.

As confidence increased and industry ironed out the teething problems, ASUs began to ask for three and even four TETRA radios, although the seven identical aircraft that Eurocopter UK finished delivering in 2010 have three TETRAs and one analogue radio, the latter being retained so that they can talk to HM Coastguard, among others.

Testing times

During the period of TETRA's introduction, Eurocopter was also introducing new police aircraft, first the EC135 and then the EC145.

'When TETRA came in, the EC135 was the predominant choice of aircraft for the police,' said Goodman. 'Where we had to do a certain number of checks was in EMC [electromagnetic compatibility] because of the aircraft's digital engine controls. We mapped the FADEC output, working closely with the engine and radio manufacturers, to see how they might be affected. But it all went very smoothly.'

'With greater capability comes greater complexity. One measure of that is the handover for a new aircraft.'

With four tactical radios and a video downlink in addition to the ATC transceivers, antenna placement is an issue that has to be thought about carefully to avoid blanking by parts of the airframe and generally ensuring that the antennas can 'see' the base stations on the ground.

One almost ideal location for mounting antennas on the EC135 is the under-belly mission pod, which Eurocopter is moving away from. Although successful, there is only room for the pod underneath if the aircraft has high skid gear. As ASUs have added more mission equipment, the extra mass reduces disposable load and their sacrosanct three hours of endurance. Removing the high skid gear saves around 26kg.

As mission systems are designed alongside customers, crews that will operate them are invited in to make sure that officers of all shapes and sizes can reach vital equipment. 'We really do work very closely with them, the customer, as to where we position control heads,' Goodman said. 'It is a very joined-up effort to get to the finished product.'

'It goes beyond just the platform's day-to-day operators,' added Atack. 'We have a workstation in there, which allows the [police] silver [tactical] commander to go on board the aircraft. He has his own mini-workstation, which has a monitor and his communications and they will set it up.'

With greater capability comes greater complexity. One measure of that is the handover for a new aircraft, which has lengthened from a two-day process to one that now takes two weeks. During the handover, ASU personnel work though every function of each system, including the EO pod, video management software and communications fit. TETRA systems allow the user to specify a number of 'talk groups' whose members can be included in all communications affecting various parts of the operation. As part of the handover, officers come to program and test their talk groups.

Radio fits

UK police aircraft are fitted with a unique 'generation two' system produced by special request, centred on Cobham's Type 7-450-3 airborne transceiver operating in a frequency band of 380-430MHz. The interface for the crew is the company's CH-450-3-YX Control and Display Unit (CDU), which is used to manage four transceivers, both TETRA and analogue. Details on the precise capabilities of UK police communications are closely guarded, but Cobham has released information on its 'generation three' offering for both UK and worldwide use, which is the system that UK air ambulance services are moving to, according to Goodman. A typical air ambulance radio suite would include one TETRA set, an analogue set, a CDU and a remote unit.

Cobham builds its generation three systems around the Type 7-450-14 and -15 airborne transceivers, which are based on Sepura's SRG core radio and also 'operate in one of the standard TETRA frequency bands, from 380-430MHz', according to the company.

To adapt this radio for airborne use, Cobham implemented in-circuit RF bandpass filtering to ➡

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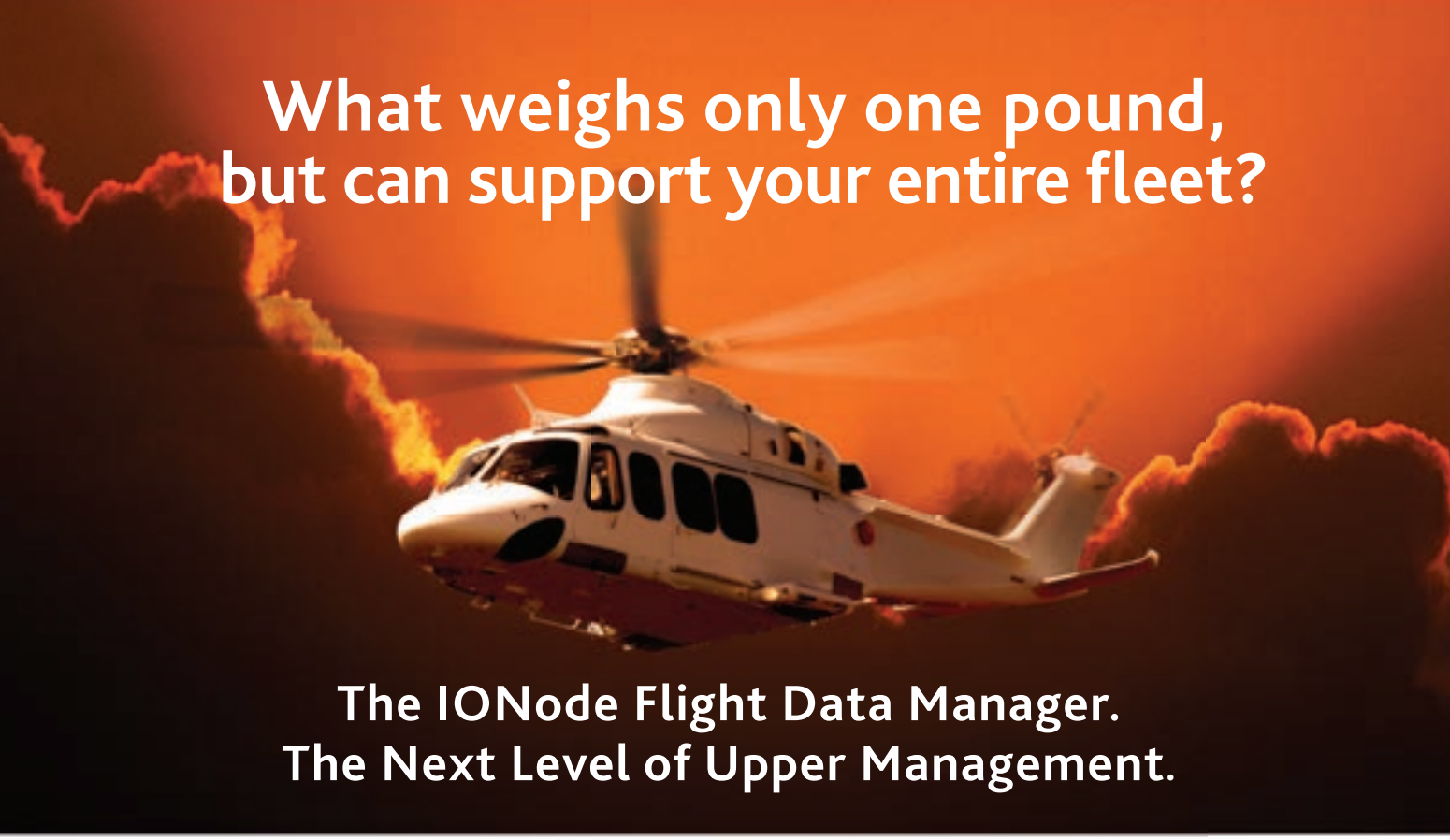

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prevent interference with and from other radios on the aircraft, particularly the VHF communication and navigation receivers. Other techniques include differential transmission of CDU-transceiver control signals to ensure immunity from noise, and suppression of transients in the aircraft's 28V power supply.

Another adaptation is highly preferred subscriber class (HPSC) operation. HPSC ensures that the airborne radio terminal affiliates with base stations designated for use with aircraft.

As a secure radio, it supports TETRA Encryption Algorithms (TEAs) 1 through 4 and security classes 1 through 3 plus end-to-end encryption. In addition to trunked mode operation, it will also function as a repeater and/or gateway in direct mode, the latter features requiring licence codes to activate.

Sepura's software management suite can be used to configure the radio to specific national TETRA networks, and it will also operate on networks from suppliers such as Motorola, Selex, Rohde & Schwarz and EADS, says Cobham.

Neighbouring networks

Some of the mainland UK's nearest neighbours have TETRA networks of their own. One of these is the Police Service of Northern Ireland (PSNI), which uses Motorola to provide the network, terminals and services for its Barracuda TETRA coverage and picked Eurocopter UK to equip its two helicopters – an EC135 and an EC145. Barracuda also serves the other emergency services.

The Republic of Ireland's National Digital Radio Service (NDRS) is owned and managed by TETRA Ireland. Again, the police helicopters, a pair of EC135s flown and maintained by the Irish Air Corps for the Garda Síochána, went to Eurocopter UK for their communications fits.

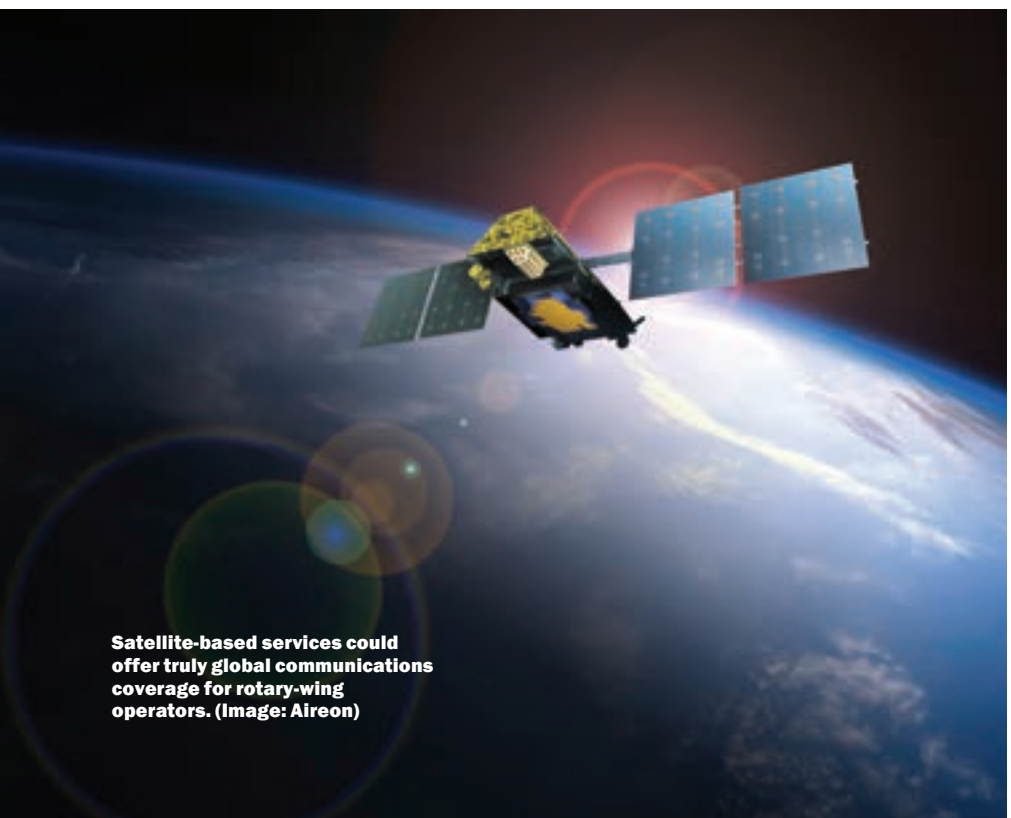
Additionally, Eurocopter UK has integrated TETRA and other customisations into helicopters in Australia, Brazil, Jamaica, Japan, Kuwait, Norway, South Africa, Sweden and the US.

'Our long-standing staff have grown up with the progression of the technology on the platforms from a design and installation perspective,' said Atack.

Meanwhile, Cobham has been selected to provide the comms fit for the Korean National Police Agency's KAI Surion helicopters, which will have a TETRA capability, the company announced in September.

TETRA offshore?

While UK police aircraft retain analogue radios to communicate with HM Coastguard, that service's Irish counterpart has gone digital. Although VHF and marine frequency (MF) remain the mainstay of Irish Coast Guard (IRCG) communications, the organisation began a trial with TETRA-equipped helicopters in 2011 after identifying a need for secure communications between its SAR aircraft and incident managers on the ground, combined with a direct link to senior coast guard management. The tests involved the coast guard helicopter based at Shannon, individual rescue coordination centres (RCCs) and the coast guard incident management team, and led to a decision to equip all bases and aircraft.



Satellite-based services could offer truly global communications coverage for rotary-wing operators. (Image: Aireon)

TETRA Ireland provided training at each helicopter base and RCC, and worked over a period of months with the IRCG's NDRS project manager and SAR manager to program the talk groups.

The initial operational capability equipped each IRCG helicopter base with six personal portable sets for crews. One CHC-operated Sikorsky S-92, based in Shannon, received a full TETRA installation and officially entered service on 1 July 2012, having begun training in January. This number is set to increase to five when the other S-92s go live. The RCCs particularly like the ability to simultaneously alert the entire helicopter crew with a single call.

While TETRA is about tactical communication, the system's incorporation of GPS position and platform identifying information into its transmissions, along with the radio's ability to function as a relay and gateway, gives it much in common with the latest flight following and air traffic management (ATM) systems that rely on data communications. Furthermore, the IRCG's installation of the technology in offshore SAR aircraft points to new possibilities.

Making inroads

However, it is ADS-B that is making inroads offshore, driven in part by impending deadlines in many countries that will make the systems mandatory, and in part by its clear benefits in terms of safety and operational efficiency compared with patchy radar coverage. Complementing and, arguably, competing with ADS-B is the wide area multilateration (WAM) principle.

Efficiency is the stated driver behind Bristow's selection of FreeFlight Systems' ADS-B FDL-978TX system for two AW139s operating in the Gulf of Mexico (GoM), which the company describes as the first certified, fully rule-compliant universal access transmitter-based ADS-B Out solution available for GoM helicopters. The unit continuously reports course, speed and altitude data to air traffic controllers and other ADS-B-equipped aircraft.

The technology, which relies on shore stations and offshore platforms, enables ATC to track aircraft far beyond the range of ground-based radar, enabling much greater efficiency through more direct, point-to-point routing. Aircraft flying in IFR without such a system must manually report their position and direction within a vast airspace grid, often resulting in complex routing, longer flights and increased crew workload, says the company.

'Our system integrates seamlessly with the AW139's advanced avionics suite in a

straightforward installation and enables Bristow and its customers to realise quickly the significant benefits of ADS-B in daily operations,' said Tim Taylor, CEO of FreeFlight Systems.

ADS-B and WAM are complementary in that, while WAM systems can triangulate aircraft positions from ADS-B Out transmissions, they can do the same with other types of transponder including Modes A, C and S, also identifying the aircraft from those signals. In this way, WAM acts as a surveillance and tracking system in its own right and a bridge to future ADS-B-centric systems such as NextGen and the Single European Sky, without requiring aircraft operators to install additional equipment.

WAM systems are rolling out around the world. One of the latest from Saab Sensis went into service around Scotland's Edinburgh airport for the UK's National Air Traffic Services. This builds on the success of the same company's North Sea WAM system that entered service in December 2010.

Individual mission system fits are designed in close cooperation with the crews who will use them. (Photo: author)

Space-based future?

More efficient though ADS-B is, the systems rolling out now rely on ground-based receivers and therefore the coverage of oceanic, polar and mountainous regions is patchy at best. But with space-based receivers, the coverage could become truly global.

This is the concept behind Aireon, a JV company formed to host ADS-B 1,090MHz extended squitter receivers on the new-generation Iridium NEXT satellite network that is scheduled for launch between 2015 and 2017. Aireon was formed in June by: SATCOM provider Iridium; Canadian private air navigation service NAV Canada; ITT Exelis, which is implementing the US ADS-B network; and Harris, which is to supply the hosted receiver packages.

Flight tracking for helicopters operating in remote areas has already come to rely on the current generation of Iridium satellites, so satellite hosting of ADS-B receivers looks set to add a layer of redundancy to ATM data communications while filling coverage gaps, and could become the dominant solution in future. **RH**

One significant launch customer for the Ka-226 was Russia's Federal Security Service. (Photo: via author)

A worthy successor?

The Kamov Ka-226 has already achieved some success with parapublic and military customers in Russia, and is slowly expanding its footprint into the commercial sector. Alexander Mladenov examines the new design and its market prospects.

Russian rotorcraft design specialist Kamov has put significant effort and resources into the development of the Ka-226 turbine twin to ensure it is a worthy successor to the well-proven but obsolete Ka-26 piston-engined utility helicopter.

Kamov hopes to introduce an 'affordable workhorse' for a variety of utility applications, as well as the law enforcement and disaster relief sectors in its country of origin.

Significant milestone

There is no doubt that 2013 is going to be an important year for the programme, with the expected certification of the uprated and vastly improved Ka-226T derivative enabling first deliveries to the biggest domestic commercial operator, Gazpromavia, as well as Russia's expansive Ministry of Emergency Situations (MES) organisation.

The 3.4t-class, twin-turbine Ka-226 was developed in the mid-to-late 1990s as a pure company-funded venture to supersede the popular Ka-26. It was designed to have considerably better performance, especially in hot and high conditions, reduced weight, lower fuel consumption and decreased levels of noise and vibration than its piston-engined predecessor.

The Ka-226 retains Kamov's traditional coaxial design, with two contra-rotating three-blade rotors, and has a fixed cockpit combined with a range of spacious cabins supplied as interchangeable mission pods.

The conceptual design of the Ka-226 was completed in 1996. At that time, it was based on the airframe of the single-engine Ka-126, a single-turboshaft derivative of the original Ka-26.

In fact, the Ka-226's first prototype, converted from a surplus Ka-126 airframe, conducted its maiden flight in September 1997. Certification trials in accordance with the new Russian AP 29 airworthiness rules (said to be equal to US FAR 29) were carried out between mid-2001 and October 2003.

The follow-on flight-test aircraft were redesigned and newly built, and featured significant structural differences compared to the initial airframe. The external appearance was roughly the same as that of the re-engined Ka-126, but the fuselage structure and cockpit glazing were new. The same was true for the rotor system, which had composite blades and a rotor hub with self-lubricating bearings.

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A Ka-226 in final assembly at KumAPE's facility in Kumertau. Russian Helicopters has plans to move this activity to its plant in Ulan-Ude. (Photo: author)

The fuselage also featured increased use of composites in a bid to save weight and ease production and repair. The cockpit was equipped with energy-attenuating seats; the new instrumentation was certified for day and night IFR operations; and an electrothermal anti-icing system was added to the rotors in a bid to enable operations in cold weather conditions.

The first flight of a Ka-226 featuring the all-new fuselage, rotor system and cockpit avionics was conducted on 28 March 2001, and two years later, the aircraft received its Russian type certificate. In 2004, an approval for Category A (Cat A) operations was obtained, and follow-on certification activities continued until October 2008.

No luxuries

'Designing the Ka-226, we deliberately did not want to make it a luxury machine,' Sergey Mikheyev, Kamov's long-serving designer general, told *RotorHub*. 'We would like instead to see it become a deserving successor to the Ka-26 – a dependable workhorse for a multitude of utility tasks, sporting affordable operating costs, high reliability and being easy to fly and maintain.'

He noted that the coaxial rotor scheme is a trademark of almost all helicopters developed by Kamov since the late 1940s – it contributes to the helicopter's compact appearance, excellent stability of flight and high agility, evident in the aerodynamic symmetry of the configuration. The control system is considerably simplified thanks to the lack of a tail rotor, and is also claimed to have better reliability than that of conventional designs.

'We would like to see it become a deserving successor to the Ka-26.'

Experienced Mi-8 and Ansat-U military pilots have commented that the Ka-226 features more pilot-friendly handling than its conventional counterparts. Furthermore, the helicopter is said to be less sensitive to turbulence and able to operate in higher ambient temperatures.

Due to the lack of a suitable Russian-made engine, the basic Ka-226 is powered by two Rolls-Royce M250-C20R turboshafts, rated at 450shp for take-off. The helicopter has an MTOW of 3,400kg, a maximum speed of 110kt (105kt cruise), a range of 600km and maximum endurance of four hours and 42 minutes (no reserve). The maximum payload of a podless aircraft is 1,400kg, while with an external sling it is capable of transporting cargo up to 1,500kg. Airframe life is said to be 18,000 hours.

The Ka-226 features a pod and twin-boom-type fuselage – the area aft of the cockpit can be used to attach interchangeable mission pods, or it can remain 'open', permitting use of the helicopter for aerial operations, with external cargo transported by hook or on a cargo platform. All the mission pods are advertised as capable of being changed within 20-30 minutes.

The most commonly used mission pod is the one for passenger and general cargo transport, provided with folding seating for six to allow cargo accommodation. There is also a dedicated VIP pod, fitted with four increased-comfort seats. A SAR pod is also available, equipped with a 300kg electric winch, an external fairing for mission equipment, a searchlight and a loudspeaker. The air ambulance pod is outfitted with up to two stretchers and has seating for three or four casualties and one medical attendant.

To a T

The Ka-226T is a derivative tailored for hot and high conditions, powered by more powerful Turbomeca Arrius 2G1 engines, rated at 670shp, although for use on the Ka-226, this engine was de-rated to 580shp (705shp in emergency mode). It provides a significantly enhanced hot-and-high capability, allowing operations up to 8,200ft without affecting performance.

The Ka-226T sports the VR-226N main gearbox and a newly designed main rotor system, which demonstrated better performance than expected, enabling the MTOW to increase to 3,600kg.

During flight tests in 2009, the prototype Ka-226T demonstrated a dynamic ceiling of 24,600ft and a static ceiling of 20,300ft – the stated dynamic ceiling on documentation is only 18,700ft, with a static ceiling (out of ground effect) of 13,400ft.

The Ka-226T's maximum payload is 1,500kg on an external sling or 1,200kg in the cabin, while flight endurance is 3.3 hours and maximum range is 525km with a ten-minute reserve. Rate of climb at sea level is 28.5ft/s, while at 11,200ft it is still an impressive 25.3ft/s. Maximum speed is 135kt (120kt cruise).

Cat A operations are possible from helipads up to 7,200ft above sea level. VFR type certification was granted in 2012, while a certificate for IFR operations is expected this year. EASA type certification is expected no earlier than 2015.

Production of the Ka-226 was launched simultaneously at two plants in Russia – PO Strela in Orenburg, was to manufacture helicopters for Gazprom and other civil customers, while the line established at KumAPE in Kumertau (in the autonomous republic of Bashkortostan) was set to produce machines for paramilitary and government customers under the Ka-226.50 designation.

Utility version

The MES funded the initial development of a dedicated SAR version, the Ka-226A, while Russia's gas production and distribution monopolist, Gazprom, in turn invested in the development and production of the utility version, with vastly improved equipment and avionics. Dubbed Ka-226AG, it was intended to replace the obsolete Ka-26 in the logistics support and pipeline patrolling roles, operated by the company's air transport subsidiary Gazpromavia.

This particular derivative was tailor-made to operate in variable and extreme climatic conditions, such as in Siberia and Russia's far northern territories.

The MES took delivery of only one machine in 2004 – this particular Ka-226.50 was operated by the detachment stationed in Bashkortostan, although in 2008 the helicopter was handed over to the state's police service.

In fact, the MES' eventual intent to place a 25-aircraft order for urban environmental monitoring, surveillance and medevac use was postponed, and the first order for the much-improved Ka-226T derivative was placed in 2012.

Gazpromavia, the other early customer for the type, also delayed acceptance of its first batch of Ka-226As. After a prolonged testing and development programme, the first two examples were handed over in 2011 and commenced operations in 2012 – currently its fleet numbers six examples.

This view of a simulator shows the Ka-226's typical cockpit layout, with flat-panel displays plus analogue backup instruments. (Photo: author)

The operator also abandoned its plans for purchasing further M250-C20R-engined Ka-226AGs, and decided instead to go ahead with the uprated and redesigned Ka-226TG, subsequently placing a firm order for 16 examples in September 2012.

The initial production Ka-226 derivative achieved the majority of its sales with two parapublic operators in Russia – the all-powerful Federal Security Service (FSS) and the Ministry of Interior (MoI), which placed their first orders in 2005-2006 (the unit price was around $5 million).

In 2010, the Russian Ministry of Defence also placed its first order for the Ka-226 in the utility transport and training configuration.

Currently, there are around three dozen Ka-226s in operation in Russia – six with the FSS, 12 with the MoI, 12 with the air force, six with Gazpromavia and two with Orenavia. So far, the only known foreign customer for the type is Ukraine's MES, which purchased one example.

Rolls-Royce M250-C20R-powered Ka-226.50 production at KumAPE is due to end this year, and will be replaced by the Arrius 2G1-engined Ka-226T.

This air ambulance mission pod can carry two stretchers and has room for three to four attendants or seated casualties. (Photo: author)

Moving the line

In mid-2012, Russian industry officials announced the relocation of the Ka-226T production line from KumAPE to the Ulan-Ude Aviation Plant. Both companies are controlled by Russian Helicopters, the management body for all Russian rotorcraft design bureaus and production plants.

The move is considered part of Russian Helicopters' efforts to establish centres of competence at each of its five production plants. In this case, KumAPE will retain its role as principal supplier of parts and assemblies for the Ka-226. So far, there are no signs that this relocation plan has received the go-ahead from Russian Helicopter's top management and the Ministry of Industry and Trade.

The second production line at PO Strela is facing a grim future due to the lack of orders, and the plant, which is outside the structure of Russian Helicopters, is likely to retain only the status of sub-contractor, supplying fuselage parts and sub-assemblies.

Currently, the order book for the Ka-226T comprises ten units for the Russian MES, the first of which was originally slated for delivery by late 2012, but is now expected to arrive some time in the first half of 2013, with final deliveries due in 2015. These machines will be outfitted for the HEMS role.

The unit price of the first Ka-226T, ordered in HEMS configuration in 2012, amounted to 232.2 million roubles ($7.7 million).

FSS procurement plans call for the acquisition of another ten Ka-226TM shipborne helicopters to undertake maritime patrols. The service is expected to place an order for the definitive shipborne derivative of the Ka-226, featuring folding blades, an emergency flotation system and life support for the crew members wearing immersion suits.

In addition, the Russian Air Force is set to take delivery of 18 Ka-226Ts for training and general duties by the end of 2015, and two more examples are set to complement the Russian MoI's rotary-wing fleet, operated by police special-purpose air detachments stationed across the country.

Central contract

From a commercial point of view, the most important contract for the Arrius 2G-engined derivative is the one placed by Gazpromavia. Signed in September 2012 between Russian Helicopters and the NefteGazAeroCosmos research and production centre (a subsidiary of Gazprom), it covers delivery of 18 helicopters in the highly customised Ka-226TG version.

'The Russian Air Force is set to take delivery of 18 Ka-226Ts for training and general duties by 2015.'

A total of six are due for delivery in 2013, and the other 12 are to follow suit in 2014. They will be used to monitor Gazprom's large gas pipeline network across Russia, as well as in a variety of other roles, such as corporate transport, repair work and cargo transportation.

The cockpit instruments and navigation equipment outfit of the Ka-226AG, the KBO-226TG avionics suite, is tailor-made for operations in Arctic regions, with prevailing low temperatures and limited visibility conditions, enabling long-distance IFR operations.

The new suite will also include a gyro-stabilised EO payload for night operations installed in the nose, and the Ka-226TG will feature an additional fuel tank for extended-range, all-weather operations. **RH**

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Following the tradition of many Hollywood action films, the latest James Bond outing, *Skyfall*, contains extensive and dramatic helicopter sequences. Rob Coppinger speaks to the special effects team involved, as well as AgustaWestland, which provided the aircraft.

Making a scene

What involves destroying a training cockpit, strafing a mock stately home, 55kg of high explosives, the Farnborough International Airshow, a UK Ministry of Defence (MoD) heavy-calibre machine gun, a modified AgustaWestland AW101 and an AW159 Lynx Wildcat with special markings?

This strange mix was all for the latest James Bond film, *Skyfall*, as its special effects supervisor Chris Corbould told *RotorHub*. 'The whole helicopter sequence developed as we were making the film, so all of a sudden we had to find a funky-looking helicopter pretty quickly,' he said.

Homeland protection

The film's director, Sam Mendes, decided that rather than have Bond, played by Daniel Craig, assault the villain's base, he would be attacked by his enemy's armed helicopter while at his ancestral home in Scotland.

'Sam was keen to have a very big helicopter – he didn't want one that was "namby-pamby",' explained Corbould. 'Our initial conversation [with AgustaWestland] started around the table in mid-January.'

Corbould's team originally considered a Boeing Chinook, but ultimately opted for the AW101, which is in service with Algeria, Canada, Denmark, Italy, Japan, Portugal, Saudi Arabia, Turkmenistan and the UK for military and government applications.

Flying Pictures' AS355 camera ship films the AW101 supplied by AgustaWestland as it attacks the fake stately home. (All photos: AgustaWestland)

'In a way, we treated [the request] rather like an urgent operational requirement,' Richard Folkes, head of UK government and corporate affairs at AgustaWestland, told *RH*. 'It had that similar kind of atmosphere around the project, with the ➡

Richard Folkes (AgustaWestland head of corporate affairs), Andy Strachan (AW test pilot), director Sam Mendes and Andy Stephens (head of film services, Flying Pictures) stand around a model of Bond's ancestral home, Skyfall, on the film set at Hankley Common.

limited time we had to get this work done for the filming.'

While the request for a helicopter came in mid-January, filming was planned for mid-March at Hankley Common in Surrey, southern England. Folkes said that they were originally asked if the company had something 'green with a ramp' – AgustaWestland suggested the AW101.

Corbould explained: 'We did a test day with the helicopter before we started filming. I was waiting in a camera helicopter, and [the AW101] came over and did this most spectacular entrance, and for such a big helicopter it was breathtaking.'

This 'non-namby-pamby' AW101 would be modified for the needs of the villain, Silva, played by Spanish actor Javier Bardem. The modifications included: a Spectrolab Nitesun search light, which was fully functional; a 'sky shout' loudspeaker, which was not integrated; and a .50 calibre machine gun in the side door provided by the MoD, according to Folkes.

Firing blanks

AgustaWestland's test pilot Andy Strachan was also the principal AW101 pilot for the filming. Describing the gun used, he said: 'It was similar to the UK military-style ones, but it had to be modified because the film people wanted to fire blanks – you can't fire blanks from the normal weapon because there's not enough gas in the discharge to re-cock it. So this was a specially modified one which could fire blanks – essentially it's a half-inch machine gun.'

> 'You can't fire blanks from the normal weapon because there's not enough gas in the discharge.'

Hiding the helicopter's actual registration marking, the AW101 had a decal added – an orange circle with an upturned triangle at its centre. 'The film company came up with that,' said Strachan.

Once the AW101 modifications had been completed, there was the small task of filming the action sequence around Bond's stately home, the name of which is Skyfall. While 007's ancestral home is supposed to be in Scotland, the mock residence that is attacked by the AW101's heavy machine gun was a fake structure built on Hankley Common, which is MoD land and also a public park.

'We had an initial meeting at Hankley without the aircraft, where the film team essentially previewed us the storyboard – now done on computers and animated as opposed to old-fashion drawings – and they had a very clear idea of what they wanted,' continued Strachan, noting that the final film sequence is very close to the animation his team was shown.

According to AgustaWestland, almost 15 hours were spent rehearsing and shooting the action scene with the aircraft. Strachan worked with Marc Wolff, the aerial coordinator and pilot for the camera helicopter provided by aerial filming company Flying Pictures. At times, Wolff's camera helicopter would only be 6-9m from the AW101. 'Marc Wolff – he is a genius. He had to be very aware of the rotor wash of that massive [AW101],' added Corbould.

Skyfall was not Wolff's first Bond film – he worked on Daniel Craig's second 007 movie, *Quantum of Solace*, which was in cinemas in 2008. 'Marc acted as the aerial director, so we were essentially under his direction,' noted Strachan. 'We chatted as much as necessary over the radio when we were flying.' In turn, Wolff was getting instructions from one of Flying Pictures' staff who was on the ground with the director.

As Silva and his henchmen arrive at Skyfall at dusk, there needed to be both day and night-time filming. 'Hankley is quite a dark space, but we weren't using any form of night vision devices,' added Strachan. 'The flying round the set wasn't too bad – it was generally lit up with flames or something.'

He found that the flying was 'relatively benign', as much of the scene was simply flying around the building. 'Having done it several times a day, we were very aware of where the main obstructions were,' he explained.

Looking up

Mendes wanted the helicopter to be close to the stately home, but its height and distance from the house had to match interior scenes shot earlier at Pinewood Studios – the actors had previously been filmed looking out of the windows and up at the helicopter.

'We had to be at the height they were looking at and we did an experiment on the first day, looking at downwash and other things to see how close they wanted us to be to the building,' said Strachan. 'That was quite interesting because it was a case of, "Well, how close can you get?" We all said we think we can get closer than you want us to be, and that proved to be the case.'

Strachan estimated he was flying 9-12m from the building, and around the house his speed was 'no more than 20-30kt'.One problem the film-makers had with all this was the rotor downwash.

'We did some shots with the crew all underneath [the AW101] with it flying around, and it was very busy, wind-wise,' explained Corbould. 'To make it more controllable, we shot some like that, but also some with a light on the crane to simulate the helicopter coming round.'

'They got some crucial shots they needed, to sell the fact the [actors] were out there and amongst it, and they used the crane with the light on and digitally put the helicopter in on some occasions.'

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As well as digital computer graphics, 1/3-scale models of the AW101 were used, and Folkes was particularly impressed by them. 'The model was quite extraordinary – every single rivet on it, it was uncanny when you look at it, how realistic it was. It was an extraordinary piece of special effects.'

Crash sequence

At the end of the action sequence, the AW101 is destroyed, crashing into the stately home, which is ruined, along with Bond's iconic Aston Martin DB5.

'We did use models – the only time we used models is where it actually crashes into the house because AgustaWestland weren't too keen on us using a real helicopter for that,' said Corbould.

At Pinewood, two third-scale AW101 miniatures, which were still 6m long, were crashed into a 1/3-scale model of the Skyfall house using a hydraulic arm. Corbould matched the models' destruction with the exploding of the full-scale mock house at Hankley Common.

'It was probably about 120lb [55kg] of high explosives, with a bit of fuel in it to colour it up,' he continued, describing what it took to explode the mock stately home. The additional fuel to make the explosion red in colour also represented the exploding AW101 fuel tanks.

When Silva's helicopter is fatally damaged, the audience briefly sees a shot of the unfortunate pilots' demise. This was not computer graphics, but rather two stuntmen acting as aircrew while sitting in an AgustaWestland-provided training cockpit that was then destroyed.

'We also did loan them a cockpit, a training cockpit, which they effectively destroyed and then repaired back again to its original condition and gave back to us,' added Folkes. 'They used that to simulate the cockpit scenes, firing various bits and pieces of debris through a sugared glass windscreen.'

Despite the house strafing and ramming by the helicopter, Strachan felt the action sequences could have had more. 'We would have liked the action to be a bit more dynamic, but that didn't fit with what the director wanted, so we were doing very much what they wanted,' he said. 'Having gone through the [animation] several times, there's a couple of amendments along the way, but not much. It was just a case of going through it until they were satisfied.'

Sideways slew

One amendment is the AW101's sideways slew as it strafes the building. 'When we started shooting the house, there was fairly big yaw input, where the aircraft goes sideways, and that was something we suggested, and they liked it – we tried it a couple of times,' explained Strachan.

In one other dramatic moment in the film, Bond is saved by three AW159 Lynx Wildcats, a twin-engine multirole, maritime and utility helicopter that is used by the British Army and Royal Navy.

'At the end of the action sequence, the AW101 is destroyed, crashing into the stately home.'

In the film, the Wildcats, which are computer-generated, have very distinct markings, with union flag decals on their sides. 'We marked up an aircraft, a real aircraft, in exactly the kind of markings you see in the film, and they used that to provide them with all the information to create the [computer images],' said Folkes. (Actual flying Wildcats were used in the film, but only for sound effects.)

'We needed to record three Wildcats in the air, so we had exactly the right sound, and it just happened the guys were at the Farnborough Airshow. We had done a big event at Farnborough, and so we had three Wildcats coming back in formation, so we were able to record the three in the air – we got the exact sound effect.'

In AgustaWestland's *Skyfall* press release, it stated that it expects to work on the next Bond film. Corbould certainly sounds like he'd like to work with the company again. 'All credit to AgustaWestland, they really pulled everything out of the hat for us, and right the way throughout the entire relationship they were just fantastic, from their support teams to their pilot Andy – he was magnificent.' **RH**

The AW101 was fitted with a searchlight and loudspeaker system as well as the door-mounted machine gun.

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Cal Fire is the state agency responsible for fighting wildfires throughout California. (Photo: Cal Fire)

In the first of a two-part series on fire-fighting, James Careless considers how, despite further advances in equipment, it is still the skill of pilots that ultimately determines the outcome of wildfires.

The technology underpinning helicopter-based fire-fighting continues to progress, as airborne fire suppressant delivery systems improve. However, even with these advances, one fact remains constant – skilled piloting is central to the safe execution of the mission. Technology may be able to help the process, but it cannot replace a competent human operator.

'There have been some small advances in equipment, but the reality is that airborne fire-fighters still fight fires the same way that they have for years,' said Keith Saylor, fire operations manager at Columbia Helicopters, a rotorcraft services operator based in Portland, Oregon.

The company operates Boeing Vertol 107s and Model 234 Chinooks under contract to a number of US government fire-fighting agencies, both as needed and on exclusive-use arrangements.

'Our job is to get these crews on site and off, and support their efforts by dropping loads of water or chemical fire suppressants,' he continued. 'It takes capable, well-trained pilots to do that.'

Fire tamer

To the casual observer, helicopter fire-fighting consists of water-bombing fires into extinction. However, the reality is very different – the rotorcraft's mission is not to extinguish the fire, but rather tame it enough to allow ground-based fire-fighters to land and put it out.

'We've all seen the news footage of wildfires, where the flames are 8ft tall and roaring,' said Travis Alexander, battalion chief with Cal Fire Tactical Air Operations, the state agency responsible for fighting wildfires throughout California, using a mix of its own helicopters and crews, plus professional ground firefighters. 'The truth is that humans cannot get close to fires where the flames are taller than 3-4ft – there's too much heat. So our job is to cool down the fire with aerial drops to make the site safe for firefighters.'

Another reason that helicopters fly support missions, rather than try to put out fires on their own, is due to the nature of the fires themselves.

'When you have a 4ft-thick log that's on fire, you can douse it with water for hours, then leave it alone and find it still burning the next day,' added Saylor. 'The fire gets deep into the wood, and can smoulder on for hours, even in rainstorms, so there's no point trying to fight it with repeated air drops.'

Of course, helicopters are not the only form of aerial fire-fighting platform. Fixed-wing aircraft are also in use, with a trend towards creating ➡

ever-larger bombers, such as the Evergreen Supertanker, which is a converted Boeing 747-100 with a payload capacity of 93,200l.

In comparison, the largest helicopter fire-fighting platform, the Erickson S-64 Aircrane Helitanker, only carries around 12,000l. However, it can draw water by hovering over a water source, whereas the Evergreen Supertanker has to land to be refilled – and requires a minimum 2,400m runway for take-offs and landings.

'Our Chinook carries the same amount of water as the Aircrane,' noted Saylor. 'However, the Aircrane requires adequate rotor clearance to fill its tanks. With our buckets at the end of 200ft-long lines, we – and other bucketed aircraft – can fill from tree-lined streams and rivers. It's conceivable that we could even pull water from a backyard pool – but that's unlikely to happen.'

Bristow Academy offers the Wildland Fire Orientation for Rotary Wing Pilots six-day course to help train less experienced crews. (Photo: Bristow)

Setting the standard

For three decades, SEI Industries' Bambi Bucket has been the standard helicopter fire-fighting tool. Its ability to carry up to 11,800l of water with a pilot-controlled drop valve has made it an invaluable asset towards the global annual aerial attack on wildfires.

Thirty years of experience has led the company to improve upon its original design – offering model ranges compatible with helicopters like a Robinson R44, right up to an Aircrane or Chinook.

SEI also pioneered other advancements in fire-fighting buckets, including multiple-drop valves, coverage level control, foam injection and the Powerfill system, which allows bottom filling in shallow water sources closer to the fires, minimising transit times between drops.

In early 2012, SEI Industries purchased the Fast Bucket product line, and added yet another type of gated, variable-capacity multi-drop heli-bucket

'Soon there will be GPS-based records of water drops to help improve accuracy when attacking a fire.'

technology to its product line. 'With the addition of Fast Buckets, we now offer a complete line of fire-fighting buckets to meet the demands of the end-user pilots, but also the requirements of the fire management agencies,' said Shawn Bethel, SEI Industries' division manager.

'The Fast Bucket line is aimed at supporting smaller helicopters with lighter-duty mission requirements. Meanwhile, our new Bambi Max, which comes with a low-power/quick-operating multiple-drop valve, lets medium- and heavy-load operators improve efficiency by managing their loads, allowing them to pull more water to the fire through each fuel cycle.'

Hillsboro Aviation provides a range of services, including use of a plastic sphere dispenser to suppress areas prone to wildfires. (Photo: Hillsboro Aviation)

Operational approach

Operational improvements are not only being achieved by manufacturers. They can also be brought about by the approach of specific helicopter operators that integrate various advances to improve the quality and efficiency of their fire suppression services.

Such is the case with Hillsboro Aviation, a helicopter/fixed-wing services company based in Hillsboro, Oregon. During the recent 2012 fire season in the northwestern US, it supplied fire-fighting services using a fleet of Bell 205A-1++, 407 and 206L-3/L-4 LongRangers for a number of US government clients.

'We use lightweight, synthetic long lines, state-of-the-art Fast Buckets with split-drop capability, Bambi Buckets, remote hooks and a fleet of modern fuel service vehicles equipped with Jet A fuel tanks with capacities ranging from 600-4,000 gallons [2,700-18,200l],' said Amy Smith, Hillsboro Aviation's director of marketing.

'The equipment has improved significantly over the past decade, especially with the Fast Bucket, with its split-drop capability. With one load, the pilot can serve multiple hot spots in support of the ground crew.'

Hillsboro Aviation has also upgraded the communications systems on its fire-fighting platforms by adding digital FM radios and automated flight-following systems into its Bell helicopters.

'Having a safety management system is now a prerequisite for government fire-fighting operations,' continued Smith. 'Our head of charter operations, Franz Bergtold, imagines that soon ➡

there will be GPS-based records of water drops to help improve accuracy when attacking a fire.'

Despite all the technological advances, one constant in helicopter fire-fighting is the need for reliable, load-carrying workhorses. This is why Bell UH-1s/205s and 206 LongRangers, BV 107s and Chinooks, and Erickson S-64 Aircranes are typically fighting fires around the world.

'We have 14 Vertols and seven Chinooks in our fleet,' added Saylor. 'These are basic, hard-working helicopters that do the job, day in and day out.'

'We count on the UH-1 platform, with nine in service at our nine bases and two in reserve,' noted Alexander. 'We have done some upgrades to them, like adding Bell 212 transmissions, main rotors and tails, but in general these are older model helicopters that we can depend on – and do.'

Hillsboro Aviation operates a fleet of Bell 205s, 407s, 206L-3s and 206L-4s (pictured). (Photo: Hillsboro Aviation)

Workhorse stable

Hillsboro Aviation relies on its stable of workhorse Bell helicopters to support a range of duties. These include initial attacks on small fires, support on larger fires with water bucket work, crew shuttle, equipment transport and additional services, including plastic sphere dispenser, heli-torch, fire mapping and general reconnaissance, according to Smith. She noted: 'We also have the unique capability of performing short haul with our Bell 407, which allows us to rescue injured personnel from inaccessible areas where helicopters cannot land.'

Piloting helicopters in fire conditions is not for the faint-hearted, or the inexperienced.

'There are lots of hazards to be dealt with, such as smoke, flying in hot and high conditions and managing drops on urban interfaces,' added Saylor. 'These last areas are where modern housing is encroaching on wild lands, creating areas where civilians can get in trouble by being in the wrong place during water drops.'

Add the challenges of long-lining water buckets, bringing fire crews in and out in windy/fiery conditions and picking up water on the fly from ponds and rivers, and helicopter fire-fighting is not a job for rookies. This is why Cal Fire, Columbia Helicopters and Hillsboro Aviation look for pilots with a lot of hours under their belt, plus experience flying lumber and other long-lined loads.

Once they have such pilots in-house, these departments carefully train them as co-pilots, working with experienced fire-fighting aviators until they reach a high enough level of proficiency.

'There's a lot to be managed in fire situations,' said Cal Fire line pilot Tom McConnell. 'You're working in a 3D environment, with the need for 3D situational awareness, and you have to be able to cope when things change, like the weather, the winds, the fire – or all of the above at the same time.'

Once these pilots are on the job, they regularly train alongside Cal Fire's ground firefighters. The goal is to make these teams so well integrated that executing the mission during actual fires comes as second nature.

For pilots looking for a challenge, helicopter fire-fighting is a career worth considering. It offers a work environment that changes from day to day, posing intellectual and operational challenges that keep flying skills sharp.

Training course

Companies such as Columbia and Hillsboro do hire experienced pilots, and then enhance their skills to full fire-fighting flight status. However, it is possible to get a leg up on this process by taking a training course, such as the Wildland Fire

'A considerable amount of time will be spent on what a helicopter pilot really does on a fire.'

Orientation for Rotary Wing Pilots six-day course offered by Bristow Academy, which has locations in Gloucester, England; Titusville, Florida; and New Iberia, Louisiana.

The course covers fire behaviour, wildland fire operations and how helicopters are used in fire suppression and prescribed burning, across three modules.

The first two are S-190 Introduction to Fire Behaviour and S-130 Fire-fighter Training. Both of these were developed by the National Wildfire Coordinating Group (NWCG), the federal body that coordinates US national wildfire management, and graduates receive NWCG-recognised certificates.

The Bristow course also covers helicopter flight operations, according to Nick Mayhew, general manager of Bristow Academy's Titusville school. 'This section will cover the tasks that a helicopter pilot would do on a fire, along with the safety concerns associated with those operations,' he said.

S-190 covers basic wildland fire terminology and how and why fires burn. 'Then we look at the fire environment – how topography, fuels and weather affect how a fire spreads across the landscape,' continued Mayhew. 'Finally, students are introduced to factors which may cause extreme fire behaviour and major safety concerns.'

He noted that S-130 covers all the information a person needs to become a basic wildland firefighter, including: safety concerns, fire organisation and fire-fighting techniques; fire organisation scene elements, such as the Incident Command System; basic tools such as pumps, hoses and firing devices; and fire suppression techniques.

'Other subjects that are included in S-130 are radio communications, hazardous material awareness, use of topographic maps and fires in the wildland/urban interface,' explained Mayhew.

What it takes

Finally, the helicopter fire operations will look at what is needed to become certified (carded) as a wildland fire pilot, including the number of hours required as pilot in command, hours on type, terrain experience needed, time on appropriate engine type and the personal protective equipment they will need.

'Safety will be discussed,' added Mayhew. 'Dispatching, flight following and air-to-ground radio communication information will be presented... A considerable amount of time will be spent on what a helicopter pilot really does on a fire.'

The course also looks at different missions, covering initial attack, sizing up a fire, transporting personnel and equipment to and from the area, and water or retardant drops.

'Currently, this course does not include any airborne bucket training,' he continued. 'However, should there be sufficient interest from attendees who would like this additional training, we will consider setting this up as a future add-on course using the Bell 206.'

No matter how advanced aerial fire-fighting technology becomes, nothing can replace the pilot in the left seat. There is simply no computer that can integrate all the elements in the 3D fire environment, balancing all the factors and hazards in real-time.

Wildland fires show no signs of diminishing in the future – no matter how tight a government's purse strings, the need for helicopter fire-fighting and skilled pilots will always remain. **RH**

Intermountain Life Flight responds to emergency calls from many remote areas. (All photos: author)

Too hot to handle?

EMS is one of the toughest tasks that helicopters can be assigned. Barry Smith visited Intermountain Life Flight's base in Salt Lake City, Utah, to experience how the operator conducts its missions during summer heat and in mountainous surroundings.

As advanced as helicopters have become, there are still some missions that challenge modern machines, with one of the most demanding being EMS in hot and high environments.

Intermountain Life Flight (ILF) has been flying such missions since 1978, and is located in Salt Lake City, which is situated at the base of the Wasatch Range, a north-south-running mountain range with peaks reaching 12,000ft. With a base elevation of 4,200ft and an average of 56 days a year with temperatures over 32°C, ILF has always tried to use aircraft with hot and high capabilities able to cope with the climate.

The operator began missions with the Aérospatiale Alouette III before adopting the Agusta A109K2, and now has started to use the Agusta A109 GrandNew, being the first EMS user of the type in the US.

'We have been flying the Agusta A109K2 since 1993,' explained Bill Butts, ILF's director of operations. 'They have been very successful here because of their hot and high capabilities. Around 2008, we began to have issues with longer and longer downtimes due to parts availability. We recognised it was time to replace the aircraft and began to look for a replacement knowing that nothing could exactly replace the performance of the K2.'

Helo of choice

The pilots flew the MD 902, the Eurocopter EC145, the Bell 429 and the AgustaWestland AW109 GrandNew, and used the K2 as a ➡

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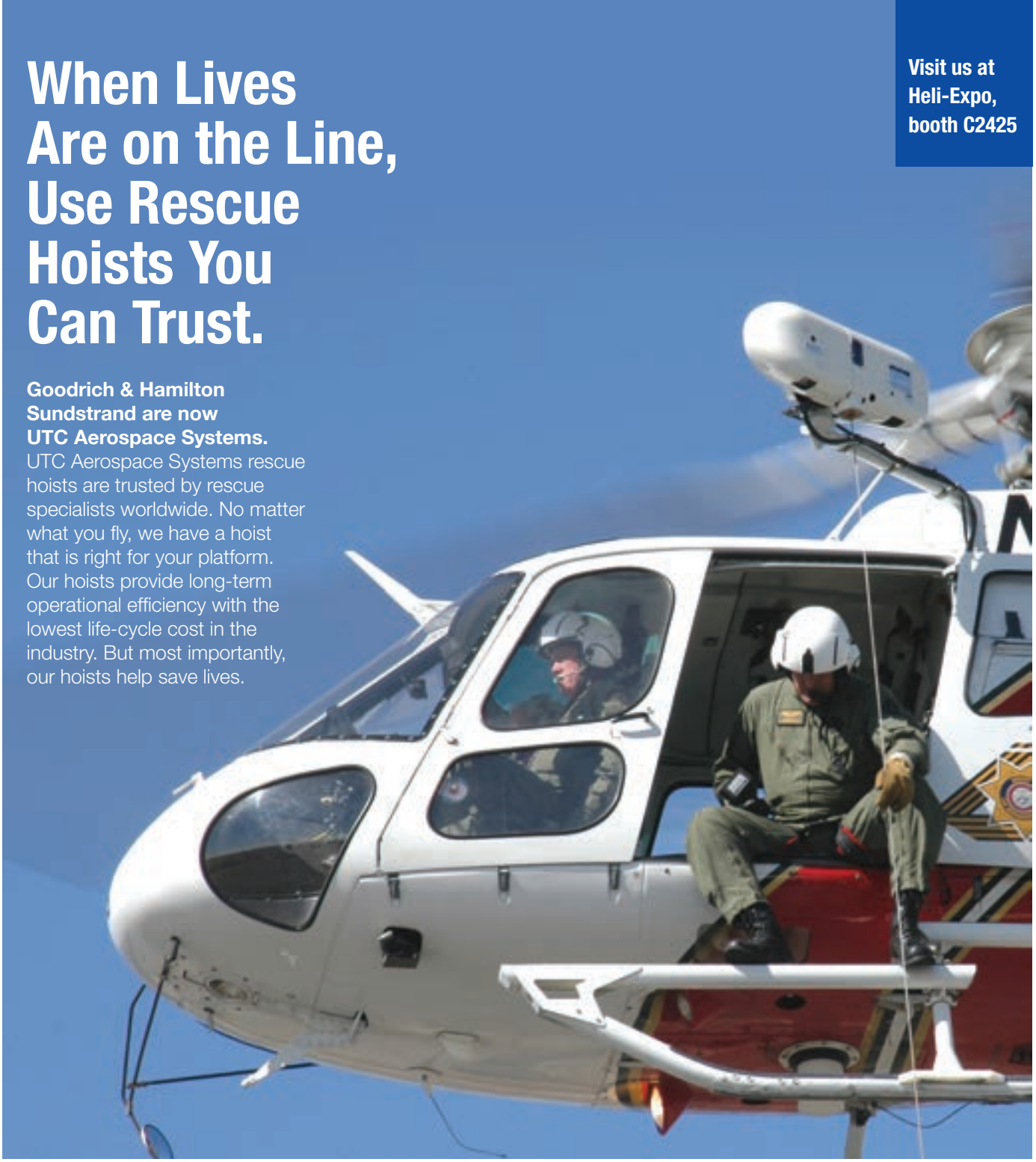

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An A109 GrandNew approaches a high-altitude landing zone at a ski resort near Salt Lake City.

benchmark to select a machine that could come as close as possible to the performance they wanted.

'It came down to the Bell 429 and the GrandNew,' continued Butts. 'We did a fly-off between the two in the month of August – the hottest time of the year. I flew on every flight for both and recorded their performance on a detailed matrix. The GrandNew was a little bit faster and performed a little bit better than the Bell 429. We also had a long-standing relationship with Agusta, so we decided to go with the GrandNew.'

ILF has so far taken delivery of three GrandNews, with a fourth to be delivered in late 2013. Currently, the programme has helicopters based in Murray, Ogden, Provo and St George in Utah. A decision to exercise an option to purchase a fifth aircraft has not yet been made. The first aircraft was put in service at Dixie Regional Medical Center in St George – ILF's newest base – some 400km south of Salt Lake City in July 2011.

> 'It came down to the Bell 429 and the GrandNew. We did a fly-off between the two in the month of August.'

'So far, we are happy with the GrandNew,' added Butts. 'We knew it would not be able to match the performance of the K2, but it has been reliable, fuel-efficient and is fast. There have been issues with some of the electronics in the aircraft that we believe are due to the high temperatures in the summer, but we have been working closely with Agusta to fix those.

'We have taken steps to keep the aircraft cool, with reflective window shades and external air conditioning units while the aircraft sits on the helipad. We are also looking at acquiring a climate-controlled hangar in St George so the ship can be moved inside under certain temperature conditions.'

'We have about 600 hours on our GrandNew at St George,' commented Nate Porter, a pilot at the base. 'We routinely fly over 10,000ft to cross the mountains to our east – I personally have been on a scene flight at over 9,000ft. Weather patterns are typical for the desert southwest – we get monsoonal patterns from July into September, with frequent thunderstorms and locally heavy rain and temperatures well over 100°F [38°C].'

The glass cockpit of the A109 GrandNew.

To the limit

On the day of *RotorHub*'s visit, it was 40.5°C. The GrandNews have a temperature limit and are not supposed to take off in temperatures above 50°C. 'I have been within one degree of that limit,' said Porter. 'Transitioning to the GrandNew was challenging for me because I had never flown a twin or a helicopter with wheels, and never flown with a glass cockpit or an autopilot. I was hired in December of 2011 and moved directly into the GrandNew.

'There is not a single mechanical gauge in the helicopter. Learning how to manage the flight management system [FMS] was hard for me. Learning how to create flight plans and input them into the FMS, using an autopilot that even has an auto-hover mode – all this was a big challenge. In the beginning, the amount of information the system was giving me was like trying to drink from a fire hose – I definitely got overloaded at first. Once, I was so overloaded in training that I forgot to put the gear down on an approach. The warning system told me, so there was no adverse effects, but it shows how basic things can be overlooked.'

Intermountain bases helicopters in Murray (illustrated), Ogden, Provo and St George, Utah.

'It generates a huge amount of information, but it puts a large number of tools at the pilot's disposal.'

He continued: 'Once I began to understand how the systems worked and developed an organised approach using all the different features, things fell into place. I was the first GrandNew pilot trained in-house – all the others had been trained by factory pilots.

'While the programme is not IFR-approved, all the pilots are IFR-rated and maintain their currency in case they encounter IMC [instrument meteorological conditions]. Every training flight we simulated inadvertent IMC and I had to use the FMS to do an IFR approach to the nearest airport using the autopilot.

'Two features of the autopilot are very useful for inadvertent IMC or if the pilot encounters vertigo at night. One is a "go-around" feature that will level the aircraft and begin a climb at 700ft/min. The other will level the ship and fly straight on the heading when it is activated. Both of these features are activated by the push of a single button on the collective. That is one of the great things about this helicopter – it generates a huge amount of information, but it puts a large number of tools at the pilot's disposal that can be used for safety in critical situations.'

Porter said in the event of an emergency where the pilot is incapacitated, say by a bird strike, the medical crew member up front could engage the autopilot to fly the aircraft. They could then make radio or satellite phone contact with one of the other pilots and be talked down to a controlled landing using the features of the autopilot.

Customer customisation

The GrandNew brochure features a long list of customisation, including avionics and navigation equipment. The main electronic flight instrumentation system was designed by Chelton (now Cobham). One option, not installed on ILF's machines, is the Synthetic Vision System. This is a computer-generated view of the landscape in front of the aircraft using data from terrain and obstacle databases, the navigation solution, attitude information and other inputs.

'We do have the terrain awareness and avoidance system,' explained Porter. 'I like it, especially for night flights and inadvertent IMC – flying among the mountains just before dawn can be difficult on NVGs. The same is true flying near cities – it is still too dark to see with the naked eye, but the horizon is bright enough to interfere with the goggles.

'This is where the terrain awareness system comes in handy. We don't use it as a primary navigation tool, but it gives us indications when we are flying below the terrain ahead of us. Another nice feature of the system is the ability to see if I will be encountering any terrain that will rise above my flight path up to ten miles [16km] ahead of the aircraft. This allows me to plan a climb long before I approach that terrain. Again, this is especially helpful at night.'

He continued: 'We also have the "Highway in the Sky" system. It draws a series of boxes on the primary flight display. As long as you fly the aircraft symbol through the boxes, you will remain on course at the altitude entered into the navigation system. It makes it very intuitive if you have to hand fly an approach to an airport. It can also be used for en-route flight from point to point using the information that was programmed into the navigation system.

'At night in the remote areas we fly in, it feels like someone has painted the windows black. I had no experience with NVGs before I started flying with Life Flight. They were difficult to get used to at first, and I wondered how I could use them to land at a remote scene. One of the

primary problems with NVGs is poor depth perception, so we trained a lot in remote areas, and this allowed me to accurately assess whether a landing zone was too small. Since everything is some shade of green, it also allowed me to see what grass, snow, rocks and bushes look like wearing goggles.

'It is also difficult to judge slopes under goggles. You just have to slow down and do a really good reconnaissance of the landing zone. This is where the crew, also on goggles, helps guide me during the final part of the landing – I couldn't image flying into the remote areas without NVGs.'

Need for speed

Porter said that a typical cruise speed is 135-140kts at 65% power. They can go faster, but fuel consumption increases dramatically. The GrandNew is about 15% faster than the K2 and more fuel-efficient. The GrandNew is a newer aircraft, but its performance in the hot and high environment is not as good as the K2.

While the engines are almost identical in terms of power output, the GrandNew's maximum gross weight is over 300kg heavier. Porter said they have to watch the performance charts carefully on the GrandNew in the summer to make sure they have the necessary power to perform a mission at a given weight. With the K2, the pilots never had to worry about the aircraft being able to perform a mission in their operating area in the summer.

Eventually, the GrandNew will participate in ILF's rescue hoist programme, the only one of its kind in the US operated by a hospital-based EMS helicopter. When ILF was first looking at purchasing the A109K2, Swiss rescue operator Rega was in the US to take delivery of a K2, and Agusta asked the operator to fly it out to ILF to demonstrate its capabilities. Rega had been doing hoist rescues using small helicopters, and the management at ILF became excited about the abilities of the K2 for hoisting.

'We started talking to the FAA and they were not receptive at all,' added Butts. 'It turned into an uphill battle, and we finally enlisted the aid of Utah senators Orrin Hatch and Jake Garn, who helped us deal with the FAA – we finally got approval after about seven years. In 1999, we brought out some people from Rega to train our crews.

'Since we had bought the K2s in 1993, we have had a very close relationship with Rega. We adopted all the same equipment they used and their operating procedures. We finally began operations in 2001. On average, we do 10-15 hoist rescues a year. We will respond out of our normal operating area to perform a hoist rescue on a case-by-case basis.'

He continued: 'We have not started the process to get the GrandNew certified to do hoist missions yet. The ships all have mounting brackets and power cables to mount a hoist. We don't know if it will be a quick transition or another long, drawn-out process. We have three new ships now and will be getting a fourth in late 2013.

'We operate the K2 under an exemption from the FAA. If we keep the K2 as a backup ship, will we lose its exemption once the GrandNew gains its exemption? We just don't know, and that worries us. If we don't buy that fifth GrandNew, we would keep one or both of the K2s as backup ships and could use them as the hoist ships.

'If we proceed with getting the GrandNews hoist-qualified, we will have to come up with some creative procedures to allow it to hoist from some areas because it does not perform as well as the K2. We will have to do a dance with fuel loads and how much equipment we take off the aircraft to do hoists at high altitudes. The first step is to get all the crews comfortable with operating the GrandNew as an EMS ship first before we even think about hoist certification. It could be up to two years before we start hoist operations with the GrandNew.' **RH**

Southern skies

With the upcoming launch of a formal trade association and an impressive rise in rotorcraft registrations in recent years, many are optimistic about the future of the Australasian market. Tony Skinner provides a timely update.

When the aviation community descends on Melbourne for the biennial Avalon airshow in February, one story of note will be the formal launch of a new trade association devoted to furthering the interests of the helicopter community.

The Australian Helicopter Industry Association (AHIA) aims to advance the Australian rotorcraft industry by bringing together government, regulatory authorities and the helicopter community, and create a productive working relationship with the Civil Aviation Safety Authority (CASA).

The organisation also aims to coordinate research efforts to create off-airport areas for helicopter operations and promote the development of new rotary-wing services to the public.

Formal representation

The Australian rotorcraft community has been unrepresented by a formal trade body since the Helicopter Association of Australia (HAA) collapsed in 2008. The formation of the AHIA is one visible indicator of not only the growth in the industry – helicopter numbers in Australia have increased 600% from when the HAA was incorporated in 1984 – but also an acknowledgement of the number of challenges it now faces.

With Australia experiencing strong economic growth, the dramatic expansion of the country's civil helicopter fleet is forecast to continue in the near- to medium term. At the end of 2012, the CASA aircraft register showed 2018 helicopter registrations – an increase of 16% over a 12-month period. In fact, in the past ten years helicopter numbers have more than doubled, and at the present growth rate, the overall civil helicopter fleet is forecast to double again in the next seven years.

By way of comparison, the fixed-wing general aviation fleet in Australia currently has a growth rate that is struggling to reach 1%. Similarly, the civil helicopter sector in the US is struggling to achieve a 2% increase each year due to economic difficulties.

The boom in numbers has been fuelled by the continuing expansion of the energy and resources sector in the north of Australia, as well as growth in the country's SAR and EMS services, which has in turn increased public demand for improved helicopter services in remote areas.

Australia's civil helicopter fleet is forecast to double in the next seven years. (Photo: author)

The use of helicopters for aerial fire-fighting is a burning issue in Australia. (Photo: *RH* picture library)

Furthermore, the latest Australian GDP figures show that the highest performing regions were the Northern Territory, Queensland and Western Australia, where growth rates are at least twice GDP. Tellingly, around 60% of the country's helicopter industry is located within these regions, and operators are expected to benefit from further expansion in energy and mining.

According to the AHIA, it is assumed each new airframe entering the register creates 1.3 new jobs, when the normal pilot attrition factors of 15% – due to retirement, sickness, change of careers etc – are considered.

While the increase in overall helicopter registrations should translate into good news for OEMs and their sales representatives across Australia, many actually stated a slowdown in orders in 2012.

The AHIA reported that while turbine sales were slow, Robinson Helicopter remained the choice of aircraft manufacturer across Australia, with the company now pushing its share of the register to around 54%. In addition, many operators are choosing to purchase second-hand machines from abroad, using the strong Australian dollar to pick up rotorcraft from Asian operators suffering debt difficulties.

In recent years, natural disasters such as the Bundaberg floods in January and Australia's frequent bushfires have only helped raise public perception of the benefits of helicopters in providing an effective response to such situations. In the former case, Emergency Management Queensland's Rescue 521 helicopter, a Bell 412, winched 50 people to safety in a single 12-hour shift.

According to media reports at the time, it is estimated 1,000 people were rescued by air in Bundaberg during the floods. By comparison, an EMS operator in the region would typically carry out between 450 and 500 retrievals a year.

In another incident that attracted a lot of media attention in January, four Dutchmen were rescued by CareFlight near Darwin after spending 22 hours clinging to mangrove trees to avoid a large crocodile.

The requirement for helicopter response during natural disasters is possibly the reason Russian Helicopters was seeking CASA certification for the Ka-32A11BC. The aircraft was certified by CASA

The Robinson R44 is popular in Australia, with nearly 500 aircraft registered. (Photo: Bidgee via Wikimedia Commons)

in December, and the company will be formally announcing the milestone at Avalon during a ceremony that will also provide technical presentations on the Ka-32 and Ka-62 – the former being widely used by the Russian emergency services, especially fire-fighting agencies, as well as operators in fire-prone countries, such as Brazil, Portugal, South Africa, Spain and Turkey.

Russian Helicopters might have been eyeing involvement with Australia's National Aerial Firefighting Centre, which had invited organisations to tender for the provision of a range of aerial services to support bushfire fighting in Australia. This tender closed in early December.

Challenges ahead

While the headline growth figures make for enjoyable reading for proponents of the civil helicopter industry, several challenges face the sector in both Australia and New Zealand.

Factors that could have an adverse effect on the industry and hamper current growth include: a shortage of experienced pilots and engineers; the overseas tourist trade; the strength of the US dollar; and the health of Australia's beef industry. Regarding the last factor, Australian mustering operators currently fly more hours than all the other industry segments combined, so any slowing of the beef export market could create difficulties for many.

Due to rapid expansion in both mining and offshore exploration, the number of heavy helicopters is increasing at almost three times the rate of the single-engine fleet. An approximate 21% annual increase in the twin-engine fleet (compared to the single-engine rate of 8% per annum) is also being fuelled by the SAR and EMS sectors.

A shortage of experienced pilots is already being felt across Australia, and there is a fear manpower problems across the industry will restrict growth, especially for the new multi-crew, IFR-capable helicopters that will arrive in the next six years, and given that CASA figures show the average age of helicopter pilots and engineers is 48 years.

On the MRO side, Australia's civil helicopter industry has traditionally relied on ex-defence force personnel, engineers who have crossed over from the fixed wing world and, to a lesser extent, helicopter-specific apprentices to meet its needs.

However, with the Australian Defence Force planning to contract a civilian operator to take over army and navy helicopter pilot training under the Helicopter Aircrew Training System project – scheduled to start early 2016 – there is concern

about industry's capacity to train enough pilots and maintainers.

If China goes ahead with plans to open its airspace to private helicopter operations, the explosion of activity that is forecast could also attract large numbers of Australian pilots and instructors to help fill the demand.

Beyond the need to train more pilots and engineers, there is also a current lack of night-flying and IFR capabilities in flight schools.

Theory test

The shortage of licensed aircraft maintenance engineers for the helicopter industry has led Aviation Australia – a government-owned organisation established in 2001 – to start offering its first rotary-wing-specific courses. The organisation allows students to complete the theoretical component of an apprenticeship before joining a private organisation to complete their training.

As part of the new helicopter-specific training, the students will work on an OH-58A and a number of Robinson R44s, and receive training in helicopter-specific structures, aerodynamics and flight control systems.

A further consideration for Australian operators looking to take advantage of the current expansion of the offshore oil and gas industry – and the resultant demand for more multi-engine helicopters – is CASA's overhaul of the regulations governing the operation of heavier rotorcraft.

The regulator has started issuing a number of updated civil aviation advisory publications (CAAPs) that largely follow International Civil Aviation Organization rather than FAA regulations.

These include CAAP 92-4(0), governing the development and operation of offshore helicopter landing sites, including vessels, which was released in draft form in October; and Project OS 11/24, incorporating 'performance class concepts into Australian helicopter operations'. The majority of these changes are expected to be completed in 2013.

Island hopping

Across the Tasman in New Zealand, the country's geographical spread and relatively small population of just over four million has resulted in one of the highest per capita helicopter ownership levels in the world.

Rotorcraft in New Zealand are used for such diverse roles as deer hunting, crop spraying, lifting, fertiliser spreading, heli-skiing and frost protection missions over vineyards during critical months.

However, the role the helicopter is perhaps best known for – providing sightseeing flights across the country – has suffered in parallel with the global financial crisis.

While the New Zealand helicopter industry has traditionally grown at the same rate as Australia in the 6-7% range, the smaller neighbour has not matched Australia's increased growth rate in recent years. The number of helicopters in the country stands at 776, according to the most recent figures, and many expect this to decline until the tourist industry returns to pre-financial crisis levels.

According to statistics provided by the New Zealand Helicopter Association, the country also suffers from a high accident rate, with 41 serious crashes occurring during 2010/11. These included nine agricultural incidents, 15 accidents by other commercial operations and 13 by private operators.

Public perception surrounding this issue took a further blow when a private pilot was convicted in March 2012 of flying a helicopter over a lake with a passenger dangling from its skids in an impromptu thrill ride.

However, when it comes to CAR Part 135 operations (commercial air operations), New Zealand reached its ten-year fatality-free record in December 2011. The eight years prior to 2001, by comparison, saw 34 lives lost during a period that ended with only 450 helicopters in the country. **RH**

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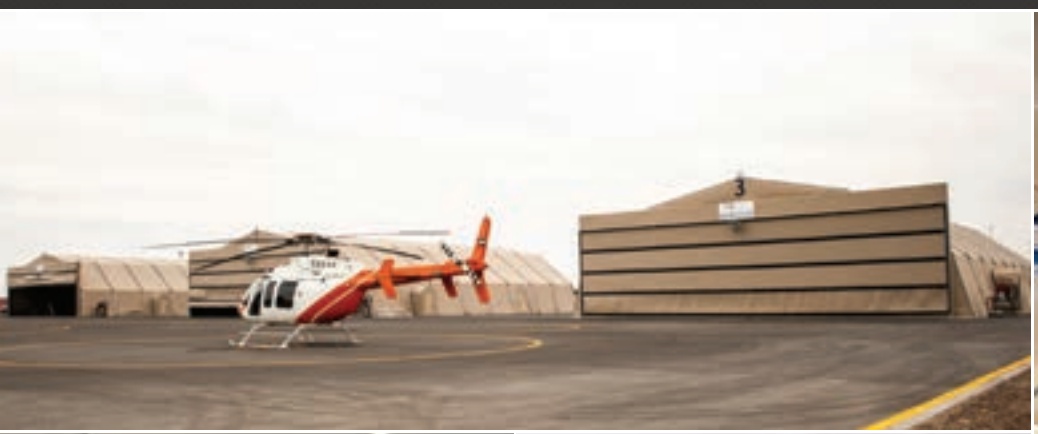

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Maturity assessment

Gasoline piston engines are still the powerplant of choice for most light helicopters. Rob Coppinger looks at what emerging technologies could augment – or even replace – internal combustion.

Avgas piston powerplants remain dominant in the light helicopter market. (Photo: Robinson Helicopter)

Helicopters have come a long way since a 24hp Antoinette engine powered Frenchman Paul Cornu's pioneer rotorcraft on a brief tethered hover in December 1907.

Rotary-wing aircraft have achieved greater altitude and range performance with the adoption of turbines, yet aviation gasoline (avgas) piston powerplants still persist on light helicopter types.

A mature technology, the internal combustion engine has a history going back over 100 years, with parallel development in the automotive industry. Unlike cars, aircraft engines' performance metrics include: inspection after so many flight hours; regulated oil and component changes; mandatory time periods between engine overhauls (TBOs); and continued use of leaded fuels, such as 100 low-lead avgas.

To equal or better the initial purchase, maintenance and operational costs and fuel efficiency of such an established powerplant requires a lot from any technology, new or old.

Limited options

The options open to the helicopter operator are limited. All-electric aircraft have so far been confined to technology demonstrators, although the automotive industry's hybrid drive trains seem to hold promise – and what of diesel?

Of these possible options, diesel engines have been used in the car industry for decades – can they now meet aviation's performance requirements?

'The advantages of diesel are fuel commonality and availability,' explained Dale Taft, a propulsion and flight test engineer at Robinson Helicopter. 'The fuel economy of the diesel engine is usually 20% better than a spark ignition engine.'

Because of these factors, there are ongoing attempts to develop diesel power for helicopters. 'We are talking to various US homebuilt diesel helicopter projects and a military unmanned rotorcraft project,' said Stoney Burke, DeltaHawk Engines' VP of sales and marketing.

His company is working on an aircraft engine, and Burke expected certification by the end of 2012, so he could then offer it to that military project and the homebuild community.

One higher-profile effort DeltaHawk has been involved with is Brisbane-based Delta Helicopters' D2. The invention of Graeme Smith, this A$200,000 (US$208,000) two-seat kit-

Sikorsky's Firefly project aims to quantify the benefits of electric propulsion for rotorcraft. (Photo: Sikorsky)

built rotorcraft was to use DeltaHawk's DH200 V4 two-cycle engine.

For Smith, the advantage of diesel was that it is more suitable as a helicopter engine because it allows the user to better maintain horsepower. As diesel is a subsidised fuel for Australian farmers, he also expected a ready market in his home country. The goal was to certify the D2 by 2010, but two over years on he is still trying to get a completed engine.

'He had a tethered test flight two years ago with the diesel engine, he modified it but the company [DeltaHawk] can't certify it at this time,' said Burke. 'We could not certify his modifications until we have finished doing what we're doing with our customers for their aircraft.' The last contact DeltaHawk had with Smith was early in 2012 – Smith was not available for comment to *RotorHub*.

While DeltaHawk's customers and Smith wait for a certified engine, Lycoming field service engineer Brian Costello is less than enthusiastic about diesel's future. 'Lycoming has done quite a bit of R&D,' he said. 'From a technical standpoint, the advantages of diesel only really exist and the numbers only work out when avgas is not available or is priced extremely out of reach.'

Other disadvantages Costello sees are that diesel engines are heavier and more expensive. 'Lycoming builds engines to accommodate our airframe customers and we're ready to move forward when the appropriate customers move down that [diesel] road,' he noted.

Electric dreams

While helicopters are not about to adopt diesel engines en masse, other technologies advanced by the automotive world could be coming to rotorcraft – electronic ignition and electronic fuel injection being two examples.

'[Lycoming and Continental], and some start-up companies, are looking at multiple options in terms of improving the systems or upgrading them on the current engines – electronic ignition, electronic injection, certifying existing engines to run on some variation of unleaded fuel, even unleaded automotive fuel,' Taft said, adding that he is unconvinced unleaded fuel could be adopted. 'You can't just use automotive fuel because there are some security requirements and stuff for aviation.'

Costello declined to talk about what specific improvements Lycoming is working on. 'There is nothing I can discuss at this time,' he said, adding that any discussion of ongoing improvements would 'delve into the quite technical'.

For Costello, piston engine development is not about big improvements anyway, and the technology has matured to the point where it results in 'small but significant refinements over the years', with the aim of reducing operational costs.

Past refinements Costello was able to mention include: a new roller tap that rolls over the cam; improvements in thunderheads, valves and guides for reducing unscheduled maintenance; changes to cylinders and pistons to increase operating temperature; the use of magnesium in engine sumps and the retention of steel where strength is needed in crankshafts and connecting rods.

'We have a very mature product that is engineered with reliability and minimal unscheduled maintenance as primary goals. We have achieved 99% of it and now we work on the small bits,' he added.

This incremental approach has always been necessary because of the need to maintain an engine's airworthiness certification. 'For direct performance increases, we have to recognise that an engine is certified for a specific horsepower,' continued Costello. 'If we improved that, [the engine] wouldn't be legal any more. Our engines have a TBO, then the government agencies turn it into a mandatory requirement.'

The reason regulators take that TBO as mandatory is that Lycoming dominates the market for non-kit light helicopters in the US. Robinson uses the company's engines for its entire piston-engined range, as do Enstrom, Sikorsky and Hiller.

'They are the only engines we use,' said Taft. 'All of the companies that make piston helicopters use Lycoming. The other most common general aviation piston-engine manufacturer is Continental.'

Hybrid tendency

If, as Taft says, automotive technologies such as electronic ignition and injection are of interest to aircraft engine makers, then what of the trend for hybrid drive trains, where battery-powered electric motors aid the internal combustion engine?

Eurocopter has been developing a hybrid system for autorotation situations when the main turboshaft has lost power. In October 2011, the ➡

Lycoming piston engines power helicopters from Enstrom, Hiller, Robinson and Sikorsky. (Photo: Lycoming)

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DeltaHawk is working on a diesel engine option for helicopters. (Photo: DeltaHawk)

company announced that an AS350 had been used as a demonstrator fitted with an electric motor and lithium ion battery.

At the time, Eurocopter CEO Lutz Berling said: 'We are proud to have brought the first helicopter equipped with an internal combustion engine and electric propulsion system to flight. Hybrid propulsion is an important element of Eurocopter's innovation roadmap.' The next step is to mature the technology for the company's series production models.

Eurocopter's hybrid system is still only a supplementary power source for emergency situations, and Costello does not expect to see a role for hybrid main propulsion. 'With the continuous power that is needed for aircraft, where we operate at a high percentage of the engine potential, virtually any time it is in the air, the advantages of a hybrid don't exist,' he explained. 'And with the added complexity and weight, it's simply not appropriate.'

If diesel is heavy and expensive and automotive electric technologies deliver too little power and too much complexity, why not simply scale down turbines? Some light helicopters are already turbine-powered – Robinson's five-seat R66, with a maximum gross weight of 1,225kg, uses a Rolls-Royce RR300 300hp turbine, while Sikorsky's S-333 and S-434, weighing in at 1,155kg and 1,315kg respectively, both use the Rolls-Royce 250-C20W gas turbine, derated to about 420hp.

However, these aircraft, according to Taft, could also use piston engines. 'We did some parameters studies, and we figure that somewhere between 300 and 400hp it starts to make a lot of sense to look at a turbine,' he said. 'If you use a rough rule of thumb, [with] 10lb [4.5kg] of lift per horsepower and a take-off weight of 3,000-4,000lb [1,360-1,815kg], then turbines start to look attractive.' Below those figures, turbines are very fuel-inefficient – 'they suck down gas'.

So the gasoline piston engine seems to have an unassailable position at the low end of the size spectrum.

Making history?

However, that could change following a brief but historic flight in France. Designed and flown by Pascal Chretien, a battery-powered helicopter made an untethered hover lasting a few minutes in August 2011. Funded by Provence-based racing car specialist Solution F, the aircraft used Danish firm Lithium Balance's battery management system. Neither Solution F nor Chretien were available to interview.

Their success raises the eventual prospect of all-electric rotorcraft competing for the two-seat market that the Robinson R22 dominates, however Taft is not convinced.

'Electric motors are really heavy, as they are made out of copper and iron, so without some quantum leap I find it difficult to believe you can get a powerplant installation that leaves you anything left over for people,' he explained

Costello is equally unconcerned about the threat posed to Lycoming's engines. He said: 'Electric technology is fascinating. It doesn't matter how boring a tank of gas is, it does an amazing job of storing energy, and batteries are not there yet in terms of the energy density.'

However, helicopter history may repeat itself, with the employees of pioneer Igor Sikorsky's eponymous company determined to unlock electricity's potential.

Jonathan Hartman, the company's programme manager for its battery-powered rotorcraft project, Firefly, said: 'The hope of the programme is for Sikorsky to really quantify the benefits of electric propulsion for rotorcraft.' All-electric can mean fuel cells or ultra-capacitors as well as batteries. The latter are a capacitor that can store a huge amount of energy and deliver it to a motor instantly.

Sikorsky estimates that an all-electric helicopter will have up to 15% fewer parts, leading to a direct operating cost reduction of up to 30%. Firefly, a modified S-300C, is based at Sikorsky's West Palm Beach facility where it has gone through all the maintenance and certified checks needed for flight.

As for the electric technology, final system bench testing is ongoing. This is to ensure that battery packs, motor and controller are all working together before they are installed in the airframe. Once all that is done, ground and flight tests will be undertaken.

But Hartman is not setting a schedule yet. 'We're not putting a date on either the ground or flight test, at this point,' he said. 'We'll conduct ground tests at the end of our system bench testing, and flight test when we go through our safety reviews in accordance with our standard practices.'

Worth the weight?

The key metric for electric helicopters is how much power the battery or fuel cell holds. According to Hartman, as power is measured in Watt-hours (Wh), the goal is 500Wh per kilogram of battery or better. This will deliver an hour of flight for a light helicopter, with reserves.

He noted that Firefly 'is now in the 100-120Wh/kg range with our current battery cells'. Today's state of-the-art batteries are at about 200Wh/kg – Hartman declined to estimate when 500Wh/kg will be available, but said technology is advancing rapidly and 'there are 10-15 chemistries vying for that award'.

Sikorsky is trying to learn as much a possible about the technology, which means 'Firefly is a fully funded programme that allows us the opportunity to continue to discover'. While the aircraft is an all-electric technology demonstrator, Hartman expects to see spin-offs for electric subsystems, from the drive train to avionics.

For the foreseeable future then, avgas piston engines will dominate the powerplant market for light helicopters, delivering predictable maintenance requirements and fuel consumption for operators. However, whether in the form of hybrid power or subsystem technology, electrics could be set to deliver more options to enhance propulsion performance. **RH**

'Somewhere between 300 and 400hp it starts to make a lot of sense to look at a turbine.'

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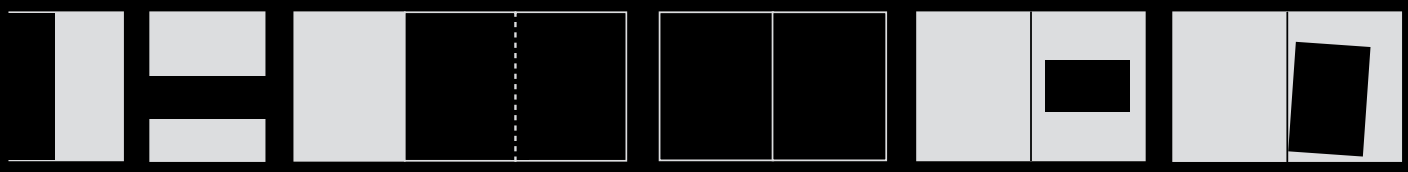

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All photos: Alexander Mladenov

Cream of the crop

The launch customer for the agricultural version of the Enstrom 480B was Bulgaria's Fortuna Air. Krasimir Grozev and Alexander Mladenov visited the company to find out how it uses the type in its new role.

When Fortuna Air's owner, Gancho Daskalov, opted to replace his five-strong fleet of worn-out Kamov Ka-26s with the Enstrom 480, many saw it as an adventurous move. However, the Veliko Tarnovo-based aviation entrepreneur, who is also chairman of the influential Association of Agricultural Air Operators in Bulgaria, stands by the decision.

'The new helicopters are in high demand for all types of agricultural work across Bulgaria due to their good productivity and high spraying quality, provided by the Isolair gear, the first [spray system] in the world designed for the Enstrom 480B,' he said.

The initial phase of Fortuna Air's fleet renewal programme called for purchasing a brand-new Enstrom 480B, which was ordered in June 2008, together with the associated and yet-to-be-developed agricultural spray equipment.

The deal also included type rating training for one pilot, one engineer and one mechanic. The overall investment made during the first phase amounted to about $1.2 million, secured through bank financing.

Spray service

The new machine was delivered in December 2008 and entered operation with Fortuna Air in January 2009. The following month, an Isolair technical team came to Bulgaria to complete installation of the spray equipment and assist the company in achieving certification by the local civil aviation authorities.

The new Enstrom 480B was the first of its type to be used for crop spraying, outfitted with a tailor-made Isolair 480B spray kit system with a belly-mounted tank assembly. The helicopter began undertaking its unsung but important, agricultural tasks in early April 2009.

The 545l Isolair 480B spray equipment has Kevlar booms with a swathe of some 25m – this is a very important consideration, affecting productivity, and was checked during tests at Fortuna Air's base at Gorna Oriahovitsa in April 2009, using coloured water.

Fortuna Air instructor pilot Spiridon Khristov praised the quality of spraying, noting that the rotor jet wash contributes greatly to the excellent dispersion of the preparation/water solution.

The system is equipped with a flow control in the cockpit, so adjusting spray volume is fast and easy. The tank mounts under the belly and the entire assembly of pumps and booms attaches with only a few quick disconnect pins. This means that the helicopter can be reconfigured for other applications quickly and with less work.

In order to satisfy the growing demand for crop-spraying helicopters from its traditional customer base in Bulgaria following the grounding of the Ka-26 between 2010 and 2012, Fortuna Air went ahead with the second phase of its fleet renewal drive by purchasing three more Enstrom 480s.

Fortuna Air still operates one Ka-26, which will be kept in flying condition until 2015.

'The helicopter is much more versatile than the An-2, which requires airstrips next to the fields.'

All of these are second-hand machines, carefully selected and modified after delivery to integrate the Isolair 480B spray kit system. Currently, the company has five pilots rated for carrying out crop-spraying work on the Enstrom 480.

As Daskalov noted, an annual utilisation of 350 flight hours per helicopter provides a good return on investment from the new machine and its high-tech spraying gear. For the first example in particular, return on investment took three years, while for the much cheaper second-hand Enstrom 480s, this period was shorter.

Their principal work during the busy spring months comprises spraying cornfields with herbicides. The helicopter is a particularly useful piece of equipment in fighting plant diseases, such as those spread by insects, especially at the stage when the corn is already grown and thus cannot be treated by ground equipment due to the risk of damaging the crop, or when the soil is too wet after heavy rainfalls.

The helicopter is also much more versatile than the An-2 fixed-wing crop-spraying aircraft, which requires airstrips next to the fields. Taking into consideration the growing importance of helicopters and the sharply reduced number of airstrips available for fixed-wing agricultural operations across Bulgaria, Daskalov is planning to further expand the company's rotary-wing fleet by introducing even heavier and more productive machines.

Getting technical

The Enstrom 480 has also proven itself in spraying using ultra-small-volume equipment – ie technical-grade material, using a rotary atomiser system. There are a number of advantages in using technical-grade materials, particularly in forestry protection, as there is no need for solvents and carriers and no mixing is required.

That is why, in addition to treating cornfields and fruit tree plantations belonging to private owners or commercial companies, the Fortuna Air Enstrom 480s have been contracted on numerous occasions by Bulgaria's Ministry of Agriculture and Forestry to spray – using the ultra-small-volume method – over areas affected by diseases and contamination.

In addition, the helicopters use the Isolair spray gear to kill mosquitoes in the summer. This is undertaken around the towns situated alongside the Bulgarian part of the Danube river and on the Black Sea coast under contract with the local municipal authorities.

Outside the crop-spraying season, the Enstrom 480s are used for a wide variety of commercial applications, including occasional SAR work – the helicopters can be equipped with pop-out floats and cargo hooks.

In summer 2012, one of the machines was hired by the Bulgarian Maritime Administration to provide SAR coverage over the southern part of the country's Black Sea coast. The helicopters are also highly valued by the regional police departments in Veliko Tarnovo and Gorna Oriahovitsa, where they support operations.

The type is also called upon in case of emergencies, such as searching for criminals, surveillance of areas of interest and disaster-relief efforts. Daskalov noted that when his helicopters are being used on request from the local police services, he does not charge the customer for these flights, and even the pilots do not ask for payment for such missions.

Staying in-house

Fortuna Air has a Part 145-certified maintenance organisation and approved Enstrom Helicopters service centre, situated at Gorna Oriahovitsa airport. Daskalov also runs a flight training organisation out of this location, which was approved by the Bulgarian CAA in the summer of 2012, and is mainly used for type rating of new pilots on the company's Enstrom 480s.

Both these in-house make the operator self-sufficient in terms of maintenance and training, allowing significant cost savings.

'Our new helicopters have exceeded our expectations by far,' noted Khristov. He is an experienced Enstrom 480 pilot, with more than 1,000 flight hours on the type, most of them logged in demanding agricultural missions since 2009.

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'The pilot enjoys ample tail rotor power, an important consideration when flying low.'

Khristov supported the manufacturer's claim that the Enstrom 480B is a responsive, versatile and easy-to-fly machine, with reasonably low purchase and direct operating costs.

The Enstrom 480B is powered by a Rolls-Royce M250-C20W turbine capable of producing 420shp, although only 304shp are used in continuous mode, thus providing plenty of reserve power for operations in a heavy configuration in hot-and-high conditions over rough terrain – a welcome feature for risky agricultural work. The other three Fortuna Air Enstrom 480s, purchased on the second-hand market, are powered by a slightly less powerful derivative of the same engine, rated at 290shp.

Using a high-inertia, three-blade rotor, the helicopter is free from any critical hovering restrictions in winds up to 35kt from all directions, noted Khristov. The pilot enjoys ample tail rotor power, an important consideration when flying low and performing sharp turns over crops or forests, especially in windy conditions over rugged terrain. The Enstrom 480 has also proven well suited to high-altitude operations, spraying in mountains at elevations up to 6,500ft above sea level without any significant payload restrictions.

The pilot enjoys excellent visibility, especially downwards, and can also operate from slopes up to 15° – a remarkable feature that, as Khristov explained, is expanding the number of suitable spots next to crop fields for refuelling and refilling the tank of the spray system.

Proving its worth

Khristov observed that, thanks to the advanced Isolair spray system, combined with the easy-to-use turbine engine and excellent controllability, the nimble Enstrom 480 has proven to be more than just a match for the much heavier Ka-26, a Soviet-made model designed in the 1960s and widely used in the past for agricultural work, with a few examples still in operation.

'The piston-engined Ka-26 is a very tough machine – I can say it is a remarkable Murphy's Law-proof helicopter,' he explained. 'It is very rugged – you can give it a kick, to pull it about, and it keeps working and working. Compared to the Ka-26, the Enstrom 480 was a brand new world for us, having virtually nothing in common with its Russian-made forerunners we used to fly in the past.'

The empty weight of the Ka-26 equipped for agricultural spray work is 2,200kg, while the Enstrom weighs only 800kg – maximum payloads are 600kg and 400kg respectively.

The Russian rotorcraft, employing a coaxial rotor, is powered by two M-14V-26 nine-cylinder piston engines (each rated at 325shp) that burn 180l per hour of expensive and hard-to-procure avgas, while the Enstrom 480B's Rolls-Royce M250-C20W boasts an hourly fuel consumption of 100l and burns the much more affordable jet fuel – in Bulgaria, as a rule, jet fuel is almost three times cheaper than avgas, and is also much easier to buy.

A sortie for spraying herbicides on a cornfield takes between eight and ten minutes, and on a good day, the machine can amass between 30 and 40 such flights. The helicopter is mostly in demand for work over rough terrain, where fixed-wing aircraft cannot operate safely and effectively.

Khristov acknowledged that the most difficult job is to spray over forests, where, in order to be effective, the helicopter is required to be around 30ft above the terrain at all times, with the pilot constantly monitoring both the wind direction and speed, as well as scanning for obstacles in front of him.

Getting overheated

'The Ka-26 features a slightly better productivity, around 1,000 decares per hour, but is very dependent on the ambient temperature, as its performance starts degrading when the temperature exceeds 20°C, continued Khristov. 'In addition, the Ka-26's performance is adversely affected with the increase in the crop field's elevation above sea level. This, however, is not the case with the US turboshaft design, which also boasts less wind limitations and landing site longitudinal/latitudinal slope limitations – ie 15° versus only 3° for the Ka-26.'

Compared to the Ka-26's economy of operations, the Enstrom 480B offers a slightly higher spraying cost per decare, chiefly due to its higher acquisition costs, resulting in greater amortisation expenses.

'There are no chances for developing modern agricultural business in Bulgaria without crop-spraying support from the air, and we are committed to continue providing a big added value to this important economic branch in our country,' concluded Daskalov. **RH**

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In each issue, *RotorHub* presents part of what will become a comprehensive guide to the world's civil-operated rotorcraft – in production, in service or under development.

Hiller UH-12E

Despite being designed in the 1940s, the UH-12 light helicopter continues to be built and sold by Hiller Aircraft. Developed from the Model 360 of 1948, the UH-12 features an uprated piston engine, making the type ideal for pilot training, and was bought by the US Army and US Navy for that purpose. The UH-12E4 featured a stretched cabin with seating for four. The UH-12E3 is the current production version, making its first flight in June 1995. The aircraft has proven successful in the agricultural sector, and the company claims the highest useful load of any aircraft in its class.

Weights

Maximum Take-off Weight:	3,100lb (1,406kg)
Useful Load:	1,341lb (609kg)
Empty Weight:	1,759lb (797kg)
Maximum Fuel Capacity:	308lb (140kg)

Powerplant

One Lycoming VO-540-C2A flat-six piston engine, producing 340hp (253.5kW) derated to 305hp (227.5kW), driving a two-bladed main rotor and two-bladed tail rotor.

Performance

Maximum Speed:	83kts (155kph)
Maximum Cruising Speed:	78kts (145kph)
Fuel Consumption (Fast Cruise):	N/K
HIGE (3,100lb):	7,300lb (3,318kg)
HOGE (3,100lb):	3,800lb (1,725kg)
Service Ceiling:	15,000ft (4,573m)
Range (Standard Fuel):	201nm (374km)
Range (Plus Aux Fuel):	376nm (697km)
Maximum Endurance (Standard Fuel):	2hr 42min
Rate of Climb:	1,290ft/min (6.55m/s)
Temperature Limitations:	N/K

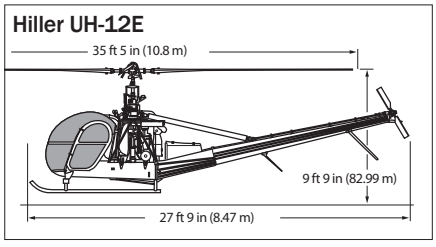
External Dimensions

Rotor Diameter:	35ft 5in (10.8m)
Fuselage Length:	28ft 6in (8.69m)
Overall Length:	40ft 8½in (12.41m)
Disc Area:	990ft² (91.97m²)
Width (Skid Track):	7ft 6in (8.69m)
Height:	10ft 1¼in (3.08m)

Internal Dimensions

Cabin Width:	4ft 11in (1.5m)
Cabin Height:	4ft 5in (1.35m)
Cabin Length:	5ft 0in (1.52m)
Floor Area:	12.5ft² (1.16m²)
Baggage Volume:	N/A

Maximum Seating: Three people



Hiller UH-12ET

A turbine-engined version of the UH-12 was originally developed by Soloy, which saw the potential of not only offering a new variant of the helicopter, but retrofitting the engine to piston-engined models. The first turbine-powered UH-12, designated UH-12ET, received certification in April 1975. Production was halted in 1983, but restarted again in 1995, with the turbine version being re-designated the UH-12E3T. Production of this model continues alongside the piston E3 variant, albeit in small numbers.

Weights

Maximum Take-Off Weight	3,100lb (1,406kg)
Useful Load:	1,460lb (664kg)
Empty Weight:	1,640lb (745kg)
Maximum Fuel Capacity:	308lb (140kg)

Powerplant

One Rolls-Royce Allison 250-C20B turboshaft producing 400shp (298kW) derated to 301shp (224kW), driving a two-bladed main rotor and two-bladed tail rotor.

Performance

Maximum Speed:	83kts (155kph)
Maximum Cruising Speed:	78kts (145kph)
Fuel Consumption (Fast Cruise):	N/K
HIGE (3,100lb):	8,600ft (2,620m)
HOGE (3,100lb):	5,600ft (1,700m)
Service Ceiling:	14,000ft (4,260m)
Range (Standard Fuel):	150nm (278km)
Range (Plus Aux Fuel):	279nm (516km)
Maximum Endurance (Standard Fuel):	1hr 55min
Rate of Climb:	1,518ft/min (7.7m/s)
Temperature Limitations:	N/K

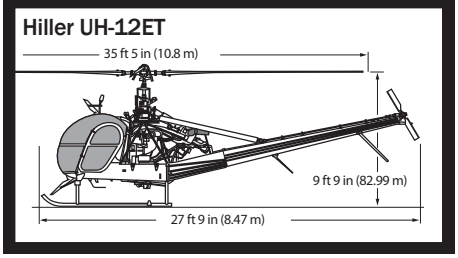
External Dimensions

Rotor Diameter:	35ft 5in (10.8m)
Fuselage Length:	28ft 6in (8.69m)
Overall Length:	40ft 8½in (12.41m)
Disc Area:	990ft² (91.97m²)
Width (Skid Track):	7ft 6in (8.69m)
Height:	10ft 1¼in (3.08m)

Internal Dimensions

Cabin Width:	4ft 11in (1.50m)
Cabin Height:	4ft 5in (1.35m)
Cabin Length:	5ft 0in (1.52m)
Floor Area:	12.5ft² (1.16m²)
Baggage Volume:	N/A

Maximum Seating: Two people



Hughes 300C

An improved version of the Model 300, the Hughes 300C features a more powerful engine, increased main rotor diameter and larger tail rotor and fin. The improvements led to a 45% increase in payload. First flight was in August 1969, followed by FAA certification in May 1970. FAA certification was also gained for a quieter version, based on the techniques developed for the OH-6A 'Quiet One', and this was known as the Model 300CQ.

Weights

Maximum Take-off Weight:	2,050lb (930kg)
Useful Load:	1,000lb (454kg)
Empty Weight:	950lb (431kg)
Maximum Fuel Capacity:	308lb (140kg)

Powerplant

One 190shp (141kW) Lycoming HIO-360-D1A four- cylinder piston engine, horizontally mounted below the seats, driving a three-bladed main rotor and two-bladed tail rotor.

Performance

Maximum Speed:	91kts (169kph)
Maximum Cruising Speed:	82kts (151kph)
Fuel Consumption (Fast Cruise):	N/K
HIGE:	6,000ft (1,830m)
HOGE:	2,700ft (823m)
Service Ceiling:	8,000ft (2,440m)
Range (Standard Fuel):	200nm (370km)
Maximum Endurance (Standard Fuel):	N/K
Rate of Climb:	750ft/min (3.81m/s)
Temperature Limitations:	N/K

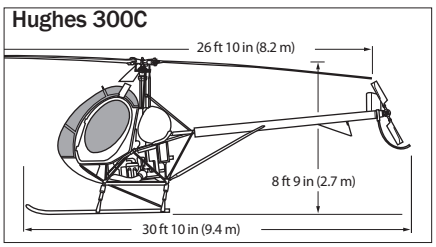
External Dimensions

Rotor Diameter:	26ft 10in (8.18m)
Fuselage Length:	22ft 0in (6.8m)
Overall Length:	30ft 11in (9.42m)
Disc Area:	565.5ft² (52.5m²)
Width (Skid Track):	6ft 3in (1.91m)
Height:	8ft 9in (2.67m)

Internal Dimensions

Cabin Width:	4.2ft in (1.30m)
Cabin Height:	7ft 1in (2.18m)
Floor Area:	12.4ft² (1.16m²)
Baggage Volume:	100lb (45kg)

Maximum Seating: Three people



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Good times, bad times

As both new and pre-owned helicopter sales begin to stabilise, William Sturm of Heli Asset questions if we will ever return to the unprecedented pre-2008 activity levels, and if that is even a good thing.

I grew up with a father in aircraft sales and learned at a young age that feasts and famines come with the territory. In the same way I can remember a shiny new Corvette parked in a Wichita driveway, I can also remember friends and neighbour kids moving away because of downsizing. These situations can come and go quickly, or they can linger for years. However, I can vividly remember my father saying: 'It will come around, it always does – it's the nature of the beast.'

The helicopter industry has always enjoyed the cushion of being able to provide more of a commoditised lift aspect that stays strong during economic downturns. Utility rotorcraft are neither viewed nor implemented in the same way as their VIP brethren, and continue to be operated in such a way that replacement machines are frequently required. However, steep economic downturns can seriously affect the overall health of an OEM and its ability to supply these machines.

Slow recovery

A poignant example of this was the economic malaise of the late 1970s. High inflation and skyrocketing fuel prices forced a large percentage of VIP helicopter owners to abandon the industry altogether. Utility operators were forced to struggle on amidst high prices and a shortage of access to new machines. In 1979, the civil aviation industry produced more than 17,000 aircraft – three years later, that number was less than 2,000. Recovery was slow but steady, not returning to a true healthy state until the early 1990s.

The 'flash crash' that we later saw as a result of 9/11 was altogether different. Insurance rates and fuel prices immediately went through the roof, grounding the majority of the industry overnight. However, the rebound was swift, marked by an increase in access to credit and the introduction of invasive airport security procedures that made the use of private helicopters seem like something both attainable and far superior. And so began the boom.

Wild ride

As a young pre-owned broker in 2006, it was a wild ride with a steep learning curve. Every deal was crazier than the last, and there were no shortage of buyers with money to burn. Then the music stopped, and everybody went to battle stations. Seasoned brokers knew how to weather the storm and stuck to their loyal client base, while anyone with a mobile phone and a real estate licence decided to jump all over the overflowing pre-owned market.

With zero experience and rock-bottom commissions, the market was flooded with aircraft brokers representing a recently busted neighbour that was ready to offload its latest model twin for a song. It was a lousy environment to work in, but you did what you had to do.

So after a few years of grinding it out, the situation has begun to normalise. Eurocopter has shown small but increased orders for civil aircraft in 2012. After an up and down year, Textron stock is trading at its highest level since 2008, bolstered by the strength of Bell Helicopter. AgustaWestland has been able to maintain its order book levels, in comparison to 2011, and increased its revenues by almost 10%.

Having briefly seen the boom, I have spent the majority of my professional life working in what can only be compared to a post-apocalyptic market. Many of my peers are back on the hunt for clients with a limitless budget and a voracious appetite for champagne wishes and caviar dreams.

However, these clients are more often than not incapable of maintaining a high level of opulence and are the first ones to take a dive when the cycle repeats itself. When the eventual boom comes around again, as it inevitably will, I plan on sticking close to my core clients and trying to develop new relationships that value the broker-owner dynamic that enjoys a boom, but has the experience to know how to survive a bust. If you are good at what you do, you will keep doing business and that is the way it should be. **RH**

William Sturm is sales director of Heli Asset, specialising in Eurocopter models. www.heliasset.com

The editor welcomes *RotorHub* reader contributions for consideration on the Collective Pitch page. Submissions should be in the region of 750 words and offer comment and reflection on a particular issue affecting the civil helicopter industry. *RotorHub* reserves the right to edit copy for style, length or legal reasons.

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