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June/July 2012

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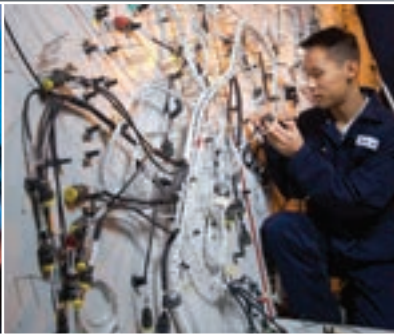
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Shephard's aerospace and defence publishing portfolio incorporates six titles: *Defence Helicopter*, *Digital Battlespace*, *Land Warfare International*, *Military Logistics International*, *RotorHub* and *Unmanned Vehicles*.

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ROTORHUB

THE HUB OF THE HELICOPTER BUSINESS

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ROTORHUB (ISSN 1754-520X) is published 6 times per year – in February, April, June, August, October and December – by The Shephard Press Ltd, 268 Bath Road, Slough, Berkshire, SL1 4DX, UK. The 2012 US Institutional subscription price is £65. Airfreight and mailing in the USA by agent named Air Business, c/o Priority Airfreight NY Ltd, 147-29 182nd Street, Jamaica, NY 11413. Periodical postage paid at Jamaica, NY 11431. US Postmaster: send address changes to Air Business Ltd/ Priority Airfreight NY Ltd, 147-29 182nd Street, Jamaica, NY 11413. Subscription records are maintained at CDS Global, Tower House, Lathkill Street, Sovereign Park, Market Harborough, Leicestershire, LE16 9EF, UK. Air Business Ltd is acting as mailing agent. Articles and information contained in this publication are the copyright of The Shephard Press Ltd and may not be reproduced in any form without the written permission of the publishers. No responsibility can be accepted for loss of or damage to uncommissioned photographs or manuscripts.

DTP by Vivid Associates Ltd, Sutton, Surrey, UK

Printed by Williams Press, Maidenhead, UK

© The Shephard Press Ltd, 2012
 ISSN 1754-520X



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SAR standardisation

With Greece teetering on an economic precipice, there has been much debate in recent weeks about the concept of 'Europe' and its future survival.

However, it was cooperation of a different kind that absorbed the attention of delegates at the SAR Europe 2012 conference in Dublin earlier this year, with discussions surrounding the potential creation of a unified European Coast Guard.

Chris Reynolds, director of the Irish Coast Guard, outlined measures the EU is taking to bring broader coordination to the sector, including commissioning a feasibility study that will look at how to offer a standardised SAR service across Europe, potentially

cutting across civilian and military lines.

While this is by no means a new idea – the last such report to be commissioned stalled before any concrete recommendations were made – this time the European Commission, through the Directorate-General for Mobility and Transport, is examining three SAR 'products': structured cooperation forums; member nations working together on an ad-hoc basis; and permanent coordination in certain areas.

From a SAR helicopter perspective, it is certainly a provocative image – the pooling of assets by need rather than national boundaries, the introduction of common training and branding and bringing greater buying power to the collective.

Despite this, when it comes to the pooling of helicopters, the concept is easy to dismiss, especially given the current situation that sees responsibility for the tasking of assets among the member states fall to a myriad of government organisations, both civilian and military, and private companies, all with their own cultures, priorities and motivations.

In developing an acceptable and workable model that covers the three desired end states, the European Commission will be examining the activities of the European Defence Agency (EDA) as a guide.

On the helicopter front, the EDA's most high-profile initiative is the Future Transport Helicopter project, which is seeking a new heavy-lift rotorcraft for France and Germany by 2020. However, it is an indication of where Europe finds itself that a two-state collaboration to buy essentially off-the-shelf equipment for a well-defined mission is often described as 'ambitious'.

More relevant to what the European Commission is trying to achieve with this latest feasibility study is the EDA's Helicopter Training Programme, which was launched in 2010 and has since trained more than 150 crews.

In addressing the training element, the EDA hopes to raise operational output for a relatively low cost through the hosting of multinational exercises, helicopter tactics courses and operational English language training.

Helicopter training is just one of 11 pooling and sharing (P&S) initiatives the EDA coordinates that have been endorsed by EU ministers of defence. This model of identifying shortfalls in national capabilities for potential P&S is supposed to promote savings, efficiencies and rationalisation, while simultaneously raising overall capabilities for member states.

Another possible vehicle for change is the European Coast Guard Functions Forum, which is a non-binding, non-political gathering of the various heads of coast guard services across each EU maritime nation and associated Schengen states.

However, applying such top-down models to the SAR arena in the context of a 'European Coast Guard' may fall short of genuinely cooperative ways of working. Industry sources in Dublin were generally sceptical that this approach will bring effective change. They argued that Europe's SAR coverage has evolved alongside the development and actions of the various operators, and it is at that level where collaboration can be best identified and carried out.

Moreover, any adoption of the P&S model to SAR should clearly be about more than cost savings or rationalisation for its own sake. Obviously, the person in the water does not particularly care which logo is on the side of the helicopter, what kind of uniform the crew wears or the type of funding mechanism covering the operation, as long as rescue arrives in time.

Tony Skinner, Editor

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- ◆ Helicopter retrofits
- ◆ Heavy lift

- ◆ Avionics
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Photo: Eurocopter



X³ ready for US debut

Eurocopter's X³ high-speed

demonstrator has arrived in the US to begin an exhibition tour.

The aircraft arrived at the HQ of American Eurocopter in Grand Prairie, Texas on 11 June aboard an An-124 freighter. It was then re-assembled for flight, ready to perform a series of demonstrations for potential civil and military customers.

A critical part of the trip will be to showcase the type's performance to the US Army, which is looking for a

high-speed capability under its Future Vertical Lift programme to replace the current inventory with a new generation of aircraft. As part of the tour, the X³ will fly to Redstone Army Arsenal in Alabama, Fort Bragg in North Carolina, Virginia's Manassas Regional Airport and military installations in the Washington, DC area.

'After our highly successful flight trials in Europe, the US tour will underscore the maturity of Eurocopter's answer for applications where mission success

depends on short flight duration through maximum cruise speed at reasonable operational costs,' said Lutz Bertling, Eurocopter president and CEO.

'It's important to demonstrate how we are applying innovation in responding to market needs with solutions that are available today, and which deliver cruise speeds 50% faster than standard helicopters at highly affordable costs – allowing for significant increases in productivity,' he added.

By Tony Osborne, London

HAD 1-T light helicopter completes maiden flight

France-based Heli Air Design (HAD)

has announced the successful first flight of its HAD 1-T light helicopter.

In a press release on 12 June, the company revealed that the milestone took place on 26 April.

Despite poor weather conditions at Metz-Nancy Lorraine airport, test pilot

Stephane Lignier was able to take the turbine-powered two-seater through a series of take-offs and landings before carrying out hover-taxi manoeuvres in ground effect.

The company said that the flights 'demonstrated that the aircraft complies with earlier technical forecasts'.

HAD now plans to conduct further flight trials leading to French (DGAC) civil certification. It will build two more pre-production aircraft and 'implement the industrial resources for series production'.

The company debuted the machine at Helitech Portugal in 2010. The 1-T features a carbon-fibre body and weighs in at around 370kg empty. The manufacturer claims that, even with the Solar T-62 turbine engine, operating and ownership costs of the type will be comparable to similar-sized piston-engine aircraft.

The aircraft will have a range of 300km and cruise at 108kts. HAD said that market studies suggest sales potential for more than 30 helicopters per year.

By Tony Osborne, London



Photo: HAD

PW210 to power Eurocopter X4

Pratt & Whitney Canada's

(PW&C) PW210 turboshaft has been selected as an alternative powerplant for Eurocopter's X4 next-generation helicopter.

RotorHub revealed that a P&WC option would feature on the new aircraft in February, but at the time Eurocopter CEO Lutz Bertling would not disclose the model or size.

PW&C gave details about its involvement in the X4 project in a press release on 25 April. 'With a PW210 engine you get high power, fast response and the lowest fuel burn in this market segment,' said Richard Dussault, VP of marketing at the company. 'That means payload and range benefits that keep our customers' assets flying efficiently and reliably.

'We have focused our technology on fuel efficiency, reduced emissions and maintenance technologies that deliver real value to our operators,' he added.

The PW210 variant to be fitted to the X4 will feature new alloys to improve its life cycle and a dual-channel FADEC. PW&C also said the engine will employ what it calls a 'state-of-the-art diagnostics capability, including automatic fractional cycle counting to minimise downtime and keep PW210 operators flying'.

The addition of the PW210 means that X4 customers will have two power options available. The other engine will result from Turbomeca's TM800 demonstrator, which is expected to be available from 2017 and is designed to produce around 1,100shp and deliver a 20%-plus reduction in fuel consumption.

No power or fuel consumption figures for the X4's PW210 model have been released by the company as yet. The powerplant also features on the Sikorsky S-76D (PW210S) and the AW169 (PW210A). The 'S' model was certified in 2011 and the 'A' is slated for certification in 2013.

By Tony Osborne, London



AW169 prototype AC1 will be joined by two more examples before the end of the year. (Photo: AgustaWestland)

AW169 makes flight test progress

AgustaWestland is building up flight hours on its prototype AW169 following the helicopter's maiden flight.

Since taking to the air on 10 May, the aircraft has flown ten hours (as of 15 June), as test pilots open the flight envelope of the 4.5t intermediate light twin.

The 25-minute first flight of prototype AC1 (I-EASF) assessed the type's handling qualities and basic systems. The test fleet will be expanded later, with the addition of two more prototypes due to fly this year, plus a fourth in 2013.

The AW169 is AgustaWestland's answer to Eurocopter's AS365 Dauphin family, which has dominated the intermediate twin market for 20 years. The former company has used its experience in the development of the AW139, and more recently the AW149 and 189 family, to deliver a relatively low-risk but extremely capable new aircraft to the market before Eurocopter has a chance to deliver its own modern high-technology and high-risk Dauphin replacement in the form of the X4.

Nonetheless, AgustaWestland is fitting new technology into the AW169, including an auxiliary power unit (APU) integrated into the Pratt & Whitney Canada PW210A engine. This APU mode allows the turbine core to be spooled up, providing electrical power for key systems without the need for ground power or starting the engine.

The main gearbox has been designed with a 30-minute dry run capability in the event of an oil leak. In the cockpit is an AgustaWestland integrated avionics system with a four-axis digital autopilot, TCAS II, an enhanced vision system and a health and usage monitoring system. Flight information for the crew is presented on three 10x8in touchscreen displays.

The company has collected around 50 orders for the AW169 so far. Among the customers is Bond Air Services, which secured a framework agreement with AgustaWestland for 15 helicopters, comprising ten firm orders and five options for the AW169, AW139 and AW189. Similar orders were placed by Lease Corporation International, part of the Libra Group, with a deal worth

€300 million (\$377 million), while two were ordered by Russian firm Exclases Holdings.

One of the largest purchasers of the type has been Spanish operator Inaer, which signed up for ten aircraft in June 2011. Two AW169s have been ordered by Abu Dhabi-based Falcon Aviation Services, while a further three examples have been ordered by Capitale Hélicoptère of Canada.

Other operators committed to the AW169 include New Zealand's Auckland Rescue Helicopter Trust, which ordered a pair of aircraft for EMS and SAR roles, and Malaysia-based Weststar Aviation Services, which ordered two to support its offshore oil and gas operations. The UK's Warwickshire & Northamptonshire Air Ambulance has inked a preliminary sale contract for two AW169s, making the charity the first UK-based operator to acquire the type.

Certification of the AW169 is due in 2014, with the first customers due to receive their aircraft shortly afterwards. The company predicts it will sell around 1,000 AW169s over the next 20 years.

By Tony Osborne, London

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11 June 2012

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28 May 2012

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23 May 2012

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18 May 2012

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21 May 2012

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15 May 2012

NEW E-APU60 COMPLETES FIRST FLIGHT TESTS
14 May 2012

KA-32A11BC DELIVERED TO EMERCOM OF KAZAKHSTAN
10 May 2012



All these stories can be found at www.rotorhub.com

Norway releases SAR shortlist

Norway has pre-selected four candidates to submit tenders for its All-Weather SAR Helicopter (NAWSARH) programme, the country's Ministry of Justice has announced.

The AgustaWestland AW101 Merlin, NHIndustries NH90, Eurocopter EC225 and Sikorsky S-92 have been shortlisted for the project, which is seeking a new fleet to replace the country's aging Westland Sea Kings.

Norway intends to acquire up to 16 SAR helicopters, with options for an additional six, while Iceland, which joined the programme in 2007, is looking to buy one aircraft with options for a further two.

The first examples are expected to be delivered during 2016, with the Sea Kings phased out by the end of 2020.

On 30 May, Eurocopter announced it is teaming with Heli-One to bid for the contract. Partnering as 'Team

NORDSAR', the two companies said their proposal would include the EC225 and the in-country support of Heli-One Norway.

'The Eurocopter EC225 is already on high-readiness alert in the SAR role at Hammerfest and offshore in the North Sea,' Eurocopter noted in a statement. 'The EC225 NORDSAR and its military-qualified equivalent, the EC725 NORDSAR, will in addition combine anti-terror capabilities, offering Norway a true multi-role solution.'

The Norwegian Ministry of Justice operates 12 Sea King Mk 43Bs, which were introduced in 1973 and are flown by the Royal Norwegian Air Force's 330 Squadron. The aircraft are used for SAR and air ambulance missions and are under the command of the Joint Rescue Coordination Centre of Southern and Northern Norway.

By Tony Skinner, London

Comment: Helicopters sell in Brazil

Latin America is one of the fastest growing helicopter markets in the world. After a brief decline in 2008, the region's appetite for used and new civil turbine rotorcraft rose as private and commercial operators replaced and expanded their fleets amidst the worldwide economic downturn.

A total of 141 helicopters was imported into South America in 2011, evenly divided between new and pre-owned turbines. Brazil, with the continent's largest fleet, is the dominant force in the region. Its helicopter imports rose 6% in 2011 and currently account for 52% of all

imports to South America and approximately 5% of the global fleet.

This is despite Brazil's convoluted tax regime, where multiple federal and state duties may be applicable depending on the individual case. Having an experienced agent locally is an invaluable resource in determining how to legally pay the least tax possible. This can be achieved, for example, by purchasing through trading companies that are levied at a significantly lower level, or by setting up a lease structure where the aircraft is 'temporarily' imported.

By Valerie Pereira, market intelligence analyst with Heli Asset

Rotorcraft orders placed since 6 April 2012

Aircraft	Customer	Order date	Total
EC145 T2	Gama Aviation	11 June 2012	2
AS350 B3e	Europavia	16 May 2012	6
EC130 T2	Europavia	16 May 2012	1
EC135	Romanian Ministry of Health	25 April 2012	2
EC225	Omni Helicopter International	20 April 2012	6
GrandNew	Japan National Police	13 April 2012	2

Sikorsky announces new president

Sikorsky parent United Technologies Corp (UTC) announced on 7 May that Mick Maurer has been appointed as president of Sikorsky Aircraft following the retirement of Jeffrey Pino from 1 July.

Pino, a former army aviator who became president in 2006, will continue to serve as a consultant to the company. Under his leadership, Sikorsky doubled its production rates and now competes with Eurocopter for the title of world's largest helicopter manufacturer, depending on exchange rates.

Maurer joined Sikorsky in 2000 from fellow UTC subsidiary Otis Elevator and most recently served as president of the Sikorsky Military Systems unit.



AgustaWestland has handed over an AW101 to the government of Turkmenistan. The aircraft – seen here lifting off from the company's Yeovil factory on 16 June – is the first civil AW101 since the delivery of a single aircraft to the Tokyo Police in 1998. The helicopter will be registered EZ-S715 on arrival in-country, and is fitted with a VIP interior. A second example will follow later this year. AgustaWestland has not publicly acknowledged the order for the two aircraft, which are believed to be replacing a pair of S-92s. (Photo: Rick Ingham)

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Bond Offshore has expanded its fleet in recent years with the addition of new AS365 N3 Dauphins and AW139s. (Photo: Bond Offshore)



Weathering

It is fair to say that the British press has not given the Bond Aviation Group an easy time in recent weeks. The national papers headlined concerns over the grounding of EC135s used by air ambulance operators in April, while the 10 May ditching of an EC225 in the North Sea unleashed a media frenzy, questioning the firm's safety record over the past three years.

Group CEO James Drummond is keen to set the record straight. In an exclusive interview with *RotorHub*, he praised the flight crew of Bond 88R and the team at Bond Offshore Helicopters for thoroughly investigating and examining the incident before returning to operations. 'We are completely open and transparent to customers,' he explained. 'We have absolutely nothing to hide on this and we want the customers to understand – I believe they do.'

'I believe that when you look at what happened, the Bond commitment to safety, the way the crew

acted in getting the aircraft down onto the water, getting everyone off safely and in enabling the recovery of the helicopter so that we have a pristine airframe, means that the AAIB [UK Air Accident Investigation Branch] are now able to work through [what happened] and we will get to understand what the issues are.'

Image change

The incident on 10 May was the third involving a Bond Offshore machine in just over three years. The worst of these occurred on 1 April 2009 when one of the company's AS332 L2 Super Pumas suffered a catastrophic main gearbox failure, resulting in the loss of all 16 on board. Today, Bond faces the challenge of reversing the perceived image of another red helicopter bobbing on the surface of the North Sea.

'A successful ditching is exactly what it was,' underlined Drummond. 'The captain and co-pilot

flew the aircraft fantastically in what was a challenging situation, and their judgment was exactly right. They acted that way because they are high-calibre individuals and we select high-calibre individuals – we train them as we sustain and grow. *The Press & Journal* newspaper in Aberdeen appreciated that point exactly, and that's why they had "heroes" printed on the front page.

'Having said that, it doesn't help seeing pictures of your helicopter floating in the sea, and it's not what we want. The reality is that we have been extremely unlucky – two gearboxes, about which we can do nothing, failing on our aircraft. These are replaceable units – they were in a Bond helicopter, but they could have been in anyone's. We are working closely with Eurocopter and the regulators to make sure this cannot happen again.'

The company is now acting to rebuild the confidence of oil workers. 'We need to communicate with our passengers because they

The Inaer-owned Bond Aviation Group has had a difficult past three years, with a number of helicopter accidents occurring. CEO **James Drummond** spoke to Tony Osborne about how the company is moving forward, rebuilding confidence and looking for new market opportunities.

the storm

are understandably concerned, and we need to show them that it is safe to travel on these helicopters and what we are doing to ensure their safety,' continued Drummond.

'We will be doing that extensively – we are talking about putting together a communications programme and educational courses for people who may be nervous flyers, further to the health and safety briefings they already get.'

The events of April and May have rounded off an extraordinary first year for Drummond. He joined the company in July 2011, just weeks after the owners of Inaer, Investindustrial and KKR (under the banner of World Helicopters), acquired the entire Bond Aviation Group. Since then, the company has invested in new aircraft, begun bidding for contracts in Australia and launched a new operating company in Norway.

The previous owners, brothers Peter and Stephen Bond, now have shares in the enlarged

'Even though those companies are global, they are contracting locally – helicopters don't fly that far.'

group. Peter remains chairman of the Bond Group and continues to support the business with its commercial development and customer relationships.

'The past eight months have been transformational for the group,' added Drummond. 'What was a good-sized and successful group of companies in Inaer in 2010 brought in a new investor, KKR, joint invested with Investindustrial, and that enabled significantly greater access to capital markets for the →





Inaer operates a large fleet of aircraft, including ten Kamov Ka-32s mainly employed for fire-fighting duties. (Photo: author)



group. As a result, the balance sheet was significantly strengthened and the business was positioned in a much stronger way financially to support future growth.

The next big change was that World Helicopters acquired the Bond Group, and then came the obvious question – what is the organising principle for the two groups of companies?’

Local connections

With such a large and diverse group operating in countries across Europe and in South America, Drummond was keen to retain the network of local operating companies in order to retain a close proximity to the customers.

‘We didn’t want to integrate the operating companies and we don’t want to create one single large integrated helicopter operating business. What we want to maintain is our very specific local operating companies, typically local to the countries and/or significantly different lines of business. The reason for this is that our customers are local, typically regional or national governments, or they are large oil and gas companies.

‘Even though those companies are global, they are contracting locally – helicopters don’t fly that far, they essentially provide a local service, and we believe firmly that the closer the operating companies are to their customers and better understand requirements, then the better they are

at operations to deliver a safe, high-quality service. That’s one of the fundamental organising principles.’

While there are obvious benefits in becoming a large operator, like CHC and Bristow, Drummond believes that the local approach to customers will be a more effective strategy in the long term. ‘What we want to do is try and get the best of both worlds. I think the local operating companies ensure that we aim at focus and proximity to the customers and retain a deep understanding of their requirements.’

Currently, the majority of Inaer’s work comes from what it describes as mission-critical services. In the UK, Bond Air Services provides helicopters to a large number of air ambulance operators

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Super Pumas and EC225s are seen here undergoing maintenance at Bond's facilities in Aberdeen. (Photo: Bond Offshore)

'The mission-critical business serves people and communities – we literally save people's lives.'

as well as the country's first wind farm support programme, while Bond Offshore Helicopters provides an offshore SAR service as part of Project Jigsaw in conjunction with oil company BP.

New opportunities

In Spain, Inaer has been working with the country's maritime agency SASEMAR for around 20 years, providing SAR around the Spanish coastline. Other Inaer group companies provide critical EMS services across France and helicopter flight training for all four of that country's armed services. Nonetheless, the group is keen to expand the work and sees new opportunities emerging in other regions.

'There are other markets we are considering in Northern Europe and also the Middle East, more for the mission-critical work rather than the offshore work,' explained Drummond. 'We want to retain a balance within the business, roughly 25% is heavy offshore oil and gas work, mainly with Bond, but we also have some in the Inaer companies as well, and we don't want to upset that portfolio mix too much.'

He pointed to the rapidly expanding oil and gas market in Brazil, where a number of major helicopter operators have set up shop, either through the creation of subsidiaries or buying local providers to support the country's offshore exploration needs. However, the group is ignoring the oil and gas work and pursuing the mission-critical work instead.

'Some companies are heavily investing in Brazil right now where there are very significant opportunities in oil and gas, but we have chosen not to because the mission-critical part of the business is a very important part of our strategy. I don't want to curtail the growth opportunities that are there and focus overly on just one particular segment.'

'I want to develop the portfolio as a whole and roughly maintain that balance as we grow. We want to maintain and develop the breadth of our business – we don't want to be a Bristow or a CHC, we have that heavy offshore oil and gas in our portfolio and we are continuing to invest in it, but its not the totality of the business.'

Outsourcing SAR

According to Drummond, many more nations, particularly those in Europe facing tough austerity measures on public spending, are increasingly

exploring the potential of contractorising critical helicopter services. Perhaps the best-known of these is the UK, which has been looking to outsource its SAR coverage for the past decade in a bid to reduce the reliance on the military.

'All governments in Europe are having serious thoughts about what they can and should be funding, the assets they should be using and services they are providing,' he noted. 'Numerous governments are beginning to think about using private companies like ourselves to take over and provide support' ➔



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With a backdrop of rough seas, this picture demonstrates the demanding environment faced by offshore oil and gas operators. (Photo: Bond Offshore)

'I don't want to curtail the growth opportunities that are there and focus overly on just one particular segment.'

to what have been traditionally government-run services.'

Drummond said that Germany in particular is thinking about outsourcing its SAR capabilities and is conducting a review into other potential mission areas. Having secured the Helidax flying school contract for the French military in conjunction with DCI, he believes there may be similar opportunities available in Portugal and Spain.

'In the medium term, we see real opportunities in being able to apply the efficiencies and economies we can bring to provide more essential services that are currently done within the public sector. We have been doing that already, but in the medium term, the opportunities in Europe are very significant.

'The mission-critical business serves people and communities – we literally save people's lives. It is essential infrastructure, like the road ambulance or the fire engine, and it's difficult to take that essential infrastructure away. It's both politically and socially difficult and economically counterproductive.'

He continued: 'Having said that, customers in Europe are under pressure. We need to work closely to ensure we can improve the efficiency of our product and services, and then we can share that benefit with the customers.'

Even further afield, the company is setting its sights on Australia. Inaer already had a subsidiary called Australian Helicopters, which is well known for its mission-critical work, but with expanding oil and gas extraction operations taking place along

the north-western coastline, the company has established a new branch of Bond, called Bond Helicopters Australia. The Brisbane-based outfit is in the process of talking to potential customers and applying for tenders in order to secure a piece of the rapidly changing market.

Sea change

Meanwhile, the North Sea is likely to remain an important market for the group for the foreseeable future, as current oil prices allow the extraction of resources that were previously considered too costly to exploit. Once the extractable oil has been removed, there is also an expected 10-20-year phase of decommissioning the various facilities, both onshore and off.

However, the North Sea is not just served from Aberdeen – there are also major operations from the Norwegian side, with platforms served from Bergen and Stavanger. As a result, Inaer through Bond Offshore has formed a new Norwegian subsidiary, Norsk Helikopterservice – due to begin operations this summer with AW139s.

'In line with having local operating companies, it has got Norwegian leadership and postholders, and it will be a Norwegian operating company, but we are supporting it with the experience, technical expertise and know-how from the offshore operations in Bond,' explained Drummond. 'It's not orphaned – we want it to be Norwegian, but it can rely on the experience of our offshore capability. This was part of the business development plan for Bond, and they remain heavily supportive of the start-up.'

He added that Investindustrial and KKR are committed to the business and bring expertise and access to the market without which the company would probably have to pay a large amount of money to get. 'They bring us genuine, world-leading expertise in capital markets and access to the

capital we need to be able to grow. That's a significant source of value for us.'

An example of this extra spending power was displayed at Heli-Expo this year when the company announced not only the one of the largest ever orders for the S-92 (16 aircraft), but also a framework agreement with AgustaWestland for the AW139, AW169 and AW189 family of aircraft.

Attracting attention

'The S-92s attract a lot of attention because they are big and expensive aircraft, but we have forecasts for a whole range of aircraft across the portfolio. This is part of being able to work more closely with the OEMs. Part of the strategic decision is looking at which markets we are going to be in, the businesses we will be investing in and then going to the OEMs and telling them: "Here's what we are planning on investing in, you can work with us, and this will help you plan your investment programmes."

'The purchase of the S-92 isn't some radical plan to replace the Eurocopter helicopters, but as we continue to grow, we realise that the EC225 is a popular aircraft, and the one issue is that Eurocopter is close to capacity and therefore we cannot allow our own business to forego growth by not being able to place orders on a line which is at capacity. The S-92 is a fantastic aircraft, and also we don't want to be overly dependent on a single aircraft type – our heavy fleet is entirely Eurocopter, either EC225 or AS332 L2, and so there is a systemic risk with that that we don't need to take.'



Inaer operates AW139s to provide SAR coverage for Spain's SASEMAR. (Photo: SASEMAR)

He concluded: 'We see good prospects for continued organic growth in existing and new markets, and I think there will be opportunities for growth through acquisition. We only want to do moderately sized acquisitions that give us access to new markets. We would rather invest in new markets, and that's how we prefer to use our acquisition firepower.' **RH**

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Global reach, local expertise

Ensuring the safety of the crews who fly helicopters is a multi-layered activity. Matthew Smith speaks to operators and discovers how they go about it.

A number of companies provide BOSIET training, including Aberdeen-based Survivex, whose facilities are illustrated here. (Photo: Survivex)

Prevent, protect, locate

The ability of helicopter operators to ensure the safety of crew and passengers rests on two inseparable elements – equipment and training.

Clearly, the most effective way of ensuring that crews remain safe is to avoid accidents in the first place, which is one of the reasons why some of the most important technological elements of crew safety fall into the prevention category.

Foreseeing failure

Cockpit aids such as terrain avoidance and warning systems (TAWS), which provide alerts to pilots, are increasingly a baseline capability, and advances in the use of health and usage monitoring systems (HUMS) increase the ability of operators to pre-empt mechanical failures.

Robert Paterson, health and safety director at trade body Oil and Gas UK, outlined some of the steps the organisation has been taking in the field of HUMS to improve the likelihood of detecting potential catastrophic failures before they occur.

'HUMS systems are about 65% effective, which is a lot better than nothing at all, but it's not perfect. So we've been working with the CAA through research projects to look at what else can be done to enhance our analysis of the data that comes from the HUMS.'

He noted that the two bodies have jointly 'developed an advanced anomaly detection system, which uses a new algorithm to analyse the data that comes from HUMS systems', and was keen to point out that although this may sound like a simple matter, the diversity of

helicopters in service in the UK makes it a challenging project.

'There are quite a number of different types of helicopter and there are about seven or eight types of HUMS systems, so it's not straightforward. But we are optimistic that for some of the more frequently used modern helicopters we will be able to apply this technology to them later this year or early next year. Then we will continue to progress through the rest of the fleet.'

Simpler controls

Cockpit ergonomics are also a consideration, with more recent aircraft types reducing the complexity of the crew environment in order to assist better decision-making in emergency situations. ➔

For Bond Air Services operations director Peter Cummings, one of the main safety features of his new fleet of EC135 HEMS aircraft is the reduction in complexity of the cockpit: 'Anything that allows you to manage the flight with greater spatial awareness is an enhancement to safety. The more aware the pilot is, the more brain power he has to deal with unexpected issues, and the better they'll be dealt with.'

'You typically find, in older aircraft or helicopters, let's say two levers - very similar in style and possibly very close in location and one of which does one job, one of which does a completely different job. In an emergency it's very easy for a pilot or crewman to make a grab for the wrong lever. What has happened in modern technology helicopters is that you take that element away. You remove the systemic error in the helicopter that might lead a pilot or crewman to make a wrong choice.'

Another example given by Cummings is the Bell 429, a type evaluated by Bond, in which none of the electrical circuit breakers are visible in the cockpit.

'Traditionally, in old helicopters the circuit breakers were the things a pilot first reached for, but of course a circuit breaker panel has a row of maybe 30 or 40 almost identical buttons, only distinguished by their label. Immediately you can see that under a high-stress situation, perhaps with changed lighting conditions or contamination in the cockpit, whether it be fluid or gas, it would be very easy to make a mistake.

'The Bell 429 says: "You know what, the systems are better at looking after this than the pilot and therefore circuit breakers are not on display for the pilot to play with." So something as



Helicopter operations to oil and gas platforms present major challenges for crews. (Photo: RH Photo Library)

simple as that, taking away the things that you don't need to have in front of you all the time, gives you the capacity to deal with unexpected issues.'

Mitigating mishaps

However, unfortunately things sometimes do go wrong and accidents occur. It is in these situations that protection becomes all important.

Tim Glasspool, head of European flight operations for Bristow, summarised the personal protective equipment used by passengers and crew on the company's offshore helicopters.

'The crews have got immersion suits, Mk 28 life jackets, and we provide thermal undergarments. You'll have a crashworthy floor system and the seating will all have four-point harnesses for the passengers,' he said. 'There's a 20G impact certification for the seating, which compresses and absorbs some of the impact so that it's not directly on your spine. It's made of all sorts of exotic materials so you should be able to get up and walk away from it. This kind of equipment is in place to make sure you are in a fit state to conduct the emergency exit.'

John Constable, head of training for Bond Offshore, outlined a similar situation in its fleet: 'In the aircraft, all the passenger seats have a four-point shoulder harness, over-the-shoulder and lap straps. Everyone wears immersion suits and life jackets with rebreathers. The crew again all have immersion suits, life jackets, beacons, flares and the aircraft itself, it obviously carries the emergency flotation system which also has automatic safe deployment.'

Although they are commonly worn by military pilots and SAR crews, whether or not to use



Multi-lateration technology gives controllers a radar view of North Sea airspace for the first time. (Photo: NATS)

‘HUMS systems are about 65% effective, which is a lot better than nothing at all.’

helmets is a more difficult decision. The main issue is fatigue brought on by weight, heat and noise, Glasspool told *RotorHub*. ‘Although there are some safety benefits to wearing them, it’s actually noisier wearing a helmet than it is with just a headset. The sound resonates and it’s right next to your skull.’

According to Bristow, internal research on helmet noise levels using in-ear microphones showed that across ‘15 or 20 different types and variations of helmets, earplugs and headsets... at no time do helmets on their own score very highly at all’. This leads to a situation where ‘you’ve got to offset these two things [protection and fatigue]’.

Key in finding this balance is the amount of time crew members would expect to be wearing a helmet. ‘For SAR crews who fly maybe 150 hours a year and none of their flights are more than an hour or two long, that’s not too bad. When you’ve got oil and gas crews who fly 800 hours a year and would be wearing these things for six or seven hours a day, that changes it quite a lot. So we need to balance any potential safety benefit against the fatigue which is likely to cause an accident in the first place,’ said Glasspool.

Dressing up

Crew protection systems are a mature technology and in general there is little sense within the operator community that radical changes are on the way. Nevertheless, according to Glasspool the move of regulatory power to the European Aviation Safety Agency (EASA) may require some alterations to crew apparel.

‘With the advent of EASA, there are some slightly different requirements which will be phased in and we’re looking at moving to a new type of suit,’ he said. Although the changes are little things – for example, having the thermal insulation included as part of the suit rather than being separate – one issue that has arisen is over coloration. Bristow has resisted a move to completely bright suits, arguing that it has the potential to cause distraction in the cockpit through reflections from glass displays.

‘Everything we fly these days has got TV screens and you don’t necessarily want yourself reflected all over the displays in the cockpit,’ said Glasspool, but he added that EASA was addressing his concerns with new designs.

‘They [EASA] are coming up with more innovative ways of doing things so that the chest

and the front of the arms are one colour with high-visibility areas on the legs, back or shoulders so that they don’t reflect in the cockpit. So with that kind of feedback and working with them, we’re getting to a state where actually we’ll be moving to the next generation.’

Making an exit

Assuming that the protection systems have worked, the next critical element to ensuring safety is enabling a quick exit from the aircraft, particularly for those operating offshore in the North Sea.

Constable noted that the importance of escaping a downed aircraft is reflected in updates to the design of the EC225. ‘What they [Eurocopter] have done on the latest aircraft is basically enlarge all the windows down the side to make them larger escape exits.’

Glasspool agreed with the need to ensure a rapid exit in an emergency, and described the process in Bristow’s helicopters: ‘It’s largely about egress. All the doors are emergency exits and pop out. The people at the windows pull the tags and pop the window out and that is an emergency exit as well, so everyone’s got pretty direct escape routes.’ ➔

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Once in the water, the priority then switches to finding a downed aircraft and crew and beginning the rescue mission, a task facilitated by overlapping levels of tracking and sensing from ATC, the helicopter operators and potentially even the military.

Paterson told *RH* that although the helicopters are tracked on ATC radar for around 30km offshore, beyond that they disappear from the screen. Although VHF rebroadcasting allows pilots to continue speaking to ATC beyond that, reporting only happens every ten minutes, during which time the aircraft could have travelled a significant distance.

Lights on

This means that should an accident occur, it 'could be 100 square miles since the last reporting in'. In order to improve tracking and locating, UK ATC provider National Air Traffic Services has implemented a 'multi-lateration' system that uses transponders on the helicopters and a network of antennas on offshore platforms to create a picture that fills in the blank spaces for ATC.

This is supplemented by personal locator beacons supplied to crew and passengers and installed on life rafts as well as mini and day/night flares. In addition to this, Glasspool told *RH* that Bristow helicopters are equipped with satellite trackers and satellite phones, enabling their internal operations centres to keep track of aircraft movements.

'If the satellite tracker doesn't give out a signal for more than three minutes, it flags it up on our tracking screens, which are watched both here and in the US at our operations centres.' This is a great benefit as, according to Glasspool, 'we know where they all are regardless of whether they are in radar contact with anybody or anything'.



Ultimately, the degree of surveillance in the North Sea means that, in the event of an emergency, help is unlikely to be far away: 'The reality is that you're not expecting to be in the life raft all that long because of the level of coverage and the number of search and rescue helicopters. At least one if not three or four will be overhead within an hour to an hour and a half.'

Practice makes perfect

Of course even the best equipment in the world is ineffective if it is not used properly, which is why crew training is such a critical element of the safety regime, something that is agreed on across the industry.

Paterson observed: 'Certainly synthetic training is absolutely vital. It gives pilots the opportunity to practice the sort of things that you couldn't practice in real life – single-engine take-offs, engine or other failures.'

Constable is equally convinced of the benefits of training for both crew and passengers, noting that 'definitely all the passengers go through BOSIET [basic offshore survival induction emergency training], which includes the underwater survival training'.

'This covers the evacuation of an aircraft should it land on water. The crew also go through an abbreviated version of BOSIET which covers just the underwater escape training. This is validated every three years and we do emergency and survival equipment training with them every year. We also do wet dinghy drills every three years, and emergency door jettisoning every three years where they physically go and eject doors off the aircraft.'

In addition, both Bond and Bristow make extensive use of simulators. 'All our crews go to simulators once if not twice a year. The pilots go twice a year and basically we practice all these emergencies – we practice a total loss of gearbox which results in ditching over water,' said Constable.

Synthetic substitute

Hugh Teel, in charge of commercial sales and contracts at Survival Systems' Groton Training Center, told *RH* a significant portion of training can and should be accomplished through synthetic means.

'It provides a simulated experience for many of the routine tasks, and many of the non-routine tasks that an aviator will experience. It also provides a safe platform for emergency training,' he argued.

However, synthetic training cannot replicate all the additional stress that a real-world situation entails – whether it is the physiological response that the human body undergoes during rapid or



Crashworthy seats and large jettisonable windows are standard on the latest generation of helicopters. (Photo: Eurocopter)



Immersion suits are an essential item for commuting oil workers and must be worn throughout the flight to the platform. (Photo: Helly Hansen)

explosive decompression, the 'fight or flight' rush of adrenaline, or the thousands of other nuances that might make the difference between surviving and not.

'Our systems – the simulators and training procedures – take training to a level that cannot be replicated by synthetic training. Personnel

'You're not expecting to be in the life raft all that long because of the level of SAR coverage.'

experience the physiological (and psychological) responses that one would go through in a ditching scenario.

'Some have claimed it's the closest to feeling like they were drowning that they have ever experienced – but through it all, the training package taught them how to control their responses, and take the appropriate steps to ensure their survival.'

Real emergency

The importance of a rigorous safety regime was recently underscored when a Bond EC225 carrying 14 passengers ditched in the North Sea on 10 May following a gearbox failure.

Fortunately, all the crew and passengers escaped without major injury, an outcome

Constable attributes at least in part to their high standard of training. Speaking to *RH* about the incident just a few days after it happened he outlined some of the potential lessons learned.

'It's bit early yet, but as far as we are aware it's more or less a textbook landing on water and evacuation of the aircraft. From what we've heard from the passengers on board and from the crew, the training worked extremely well. They inflated the floats on the way down, they did a smooth landing. Talking to the crew, they said their training just kicked in and it all came more or less automatically to them. They didn't really have to think unduly, they just knew instantaneously what they needed to do.'

This sentiment is echoed by Cummings, who said of the incident: 'This is an absolute prime example of how proper training led to a very successful outcome. No indecision, pilots knew exactly what was being presented to them in terms of the emergency. They took the required immediate steps and then did exactly what it says in the book, went down and had a controlled landing. That only comes through consistent high-standard training.' **RH**



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The ongoing world economic crisis is just the latest blow to battered police department budgets. In extreme cases, some cash-starved operators have responded by grounding their helicopters. Others have kept their aerial units flying through a mix of creative financing, penny-pinching and cost-saving reorganisations.

St Louis County, Missouri, lies outside the city of St Louis and is part of its metropolitan district. A few years after the turn of the millennium, the St Louis County Police Department was in serious financial straits. It was so bad that 'funding for specialised equipment such as aircraft – specifically fuel – was cut', according to Capt Kurt Frisz, the precinct's commander, who is also president of the Airborne Law Enforcement Association (ALEA).

While it was only halfway through 2003, he had to somehow deal with the reality that 'we were out of fuel funding for the year'. Faced with this, Frisz and other members of the unit started brainstorming, and no option was too radical to be considered. 'We explored grant funding options, as well as establishing a not-for-profit foundation to support the operation and merging our operation into a regional unit,' he explained.

Single option

The St Louis County Police Department eventually decided to try every single option at its disposal. First, it merged its aerial units with those of the St Louis Metropolitan Police and the St Charles County Sheriff's Department, creating the St Louis Metro Air Support Unit. Today, it operates six helicopters (three MD 500Es and

three Hughes OH-6As) and one fixed-wing aircraft (a Cessna 172).

Regarding the consolidation, Frisz said: '[It] spread the cost over the three major jurisdictions, [and] has also increased the amount of coverage that the unit provides for the region.'

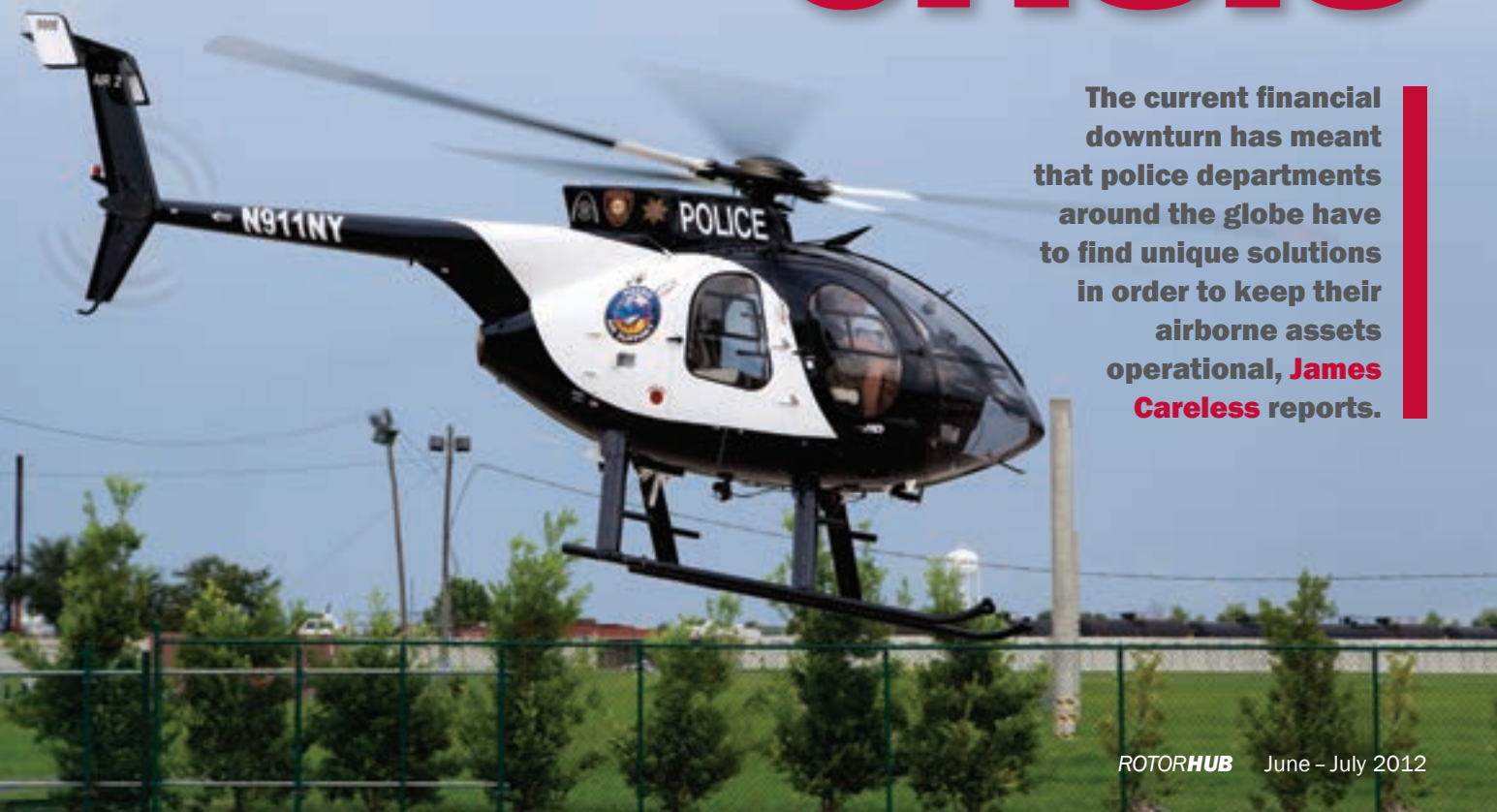
The new regional unit applied for federal money from the Department of Homeland Security's Urban Areas Security Initiative. 'This was successful in funding equipment to enhance operations such as radios, GPS/comms, moving map systems, a FLIR system, a microwave downlink system and one new aircraft,' he continued. 'Since 2004, we have been able to secure over \$5 million dedicated to the air support unit.'

It also established the Metro Airborne Law Enforcement Foundation, a not-for-profit body. ➔

Cashflow crisis

'Air 2', an MD 500E of the St Louis Metro Air Support Unit, lifts off after appearing at the ALEA exposition in New Orleans. (Photo: Tony Osborne)

The current financial downturn has meant that police departments around the globe have to find unique solutions in order to keep their airborne assets operational, **James Careless** reports.



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'This allowed us to build corporate partnerships and bring in funds to purchase safety equipment that was above and beyond our budget, and not able to be funded through grants,' said Frisz.

Collectively, these solutions saved police helicopter coverage in metropolitan St Louis. However, they did not come without sacrifices. These included the loss of the sole identity of a St Louis County Police Department Flight Operation Unit, 'but the regionalisation made too much business sense not to pursue. The officers from three separate departments had to learn to work together as one cohesive unit with one mission. While this was a challenge for a time, it has evolved into a good team.'

Spreading knowledge

So what knowledge did these police aerial units gain that others might benefit from? To make the St Louis Metro Air Support Unit a functioning reality, it gave 'each of the three departments the feel of ownership of the unit', according to Frisz. 'The sheriff and two chiefs serve as the board of governors and have opportunities to provide direction to the unit. This ownership trickles down to the officers from each department.'



Single-engine types like the Bell 407 are widely used by law enforcement agencies around the US. (Photo: Bell Helicopter)

To drive home the fact that all three departments jointly own the Metro Air Support Unit, the aircraft are even marked with the three

department decals. 'To obtain grant funding, we learned it is better to become part of the process instead of working from the outside,' said Frisz.

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'[Consequently], I ended up chairing the law enforcement committee for the St Louis region, ensuring tactical teams, bomb units and air support received sufficient funding.'

To successfully create and then operate the Metro Airborne Law Enforcement Foundation, he advised: 'A business mindset and approach to the airborne law enforcement mission was needed – this is what the corporate community wants to see before they commit their financial support.'

Nine years on, the willingness to try anything has paid off. 'Our unit has evolved into a model for survival and taking a regional approach to airborne law enforcement,' explained Frisz. In recognition of his leadership in making this happen, the International Association of Chiefs of Police gave Frisz an Excellence in Police Aviation Award in 2008.

Other agencies have adopted a lower-cost approach to policing from the air. At the Tomball Police Department, near Houston, Texas, police chiefs realised an urgent need for air support, but simply could not afford to introduce a helicopter. However, using funds from a Department of Justice (DoJ) aviation technology project investigating low-cost options for law enforcement aviation, it managed to purchase a German-built MTOsport autogyro at the beginning of 2011. The aircraft has been in regular use ever since.

The machine is used to patrol public events, follow vehicle pursuits and monitor the area's critical infrastructure. The acquisition price of the autogyro was \$76,000, with hourly operating costs of around \$45, including fuel and maintenance – a tiny fraction of the sums associated with a typical helicopter.

Efficiency gains

The aircraft is flown with a pilot up front and a tactical flight officer in the back who uses a zoom camera to see what is going on below, while a radio keeps them in touch with officers on the ground. Further efficiencies are gained through a partnership with the neighbouring Harris County Sheriff's Office, which is providing hangarage for the machine. This approach was taken further by other agencies. Ripon Police Department in California used a Powered Parachute to fly patrols over the area. According to the DoJ, this helped to decrease daytime burglary rates by 64%.

Running a police helicopter unit can be an expensive proposition. In the UK, the government is currently spending £70 million (\$109 million) annually to keep police helicopters flying. This is why Nick Herbert, the Minister of State for Policing and Criminal Justice, is spearheading the establishment of the National Police Air Service

'Running a police helicopter unit can be a particularly expensive proposition.'

(NPAS). By combining independent police aviation units in England and Wales into a single service operating from 23 bases, he hopes to save £15 million annually. Eventually, the NPAS will have

27 aircraft at its disposal – most of them helicopters.

'The plan has the full support of chief constables and will give all forces access to helicopter support 24 hours a day, 365 days a year – in contrast to the current system which sees some force helicopters grounded for days at a time while they are being repaired,' said Herbert in a recent speech. NPAS will take over police aerial support on 1 October 2012, with existing aerial units joining it from early 2014.

A 22-year military helicopter pilot who moved into police aviation in 1997, Oliver Dismore is ➔

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NPAS flight operations director. 'This project initially started pre-financial crisis, with the intent of doing things in a joined-up way and saving money, but these priorities have now been reversed,' he told *RotorHub*. 'Overall, NPAS will deliver 20% savings over existing standalone arrangements. This will be achieved by the closure of some units where there is overcapacity in existing arrangements and by moving others to rebalance the coverage. A single organisation will also tease out economy-of-scale savings that are not currently available.'

Centralised concept

NPAS is meant to save money by integrating the various flight departments into a single, centrally managed unit. 'NPAS will introduce a centralised dispatch and flight-following function that will operate to nationally agreed tasking protocols,' continued Dismore. 'This has been trialled on a regional basis and has been well received. It saved money by sending the closest/most suitable asset and by reducing nugatory transit flying.'

NPAS has not been universally welcomed. For instance, fearing that the new system would

UK air assets like this Metropolitan Police EC145 will be operated by NPAS in future. (Photo: Tony Osborne)



lengthen response times in its jurisdiction, the South Yorkshire Police Authority resisted joining. Meanwhile, the move to centralisation is resulting in fewer bases and aircraft being used, compared to pre-NPAS levels.

'Three bases have gone already, with neighbouring facilities providing operational coverage to those areas,' acknowledged Dismore. 'There will be three more base closures, but with the aircraft retained as maintenance spares.'

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There will also be three base moves to rebalance the overall coverage.'

In addition, some civilian jobs may be lost, and some police staff assigned to new duties. Given these facts, why does NPAS qualify as a 'good news' story? For one thing, the project will result in increased coverage across the country.

'Pre-NPAS, 97% of the population received air support within 20 minutes of decision to launch,' replied Dismore. 'Under NPAS, this rises to 98% in an area slightly smaller than Florida, with a population of just over 60 million.'

Downsizing threat

Furthermore, had NPAS not been implemented, government spending cuts would have likely grounded some independent aerial units. 'No units have had to close as a direct consequence of the financial crisis,' he noted. 'But there is no doubt at all that a significant number would have gone had NPAS not been on the horizon.'

Since 1983, the Fairfax County Police Helicopter Division in Virginia has been flying police, EMS and rescue missions. Its two Bell 429s currently log 1,250 hours and 3,000 missions per year, on a 24/7 basis.

Despite tight budgets, 'things are good', according to chief pilot Paul Schaaf. 'We are still at full strength.' At the same time, being funded by a cash-starved government means that this helicopter division is under 'increased scrutiny'. There are no more 'blank cheques' and everything must be justified.

To ensure that its political masters feel good about the Fairfax County Police Helicopter Division, the unit is being run with 'absolute accountability and transparency', according to Schaaf. 'Literally

every minute we run the helicopters is accounted for and documented. We produce and distribute statistics from this documentation that clearly show what we are doing.'

At the same time, the unit makes sure that its successes are publicised. 'We video record almost everything of significance and disseminate these recordings that demonstrate the value of the eye in the sky,' he added.

With money being so tight, the Fairfax County Police Helicopter Division takes extremely good care of its equipment. 'We simply cannot afford to crash or break things,' said Schaaf. 'Our people

know that mistakes may very well shut down the operation... We work hard to develop firm procedures that enhance safety, and train hard so that we all know how to best operate our equipment with minimal wear, tear and accident potential.'

In regard to requests for new equipment, Schaaf said: 'We anticipate our future needs, project the costs and benefits and get them out front to our financial resources team.' Thanks to a combination of accountability, recognition and care, the Fairfax County Police Helicopter Division is still on the job. **RH**

Additional reporting by Tony Osborne

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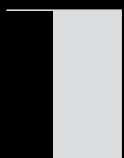
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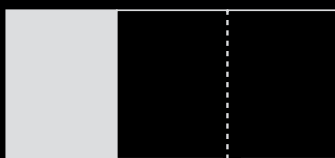
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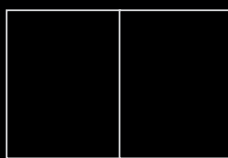
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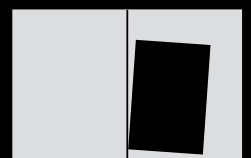
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Policing in Chile has often relied on aviation to be successful due to the country's varied terrain. David Oliver spoke to the national police air unit about how it has utilised air assets for law enforcement, and considers their future role.

Air arm of the law

Few countries encompass such a wide variety of terrain as Chile, with its arid deserts in the north and near-Antarctic conditions in the extreme south. The South American country is a 4,300km-long rugged strip sandwiched between the Andes and the Pacific Ocean, stretching from Peru in the north down to Cape Horn. The most highly populated region is the arable central area, which has a mild Mediterranean climate.

Policing such a country is a challenge, and it is no surprise that aviation has played an increasingly important role over the years in enforcing law and order. Police aviation began in 1946 when the Carabineros de Chile – the uniformed national police force – used a single fixed-wing Aeronca Champion aircraft belonging to the Aero Club de Santiago. However, since 2011 the Ministry of the Interior and Public Security has had full control over it, although the Carabineros are still considered to be part of the nation's armed forces.



The PDI operates a trio of AS350 B3s on law enforcement duties and other missions. (Photos: Antonio Segovia/PDI)

In June 1948, the Club Aéreo de Carabineros was established, and its first aircraft, a Cessna 145, was acquired in August 1949. The Carabineros subsequently used various Cessna types for training, while the first aerial patrols took place in 1953 using Cessna 170s. Its air tasking was coordinated by the aero club until the Brigada Aeropolicial was established in February 1960 to control Carabineros air operations.

Greater tasking

The first helicopters arrived in 1969 when the brigade acquired a Hughes 300, and this was followed by two Fairchild-Hiller FH-1100s a year later. The tasks of the brigade had now expanded to include air patrol, SAR, traffic observation, forest surveillance, medical transport and disaster relief, and these factors contributed to the decision to form the Prefectura Aeropolicial, a separate specialist branch within the Carabineros, on 24 April 1972.

The fixed-wing aircraft and helicopter fleets are now organised into separate sections within the prefecture, although in effect they are operated by sections spread over seven police zones throughout the country.

The Prefectura Aeropolicial's current rotary-wing fleet comprises a Bell 206B used for training, five Bö 105Cs, two Bö 105LAS-3s, two BK 117 B1s, a single EC135 T1 and four A109 Powers, with a fifth on order. Its main operating and maintenance base is located at the ➔

'The geography of our country allows many illegal activities to be carried out.'

Aeródromo Eulogio Sánchez Errázuriz at Tobalaba on the outskirts of the Chilean capital, Santiago.

Based alongside the Prefectura Aeropolicial at Tobalaba is a small fleet of aircraft belonging to Chile's Policía de Investigaciones (PDI), a national plainclothes police organisation comparable in some respects to the US Federal Bureau of Investigation. The PDI works in close collaboration with Interpol and with the intelligence services of the Chilean Army, Navy and Air Force.

The PDI obtained its first aircraft, a fixed-wing Cessna 182E, in 1962, and in 1973 the unit received a Beech Queen Air on loan from the Interior Ministry. Originally known as the Investigaciones de Chile, the PDI became part of the Ministry of National Defence in 1974 when an official Air Transport Division was formed. In January 1976, the unit became subordinated to

the newly formed Department of Transport, becoming the Brigada Aeropolicial a year later when its headquarters moved to Santiago.

A Cessna 310R, 414A and 401 were added to its inventory in 1979. The main role of the air unit at this stage was the transportation of officers and suspects, although there was a growing awareness of the tactical capabilities of rotary-wing aircraft, particularly when operating in challenging and remote locations.

Planning the acquisition of rotary-wing aircraft had begun long before the unit was redesignated the PDI in 1984. It originally planned to base helicopters in six of the largest cities in the country to enable them to participate in the detection of clandestine cocaine laboratories in the north and smuggling in the south, in addition to coordinating raids, arrests and SAR missions in different regions.

However, this has not yet been achieved. Establishing an infrastructure for rotary-wing operations, including helipads and a pilot training regime, took most of the available funding, and it was not until 2002 that the unit got its first helicopter, a Eurocopter AS350 B3. A second machine was procured in 2009, while a



A PDI Ecureuil lifts an underslung load of seized cannabis plants. (Photo: PDI)



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third was delivered exactly ten years after the first in April 2012.

After 40 years of air operations, of which 20 had been accident-free, the PDI's aviation unit decided to change tack and concentrate more on the investigation and surveillance roles rather than moving people from one place to the other.

As a result, its fleet of three twin-engine aircraft was disposed of in 2010, with only a single Cessna TU206G Super Skywagon, which was acquired in 2004, being retained for the transport role. At the same time, it was recognised that its helicopters were, for the public, the visible face of this operational branch's daily routine.

Under its commander and chief pilot Capt Hans Eberl, the PDI air unit has plans for further expansion, but as before these will be reliant on future funding from the Interior Ministry to which the PDI was transferred in 2011. Anti-narcotics operations are currently the main focus, and this involves searching for, identifying and destroying cannabis fields and illicit laboratories.

'There are many factors that we have to deal with, but the main ones are the difficult access and geography of our country which allows many illegal activities to be carried out, especially in remote river valleys and the foothills of the Andes mountains,' Eberl told *RotorHub*.

'In addition to counter-drug operations, we are tasked with command and control of police task forces, mountain SAR, dead body retrieval and suspect and law enforcement personnel movement. We practice rappelling, fast-roping and underslung load carriage.'

Gaining qualifications

With eight pilots on strength, four of whom are qualified helicopter instructors, two more are under training. All of the air unit's aircrew are policemen first, before they embark on pilot training, initially at their own expense. This is carried out on the Club Aéreo de Carabineros Bell 206B to PPL (helicopter) standard before gaining a CPL (helicopter) on the unit's Ecureuil.

Maintenance of the PDI helicopter fleet is carried out under contract by Eurocopter Chile, which is also based at Tobalaba. The three Ecureuils are all equipped with ceramic floor armour, a 200kg Goodrich hoist, Nightsun searchlight and loudspeaker. The FLIR Starfire sensor is used for night operations, although the cockpits are not NVG-compatible. The use of Tyler Special Operations Platforms enables rapid deployment of law enforcement personnel and enhances SAR capability.

The helicopters are flown with two pilots, and an average of 250 flight hours are logged

every year. Since unit's formation in 1974, it has flown more than 12,000 hours in total, 3,000 of which have been accumulated by the two Ecureuils prior to the delivery of the third aircraft.

Eberl outlined his vision of the PDI air unit's future: 'We have several projects in the pipeline. We are thinking of acquiring a new fixed-wing aircraft in conjunction with the PDI narcotics division due to the long distances we have to travel from the metropolitan region.

'These flights require long transits by helicopter and a fixed-wing aircraft would be beneficial. In the short term, we have a prerogative to train

more pilots, and we intend to base one of the helicopters in the north or south of the country, depending on our requirements at the time, as well as having a fixed-wing aircraft that can support the PDI and as an air ambulance that could be used in cases of natural disasters or emergencies. However, we recognise that training new pilots as well as acquiring new aircraft will be a long process.'

If these plans come to fruition, the PDI air unit would outgrow its current single hangar, office and control room at Tobalaba and may have to find a new permanent home base. **RH**

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The 3.5t-class Ansat helicopter is used by the FSB in the passenger transport and liaison role. (Photo: Kazan Helicopters)

Law and peace

Russia has two large internal security organisations to enforce its constitutional order, protect the borders and fight organised crime and terrorism. **Alexander Mladenov** explores their rotary-wing fleets.

The helicopters of both the Federal Security Service (FSB) and the Internal Troops in Russia have been used in anger in multiple internal conflicts, the first of which took place prior to the break-up of the Soviet Union in 1991. Now, they continue to fight terrorism and the various insurgent movements in the country.

Russia's all-powerful FSB is the most important organisation participating in the country's own war on terrorism. Its border protection assets have been employed in real-world combat operations virtually non-stop since the establishment of Russia as an independent state and the successor to the USSR.

The FSB aviation department currently has a large rotary-wing fleet for combat and support duties, and its battle-hardened crews are still actively engaged in operations against the surviving insurgencies in the Caucasus region. In addition, FSB air assets are routinely tasked to patrol the immense land and sea borders of Russia in an effort to counter illegal fishing and large-scale smuggling of drugs and other goods. Another important task of the border protection force is to combat terrorist groups attempting to penetrate into Russian territory from neighbouring unstable states.

Military machines

The aviation department is headquartered in Moscow, and was established a paramilitary service in its present form in 1999. It is headed

by Lt Gen Nikolay Gavrilov, a well-decorated and highly experienced helicopter pilot. Initially, the FSB rotary-wing fleet comprised only two Mi-8MTV passenger transport and utility machines transferred from the Russian Ministry of Defence.

These rotorcraft, together with two fixed-wing passenger aircraft, were operated by an independent squadron stationed at Moscow's Vnukovo airport, which subsequently grew into an independent special operations air group. In October 2000, the FSB Mi-8MTVs saw their first use in anger supporting the operations of the Alpha and Vimpel elite anti-terror groups in the troubled Russian republic of Chechnya.

'The FSB's combined fleet today comprises some 250 rotary-wing aircraft of various classes.'

Later on, its continuously expanding rotary-wing fleet began to be deployed on a regular basis to various hot-spots in Russia for special operations support, seeing active involvement in the protracted and bloody fighting against insurgents hiding in the Caucasus mountains. Most, if not all, of the helicopters of the Vnukovo-based group are decked out in military-style

camouflage, but remain anonymous-looking, with no serials, registrations or national insignia.

In March 2005, the FSB organisational structure was expanded considerably, as it assumed command of Russia's Federal Border Service. As a result, its combined fleet today comprises some 250 rotary-wing aircraft of various classes, from the 3.4t Ka-226 to the 40t Mi-26.

The aviation department was initially staffed by experienced personnel with ex-border guard and army aviation backgrounds, but later the most influential and resourceful law enforcement service in Russia began recruiting large numbers of young pilots and technicians who had just graduated from the Russian Air Force (RuAF) training institutes.

For helicopter pilots in particular, the principal source is the RuAF's Syzran flying training centre. In fact, there are currently many candidates aspiring to serve with the FSB aviation service, as this organisation can offer them a better paid and more prestigious job, as well as more flying opportunities than either the RuAF or Ministry of Interior aviation services.

Border placements

The Russian border guard aviation service is currently part of the FSB aviation department and comprises 18 independent aviation groups and squadrons. They are mainly stationed along Russia's borders, stretching from the far east ➔

(Khabarovsk) to the country's Black Sea (Gelendzhik) and Caspian Sea coasts (Kaspiysk) in the west.

In addition, the service has a dedicated heavy-lift and logistics/maintenance group stationed in the city of Yoshkar-Ola. The busiest unit, involved in combat operations in Chechnya and patrolling the border with Georgia, is stationed in Mikhailovsky near the city of Stavropol.

There are 230 helicopters currently in the border guard inventory. Both the Mi-8T/MTV/AMTSh (200 examples) and Mi-26 (around ten) are mainly used for troop transport and resupply of remote garrisons and posts, while Mi-24V/Ps (around 20) are used for fire support and armed escort, with the Ka-27PS (around two dozen remain in service) employed for economic exclusive zone patrol and SAR tasks. For border patrol in extremely cold weather conditions within the Arctic regions, the Vorkuta-based group operates the specially modified Mi-8MA-1 Arctica derivative.

FSB border guard rotorcraft can be easily distinguished thanks to the presence of a red or white horizontal bar on the rear fuselage. In 2007, the fleet also received the new Russian

government five-digit aviation registration numbers beginning with the 'RF' prefix worn on the tail boom or fin. They are also adorned with the Soviet-era military insignia – a five-pointed red star with blue and white outline.

The FSB aviation department is among the most active government organisations in Russia supporting local aircraft and mission equipment developers and integrators. It has placed significant orders for newly built Mi-8MTV-2s and Mi-8AMT/AMTShs outfitted for armed patrol, utility, tactical and VIP transport roles. Between 2001 and early 2012, 20 of these affordable workhorses were taken on strength to replace the service's worn-out Mi-8MT/MTVs.

Prospective programmes

The FSB is the launch customer in Russia for the new Kamov Ka-226, a 3.4t twin-engine helicopter type used for liaison, surveillance and special operations. It is among the largest procurements being made by the FSB aviation department – this co-axial design is slated to be acquired in relatively large numbers in the near to medium term, mainly for land and border patrol duties.

FSB aviation units use some two dozen Ka-27PS helicopters to patrol Russia's maritime borders. (Photo: via author)



The first two Ka-226s were procured in December 2005 and were initially used for test, evaluation and training purposes. These flexible machines were also actively utilised as jump ships to train FSB special operations personnel and are capable of providing up to four fully equipped operatives. There are currently four Ka-226s in active use, operated by the Vnukovo-based unit.

In 2009 and 2010, an improved Ka-226 derivative was tested by the FSB, equipped with a four-axis autopilot and the Cobalt 350 optronics payload for day/night patrols over land and sea. It has an NVG-compatible cockpit, enabling the pilots to use the Geophysika-NV Geo-ONV-1-01



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Gen III NVG sets. At the same time, it underwent trials from a ship deck in a bid to demonstrate its suitability for afloat deployment.

The definitive shipborne derivative of the Ka-226 for the FSB – intended for use in the sea border patrol role – will also feature folding blades, an emergency flotation system and life support for the crew, who are equipped with immersion suits. This special mission derivative is seen as an eventual successor to the Ka-27PS currently employed by the FSB for sea patrol and SAR operations from the decks of large coastal patrol vessels.

There is photographic evidence dating from early 2012 for the existence of another

‘Chechnya presents an environment similar to that encountered by coalition forces in Afghanistan.’

Ka-226 variant in FSB colours, equipped with signals intelligence and optronic surveillance equipment, most probably intended for use as a communication intercept platform.

In 2008, two Kazan Helicopters Ansat 3.5t-class twin-engine helicopters were acquired by the FSB aviation department to be used in the passenger transport and training role. At the moment, there are no publicly announced plans for additional purchases of the baseline model or the development of any special mission derivatives.

Effective examples

The primary FSB special operations round-the-clock surveillance and attack platform is a highly modified and newly manufactured helicopter similar to the Mi-8AMTSh (also known as the Mi-8MN), purpose-developed in the early 2000s

by Mil Moscow Helicopter Plant and avionics upgrade specialist Russkaya Avionika.

According to FSB aviation service founder Gavrillov, these armed night operations-capable machines have proven highly effective in Russia’s war on terror. The first two were taken on strength in the first half of 2011 and were immediately flown in combat.

These highly capable attack and transport helicopters – built at the Ulan-Ude Aviation Plant and armed with up to eight 9M120 Ataka-V anti-tank guided missiles (ATGMs), 23mm gun pods, 80mm rockets and unguided bombs – were used to permanently patrol the night skies over Chechnya and adjacent territories with known insurgent activity, and tasked to destroy any positively identified targets there.

The night-capable Mi-8s can also be utilised for insertion and recovery of special operations groups (mostly comprising Alpha and Vimpel operatives) engaged in anti-terror missions. Chechnya presents an environment somewhat similar to that encountered by coalition forces in Afghanistan, where only helicopter types featuring a high power-to-weight ratio can operate safely at their MTOWs. ➔

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Some photographs of similar helicopters appeared in the late 2000s, showing them upgraded with an as yet undisclosed signals intelligence suite utilising numerous antennas.

The Internal Troops (VV) is a Gendarmerie-style armed service within the Russian Ministry of Interior with around 170,000 personnel and operating its own aviation arm. Established in 1978 and controlled by the VV's own aviation department in Moscow, the assets of this organisation are used mainly for: transport of troops and materiel; patrolling over important federal infrastructure (highways, railways, pipelines and rivers); disaster relief; search for prison escapees; and all-encompassing support of small- and large-scale counter-insurgency (COIN) operations undertaken by VV ground units.

The VV aviation service was an active participant in all conflicts that sprung up during the Soviet dissolution, including those in Nagorno-Karabakh (Azerbaijan), Fergana (Uzbekistan) and Sumgait (Azerbaijan). In 1990, in order to substantially increase the airlift capability required for a prompt response to conflict situations in the numerous hot-spots within the former Soviet Union, the service was supplied with a small number of Mi-26 heavy-lift helicopters.

The VV's small fleet of Mi-24P/V armoured helicopter gunships has been extensively used for close air support in offensive operations as well as for escort of transport helicopters during air assaults and routine re-supply missions in combat zones.

Active service

The service saw an active involvement in both the first and second Chechen campaigns (1994-1996 and 1999-2000 respectively), where the helicopters were actively employed for both logistic support of troops on the ground as well as



The FSB has around ten Mi-26s that are used for resupply and transport of heavy equipment in remote regions. (Photo: Andrey Zinchuk)

'Aircraft are anonymous-looking, without any serials, registrations or national insignia.'

for close air support of COIN operations in Chechnya and adjacent regions.

The VV has suffered some painful losses, with the most widely publicised example occurring on 27 January 2002, when an Mi-8MTV-2 was downed by Chechen insurgents near the city of Grozny. All on board, including one of Russia's deputy ministers of interior and a deputy commander-in-chief of the VV, were killed when the helicopter was hit by a shoulder-launched surface-to-air missile, impacting the ground at high speed.

The VV ground and air units are still conducting operations against the remains of the armed

Chechen insurgent groups hiding in the mountainous regions in and around the troubled republic, which occasionally attack local and federal law enforcement authorities.

The VV aircraft fleet is currently grouped into nine independent composite squadrons and three composite special-purpose regiments, equipped with a mixture of rotary- and fixed-wing aircraft. The regiment stationed at Ermolino near Moscow is among the biggest units and operates the service's Mi-26 helicopters, while the other two regiments are stationed in Nizhny Novgorod and Rostov-on-Don. Its squadrons are stationed in Chita, Engels, Krasnodar, Mozdok, Novaya Derevnya, Novosibirsk, Pushkin near St Petersburg, Voronezh and Yekaterinburg.

Fleet focus

Currently, the VV fleet includes 130 rotorcraft of three types, including the Mi-8T/MT/MTV-2 (over 104 examples), Mi-24V/P (around 20) and Mi-26 (11). In the 2000s, it took on strength six newly built Mi-8MTV-2s as attrition replacements.

There are some half a dozen night-capable armed Mi-8MTV-2RN helicopters dubbed Antares, endowed with the capability of firing the Ataka-V ATGM. These machines are operated by the Mozdok-based squadron and are in active use for armed reconnaissance, surveillance, special operations group support (insertion and extraction) and medevac in Chechnya.

VV aviation personnel receive initial training with the RuAF flight and technical institutes, and there have been numerous pilots and technicians who have been transferred from the air force. Personnel from all air units are deployed on a rotational basis to Chechnya and adjacent regions in order to gather combat experience in COIN operations. **RH**

The Ka-226 is set to be procured in significant numbers by the FSB. (Photo: Russian Helicopters)





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One of Helidax's 36 EC120s performs for the camera. The organisation is the largest operator of the type outside China. (Photo: Eurocopter)



Eurocopter's EC120 B is the smallest and lightest of the company's civil range. It brings modern safety, comfort and technology standards to a sector long dominated by 1960s-era machines, finds Jim Winchester.

Leading light

Named the Colibri (after a type of hummingbird found in the Americas), the EC120 has been particularly successful in the US and Canada with law enforcement and border patrol agencies, but can be found worldwide, with examples of the species flying in more than 50 countries.

The first flight of the Arrius 1F-powered prototype was in June 1995, but formal development can be traced back to 1990 when Aérospatiale, China National Aero-Technology Import & Export Corporation (CATIC) and Singapore Technologies (ST) Aerospace signed an agreement to jointly develop a new light helicopter under the designation P-120 to replace the SA 341 Gazelle. Design goals included mission flexibility, low noise, simplicity of maintenance and superior pilot/passenger view.

The first EC120 B, with an Arrius 2F engine, was flown in August 1997, with the first full production machine (and sixth flyable airframe) following in December that year.

Asia-Pacific input

Eurocopter's Asian partners build a considerable proportion of the airframe. China's Hafei Aviation Industry (part of the CATIC conglomerate) is responsible for 24%, including cabin structure, main doors, engine cowlings and fuel system. ST Aerospace manufactures the tail boom, fin, horizontal stabiliser, fenestron, access doors and instrument pedestal, amounting to 15% of the airframe. The remaining 61% comes from Marignane.

Following a 2004 agreement, an assembly line was established in Harbin to complete a version for the Chinese market designated HC120.

Production of around 20 aircraft a year was kicked off by an order from the People's Liberation Army for 150 for training purposes, with deliveries to the 3rd Training Brigade at Linfen beginning in 2005.

As part of the offset deal to supply Tiger attack helicopters, an assembly line was set up in Brisbane, Australia, by Eurocopter subsidiary Australian Aerospace, and the first two aircraft rolled out in 2003. American Eurocopter delivered the first EC120 to Customs and Border Protection in July 2006, and Eurocopter Canada is assembling airframes for the Royal Canadian Mounted Police (RCMP) at Fort Erie, Ontario.

The EC120 fleet is approaching 1,000,000 flight hours, and deliveries passed 670 during 2011, excluding Chinese production, to customers in over 55 countries. At one point, target production was hoped to be 900 by 2008, with an estimated total of 1,600-2,000, and in the 2000s, Eurocopter was marking another 100th delivery every year, but the sales rate has since declined. A total of 13 new orders was booked in 2011, the least of any civil Eurocopter model or family except the new EC175.

Colibri compliance

The Colibri is the first helicopter in its class to comply with JAR 27 requirements, receiving JAR certification in June 1997 and FAR Part 27 seven months later. Safety features that contribute to this certification include crash-attenuating seats, a crashworthy structure and the fuel system.

In the cockpit, the vehicle and engine multi-function display (VEMD) is a dual-screen unit fitted as standard and usually occupies the centre of the instrument panel. In 'operational mode', it



The EC120 has become a common choice for private owners looking for an aircraft larger than the R44. (Photo: Eurocopter)

constantly monitors aircraft performance, shows available power and alerts the pilot when he approaches the limits of torque, exhaust gas temperature and engine speed. In 'maintenance mode', it offers enhanced monitoring, recording engine cycles and the use and abuse by the previous pilot. VEMD data can be downloaded for diagnostic purposes and fleet data management.

The most basic panel configuration includes little more than the VEMD, airspeed indicator, altimeter and warning caption panel. Even with the factory options of a gyro horizon, horizontal situation indicator, vertical speed indicator,

distance measuring equipment indicator, slaving control and compensation unit, chronometer and radio/navigation suite, there is plenty of blank panel space, particularly on the left.

Right-side controls come as standard, but the removable parts of the dual controls are optional. More sophisticated panels are available, such as Sagem's Integrated Cockpit Display System.

Dynamic components include a Spheriflex-type rotor head with three composite blades and new-generation eight-bladed fenestron tail rotor in a composite housing. The asymmetrical fenestron

'The Colibri is the first helicopter in its class to comply with JAR 27 requirements.'

blade spacing reduces noise inside and out compared to a conventional tail rotor, which is more susceptible to strong crosswinds. Eurocopter claims the EC120 was the first light single to include this level of new technology, and this is reflected in its price of around \$1.7 million.

Seating specs

The standard seating is reasonably basic, with a bench-type unit for three passengers in the rear, notable for having stroking supports for crash attenuation. The front seats are adjustable fore and aft – unlike competitors' machines which only have adjustable pedals – and are comfortable, even after long periods of use. The EC120 is offered with the Stylence corporate interior, which adds about 40kg to the weight of a basic transport-configured aircraft, and a significant amount to the price. Many third-party custom interiors are also available. ➔



Baltimore Police is one of many agencies in the US using the type on law enforcement duties. (Photo: Baltimore PD)

The extensive glazing and elevated rear seating provides everyone with a good view, including the rear centre seat passenger – something that cannot be said for competitors such as the MD 500 and Bell 206. It does, however, cause a greenhouse heating effect that is not always fully counteracted by the air conditioning system.

The cabin and cargo compartment floors are on the same level, and a panel can be removed to allow carriage of bulky items such as skis. Normal capacity is five suitcases, and access is through the right side and rear cargo doors.

Eurocopter's own documentation lists four missions for factory-fitted EC120 Bs: passenger transport, corporate, training and utility. Beyond that, however, there are many uses and configurations devised by the dozens of operators worldwide.

At the smaller end of the scale for a HEMS machine, the EC120 B has been sold to a number of operators for medical missions. The limited space allows for a pilot, a paramedic and one stretcher patient. A rear-facing front seat may be needed for the paramedic and it has been said that some treatments, such as aggressive



The simple and ergonomic layout of the EC120 instrument panel. (Photo: author)

airway management, should probably be done on scene before loading the patient due to the restricted cabin space.

The EC120's low noise footprint has made it a popular choice for law enforcement in urban jurisdictions. Baltimore Police Department in Maryland has been an enthusiastic user since 2000, and now operates eight EC120 Bs, including the first to reach 10,000 hours. The aircraft are equipped with a thermal imager,

searchlight, moving map and video downlink. Custom-designed consoles are fitted for tactical flight officers in the front and rear seats.

Road safety

In Canada, the RCMP employs its EC120 Bs mainly in the road safety role on behalf of local police forces, pursuing speeders and stolen cars. Edmonton's RCMP machine has FLIR, NightSun searchlight, video recording capability and a

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comprehensive radio fit. Winnipeg's also has a moving map and a loudspeaker.

Consequently, all this gear adds to the weight, and a common wish of law enforcement operators is for more power and an upgraded transmission in order to handle it. San Bernardino County Sheriff's Department was the first US law enforcement operator of the EC120 B, but the same county found it was unsuitable for fire service use, as it is unable to pick up command personnel from off-base sites at high elevations during the heat of summer.

US Customs and Border Patrol (CBP) has introduced the Colibri for its own light missions, mainly for tracking suspects in border regions and general support of ground units. The CBP calls EC120 B's role 'sign cutting', a reference to following signs of human movement such as footprints and damaged foliage. The superior view for the pilot (the only crewman on these missions) was an important factor in the choice of the EC120 B, of which CBP plans to acquire 55 from the Columbus, Mississippi, production line.

A number of operators have found the EC120 a cost-effective platform for aerial film work. However, one issue is the low skid height and the

'Design goals included mission flexibility, low noise and superior pilot/passenger view.'

resultant poor clearance, preventing fixed mounts on the underside with 360° views. The Helistar Unimount 4000 is one solution, as it features a rail that runs up the rear of the cabin to the base of the tail boom. The camera is slid down the rail after take-off to a position that gives an all-round view. A potential problem with any underslung camera is a failure mode where it becomes stuck and the helicopter cannot safely land. The Unimount has a gas-spring operated emergency system that returns it to the top of the rail in the event of electrical failure.

Common cameras

For less demanding tasks, Meeker Aviation in Canada is one supplier of a fixed EC120 side mount, suitable for most common cameras, FLIR units and searchlights. Even simpler is removing

the rear lower door, allowing a camera operator to shoot backwards from a prone position, or with a handheld camera from either front seat. In the rear, the main doors can be slid open in flight below 60kts, while the aircraft can return to cruise speed with them open.

Although classed as part of Eurocopter's civil range, the EC120 has had considerable success in the military training market. The first such customer was Spain, which made an order for 15 for use as basic trainers in 1999. These were delivered to the Spanish Air Force from July 2000 to June 2001.

The most significant sale followed selection in 2008 as the French military's new primary rotary-wing trainer to replace a fleet of 54 Gazelles. Deliveries of the 36 Colibris were completed in late 2010 to Helidax, a private company supplying basic helicopter flight training at the School of Army Aviation to pilots from the French Army, Navy, Air Force and Gendarmerie. The aircraft were delivered with a civilian paint scheme and registration and are configured to NHE (Nouvel Hélicoptère Ecole/New Training Helicopter) standard with a Sagem glass cockpit providing NVG capabilities and an automatic pilot. ➔



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The EC120's low noise signature has made it popular among operators. (Photo: Eurocopter)

The school at Dax is now the biggest helicopter training academy in Europe, and the public-private partnership will see the contractor provide up to 26,000 flying hours annually over 22 years.

Indonesia also ordered 15 – three for its navy and 12 for the air force – and they are used for light utility duties. The Republic of Singapore Air Force's 124 Squadron flies five EC120s in the basic rotary training role. The aircraft are owned and operated by ST Aerospace.

The best book endurance at most efficient speed of 65kts is given as 4.5 hours, but 3 hours 45 minutes is a more realistic figure in practice. One user said: 'She can hold 315kg fuel, five people and lots of luggage – just not all at the same time.' Limitations appear when all the seats and baggage spaces are full, especially when kit like floats or VIP seats is installed.

It is also true that centre of gravity (CoG) is an important consideration. Early EC120s suffered from a forward CoG with no or lightweight rear passengers, and Eurocopter added a 15kg balance weight in the tail boom to rectify this issue.

Book maximum cruise speed is 120kts, but 110-115kts is a more realistic figure, and 100-105kts is more comfortable. Vibrations at higher speeds were a problem that the pilot could feel, but which passengers rarely noticed, although this tendency is now largely cured.

Class distinction

The EC120 B is certainly cheaper to buy than a new AS350, and many would say that it has been built to specifications that prevent it competing too closely with its older but much better selling stablemate. More comparable are the MD 500 series and Bell 206.

'The 500 is good if doing only aerial work,' explained Mikael Randhem of Sweden's Northern Helicopters. 'The 206 and 120 are good for training as well.' The EC120 is relatively

'The 12-year inspection and overhaul process takes approximately 300 man-hours.'

inexpensive if you fly it a lot, and only requires maintenance inspections every 100 hours, rather than 50 like the Bell 206. The 100-hour check takes four hours to complete on the 120, as opposed to around four days on the JetRanger. Hourly flying costs are in the region of \$500.

Offered at an initial price of around \$840,000 in 1999, a small sample of advertisements in 2012 shows early EC120s on offer from \$749,000 for a basic aircraft with 1,435 hours on the clock to \$1.8 million for a 1,500-hour factory custom example with XM satellite radio,

leather seats and a comprehensive comms and navigation fit. Both examples are 2000-built aircraft now approaching their 12-year point, showing that they retain their value even as they come up for expensive maintenance.

The 12-year inspection and overhaul process takes approximately 300 man-hours and costs in the range of \$80-200,000. A new EC120 buyer would be wise to budget for \$150,000 in the overhaul account a dozen years later. Customers can now choose between Eurocopter or an approved maintenance organisation following amendments to the master servicing manual.

Pricy parts

Parts availability and cost do still seem to be a bugbear of Eurocopter owners, and not just those of the EC120. Bell is regarded as more efficient at supplying parts, and there are many non-OEM parts makers, unlike with Eurocopter, which is usually the only game in town.

Pilots praise the EC120's ease of starting and quickness of shutdown. However, some customers initially had problems with overtemping on start-up, particularly in hot environments. This was often related to low battery voltage (allowing it to drop below 17V), but throttle position at start-up was also a factor. Amendments to the operating instructions helped reduce these incidences.

In general, operators love their 120s. 'If you want big lifting capacity, it's not the right aircraft. You want an [AS]350 for that, but that's not a nice aircraft to fly passengers in,' concluded Randhem. 'The EC120 is very nice to fly – as an instructor, you can sit here all day and feel very safe.' **RH**

Recent years have seen a fall in EC120 sales, but Eurocopter is confident numbers will build from the 13 sold in 2011. (Photo: Eurocopter)



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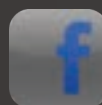


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Industry and governments across the globe are pushing forward efficiency and improvement programmes in order to create the next generation of helicopter engines. **Peter Donaldson** asks just how good the turboshaft can get.

Quantum leap?

Modern turboshaft engines are efficient machines that are difficult and costly to make significant improvements to. However, government and industry efforts on both sides of the Atlantic promise progress that could define a new generation of engines for both civil and military helicopters.

A 25% improvement in specific fuel consumption (SFC) would be a big deal, and it is a headline figure in the US Army's Improved Turbine Engine Program (ITEP), which challenges competitors General Electric (GE) and Honeywell/Pratt & Whitney to produce a step-change in technology. That figure also appears as one of the main goals of the Green Rotorcraft Integrated Technology Demonstrator under the EU's Clean Sky umbrella programme, in this case referring not to SFC but to CO₂ emissions (although they are intimately linked because the latter is a combustion by-product).

Going green

The baseline for comparison for Green Rotorcraft is 'the status of the global helicopter fleet in the year 2000', whereas ITEP engines will be compared with GE's T700-701D. A further complication is that Green Rotorcraft will measure the CO₂ reductions on a per-mission basis, and efficiency improvements to all areas of the helicopter will count.

Clean Sky's powerplant effort is the Sustainable and Green Engine (SAGE) project, under which industry is to develop five demonstrator engines, including a turboshaft, under the leadership of Rolls-Royce and Safran (Turbomeca's parent group). The turboshaft technical focus will be on a light and efficient

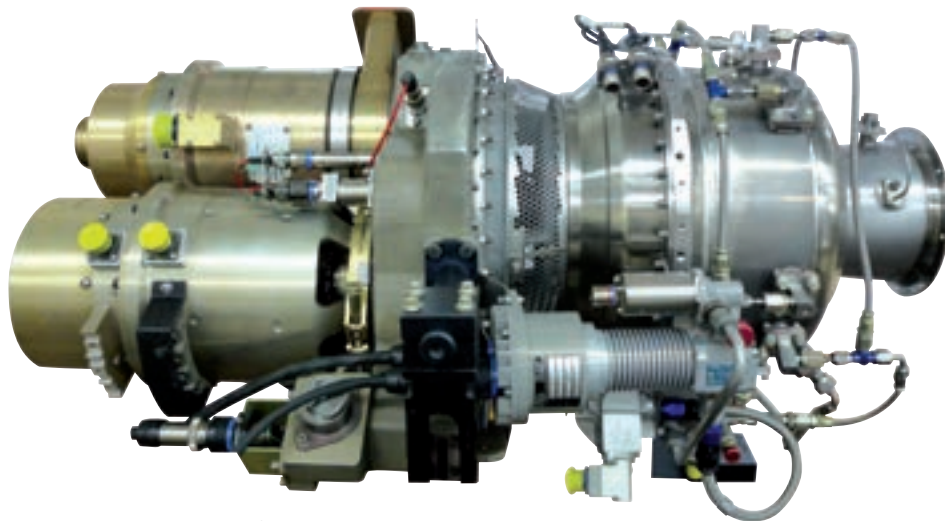
compressor and turbine, and a low-emission combustion chamber. Launched in 2008, SAGE should run its demonstrators between 2012 and 2015.

ITEP is part of the Versatile Affordable Advanced Turbine Engines (VAATE) programme, an ongoing effort to improve engines for all applications. The ambition of ITEP's 25% SFC reduction target is thrown into sharp relief by recent remarks from Jacques Brochet, head of engineering at Turbomeca, about the technology demonstrator for a new family of engines intended to replace the Arriel 2 and TM 333.

'The Tech 800 will mark a quantum leap in technology compared to current engines, including a 20% reduction in fuel consumption during cruise,' he told Safran's house magazine last summer. 'This engine is designed for new

medium helicopters such as the Eurocopter X4.' The initial product resulting from the Tech 800 programme will be the TM 800, which is scheduled for certification in 2016.

Airframers and operators tend to regard up-front cost and SFC as key points of comparison for engines, according to Rick Buchanan, director of technical sales for mechanical systems at Honeywell. 'Those are the two that everybody seems to focus on, followed



Microturbo's 60kW e-APU family is designed to be used constantly in flight for electrical generation. (Photo: Microturbo)



The Turbomeca Ardiden 3 engine is slated to appear in a number of new aircraft including the Kamov Ka-62 and the Chinese version of the EC175. (Photo: Turbomeca)

can go. But it is reaching the point where getting 1, 2 or 3% in SFC improvement can be costly.'

It is partly these diminishing returns that motivated ITEP. 'The US military is really driving hard on SFC reduction,' he continued. 'Technology allows us to find that level of refinement, provided you get to start with a new design.'

ITEP is intended to yield a new 3,000shp engine for the Black Hawk and Apache to restore performance lost to weight gain and extreme operating conditions. The baseline T700-701D engine creates 1,994shp at sea level, at which it burns 0.465lb/shp/hr, translating into 927lb/hr, and weighs 456lb dry. An ITEP engine should boast an SFC of about 0.349lb/shp/hr and burn around 1,046lb/hr to make 3,000shp.

closely by direct operating cost,' he told *RotorHub*. 'Weight usually comes in towards the bottom, mainly because if you get the top three right and the engine happens to weigh a little bit more, people are willing to trade that weight.'

Price comparison

It is straightforward to compare the prices of engines with similar power outputs, but deciding whether a new engine in a new power class is well priced requires a rule of thumb. 'If you compare engines on a dollar-per-shaft horsepower basis, it negates the size differences and is a useful general way to look at them,' explained Buchanan. 'So, \$100 per shaft horsepower is kind of the industry standard that everybody shoots towards. If you double that, you start to get the feeling that the price of the engine is a little bit high.'

Expressed as pounds of fuel burned for each shaft horsepower generated over a period of an hour, SFC provides another comparison measure, cutting through differences in power ratings, size and configuration. However, more powerful engines tend to offer better SFC. For example, Rolls-Royce's new RR500, which completed its first development test runs in March 2011, burns 0.62lb/shp/hr at its take-off rating of 475shp. In comparison, Honeywell's



AgustaWestland has adopted the Pratt & Whitney Canada PW210 engine for the new AW169, seen here on its first flight. (Photo: AgustaWestland)

HTS900-2, rated at 998shp for take-off, burns 0.526 at this setting.

Industry research and development is driving fuel consumption steadily downwards, but slowly. 'Generally, somewhere between 0.425 and 0.45lb/shp/hr is where the good engines in the industry sit,' added Buchanan. 'Low fours is where the industry is going today, and it is only limited by materials technology as to how low it

Meeting targets

Other ITEP goals are ambitious, amounting to a 65% improvement in power-to-weight ratio, 35% reductions in both production and maintenance costs and extended service life. The design life target for the ITEP engine is 6,000 hours, with 15,000 cycles for intake and compressor section and 7,500 for the combustor and exhaust section. ➔

To date, the programme has resulted in two demonstrator engines, the HPW 3000 from Honeywell/Pratt & Whitney and the GE3000 from GE, which are both due to complete a series of tests later this year to prove their progress towards the army's goals. ITEP is a 48-month programme that is due to finish at the end of US FY2012, which runs from 1 October 2011 to 30 September 2012.

'At the end of the programme, each competitor runs a core – not the complete engine, but the compressor and the turbine – to demonstrate how close you got to the programme goals with your core technology,' explained Buchanan.

The first production military engines are scheduled to be available from 2019, so any civil ITEP derivatives will arrive later still. As ITEP is a competition, Buchanan was naturally reluctant to go into detail on the HPW 3000, but confirmed a focus on increasing combustion temperatures in all turbine engine development. 'The higher the temperature at which you can run your engine, the more efficient combustion you get, and that is limited by materials technology,' he said.

Honeywell is also looking to its experience in tank engines in the quest for further efficiencies, specifically the AGT1500 that powers the M1 Abrams. The engine uses a recuperator, a heat exchanger that recovers waste heat energy from the exhaust gas and returns it to the combustion chamber, reducing the amount of fuel that must be burned to heat the gas upstream of the turbine.

'Right now, recuperator technology is a little heavy and a bit big,' explained Buchanan. 'If you can solve those issues, I see this as something we can use to gain efficiencies in the future.'

Cold gains

There are also gains to be had from the cold section, and a key focus is on increasing the compressor's pressure ratio, as air at higher pressures encourages easier, faster and more efficient combustion, according to Buchanan, who described Honeywell's industry leadership in this area, gained through its development of the dual-centrifugal compressor for the HTS900 engine.

He contrasted this with other turboshafts that use axial compressors, which he described as very long and not very efficient. 'We have back-to-back impellers in a dual centrifugal arrangement,' he said. 'In a very small space – approximately 6in [15cm] – we have a 10:1 compression ratio, so we get very high efficiency in a very small package.'

Honeywell is responsible for this area of the HPW 3000, with its 50-50 partner in the Advanced

Turbine Engine Company (ATEC), Pratt & Whitney, working on the hot section. The evidence is that the twin centrifugal compressor is becoming an industry standard in turboshafts, as Pratt & Whitney uses this configuration in its new PW210 family, which will provide a choice in powerplants for future operators of Eurocopter's X4.

'With a PW210 engine, you get high power, fast response and the lowest fuel burn in this market segment,' explained Richard Dussault, VP of marketing at Pratt & Whitney Canada, speaking in April when the engine's selection by Eurocopter was announced. 'We have focused our technology on fuel efficiency, reduced emissions and maintenance technologies that deliver real value to our operators.'

He also cited advances in materials and compressor design, including alloys proprietary to his company, a dual-channel FADEC and 'state-of-the-art' diagnostics, including automatic fractional cycle counting.

Balancing act

Another way to increase efficiency is to separate the gas generator into optimised low- and high-pressure spools. However, the efficiency gains must be weighed against increases in weight, cost and complexity. ATEC chose a two-spool gas generator for the HPW 3000, the rationale for which Jerry Wheeler, the company's VP of programmes, explained to *RH*.

'Essentially, in a single-spool design all the rotating components are on one shaft, so they all turn at one speed,' he said. 'When you break that apart into a two-spool gas generator, you separate those rotating components out onto two different shafts so that you can spin the ones at the back of the compressor at a higher speed and the ones at the front at a lower speed, so they both operate at their most efficient condition.'

ITEP is not the only demanding US military effort to move turboshaft technology forward. In



Honeywell's HTS900 will feature on types such as the Marenco Swiss helicopter and the Bell 407 as an upgrade. (Photo: Honeywell)

Kamov's Ka-62 promises lower levels of fuel consumption thanks to the Ardden engine that will power it. (Image: Kamov)



January 2011, the US Army Applied Advanced Technology Directorate (AATD) solicited proposals from industry in a broad agency announcement for technologies to be used in a 5,000-10,000shp engine that, like ITEP, would take advantage of developments made under VAATE.

AATD wants the Future Affordable Turbine Engine (FATE) programme to demonstrate advanced technology capable of providing good reliability, maintainability, durability, operability, ballistic tolerance and producibility requirements, in addition to meeting or exceeding other programme goals.

FATE's goals are, on the face of it, even more ambitious than ITEP's, and include a 35% reduction in SFC, an 80% improvement in power-to-weight ratio, a 20% improvement in design life, a 45% cut in production and maintenance cost and a 20% saving in development cost. However, the baseline for comparison of FATE technologies is engines fielded in the year 2000.

Meeting halfway

Part-power SFC is emphasised in FATE to meet emerging endurance and cruise requirements for future US Army aviation platforms. AATD defines part power as 50% of intermediate rated power (IRP), and has SFC goals for this setting as well as for IRP, both of which will be measured at sea level and 15°C. AATD uses IRP to define the power-to-weight ratio.

AATD is looking for more than 6,000 hours and 15,000 hours, with the exception of hot parts such as the turbine blades and combustor liners, which are expected to last for 7,500 hours. The directorate is also seeking a reduction of more than 45% in maintenance costs, predicated on an agreed baseline and 250 flying hours per year.

The commercial potential of engines developed under FATE has led the US government to ask industry for at least half of the project's costs, to demonstrate commitment to the programme. Only one full development programme will be funded.



In November 2011, GE announced its award of a FATE contract worth more than \$45 million spanning five years. 'We are pleased to be selected for this important programme,' said Harry Nahatis, general manager for advanced turboshaft and turboprop engines at the company. 'We have several very exciting, advanced technologies that will be built into a robust, durable architecture that allows us to deliver tremendous performance at low weight while meeting aggressive cost targets.'

As well as advanced core engine technologies, innovative power architectures also promise efficiency gains. Helicopters require much more power to take off and hover than they do in cruise flight, and each engine in a twin must be able to power the aircraft to a safe landing if its partner should fail. These requirements force manufacturers to fit very powerful engines that are 'loafing' relatively inefficiently most of the time.

Turbomeca is considering ways around this problem. Speaking to *RH* last year, Charles Claveau, VP of products and market strategy at the company, suggested an expansion of the auxiliary power unit's (APU's) role into providing extra mechanical power during take-off and hover. This would allow the use of smaller, more frugal main engines that again could operate at a more efficient power setting – closer to maximum – in cruise.

Electric architectures

APUs are becoming more important as the need for electrical power for mission systems and other ancillaries grows with the advent of 'more electric' and 'all-electric' architectures. Microturbo's new e-APU family is designed to meet such needs, and AgustaWestland has selected the 60kW e-APU60 for the AW149 and AW189. Microturbo says that the e-APU60 can meet all the aircraft's electrical needs throughout the flight envelope.

This suggests a further means of improving fuel efficiency in which the APU relieves the main

engines of electrical power generation duties. This way, both prime mover and APU can operate more efficiently more of the time.

A further approach that would allow a twin-engined helicopter to reduce its fuel consumption in cruise is to shut one engine down, with the obvious drawback that it might not restart quickly enough for the aircraft to recover from failure of the other engine. The answer to this, as Claveau suggested, is a 'super idle' setting akin to the stop-start feature in some new cars. The challenge here is to minimise fuel consumption at idle, but still enable the engine to respond rapidly when required, a job for advanced engine controls.

Future functions

In addition to improvements in core engine technologies, evolution in key ancillaries also holds promise. For example, FADEC has brought carefree handling and more efficient operation to a new generation of turboshaft engines, and dual-channel FADEC has become an industry standard – in many cases a ticket for engine makers to play as far as airframe OEMs are concerned.

FADEC per se is well understood, but Buchanan believes that there is room for improvement by incorporating functions such as condition-based monitoring and cycle counting into the FADEC box. Advanced cycle counting could soon contribute to fatigue prediction by superseding the 'dumb computing' approach of counting every period between starting the engine and shutting it down as one cycle, regardless of how hard the engine worked during the flight.

'If you only use 50% of the cycle, the FADEC will be able to tell and count 0.5 for that particular cycle,' he said. 'I think future FADECs will be able to determine engine life based on how you have used it.' Buchanan also sees wireless transmission of recorded data to a maintenance ground station becoming industry standard in the not too distant future.

More flexible FADEC software is also something he sees as desirable. 'Some way of making software changes or multiple-use applications for the same software, I think, would be a big advantage to a customer or to an operator,' he said. 'What happens is that you take the FADEC software and map the engine to the rotor and the aircraft. Now, if I use that same engine in a different application, I basically have to start that process all over, so it's time and money. An easier way to update or revise software is something that the whole industry would benefit from.' **RH**



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It's not easy being green

Helicopters are one of the most energy-inefficient modes of transport. **Peter Donaldson** explores how the concept of electric or hybrid power is becoming a real possibility for future generations of rotorcraft.

Although yet to fly, Sikorsky's diminutive FireFly represents a real first attempt at manned electric helicopter flight. (Photo: Sikorsky)

Electric and hybrid propulsion systems are establishing themselves in a growing number of transport niches at sea and on land, and development activity is increasing in an aircraft industry encouraged by improvements in electrical energy storage and power transmission technologies.

Lithium-ion (L-ion) and lithium polymer batteries, fuel cells, ultracapacitors, rare earth magnet electrical machines and high temperature superconducting are all making significant strides towards maturity in terms of reliability, cost and weight, although the more exotic of these still have a long way to go.

A little help

Small general aviation aircraft and helicopters are seen as the best candidates for electric propulsion, and, separately, Sikorsky and Eurocopter are pioneering the technology for rotorcraft, but in very different ways. The latter's engineers have given an AS350 ➔

demonstrator a soupçon of electrical assistance to help the pilot cope with an emergency autorotative landing.

In contrast, Sikorsky has thrown away the engine and fuel system of a Schweizer 300C and replaced them with batteries and an electric motor for its experimental foray into pure electric power.

The Eurocopter project is concerned with providing a safety benefit on a range of aircraft in the near future, and Sikorsky's with gaining deep fundamental understanding of an emerging technology and moving the state of the art forward. However, there is still much heavy lifting to be done.

'All-electric systems using electrical energy storage still require significant technology development for anything apart from very specialised, niche applications,' Eric Blumer, director of engines and air management technology at Honeywell Aerospace, told *RotorHub*.

In addition to turbine engine expertise, Honeywell knows electrical power and control systems and applies technology to turbo-electric hybrid systems, although not so far in aircraft.

'Hybrid and full-electric vehicles have gained a foothold in the automotive field because of their attractive operating economics,' he continued. 'For aircraft applications, weight is a significant driver to performance and fuel consumption, much more so than in automotive applications. Reducing the weight and size of the complete, end-to-end electrical system is the most significant challenge for aircraft electric propulsion.'

Positive attitude

Jonathan Hartman, programme manager for Sikorsky's FireFly, acknowledges this, but remains optimistic. 'The prospects for medium and heavy electrically powered aircraft in general are good,' he told *RH*. 'Overall, I do not see a technical hurdle that would stop electrical

'The energy storage density problem has to be tackled before operators can realise the benefits.'

propulsion moving into increasingly larger and heavier aircraft.

'FireFly is a technology demonstrator, so for us the goal of the programme was to learn about electric propulsion as rapidly as possible. For that we used an existing airframe, in this case an S-300C, and did a one-to-one propulsion swap.'

The new propulsion system combines a L-ion battery pack from Gaia and a 200hp permanent magnet motor with an electronic control system from US Hybrid, and is monitored for health via integrated sensors.

FireFly is in the final stages of full component bench testing, the team having completed initial component testing as well as the fabrication and build work. The airframe has arrived at Sikorsky's West Palm Beach facility and has undergone airworthiness qualification for ground and flight tests. When Sikorsky unveiled the machine in July 2010, it hoped to fly that year, but this has not happened yet.

'What has happened is additional learning,' added Hartman. 'As we went through this, we realised that to meet that goal of understanding electric propulsion, we wanted to take more time at each step to learn as much as we could before we moved on. We consider both ground and flight test as important parts of the learning process, but they are certainly not the only ones. We are treating this as a methodical test programme to gather as much data as we can to inform future decisions.'

Pure electric propulsion has several advantages over any system that includes an

internal combustion engine, first among these being a significant reduction in noise and vibration, which Hartman regards as energy leaving the system in a non-productive way. 'That has benefits, not only in terms of helicopter operation, but also in how you might design a future helicopter,' he explained.

Next comes lower direct operating costs enabled by a fairly dramatic reduction in parts count through elimination, not only of the engine, but gearboxes and driveshafts. 'With FireFly, we have done some very early calculations that say with a pure electric system you can realise up to a 15% parts count reduction, which translates into a reduction in direct operating cost of up to 30%,' he continued.

Commercially viable

However, the energy storage density problem has to be tackled before operators can realise these benefits, which is why Sikorsky does not envisage a commercial product emerging from the FireFly effort any time soon.

'The reason is really straightforward,' explained Hartman. 'FireFly in its current configuration has a duration of somewhere between five and 15 minutes, depending on how you fly the aircraft. To be commercially viable, we think we need at least an hour. Until we get there – and that's us working with our suppliers and technology partners – we are going to continue to monitor the area and be actively involved in the community through the technology demonstrator and project flight data.'

To get that 15 minutes of flight time, the helicopter needs a battery pack that, complete with control and protection systems and associated structure, weighs 500kg. However, there are no weight issues with the 200hp motor, which, with its control system, has about half the weight of the Lycoming H10-360 and its fuel system. 'From that perspective, electric motors are very mature technology – almost COTS,' explained Hartman.

Based in Torrance, California, US Hybrid has been making permanent magnet motors in this power range for integration into large hybrid vehicles, such as buses, port trucks and street sweepers, for over a decade.

'We gave them the additional challenge of making it ready for aviation,' added Hartman. 'And you are talking about greater than 90% commonality with the automotive legacy products, which for us is a great thing. That is a great way to mature the technology, while maintaining reliability and affordability for customers if we were ever to bring it to market.'

Eurocopter modified this AS350 with a hybrid electric engine in order to give extra control during autorotation. (Photo: Eurocopter)



Our point of view.



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First to market

It is more likely that practical electric propulsion for helicopters will initially come to market in hybrid form because hybrids retain the high energy storage density of liquid fuel. However, inevitably, there are drawbacks, as Blumer explained.

'Series hybrid propulsion can eliminate the issue of energy storage weight, but system weight is still significantly higher than conventional shaft-driven propulsion,' he said. 'Adding electrical energy storage to the system can allow the gas turbine to operate in its most efficient region more frequently, but adds weight to the system. With today's electrical technology, this is a difficult equation to balance in favour of the hybrid system.'

'Other operational factors, such as reduced noise on take-off and landing using only electric propulsion, might drive some applications. Parallel hybrids where the electrical system provides peak power fill-in or emergency propulsion might be nearer-term applications.'

In series hybrid systems, the engine drives a generator to power electric motors, charge batteries or both. In parallel hybrids, both prime mover and electric propulsion system are coupled to the final drive through gearing.

Besides sidestepping the energy storage problem, hybrids – and series hybrids in particular – hold out the tantalising promise of lighter weight and even greater safety by eliminating the need for driveshafts and gearboxes through the use of advanced rare earth magnet and superconducting motors and generators.

Again, however, Blumer cautions that there is still much work to be done: 'Electrical machines are not the only concern – other areas of the electrical system have significant influence.' He cited power converters and controllers that drive motors and condition the output of power sources, distribution switches and controls that ensure integrity and wiring.

'The problem needs to be considered at an overall system level,' continued Blumer. 'Component- and equipment-level improvements need to be combined with advanced, integrated architectures to optimise the aircraft. For example, wide use of superconductors could reduce power wiring and electrical machine sizes, but, except on cryogenic-fuelled vehicles, the large cooling system and insulation will likely more than offset all of the benefits at the system level.'

Although there have been a small number of major accidents caused by catastrophic gearbox failure in large helicopters, mechanical power transmission is very reliable, so it will be with us



The US Hybrid electric motor on the Firefly is half the weight of the piston engine it replaces. (Photo: Sikorsky)

for a long time yet. 'Electrical systems of this type have not yet been proven more reliable,' he continued. 'But it is easier to introduce redundancy into an electrical system, for a smaller weight penalty.'

Hartman recognises the potential advantages of hybrids, but regards that technology as secondary at the moment. 'That was a choice when we were defining the FireFly programme,' he said. 'The reason we chose all-electric technologies was that we wanted to tackle the toughest problem of the propulsion system first, which was this new technology that we didn't have a lot of knowledge about. We feel that hybrid systems are a subcategory of that, but having the knowledge base for electric propulsion was key, no matter which direction you decided to take the technology in.'

An easier life

In October 2011, when Eurocopter announced it had successfully flight tested its parallel hybrid AS350, it emphasised that the L-ion battery and motor are there simply to make life easier and safer for a pilot to guide the aircraft to a safe touchdown in autorotation, so endurance is not an issue.

Jean-Michel Billig, executive VP for research and development at Eurocopter, believes all pilots of single-engine helicopters will appreciate the lower workload and stress levels in autorotation that this system promises. 'The operation performed by the pilot is the same as usual,' he told *RH*. 'The difference is in the greater margins and ease of operation.'

The system works at full power at the beginning and end of an autorotation, powering down during the descent phase to save energy. The battery and electric motor combination provides more time to react to an engine failure by maintaining rotor speed for longer.

'The pilot shouldn't face a situation with a very low rotor speed and too high a descent rate,' continued Billig. 'Finally, just before landing, the power of the electric motor allows the pilot to stop more easily, to choose the landing point better and to better control the touchdown. Furthermore, even if the pilot hasn't calculated the right distance to the ground, the backup system allows him to avoid a hard landing.'

Promising results

Eurocopter launched the project in September 2010 and began flight testing of the demonstrator less than ten months later on 7 July 2011 at its Marignane facility. 'The system is promising, as all the tests have successfully been performed in real conditions with a production helicopter,' said Billig. 'So far, the flight tests have confirmed the possibility of integrating an alternative power source in the helicopter – they have shown that the system can ease autorotation.'

'The next steps are to bring it to maturity and evaluate the implications for serial production. We are still working on ensuring that the new system does not penalise the aircraft in terms of size, weight and cost. This will be our challenge for the next few months. No exact date for market entry is yet available.'

Blumer seems optimistic towards parallel hybrids, despite cautioning that electrical technologies need to develop much further before they are ready for widespread adoption in aircraft propulsion. 'Parallel hybrids for helicopters might be one of the more attractive areas of application,' he explained. 'In addition to emergency propulsion power, the electrical system can provide peak power fill-in, allowing for smaller engines that can run in a narrower peak efficiency band.'

Recent developments in battery technology excite Hartman about the prospects for pure electric rotorcraft. 'Part of the FireFly programme for us is to be able to engage the energy source community,' he said. 'FireFly has been almost a virtual conference room for discussion with those suppliers, and we are really encouraged.'

For one development, he cites Californian company Envia Systems' February announcement of a breakthrough in energy density for rechargeable L-ion batteries for automotive applications.

Envia said that its prototype cells have achieved 400 Watt-hours per kg, bettering the state of the art by 160%. With such an improvement, FireFly's endurance could reach 24 minutes, which is still short of the hour Hartman would like, but is a big step in the right direction. **RH**

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.



Eurocopter EC175

Officially launched at Heli-Expo 2008, the EC175 is a twin-engined medium helicopter aimed firmly at the oil and gas market. It was jointly developed with Avicopter in China, where the aircraft is known as the Z-15. Key components, such as the airframe, fuel systems and controls, are made in China, while Eurocopter in France manufactures the main gearbox and carries out avionics integration. The first flight was made on 4 December 2009, with a public flight on 17 December. Certification is due in 2012, with first deliveries to Bristow – the launch customer – expected during the fourth quarter.

Weights

Maximum Take-off Weight:	16,535lb (7,500kg)
Useful Load:	N/K
Empty Weight:	10,150lb (4,603kg)
Maximum Fuel Capacity:	4,699lb (2,136kg)

Powerplant

Two Pratt & Whitney Canada PT6C-67E turboshafts each producing 1,775shp (1,324kW), driving a five-blade main rotor and three-blade tail rotor.
Maximum Continuous Power (MCP): 1,645shp (1,227kW)
Take-off Power (TOP): 1,776shp (1,324kW)

Performance

Maximum Speed (V_{NE}):	151kts (280km/h)
Maximum Cruising Speed:	135kts (250km/h)
Fuel Consumption at Maximum Speed:	N/K
Economical Cruise Speed:	N/K
Fuel Consumption at Econ Cruise:	N/K
HIGE:	N/K
HOG:	N/K
Service Ceiling:	19,680ft (6,000m)
Range:	700nm (1,296km)
Maximum Endurance (no reserves):	N/K
Rate of Climb	N/K
(all engines operative, MCP):	N/K
Temperature Limitations:	Min: -40°C (-40°F) Max: 50°C (122°F)

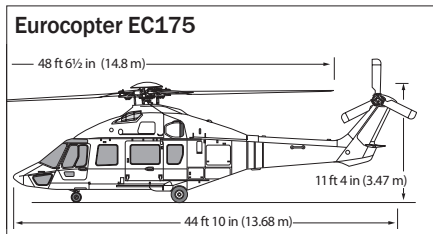
External Dimensions

Rotor Diameter:	48ft 6½in (14.8m)
Fuselage Length:	51ft 5¼in (15.68m)
Overall Length:	59ft 3in (18.06m)
Disc Area:	1,851.7ft² (172.03m²)
Height:	17ft 2½in (5.34m)
Tail Rotor Clearance:	7ft 6½in (2.3m)

Internal Dimensions (Rear Cabin)

Cabin Width:	6ft 11in (2.13m)
Cabin Height:	4ft 7in (1.4m)
Cabin Length:	12ft 6in (3.81m)
Baggage Area:	35.9ft² (3.34m²)
Baggage Volume:	95.3ft³ (2.7m³)
Total Floor Area:	87.6ft² (8.14m²)
Total Floor Volume:	434.3ft³ (12.3m³)

Maximum Seating: Up to 18 passengers



Eurocopter EC225

The EC225 is the latest civil variant of the Puma/Super Puma/Cougar family, and is a medium-weight twin-turbine helicopter in the 11t class. Large sliding doors are provided on both sides of the cabin, facilitating rapid emplaning and deplaning. Extensive use of composites, modular construction, state-of-the-art avionics and Turbomeca Makila 2A engines are combined with a rugged and proven airframe. The aircraft is aimed principally at offshore and SAR roles, and is available for the military market as the EC725. The aircraft is produced in Marignane and a line for the EC725 in Brazil will also produce the EC225 for the country's oil and gas market.

Weights

Maximum Take-off Weight:	24,690lb (11,200kg)
Useful Load:	24,251lb (11,000kg)
Empty Weight:	11,621lb (5,271kg)
Maximum Fuel Capacity:	4,447lb (2,017kg)

Powerplant

Two Turbomeca Makila 2A turboshafts producing 3,413shp (1,800kW) each, driving a five-blade main rotor and four-blade tail rotor.
One Engine Inoperative (30s power): 2,328shp (1,758kW)
One Engine Inoperative (2min power): 2,228shp (1,661kW)
One Engine Inoperative (MCP): 2,110shp (1,573kW)
Maximum Continuous Power (MCP): 1,892shp (1,410kW)
Take-off Power (TOP): 2,097shp (1,563kW)

Performance

Maximum Speed:	175kts (324km/h)
Maximum Cruising Speed:	149kts (275km/h)
Fuel Consumption at Maximum Speed:	1,367lb/h (620kg/h)
Economical Cruise Speed:	142kts (263km/h)
Fuel Consumption at Econ Cruise:	1,220lb/hr (555kg/hr)
HIGE:	12,755ft (3,887m)
HOG:	10,039ft (3,059m)
Service Ceiling:	19,408ft (5,916m)
Range:	475nm (879km)
Maximum Endurance (no reserves):	4hr 28min
Rate of Climb (all engines operative, MCP):	1,712ft/min
Temperature Limitations:	Min: -30°C (-22°F) Max: 50°C (122°F)

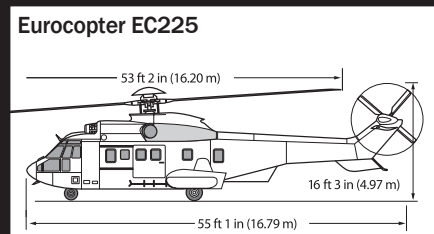
External Dimensions

Rotor Diameter:	53ft 2in (16.2m)
Fuselage Length:	55ft 1in (16.79m)
Overall Length:	63ft 11¼in (19.5m)
Disc area:	2,218.7ft² (206.12m²)
Fuselage Width:	6ft 7in (2m) without sponsons
Height:	15ft 1in (4.6m)

Internal Dimensions (Rear Cabin)

Cabin Width:	5ft 11in (1.8m)
Cabin Height:	4ft 5in (1.35m)
Cabin Length:	25ft 9½in (7.87m)
Cabin and Baggage Floor Area:	112.95ft² (10.5m²)
Cabin and Baggage Volume:	547.3ft³ (15.50m³)
Total Floor Area:	112.95ft² (10.5m²)
Total Floor Volume:	547.3ft³ (15.5m³)

Maximum Seating: 24 passengers



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Mission: possible

Eurocopter's Lutz Bertling stresses the importance of conveying the benefits of helicopters to both decision-makers and the public, while considering what future lies ahead for the industry.



Such capabilities are vital, as the demand is for greater range, especially with oil and gas platforms and wind energy farms being located further offshore.

Productivity will be another keyword for future helicopters. The current focus on speed in the industry will generate value whenever mission time is a determining factor, as long as the benefit of such higher speeds outweighs the cost of purchasing, operating and maintaining the machine.

Ecological evolution

The helicopter itself is becoming increasingly eco-friendly – another attribute that is equally important for its users and the public. Research on materials, blades and engines will yield exciting developments in reducing emissions, lowering sound levels and cutting fuel consumption, as well as enhancing the overall flying experience for passengers.

With the global helicopter sector poised to bring great new benefits for the next decade, our industry should be placing equal importance on evolving technology and ensuring the public is aware of the benefits that these machines bring to daily life. **RH**

Lutz Bertling is CEO and president of Eurocopter.

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.

Our industry faces an increasingly important mission – communicating the message that helicopters are essential in today's society, underscoring the growing number of vital services they perform in a widening number of applications.

This message needs to be heard 'loud and clear' by decision-makers, government regulators, community officials and the public at large if the appreciation of our helicopters' capabilities keeps pace with the technical advancements that we incorporate in them.

Most people understand that helicopters enable worldwide operators to perform certain high-profile missions, as underscored by the familiar sight of rotary-wing aircraft at medevac scenes, in TV coverage of SAR missions and the reassuring presence of law enforcement helicopters overhead.

Rotary-wing roles

Our industry's numbers are impressive. Some 12,000 helicopters are currently in service worldwide for emergency medical airlift, public service, passenger transportation and aerial work, with more than half of all civil and parapublic deliveries during the past ten years going to these segments.

About 1,400 rotary-wing aircraft are deployed for SAR duties – often operating under extreme climatic conditions. Helicopters are also becoming increasingly indispensable in fire-fighting, with an estimated 530 aircraft dedicated to such missions, and many more multirole machines available for fire-fighting activities.

Less known, however, is the important role of rotorcraft in utility duties, with the worldwide inventory for these missions accounting for approximately 4,500 aircraft. Covering a wide range of applications, these machines are called upon to build and maintain power lines, airlift cargo and passengers to remote areas, carry

external sling loads, support the development of agriculture and explore new areas for natural resources – an activity that offers an important growth potential.

Another emerging mission is tied to the rapid development of offshore wind farms. Offering a quick and cost-effective solution, the helicopter stands out as an ideal tool to build and maintain wind turbines, thanks to its reliability and availability in demanding conditions.

Even lesser known to the public are such rotorcraft applications as the round-the-clock heliborne airlift of maritime pilots to ships entering busy port facilities – already adopted at locations such as Le Havre, Bordeaux and Dunkirk in France.

With all of these missions in mind, our responsibility as manufacturers is to further push the boundaries in the versatility of helicopters. To be successful, we must be able to offer products that are rapidly reconfigurable for a wide variety of applications – from transportation support for the oil and gas sector to SAR, emergency medical airlift, police and public service missions, as well as others.

Safety will continue to be a major priority for industry – particularly regarding its public image. Manufacturers are working on reducing pilot workload, allowing crews to fully focus on the mission ahead, as well as improve ergonomics and the human-machine interface.

Better access to simulators and training centres worldwide will also boost fleet safety across the globe. To provide operators with the highest levels of aircraft availability at optimised costs, future helicopters are to be more intelligent and communicative to facilitate maintenance tasks.

In addition, next-generation mission equipment will increasingly incorporate avionics that include four-axis autopilots and weather radar, along with fully coupled TCAS II systems.

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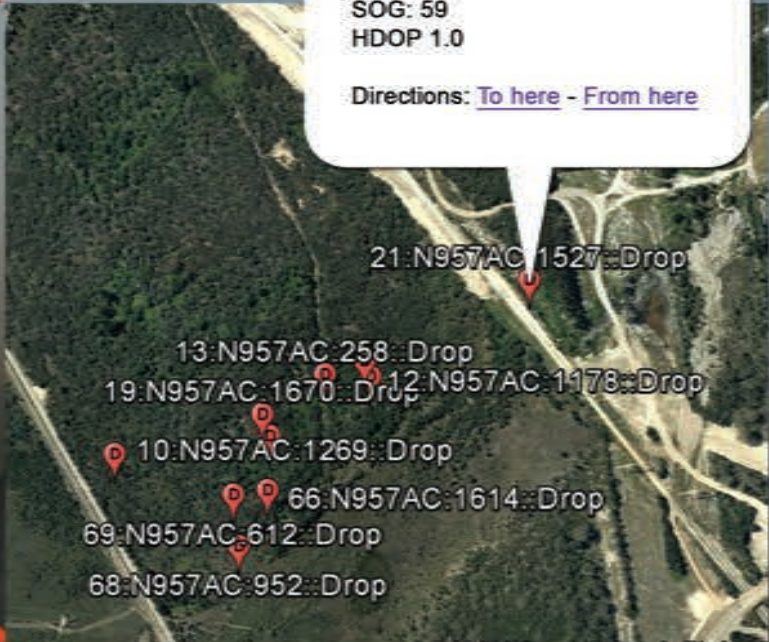
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