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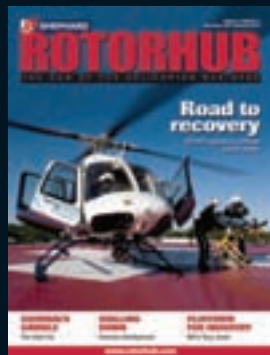
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Ambitious agenda

A decade ago, you could count on both hands the number of nations that could claim indigenous production of rotary-wing aircraft.

The development and manufacture of helicopters is no easy feat – the experience and knowledge garnered over years of trial and error seems an obvious barrier to entry in an industry that has seen projects and start-ups disappear as fast as they emerged.

However, somewhat impressively and despite the financial constraints in the world economy, it seems that more nations are jumping onto the development bandwagon.

Where governments once launched state-owned companies to build identikit turboprop or jet trainers for the military and underpowered regional airliners, today it seems that helicopters are becoming the official projects of choice. And if the state doesn't do it, a private company with the blessing of government will step in instead.

Nowhere was this more apparent than at this year's Dubai Airshow, where two nations revealed their helicopter-building ambitions. Perhaps the most unlikely was Sudan's state-owned Safat Aviation Complex, which proudly displayed its AK1-3 light helicopter under the blazing sun.

While not technically complex, the helicopter and the fixed-wing trainer sat beside it represent an embryonic aircraft industry in a country once troubled by internal strife.

The other nation was the UAE itself, where a curious mix of Ukrainian design, British management and Emirati investment has resulted in the emergence of the Quest AVQ family of tandem-rotor helicopters, with planned variants seating up to 15 passengers (see p6).

Show visitors were told that the machines would make use of technologies only beginning to find their way onto the most modern of military helicopters: fly-by-wire controls; a HUMS downlinked in real time; and even an escape pod to be used as a last resort in the event of a catastrophic incident.

More importantly, the venture represents a step towards the emergence of a helicopter industry within the UAE, a move that has the full backing of the rulers of Umm al-Quwain where Quest hopes to begin production in two years. The Quest team's enthusiasm is doubtless, but the organisation may face constraints imposed by the investors who have so far put up \$50 million for the AVQ's development – a sum that seems small compared to the hundreds of millions spent by the bigger OEMs on new programmes.

Work to develop a commercial helicopter in Turkey is also considerably more advanced than many outside the country realised. Inklings of such a development were released when Turkish aerospace firm TAI announced its partnership with Sikorsky to build Black Hawks. In fact, TAI has quietly been working with universities on the commercial venture since 2005, and the project team has even built a prototype fuselage and main rotor blades. As TAI gains experience on the military T129 and T-70 projects, it's not hard to imagine a civil programme following closely behind.

China, despite claiming for years that its helicopters were indigenous, has finally begun production of genuine locally designed and built helicopters that are not obvious copies of European designs.

Brazil's Helibras (admittedly with the assistance of parent company Eurocopter) may well be in a position to develop and build a home-grown machine in the next ten years, while South Korea – also benefitting from Eurocopter's experience – is flight testing the Surion, an aircraft that is already set for parapublic work on the Korean peninsula. There is optimism for further success in the Asian civil market for medium twin helicopters.

Marengo Swisshelicopter, meanwhile, may well put Switzerland on the map as a helicopter-producing nation after a successful launch of its SKYe SH09 at Heli-Expo 2011, and even the UK may get back in on the commercial rotorcraft act with its involvement in the AgustaWestland AW169 programme.

As the industry evolves, it seems that more nations than ever before are keen to make their mark.

Tony Osborne, Deputy Editor

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- ◆ Aircraft support

North Sea helicopter tragedy report published

The UK Air Accident Investigation Branch (AAIB) has released its final report on the causes of a fatal offshore helicopter crash in 2009.

Fourteen oil workers and two flight crew were killed on 1 April when the Bond Offshore Helicopters AS332 L2 Super Puma, G-REDL, crashed into the North Sea 18km off Peterhead.

The investigators concluded that the primary cause of the disaster was a catastrophic failure of the main rotor gearbox, triggered by a fatigue fracture in a second-stage planet gear in the epicyclic module.

The crash report, which has taken more than two years to complete,

made 17 safety recommendations.

It established that the actions taken following discovery of a magnetic particle on the epicyclic module chip detector, some 36 flying hours prior to the accident, resulted in the particle not being recognised as an indication of degradation of the planet gear, which subsequently failed.

The particle's discovery had originally led the operator to initiate a plan to remove the gearbox and replace it with a unit from another helicopter undergoing heavy maintenance, the AAIB found.

However, 'the gearbox was declared serviceable by the operator and its

planned replacement cancelled', said the report.

The fatal flight was the aircraft's second return journey that day. After lifting off from BP's Miller platform, the aircraft headed back to Aberdeen. The crew were not aware of any anomalies with the helicopter until a main gearbox oil low pressure warning was recorded. The report said this was accompanied by a continuous 'grinding' sound associated with the break-up of the gearbox.

Within two seconds, the helicopter ceased responding to pilot control inputs and, 20 minutes before its expected arrival time at Aberdeen,

the Super Puma crashed into the sea. The failure of the gearbox caused the separation of the main rotor head and all four blades from the aircraft.

Paint from the tail boom was found on all the blades, which confirmed that they had struck the tail during the failure sequence, the report added. The accident would not have been survivable.

'The reason for the initiation of the crack in the failed second-stage gear could not be established fully, and the possibility of a material defect within the gear or foreign object debris could not be discounted,' the report stated.

By Tony Osborne, London

X³ flight testing enters new phase

Eurocopter is on the verge of

commencing a further phase of flight trials of its X³ hybrid demonstrator as it looks to the commercial viability of the design.

The company has already carried out two series of tests of the X³ to validate the concept of a 50% speed increase (220-230kts) for a corresponding 10-20% increase in the cost of ownership.

Eurocopter executive VP for engineering Jean-Michel Billig told *RotorHub* that, while the company had learned a lot about such parameters as airframe behaviour, vibration and power control at high speed in the earlier tests, the additional flights would push the envelope further.

'One thing we did not anticipate is that we would exceed our expectations,' he said. 'To give you a flavour of the potential of what we have been doing, we have reached our target speed of 220-230 with about 75% of available power, but we had anticipated much higher power. So



if we go for more power, what can we learn from it?'

However, this third set of tests is unconnected to a formal go/no-go decision on launching X³ as a commercial programme, which Billig said was expected to take place in early 2012.

That assessment will consider future applications for the platform – Billig cited the oil and gas and SAR markets as obvious starting points – as well as possible configurations of the aircraft given the current placement of its propellers.

Billig also revealed that the company was looking to formally assess its Blue Edge main rotor blade, which uses a double-swept shape to reduce noise levels, at Technology Readiness Level (TRL) 6 by the end of 2011. While unconnected to any one platform, if the Blue Edge technology does achieve TRL 6, it is likely to be incorporated into the development of Eurocopter's X4 replacement for the Dauphin.

By Tony Skinner, Marignane



UK launches tender for long-term SAR contract

The UK Department for Transport

(DfT) has begun the procurement process for a new long-term SAR service contract, which will see the end of military involvement in dedicated rescue operations.

The programme, known as 'Long SAR', went to tender at the end of November and will see rescue services provided by civilian crews working under ten-year contracts worth between £2 and £3.1 billion (\$3.1-4.8 billion).

Secretary of State for Transport Justine Greening said that bidders would be able to put forward options such as utilising mixed fleets of helicopters based on the capabilities required at each of the bases, such as range, carrying capacity and endurance, and that the service could be provided by more than one contractor.

Bid documentation reveals the tender can be delivered in three 'lots'. The first lot would see the use of an aircraft capable of lifting of eight casualties from Sumburgh, Stornoway, Culdrose, Leconfield and Valley. Lot 2 allows the use of an aircraft capable of lifting four casualties operating from Chivenor, Prestwick, Lossiemouth and Wattisham. The third lot is a combined package, delivering both lots 1 and 2.

The winning bidder will be expected to operate from ten locations around the UK, but provide at least the same level of service as at present. Under the plans, SAR operations at RAF Boulmer would end in 2015 and at Portland when the current Maritime & Coastguard Agency (MCA) contract expires in 2017. The DfT expects to award the new contract in early 2013.

Shipping minister Mike Penning said: 'Commercial operations are nothing new in this area – the MCA's search and rescue functions have been provided on a contract basis for almost 30 years – and this system has served us well. This new, long-term contract will see the UK served by some of the most modern, well-equipped helicopters in the world.'

A number of potential bidders have already expressed an interest in the programme, including North Sea operators Bond, Bristow and CHC. Other respondees include Babcock, KBR and several of the major helicopter OEMs.

The introduction of a new contract follows the abandonment of the previous SAR-H programme at the beginning of 2011 after irregularities were found in the bidding process.

Currently, SAR helicopter operations are carried out by the Royal Navy and the Royal Air Force flying the Westland Sea King, and by the MCA using a mix of S-92s and AW139s provided by CHC under an interim contract operating from Portland, Lee-on-Solent, Shetland and the Isle of Lewis. That contract is due to end in spring 2013.

Under previous plans, the helicopters involved in the interim contract would have been replaced by a new single-type fleet supplied by preferred SAR-H bidder Soteria – a consortium of CHC, Thales and the Royal Bank of Scotland. The service would have commenced when the interim contract ended, and was due to be fully in place by 2016, when the Sea King is planned to be retired.

In the meantime, four bidders are believed to remain in the running for the Gap SAR requirement launched by the DfT this summer. This contract will cover the hiatus between the interim MCA service and the new long-term arrangement. It has to be operational in the spring of 2013, with total cost estimated to be between £200 and 235 million.

By Tony Osborne, London

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16 November 2011

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Quest aims for new markets

A UAE-based company has revealed plans to build a tandem-rotor, twin-engined light helicopter for the commercial market.

Quest Helicopters, a subsidiary of UAE-based Quest Investments, has ploughed \$50 million into the venture launched at the Dubai Airshow in November, which will see the development of the Quest AVQ family of rotorcraft.

Designed by Ukrainian engineer Volodymyr Udovenko, the AVQ will boast a number of unique features for a helicopter of its type, including a fly-by-wire (FBW) system, currently only found on the military NH90 and S-92-based CH-148 Cyclone, and a rocket-propelled escape pod that would extract passengers and crew in the event of a 'catastrophic' failure.

Mike Creed, commercial and deputy project director at Quest, said he was keen to introduce new technologies into the AVQ to differentiate it from conventional helicopters available on the market.

'With this new family of helicopters, we are pursuing a niche market with a design that combines the technological advances of the east with many innovative refinements from the west, as well as adding some exciting commercial enhancements,' he said.

While enthusiastic about the escape pod, Creed accepted that it



might be a challenge to get such a system through the certification process. The pod would be activated by the pilot as a last resort after a major failure in a component such as the gearbox, and is designed to be effective at heights above 300ft. The company plans to prove the concept with a prototype capsule, displayed at Dubai, which will be tested to destruction.

Other features of the design include a HUMS downlinked in real time, which Creed said would allow the AVQ to benefit from condition-based maintenance. He revealed that the FBW technology would be provided by a company producing such systems for Antonov fixed-wing transport aircraft. Flight controls and instruments will be installed in the left-

hand side of the cockpit, with the pilot using a pair of side-stick controllers.

In terms of the powerplant, the current plan is to use a pair of 465shp Progress/Motor Sich AI-450M turbines with FADEC.

A mock-up displayed at Dubai was in a four-seat VIP configuration, but Creed said the aircraft was also targeted at EMS, law enforcement and utility operators. He was also keen to point out that the design allowed for different cabin sizes – all the way up to 15 seats – although an initial focus would be on the ten-seat category, competing against the likes of the Dauphin and S-76.

Quest plans to build the helicopter at a new factory in the emirate of Umm al-Quwain, where it has a plot of land ready for construction to start.

The company aims to begin initial production in 2014, while certification will be carried out in Ukraine, the UAE and for EASA.

Creed said the AVQ will cost just under \$3 million, with plans for 20 to be built in the first year, rising to 40 two years later. The four-seater would have an MTOW of 2,250kg, a range of 700km, a maximum speed of around 160kts and an endurance of 3.6 hours.

As well as designing the AVQ, Udovenko is responsible for the AeroKopter AK1-3 light helicopter, development and production of which was moved to the UAE in 2009 by the Perla Group. That aircraft is now also being offered for sale by Sudanese company Safat as the Safat AK1-3.

By Tony Osborne, Dubai

Surion chosen to replace Korean police fleet

Korea Aerospace Industries (KAI) has announced that the Surion utility helicopter has been selected by the Korean National Police Agency (KNPA) for its Police Helicopter project.

According to a press release issued by KAI in mid-October, the Surion, which has been developed in co-operation with Eurocopter to replace the existing utility helicopters in the Republic of

Korea Army fleet, will also replace the MD 500s and Bell 206s used by the KNPA. KAI said the aircraft won against the AgustaWestland AW139 in a competitive tendering process.

The company said the KNPA will use the helicopters for tracking and surveillance, traffic management and patrolling, VIP and cargo transport plus the support of police commandos.

The aircraft will be armoured and feature video downlink systems, EO/IR cameras, searchlights, loudspeakers and other mission equipment.

Contract negotiations are expected to be concluded before the end of 2011, and the first police Surions are due to enter service around 2014. It is not clear how many aircraft are required by the KNPA.

KAI said it was encouraged by the decision, and hopes that other national parapublic agencies will be interested in the aircraft. The company said it had competed on 'equal terms' against the world's leading helicopter manufacturers as regards price, competitiveness and performance, and argued that the export prospects of the aircraft have been 'brightened' as a result.

By Tony Osborne, London



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AgustaWestland and Bell complete 609 transaction

AgustaWestland and Bell Helicopter

have formally completed the process that will see the former take full control of the AW609 civil tiltrotor programme.

In a statement on 29 November, AgustaWestland said all 'legal and regulatory approvals' had now been given and it was moving towards civil certification of the AW609 in late 2015 or early 2016. First deliveries of the aircraft would follow shortly afterwards.

AgustaWestland's move to take full control of the 609 project was first revealed during Heli-Expo in March, with the acquisition officially announced in June. The negotiations between the two companies are understood to have centred on the status of the intellectual property rights to the tiltrotor technology, which is also used on the Bell-Boeing V-22 Osprey.

Bell/Agusta Aerospace will now be wholly owned by AgustaWestland and renamed, although it will remain a US company as the type certificate applicant to the FAA.



AgustaWestland said the AW609 programme will be managed by a single integrated development team, based in Cascina Costa, Italy, and a new operational base will be opened in Arlington, Texas, to manage US-based tiltrotor operations. The company also revealed that 'preliminary orders' for some 70 AW609s have already been placed by around 40 customers around the world for a range of commercial and government roles.

It has plans to develop a new satellite-based navigation system and mission avionics for the AW609, as well as a 'state-of-the-art' avionics architecture.

In terms of the test programme, the first two prototypes have completed more than 600 flight hours, including at altitudes of up to 25,000ft and cruise speeds of up to 275kts at the aircraft's maximum weight. The third prototype, now being assembled in Italy, will be devoted to icing certification testing, while the fourth will be used for the development and integration of the new avionics.

'Additionally, STOL (short take-off and landing) procedures will be investigated in order to permit operations at increased maximum gross weights to further enhance the AW609's operational capability for specific applications,' the company said in its statement.

Bell will remain a sub-contractor, building components such as rotor blades, and be a key supplier of engineering services. According to company sources, Bell's decision to withdraw from the 609 programme was largely due to a differing opinion about the commercial prospects of a civilian tiltrotor. The move will also allow it to invest further in future variants of the V-22.

By Tony Skinner, London

Eurocopter ramps up production rates

Eurocopter plans to ramp up

the production of key aircraft types, reflecting the company's confidence in the recovery of the civil helicopter market.

At its Marignane facility, solid sales of the latest version of the Super Puma, the EC225/725, have seen production steadily increased since 2009 and the goal is for 50 aircraft to be produced annually from the end of 2012.

EC225 and Super Puma sales and support contract manager Alexandra Cros said the company had delivered around 100 EC225s and EC725s in the last five years, with 100 more in the order book.

'This surge in orders meant we had to really increase our production capability. We have had to take over the whole hangar and we may need to increase it further. There was a very steep production

ramp-up, roughly between 50% and 70% between 2009 and 2013. It's been challenging, but so far we have been able to deliver everything.'

On the light assembly line, processes are being revamped to increase production of the AS350 B3e from 230 aircraft per year to 280 by 2013. Following certification of the B3e in June 2010, this version has been the sole Ecureuil produced since May 2011.

Changes are currently being incorporated into the design, including a new metal canopy shaped using technology from the automotive industry, as well as the inclusion of the Vision 1000 flight data and cockpit image recording device and a new centre console with a reduced number of switches. The latter is expected to be certified in the coming weeks.

By Tony Skinner, Marignane

Rotorcraft orders placed since 30 September 2011

Aircraft	Customer	Order date	Total
EC225	MHS Aviation	12 December 2011	1
EC225	Awan Inspirasi	12 December 2011	1
AW189	Bel Air of Denmark	12 December 2011	2
AS350 B2	Weststar Aviation Services	8 December 2011	1
AW139	Weststar Aviation Services	7 December 2011	6
AW169	Weststar Aviation Services	7 December 2011	2
AW189	Weststar Aviation Services	7 December 2011	2
AW139	SFS Aviation	6 December 2011	1
Bell 412	Indonesian government	1 December 2011	5+2
EC145	Duke Life Flight	30 November 2011	2
AW119Ke	CPI Group	30 November 2011	1
AW139	Euro Asia Air	17 November 2011	2
EC145 T2	DRF Luftrettung	15 November 2011	25
EC135	STAT MedEvac	15 November 2011	2
EC145	STAT MedEvac	15 November 2011	3
AW189	Bristow Group	10 November 2011	6
AK1-3	Yacht Chandlers	10 November 2011	9
S-61T	US Department of State	8 November 2011	3
AS350 B3e	Wuhan Helicopter Group	7 November 2011	2
EC120	Wuhan Helicopter Group	7 November 2011	1
EC120	Baltimore Police Department	25 October 2011	4
Ka-32	Ordos Civil Administration	24 October 2011	1
AW169	Auckland Rescue Helicopter Trust	19 October 2011	2
EC130	Milestone Aviation Group	19 October 2011	5
EC145	Helistar (Colombia)	12 October 2011	3
EC225	Southern Service Flight Co	10 October 2011	1

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Under pressure

British International Helicopters operates one of the few rotary-wing air links in Europe, but politicking and tight finances are creating doubts about the future of this valuable transport service, as managing director Tony Jones explained to Tony Osborne.

Since 1964, helicopters have been transporting passengers between the UK mainland and Isles of Scilly. The aircraft are a lifeline to the community of 2,000 people who live there, shuttling them back and forth for grocery shopping or to attend medical appointments. More importantly, however, it helps sustain the islands' thriving tourism industry, which accounts for 85% of the archipelago's income.

Today, the service is provided by British International Helicopters (BIH), an operator formed through a management buy-out of the non-oil-related operations of Scotia Helicopters and Canadian Helicopter Corporation. Although it is small in size compared to the likes of Bristow and Bond, which both work in the North Sea, BIH is widely recognised and respected for running one of the few public helicopter air links anywhere in the world.

Transport options

'Apart from anything else, it's a novel way of flying,' Captain Tony Jones, managing director of BIH, told *RotorHub*. 'The transport options for the islands are very different. There's the ferry, which some people love and wouldn't go another way – others wouldn't even dream of going on it – but if you are travelling on a budget, that's the way you would go.

'Others would go from Bristol, Exeter or Southampton on the Skybus because it is convenient or cheap. And then there's our share of the market – for example, we are the only operator that flies directly into Tresco, so if you are going there, it makes sense to go by helicopter.'

The services are run out of a heliport on the seafront of Penzance, with journey times to the islands of around 20 minutes each way. Since 1964, more than 4 million passengers have flown on the helicopter services, with more than 1.2 million of those during BIH's tenure.

The workhorses of the fleet are six S-61Ns configured to carry between 28 and 30 passengers. Three are regularly stationed at Penzance – two operate the shuttle service, while the third is held on standby in order to meet higher passenger demand or in case an aircraft develops a fault. During the height of the summer season, the company will operate 12 return journeys a day, falling to ten and then eight later in the year. During the winter, this drops to around four.

The market is tough – the helicopter faces competition from the ferry and fixed-wing Skybus air services provided by the Isles of Scilly Steamship Company. However, the rotary-wing



St Michael's Mount is an impressive sight for passengers as they fly to and from the Isles of Scilly with BIH. (Photo: BIH)

service is reliable, and in some weather conditions it becomes the only link with the mainland. In IFR conditions, the crews use a modified version of the offshore rig radar approach.

'It's a very convenient way of flying – we are a shuttle service, not flying to a timetable per se,' explained Jones. 'We start at 7:30 in the morning, and there's a flight every hour until the evening. If a passenger misses one, they can just jump on the next.'

Passenger numbers on the helicopter routes have levelled off to a steady 90,000 a year, down from a peak of 137,000 in 2002. 'The numbers have dropped off,' admitted Jones. 'I think it is a realisation you can have a sunshine holiday in the Mediterranean at the same sort of cost. On the islands, everything is more expensive than it is on the mainland, as you have to sea freight it all across, while accommodation, especially at the peak of the season, is generally in limited supply.'

The Friday feeling

The cost of shopping on the islands is so prohibitive that islanders will now often order their groceries online and get a supermarket chain to drop items off at the heliport so they can be flown across. On Fridays, passengers heading for a weekend break are joined by a consignment of takeaway food ordered from the mainland and flown across to be picked up by the islanders.

'On the islands, everything is more expensive than it is on the mainland, as you have to sea freight it all across.'

Such services are charged for by BIH, but appreciated by those living on the islands.

Recent years, however, have seen the air link facing some challenges. Indeed, the last few months of 2011 have been some of the most testing for the company in its short history. At the time of interview with *RH*, BIH was putting the finishing touches on plans for a new heliport at St Erth, northeast of Penzance. A supermarket chain is purchasing the land that the Penzance heliport currently sits on, and wants to build a new store, petrol station and business units on the site, while the local council are keen to construct a park and ride.

'The sale releases the capital that is tied up in the land at Penzance, and allows us to restructure the finances of the company,' explained Jones. 'The proposed new heliport site would be leased from the local landowner – buying the land at St Erth would defeat the purpose.'

However, following the interview with *RH*, the planning application for the St Erth facility

was withdrawn due to objections by the local residents, claiming it would create noise and pollution. BIH still has to vacate the site at Penzance by 30 June 2012, and now plans to move the operation to Newquay Airport, some 50km to the northeast, until a new location for the heliport can be found.

'As you might expect, people don't want a heliport near them,' continued Jones. 'But what you don't see is the hundreds of letters of support from the islanders, customers and people from all over the country who want to see the helicopter link survive, and that is what we are talking about here.'

The move to Newquay will add more minutes to the flight time to the islands, but the company says there will be no increase in fares, although passengers will have to pay a £5 (\$8) development fee, which is collected by the airport. BIH already has its main S-61 maintenance facilities at Newquay.

Military contract

As well as the Isles of Scilly service, the company also operates contracts for the UK Ministry of Defence (MoD), providing a pair of S-61s that support the garrison on the Falkland Islands. BIH also operates a pair of Eurocopter AS365 N2 Dauphins for Royal Navy flag officer sea training duties. This was run out of the small airport at Plymouth, but the company was asked to vacate the hangars it had ➔



'Romeo India' lifts off from a location in the Falkland Islands, where BIH has supported the British garrison for more than a decade. (Photo: Neil Jones)

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been using, therefore the operation will also re-locate to Newquay. If all these moves were not enough for the company, then changes to government policy regarding passenger duties and rights may present even more of a challenge.

During 2011, Jones, who is also the chairman of the European Helicopter Operators Committee, worked with some of the offshore oil and gas operators to lobby against new government reforms on air passenger duty (APD), a tax on the carriage of passengers from a UK airport on a chargeable aircraft – defined as having an authorised take-off weight of more than 10t or carrying more than 20 passengers.

Government reforms announced in May 2011 suggested expanding the APD in a bid to target users of business jets. However, this would equally put pressure on the operations of BIH and other rotary-wing operators. The APD banding on helicopters could put the cost of the tax at as much as £176 per person per sector of a flight, adding 30% onto the fare. The government is expected to make a decision in the second quarter of 2012.

'This is clearly aimed at high-net-worth individuals,' said Jones. 'But when you are going to an offshore installation in a rubber bag, luxury it is not, nor is it luxury transport when you take our helicopter over to the islands.'

He is optimistic that the lobbying against the APD reforms will be successful, but now a new issue has reared its head – denied boarding. Under European law, commercial airlines are required to provide assistance to passengers during delays, including catering, communications and overnight accommodation, if necessary. Currently, tickets sold for carriage of passengers by helicopter are exempt from the rules, but there are concerns from operators that politicians may try to introduce them.

Covering old ground

'As a helicopter operator, we fought against and persuaded the EU that helicopters should not be subjected to that regulation,' explained Jones. 'But now, the Department for Transport has recognised the potential to penalise the helicopter industry again, and it is consulting with the potential to bring in denied boarding penalty fees onto us for flights that are delayed.'

'This is going over old ground, but if it comes in, it is the finish for us. The penalty is €200 per passenger. [If you] look at how much revenue we get on a ticket from those passengers, it goes nowhere near the penalty the government is intending to put on us.'

'£170 for a top-rate journey in the peak period [return fare] – if we cancel all the people

‘Offshore oil and gas companies will only use helicopters built to FAR 29 standards.’

on the first flight, we can pay them and then all subsequent flights would depart on time. But that business model isn't going to last forever. The worst thing for passengers is to see your flight cancelled, and then see people who check in 30 minutes later get on your flight – you are never going to fly with that service again. But that's the only way we could satisfy that demand financially.'

New standard

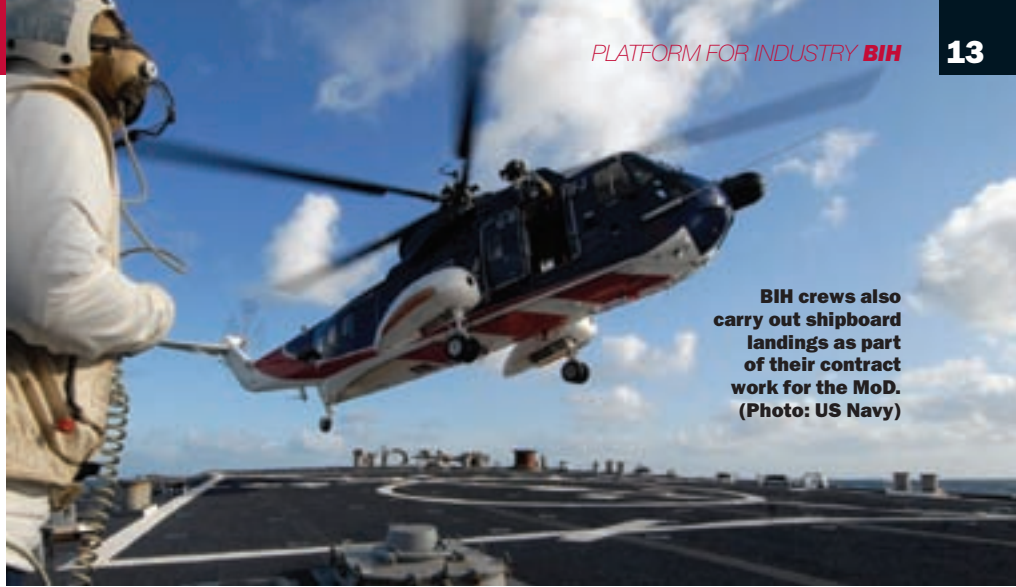
The majority of the company's turnover comes from the successful MoD contracts with the Royal Navy and in the Falkland Islands, but recent ad-hoc work to support oil and gas operations has dried up, as oil companies are not keen on using types like the S-61 to carry their workers.

'Offshore oil and gas will only use helicopters built to FAR 29 standards, and the S-61 never will be, so our oil and gas revenue has dried up,' explained Jones. 'This is one of our reasons for selling the land at Penzance – releasing the capital tied up here will allow us to invest in modern equipment.'

'All modern aircraft are restricted to 19 seats and don't have very much baggage space, and although it's less of an aspect for the Scilly Isles work, in the Falklands, because it has a tail wheel, the S-61 can land in locations that others with a tricycle landing gear cannot.'

He continued: 'The landing gear on the S-61 makes it a much more stable aircraft on those types of landing sites. The other aspect of the S-61 in the Falklands is that it can carry a mixture of passengers, freight and under-slung loads, and there is nothing else I am aware of in the industry that can do that.'

'Helicopter design today is all written around what the oil and gas industry wanted a few years ago when they were constructing in northern Europe. They needed a lot of people, to go a long way offshore to operate these rigs. Of course, these platforms are now manned by fewer people and you no longer need huge helicopters to go a vast quantity of miles, so smaller, comparatively faster helicopters are going to be the order of the day.' **RH**



BIH crews also carry out shipboard landings as part of their contract work for the MoD. (Photo: US Navy)

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With the 2008 spike in helicopter accidents still on the mind of US operators, **Peter Donaldson** looks at the measures being taken by industry and regulators to improve safety standards in HEMS operations.

Avoiding the worst-case scenario

When the FAA eventually publishes its new rules governing HEMS in the US, there is a good chance that the leading operators will already be compliant with the spirit of the legislation as well as most of the letter of the law.

The industry in the US is still haunted by the spike in fatal accidents in 2008 that triggered much soul-searching, along with more empirical examination of the issues by a wide range of stakeholders and regulators. A number of national organisations have also addressed these and seem to agree in their analyses of the immediate and ultimate causes of the majority of accidents, and of the technical, organisational and cultural means of reducing the accident rate.

In addition to the FAA, these include the National Transportation Safety Board (NTSB), the Association of Air Medical Services, the National EMS Pilots Association (NEMSPA), the Commission on Accreditation of Medical Transport Systems, HAI and the International Helicopter Safety Team.

However, legislation forcing any operators lagging behind the industry leaders to implement those measures has yet to be enacted, although many that are expected in the final ruling already exist as guidance.

Mandatory measures

In 2009, the FAA began a rule-making project that could mandate helicopter terrain awareness and warning systems (HTAWS) for all air ambulance platforms, radar altimeters for all aircraft operating under Federal Aviation Regulations Part 135, and Part 135 minima for all flight legs.

Flight data monitoring and cockpit voice recording could also be made mandatory, as could operational control centres for all air ambulance operators with ten aircraft or more. All HEMS pilots could be required to annually demonstrate recovery from inadvertent instrument meteorological conditions (IIMC).

The new rules could also allow operators to continue IFR approaches into hospitals or airports using weather reports from nearby stations rather

than from their destination. Operators might also be required to implement approved risk-management programmes.

This emphasis on IFR capabilities and weather information is clearly driven by the proximate causes of many crashes. Most fatal HEMS accidents occur when pilots become spatially disorientated or otherwise lose situational awareness in a degraded visual environment.

Spatial disorientation following IIMC frequently results in loss of control, while a less immediately dramatic loss of situational awareness – critically of the helicopter's height – often results in controlled flight into terrain. Most happen en route – either between the helicopter's base and the scene of the emergency it is responding to, between the scene and the destination medical facility, or returning to base – rather than during take-off or landing.

Technological aids that help tackle these proximate causes are familiar ones, and include blind-flying instrumentation, radar altimeters, NVG and HTAWS. Naturally, their proficient use requires regular training.

Air Evac Lifeteam has mandated the use of helmets for all crew members and the installation of flight following systems on its helicopters. (Photo: Air Evac Lifeteam)





Paramedics about to land at the next emergency. This Eurocopter EC145 is assigned to Memorial Hermann Life Flight of Houston, Texas. (Photo: Eurocopter)

Emotional disconnection

The ultimate causes that lie in the management and culture of many HEMS operators are also well understood, as are preventative tools, techniques, procedures and leadership.

For example, safety management systems provide risk matrices that help pilots decide whether to accept a particular mission, while not disclosing the nature of the medical emergency in order to avoid subjecting them to unnecessary emotional pressure. In addition, using flight data recording and flight-following systems keeps management informed, resisting commercial pressures, and ensuring proper adherence to crew duty times and weather minima are also recognised as vital.

All these approaches are recommended by authorities and associations, and most have been adopted to some extent, along with other measures, by leading operators. NEMSPA's widely supported 'no pressure' initiative, for example, seeks to provide three layers of protection embodied in organisational culture, risk-assessment procedures and the use of an en route decision point concept.

Under the culture heading, the advice is to avoid applying pressure to oneself or any member of the flight team, and to support conservative decisions. Risk-assessment tools should be used before each flight, and the team should consult outside authority before accepting any mid- to high-risk flight.

The en route decision point concept seeks to prevent VFR aircraft from being forced lower and slower into worsening visibility by encouraging crews to establish airspeed and altitude limits and to turn around, land or transition to IFR instead of continuing under VFR when they reach either limit.

Leading operators all have their own safety initiatives, and many state the aim of exceeding regulatory requirements and setting industry standards in what appears to be a virtuous race to the top.

Award winning

PHI Air Medical, for example, labels its own safety drive 'Destination Zero', reflecting the aspirations of the American Eurocopter-sponsored 'Vision Zero' (accidents) award, of which the operator was the first winner.

PHI boasts that it was the first company of its size to equip all its aircraft with NVG, and now fits emergency locator transmitters capable of the latest military frequencies. The company also prepares pilots for IIMC through its Line Oriented Flight Training programme.

On the risk management front, PHI says that it developed and introduced the Enhanced Operational Control Matrix, which was subsequently adopted by the FAA as a 'best practice', and in its operational culture empowers any crew member to veto any flight they are not happy with in what the company calls its 'four to

go – one to say no' protocol. Employees also have the power to 'stand up, speak out and take action' against unsafe behaviour, says the company.

Air Methods styles itself as the world's largest air ambulance operator, and has reinforced that claim with its recent purchase of Omniflight Helicopters.

A cornerstone of its safety policy is implementation of the FAA's (currently voluntary) Safety Management System (SMS) programme, of which the company achieved the second of five levels in December 2010, and is now working to gain the third. Level zero encompasses orientation and commitment to the programme, level one covers planning and organisation, level two covers 'reactive' processes, level three 'proactive' processes, while level four addresses continuous improvement.

This FAA-endorsed SMS follows a standard established by the International Civil Aviation Organisation (ICAO), and according to Air Methods: '[It] takes a quality management approach to controlling risk by providing the organisational framework to support a sound safety culture. It also provides the company's management with a detailed roadmap for monitoring safety-related processes.'

In early 2010, Air Methods bought three Advanced Aviation Training Devices from AeroSimulators for pilot training. One device, which is now based at the company's ➔



Florida-based Lee County Medstar lost this EC145 after it landed in water and flipped over. (Photo: American Eurocopter)



PHI Air Medical was an early adopter of NVG technology and emergency locator transmitters. (Photo: Bell)

Colorado HQ, replicates an EC135 with a cockpit specific to Air Methods, and the other two are mobile AS350 simulators.

Speaking when the contract was signed in February 2010, CEO Aaron Todd said: 'Official regulation on the use of these devices is still to be seen. However, we believe there are tremendous operational and safety benefits, making these devices well worth the investment, even without formal federal regulation.'

The control element

Operational control centres (OCCs) are now recognised as essential elements of safe HEMS systems, and Air Methods established its own in March 2007 at its HQ. Staffed permanently in two 12-hour shifts by a lead controller (who is also an experienced EMS pilot) and a specialist, the OCC is equipped with a computerised flight-management system along with Site Watch software.

Site Watch compares flight plans with weather reports and generates an alert for any path that travels within 55km of any hazardous weather. Other systems in the OCC monitor parameters such as pilot duty hours and flight releases, and track flights. In addition to normal radio communications, the aircraft are also linked to the centre via a Siemens HiPath satellite phone system.

With a view to staying ahead of FAA equipment requirements, Air Methods is publicly committed to equipping 'all new and refurbished aircraft' with NVG, HTAWS, Garmin GPS-driven moving maps, high-resolution satellite-derived weather information that is constantly updated and fed into the cockpit, plus satellite-based flight tracking.

Omniflight Helicopters announced its completion of FAA SMS level one following a seven-month effort and its embarkation on level two in March. 'We have had proactive safety programmes in place for years,' said Tom Levertson, CEO of the company, speaking at the time of the announcement.

'Among them is the use of NVG for our helicopter pilots in most of our operations.

We have also worked hard to train our flight crews to the highest standards. We see involvement in the FAA's SMS programme as one more opportunity to further improve our safety and quality, and demonstrate our commitment to our customers.'

Also among the company's safety initiatives is the addition of satellite tracking systems and a web-based program that enables staff to train at any time convenient to them.

Air Evac Lifeteam (AEL) emphasises the importance of preparation for IIMC, requiring all of its pilots to demonstrate emergency IFR proficiency in a dedicated flight training device.

As part of an annual training week at a central facility, all AEL pilots must demonstrate the ability to properly execute a touchdown autorotation. The company also claims to have been the first to station an EMS pilot in its operations centre to provide weather updates and flight risk assessments, and be the largest US air medical provider to complete implementation of night vision technology at all of its bases.

Other safety initiatives at AEL include the mandating of helmets for all crew members, installation of SkyTrac satellite-based flight-following equipment, employment of full-time safety staff whose sole responsibility is to ensure that everyone is well trained and highly conscious of safe operating procedures, backed up by monthly meetings of an interdepartmental safety committee.

Among the formal tools the company uses is 'sentinel event analysis', which is applied to all incidents in order to identify root causes and means of preventing recurrence, and a system-wide Air Medical Resource Management programme.

In October 2011, AEL announced that it had begun working in partnership with North Flight Data Systems in order to develop a flight data recording system for use in analogue Bell 206s. The system will use the latter company's C-2000 for voice capture, video, GPS and detailed analogue and digital information, including ARINC aircraft

system data using a recorder embedded in a multi-function data acquisition unit along with a quick access recorder.

'Over the next six to eight months, Air Evac Lifeteam has agreed to work with North Flight as they go through the supplemental type certification process for the Bell 206 aircraft and trial the systems in our training fleet,' said AEL president Seth Myers. 'We are pleased to be a part of this project to improve upon efforts [and] help promote more safety within the air medical industry.'

Reduced rate

These intensive safety efforts by the major operators seem to be having a positive effect on the accident rate. 'We haven't seen anywhere near the numbers we saw in 2008, and we have every bit as much helicopter activity going on,' said Ed MacDonald, who chairs NEMSPA's safety committee. 'So I would say intuitively that it's got to be a lower rate.'

'Almost all of the things that came out in the advisory circulars and most of the NTSB recommendations have been adopted in some form by the major operators. I think that they are way ahead of the game. The ones that scare me are the ones that aren't on board with this. I don't know whether that is because they are financially unable or unwilling, [but] I think that puts them at higher risk.'

Many of the measures being implemented voluntarily today – and which may soon become mandatory – gain leverage from technologies and techniques that have become familiar and widespread over the past decade. There are others that warrant close examination for life-saving potential in EMS, not least the anti-brownout and obstacle-warning technologies being developed for military helicopters.

A low-level IFR infrastructure dedicated to rotorcraft that includes many more established precision approaches to dedicated landing zones in potentially useful places, should also be considered, but attempts to provide such infrastructure have a long and frustrating history. **RH**

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The Guimbal Cabri G2 is cementing itself as a desirable alternative to the Robinson R22, which has previously dominated its market. Jim Winchester explores its roots and why pilots and operators are now considering it the light helicopter of choice.



Guimbal's gamble

Aimed squarely at the market sector occupied by the Robinson R22, the Guimbal Cabri G2 brings Eurocopter pedigree to the light training and utility field, while new technology promises greater safety, lower cost of ownership and ease of handling.

Claimed to be the first production piston-engined helicopter of wholly European origin, the Cabri G2 incorporates a number of technologies not seen before in its class, and offers an experience much closer to that of flying and operating a modern helicopter from one of the major manufacturers than existing training machines.

The Cabri's three-bladed elastomeric main rotor is a miniature version of that on the Eurocopter Tiger combat helicopter, and is made from carbon-fibre-reinforced composite material with stainless steel leading edges. The Cabri's most distinctive feature is the seven-bladed fenestron tail rotor, which contributes to the aircraft's low noise – less than that of an average aero club machine such as the Piper PA-28. However, it is said to provide a little less authority than a conventional tail rotor with the same powerplant.

The engine is the well-proven Lycoming O-360-J2A four-cylinder piston engine, with both magneto and electronic (plasma) ignition and automatic carburettor heating. It is rated at

145shp at around 2,650rpm. Maintenance is simplified by the high mounting of the engine, easily reached by upwards-hinged doors that are supported by gas pistons.

The standard avionics fit includes a digital electronic pilot monitor alongside analogue instruments, but many customised installations, including touchscreen GPS and iPads, are available.

Rotor roots

The Cabri G2's origins lie with Bruno Guimbal, a former Eurocopter engineer, who left Marignane in 2000 to found Hélicoptères Guimbal near Aix-en-Provence. He explained that the platform's name is an acronym deriving from 'Comfort in Autorotation Belongs to Rotor Inertia'. Cabri is also the French word for a kid or baby goat.

During his time at Eurocopter, Guimbal invented the hingeless Spheriflex rotor head, which is now employed on the NH90, EC155 and EC255, among others, and was used to set a 3km circuit helicopter speed record of 372km/h with a Dauphin in November 1991.

In his spare time, Guimbal built the original Cabri (FPILA), which flew with a 150hp Lycoming O-320 in April 1992. The Cabri was used to break a range record for helicopters under 500kg in 1996, flown by the designer.

After some revisions, including raising the horizontal stabiliser, modifying the fin shape and improving crashworthiness, the Cabri G2 prototype (F-WYHG) flew in Aix on 31 March 2005. This aircraft was used to set further records for altitude and time to climb at the World Helicopter Championships in Rouen in August 2005. EASA certification was achieved in December 2007, and in September 2008 the first production aircraft was delivered.

The G2 is built in Les-Milles, Provence, southern France, in a small factory with only 25 employees. Consequently, its output has been slow, with 13 aircraft delivered in 2010, although the goal is to increase production to two per month in the near term. Of course, a customer who has decided he wants a Cabri would ideally get it right away, however this is not realistic at the current tempo. The manufacturer's caution reflects an approach to business that would rather see a full order book than risk over-expanding and going bust.

To date, 28 G2s have been constructed. One is Guimbal's development/demonstrator aircraft, one is a non-flying ground test airframe and the others have been delivered to customers in Australia, France, Germany, Monaco, the Netherlands, New Zealand, Switzerland, Romania, Sweden and the UK. One of the latest examples



The Cabri has generated a lot of interest, but production levels are low at the moment. A Swedish-based example is seen here silhouetted against a Scandinavian sunset. (Photos: Northern Helicopters)



The Cabri G2 features a distinctive cockpit layout and instrument panel.

was delivered to the Cotswold Helicopter Centre in Kemble in September, but was damaged in an accident in late October, although it is expected to fly again. There have been three Cabri accidents to date, although none appear attributable to component failure or the aircraft design.

In 2009, Eurocopter took delivery of its first G2, equipped for night VFR flights for evaluation at its Baden-Baden training centre. Possible sales of up to 20 G2s for Eurocopter's training schools have not yet materialised.

Safety focus

One of the guiding philosophies behind the G2 has been an emphasis on safety, and occupant protection in the case of an accident. Extensive testing to comply with and exceed EASA CS-27 and FAR Part 27 rules, which govern small rotorcraft, is partly behind the long gestation of the G2.

Technology developed for Formula One racing cars and combat helicopters, including untearable fuel bladders and reinforced fittings, are used on the fuel system to prevent rupture in a crash. Fuel tanks have been tested with drops from up to 15m without leaking. Energy-absorbing stroking seats with four-point

harnesses have survived drops with a sink rate of 2,000ft per minute. Certification testing involved subjecting the airframe to 35g and simulated rainfall equivalent to the highest ever recorded on earth.

The high inertia of the three-bladed elastomeric main rotor is a key element of the G2's level of safety. Mast bumping is said to be impossible with this system, and high inertia is critical to good autorotation characteristics. Nevertheless, like all light helicopters, the Cabri has a large 'dead man's corner' of the flight envelope where there is insufficient speed and altitude to develop enough windmilling rotation for a safe power-off landing.

In the opinion of some operators, this effectively restricts the G2 (and others in its class) to training and very light utility jobs, such as 'photography into the wind', as one operator puts it. Another suggests that pipeline or power line patrol would be an ideal application because of the visibility, comfort, long endurance and engine dependability.

There are essentially only three choices of training helicopter on the market for western flight schools at the moment – the 1970s-designed Robinson R22, the 1960s-vintage Sikorsky (formerly Schweizer, née Hughes) S-300 and the Cabri G2. ➔



The Cabri G2 prototype and company testbed is seen here performing at Hyères in southern France. (Photo: Tony Osborne)

Fully equipped for IFR training, a Cabri G2 is the most expensive of the three competitors at around \$400,000, with a new S-300C being about \$360,000 and an R22 around \$290,000. Operating costs are calculated as the same for the R22 and the Cabri – around \$185/hr – but monthly finance costs are a little higher for the former. At the 2,200-hour point, when the Lycoming engine needs overhauling on the G2 and R22, the differences become more marked – the Robinson needs a comprehensive airframe and dynamic system overhaul, unlike the others.

One operator likens buying an R22 to leasing 75% of it for 2,200 hours and 95% for the next 2,200. Many Cabri components are replaced on condition, rather than based on the life of the parts. The G2's gearbox is good for 5,000 hours, and the rotor blades for life, or approximately 10,000 hours. If costs are spread over 4,400 hours, by which time an R22 essentially needs a complete rebuild, a Cabri or an S-300 still has considerable value remaining.

With higher unplanned maintenance costs on the S-300, the Cabri, despite its higher price, has more appealing economics for training purposes. For a commercial utility operation, the costs of adding the type to an air operator's certificate would likely be prohibitive with the hours that one or two aircraft would be able to work.

Ease of operation

As a training machine, the G2 is simpler to fly and more like most modern European helicopters that a commercial pilot trainee is likely to fly. One operator claims that about 60% of his first-time students are able to hover after a one-hour lesson. He said that in a Cabri, this is not hard to achieve, but is a miracle in an R22. 'A breeze to fly' and 'super responsive' are other plaudits from pilots.

One important reason for the improved stability is that the gearbox runs through the aircraft like a spine, unlike the R22's, which is positioned higher and has several stress points where it mounts to the airframe, leading to a lag of two or three seconds between control input and full response.

The Cabri's control inputs are transferred directly through the chassis rather than the 'neck', and, correctly trimmed, can be hovered with no hands in nil wind conditions. One Cabri

instructor told *RotorHub*: 'From a pilot's view, and especially while instructing, the rock-solid stability of the rotor is a complete joy to experience after six years of teaching ab-initio on teetering head types. The control power and response is staggering, and the flight envelope is seemingly un-burstable.'

In practice, aerobatics are not permitted on production aircraft, but demonstrations with the factory aircraft in the hands of test pilot Olivier Gensse have given purchasers confidence that a student is unlikely to put a Cabri into an unrecoverable attitude.

One issue that may hold the Cabri back from dominating the market, however, is its low production rate. With fewer than 30 examples delivered in three years, the evident demand is barely being met, even in the current economic downturn. Guimbal's philosophy is to produce high-quality aircraft that are right first time – reflected in the high standards of systems and accessories.



This Monaco-registered Cabri G2 is fitted with pop-out floats. (Photo: Guimbal)

Each Cabri comes with a remote locking system and keyless start similar to that found on many modern cars, and, according to Guimbal, a world first in aviation. The transmitter can send a signal to flash a strobe in case you forget where you have parked. Customised paint schemes are available, with a choice of 13 pattern styles in five colour palettes offered on the manufacturer's website, but beyond that a scheme can be chosen to match your Ferrari, should you have one. Single-colour Cabris have been delivered in bottle green, dark blue and bright yellow.

Different cockpit configurations are catered for. SkyDemon is the factory-preferred GPS installation and other options include the Flymap L GPS moving map and Garmin's new touchscreen maps, and a single or twin iPad installation is also possible. Since mid-2011, air conditioning has been another customer extra, and there are many other add-ons in the works, including rotor trim tabs and adjustable pedals. LED landing and navigation lights are available, and some operators have also expressed interest in LED strobe lights.

Corporate capabilities

Beyond training, the G2 can be used as a light business machine. Its baggage compartment will carry two cabin bags or one small suitcase up to about 40kg. The upper part of the compartment is accessible in flight, and good for storing items such as jackets, cameras and manuals. A smaller compartment in the instrument pedestal can also carry small items, as well as the pedals and stick if the dual controls are not needed. Endurance is a maximum of five hours, although four is more realistic. At a comfortable 167km/h, this gives a range of about 667km.

For broader utility duties, a hook is an option that is on the way. Pop-out floats, which can be installed and removed very quickly, have been certified for overwater emergency use, and are fitted to the G2 operated by the Aéroclub de Monaco.

Rates for hiring a Cabri vary a fair amount depending on location, due largely to local overheads and taxes. Northern Helicopters of Sweden hires out the Cabri for \$365 per hour; Helitrans at Basel hires for \$590 for a 40-60-minute flight, or \$900 for 30 minutes instruction; and HTT in Australia will provide a G2 for \$450 plus 10% GST, the same rate it offers for an R22 – the company is considering raising this because every pilot who jumps in one of its R22s then wants back in the Cabri, according to instructor Nikolai Eltarenko. Cotswold Helicopters' Cabri rate is \$60 more than they charge for the R22.

The G2 will face its strongest test and potentially biggest market on the home turf of its competitors. Northern Helicopters, which has totalled about 1,600 hours to date on its two Cabris, making it one of the most experienced operators, plans to introduce the G2 soon to its Fort Lauderdale flight school, Northern American Helicopters, currently the only one in the US offering training on the EC120.

'The Cabri is designed now, not in 1957,' said Northern Helicopters' Mikael Randhem. 'It's time for something new.' **RH**

Seeing the light



Although night flying has significantly improved in terms of safety, it is still demanding for even the most experienced of pilots. **James Careless** explores the current issues surrounding night vision technology and the products addressing them.

For EMS, public safety and private helicopter pilots alike, night flying is a fact of life. Compared to the early days of aviation, it has become far safer thanks to NVGs, FLIR cameras, IR spotlights and other assistive guidance systems.

Yet, night flying still remains demanding and dangerous. 'The challenge of night flying boils down to the fact that the aircraft doesn't know or care that it's dark,' said Ron Doepfner, chief research and development pilot at Sikorsky. 'In daylight, maintaining proper situational awareness can be a challenge in itself. Yet, at night your ability to see where you are going and pick up the right visual cues is considerably reduced. Now, our job as helicopter manufacturers is to make visual cues more visible at night, or to capture these with automation when we can.'

Nighttime necessity

When it comes to ensuring safer night flying, nothing matters more than NVGs that make it possible for pilots to literally 'see' in the dark. This is why they 'are the fundamental tool for night flying', according to Chad Oakley, the chief flight instructor at the Bell Helicopter Training Academy in Fort Worth, Texas, which occupies 100,000ft² of classrooms, labs and hangar space. 'I often hear from customers after completing NVG training that they can't imagine operating without NVGs at night.'

Developed for snipers by the German Army in the 1930s, NVGs initially required their targets to be 'painted' with IR light in order to be seen. Some 30 years later, the US Army invented

'passive IR' NVGs, which allowed these devices to capture whatever IR light was available, translating it into viewable monochrome video images for the viewer.

Since the 1960s, there have been successive generations of NVGs released. Each has had improved sensitivity to low light levels. In addition, the tendency of earlier, full-face

'Night flying is still demanding and dangerous.'



While NVGs have made night flying considerably safer, there are still issues such as limited field of view and depth of field. (Photo: Eurocopter)

models to shut down when flooded with white light – leaving the user temporarily blind – has been dealt with. Add in the advent of smaller wearable displays, which allow pilots to look above and below the goggles to see around the cockpit and compare the NVG display with visible outdoor light, and night vision technology has come a long way.

This said, even the most modern NVGs have limits that pilots must be aware of. Chief among these is their 40° field of view – a much narrower window than that pilots work with during daylight hours. ‘Imagine driving your car at night looking through two toilet paper rolls, and you have an idea of how limiting this can be,’ explained Justin Wisdom, principal marketing manager at Rockwell Collins.

The company’s night vision systems are used in many military helicopters, including the CH-47F Chinook and UH-60M Black Hawk. ‘Obviously, night operations do not provide adequate visual cues, so the pilots must develop skills to adapt to this environment,’ he added.

In regard to skills, Doepfner said: ‘Pilots wearing NVGs must constantly turn their heads to stay aware of what’s happening around the aircraft. You can’t just flick your eyes left or right



NVG-compatible cockpits now come as standard on many machines, including the Sikorsky S-76D. (Photo: Sikorsky)

using NVGs – their field of vision is too narrow to allow this.’

Depth of field is another issue with NVGs. Because these devices use a single-camera view, what the pilot sees is two side-by-side 2D images (one for each eye). Even factoring in the brain’s ability to combine these together into a somewhat 3D view, ‘the depth of field that you

can perceive in NVGs is not the same as what is possible in daylight with a pair of human eyes’, argued Oakley.

‘In the same vein, the fact that you are seeing everything in one colour, and at a level of resolution far lower than what you see with your own eyes, reduces the amount of information that your brain can work with.’

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Light overload

Pilots may also face NVG overloading due to the use of white and red lights within the cockpit and cabin. Chief among these culprits are the displays found in glass cockpits – unless adapted for use with NVGs, they can overwhelm the sensors and render the pilot blind. ‘Our latest helicopters, like the S-76C++, the upcoming S-76D and the S-92, all come with NVG-compatible glass cockpits,’ added Doepfner. ‘We have designed them with two light level modes, and placed the timer controls in a central location, so that you can go from normal night to NVG night lighting with the flick of a switch.’

Older helicopters with white-light ‘boiler’-style gauges can pose real problems when used with NVGs. Again, simply jumping into the aircraft and taking off is not good enough. The cockpit environment must be made NVG-compatible – whether that requires a retrofit with suitable gauge lighting or an overall avionics upgrade.

FLIR video cameras and spotlights can help pilots light up the darkness, however such technology is better used by two-person crews. This is because the output is shown on a

panel-mounted display, and to view it, you have to stop looking at everything else – including the outside flying environment.

It may also be necessary to move the spotlight manually in order to stay on top of the desired target/landing area. Again, doing this distracts the pilot from flying. However, modern avionics systems have been created that help ensure safer night flying.

L-3 Avionics Systems offers two such products – the GH Electronic Standby Instrument System series and the Trilogy Electronic Standby Instrument series. ‘The instruments present critical flight cues, such as altitude, attitude and airspeed, on a compact, full-colour active matrix LCD, which has exceptional readability in dark cockpits,’ said L-3 spokesperson Jennifer Barton. ‘Both are available in NVG-compatible models, if desired.’

Digital mapping

Eurocopter’s four-axis AFCS coupled to a digital map system is also a key contributor to safe night operations. The combination assists the crew whenever needed to ‘optimally master the safe trajectory in all flight phases’, says the company.

‘Simply jumping into the aircraft and taking off is not good enough.’

Elbit Systems is perhaps best known for its military products. However, the company also makes NVG-compatible, smart colour multi-function displays (SCMFD) that display primary flight display data for civilian helicopters. The SCMFDs include an advanced, embedded digital map for situational awareness and orientation, which is integrated with the helicopter sensors.

‘When the pilot flies lower than the surrounding terrain, the terrain above his height in the map is coloured red,’ said Benjamin Weiser, senior director of business development for helicopter solutions at the company. ‘An embedded terrain avoidance warning system is also featured in the digital map. Based on the vertical descent rate of the helicopter and the elevation of the terrain [provided by the Digital Terrain Elevation Data] →



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Elbit has developed its Aviator Night Vision Imaging System HUD to include both day and night displays on a single integrated unit. (Photo: Elbit Systems)

map], the system provides visual and aural warnings to the pilot if he becomes disoriented during night flight and plunges toward the ground.'

Through Elbit Systems of America – Kollsman, the company also makes enhanced vision systems for civilian helicopters. 'These systems include a cooled FLIR sensor that provides a high-resolution video of the runway for take-off and landing in extreme low-visibility weather conditions,' said Weiser.

The Kollsman All Weather Window uses a certified IR sensor with a video output coupled to an LCD display. This 'allows the pilot to clearly view lights and ground features – such as runways, aircraft and buildings – at night and in low visibility conditions,' he noted.

Meanwhile, Sikorsky is pushing the envelope by developing automated landing and take-off procedures for helicopters flying to offshore oil rigs. 'Flying to rigs at night is extremely difficult,' said Doepfner. 'NVGs don't help much when you're over water, the image just comes in as flat black. Meanwhile, when you get to the rigs themselves, they are lit up like Christmas trees.'

This contrast in lighting level makes landings difficult, but take-offs even more dangerous. Going from bright light into inky blackness can result in situational confusion, which in turn can lead to disorientation and have fatal results.

'Pilots can easily lose awareness of their vertical position, which is why controlled flight into

water can occur during take-offs,' added Doepfner. 'This is why Sikorsky is automating both the take-off and landing procedures. Essentially, you can instruct the helicopter to bring you into the right altitude and hovering speed for landing, at which point you take over and finish the touchdown manually. In the same way, our system allows you to initiate take-off, then get you safely away from the rig at the right angle and rate of climb, preventing controlled flights into water.'

No substitute

Even with all of these night flying aids, there is no substitute for proper training. 'You can't just strap on a pair of NVGs and fly safely at night,' he continued. 'You need training to acquire the right skills, and refresher training to stay qualified.'

Both Bell and Sikorsky provide night flight training to their customers. 'We have a number of FAA Part 141-approved night flying programmes,' explained Oakley. 'They cover everything from introduction to NVGs to qualifying as an NVG helicopter instructor. We provide these either in Fort Worth using Bell 206Bs or 407s equipped with NVG-compatible cockpits or at the customer's location in their aircraft.'

Night flying courses cover available technology both in the classroom and aloft in the cockpit. However, they also teach students how to use NVGs and other devices, while remaining focused on flying.

'You need the complete package of equipment, training and attitude to maximise safety.'

'It is common for new NVG users to focus on what they are seeing in the displays to the detriment of keeping an eye on their other instruments – you can't fly safely with this approach,' added Oakley. 'Through proper training, you have to develop an NVG scan. Because of the reduced visual cues and limited field of view, you must develop a scan pattern that is outside the aircraft with an instrument cross-check to maintain situational awareness.'

Finally, approaching night flight with the proper attitude is vital. 'It doesn't matter if you are fully trained for night flying, if you do not handle it with the proper attention and caution,' stressed Doepfner. 'You must never take that for granted even with all the aids in the world – you are flying without the same level of cues and situational awareness that you enjoy on a bright sunny day.'

'There are military pilots who fly night missions so often, it could be said that they are as comfortable in the dark with NVGs as they are during the day,' added Oakley. 'Maybe so, but these experienced pilots survive because they never take night flying for granted. This is why having the right attitude is critically important. If you take off at night without due respect for the dangers inherent in that environment, you are putting yourself, your crew, your passengers and your aircraft at risk.'

One without the other

It is possible to make night flying safer through the use of modern night vision aids and automation, proper/ongoing training and maintaining the right attitude to these missions.

Achieving safe night flight is based on combining these elements. Technology without knowledge is dangerous, as using NVGs without taking their limited field of view and depth deficiencies into account is an accident waiting to happen. In turn, having the latest night vision tools and training without the right attitude is also hazardous, because the first two cannot save a negligent pilot from himself.

'You need the complete package of equipment, training and attitude to maximise safety during night flight,' concluded Doepfner. 'Put them altogether, and you will be good to go.' **RH**

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Dialling down

The introduction of multi-function displays has led avionics manufacturers to look to the next stage of evolution. (Photo: Eurocopter)

The shift from traditional analogue avionics suites to digital displays has not only been for aesthetic reasons, but allows future upgrades to be made at the software level, opening new possibilities, finds

Tony Skinner.

With glass cockpits on their way to becoming de rigueur for the fashion-conscious helicopter operator, avionics manufacturers are studying how to take the technology to its next natural extension.

Apart from some light types, new-build helicopters now come with glass cockpits that feature two to six multi-function displays (MFDs) in place of the traditional instrument panel – made up of separate displays or gauges for each function – to present critical flight information.

For example, the Thales TopDeck avionics suite comes as standard on the Sikorsky S-76D, and Eurocopter has developed the Helionix suite for its new aircraft models. Honeywell's Primus Epic is the core avionics system for the AW139.

On 8 November 2011, Russian Helicopters announced that it had delivered the first batch of Mi-17V-5 helicopters to India, featuring the KNEI-8 avionics suite with four MFDs.

However, the trend is more than a simple aesthetic change. The fact that such an approach is underpinned by the open integrated modular avionics (IMA) concept allows for future upgrades to be undertaken at the software level rather than hardware level. It also allows avionics manufacturers to overhaul how pilots interact with the aircraft through changes in the human-machine interface (HMI).

Glass retrofits

Reflective of the popularity of such systems, a number of manufacturers now offer glass cockpits as retrofits on older in-service helicopters. In March 2011, Rockwell Collins announced the integration of its Pro Line 21 Integrated Display System into a Sikorsky S-61 in partnership with Vector Aerospace. The company is also fitting its Common Avionics Architecture System to the USCG's upgraded MH-60T aircraft.



The EC145 T2 will feature Eurocopter's new Helionix suite, which prioritises information that is displayed to the pilot. (Photo: Eurocopter)



When the X4 Dauphin replacement emerges, critical flight information is likely to be displayed on an HUD. (Image: Eurocopter)

In another example, on 1 November, Cobham and Carson Helicopters announced a similar partnership to provide a new suite of avionics for Sikorsky S-61, S-76 and UH-60 derivative helicopter retrofits. The former company claims that its Primary Flight Display is the only synthetic vision system in the world certified for IFR rotary-wing operations.

Juan Picon, VP of defence and space international business at Honeywell Aerospace, said that despite current budgetary pressures, his company was seeing increased demand for such retrofits. It offers the Primus Epic Control Display System/Retrofit for the Mi-17, with each MFD capable of replacing ten conventional instruments.

Picon said that operators have the option of adding the Primus 700A/701A weather radar, a

'IMA allows avionics manufacturers to overhaul how pilots interact with the aircraft.'

helicopter terrain awareness warning system and a TCAS. 'At the end of the day, you are flying in an environment that is less demanding, you can get more information at your fingertips and you are in a much safer situation,' he told *RotorHub*.

According to Picon, the software upgrade path was seen as one major advantage of installing the system, with additional functionality able to be added more quickly and cost-effectively. 'The software upgrades are faster to implement, easier to implement, easier to train and you don't need to keep the aircraft on the ground as long in order to do it,' he explained.

'That easy upgrade path is a very attractive feature – if you need to do an upgrade on the helicopter and everything that you are focusing on is in the hardware, you can imagine how long that aircraft is going to be grounded in order to do the upgrade.'

All-in-one solution

Given the obvious benefits of both MFDs and the IMA concept, several companies are looking to take the technology one step further, developing large touchscreen displays that include all avionics components in one suite.

At the Paris Air Show, Elbit Systems unveiled the fully developed version of its CockpitNG, featuring a large touchscreen central display that provides all avionic components in one package. It has a 22in high-definition screen that displays the same information provided by five standard 6x8in displays seen in many current glass cockpits. It is fully integrated with helmet-mounted displays and HUDs, and employs an 'iPhone-like' click-and-drag touchscreen technology.

Company sources told *RH* that Elbit has provided its CockpitNG to a major OEM as part of a joint R&D project for a next-generation helicopter. The company has also been in discussion with Rockwell Collins and ➔



Bristow is offering its TCAS II kit on larger aircraft such as the S-92. (Photo: Bristow)

Collision avoidance

Bristow engineers are developing a series of kits allowing the fitment of the Traffic Collision Avoidance System (TCAS II) to a wider number of medium-sized helicopters.

The company's Technical Services division successfully installed TCAS II on an Aberdeen-based 'Tiger' Super Puma in 2008 as part of trials held in conjunction with Rockwell Collins and oil firm Shell. Now that it has proven the system, the company is offering it for fitment on other aircraft types.

The system is in use on the AS332 L1 and has been certified for (and should have been fitted on) all seven of Bristow's UK-based Sikorsky S-92s.

Today, Technical Services is working on a kit for the Sikorsky S-76C+ and C++, and is also investigating its potential on the Eurocopter EC225.

Mike Imlach, Bristow's director of European operations, said: 'Bristow is responsible for many of the safety advancements and modifications that are now taken for granted as standard equipment on offshore helicopters worldwide, such as integrated HUMS, HFDM (helicopter flight data monitoring systems), automatic flotation deployment and externally stowed life raft systems.'

TCAS II detects nearby aircraft through the transponder, and for those that may represent a collision risk, the system directs each crew to execute coordinated avoidance actions to ensure maximum clearance between the helicopters. With TCAS II installed, pilots are aware of other aircraft in the vicinity up to 22.5km away, and even high-speed aircraft closing at speeds of up to 1,200kts.

'The applicability of the commercial airline collision avoidance system to slower-moving helicopters was questionable,' said Imlach. 'Bristow developed the first TCAS II a number of years ago specifically for rotary-wing aircraft, and since then has been developing TCAS II solutions for its entire fleet to improve flight safety.'

Bristow decided to fit the system following a series of air proximity incidents, in particular several over the North Sea. Now, with TCAS II, pilots are more aware of traffic around them – if the system detects possible traffic conflict, it will cue the pilot to climb or descend as appropriate.

Tailored solutions

The company has had to develop different solutions for each type of aircraft. As well as the cockpit interface, the system also makes use of two large antennas that need to be fitted onto the topside and underside of the fuselage in locations giving the best hemispherical viewpoint around the aircraft. In the cockpit, rather than try to integrate it directly into the avionics system, the TCAS II kit uses a separate display.

On the AS332, for example, the TCAS display is installed into the instrument panel under the vertical speed indicator. On the S-92, the engineers have removed the approach plate clip holders on the left- and right-hand edges of the cockpit and fitted the TCAS II instrument.

The modification is one of a number of systems developed by the Technical Services division, which completed changes to Bell 412s used by the Royal Air Force's 84 Squadron in Cyprus. Bristow also created automatic float deployment systems for the AS332 and EC225, and came up with the idea for rear-view mirrors to be installed in order for pilots to be able to conduct a visual inspection of the engine intakes in flight.

Tony Osborne

Honeywell about possible partnerships involving the technology for fixed- and rotary-wing applications.

A representative said that the modular nature of the system, which could be tailored to multiple platforms, helps reduce aircrew workload, while younger pilots, raised on flight simulators and smartphones, were extremely comfortable with the layout and touchscreen aspects of the technology.

Thales highlighted a similar system at Le Bourget, although its 'Cockpit 3.0' concept for fixed- and rotary-wing platforms is a single display that stretches across the flight deck. Developed as part of the One Display for a Cockpit Interactive Solution project, which is currently drawing to a close following its launch in 2009, it builds on work on the TopDeck suite developed for the S-76D.

The cockpit employs five projectors behind the screen to generate the imagery, while piloting information could be displayed on a HUD or helmet-mounted display. Thales and its partners are targeting the next generation of aircraft with the cockpit, as well as offering it as a retrofit.

A company spokesman said the project was centred on three main challenges: proving the technical feasibility of a large seamless avionics display, which can possibly be curved; defining and implementing the correct means of interaction with the display; and evaluating the human factors considerations of using a completely new layout on a single display.

Renewal drive

One manufacturer that has revealed more about its thinking in this area is Eurocopter, which has tasked itself with a renewal of its product family within the next nine years. The company's new Helionix suite features in the EC175 and the recently launched EC145 T2.

The first prototype of the latter featuring the new avionics configuration took to the air for the first time on 28 October, as the company moves towards FAA and EASA certification of the model in 2013.

Bernd Osswald, EC145 products and services programme manager at Eurocopter, told *RH* that, unlike the legacy Meghas avionics system, the new configuration does not try and replicate the traditional helicopter gauges at all times on its flight and navigation displays (FNDs), but instead prioritises the information offered to the pilot.

'The functions of the avionics suite are kept, but the principle of how it is displayed is a little different,' he said. 'The philosophy change is that the first limit parameters will not always be displayed like on the Meghas systems. If you

'The new configuration prioritises the information offered to the pilot.'

have a shift or a change in the parameters, they will be indicated, but if they are not really relevant for the flight, if everything is OK, they will not be displayed. This means the pilot is not distracted by unimportant figures or non-useful information.'

The Helionix suite features three large displays: a single FND providing all parameters necessary for flight and navigation; a second dedicated one for basic or optional mission systems; and a third providing identical information to the second crew member.

Jean-Michel Billig, executive VP of engineering at Eurocopter, said the new avionics architecture aimed to both address the crew's core workload and best manage obsolescence by decoupling hardware from software. 'We want to ensure that in any configuration, including degraded modes, the pilot is not overfed with information coming from any direction,' he explained. 'We need to have an organised way of presenting the necessary information to the crew.'

'I believe it makes a lot of sense to simplify the architecture, address obsolescence and reduce cost. Instead of having ten computers hosting all their own functions, we may have a common hardware platform hosting different software for the different functions.'

Elusive update

The company is already eyeing the next stage in this evolution through the work it is doing with the X4 project that is set to replace the Dauphin. However, Billig was unable to provide any firm details of the final make-up of the aircraft's

cockpit, but noted that a new avionics suite and fly-by-wire system will be included as part of the second iteration of the helicopter in 2020.

The work currently taking place alongside partners Thales and Sagem would 'not be an evolution, it will be a revolution', according to Billig. 'On the X4, we are trying to entirely revisit the cockpit layout, overhaul the HMI and make use of all available volume. Today on a helicopter, it is efficient, but one could question if we could not do it better – the information is primarily shown in a head-down mode.'

'One question was: "Couldn't we think of better distribution of the information in head-up mode, which could contribute to lowering the crew workload?" So you superimpose some information in the head-up mode along with the external view, which would raise safety.'

His comments echoed details provided by Sagem to reporters at the Paris Air Show, which revealed that the X4's main display is likely to be projected directly onto the windshield itself, in 'highway-in-the-sky' style.

With traditional avionics manufacturers looking to break down some long-established barriers, software developers are also exploring the art of the possible. The landscape is likely to be transformed significantly for the latter group with the release of the DO-178C standard in the first quarter of 2012.

The standard, which is published by RTCA, is the primary document by which certification authorities such as the FAA and EASA approve all commercial software-based aerospace systems. Incredibly, the current standard – DO-178B – was last revised in 1992, creating a major impediment for software developers.

'What has happened since 1992 is that software and software tools have advanced considerably,' explained Simon Kampa, managing director of Critical Software Technologies. 'We have got new languages, libraries and tools, [but] unfortunately we can't easily use them because



Cobham and Carson Helicopters have a partnership to provide a new suite of avionics for Sikorsky helicopter retrofits. (Photo: Cobham)

we are constrained by the limitations of the current standard. DO-178C, on the other hand, includes support on how some of these newer approaches and technologies can be used to better develop avionics systems.'

Formal methods

Kampa said that in addition to this potentially game-changing development, a further trend has seen engineers using new techniques for the verification of software and hardware systems into the avionics industry. Known as 'formal methods', the mathematically based technique has the ability to not only improve the quality of the developed system, but also significantly lower the cost of downstream activities such as verification and validation.

He cited the example of the Paris Metro, parts of which were developed using the method. 'The automatic door system for the train is still running on version 1.0 – it has never crashed, [nor] needed a change,' he explained. 'So the through-life cost has been very low. We are looking at expanding this concept into the avionics industry, where we are conducting a number of research projects with our customers to demonstrate the value of the approach.'

'We have many software engineers who are keen to see how some of the advances in technology and processes can be safely deployed and used to improve productivity and reduce cost in the avionics industry.' **RH**



Under the ODICIS project, Thales has developed a single display that stretches across the cockpit (left), offering the same flight information as multiple-MFD suites like Rockwell Collins' Pro Line 21 (right). (Photos: Thales/Rockwell Collins)

The upgrades industry manages to breathe new life, engines and avionics into even the oldest airframes. **Tony Osborne** looks at some of the programmes currently available to operators and owners.



Transplant

The term 'one size fits all' seldom applies to helicopters. As operators and pilots learn about their aircraft and mature procedures, they try to eke out every ounce of power available, reduce workload or improve the creature comforts for the passengers or rear crew.

While OEMs attempt to cater for the many permutations demanded by their clients, other companies have developed solutions catering for customer needs, often producing and designing them at a considerably lower cost than the OEMs ever could. While some upgrades are for improving performance, others aim to reduce operating or maintenance costs.

One area of the helicopter that is virtually guaranteed to deliver improved performance is propulsion, and a number of companies have developed upgrades for popular single-engined light helicopters such as the AS350 Ecureuil and Bell 206 and 407.

Experienced approach

Calgary-based Eagle Copters has been working on an engine upgrade for the 407. Learning from its experience with the Eagle Single, a conversion of the Model 212 that strips out the type's PT6

Twin-Pac engine and replaces it with the Honeywell T53-17, the company is now working with Honeywell to re-engine the 407.

The programme, which was launched at Heli-Expo 2010, will marry the aircraft with the HTS900 engine originally destined for the US Army's ARH-70 Armed Reconnaissance Helicopter. Fitting the HTS900 would, according to Eagle, provide operators with up to a 40% increase in HOG performance and deliver a 10% reduction in fuel consumption.

'There has been interest expressed by all 407 owners for different reasons, but primarily the intent was to enhance the 407 at higher temperatures and/or altitudes,' explained David Whiting, VP of sales at Eagle Copters. 'We are progressing nicely – the cowling configurations have been defined, and the engine inlet and exhaust designs have been frozen as well. The first flight of the prototype is scheduled for next spring, with tests on-going throughout the summer.'

'Transport Canada certification is expected next year, with other foreign validations to follow, and we anticipate bringing the conversion to market around that time.'

Eagle Copters carries out work on a number of Bell types, including upgrades to Model 412s that are operated by the Houston Police Department. Eagle was also selected by the National Research Council of Canada's Institute for Aerospace Research to re-engine its 412 Advanced Systems Research Aircraft with a Pratt & Whitney PT6T-9 Twin-Pac that allows digital engine control.

'We had just come off a very successful engine conversion programme [the Eagle Single] and [there was] pent-up demand from the cancelled Bell 417 programme – [those] were just a couple of reasons why we believed the industry would support our initiative,' added Whiting. 'Although the test flying will produce the actual hard performance advantages, we remain confident that an owner or operator will be able to clearly identify the merits of the conversion.'

Soloy is another well-known name in the field of re-engineing and upgrading, offering conversion programmes for both the AS350 and Bell 206. The company's 'Super D' conversion is based on the original AS350 D, but can also be fitted to the B model. The programme installs the Honeywell LTS101-600A-3A, which helps improve

(Main) BLR's FastFin can be seen on this Bell 412, and is now a standard fit on the popular medium twin. (Below left) Malaysian operator Hornbill Skyways is updating its five EC135s to P2e standard. (Below right) The Soloy SD1 upgrade replaces the Arrius on AS350 BA models with the Honeywell LTS101. (Photos: Bell/Eurocopter/Soloy)



surger

fuel economy by around 8%. The AS350 'SD1' kit is based on the BA model, replacing the Turbomeca Arrius with the same engine as the Super D. However, the SD1 uses Soloy-developed drive-train components, allowing potential upgrade to 'SD2' standard.

The SD2 conversion was developed for the AS350 B2, and sees the installation of the LTS101-700D-2, which replaces the Turbomeca Arriel 1D1. The SD2 was developed at a time when Ecureuil operators were becoming unhappy with Turbomeca's customer support and increasing maintenance, parts and overhaul charges, which were causing higher operating costs.

Economic ride

Soloy claims that customers with the SD2 would realise identical levels of performance to the Arriel-engined machines, but enjoy improved fuel economies of 5%. Soloy's AS350 'Allstar' kit, retrofitting the Rolls-Royce 250-C30M turboshaft, continues to be supported, but is no longer actively offered by the company.

'The reduced operating cost, both in terms of maintenance and fuel consumption of the LTS101-series engines, has proved to be the

most important benefit in selecting the alternate engine option,' said Nick Parkinson, director of helicopter sales and new business at Soloy. 'The most popular conversion at the moment is the installation of the LTS101-700D-2 engine in the AS350 B2 – so far we have delivered 120 kits at approximately 20 per year.'

Soloy's conversions are certified by the EASA, FAA, Transport Canada and ANAC Brazil, with the FAA supplemental type certificate also recognised in Australia and New Zealand. The company continues to offer its Bell 206-C20R2/R4 conversion programme, which was first developed in the mid-1980s. Three kits are available for different variants of the 206, including the 206L, 206B and the 206B-III. Soloy says that the kit not only enhances the hot and high performance of the Model 206, but is also inexpensive and easy to install.

In 2009, Texas-based Uniflight was chosen by Bell and Rolls-Royce to develop an upgrade kit to fit the latter company's RR500 turbine to the Model 206B and 206L. The engine, developed from the RR300 which powers the Robinson R66, features a scaled-up core for increased power. Uniflight currently has a small team

working on the upgrade's development, and, according to Joe Hawke, CEO of the company, the introduction of the new engine would be a relatively simple and cost-effective update for operators.

'With the upgrade, the power available to the pilot would only be limited by the gearbox,' he said. 'At 10,000ft on a 100°F [38°C] day, a normal JetRanger with five seats will lose two of those places – this upgrade would give those operators increased lifting capability.'

The kit will apply to all variants of the 206B JetRanger series and the 'straight L' model of the LongRanger as a retrofit option, and Hawke estimated that the upgrade would give the aircraft at least another 15 years of life compared to the former family.

He is planning to offer two upgrade options: the first, costing around \$500,000, would deliver the engine upgrade and the associated modifications; while a more extensive kit, costing around \$650,000, would also include an upgrade to the avionics systems. Rolls-Royce plans to certify the RR500 in 2013, and Hawke is hopeful of getting the upgrade kit to market in the same year. ➔



Eurocopter offers an upgrade for its EC155, taking early production models to B1 standard with the Arriel 2C2 engine. (Photo: Eurocopter)

Additional benefits

Other design features of the engine include ease of retrofit, enhanced gearbox durability and 2,000- or 4,000-hour service intervals. Also included in the upgrade are engine monitoring and generator control units, engine mounts sized for 12g crash conditions, a fire detection system and new engine cowl to improve access and serviceability. Aircraft with the new engine will be identifiable through the use of a modified exhaust stack, which is designed to reduce the impact of emissions on the tail boom and rotor assembly.

Washington-based Northwest Helicopters is another Bell specialist. The company has developed a comprehensive upgrade to the UH-1H/Model 205 helicopter, which involves lightening the airframe in order to reduce empty weight and increase useful load.

The company removes the engine and replaces it with the uprated Honeywell T53-L703, which provides 28% more power. Other modifications include the installation of the intermediate gearbox from the Model 212 and the oil cooler blower from the 209 (AH-1). Northwest also installs other customer-specified equipment, such as new avionics suites or extended-height landing gear.

Northwest claims its upgraded UH-1H+ can lift a greater payload than a Bell 412, which costs several times more than the upgrade, as well as significantly reducing operating costs. The company is also working on new composite main rotor blades for the aircraft. The upgrade also makes use of BLR Aerospace's strakes and FastFin system, which together give the Model 205 and 212 improved altitude performance, climb rates and a reduction in operating costs. The modifications help to extend the life of many components, such as the tail rotor bearings, pitch change links and tail rotor control rods, because of a decrease in the required pedal inputs made by the pilot.

The FastFin on the Model 205 and 212 'cuts away' roughly one-third of the standard Huey fin

and replaces it with a composite fairing that covers the trailing edge and the tail cone. With the FastFin in place, pilot workload can be reduced by improving stability, tail rotor margins and wind azimuth tolerances, while the strakes provide additional tail-rotor authority and increased stability.

Standard fit

Some 400 Bell medium aircraft – including UH-1s – are fitted with the FastFin, and it is now being provided on Bell 412s as standard straight off the production line in a decision announced by the OEM in August 2010.

'FastFin has been purchased by every segment of the market,' said Dave Marone, VP of sales and marketing at BLR. 'Most are looking for increased useful load, [with] some for higher density altitude operations [and] the safety associated with increased tail rotor authority. [The company] has recently certified a 500lb [225kg] OGE hover increase for the Bell 212, and we are working on a performance improvement for the 206L.'

The OEMs themselves also offer a number of upgrade programmes to operators for performance improvements. At the beginning of 2011, Eurocopter launched a series of product improvement programmes to deliver extra performance out of its products. Among the aircraft benefitting were the EC135 P2 and T2, re-designated as P2e and T2e. Customers updating their aircraft configuration gain an additional 40kg of payload, taking MTOW to 2,950kg, while operators upgrading from the P2 and T2 standard aircraft gain an additional 115kg of payload.

The company is also carrying out conversions of the EC155 B to the B1 standard with the Arriel 2C2 engine, which allows a 120kg increase in MTOW to 4,920kg. Eurocopter claims that the upgrade work can be completed in three months, with 15 aircraft expected to go through the process. The first two examples to be upgraded

were a pair of 2003-delivered EC155 Bs to Vietnam's Service Flight Corporation for use on oil and gas operations.

Further boosting capability is the introduction of more modern avionics systems (see p26). The introduction of a glass cockpit delivers increased levels of information and automation to pilots, helping reduce workload and improve situational awareness in busy skies.

Popular choice

Sagem's Integrated Cockpit Display System (ICDS) has been developed for retrofit into a wide range of aircraft, and the system is now being offered by workshops and helicopter engineering firms around the world. It is proving hugely popular with companies such as Vector, which offers the system for installation on the Bell 206. United Rotorcraft Solutions is offering the ICDS-8 for use on the MD 500 helicopter, which the company says will provide a centralised display for integration, computation and control.

Two screens, a primary flight display (PFD) and a multi-function display (MFD), allow operators with ICDS-equipped aircraft to dispense with the electro-mechanical instruments that require repair, and deliver information to the crew, including a moving map, terrain awareness, traffic and weather on the MFD, with heading, navigation, altitude, attitude and airspeed on the PFD.

The caution warning system will also be displayed on the MFD, and operators have the option of adopting flight data services that are available through the Globalstar SATCOM system, including met reports and NOTAMS. This work was followed up by MD Helicopters itself, which began offering the ICDS in new-build aircraft.

More recently, Cobham and Carson have teamed up to provide what they call an 'advanced suite of avionics for Sikorsky S-61, S-76 and UH-60 derivative helicopter retrofits'. The cockpit will feature large-format synthetic vision flight displays with advanced flight management capability, integrated hazard alerting for terrain, traffic and weather as well as dual-audio/radio control units, dual-VHF navigation and communication radios and an optional mission computer and display system.

Today, operators increasingly recognise that the use of avionics and engines upgrades can put new life into even the oldest of helicopter models, allowing them to take on new missions and capabilities at a fraction of the cost of those straight out of the factory. There can be no doubt that as current airframes begin to age, new technologies will emerge to keep them in the air for many years to come. **RH**

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Eurocopter EC130 B4

Derived from the AS350/355 Écureuil/Squirrel family, the EC130 is a seven to eight-seat single-turbine helicopter that has an MTOW of just over 2t. To the tried and trusted Squirrel airframe, Eurocopter added FADEC, the fenestron tail rotor of the EC135 and 155, a more spacious cabin and the redesigned cockpit glazing of the EC120, 135 and 145, as well as the streamlined skid landing gear of the EC120. The aircraft retains the AS350 B3 main rotor head, engine and gearbox. The result is a much quieter, roomier and more modern helicopter that retains the impressive performance of the AS350.

Weights

Maximum Take-off Weight:	6,172lb (2,800kg)
Useful Load:	2,311lb (1,048kg)
Empty Weight:	3,040lb (1,379kg)
Maximum Fuel Capacity:	939lb (426kg)

Powerplant

One Turbomeca Arriel 2B1 turboshaft producing 728shp (543kW), driving a three-blade main rotor and eight-blade fenestron shrouded tail rotor.

Maximum Continuous Power (MCP):	728shp (543kW)
Take-off Power (TOP):	847shp (632kW)

Performance

Maximum Speed:	155kts (287km/h)
Maximum Cruising Speed:	135kts (250km/h)
Fuel Consumption at Maximum Speed:	386lb/h (175kg/h)
Economical Cruise Speed:	120kts (222km/h)
Fuel Consumption at Economical Cruise:	328lb/h (149kg/h)
HIGE:	19,255ft (5,865m)
HOGE:	17,590ft (5,360m)
Service Ceiling:	>23,000ft (7,010m)
Range:	347nm (644km)
Maximum Endurance (no reserves):	4hr 7min
Rate of Climb	
(all engines operative, MCP):	2,290ft per min
Temperature Limitations:	Min: -40°C Max: +50°C

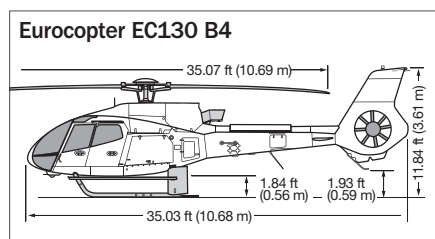
External Dimensions

Rotor Diameter:	35ft 1in (10.69m)
Fuselage Length:	35ft 1in (10.68m)
Overall Length:	41ft 5½in (12.64m)
Disc Area:	966.1ft² (89.75m²)
Fuselage Width:	6ft 7in (2.03m)
Height:	10ft 11½in (3.34m)
Fuselage Ground Clearance:	1ft 9½in (0.56m)

Internal Dimensions

Cabin Width:	6ft 1½in (1.87m)
Cabin Height:	3ft 10in (1.18m)
Cabin Length:	7ft 2in (2.19m)
Cabin & Baggage Floor Area:	48.45ft² (4.50m²)
Cabin & Baggage Volume:	169.51ft³ (4.80m³)
Total Floor Area:	32.3ft² (3m²)
Total Floor Volume:	130.7ft³ (3.7m³)

Maximum Seating: Eight people



Eurocopter EC135 P1

The EC135 began life as the Bö 108 technology demonstrator flown by MBB in 1988. In 1992, the design was revised with the fenestron tail rotor, and the aircraft that would become the EC135 prototype took to the air in 1994. The plan was to offer the helicopter in two versions: the P1, powered by the Pratt & Whitney PW206B turboshaft; and the T1, powered by the Turbomeca Arrius 2B1. European JAA certification was awarded in June 1996, with FAA approval the following month. Large numbers of P1s are used by German parapublic operators, including ADAC and the police.

Weights

Maximum Take-off Weight:	6,250lb (2,835kg)
Useful Load:	2,734lb (1,240kg)
Empty Weight:	3,263lb (1,480kg)
Maximum Fuel Capacity:	1,255lb (570kg)

Powerplant

Two Pratt & Whitney PW206Bs each producing 621shp (463kW), driving a four-blade bearingless main rotor and a fenestron shrouded fan tail rotor system.

One Engine Inoperative (2.5min power):	732shp (546kW)
One Engine Inoperative (MCP):	671shp (500kW)
Maximum Continuous Power (MCP):	562shp (419kW)
Take-off Power (TOP):	621shp (463kW)

Performance

Maximum Speed (VNE):	150kt (278km/h)
Maximum Cruising Speed:	140kt (259km/h)
Fuel Consumption (Fast Cruise):	N/K
Economical Cruise Speed:	122kt (226km/h)
HIGE:	13,600ft (4,140m)
HOGE:	10,700ft (3,260m)
Service Ceiling:	20,000ft (6,09m)
Range:	402nm (745km)
Maximum Endurance:	3hr 51min
Rate of Climb:	1,653ft per min
Temperature Limitations:	Min: -45°C Max: +50°C

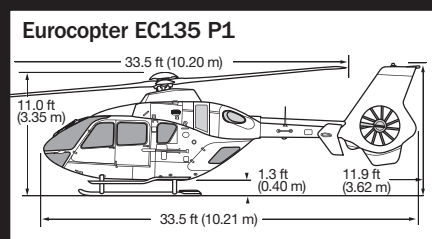
External Dimensions

Rotor Diameter:	33ft 5½in (10.2m)
Fuselage Length:	33ft 6½in (10.2m)
Overall Length:	39ft 6½in (12.2m)
Disc Area:	880ft² (81.7m²)
Fuselage Width:	5ft 1½in (1.56m)
Height:	11ft 10½in (3.62m)

Internal Dimensions

Cabin Width:	4ft 11in (1.5m)
Cabin Height:	4ft 1½in (1.28m)
Cabin Length:	10ft ½in (3.06m)
Cabin & Baggage Floor Area:	46.83ft² (4.35m²)
Cabin & Baggage Volume:	173.04ft³ (4.90m³)
Total Floor Area:	59.21ft² (5.50m²)
Total Floor Volume:	208.35ft³ (5.90m³)
Volume:	134.2ft³ (3.8m³)

Maximum Seating: Eight people



Eurocopter EC135 T1

Powered by a pair of Turbomeca Arrius 2B1s, the T1 offered customers an alternative engine to the P1 variant. The first aircraft was delivered to the US in November 1996. Early helicopters featured the 435kW (583shp) Arrius 2B engine, but this was later replaced by the 500kW (670shp) Arrius 2B1 – the latter certified in April 2001.

Weights

Maximum Take-off Weight:	6,400lb (2,900kg)
Useful Load:	2,767lb (1,255kg)
Empty Weight:	3,230lb (1,465kg)
Maximum Fuel Capacity:	1,255lb (570kg)

Powerplant

Two Turbomeca Arrius 2B1s each producing 670shp (500kW), driving a four-blade bearingless main rotor and fenestron shrouded fan tail rotor system.

One Engine Inoperative (2.5min power):	751shp (560kW)
One Engine Inoperative (MCP):	N/K
Maximum Continuous Power (MCP):	570shp (425kW)
Take-off Power (TOP):	670shp (500kW)

Performance

Maximum Speed:	150kt (278km/h)
Maximum Cruising Speed:	140kt (259km/h)
Economical Cruise Speed:	126kt (234km/h)
HIGE:	13,250ft (4,040m)
HOGE:	10,200ft (3,100m)
Service Ceiling:	N/K
Range:	402nm (745km)
Maximum Endurance:	3hr 39min
Rate of Climb:	1,653ft per min
Temperature Limitations:	Min: -45°C Max: +50°C

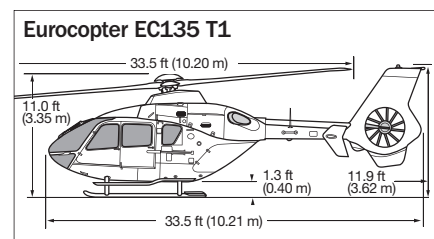
External Dimensions

Rotor Diameter:	33ft 5½in (10.2m)
Fuselage Length:	33ft 6½in (10.2m)
Overall Length:	39ft 6½in (12.2m)
Disc Area:	880ft² (81.7m²)
Fuselage Width:	5ft 1½in (1.56m)
Height:	11ft 10½in (3.62m)

Internal Dimensions

Cabin Width:	4ft 11in (1.5m)
Cabin Height:	4ft 1½in (1.28m)
Cabin Length:	10ft ½in (3.06m)
Cabin & Baggage Floor Area:	46.83ft² (4.35m²)
Cabin & Baggage Volume:	173.04ft³ (4.90m³)
Total Floor Area:	59.21ft² (5.50m²)
Total Floor Volume:	208.35ft³ (5.90m³)
Volume:	134.2ft³ (3.8m³)

Maximum Seating: Eight people





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Blue-light thinking

Tony Nicholson, director of specialist consultancy Primeguild, talks about the need for cost-effective optimisation of the UK's parapublic helicopter fleet, which, in its current form, has an almost open-ended structure and no common model.



(and inherently more costly) solution. When the competition collapsed a year ago, the future of SAR went back to the drawing board.

Top-down focus

'Future SAR' is just coming onto the (re)launch platform, and we do not yet know how it will be pitched (see p5). A straight re-run on the terms of SAR-H would have been the equivalent of keeping the blinkers on. However, there also seems to be some welcome green shoots here.

That is the good news – these two are both in the formative stages. Who can test for connectivity between them before the chance is lost? Bottom-up is not enough, top-down must be the key. This is the component that has never been there – to join up the range of interests.

Urgently wanted, therefore, in government language, is a senior responsible owner – or, in media terms, a new Tsar for civil emergency helicopters. The prize could truly be some big steps towards the optimisation and cost-effectiveness that the UK needs and deserves. **RH**

Tony Nicholson is director of specialist consultancy Primeguild

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.

In the UK, the blue-light helicopter community – the dedicated SAR, police and air ambulance assets – adds up to quite a lot. There are no hard figures on costs, but at least £200 million (\$313 million) per year supports more than 100 helicopters spread across some 66 bases. However, I'm a taxpayer, and these are tough times. Does this spending stand up to scrutiny – is it optimised and cost-effective?

The helicopters actually belong to more than 50 different organisations. SAR, for example, is provided by the Maritime & Coastguard Agency, the Royal Navy and the Royal Air Force. A total of 27 separate police air-support units operate the platforms, and there are 24 distinct air ambulance bodies. There are multiple helicopter types and support providers, with some aircraft being owned and others leased – there is no common model.

Financial roots

Behind the operating bodies are the sponsors. Air ambulances are typically based on voluntary subscriptions to independent charities. SAR and the police are publicly funded, with responsibilities and budgetary interests spread across three major government departments – the Ministry of Defence, the Department for Transport and the Home Office. Fire, floods and the National Health Service (NHS) add to the stakeholder mix, together with the devolved administrations and the Cabinet Office.

There is no 'fault' in this – it is simply how things have evolved from different starting points. However, it does mean that there is no single owner of the national interest, in respect of blue-light services.

There is also no common definition of tasks and roles, and no master authority for dispatch and prioritisation. As a result, there are both gaps and overlaps. It also means that there are

no opportunities for capturing economies of scale – whether in procurement, maintenance, training or infrastructure. Therefore, the situation is not optimised, or cost-effective.

Following a series of conference presentations that aired these issues, and a relevant research study from the Royal United Services Institute, two main strands appear to be coming out. Considering the categories of task, commonalities can be identified: 'find' touches SAR and police; 'observe' has elements for police and fire and rescue; and 'transport' of specialist teams attracts police, fire and rescue and perhaps even the NHS. If we could follow this through, it could have implications for fleet mixes, cross-tasking and sharing of assets, back-up and resilience.

However, the new twist is a growing sense of a real chance for change, stemming from the accidental conjunction of three key drivers – politics, a National Police Air Service (NPAS) and SAR.

Regarding the former, with budgets under pressure on all side, the coalition government is putting weight behind improvements in efficiency – important top cover when there are so many parties involved.


Driven by the Association of Chief Police Officers, NPAS is moving rapidly towards roll-out in April 2012. It will offer a coherent rationalisation of police air units across England and Wales, with a common definition of task, improved coverage, one owner and a unified dispatch function. It has the potential to take police aviation significantly further down the path of optimisation and improved cost-effectiveness.

The SAR-H project for harmonising services under a single contractor had looked at SAR requirements in isolation. Against the run of the mass of actual incident data, it also seemed to acquire a tilt towards a wholly large-aircraft

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