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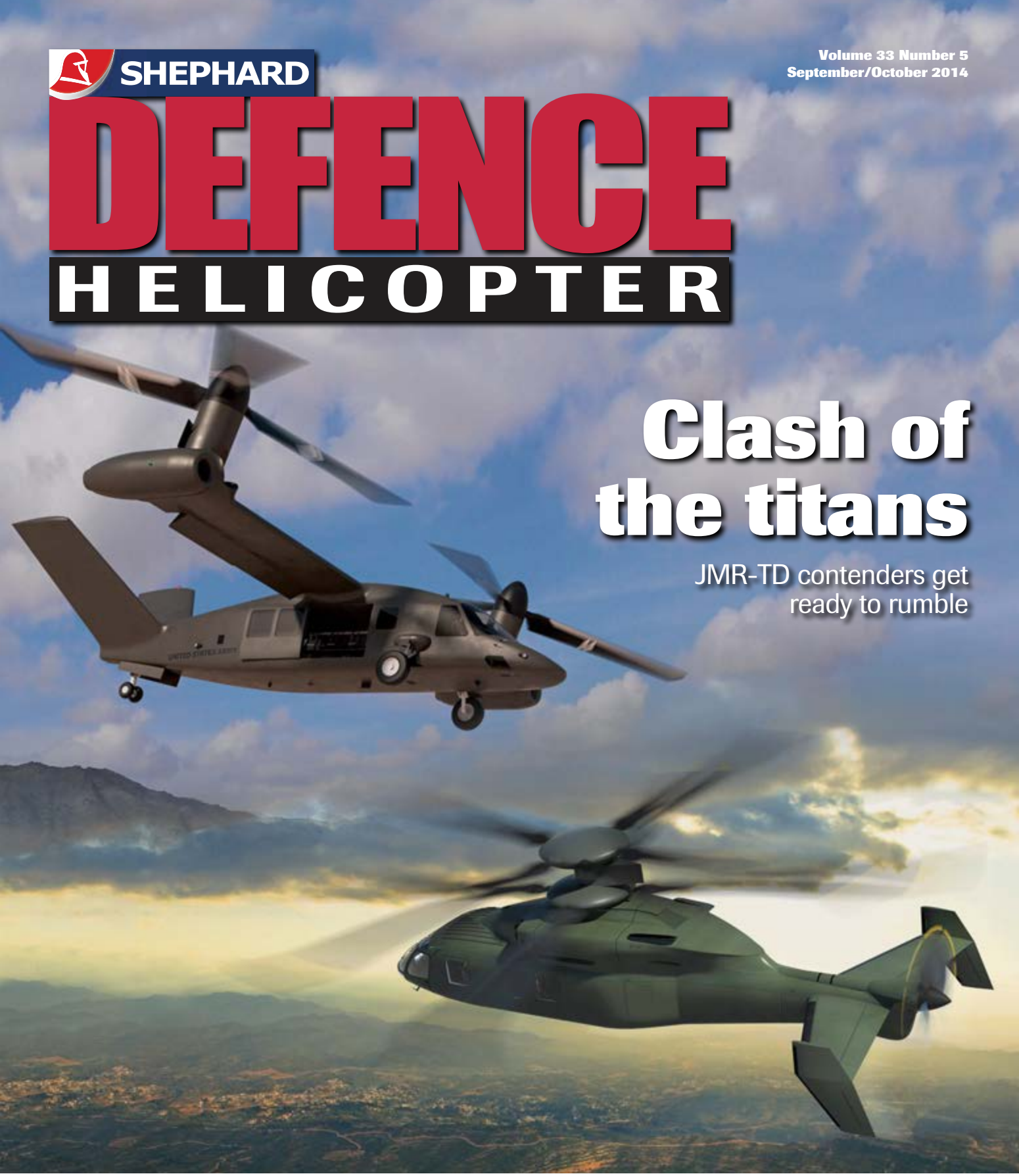
DEFENCE HELICOPTER



Clash of the titans

JMR-TD contenders get ready to rumble

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DEFENCE HELICOPTER

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Front cover: The US Army announced in August that it had chosen Bell Helicopter and Sikorsky-Boeing to build demonstrators for the JMR-TD programme. (Image: Bell Helicopter/Boeing-Sikorsky/Lorna Francis)

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JMR-TD field narrows,

but FVL's known unknowns remain

IT HAS BEEN QUITE A WHILE SINCE THE US Army last made an attempt at a clean-sheet rotorcraft design.

The story behind the previous effort with the RAH-66 Comanche hardly needs to be recounted here – although in hindsight the decision to terminate the programme was a sensible one.

Cancelling development after nearly $7 billion had already been spent is never going to garner positive headlines, but this step allowed the army to pump funds into an upgrade of the current fleet, a vital necessity given the nature of the Afghan conflict.

This time around, with the Future Vertical Lift (FVL) programme, the army is taking a very deliberate approach in an effort to avoid the pitfalls of projects such as Comanche, and more recently the F-35 Joint Strike Fighter.

The selection of Bell Helicopter and a Sikorsky-Boeing team for the next phase of the Joint Multirole – Technology Demonstrator (JMR-TD) effort was predictable enough not to require too much further examination – although I outline the plans of both teams on p10.

Nevertheless, some intriguing aspects remain – to quote that well-known philosopher Donald Rumsfeld, we are dealing with many 'known unknowns' when it comes to FVL.

FUTURE ROLES

The future role of the other two contenders for JMR-TD – AVX Aircraft and Karem Aircraft – was unclear at the time of writing, although the technology investment agreements (TIAs)signed with all four venders may allow funding to be allocated to take their designs forward.

Dan Bailey, the army's programme director for JMR-TD/FVL, revealed earlier in 2014 that 100 flight hours for each of the two selected vendors had been built into the programme, so if this amount wasn't required it could open up additional funding.

'These are TIA agreements, not procurement contracts fully funded by the government, therefore using the term "downselect" is improper. Each party, government and vendor, has rights to rescope the agreement or stop efforts under the agreement. That is the beauty of an S&T effort,' Bailey told *Defence Helicopter* in clarification.

It would certainly be worth advancing aspects of the designs by AVX and Karem to help inform FVL, in particular the latter's optimum-speed tiltrotor technology.

'What makes it different is the rotors are very lightweight, very rigid, they are not articulated and they are capable of wide-range speed variation, which gives it the ability to build in efficiency both in hover and forward flight. This removes some of the design compromises that traditional tiltrotors have between the need to be an efficient hover rotor and an efficient forward flight rotor,' Ben Tigner, JMR programme manager for Karem Aircraft, told an audience in July.

OPEN COMPETITION?

The other pertinent question is how open any future FVL competition will be to European rotorcraft manufacturers.

Bailey has been careful to specify that not being selected for the flight demonstration phase of JMR-TD does not mean companies are 'out of the game in any way'. Certainly the US team at Airbus Helicopters is outwardly confident that its internal S&T efforts will keep it in the running when any FVL solicitation finally rolls around.

Such uncertainties must be frustrating for an industry that is used to chasing 'winner-takes-all' procurement competitions. However, despite previous acquisition disasters, there is some evidence that the army is taking a more sensible approach this time around.

The multirole and joint nature of the plan is aimed at addressing long-term life-cycle costs, a sensible move given that more than 70% of a platform's cost comes from operation and sustainment after it has been fielded.

According to Bailey, the FVL effort gives the army 'an open door' to think about how

it maintains its aircraft, rather than being restricted by legacy systems and processes.

The Pentagon is also attempting to 'cross boundaries' and take a mission-centric approach to the way today's helicopters will eventually be replaced under FVL.

For example, the USN chose the H-60 as its SH-2 replacement in the mid-1970s largely because it was already in production for the army and had a cabin big enough for the racks needed for the mission systems.

As plans evolve to replace the current Seahawks and Black Hawks, it is unlikely that the successor for each will be in the same weight class, given the differing mission and payload requirements of the two services.

So some grounds for cautious optimism then, although there is still plenty of time in the lead-up to the full FVL procurement for requirements to snowball out of control or for efficiencies to be lost in the pursuit of commonality.

One thing is certain, however – with the FVL programme expected to replace between 2,000 and 4,000 medium-class utility and attack helicopters, it's all to play for.

Tony Skinner, Editor

Northrop Grumman to upgrade UH-60L cockpit

NORTHROP GRUMMAN WILL MODERNISE the cockpit of the US Army's UH-60L Black Hawk fleet under a contract announced on 15 August.

This will see the manufacturer supply and integrate a scalable mission avionics equipment package for a digital cockpit upgrade on 700-900 aircraft in service, and replace older analogue gauges with digital electronic instrument displays.

The designation for this upgraded aircraft will be UH-60V. The system essentially replicates the newer UH-60M's pilot-vehicle interface, providing a common training environment.

It also features a centralised processor with a partitioned, modular operational flight programme with an integrated architecture that enables new capabilities through software-only solutions rather than hardware additions.

The package is claimed to be smaller in size, lower in weight and require less power than legacy processing systems. The avionics system is aligned with the Future Airborne Capability Environment (FACE) standard, and supports integration of off-the-shelf software and hardware, allowing the aircraft to keep pace with new capability requirements.

The solution has already undergone flight test demonstrations on a UH-60L.

Ike Song, VP of situational awareness systems at Northrop Grumman Electronic Systems, said: 'We are committed to this critical upgrade programme that will prolong the life of the UH-60 while keeping warfighters safer by enhancing their situational awareness.

'Our integrated mission avionics solution is built on mature, proven technology and an open-architecture approach for superior performance, affordability, growth potential and reliability.'

By Claire Apthorp, London

First overseas deployment for UK Puma HC2s

Photo: EDA

THE UK RAF'S PUMA HC2 HELICOPTER has successfully completed hot and high flight trials during Exercise *Hot Blade* in Portugal, marking the first overseas deployment of the newly upgraded platform.

The rotorcraft is being put through hot weather training as part of the type's work-up towards achieving initial operational capability in April 2015, after which it will be able to deploy wherever it is required around the globe.

Portugal hosted the European Defence Agency-sponsored exercise at Ovar in July, as part of the wider Helicopter Training Programme.

A total of 25 rotorcraft and 3,000 military personnel took part in two weeks of intense cooperative training between the six participating member states, including the UK, for the first time.

The British detachment, led by Sqn Ldr Trev Simpson of 230 Squadron RAF, comprised three Puma HC2 aircraft, accompanied by 50 personnel which included six three-man aircrews.

Simpson told *Defence Helicopter* the HC2s flew from Benson to Ovar in a single day, refuelling at Cazaux in France. Prior to *Hot Blade*, two of the Pumas undertook dust trials at Beja in southern Portugal to test the aircraft's four-axis autopilot and automatic flight control system.

By David Oliver, Ovar

Russian Air Force reforms Army Aviation branch

THE RUSSIAN AIR FORCE (RUAF) is poised for a deep reform and recapitalisation of its Army Aviation branch.

After a cut in the number of units on strength during a previous round of reforms in 2009, the structure of Army Aviation, which operates transport and attack helicopters in support of land forces, is set to be expanded once again in order to provide reliable support to the Russian Army, according to the RuAF's commander, Lt Gen Viktor Bondarev.

Bondarev told the Russian press on 28 July that following the reform, Army Aviation will comprise ten frontline regiments and four brigades, replacing today's air base structure.

Each of the regiments will be assigned to a 'combined-arms army' spread across Russia, while each of the four brigades will be assigned to a specific military district.

A regiment will comprise three squadrons, each with 20 to 22 helicopters, plus a command section and support services, while its total fleet will include 66 helicopters, of both assault transport and attack types. The former will comprise Mi-8AMTShs and Mi-8MTV-5-1s, while the latter will be represented by the Ka-52, Mi-28N and Mi-35M.

The four brigades will be larger units, with a command section and four squadrons, and the total fleet of each will comprise 84 to 88 helicopters of several types.

The brigades will have heavy-lift capabilities thanks to incorporation of an Mi-26 squadron in their structure, and will serve the entire military district, including multiple combined-arms armies within the land forces element, as well as the respective Russian Navy fleet assigned to their district.

By Alexander Mladenov, Sofia

NHIndustries establishes anti-corrosion plan for NH90 rotorcraft

Photo: author

NHINDUSTRIES (NHI) HAS FINALISED AN action plan aimed at preventing further occurrence of corrosion issues on the NH90.

After feedback from the Dutch MoD, the company established a task force in late 2013 with the aim of looking into the causes of these problems encountered by the Netherlands while operating its new NH90s at sea.

The country deployed two of its NH90 NATO Frigate Helicopters (NFHs) in 2013, one of which was in Meaningful Operational Capability (MOC) configuration, with the other at Full Operational Capability (FOC) standard.

Led by Aurelie Colin, one of NHI's programme managers for the NFH variant, the investigation led to a series of measures designed to make the NH90 better cope with saline conditions.

While the company made it clear that corrosion is a concern for every maritime helicopter and that the NH90 is less sensitive to the problem due to its composite cabin, some details were provided during the recent Farnborough International Airshow in July on the new technical measures now being taken.

These include better resistance to galvanic coupling by using new and improved insulation material, as the film currently applied as a physical barrier provides inadequate protection.

Also implemented will be enhanced rinsing procedures as well as the use of new sealants, while the overall number of anti-corrosion products being used will also be reduced.

With the help of nanotechnology, NHI has also developed a coating that can be applied to the NH90, thereby rendering its surfaces extremely hydrophobic.

One of the findings of the Dutch National Aerospace Laboratory's report into corrosion occurrences on NH90s published in June was that water could enter the fuel tank area. The manufacturer has now put a solution into production to stop this from occurring again. Meanwhile, preventive directives have been issued to all plants involved in the assembly of NH90 airframes.

A modification scheme for existing NH90s is also currently being looked into. A number of MOC airframes have recently been inducted into the MOC-to-FOC upgrade programme, and the anti-corrosion measures that have been devised are likely to now be implemented during this process.

However, it remains to be seen if FOC aircraft that have already been delivered will be retrofitted, and how this will impact the transition schemes of the user countries involved.

By Pieter Bastiaans, Breda

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India debates blacklist policy as helo projects stay stalled

INDIA'S PROCUREMENT OF MILITARY helicopters remains mired in delays due to policy paralysis in decision-making and a failure to develop indigenous manufacturing.

Even as Italian prosecutors shelved proceedings against Finmeccanica, parent company of AgustaWestland, in the case of alleged wrongdoings surrounding a $770 million deal to supply 12 AW101 VVIP helicopters to India, the fate of the nine undelivered aircraft is unclear.

In a snowball effect, the procurement of 16 multirole helicopters for the Indian Navy – which both NHIndustries and Sikorsky were competing for – has been deferred until clear guidelines on the blacklisting of companies are announced.

Until now, the issue of blacklisting has remained ad-hoc, with former Defence Minister A K Antony often putting bids on hold following the smallest complaint by a competitor in an attempt to keep a 'clean' image.

'It's a clean-up signal for industry,' he stated in reply to a query on why Finmeccanica was not permitted to exhibit at Bangalore's DefExpo event in February.

Now, after a change of government, OEMs are hoping for more clarity.

'The [new] government and MoD have been very clear [on blacklists]… having indicated that allegations must be based on proof and process, not conjecture,' a senior Indian MoD official told *Defence Helicopter* on condition of anonymity.

However, at time of going to press, no announcement had been made.

Meanwhile, following the July crash of an Indian Air Force (IAF) Dhruv Advanced Light Helicopter (ALH), which resulted in seven fatalities, the armed force have grounded 100 ALHs until a court of enquiry submits its report. Earlier this year, an ALH exported to Ecuador also crashed.

An IAF spokesman told *DH* the ageing fleet of Cheetah and Chetak helicopters, due to be retired, would fill the gap, and that the grounding of the ALH would not hamper operations.

There are currently 199 commitments for the ALH Mk III, including 32 recently ordered by the Indian Navy.

The thrice-released RfP by the Indian Army for Light Utility Helicopters also remains stalled over bribery allegations.

By Neelam Mathews, New Delhi

Iran overhauls military helicopter fleet

Photo: author

A CEREMONY WAS HELD AT THE IRANIAN Helicopter Support and Renewal Company (IHSRC) in June to mark the delivery of 20 overhauled military helicopters.

Attended by Minister of Defence Brig Gen Hossein Dehghan, and Commander of the Iranian Navy RAdm Habibollah Sayyari, the ceremony also gave the chance for the media to see two new weapons installed on the helicopters.

The first was a pod-mounted DShKM 12.7x108mm machine gun installed on the port side of a navy AB212. The new gun pod was developed in 2012 and tested for the first time on board an Islamic Republic of Iran Army Aviation (IRIAA) Bell 214A during an exercise in Isfahan in 2013. The second displayed weapon was described as a domestically developed IR-guided air-to-air missile (AAM), which was installed in a launcher on a hardpoint of an AH-1J (serial 3-4554) attack helicopter.

However, the missile is believed to be a Chinese short-range AAM with its control surfaces and IR seeker removed.

The 'Eftekhar-1' project was also identified as the programme to install the missile on the helicopter. Analysts believe this was in fact to cover up a long delay in the delivery of the overhauled aircraft 3-4554.

IHSRC has been responsible for providing logistics and maintenance support for Iranian civil and military helicopters since 1969.

Before the 1979 revolution, the company was able to perform depot-level maintenance of US-designed helicopters such as the AH-1J, Bell 214A/B/C, AB205A-1, UH-1H, AB206A/B, Bell 212ASW and HH-43F.

While the fleet of around 500 helicopters currently in service with the Iranian Armed Forces is around half of that in 1979, the overhaul capacity of the IHSRC has also dropped dramatically, equal to around one fourth of what was available before the revolution.

Among the overhauled helicopters delivered in June were: a Vietnam War-era UH-1H (6-4965); two IRIAA AB205A-1s; and one Bell 214A of the 4th General Support Base.

The Islamic Republic of Iran Navy Aviation received: a Sikorsky RH-53D Sea Stallion (9-2701); an AB212ASW (6-2410); an Agusta-built ASH-3D (8-2313); and an AS-61A-4 (8-2320).

Restoration of 8-2320 started in 2009 and was not completed until this year.

A Bell 212 (6-9205) and a Bell 412 (6-9221) were also delivered to the air force after a six-month depot maintenance period at IHSRC.

By Babak Taghvaee, Tehran

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Russia faces helicopter engine crisis

THE PROTRACTED INTERNAL CONFLICT IN the south-eastern regions of Ukraine has caused an effective termination of helicopter engine exports to Russia.

Take a look inside the engine bays of any Russian-made helicopter in the 12-14t class and you are likely to find a TV3-117 turboshaft, or its newer derivative, the VK-2500.

This remarkably mature design continues to power almost all commercially viable domestic rotorcraft models in this size bracket, and has contributed to the success of Russian military helicopters around the globe.

However, the acutely strained political and economic relations between Ukraine and Russia are going to inflict serious damage on the latter's helicopter exports, as well as a proportion of domestic sales due to a shortage of engines, which is expected to come to a head by late 2014.

The chief reason is that the vast majority of the TV3-117/VK-2500 turboshafts are built by Motor Sich of Zaporozhia, Ukraine.

The company's current market share of TV3-117/VK-2500s for installation on new Ka- and Mi-branded rotorcraft is about 80%, which translated to around 400 engines in 2013. The original delivery schedule for this year had called for the same quantity.

Even domestic engine manufacturing in Russia, undertaken by Klimov, is dependent on important parts and assemblies supplied exclusively by Motor Sich, such as engine cores.

The well-established and mutually advantageous cooperation between Motor Sich and Russian Helicopters was interrupted following the announcement on 15 July by Ukrainian President Pyotr Poroshenko that all kinds of military-technical cooperation with Russia will be severed immediately, effectively imposing an export embargo on Russia.

While there was a set of previous bans on exports to Russia imposed by the Ukrainian authorities in 2014, these only covered defence equipment parts and assemblies, not dual-use goods such as Motor Sich turboshaft engines.

This is not only harmful to Russian OEMs, but has hit Motor Sich, as sales to Russia account for 40% of its annual turnover.

In addition, around 70% of the materials and parts the company is using in its production cycle are supplied by Russian vendors, including the raw titanium used for fabrication of the compressor and other assemblies for all types of engines sold worldwide.

LOYAL PARTNER

Vyacheslav Boguslayev, president of Motor Sich, has declared on many occasions that his company will remain a loyal partner of Russian Helicopters.

Before Ukraine's embargo decision, Boguslayev asserted that Motor Sich will continue working with its Russian partners.

'We have everything laid up well with the Russian plants, such as cooperation, mutual assistance and mutual understanding,' he claimed at the time. 'The Ukrainian plants are ready to work despite the complicated political situation, and there are no problems encountered with manufacture, shipping and acceptance.'

Since then, the reality of the situation has forced Motor Sich to respect the exports embargo imposed by Ukraine. Russia's United Engine Corporation, an umbrella company controlling all major design houses and production plants, has begun taking active steps to reduce, and ultimately eliminate, its dependence on Ukraine by setting up a full production cycle for the TV3-117/VK-2500 in Russia.

Russia's own manufacturing capacity for the TV3-117/VK-2500 family of engines is at the newly constructed final assembly plant in Shuvalovo, near St Petersburg, which is managed by Klimov. It commenced operations in 2012, and in 2014 the plant is expected to deliver 60 engines, while for 2015 the output is set to be doubled.

The eventual full production rate of 500 engines a year – the quantity needed to meet the near- and mid-term requirements of Russian rotorcraft manufacturers – is expected to be reached by the end of decade and this would mean an effective independence from Ukrainian engine supplies.

The process of setting up fabrication of the critical parts and assemblies for the TV3-117/VK-2500 family in Russia is not, however, slated for completion until 2016.

The embargo on rotorcraft engine exports to Russia will not have a negative impact on the completion of deliveries of 63 Mi-17V-5 tactical transport helicopters for the Afghan armed forces, which have been ordered by the US at a total price of some $1.33 billion.

The remaining 12 helicopters from the second contract for 30 Mi-17V-5s, signed in 2013 – all powered by TV-117VMA engines supplied by Motor Sich – have already been assembled, with the last three examples slated for delivery to Kabul in September or early October.

Indeed, as of early August, as *Defence Helicopter* was closing for press, it appeared there had been no effective enforcement of the sanctions and Motor Sich was continuing deliveries to its Russian customers.

According to Vadim Ligay, director general of Kazan Helicopters, Motor Sich supplied TV3-117s well in advance of the original delivery schedule and the international sanctions have had no impact on the engine supply.

Nevertheless, Kazan Helicopters expects to only use Russian-made engines for its helicopters by 2017, as a result of the ambitious, government-sponsored export replacement programme.

By Alexander Mladenov, Sofia

Photo: via author

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No surprises

With Bell Helicopter and Sikorsky-Boeing being downselected for the US Army's Joint Multi-Role – Technology Demonstrator programme, focus is now on how the two companies are going to approach this head-on battle. **Tony Skinner** sizes up the two offerings.

When the story of the Pentagon's replacement of its current fleet of rotorcraft comes to be written, it is unclear what significance future historians might place on one development in August 2014.

In a move that came as a surprise to precisely no one in the industry, the US Army announced on 12 August that it had chosen Bell Helicopter and Sikorsky-Boeing to build demonstrators for the Joint Multi-Role – Technology Demonstrator (JMR-TD) programme.

The former company is offering its V-280 Valor, which it describes as a third-generation tiltrotor, while the latter team is extolling the virtues of its SB>1 Defiant co-axial design.

The two contenders will now manufacture and prepare their aircraft for a first flight in 2017, in what is the opening round of the Future Vertical Lift (FVL) programme tasked with eventually replacing all types of military helicopter currently in the US inventory. A number of unknowns about the future direction of the project remain, however.

ACQUISITION UNCERTAINTY

The JMR-TD is not a 'fly-off' in the traditional sense, and only aims to better inform any future FVL decision, of which acquisition activity beyond this point is yet to be funded.

In addition, programme managers stress that the competition will remain open to other bidders beyond 2017, seemingly leaving the door open for the likes of AgustaWestland and Airbus Helicopters.

At the time of writing, it was also unclear about the future role of the other two competitors for JMR-TD Phase 1 – AVX Aircraft and Karem Aircraft.

This latest decision was described by Bailey as a 'descope' of the programme rather than a traditional downselect, and under the technology investments agreements signed with all four teams in 2013, AVX and Karem may yet be contracted to further develop their designs, depending on programme funds left.

Nevertheless, for those competitors targeting future involvement in FVL, the stakes could hardly be higher – the army envisages a common and joint solution that can be scaled across the light, medium and heavy class of rotorcraft in a project that could be worth upwards of $100 billion, according to some analysts.

FVL will not only completely reshape the helicopter industrial base in the US, it will also likely alter how the army conducts future operations depending on the final aircraft configuration fielded.

Bell Helicopter and its V-280 Valor tiltrotor has been selected for the next stage of the JMR-TD programme. (Image: Bell Helicopter)

With a number of failed projects behind it, the service is taking a very different and deliberate approach to FVL, looking to firstly reinvigorate the technological base expected to develop the technologies supporting the final solution, and incorporate lessons from other joint programmes such as the F-35 Joint Strike Fighter (JSF) as well.

NO PROTOTYPES

While the initial focus is on the medium segment to replace the Black Hawk and Apache fleets sometime from the mid-2030s, defence officials have been at pains to stress that the JMR-TD effort is not going as far as seeking a prototype aircraft for FVL.

'This is not a downselect, because what we are doing is investing in S&T and knowledge, increasing our tools,' Dan Bailey, programme director for JMR-TD/FVL, told the press earlier in 2014. 'We are not buying an aircraft under JMR – it is not a prototype effort; they are not aircraft that can turn into a FVL; we are not pre-disposing a decision for FVL.

'I have heard it said many times that they are prototype aircraft – they are not, they are Frankenstein aircraft that will attempt to demonstrate new and critical technologies that enable new designs that will give us the capabilities that we desire for the future.'

With today's helicopters largely based on designs from the 1960s and 1970s, the Pentagon is increasingly identifying capability gaps with the current fleet, especially following the high operational tempo of the past decade.

CAPABILITY GAPS

'There was a capability assessment done at a joint level that identified about 55 critical gaps in our current fleet, and it also identified that you cannot efficiently satisfy those gaps with the current fleet designs… The environment we are going to be fighting in the future, our current fleet is not optimised for,' Bailey explained.

'Hanging behind our heads is a timeline because we have an ageing fleet. The most significant of which at this point is in the medium-class, and that is in the H-60 fleet in both the army and navy.

'Somewhere around [the 2030 timeframe] we have to deal with an ageing H-60 fleet across the DoD. That is hanging over our head to get after this pretty quick. But, we do not want to lose the opportunity or water down the opportunity to conduct the real analysis that a new designed aircraft will allow for.'

Bell Helicopter and Sikorsky-Boeing can now begin to prepare their candidate aircraft for a first flight in 2017, in what is shaping up to be a protracted battle of tiltrotor versus co-axial compound configurations.

Robert Hastings, senior VP and chief of staff at Bell Helicopter, said in designing the V-280 Valor, the company's objective from the beginning was to deliver next-generation tiltrotor performance at a fraction of the cost through the use of modern technology and engineering.

In an attempt to fight the impression that Sikorsky-Boeing is the 'incumbent', Bell has assembled a team that includes Lockheed Martin, Moog and GKN.

'We looked at the drivers of our cost and designed ways to remove or minimise them, while also reducing weight and complexity,' he said 'First, the army does not need the expensive folding mechanisms that are required for carrier operations. This aircraft utilises the latest state-of-the-art composites to reduce weight – and cost – throughout, and incorporates innovative manufacturing techniques that reduce labour and production costs.'

For example, the design of the V-280 wing box will provide around 30% savings against the V-22, but at about the same size due to a reduction in parts, tool count, weight and detailed components.

Sikorsky-Boeing believes the co-axial compound design of its SB>1 Defiant offers the best mix of range, speed and tactical manoeuvrability. (Image: Boeing)

While AVX Aircraft and Karem Aircraft were unsuccessful for the JMR-TD, both designs may yet receive further funding. (Image: AVX Aircraft)

NEED FOR SPEED

Hastings also argues that much as the CV/MV-22 was becoming the aircraft of choice for an increasing number of mission types due to its speed and range, the V-280 would help reshape the way the army operates. Bell is confident that 280kts at 6K/95 was 'easily achievable and easy to exceed'.

For its part, Sikorsky-Boeing has placed its faith in the co-axial compound design, which Sikorsky first worked on under the XH-59A Advancing Blade Concept project in the late 1970s, and more recently developed as part of its X2 Technology aircraft.

Patrick Donnelly, director of the JMR programme for Sikorsky-Boeing, said the hingeless, stiff rotor system promised the speed and range of a tiltrotor without compromising low-speed manoeuvrability.

'The aircraft is called the Defiant because we are going to change the way people think about aircraft,' he said. 'Unlike the AVX [co-axial design], the Defiant has a large propulsor in the back, but it is unique because it has variable pitch, to the point that we can provide negative thrust – so we can slow down and use it as an air-break, we can accelerate it up, we can actually clutch it so it can stop when it is in the LZ so it is quieter.

'In addition, with the negative pitch, the aircraft can operate with a nose-down attitude and nose-up attitude for pitch pointing when we are in the attack aircraft.'

The team believes it can demonstrate an aircraft of 'tactically relevant size' at more than 230kts.

SECOND PHASE

Running concurrent to the JMR-TD is Phase 2 of the programme, which is looking to define the mission systems architecture needed for the FVL aircraft. Bailey said the key here was defining a supporting architecture that was flexible enough to incorporate technologies available in the 2020-25 timeframe, when a FVL mission system may be developed.

'We have made a lot progress down that path – the Future Airborne Capability Environment [FACE] is a standard that attempts to get after that openness,' he explained. 'We also have a programme called Joint Common Architecture [JCA] and really that is to wrap up the FACE standard into a larger definition of the architecture. That effort has been ongoing since 2009, funded by the army and developed here within the AMRDEC. We and the Joint Multirole [office] are now picking that up.

'We have a base standard for JCA – we are going to pick that up and demonstrate the validity of that standard to what could become the specification that ultimately we would put on a programme of record for FVL.'

Asked during a panel at the Center for Strategic and International Studies (CSIS) in July about the prospects of FVL being unmanned or optionally piloted, Bailey said the latter was highly likely.

'All of the [JMR-TD candidates] are fly-by-wire flight control systems, so the basic aircraft will fly that regardless if there is a pilot in the aircraft or not,' he said. 'The interface will be through a flight management computer which will have fully coupled modes – so generally if there is a pilot on board these aircraft in the future the vision is that he will not be flying it very often anyhow,' he explained.

'Whether that's an uploadable autonomous flight profile that gets inputted into the flight management computer and the aircraft goes and flies it; or whether you data-link it to a ground control centre – that's the operational context that's not yet defined. But the aircraft will not really know the difference.'

COMMON APPROACHES

In terms of the level of commonality envisaged across the weight classes and between variants for the various services, Bailey said the army was working with the JSF office to identify potential issues.

'You don't want to force commonality – that is something we learned from the JSF. One of the issues they had is the commonality goals up front forced them to make trades that were not realistic. The requirements were so drastically different in so many areas they could not gain the commonality they wanted and ultimately made them go back and re-develop which increased costs, so we are learning their lessons.

'A natural inertia that we have to overcome is that our requirements are not necessarily the same. Navy requirements are not speed-centric, they are endurance-centric. The army wants longer legs, but also speed because we want the element of surprise and operational flexibility in manoeuvre. So you have to think about the optimisation of both of those.'

Bailey also noted that in defining how current aircraft will be replaced, the FVL office was largely taking a payload approach. For example, the navy Seahawks and army Black Hawks are unlikely to need to be replaced by the same platform even though both are based on the H-60.

KICK START

It is clear that much of the FVL progress to date has been in kick-starting the design capabilities of a rotorcraft industry that has been largely nourished by incremental upgrade funding for the past 20 years, and has therefore been slow to innovate.

'The industrial base has really been shored up over the past five years,' Bailey told the CSIS in July. 'The configuration and trades analysis we have done and the work the team has done in the last year on the designs have put us in a position where we can go to industry today and say, "we want you to alter a particular aspect of your solution", and they can give us a solution feedback fairly quickly.

'As a programme of record, what we have done to date is already leaps ahead of where we were five years ago. Building and flight testing something is certainly important, but not the only path for any of these things to continue. And when we get ready to do a source selection for an actual programme of record, having the industry competency and the government team competencies that are in place today are going to be the critical aspect to make sure we have a programme that is solid going forward.' ***DH***

Additional reporting by Tim Fish

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Poland's extensive helicopter modernisation efforts are gaining momentum, with OEMs strategically positioning themselves to secure these lucrative contracts. **Jonathan Tringham** reviews progress in light of the growing conflict between Russia and Ukraine.

As the crisis in Ukraine intensifies, Poland has been forced to confront the uncomfortable reality that it has front-row tickets to what is shaping up to be a drawn-out confrontation between Russia and NATO, right on its eastern doorstep.

With most of the country's military infrastructure dating back to World War II, Poland is now fast-tracking steps to update its ageing and threadbare inventories.

The 'Polish Armed Forces Technical Modernisation Plan', announced in September 2013 as part of an estimated 130 billion zloty ($41.4 billion) financing package for defence spending out until 2022, represents one of the largest military investments by any European NATO member.

PURCHASING PLANS

The shopping list for Poland's modernisation effort is extensive, and will see equipment purchased for 14 operational programmes, including new air defence systems, UAVs and helicopters for the country's air, naval and ground forces.

However, with neighbouring Ukraine in turmoil, the nation is looking to beef up its immediate attack and defensive capabilities, and tenders for 70 multirole helicopters, 30 attack rotorcraft and a short and medium-range missile and air defence system have been given priority status.

On 30 May, the Polish MoD announced it was entering the final stages of its utility helicopter procurement programme, and invited three companies to submit their final tender to provide 70 multirole rotorcraft capable of carrying out utility and transport, CSAR and ASW missions for the country's army. Included in the tender is a comprehensive logistics package and training provision.

The three contenders include Airbus Helicopters and Heli Invest with the EC725 Caracal; PZL-Świdnik, an AgustaWestland company, with the AW149; and a team comprising Sikorsky and PZL Mielec with the S-70i. Final bids will be submitted during the third quarter of 2014, with the signing of the agreement expected in early 2015 – a slight delay on the original schedule that called for contract award in 2014.

The deal is part of a comprehensive overhaul of the Polish military's entire fleet of Soviet-era helicopters, with up to 200 aircraft expected to be purchased over the next two decades.

For the wider requirement, the MoD has stated its plan to procure 90 utility transport, 54 medium, 32 attack and 24 heavy transport helicopters for a total of 200 aircraft by 2035.

AgustaWestland's AW149 is the newest platform in the Polish multirole competition, and was recently awarded military certification in Italy. (Photo: AgustaWestland)

DOMESTIC BASE

Warsaw indicated that domestically based manufacturers using Polish components will be favoured. Sikorsky already produces aircraft in Mielec in south-eastern Poland, while AgustaWestland is active in Świdnik, eastern Poland, leading to speculation that the companies are frontrunners for the tender.

However, Airbus Helicopters announced in 2013 that it had signed industrial cooperation agreements with Wojskowe Zaklady Lotnicze No. 1, covering the creation of two separate full assembly lines within Poland for the EC725 Caracal and its Makila 2 turboshaft engines.

Speaking to the press at the Farnborough International Airshow in July, Guillaume Faury, CEO of Airbus Helicopters, said Poland's decision to push forward both the utility and attack helicopter tenders represented a chance for the company to expand its footprint in the region.

'This is for us a unique opportunity to accelerate our strategy in Poland,' he explained. 'We see those two tenders as an accelerator, as a catalyst of this move towards Poland as a strategy for Airbus Group.'

The company appears hopeful that the two major helicopter tenders offer a chance to tempt Poland away from its traditional defence and security ties with the US.

'We are entering into this tender with an offer for a product and an industrial approach to Poland which is of a strategic nature,' continued Faury. 'We want to expand the capabilities of Airbus Group in Poland, relying long-term on the Polish industry. We want to bring Poland in the direction of Europe and the Airbus Group in defence… We view this process as an accelerator and a catalyst for Poland to become the fifth Airbus nation.'

PRODUCTION PROCESS

While Airbus is touting its ability to bring a new industrial capability into Poland, Sikorsky points to the fact that having an existing manufacturing base in-country means it can expedite the production process, and begin delivering new airframes to the Polish armed forces sooner.

'The PZL Mielec facility gives Poland a solid footing to quickly meet the requirements of its helicopter tender, because Polish workers at [that] facility can begin producing S-70 Black Hawk helicopters immediately,' Caroline Vandedrinck, Sikorsky's VP for Europe and Central Asia, told *Defence Helicopter*.

Sikorsky's S-70i Black Hawks are already in production in Poland, with 35 aircraft being manufactured at the company's PZL Mielec facility since 2007. (Photo: Julian Herzog)

Deliveries can be commenced early, she explained, because the infrastructure to produce S-70s already exists in Poland. Since acquiring the PZL Mielec facility in 2007, Sikorsky has invested $150 million to upgrade the factory, and hired an additional 800 personnel for a total of 2,200 Polish employees.

'The immediacy of production cannot be stressed highly enough given the security issues happening in Eastern Europe,' continued Vandedrinck. 'PZL Mielec has already produced 35 S-70is – we are the only competitor to have a fully functioning factory producing the aircraft we are offering the Polish Armed Forces.'

HOME ADVANTAGE

AgustaWestland is also staking claim to a home-field advantage, although believes it has the edge over Sikorsky, with a more established manufacturing capability in-country.

> 'The immediacy of production cannot be stressed highly enough given the security issues.'

'PZL-Świdnik is the only Polish OEM with the capabilities to undertake helicopter design, R&D, system integration, manufacturing, support, training and upgrades,' a company spokesman advised *DH* via email.

'The AW149 is the only aircraft taking part in the Polish MoD's multirole helicopter tender with an open architecture software totally owned and controlled by PZL-Świdnik and AgustaWestland. It means that the helicopter's systems can be easily modified and customised according to the Polish Armed Forces' specific needs now and in the future – [these] source codes [offer] operational autonomy.'

POLISH POWER

In addition, the company noted that the extent of the AW149's potential customisation does not depend on any other country's directives on the technology transfer or the current political climate. If the AW149 is selected, the intellectual property of the helicopter's software source codes will be controlled by PZL-Świdnik in Poland.

'This is of special importance, since it ensures a true technology transfer to Poland and provides for the helicopter's safe operation throughout the next 30-40 years,' noted the spokesman.

On 15 July, the company announced the AW149 had been issued with military certification by the Italian Directorate of Air Armaments following successful completion of certification trials.

Speaking to the press during the announcement at Farnborough, Paolo

T129

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TAI

The T129 ATAK is a new generation, two-seat, twin engine Advanced Attack and Tactical Reconnaissance Helicopter designed for demanding "hot and high" environments. Co-developed by TAI (Turkish Aerospace Industries, Inc.) and AgustaWestland around the combat-proven A129CBT, the T129 ATAK accommodates new engines (LHTEC CTS 800-4A), avionics, electro-optics and weapon systems, a modified airframe and uprated drive train and tail rotor. The T129 ATAK, with the best power to weight ratio in its class, has unique survivability features and asymmetric weapon delivery capability. The weapon capabilities include a 20 mm turreted gun with a 500 round capacity, 70 mm unguided rockets, MIZRAK® ATGMs, CIRIT® 70 mm guided rockets and STINGER® missiles for air-to-air purposes. The T129 ATAK was delivered to the Turkish Armed Forces in April 2014.

ATAK TEAM TAI

Tedoldi, head of product marketing at the company, said the recent achievement of the AW149 military certification would make the platform more attractive to Poland.

'The selection of the AW149 built by PZL-Świdnik for the Polish requirement would ensure local production, assembly and through life-cycle support and training, allowing PZL-Świdnik to keep and enhance its long-standing role in the rotorcraft industry, also including export opportunities,' he said.

WIDER INTEROPERABILITY

Along with a domestic content requirement, Poland is looking to ensure its new platforms share as much interoperability with NATO and US forces as possible.

'The US military continues to buy the Black Hawk in large quantities,' said Vandedrinck. 'Sikorsky expects to deliver UH-60M Black Hawks well into the 2020s to the US Army, which will operate the aircraft for 35-40 years – well into the second half of this century. In June 2014, the USAF selected the CRH-60 to replace its 112 CSAR HH-60G Pave Hawks, with initial operational capability expected to be achieved in 2020.

'Because S-70i and S-70B helicopters are in wide use internationally, both aircraft continue to receiving equipment upgrades. The wide knowledge and diversity of equipment integration for other military operators – such as avionics, navigation, weapons and mission systems – will definitely benefit the S-70 fleet of Poland's armed forces.'

AgustaWestland is keen to highlight that PZL-Świdnik is currently the largest producer of aircraft in Poland, employing nearly 3,500 people. The company also has over 1,300 business partners, of which 900 are Polish entities.

'It is important to stress that thanks to PZL-Świdnik's expertise and experience in the rotorcraft sector, the company is able to ensure the broadest "Polonisation" of the product among the bidders within the Polish MoD's tender,' argued AgustaWestland. 'PZL-Świdnik is able not only to assemble the helicopter, but also produce the majority of its parts and perform all kind of modernisation and research activities in the future.

'Additionally, a wide offer of Polonisation of production, based upon an AW149 industrial team will bring Poland important economic benefits – jobs, taxes, revenues to the Polish budget as well as the cutting-edge technology transfer. It will strengthen the entire Polish defence sector, which is considered a crucial element in the Polish national security architecture.'

THE OTHER SIDE

However, Vandedrinck countered: 'Should we win the helicopter tender, Poland's industrial base will benefit from an infusion of investment, as we and our American suppliers look to source many aircraft components from within the country. Among the potential US suppliers that will look to source from Polish companies are General Electric, which manufactures engines for S-70 Black Hawks, and Rockwell Collins, which produces the avionics for the aircraft's digital cockpit.

'Other Sikorsky suppliers have held preliminary talks with Polish companies, [including] Honeywell, Telephonics and United Technologies Aerospace Systems. As Polish suppliers become successful, we

Airbus Helicopters has announced plans to build two assembly lines in Poland for the EC725 Caracal and its Makila 2 turboshaft engines. (Photo: Airbus Helicopters)

can then begin to source parts from Poland for other aircraft programmes.'

Poland's modernisation effort also includes the 'Kruk' (Raven) programme to purchase 32 attack helicopters to replace the country's ageing Mil Mi-24D/W 'Hind-D/Es'. This has been moved forward by two years, triggered by the outbreak of civil war in eastern Ukraine.

The programme was originally supposed to launch a tender in 2018, with deliveries beginning in 2020. However, the deadline has now been moved up to 2015, with the initial order of 32 helicopters likely to increase to 40.

In August, the Polish MoD announced it was considering bids from ten manufacturers of modern combat-ready helicopters, in an 'accelerated procedure'.

According to a statement, the bidding process is set to involve both foreign and domestic companies offering production-ready helicopters, as well as components for assembly.

While it is unclear how there could be ten companies competing for the requirement, industry analysts are speculating that the Boeing Apache AH-64E, the Airbus Helicopters EC665 Tiger, and the AgustaWestland/Turkish Aerospace Industries T129 ATAK are likely to be the main platforms under consideration.

AgustaWestland and Sikorsky acknowledged the possibility they would compete for Poland's attack helicopter tender, although both declined to offer further comment until more details of the requirement were released.

WESTERN DEVELOPMENT

With Russian aggression in the region showing no signs of abating, Poland has made no secret of its desire to see the development of NATO and US infrastructure, as well as an increasing military presence of both the US and NATO forces, within its borders.

The Russia-Ukraine crisis and its impact on the security of Poland and other Eastern European states, including Estonia, Latvia and Lithuania, is set to be addressed at the upcoming NATO summit, scheduled to be held in Wales on 4-5 September.

In a written invitation to NATO's 28 leaders ahead of the summit, UK Prime Minister David Cameron advocated a series of measures to be implemented in Eastern Europe, including a schedule of joint exercises, the establishment of new military infrastructure, pre-positioning of equipment and supplies, and enhancing the regions NATO Response Force of up to 25,000 troops.

'We should agree how we can sustain a robust presence in Eastern Europe, consistent with the NATO Russia Founding Act, to make clear to Russia that neither NATO nor its members will be intimidated,' he stated.

Meanwhile, Poland's desire to maintain a robust security relationship with the US must also be balanced against the country's equally pressing goals of seeking closer economic and political ties with other EU nations, which will likely play out in the context of its military modernisation contracts. *DH*

The Merlin Life Sustainment Programme will see ex-RAF battlefield support helicopters re-roled and 'ship-optimised' to meet the littoral manoeuvre needs of the Commando Helicopter Force. **Richard Scott** and **Patrick Allen** report on progress to date.

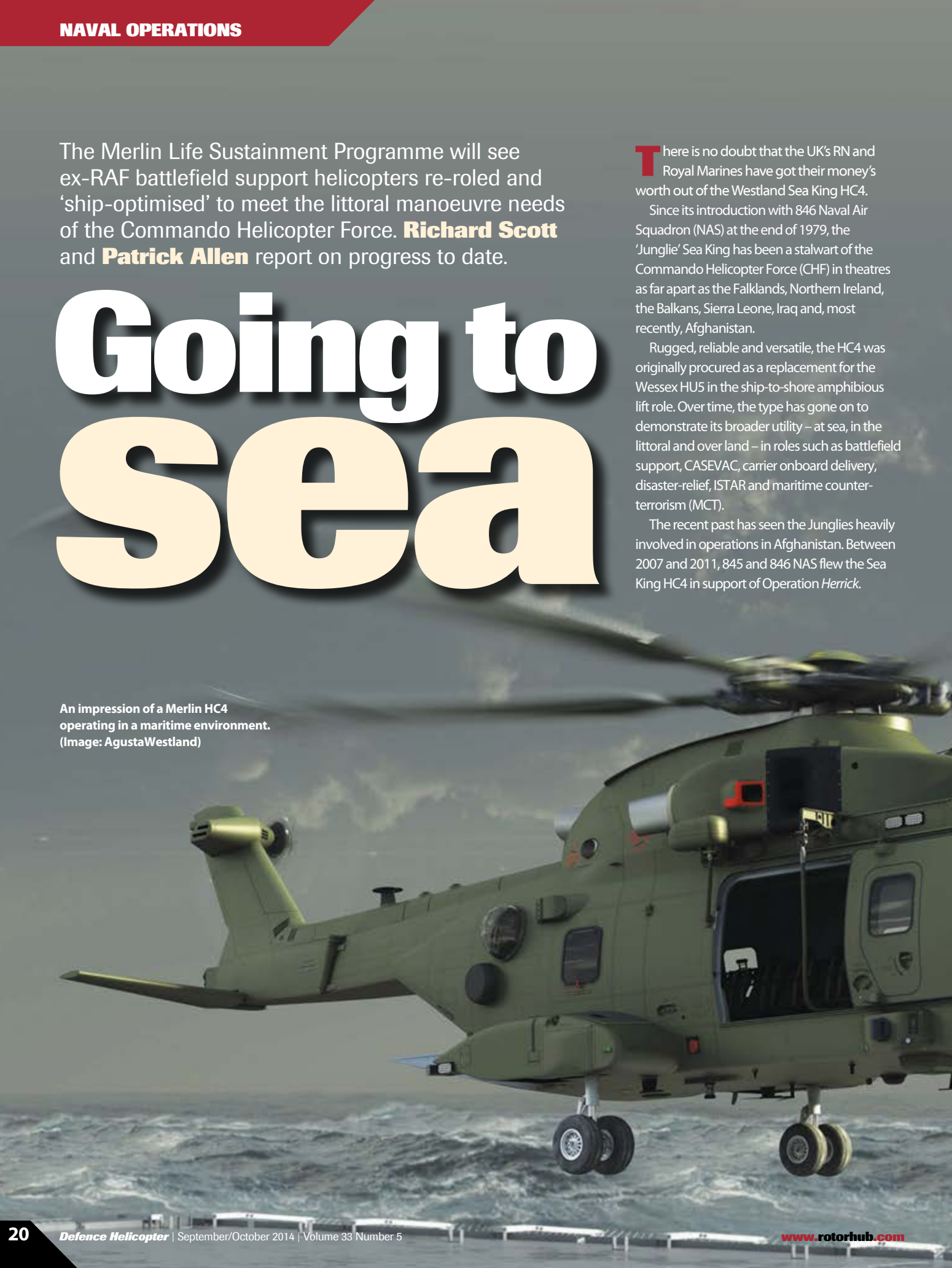
Going to sea

There is no doubt that the UK's RN and Royal Marines have got their money's worth out of the Westland Sea King HC4.

Since its introduction with 846 Naval Air Squadron (NAS) at the end of 1979, the 'Junglie' Sea King has been a stalwart of the Commando Helicopter Force (CHF) in theatres as far apart as the Falklands, Northern Ireland, the Balkans, Sierra Leone, Iraq and, most recently, Afghanistan.

Rugged, reliable and versatile, the HC4 was originally procured as a replacement for the Wessex HU5 in the ship-to-shore amphibious lift role. Over time, the type has gone on to demonstrate its broader utility – at sea, in the littoral and over land – in roles such as battlefield support, CASEVAC, carrier onboard delivery, disaster-relief, ISTAR and maritime counter-terrorism (MCT).

The recent past has seen the Junglies heavily involved in operations in Afghanistan. Between 2007 and 2011, 845 and 846 NAS flew the Sea King HC4 in support of Operation *Herrick*.



An impression of a Merlin HC4 operating in a maritime environment. (Image: AgustaWestland)

To meet the challenging operational environment of the Helmand badlands, the Junglie Sea King was upgraded to HC4+ standard. This saw the introduction of new Carson rotor blades, an improved defensive aids suite (DAS) and display NVGs to allow the crew to fly at any time, day or night, and in all weather conditions.

Aircraft in the *Herrick* theatre frequently came under small arms fire. One Sea King HC4, ZA298, famously survived an RPG strike just behind the cockpit, and was subsequently returned to service after extensive repairs in the UK.

However time is fast catching up with the type, which will retire from service at the end of March 2016 – hence the need for a new 'Junglie'.

REPLACEMENT SEARCH

The somewhat convoluted search for a replacement rotorcraft has been under way for some time. Going back to the late 1990s, Staff Target (Air) 6845 was drafted for a Future Amphibious Support Helicopter (FASH). Early feasibility studies examined a 'minimum adaptation, off-the-shelf' solution.

FASH was subsequently amalgamated with the Future Support Rotorcraft project to create the Support Amphibious and Battlefield Rotorcraft (SABR). Conceived as a common solution to replace the HC4, as well as the RAF's Sea King HAR3 SAR variant and Puma HC1 fleet, SABR was expected to fill the UK's rotary-wing medium-lift gap from about 2009.

Potential SABR candidates included the V-22 Osprey, CH-47 Chinook, EH101 Merlin, NH90 and S-92. However, the programme struggled to gain the necessary momentum within the procurement community as funding for rotary lift was cut back. The resulting shortfall in support helicopters across the UK armed forces was later to come to prominence during the Iraq and Afghanistan campaigns.

More studies followed, with the Future Rotorcraft Capability programme created in July 2004 to identify a strategy that maximised the capability that could be delivered from available funding. SABR morphed into the Future Medium Helicopter (FMH), with the aim of consolidating the legacy Sea King HC4 and Puma fleets into one common type with battlefield and maritime variants.

However, the FMH plan fell by the wayside as a result of the MoD's Future Rotary Wing Strategy, announced to Parliament in December 2009.

Established as the overarching template for the rationalisation and recapitalisation of the UK helicopter force, the strategy set out plans to bring forward retirement of the Sea King fleet, outsource peacetime SAR and buy additional Chinook helicopters. It also outlined an intention to transfer existing Merlin HC3/3A battlefield support helicopters to CHF and modify these aircraft 'to enable them to operate effectively from amphibious shipping as well as continuing to contribute to… battlefield lift requirements'.

The 2010 Strategic Defence and Security Review (SDSR) reiterated that the Merlin force would be upgraded to enhance its ability to support amphibious lift operations. In SDSR's wake, the Defence Rotary Wing Capability Study was commissioned by the MoD to review rotary-wing requirements for the land, sea and air environments. Its conclusions, announced in April 2012, reaffirmed plans to transfer the RAF's Merlin HC3/3A fleet to CHF.

TRANSFER WINDOW

A total of 25 'green' Merlins (comprising 19 HC3 variants and six HC3As) are to be transferred to CHF and put through the Merlin Life Sustainment Programme (MLSP).

This two-phase upgrade will optimise the aircraft for ship operations, including the fitting of folding tails and rotor heads, and at the same time engineer greater commonality with the Merlin HM2 already in naval service.

In December 2013, AgustaWestland was awarded a £330 million ($553 million) demonstration and manufacture contract by the MoD to deliver the MLSP. An initial seven interim Phase 1 aircraft wil be delivered to the RN from late 2015, while under Phase 2, all 25 Merlins will be brought up to a final HC4/4A standard for delivery between 2017 and 2020.

According to Cdre Andy Lison, head of Helicopters 1 in Defence Equipment & Support (DE&S), bringing the 'green' Merlins under naval ownership addresses the requirement to sustain amphibious rotary lift following the retirement of the Sea King HC4, and also offsets the reduction in MCT capability attendent on the demise of the type.

'However, we need to do some work on these Merlins,' he said. 'They are facing significant avionics obsolescence, so we are exploiting our previous investment in the Merlin Mk 2 glass cockpit. We are also introducing a range of modifications to better equip the aircraft for ship operations. That includes, as part of the full programme, the introduction of automatic main rotor head fold, and the replacement of the rear fuselage to incorporate a tail fold hinge and

Having served with the RAF in Iraq and Afghanistan, the Merlin HC3/HC3A fleet will now transfer across to CHF. (Photo: Patrick Allen)

actuators. The powered tail fold is something brought across from the international AW101 programme. But note that this is ship optimisation and not marinisation.'

For Capt Niall Griffin, commanding officer CHF, the MLSP secures the future of commando aviation. 'The programme not only provides us with ship optimisation with main rotor and tail fold, but more importantly a life sustainment package to solve Mk 3/3A obsolescence issues,' he said (for more, see p40).

'It will also provide us with an avionics upgrade to include a glass cockpit common with the Merlin HM2, and similar to that in the Wildcat. This will see CHF with the Merlin Mk 4/4As having a full operational capability out to 2030.'

TRAINING UP

CHF crew training on Merlin began at RAF Benson in 2010, although the main body of naval manpower ramped up from February 2012.

'Today, we have over 380 personnel up at RAF Benson ready to transfer across to RNAS Yeovilton starting early next year,' Griffin told *Defence Helicopter*. 'We now have an entire CHF/navy conversion flight led by a navy lieutenant commander and RN qualified helicopter instructors… we are putting through eight pilots and eight aircrewmen on each Merlin course at Benson, and plan on moving this training down to Yeovilton some time in 2015.'

The formal handover of the RAF Merlin Force to CHF will take place at Benson on 30 September.

'RAF No 78 Squadron based at [Benson] is now almost entirely naval, and the squadron is ready to transfer across to CHF as 846 [NAS],' explained Griffin. 'A number of RAF personnel, however, will remain on the Merlin Force to allow CHF to benefit from the experience of RAF crews who have operated the aircraft for over ten years, whilst also helping with the transition phase.'

846 NAS, operating six Merlin HC3s, will return to Yeovilton in April 2015. In the meantime, seven RAF Merlin HC3s will be handed back to AgustaWestland to receive MLSP Phase 1 modifications in order to provide an initial embarked capability.

The first HC3 aircraft to receive the Phase 1 embodiment will arrive at AgustaWestland's Yeovil plant in October this year.

These interim machines will feature several changes for maritime operations, including the addition of lashing points, a manual-fold main rotor head, an I-band transponder, fast-roping provision, undercarriage modifications, a flotation system and additional communications equipment for the MCT role.

The first modified example is due to be delivered to CHF in September 2015, with all seven required by the start of April 2016 for initial operating capability (IOC).

'Designated as Merlin iMk 3s, these aircraft will bridge the operational capability gap between the retirement of the Sea King at the end of March 2016 and the arrival of the first Merlin HC4 in September 2017,' according to Griffin. These interim 'Junglies' will initially be operated by 846 NAS, releasing their 'standard' HC3s to be cycled through the full upgrade programme.

The CHF's stalwart Sea King HC4 will retire in March 2016. (Photo: Patrick Allen)

CHANGING OVER

As the CHF Merlin force builds up, the Sea King HC4 fleet will draw down over the next 18 months.

'We plan to operate between ten and 15 Mk 4s until their out-of-service date,' Griffin said. 'Although these numbers will reduce as aircraft retire and crews are released into the Merlin training pipeline.'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'During 2015, 845 [NAS] will go into abeyance and hand over their Sea Kings to [a reformed] 848 [NAS] which will operate the remaining nine aircraft until the March 2016 out-of-service date. 848 will then disband.'

This will allow 845 NAS to take over from the RAF's 28 (AC) Squadron at Benson in August 2015 as the second CHF Merlin squadron, operating the HC3/3A, Griffin said. 'During the transition process we will be operating Merlin variants at both Benson [845 NAS] and Yeovilton [846 NAS]. 845 will then move down to Yeovilton in summer 2016 to join 846. This will complete the transition of the Merlin Force.'

Phase 2 aircraft – receiving the HC4/4A designation – will be fully optimised and cleared for ship operations at 15,600kg maximum all-up weight (an increase on the 14,600kg maximum in RAF service).

This programme, including conversion of the seven interim Merlins, will bring the legacy HC3/3A aircraft up to an almost identical standard, enabling both variants to operate within either of the two frontline squadrons.

A key part of the MLSP ship optimisation is the introduction of main rotor head fold motors, the associated fold management unit and the automatic tail fold. Accordingly, the aircraft mission management computer will be modified to include the head and tail fold capability.

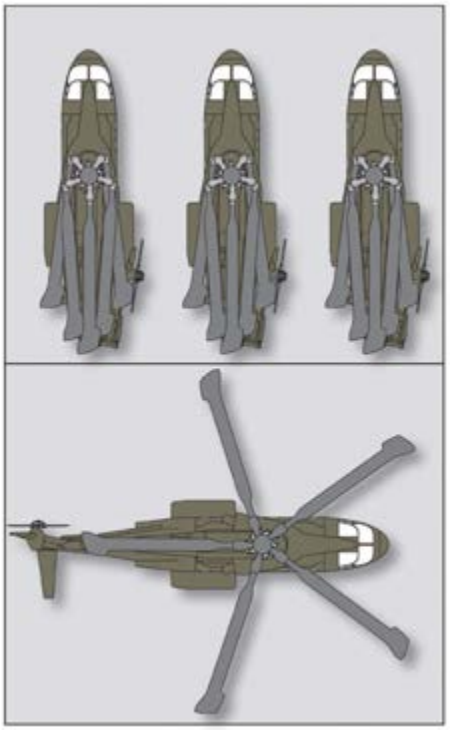
The HC4/4A aircraft will also be fitted with the same cockpit as the Merlin HM2. This will endow the 'grey' and 'green' fleets with an essentially common flight deck, featuring five 10x8in integrated display units, two touchscreen units for controlling the aircraft's systems and mission equipment, and two cursor control devices for the tactical displays.

Griffin added: 'It is hoped that the Merlin Mk 4 will benefit from… some form of modification, yet to be decided, to assist with landing in a degraded visual environment.'

TECHNICAL DETAILS

Avionics changes include a new tactical processor (common to that in the Wildcat) and a digital map display. Bowman radios will be fitted, and provision made for a FLIR Systems STAR Safire III EO/IR turret. Merlins at HC4/4A standard will also be equipped with display NVGs and a fully integrated DAS.

DH understands that retrospective integration of current standalone aircraft survivability



One major modification is the introduction of a folding tail and main rotor head. (Image: AgustaWestland)

equipment is planned, introducing an integrated DAS controller and display. Selex ES is expected to implement the new DAS controller in a manner akin to the Project Baker upgrade for the RAF's Chinook fleet.

In the main cabin, a common troop seat (based on a modification of the current HC3 seat) will be fitted to both the HC4 and HC4A. Accommodation will be made for standard lift of up to 25 troops, and a change package will be embodied to allow for common egress procedures from either variant.

The 'green' Merlins will likely end up in the same grey finish as already adorns the HM2. However, it is an aspiration, said Griffin, that they 'will be painted in the same [two-tone] scheme as the army's Wildcat Mk 1'.

AgustaWestland will receive the first MLSP aircraft for Phase 2 modification in July 2015. Flight testing is scheduled to start in August 2016, with initial release to service planned for late 2017.

CHF expects the first Merlin HC4 to arrive in September 2017 – 845 NAS will be the first unit to receive this model, with IOC planned for mid-2018.

The six HC3A aircraft will be last into the upgrade pipeline from 2018. Full operating capability (FOC) will be achieved in December 2020 with the delivery of the 25th and final aircraft. 845 and 846 NAS will then each operate ten Merlin HC4s, with five retained in the maintenance fleet.

'Each squadron will operate three flights,' Griffin elaborated. '845 will have three deployable go-anywhere flights; each flight would probably deploy with four Merlins depending on the mission, or as an entire squadron. 846 will have the operational conversion flight, maritime security flight and a deployable flight to bolster 845 if required.'

SUPPORT SERVICES

Under the demonstration and manufacture contract, AgustaWestland will also manage a competition to deliver synthetic whole-crew training equipment and infrastructure for the HC4/4A. This will build on its experience of Merlin training and delivery of the training infrastructure for the Wildcat programme.

Seperately, Qinetiq has been awarded a five-year contract, worth £16 million, to provide test and evaluation services to the MoD in support of the MLSP. In this role, the company will work closely with AgustaWestland and the DE&S Merlin project team, providing independent technical and safety advice, as well as testing and support for the certification to IOC and FOC for both phases.

As part of the contract, Qinetiq will provide recommendations for release to service to ensure that the aircraft can be operated safely in its broad operational environment, including from RN ships.

Vessels to be cleared to operate CHF Merlins include the helicopter carrier (LPH) HMS *Ocean*, assault ships HMS *Albion* and *Bulwark*, the *Bay*-class landing dock ships (auxiliary) and the two new *Queen Elizabeth*-class (QEC) aircraft carriers.

In the latter case, studies are under way to examine the maximum size rotary-wing air group that could be operated from the ships as part of wider work to inform design and layout changes necessary to broaden platform utility under the Carrier Enabled Power Projection (CEPP) concept. In particular, CEPP requires that the QEC design should be able to re-role as an LPH in support of littoral manoeuvre operations.

DH understands that studies have concluded that the QEC flight deck, initially marked up for six deck landing spots, could safely accommodate ten Merlin HC4/4As. This would allow for a company-sized air assault in a single group lift. **DH**

Photo by: Sgt. Eric S. Wilterdink

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Airbus Helicopters has selected the Thales Scorpion as a standard option for all its armed aircraft, whether new-build or upgraded machines. (Photo: Airbus Helicopters)

Typically a more cost-effective route than new airframe acquisitions, militaries often look to the upgrade market to boost their fleet's capabilities. **Peter Donaldson** examines the helmet-mounted displays, night vision devices and autonomous add-ons available within the rotorcraft sector.

Tiered approach

Reductions in military spending typically transfer investment emphasis onto upgrades and the sustainment of existing fleets, as new procurements face potential delays or cancellations.

Visiongain's latest forecast released in June predicted that the value of the military helicopter modernisation, upgrade and retrofit market will reach $5.04 billion in 2014. Two important themes are evident in the types of upgrades that operators are, or possibly ought to be, looking for: situational awareness in the low-level environment; and compatibility with civil air traffic management.

Ex-USAF H-1 and H-53 pilot and former CV-22 chief engineer Eric Braganca recently recommended that the US military helicopter fleet receives upgrades with mature or near-term technologies centred on situation awareness and automated flight control. These are all technologies he believes are needed to make operations safer in the light of the 420 or so crashes and more than 630 deaths on missions since the beginning of the US military's involvement in Afghanistan in 2001.

SINGLE APPROACH

Without naming any particular products, he called for synthesis of aircraft state information onto a single display that shows a moving map in the cruise and switches to low-speed symbology in the landing phase. The key is presenting information in one place, rather than dispersed around the cockpit. In the realm of automated flight controls, he picked out automatic landing capability, including the ability to land on ships at sea with the assistance of a data link feeding ship motion information to the aircraft's control system. While the first two are mature technologies, the third – real-time visual display of the environment despite degraded visibility and with integrated obstacle avoidance symbology – is less so.

None of these types of technology will be unfamiliar to readers, as developments in them have been covered in these pages and elsewhere extensively over many years. There are also several helicopters, admittedly high-end types, in service today with synthesised aircraft state symbology and moving map displays that automatically reconfigure themselves to suit the flight regime. Just about every avionics company involved with helicopters offers a system that does this or something similar. The upgrade in safety that they can deliver hangs on much wider acceptance and application.

Braganca's invocation of this adaptive display implies a head-down device, as maps are rarely shown on head-up or helmet-mounted displays (HMDs) in aviation – although it is sometimes done with systems designed for ground soldiers.

This is likely to be a tacit recognition that HMDs are still regarded as exotic and expensive, and are therefore likely to find it difficult to make headway in the current budgetary climate. This is despite the fact they remain the best way to display aircraft state information, guidance symbology, obstacles and a clear horizon to a pilot, particularly in a degraded visual environment. The fact that US aircraft equipped with them – such as the Apache – have a lower accident rate than those that do not means they are likely to save money as well as lives in the long run.

However, cluttering up a pilot's visual field with too much information can be as bad as not showing enough, so the combination of an HMD with a well thought-out set of screens offers the best kind of solution yet devised.

Addressing the cost issue is critical to the wider acceptance of such technology in the military helicopter market and upgrade segment in particular, something that rivals BAE Systems, Elbit and Thales clearly recognise.

SHOW SELECTION

At the Farnborough International Airshow in July, Thales made clear its two-tier approach to the market with the familiar TopOwl helmet at the highest level, which is in service in the Tiger, NH90 and AH-1Z, among other aircraft; and the new Scorpion representing the less expensive lower level, which Thales secured with its acquisition of the Visionix HMD and InterSense motion tracking businesses from Gentex in February 2013. At the show, the company announced that Airbus Helicopters had selected Scorpion as a standard option for all its armed aircraft, whether new-build or upgraded machines.

'We are delivering a complete range of avionics for helicopters, particularly for eyes-out functionality,' Yves Joannic, VP and managing director for helicopter avionics at Thales Avionics, said at the show. 'We now have a full range of products. The TopOwl addresses helicopters performing very complicated missions with many operational needs and which are very big assets, such as the NH90 and combat helicopters like Tiger, Apache, Cobra, T129 Mangusta etc. The Scorpion is more dedicated to the utility helicopter.'

This includes civil or parapublic aircraft and weaponised commercial helicopters, he noted. 'So we have two complementary products addressing the whole market.'

Scorpion was selected 'following a full and open competition with all of the major HMD manufacturers', explained Fred White, VP of business development at Thales Visionix. Although first applied to Gentex helmets in several fixed-wing applications, including F-16s and A-10s, Scorpion is both helmet- and aircraft-agnostic. 'Scorpion is the only HMD out there that can address both fixed-wing and rotary-wing with the same modules,' he continued.

MINIMAL IMPACT

Using optical waveguide technology – different from the holographic approach used in rival BAE Systems' QSight – Scorpion provides full 24-bit colour. One aspect that makes it particularly suited to upgrades is its minimal impact on the cockpit, which is a result of its hybrid inertial and optical tracking systems.

White explained: 'This system runs 100% on inertial and is periodically calibrated by the optical system. All the tracking elements are retained on the helmet, so there is no intrusion into the cockpit other than a small number of these bar codes.'

He added that the reflective bar codes can be put anywhere on the canopy or cockpit structure and do not need to be placed with precision, and they also reflect light from elements on the helmet at wavelengths that are compatible with NVGs. 'Once the system recognises where they are, it remembers where they are and its position relative to them,' he said.

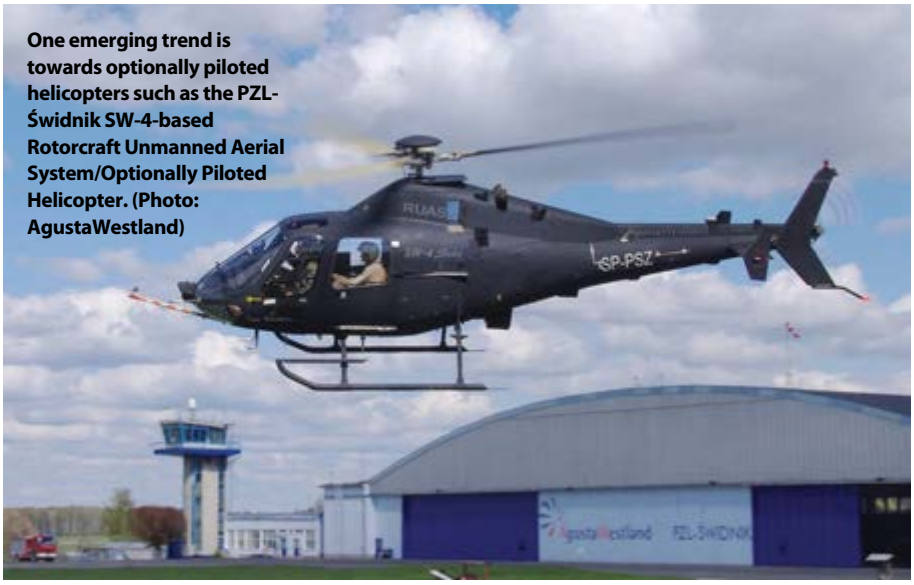
While Thales led the launches for low-end HMDs, BAE Systems announced what is very much a high-end system in the form of its Striker II, a fully digital platform-agnostic helmet for both fixed- and rotary-wing aircraft, although the emphasis was on fighter applications at the show.

No decisions have yet been announced about the Capability Sustainment Programme (CSP) for the Apache and none are expected before the UK's 2015 general election, but an upgrade to the British Army's attack helicopter fleet would seem to offer an important opportunity for the new HMD. The big changes introduced in Striker II include a new integrated digital night vision device and a hybrid optical-inertial head tracking system.

PERFORMANCE UPGRADES

The night vision camera incorporates an Intevac Silicon Imaging Engine 11 imager, which is based on the company's electron-bombarded active pixel sensor (EBAPS) technology. BAE Systems said that this sensor brings the Striker II's night vision performance up to a level 'equal to or better than HMDs using current NVGs', while also saving weight. EBAPS is a combined metal oxide silicon (CMOS) semiconductor imaging technology.

According to the company, the optical-inertial head tracker eliminates any delay in where the pilot is looking and can therefore 'perfectly position' the symbology on the visor. Like the original Striker, the new helmet has an array of LEDs tracked by a camera in the cockpit, making its integration into an existing cockpit a more involved procedure than would be the case with



One emerging trend is towards optionally piloted helicopters such as the PZL-Świdnik SW-4-based Rotorcraft Unmanned Aerial System/Optionally Piloted Helicopter. (Photo: AgustaWestland)

In July, BAE Systems announced the Striker II, a fully digital platform-agnostic helmet for both fixed- and rotary-wing aircraft. (Photo: BAE Systems)

Thales's Scorpion. With the optical and inertial systems working together all the time, rather than the former calibrating the latter at intervals, however, its performance is likely to be higher.

Introducing the new helmet, Typhoon chief test pilot Mark Bowman emphasised its low levels of latency and jitter, which he said enhances overall combat capability.

ROBOTIC ASSISTANCE

The automated flight control technology is coming from unmanned vehicle endeavours and is manifesting itself in optionally piloted helicopter programmes from the major airframers.

Sikorsky in particular is strongly focused on automation of flight controls, with its optionally piloted aircraft programmes, while on 15 July AgustaWestland announced that it had finished a demonstration of the optionally piloted PZL-Świdnik SW-4 for the Italian MoD. The Rotorcraft Unmanned Aerial System/Optionally Piloted Helicopter (RUAS/OPH) went through a series of trials to evaluate the technology and its potential benefits for the country's armed forces.

Undertaken in Italy and Poland, the development and flight trials took place between September 2013 and May 2014, with final flight tests in Frosinone, Italy. The aircraft flew in OPH configuration with a safety pilot aboard. The tests involved hands-off and remote-controlled manoeuvres, hovering and a range of mission profiles.

AgustaWestland anticipates that in RUAS configuration the aircraft will be used for the kind of roles that the US Navy has explored with the Northrop Grumman/Schweizer/Sikorsky Fire Scout and Lockheed Martin/Kaman K-Max UAS, including ISR and cargo resupply. With a pilot on board, the company talks of the OPH carrying out personnel transport, surveillance and intervention missions. As the OPV capability comes in kit form, the potential to offer the capability as an upgrade to other aircraft in the range is clear.

When Airbus Helicopters (then Eurocopter) announced completion of its own OPV demonstration programme in April 2013, which used an EC145, it said that it was 'positioned to pursue OPV flight capabilities' for the rest of its product line.

According to the company, the OPV concept enables a traditional helicopter to be flown with a pilot on board as well as be remotely operated by a ground control station, providing a cost-effective solution for both manned and unmanned missions. The system also allows a helicopter to be flown by a pilot in a national airspace and in an unmanned way in segregated airspace

'The main challenge for Airbus Helicopters' OPV products is the absence of a regulatory framework.'

'Airbus Helicopters is now pursuing a dialogue with potential customers to better understand their needs considering the mission applications of the different platforms,' said Tomasz Krysinski, head of innovation at Airbus Helicopters.

'The main challenge for Airbus Helicopters' OPV products is the absence of a regulatory framework. The realisation timeframes for OPV products depend on the requirements and the budgets of the operators for the different military missions, as well as on the timeline for a regulatory framework, which is still under construction.'

BETTER COMMS

Another important theme in military helicopter upgrades is compatibility with International Civil Aviation Organisation (ICAO) and EASA rules governing communication, navigation and surveillance. Airbus Helicopters is in the process of upgrading the French Army's AS555 Fennecs to ICAO standards.

Meanwhile, Raytheon emphasises that conformity with US government data security requirements as well as the ability to work seamlessly with legacy communications systems in a major upgrade to the US Army's helicopter fleet will enable wider and more secure data sharing among thousands of Chinooks, Apaches and Black Hawks and high-capacity satellite communications (SATCOM).

On 13 July, the company announced the successful software demonstration of the RT-1987, the newest member of the Skyfire family, with multiple flight management systems, which control the radio and provide the crew with status updates. The event took place at the army's Redstone Arsenal Engineering Lab in Huntsville, Alabama.

The RT-1987 Skyfire software-defined radio retains all its predecessor's capabilities and adds new cryptography and 'seamless' support of the Mobile User Objective System (MUOS) SATCOM network. It has also shown the ability to run the Soldier Radio Waveform, one of many additional capabilities enabled by its implementation of the software communications architecture, the principal legacy of the Joint Tactical Radio System.

Tough budgetary environments force operators to prioritise their investments carefully, and while HMDs and autonomous take-off and landing capabilities in particular might seem exotic, a convincing case could be made that they will pay for themselves in airframes – and lives – saved. ***DH***

Italian accents

The latest Italian version of the AW129 Mangusta, the AH-129D, features a number of improvements over the earlier iterations. **Davide Davario** visited the 5th Army Aviation Regiment at Casarsa della Delizia to find out more.

Another step towards the modernisation of the rotary-wing component of the Italian Army Aviation (AVES) is now under way, following delivery of its first six AH-129Ds. The new helicopters are stationed at Casarsa della Delizia in Pordenone, a small town located in Northeast Italy, near Aviano AFB and 5th Army Aviation Regiment 'Rigel' HQ.

In total, the AVES will receive 32 upgraded helicopters by 2016, retrofitting part of the 60 AH-129Cs currently operative, while a dozen will be withdrawn, keeping in line 48 rotorcraft.

The service has already achieved full operational capability with the UH-90A (and sent the aircraft to participate in operations in Afghanistan) and seen the introduction of the new version of the CH-47F Chinook, allowing the withdrawal of the 40-year-old CH-47C.

The development of the new AH-129D (G19 according to the naming adopted by AgustaWestland) took three years, and the result is a modern helicopter that has apparently exceeded the expectations of both military leaders and pilots.

KEY INTEGRATIONS

A key component was the integration of the Rafael Spike-ER wire-guided missile, which is capable of engaging targets at distances up to 8km. The weapon is equipped with switchable IR and EO seekers, and images can be displayed on the multi-function colour display (MFCD) in the cockpit through a fibre-optic cable. As a result, the gunner can correct the trajectory in real time, increasing accuracy and reducing collateral damage, or abort the attack to avoid, for example, blue-on-blue incidents.

In total, Italian Army Aviation will receive 32 upgraded AH-129D attack helicopters by 2016. (All photos: author)

The operator can either select 'fire-and-forget' mode, cutting off the communication cables to let the missile reach the previously acquired target, or 'fire-and-steer' mode, where the missile can be fired without having previously identified the location of the target – the typical example is a shot from behind a hill.

In addition to the trainer version, with no motor and warhead installed, the AVES has purchased two types of missile: the HEAT (high-explosive anti-tank) warhead with a shaped charge, used to pierce the armour of tanks and vehicles; and the PBF (penetration, blast and fragmentation), with reduced collateral damage, as the explosion occurs when the charge has already penetrated the target.

The firing tests performed during the development phase were positive – of the 11 missiles fired (including six dummy and five live), all succeeded. Even the recent validation campaign for units being deployed to Afghanistan, conducted at Capo Teulada firing range in Sardinia, saw the participation of four AH-129Ds that launched six missiles, all of which hit their targets.

The introduction of a fourth-generation missile has led to the replacement of the targeting pod and avionics management system.

A key component of the upgrade was the integration of the Rafael Spike-ER wire-guided missile and Toplite optronics system.

TOP LEVEL

The Rafael Toplite was chosen for the optronics system – the turret used for the search and identification of targets, slaved to the weapon system – which provides a technological boost over the old HeliTOW. Pilots who have flown the new helicopter have reportedly been 'amazed' at being able to see up to 15-20km, while retaining levels of detail.

The system has an optical zoom in EO mode, selectable up to a factor of 27x, while the FLIR zoom is made using interposition of lenses. It is also equipped with two digital zooms (2x and 4x) which increase the optical magnification. The visibility range now reaches 20km from the point of observation, making it possible to identify a target much further away than before.

Images acquired are then presented on the HD MFCD, through which missiles and system settings can be configured through menus and soft keys. The display replaces the pipe sight system of the HeliTOW, which was installed in the AH-129C's co-pilot/gunner cockpit (the front seat of the tandem configuration).

The cockpit is also now much more ergonomic – the co-pilot works 'head-up', providing greater support to the pilot, increasing situation awareness and maintaining better control of what is going on.

The sight unit allows the dynamic lock-on of targets, and ensures autonomous tracking of the moving target, keeping the turret aligned to it while manoeuvring the helicopter, without operator intervention.

In this mode, the system does not store the co-ordinates of the target, but instead analyses the contrast of digital images acquired by optical sensors to 'understand' in which direction the turret should be repositioned – a target that delivers a good contrast with respect to the environment is therefore almost impossible to be lost.

Otherwise, if the turret is slaved to a well-defined point on the ground – inserted via geographical co-ordinates though the MFCD or acquired in response to a laser-designation (calculated from the GPS location of the helicopter as well as slant, azimuth and elevation data) – the system stores the position of the target, so it is easier to go back to the last known position in the event of loss of contact.

LASER TECHNOLOGY

In addition to the optronics sensors, the turret is equipped with a laser designator, marker, spot detector-tracker and rangefinder.

The designator is used to assign a target for the laser-guided weapons, such as LGB bombs dropped from a fixed-wing carrier. The operation is identical to that used by special forces, but in this case it is not necessary to have a ground presence to proceed with the attack.

The marker and the spot detector tracker work in pairs – the former is used to 'mark' the target, while the latter acquires the one marked by another helicopter or operators on the ground, allowing easier surveillance during combined action.

The usefulness of this pairing is emphasised when the area of operations has few or no landmarks, as in desert areas. This mode is also useful to reduce radio transmissions on the battlefield.

The turret can be slaved to the helmet of the pilot or co-pilot, so that the image projected on the MFCD will correspond to the point where they are looking or searching for the target.

Similarly, it is possible to enslave the armament (both the gun and the Spike) to the turret, enabling the engagement of a target in a short space of time. Taking advantage of

the high zoom factor, the shots fired from the gun will be more precise and help avoid collateral damage.

Due to the FLIR, it is also possible to shoot at night, with a much greater precision than the C model. 'We had some difficulty at night before, but now there are no problems in this regard. Indeed, sometimes we can see better by night than during the day,' one pilot explained.

Further, the Integrated Self Protection System (SIAP), which also equips other AVES helicopters, has been improved.

GRAND PLANS

The development of a mission planning system ground station is also in progress, with the intended capabilities of planning a flight path with waypoints, having a database of threats that will likely be encountered during the mission, as well as planning radio frequencies during the briefing ready to be tuned.

Passive protection is provided by ballistic plates mounted on the side of crew seats, which slide forward in order to provide protection from lateral shots, by front armoured glass and by armoured seats, which can withstand 7.62mm ammunition.

The standard weapons load during operations in a theatre such as Afghanistan will be constituted by a 20mm gun and 2/4 Spike missiles. There are also configurations with external wing tanks, which extend the range at the expense of weapons, helpful in the hot-and-high operating conditions of Afghanistan.

In order to maintain a balance between weapons and operational range, the helicopter may need to be refuelled at a forward area refuelling point during an armed escort mission, for example.

ADVANCED TRAINING

Currently, the AH-129 has the most advanced helicopter training procedures inside the AVES, as it is equipped with all the necessary teaching aids for both the instruction and preparation of crews and specialists.

Pilots have reportedly been amazed at the capability to acquire EO or FLIR images at distances up to 20km in all weather conditions.

Transition of crews to the Delta model requires around 15 days, during which they carry out theoretical courses, practise on the simulator and undertake flight operations. To date, about 50 pilots have been qualified on the new helicopter.

The course is run at the Crew Formation Centre (Centro Formazione Equipaggi (CFE)) at Casarsa, where a static tactical simulator is installed. AgustaWestland is completing the delivery of containerised simulators that can be brought to the operational area on board a cargo aircraft. A

total of three have been acquired, distributed to Casarsa, Rimini and Viterbo bases.

These simulators, which reproduce the cockpit of the co-pilot/gunner both in terms of avionics equipment and instrumentation sensitivity, provide a 3D battlefield model that includes areas of Switzerland and Afghanistan. Using these, the crews can practice and become familiar with the new system, relieving the burden on the fleet's flying hours.

The CFE is currently used by all pilots and specialists of the AVES, so the personnel of 5th Army Aviation Regiment and 7th Army Aviation Regiment, as well as those coming from the Crew Training Centre (Centro Addestramento Equipaggi (CAE)) based at Viterbo, are sent to Casarsa.

The CAE is responsible for the basic training of pilots and co-pilot/gunners through a course of six to seven months common to both roles.

The centre has a full flight simulator, updated in 2003-2005 to the G15 version of the helicopter (corresponding to the AH-129C). This has not been changed to the Delta model because there are no differences between the two versions of the simulator. Meanwhile, pilots with more experience team up with instructors to develop new doctrines of use for the weapon system.

FINAL THOUGHTS

According to its crews, the overall impression of the AH-129D's capabilities is positive, especially when compared to the old IR NV system, integrated helmet and display sighting system and HeliTOW.

Pilots describe the aircraft as a significant generational shift due to its capability to acquire EO or FLIR images at distances up to 20km, identify targets in all weather conditions and acquire a target autonomously with the laser spot detector. All these provide a reduced workload, while increasing safety for the helicopter and crew.

'The new system allows us to be safe, at high altitude, and observe from a distance that is not even comparable to the Charlie. The EO pod allows us to acquire the target in greater safety,' one pilot explained.

Despite the AH-129D's recent introduction in service, sources at AVES Command suggest there are expectations of a possible operational deployment by the end of the year.

It is expected the AVES will send an as yet unspecified number of helicopters to replace some of the ten AH-129Cs currently under the command of ISAF.

Given the aircraft's characteristics and subsystems, as well as the praise coming from pilots who have tested the weapon systems, there should be significant added value for troops of Regional Command West, who will be able to rely upon a rotorcraft that will be much less visible and vulnerable on the battlefield. ***DH***

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A Turkish Air Force UH-60 Black Hawk is loaded onto a USAF C-17 at Incirlik Air Base in Turkey. (Photo: USAF)

Ramping up

Budget cuts, the need for rapid deployability and 'one size fits all' demands from operators are changing the face of the helicopter ground support equipment market, finds **Mark W Grapin**.

The topic of ground support for rotary-wing aircraft, particularly those in service with armed forces around the world, covers a myriad of changes occurring to the equipment that supports military helicopter fleets.

Taken in two categories – powered and non-powered equipment – the common elements of these changes include a substantial increase in flexibility, ease of operation and operability, and a dramatic drop in the weight of each of these types of hardware.

While helicopter manufacturers only a decade ago saw huge aftermarket profits in specialised ground support equipment (GSE) for each unique model and type of aircraft, more flexibility is being demanded from the owners of the fleets, with the aim of commonality and universality of kit supporting each of the airframes across their ramps.

MAINTENANCE TRENDS

A generation back, major air forces around the world appeared to have adopted a hand-me-down approach to helicopter GSE, favouring the purchase of systems to service and maintain their largest end-item aircraft (those three- and four-holer transports or higher-end fighters), and seek adapters and conversion kits to make these same support pieces workable for their helicopters.

As the price tag of each rotorcraft has ballooned since the days of the glut of UH-1 surplus availability, through UH-60s and Mi-17s to a new generation of vertical lift support, the adaptability of hydraulic and electric carts has become an increasingly difficult issue for the ground support engineer.

Software protection for Boeing products has become a high priority for that manufacturer across each of its ground support suites – particularly those powering the aircraft during service and maintenance. Design, software,

electrical, hydraulic and systems compatibility engineers on the company's CH-47 and AH-64 production lines are all quick to echo the same concerns over those ground support carts, stands and towing/handling apparatuses that are put to their aircraft pre- and post-delivery.

Maintenance chiefs of helicopter fleets are universally quick to add concerns regarding the re-stationing of aircraft within their service areas, as well as the sources and availability of funding for repair of ageing GSE, rather than purchasing newer kit. As one example, it was once common to station aircraft of one type together in common locations, which effectively reduced the need for multiple sets of the same items of GSE.

With defence ministries under universal pressure to do more with less, collective fleets have been redistributed to provide a larger footprint for national defence and domestic response, yet the allocation of monies to keep ground support materiel available to this redistributed fleet is an admitted secondary or tertiary consideration.

While some maintenance can obviously be deferred, the more typical response is to either fly the aircraft to a facility where the relevant pieces of GSE are on hand or ship the equipment plane-side.

HANDS ON

A closer look at military helicopters from the last generation or so will evidence a proliferation of pop-out pegs, handhold accesses and stepping or working surfaces. Engine cowlings and nacelles are lined with slip-resistant footholds that only a dozen years ago might have been unthinkable.

And while even the venerable Huey and Alouette featured integral handholds, pop-out footpegs are now virtually standard for the vast majority of helicopters, where standing on terra firma is not an option for pre-flight or routine inspections and services. In short, the aircraft themselves have become, in large part, their own maintenance stands.

Major engine manufacturers such as General Electric, Lycoming, Pratt & Whitney, Rolls-Royce and Turbomeca now routinely include hoist access tabs built onto their products – negating the need for specialised lift straps and adapters to install or remove the powerplant.

Innovations in non-powered ground support equipment abound, however. One such example, embraced by special operations communities in the US and Russia, entails a dramatic shift in how helicopters are loaded onto transport aircraft.

While tow bars for wheeled types such as the UH-60 and CH-47 typically attach at a defined single end of the aircraft to move it to a loading area, the necessity of using that same tow bar to actually manoeuvre the helicopter on board begs the question as to whether the correct end of the aircraft is being steered and pushed.

This question of correctness of position was posed by John Tollenaere of HeliBasket in Seneca, South Carolina. 'With the need to preserve room between the nested aircraft in the transport for the tow bars, valuable room in the cargo hold was being sacrificed,' he said.

Fleet operators across Europe are looking for innovative and cost-effective ways to pare the number of pieces of GSE, while enhancing transportability and reliability of replacement suites. (Photo: Hydraulics International)

Tollenaere has developed a Tow Bridle that quickly attaches to the landing gear area above the main wheels and enables routine loading in closer proximity, with little variability in the loading patterns going onto and coming off the transport.

'Tow bars weigh a lot, and take up a lot of room,' he said. 'But the larger problem was in how the aircraft was guided into the cargo hold, and what risk loadmasters were willing to accept in placing the aircraft so close to one another – particularly during the loading and unloading process.'

This willingness to invert entire processes by ground support engineers has had a corresponding ripple effect among aircraft manufacturers as to how 'firm' ground handling points are selected and built into the airframe.

STANDING OUT

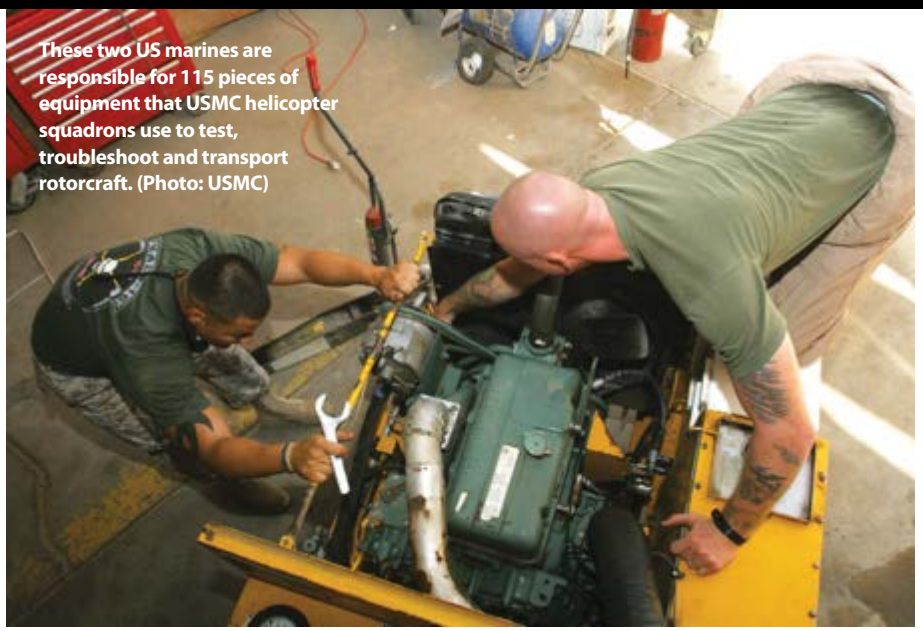
While Tollenaere's firm also designs and manufactures maintenance stands, the universality of innovation on the drawing boards of his competitors is just as astounding.

Check the back of nearly any aircraft MRO hangar at any airport in the world, and you're likely to spot rusted and ageing maintenance stands with 'advanced' technology such as hydraulic lifts, electrical cords taped to the framework and pneumatic tyres long-since dry-rotted and deflated.

With steel having been replaced by aluminium alloys as the standard material for this equipment, it is the compact size and durability of these stands that has become the norm.

GSE manufacturers are expected to unfold their stands to provide safe and secure access to the entire length of the aircraft undergoing inspection and maintenance, while enabling that same stand to be folded to a size and possess an acceptable weight that it may be neatly slid into the back seats of the same aircraft.

Fleet operators demand, however, that these stands be 'adaptable enough', and not



These two US marines are responsible for 115 pieces of equipment that USMC helicopter squadrons use to test, troubleshoot and transport rotorcraft. (Photo: USMC)

over-specialised, or so universal that their uniqueness is lost on a single model within the fleet.

The urgency to innovate and update GSE used to power helicopter systems is nearly as pressing as on the aircraft themselves.

While maintenance stands consume huge footprints of square meters in storage space, powered apparatuses require a unique brand of additional consideration, ranging from the weight capacity of the floor supporting them, adaptability to the vehicles (or personnel) moving them, ease of use, universality of the aircraft each may support, and durability – the list seems endless.

A staple of aircraft ramps around the globe is the Aviation Ground Power Unit (AGPU), manufactured en masse a generation ago by Engineered Air Systems in St Louis, Missouri.

Considered very innovative for its time – to include being self-propelled – this workhorse of the ramp has begun to show its age, particularly when compared with its more contemporary counterparts.

According to Jerome C Smith, a principal with Hydraulics International in Chatsworth, California: 'The same imperatives in non-powered ground support equipment are felt in the powered slice of the industry. It's hard enough to find a hangar large enough for a few of the aircraft in the fleet, so commanders and maintenance chiefs are increasingly under pressure to squeeze ground support equipment into shop corners, or under tarps behind the hangar.'

The HeliBasket Tow Bridle load testing an H-60 aboard a USAF C-17. Note the close proximity of the tow bridle and expected placement of the towed aircraft to the one to its left in the photo. (Photo: HeliBasket)

This necessarily puts durability high on the ground support engineer's list of priorities for their equipment.

POWERED SUPPLY

Powered platforms must support direct and alternating current of varying voltages, hydraulic systems of varying pressures and delivery volumes, air start systems of varying volumes and pressures, nitrogen charging system services, breathing air servicing capability, air conditioning provisioning, fuelling and defuelling systems, munitions dollies – the list again appears near endless.

While over-combination of the services provided is a risk inherent to the engineer's drafting board, singularity of service provided by each end-item condemns it to non-sale by the manufacturer. 'It seems defence commanders want each piece to do everything, weigh nothing and last for decades between services of the equipment itself,' Smith added.

While these are surely admirable qualities in a piece or suite of GSE, it is this diversity of use from each single item that has brought some manufacturers to the forefront in terms of being sought for that coveted purchase order.

From the safety perspective, engineers have looked hard at how components have worn on the AGPU, and have integrated these improvements into their own suites. For instance, while being self-propelled is a significant advantage in terms of not requiring a tug to relocate the hydraulic, electrical or air support system over short distances, it is this very quality that has caused upticks in customers at the sheet metal technician's shop door due to a low-speed impact caused by an errant unattended cart out for its own stroll (or roll).

Couplings have been substantially updated in the past decade, as better alloys are identified to reduce wear and increase durability, while electrical cables are often better bundled and wrapped to minimise wear when being installed and removed untold numbers of times in any given month.

Purity of air – be it from nitrogen servicing units or cabin breathing oxygen – is a universal concern for everyone from the maintenance and servicing technicians to the flight crews and passengers whose lives depend on the quality of these gasses.

Likewise, the quality of the hydraulic fluid circulated through the systems is now found to be nearly always of purer quality for longer durations between servicing of the units.

SUPPORTING CAST

Regardless of which nation's military helicopter fleet is being serviced, a close secondary concern to the aircraft themselves is the equipment used to support each one.

Maintenance managers and commanders universally demand lighter and more durable equipment with smaller footprints required in transport cargo holds, hangar corners and storage lockers. Also expect more self-test capabilities integral to each aircraft – effectively reducing the requirement for external support and servicing equipment.

In addition, expect ageing equipment to be replaced with sets that are more intuitive to operate, lighter in weight and more durable over their expected lifespan, and the lifespan of the airframes they support. ***DH***

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Ready for action

Capt Niall Griffin, Commanding Officer of the UK's Commando Helicopter Force, speaks to Patrick Allen about the recent arrival of the Wildcat and future force structure.

'These are exciting times for the Royal Navy Commando Helicopter Force [CHF],' Griffin told *Defence Helicopter* in July.

As a result of the UK's 'Strategic Defence & Security Review' published in October 2010 and in support of the UK's Future Force 2020, the CHF is in the process of taking over the RAF's fleet of 25 AgustaWestland Merlin Mk3/Mk3As to replace its existing fleet of Sea King Mk4s.

The force is also transitioning from the AgustaWestland Lynx Mk7/Mk9As to the new AW159 Wildcat Mk1.

As part of this transition, the UK government recently approved £300million ($501 million) of funding to upgrade the existing fleet of RAF Merlin Mk3/3As for the commando role, while extending the life of the upgraded Merlin Mk4/Mk4A to beyond 2030.

This will provide 3 Commando Brigade with a modern and more capable CHF to support Future Force 2020 as the UK turns towards a global high-readiness contingency capability to undertake a wide range of maritime and land-based operations.

CONVERSION TO ROLE

'July 2014 saw eight Royal Navy and Royal Marine pilots from 847 Naval Air Squadron [NAS] begin their Wildcat conversion here at RNAS Yeovilton,' explained Griffin. 'This will be followed on 30 September 2014 when the RAF Merlin Force will be formally handed over to the Royal Navy's CHF at RAF Benson.'

On the Wildcat transition, Griffin noted that 847 NAS previously operated with the Lynx Mk7 and Lynx Mk9A until mid-2013 when the unit returned from Afghanistan and began preparations to convert to the new Wildcat.

'Once they complete their conversion to type late in 2014, 847 NAS will be capable of operating the Wildcat in a light utility role, before these crews begin their conversion to role syllabus.'

EARMARKING WILDCAT

Griffin explained that this was the first Wildcat Mk1 full conversion to type course, and it comprised eight CHF (Royal Navy/Royal Marines) pilots and four Army Air Corps pilots.

'These are all experienced pilots and had flown the Lynx previously,' he added. 'This particular course was designed to test the syllabus for future Wildcat training, which will include ab-initio aircrews.

'This first course is due to be completed in May 2015, with CHF crews completing their own final package of deck landings and environmental and field training.

'This will allow 847 NAS to embark the Wildcat as part of the Royal Navy's Response Force Task Group deployed on *Cougar 2015* later that year. 847 NAS will then be available to operate in the littoral environment for the first time as part of a Joint Helicopter Force before being signed off as "full operational capability" in support of operations by late 2015.'

Griffin stressed that the Wildcat conversion to role was a joint AAC/CHF syllabus. 'The course is designed to teach crews how to operate and "fight" the aircraft using the new glass cockpit, new sensors [L-3 Wescam MX-15], mission systems and new communications systems,' he said. 'The course is designed for army Wildcat crews operating as part of the new Army Air Corps Airborne Reconnaissance Force.

'CHF 847 NAS ground crews and engineers have been working on the Wildcat since they first arrived with 652 (Wildcat Fielding) Squadron, the Army Air Corps Fielding Squadron in 2012. This squadron has a mix of CHF and army aircrews, but almost all the aircraft ground crews and maintainers and engineers have been provided by the CHF.'

SENSOR SUITE

On the transition and make-up of 847 NAS, Griffin explained that the unit will be equipped with six Wildcat Mk1s to produce four aircraft for operations.

On operating the rotorcraft in the commando role, the captain noted that the Wildcat's glass cockpit, mission management systems and sensors in particular were 'infinitely better and more capable' than previous Lynx aircraft.

'We are working on how best to exploit these new operational capabilities for the commando role, and we plan to operate in conjunction with army Apaches.

'This is similar to the way we operated with them in Afghanistan, exploiting each other's unique capabilities. The new systems and sensors will provide the CHF with a step-change in capabilities for 847 NAS.'

Together with its new fleet of 25 Commando Merlin HC4/4As, the CHF will in future control three frontline squadrons – 847 NAS will operate six AW159 Wildcat Mk1s, while 845 NAS and 846 NAS will each operate ten Commando Merlin HC4/4As, with five aircraft in the maintenance fleet.

'All in all, the CHF will be able to provide 3 Commando Brigade, Royal Marines with a significantly improved aviation capability and be able to operate further, quicker, with greater payload and with better ISR capability in whatever scenario we are required to support.' ***DH***

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