SHEPHARD

Volume 33 Number 4
July/August 2014

DEFENCE HELICOPTER

Taking control

Making the helicopter pilot optional

SHARPENING ITS CLAWS

Wildcat HMA2 update

THE EAST–WEST DIVIDE

European helo programmes

AFFORDABLE AVIATION

US Army restructure

Achieve Positive Identification

Superior Vision, Unmatched SWAP

Star SAFIRE® 380-HDc
Long-Range Performance
in a Compact System

FLIR Systems continues to redefine what's possible with the new Star SAFIRE™ 380HDc. Unmatched multi-spectral HD imaging in a light, compact, low profile system designed for your mission.

For more information visit www.flir.com/380hdc

/flirhq @flir

FLIR®

The World's Sixth Sense

DEFENCE HELICOPTER

Editor
Tony Skinner, *tony.s@shephardmedia.com*
Tel: +44 1753 727020

Staff Reporter
Jonathan Tringham, *jonathan.t@shephardmedia.com*

Contributors
Patrick Allen, Gordon Arthur, Pieter Bastiaans, Peter Donaldson, Jim Dorschner, Scott R Gourley, Neelam Mathews, Alexander Mladenov, David Oliver, David Saw, Richard Scott, Matthew Smith, Alan Warnes, Jim Winchester, Tom Withington

Production Department Manager
David Hurst, *david.h@shephardmedia.com*

Sub-editor
Adam Wakeling

Commercial Manager
Jane Smith, *jane.s@shephardmedia.com*
Tel: +44 1753 727004

Editor-in-Chief
Tony Skinner

Managing Director
Darren Lake

Chairman
Nick Prest

SUBSCRIPTIONS
CDS Global, Tower House, Lathkill Street, Sovereign Park, Market Harborough, Leics LE16 9EF, UK
Paid subscription contacts:
Tel: +44 1858 438879
Fax: +44 1858 461739
Email: *shephardgroup@subscription.co.uk*

Defence Helicopter (USPS 023-352) is published six times per year – in January/February, March/April, May/June, July/August, September/October and November/December– by The Shephard Press Ltd, 268 Bath Road, Slough, Berkshire, SL1 4DX, UK. Subscription rates start at £65. Subscription records are maintained at CDS Global, Tower House, Lathkill Street, Sovereign Park, Market Harborough, Leicestershire, LE16 9EF, UK. Air Business Ltd is acting as mailing agent.

DTP by Vivid Associates Ltd, Sutton, Surrey, UK

Printed by Williams Press, Maidenhead, UK

ISSN 1741-6043

SHEPHARD

The Shephard Press Ltd
268 Bath Road, Slough, Berks, SL1 4DX, UK
Tel: +44 1753 727001
Fax: +44 1753 727002

www.rotorhub.com

Front cover: The MFRF programme seeks to develop an onboard sensor to perform a variety of tasks that enhance the survivability of rotorcraft. (Image: DARPA)

IN THE NEXT ISSUE
- Poland focus
- Helicopter upgrades
- Future of VTOL
- Ground support

Meeting your operational needs is our mission

IAI - for superior helicopter upgrades and maintenance

- Modular integrated upgrade packages tailored to day/night missions
- Optimized integration of advanced mission equipment and sensors
- Mission-driven displays and controls for enhanced air crew performance
- Comprehensive helicopter support

www.iai.co.il
lahav_marketing@iai.co.il

SEE US AT
FARNBOROUGH
AIR SHOW 2014

IAI
WHEN RESULTS MATTER

NH90 nears maturity,

but is the aircraft still too complex?

IF A CAMEL IS A HORSE DESIGNED BY committee, then the NH90 medium helicopter must be a development programme drafted in a lunatic asylum.

While the eventual establishment of six production sites must have been politically expedient at the time of the programme's inception, the creation of so many different variants of the aircraft – at the last count standing at 26 across 13 customers – has undoubtedly hamstrung the NH90's smooth entry into service.

Progress is being made, however, as I witnessed during a visit to Bückeburg Air Base in Germany for the annual NH90 User Conference.

A handover ceremony for an NH90 TTH to the Belgian Armed Forces during the event marked the 200th delivery, while the entire fleet has now chalked up 50,000 flight hours, including on operations in Afghanistan with Italy and Germany.

The well-publicised teething problems across the various nations – floors that warped, engine trouble, an inconsistent supply chain, problems with the aircraft's digital map, corrosion issues (see p5) – have now largely been overcome. Indeed, with a few exceptions (I'm talking about you here, Norway) all aircraft currently rolling off the production lines are in full operational configuration.

In addition, Germany now has some solid experience from operating four of the aircraft in the forward medevac role at Mazar-e-Sharif in Afghanistan, as Lt Col Kai Eggert explained to us during the conference.

PLEASANT SURPRISE

Many of the features that were originally derided as simply being 'technology for technology's sake', such as the aircraft's fly-by-wire system, are now regarded as highly valued on the NH90.

'We were pretty convinced and actually even surprised by the high amount of support that the aircraft provides to the pilot… The fly-by-wire system with the automatic flight controls was very reliable and supported us to the greatest possible extent. Coming from the UH-1s, which are a very old, basic system, the step to the NH90 was quite a large one. The fly-by-wire helped us achieve this big challenge,' Eggert explained.

Not that the deployment hasn't been without its hiccups. The NH90's digital moving map required an upgrade in-theatre in order for it to work properly, while there were also issues with the aircraft's environmental control system.

With Germany deploying the type earlier than some helicopter chiefs were probably comfortable with due to political pressure, it's hardly surprising that niggling issues were discovered in-theatre. Indeed, Eggert was complimentary about the response from NHIndustries in coming up with a solution for each.

STANDARD BASELINE

So after hearing the evidence of one outwardly satisfied customer, can we confidently say that the NH90 programme has turned a corner, especially as the momentum of deployments and flight hours begins to divert attention from the number of outstanding issues?

Certainly, one positive development that was announced during the user conference was the move towards a standard baseline that will be offered to future customers, with the current negotiations with Qatar for 22 NH90s acting as a test case for this.

NHI will now market this baseline aircraft alongside a range of optional extras, allowing customers to cherry-pick capabilities – from a basic to a more complex configuration – but with the supporting architecture based on the same standard.

'For new customers we propose a unique and flexible configuration of the NH90 – what makes it flexible is that you can go from a configuration where you don't plug in all optional equipment up to a more complex

configuration – but it will be based on a single basis,' NHI president Vincent Dubrule said.

The company is also looking at the future upgrades required to keep the type current. These include increasing the operational availability of the fleet, the introduction of new data links, enhanced communication systems to handle ever increasing amounts of information and a 'strong request' from several nations for an improved EO/IR sensor.

While the provision of a ready upgrade path should of course be applauded, it's depressing to think that it may take a relatively major effort to switch the NH90's EO/IR pod for something more modern.

Given the heritage of the programme, it was certainly well beyond the scope of the original requirements to make the aircraft's electronic architecture open and modular. But with future sales prospects of the aircraft somewhat limited, at least in the near to medium term, this lack of flexibility on such a complex aircraft may prove to be a major stumbling block for NHI salespeople.

Tony Skinner, Editor

Echo Apaches performing beyond expectations


Photo: US Army

US ARMY AH-64E APACHE ATTACK helicopters deployed to Afghanistan have been described as more lethal than their 'D'-model predecessor, according to senior figures in the service.

Describing the March deployment of the 1-229th Attack Reconnaissance Battalion to Kandahar Province, Col Jeff Hager, US Army project manager for Apache, said the two dozen aircraft were proving 'more efficient and powerful' than their predecessors.

'The AH-64E is as deadly as the D variant, but more lethal because of situation awareness provided to the pilots,' he revealed. This, he said, was a direct result of the integration of the Tactical Common Data Link (TCDL) and satellite communications, not to mention manned-unmanned teaming.

AH-64E upgrades include more efficient engines, composite rotor blades and Link 16 technology, which has been described as a 'game changer' for the Apache.

Since the 1-229th's deployment began, Echo models have completed over 17,000 operational hours at a 'higher operational tempo' (an additional 15 hours per month), with missions including escort of CH-47 platforms designated for casevac. Hagel said the AH-64Es were now capable of operating at the same speed and altitude as the army's CH-47s – something lacking in previous models.

Meanwhile, Col John Lynch, TRADOC capability manager for reconnaissance and attack, explained that the AH-64Es were routinely operating in collaboration with MQ-1C Gray Eagle UAVs in Afghanistan. 'They are working with them in-theatre as much as they can in order to take advantage of situation awareness from manned and unmanned teaming,' he said.

Elsewhere, it emerged that the US Army and Boeing will initiate follow-on operational test and evaluation (FOT&E) of the AH-64E 'Capability Lot 4' in August. Upgrades to be evaluated include Link 16, external fuel tanks, safety enhancements and maintainer updates, it was added.

Beyond this, Capability Lot 6 has been scheduled to undergo FOT&E in FY2017 to include testing of fire control radar and sensor system enhancements.

Meanwhile, Bell-Boeing new business director for tiltrotors, Rick Lemaster, said the company had teams in Israel in late June aiming to progress discussions following the Pentagon's agreement in January to supply a number of platforms under an FMS deal.

Beyond that, Lemaster said the V-22 was receiving 'strong interest' from Japan and the UAE: 'We are in discussions with [Japan] regarding the next step to allow the V-22 to compete for that business.'

He said Bell-Boeing was working up plans for roll-on/roll-off aerial refuelling and C4ISR kits, including 'additional network capabilities' as well as a pylon-mounted weapon system, most likely to be a laser-guided missile.

By Andrew White, Mesa

Poland moves ahead with helicopter purchase

THE POLISH MOD HAS INVITED THREE companies to submit their final tender to provide 70 multirole helicopters for the Polish Army.

The country's media reported that the invitation was sent on 30 May and included details of the requirement for the winning aircraft to be capable of carrying out utility/transport, CSAR and ASW missions.

Warsaw is also seeking a comprehensive logistics package and training provision as part of the tender.

The three companies chasing the contract include Airbus Helicopters (see p48) and Heli Invest Services 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 Q3 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.

With Warsaw indicating that domestically based manufacturers using Polish components will be favoured, Airbus Helicopters announced in 2013 that it had signed industrial cooperation agreements with Wojskowe Zaklady Lotnicze Nr 1 (WZL-1) covering the creation of two separate final assembly lines within Poland for the EC725 Caracal helicopter and its Turbomeca Makila 2 turboshaft engines.

The other two contenders may have had a head start however, with Sikorsky already manufacturing aircraft in Mielec, southeast Poland, while AgustaWestland is active in Świdnik, eastern Poland.

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.

By Tony Skinner, London

Netherlands suspends acceptance of further NH90 NFHs

THE NETHERLANDS HAS SUSPENDED further deliveries of NH90 NATO Frigate Helicopter (NFH) aircraft destined for the Dutch armed forces due to corrosion issues.

The MoD announced on 27 June that it had asked the NATO Helicopter Management Agency (NAHEMA) to take this step due to the excessive levels of corrosion and wear on two of its NFH airframes.

One is a Meaningful Operational Capability (MOC) aircraft, which was deployed off the coast of Somalia in early 2013, while the other is a Full Operational Capability (FOC) version which operated in the Caribbean during late 2013. Each of these platforms flew approximately 250 hours in saline conditions.

Reports of severe corrosion issues with the NH90 started to emerge in mid-March. The Dutch National Aerospace Laboratory (NLR) investigated the causes of these problems, and its findings were published in late June.

Much of the corrosion occurred due to prevention of galvanic coupling – the coupling of metals to carbon fibre-reinforced composites – not being taken into account in the design of the helicopter with other causes, including an absence of or badly applied sealant, according to the NLR's report.

A total of 92 corrosion occurrences were reported, of which the details were classified, but described as being caused by insufficient corrosion protection, as well as incorrect materials selection, design and manufacturing.

A working group has now been established to identify the operational, financial and legal consequences of the latest problems with NH90.

When informed about the corrosion issues in March, NHI established a task force which is expected to present a roadmap in September on how to remedy the current string of problems, while preventing their further occurrence

On 26 June, the Netherlands received its latest NFH aircraft – the 13th and, for the time being, last of the new naval helicopters to be delivered.

Since early 2013, NFH deliveries to the Dutch have been in FOC configuration, although all six of these still need to receive the Final Radar Configuration (FRC) upgrade for the Thales European Naval Radar. Meanwhile, two of the initial seven MOC aircraft have recently been returned to AgustaWestland in order to be brought up to FOC standard.

With the transition from the Lynx to an NH90 helicopter force again compromised, there will now be further delays to the operational testing and evaluation (OT&E) phase of the Dutch NFH fleet. The availability of helicopters urgently needed for home-based operations, including SAR, medevac and counter-piracy support, will also be affected.

INTERIM SOLUTIONS

With the Westland Lynx SH-14D already having been withdrawn from service, the Dutch government will now have to continue to rely on contractor support as an interim SAR solution.

Belgian helicopter charter company NHV has been contracted for some time now to provide AS365 N Dauphin IIs for missions such as night SAR, while the MoD has been forced to delay the planned sale of its three Agusta-Bell AB 412SPs operated by 303 Squadron. These are used for daytime SAR and medevac, and their out-of-service date has been delayed by 12 months to January 2015.

Meanwhile in early June, the Dutch government also announced that its military will discontinue providing medevac helicopter support to people living on the Dutch North Sea islands, with this now also outsourced.

The military had only just solved a series of problems relating to noise levels in the NFH's cockpit which were perceived by crew members as being too high. As a stopgap measure, additional soundproofing material was installed, while personnel received instructions in how to better combine their Alpha 900 helmets with the communication ear plugs being used.

By Pieter Bastiaans, Breda

NEWS ON THE WEB

BOEING LOOKS TO EXPAND DUTCH RELATIONSHIPS
25 June 2014

NHI LOOKS TO STANDARDISE NH90 PROGRAMME
24 June 2014

CANADA'S CH-148 CYCLONE PROGRAMME 'BACK ON TRACK'
20 June 2014

THREE MH-60R FLIGHT TRAINERS IN SERVICE WITH USN
20 June 2014

CUBIC RECEIVES USN TRAINING DEVICE TASK ORDER
19 June 2014

FIRST EC725 BUILT IN-COUNTRY DELIVERED TO BRAZIL
18 June 2014

THALES AWARDED £48 MILLION FOR FASGW(L) WORK
17 June 2014

DUKE LAUNCHES HELICOPTER REMOTE WEAPON STATION
16 June 2014

RN'S MERLIN MK 2s SET FOR EXERCISE *DEEP BLUE*
13 June 2014

SPAIN SET TO RECEIVE SH-60F SEAHAWKS
30 May 2014

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

Ukraine helicopter losses mount

This Mi-24P made a forced landing near Slavyansk after being hit by machine gun fire, and was later destroyed to avoid its capture by militants. (Photo: via author)

THE BLOODY INTERNAL CONFLICT IN Ukraine has seen the downfall of a military force that has failed to modernise its hardware in the previous decade by introducing modern sensors and weapons, adopting suitable counter-insurgency tactics and providing adequate training for its aircrews.

Ukraine is an economically weak state and its military and internal security forces have proved ill-suited to fight and win an extended conflict in the country's easternmost provinces. During weeks of asymmetrical warfare, the Ukrainian military machine has faced a motivated, well-armed and entrenched enemy, and lost a significant number of helicopters.

A combination of Cold War-style inflexible tactics and the obsolete aircraft of Ukrainian Army Aviation (UkAA) and the National Guard's aviation service has resulted in no fewer than ten attack and assault transport helicopters being completely destroyed or heavily damaged at the time of writing, with 28 crew and passengers killed.

This figure is believed to account for 20-30% of the airworthy fleet, and UkAA and National Guard Mi-24s and Mi-8MTs are now failing to provide effective support to ground forces.

The UkAA used its helicopter assets in anger against separatist militia in the eastern part of the country for the first time on 15 April, the second day of Kiev's 'anti-terror operation'. This involved an airborne assault with Mi-8MT transport helicopters escorted by Mi-24s, aimed at taking control of Kramatorsk airfield in a zone largely controlled by pro-Russian militants.

The operation was successful, but insurgents soon began taking measures to block helicopter resupply operations in the combat zone. The first loss was reported on 25 April, when an Mi-8MT laden with munitions took a hit from sniper fire just before take-off at Kramatorsk (some accounts claim that an ATGM or an unguided RPG were deployed by the militants). The crew managed to escape from the burning machine before it was consumed by fire.

A series of UkAA combat losses were sustained during a mass ground attack launched against the city of Slavyansk on 2 May, which encountered heavy resistance.

MANPADS SHOOTDOWN

Militants used MANPADS for the first time to shoot down two Mi-24Ps involved in attacks on major defensive positions around the city, killing five crew with a sixth man being captured. The *Hinds* lost belonged to the 16th Aviation Brigade stationed at Brody, and the personnel killed were among the most experienced in the unit.

In addition to the Mi-24Ps, an Mi-8MT was seriously damaged by small arms fire in the same area and made a forced landing. It was subsequently dismantled and transported by truck to a repair facility.

Another Mi-24P, also belonging to the 16th Aviation Brigade, sustained combat damage three days later in the same region while pounding hardened checkpoints set up by separatist militia close to Slavyansk.

This time, the damage was caused by hits from heavy machine gun fire, resulting in the failure of both the aircraft's hydraulic systems, with the pilot forced to crash-land in a swampy area. The three crewmen were promptly recovered by an Mi-8MT, and soon after the damaged *Hind* was destroyed by a Ukrainian Su-25 ground attack aircraft, in order to prevent its capture by the militants.

The period between 3 and 5 June saw as many as three Mi-24s heavily damaged during the ultimately unsuccessful offensive against Slavyansk. All the *Hinds* took hits from Igla MANPADS but eventually succeeded in making forced landings in the battle zone. One aircraft was subsequently destroyed by insurgent artillery but the other two were recovered and despatched for repair to the facility at Konotop.

One of the few occasions of effective use of the Mi-24 in the Ukrainian conflict was the battle for Donetsk airport on 26 May. This saw an airborne assault party delivered by Mi-8MTs, while pairs of Mi-24s mounted a series of attack passes, unleashing rockets and 23/30mm cannon rounds against the terminal building occupied by militants from the so-called Vostok battalion, inflicting heavy casualties.

FINDING FAULT

The reasons for the heavy losses and generally low effectiveness of UkAA in this kind of warfare are due to its reliance on obsolete hardware and inflexible tactics.

No more than 20 *Hinds*, and a similar number of *Hips*, were available at the onset of operations in April, and the Mi-24P/VPs used in the fighting were 1980s-vintage machines, lacking any meaningful night operating capability, modern guided weapons or self-protection suites.

In addition, inflexible and predictable tactics when operating in areas saturated with air defence weapons made the Ukrainian *Hinds* easy prey for militant gunners.

Some Mi-24Ps did receive the combat-proven Adros-KT-01 AV omnidirectional IR jammer but, as the battle for Slavyansk in early June demonstrated, this alone could not prevent hits by the relatively modern Igla missiles launched by militants from close distances, especially against helicopters lacking EVU exhaust mixers to suppress IR emissions.

In addition, three of the four Mi-8MTs lost between 25 April and 25 June fell victim to ambushes set up by the militants' dedicated anti-air teams.

By Alexander Mladenov, Sofia

BRINGING MORE POWER TO THEIR MISSION.

Army troops in the fight for freedom deserve the best support we can offer. The Army's Improved Turbine Engine Program (ITEP) will make sure they get it, specifying new combat performance, capability and efficiency standards for Black Hawk and Apache helicopters. ATEC's HPW3000 engine will provide increased power, enhanced dependability, rapid start capability, increased payload, and improved high/hot performance. With greater range. Burning less fuel. Saving billions of dollars. Learn more about the ITEP engine program and the HPW3000 Engine at **ATECPower.net**.

ATEC
Advanced Turbine Engine Company
A Joint Venture of Honeywell and Pratt & Whitney
Honeywell
Pratt & Whitney
A United Technologies Company

JMR TD bids await downselect decision

THE BIDS ARE IN AND THE US ARMY WAS mulling a decision as *Defence Helicopter* went to press that could have far-reaching consequences for the US rotorcraft industrial base.

At the start of June, four proposals were submitted for the Joint Multi-Role (JMR) Technology Demonstrator (TD) programme and each contender has now verbally pitched its concept to army aviation leadership at Fort Eustis.

The four teams – AVX, Bell Helicopter, Boeing/Sikorsky and Karem Aircraft – are each hoping their design will be chosen for the next phase of the programme, which will see potential flight tests of a TD aircraft late in FY2017. A decision is widely expected to be announced by the end of July/start of August.

JMR TD is a precursor to the wider Future Vertical Lift (FVL) effort that will initially replace the UH-60 Black Hawk and AH-64 Apache from the mid-2030s.

Although that time frame seems some way off, under current plans some 80% of the 'decision points' relating to whether the DoD's vertical lift fleets will be extended in life, retired, or replaced with a new platform will occur in the next eight to ten years.

With two teams opting for a coaxial compound design (AVX and Boeing/Sikorsky) and two choosing to submit a tiltrotor configuration (Bell and Karem), the JMR TD will go a long way to determining the future make-up of the army's rotorcraft component.

The fact that three established players are faced off against two relative newcomers also adds flavour to the contest. Aviation chiefs have been at pains, however, to stress that the JMR TD aircraft would not represent the final platform for FVL, and nor was this the only science and technology effort feeding potential FVL solutions.

HOT FAVOURITE?

The hot favourite to go forward is undeniably Boeing/Sikorsky, which have reunited for the first time since their partnership on the ill-fated RAH-66 Comanche project.

With the SB>1 Defiant, the team is taking Sikorsky's X2/S-97 coaxial compound design and scaling it up to meet the JMR TD specifications.

While this meets the requirements of 230kts+ cruising speed, 6K/95 performance and the ability carry 12 troops to a mission radius of 420km, the handling characteristics of the coaxial design were a major reason the team opted for it over a tiltrotor configuration.

'Don't forget that speed is only one part of the requirement,' Doug Shidler, Sikorsky's programme director for JMR, told *DH*.

'Yes, this design can do the speed but it also has the low-speed manoeuvre capability, and it can achieve that without changing configuration – you don't have to move elements, the wings, rotors or anything along those lines. So it's an excellent platform for flying exactly like a helicopter, but it also has the advantage of speed by just engaging or disengaging the prop – nothing more and nothing less than that.'

Image: Bell Helicopter

Pat Donnelly, Boeing's deputy programme director for JMR, said as part of the scope of work, the team was effectively working on two different designs.

'We are designing the technology demonstration aircraft and we also designing what we call a mission performance spec, so it's a fully compliant design to the current specification from the government. We are at preliminary design for the [TD] and we are at a conceptual [stage] for the MPS [Model Performance Specifications] configuration.'

A further task is maturing and validating the next-generation design tools needed to fully develop a common FVL baseline scaled across different weight classes.

VALIANT EFFORT

Bell Helicopter has attempted to dampen any impression that Boeing/Sikorsky is the incumbent by assembling a strong industry-wide 'Team Valor', which includes Lockheed Martin.

While sticking to the tiltrotor concept, unlike the V-22 Osprey, the V-280 (illustrated) features engines that remain in place on the straight wing while the rotors and driveshafts tilt.

'The main customer for this being the soldiers riding in the back, you have the ability to have a rapid ingress and egress with the large side door. You have seven feet of clearance coming in and out of the aircraft, and crew chiefs [will be] able to provide suppressive fire coming into a hot LZ in a typical air assault mission,' Keith Flail, Bell Helicopter programme director for FVL, told *DH* at the Quad A exhibition in May.

He said the team was focusing on a simple, clean-sheet design with an emphasis on manufacturing and cost considerations.

To combat perceptions the V-280 is a large aircraft, Bell displayed a mock-up at Quad A with the platform placed over a shadow of a Black Hawk to show it has a similar footprint.

It is highly likely that both Bell and Boeing/Sikorsky will advance to the next stage. The question then remains whether AVX and Karem have shown enough potential in their designs to also be allocated further funding.

By Tony Skinner, London

Note: DH will look at the JMR TD programme in more detail in the September/October issue.

T129

Now in Theatres...

PLEASE VISIT US AT

Farnborough Air Show 2014

Hall 4, Stand No: H1 & Static Display Area

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

The East-West divide

The demand for new and upgraded helicopters from European militaries varies greatly across the continent. **Matthew Smith** learns which countries are leading the way in procurement and improvement programmes.

The UK's Defence Equipment Plan 2013 outlined an £11.2 billion investment in helicopter capability through to 2023. (Photo: Crown Copyright)

Despite years of economic hardship and defence budget cuts across the region, Europe's helicopter market remains healthy, being worth an estimated $43 billion over the next nine years – a consequence of high inventory levels and creeping obsolescence in what is a highly fragmented market place.

'The total European demand for military helicopters will account for $42.8 billion between 2014 and 2022 for platforms and aftermarket support, which also includes platform upgrades,' said Alix Leboulanger, an analyst at consultancy Frost & Sullivan.

However, the growth picture is not evenly spread, and the major Western powers remain cautious with fleet replacements.

'Demand from the military sector has historically been subject to large year-to-year variations due to evolving strategic considerations. Short-term growth potential may be limited due to increasing budgetary constraints on public spending in some regions like Europe,' warned Eurocopter, now rebranded Airbus Helicopters, in its 2013 annual report.

GOING EAST

Meanwhile in the east, obsolescence and security fears are driving inventory replacements.

'If you look at the Western European countries, troop withdrawals from Iraq and Afghanistan plus stretched budgets have impacted quite negatively on demand for new military helicopters,' continued Leboulanger. 'On the other hand, the Eastern European market is growing due to higher threat perceptions and fleet renewal needs to replace very obsolete platforms.'

Another factor affecting demand in the West is that many of its established and mature markets are at a similar phase in the procurement life cycle, in part due to their participation in large multinational programmes, such as the NHIndustries (NHI) NH90 and Airbus Helicopters Tiger which are currently in the delivery phase.

In France, for example, progress towards a fleet of 140 reconnaissance and attack helicopters and 115 tactical rotorcraft, outlined in a 2013 white paper, is being supported by deliveries and new orders for the NH90. This includes the exercise of an option for 34 more NH90 Tactical Transport Helicopters (TTHs) for the French Army announced in May 2013. Belgium saw deliveries of its NH90 NATO Frigate Helicopters (NFH) start in July 2013, and in August the first NH90 NFH Step B was delivered to the Italian Navy.

Germany is also part of the programme and may even extend its purchase beyond the current level. In May 2014, *Defence Helicopter* reported that the German Social

Democratic Party (the junior member of the country's ruling coalition) was calling on the government to adjust its plans and procure 122 NH90 TTHs instead of the planned acquisition of 82.

According to NHI, current deliveries to all customers stand at 200 units out of a total order book of nearly 500, on its own a significant chunk of projected demand.

Meanwhile, progress is continuing on the Tiger programme for France, Germany and Spain. March 2014 saw delivery of the last of 12 Tiger UHT support helicopters upgraded by Airbus Helicopters for Afghan missions to the Afghanistan Stabilization German Army Rapid Deployment (ASGARD) configuration. The programme was launched in late 2011 by Eurocopter and the German MoD.

Other, smaller procurements have included two EC135s for the Spanish Army Airmobile Force (FAMET), delivered under a contract for eight units signed on 27 December 2013.

BRITISH BUYS

Perhaps surprisingly given the general despondency surrounding UK defence spending, the release of the UK's Equipment Plan 2013-2023 and its subsequent update in January 2014 offered an optimistic insight into how the UK is looking to evolve its helicopter capabilities over the next ten years.

The Defence Equipment Plan 2013 calls for investment in the UK's helicopter capability of £11.2 billion ($19 billion) through to 2023. According to the MoD, this will allow it to rationalise the fleet to four platforms: the CH-47 Chinook; AW101 Merlin; AH-64D Apache; and AW159 Lynx Wildcat, which will be sustained until at least 2040.

Included in these plans is a Merlin Life Sustainment Programme and an upgrade – or potential replacement – for the AH-64 (WAH-64D Block I in UK service). AgustaWestland was awarded a £430 million contract in January to support the Apache fleet through to 2019, although Minister for Defence Equipment, Support and Technology Philip Dunne told UK parliamentarians in March that the government was 'considering its options' on how to sustain the fleet through to its planned out-of-service date in 2040. These options are thought to include the procurement of a successor platform, with the updated AH-64E a potential contender.

While the bulk of funding, around £1 billion annually according to the plan, is reserved for supporting the fleet, funds worth around £200 million are currently programmed to be available for new platform procurements from 2016 onwards.

MOVING EAST

With the major powers in Western Europe showing little appetite for new helicopter programmes, attention has shifted east – most notably to Poland – where a number of new programmes have attracted substantial interest. The country has two major helicopter procurement efforts under way under the aegis of its wider $40 billion ten-year military recapitalisation programme.

The most advanced project is the acquisition of 70 multirole helicopters for transport, CSAR and ASW, for which final offers are required by September 2014. Three consortia are bidding: Airbus Helicopters and Heli Invest are proposing the EC725 Caracal Poland; a consortium composed of Sikorsky international Operations, Sikorsky Aircraft and Sikorsky subsidiary PZL Mielec are proposing the S-70i Black Hawk; and PZL-Świdnik, owned by AgustaWestland, is proposing the AW149.

According to the Polish MoD, a decision will be taken before the end of 2014, and contracts signed at the start of 2015. In addition to the 70 helicopters, the programme also calls for a logistics and integrated training package.

Both proposals contain a substantial level of industrial participation, a key element of many defence procurement programmes.

Airbus Helicopters and its partner Turbomeca have signed industrial cooperation agreements with Poland's Wojskowe Zakłady Lotnicze Nr 1 (WZL-1) to create full assembly lines for the EC725 Caracal and its Makila 2 turboshaft engines.

Speaking at the Eurosatory exhibition in June, Dominique Maudet, executive VP, global business and services, for Airbus Helicopters, said the tender had now been released, with responses due by the end of September.

The document calls for a multirole helicopter capable of carrying out tactical transport (36 aircraft), CSAR/SAR (26) and naval (eight) missions. (For more on Airbus Helicopters' bid, see p48.)

The procurement of utility rotorcraft will be followed by a tender for up to 32 new attack helicopters in 2015 or 2016. The new machines will be used to equip army units currently operating Soviet-era Mil Mi-24Ds and Mi-24Ws.

MOVING DATES

In May 2014, Poland's Deputy Defence Minister Czeslaw Mroczek told the state-run Polish Press Agency that he planned to bring the procurement forward from 2018 by two to three years, with the analytical and conceptual phase of the programme starting this year. The move is part of a wider acceleration of Polish defence programmes, prompted by fears about Russia's intentions in Eastern Europe following its

NHI recently delivered its 200th NH90 to customers out of a total order book of nearly 500 aircraft. (Photo: NHI)

In March, the last of 12 German Tiger UHT support helicopters upgraded to ASGARD configuration was delivered. (Photo: Airbus Helicopters)

annexation of the Ukrainian province of Crimea in January 2014.

Competition for the programme is likely to be fierce. Patrick Moulay, Bell Helicopter's managing director in Europe, told *DH* that it was attracting 'international interest' in its updated H-1 programme, noting that 'the AH-1Z can perform anti-air warfare and air interdiction, with the UH-1Y performing combat assault transport, air delivery, airborne C2, insertion and extraction, and airborne tactical support'.

The company currently has a small footprint in the military sector in Europe, although this is something it is looking to change.

'Bell Helicopter considers it important to continue the expansion of international military and commercial sales,' said Moulay. 'We are confident our Bell Helicopter products will fill the expanding needs of Europe and are always prepared to analyse the mission requirements to assure the region receives the best products to complete their mission. We are optimistic that 2014 will be a significant year in the advancement of our global military and FMS strategy.'

DEEPER RELATIONS

Boeing demonstrated its AH-64 Apache at the Polish MSPO trade show in August 2013, saying at the time that it was looking to deepen its defence-industrial relations with the country and noting that the aircraft was one of the products 'capable of supporting Poland's plans to modernise its armed forces'.

European heavyweights Airbus Helicopters and AgustaWestland are also expected to bid, with their Tiger and AW129 respectively.

Turkey has long been a priority market for the world's helicopter manufacturers, but has been looking to develop an indigenous capability. However, the signature of a $3.5 billion contract with Sikorsky for the Turkish Utility Helicopter Program (TUHP) in March 2014 suggests that the main opportunity has now passed.

According to Sikorsky, the TUHP contract will see Turkish Aerospace Industries (TAI) build 109 T-70 helicopters (Turkish variants of Sikorsky's S-70 International Black Hawk) under licence. It will also assemble a further 109 S-70is for Sikorsky.

The scope of the agreement is substantial, with the potential for TAI to manufacture up to 600 aircraft for indigenous use and export over the next 30 years. The deal positions Sikorsky as one of Turkey's main defence industrial partners in the helicopter sector (along with AgustaWestland) and appears to restrict the scope for other potential companies to win substantial future business.

MEETING REQUIREMENTS

TAI, for example, is looking to meet a requirement for a civil-certified light utility/training helicopter, but this is set to leverage the capabilities acquired under the T129 ATAK (its combat helicopter programme with AgustaWestland) and TUHP efforts, and is unlikely to result in a foreign purchase.

Indeed, it may be that Turkey will soon be using the knowledge gained through these programmes to compete for exports itself.

'TAI is benefitting from existing partnerships with AgustaWestland and Sikorsky and is now targeting export markets, with deep interest demonstrated by Middle Eastern customers,' said Leboulanger. 'At some point, they will also try to compete among traditional players in Europe.'

The trend towards greater military helicopter growth in Eastern Europe echoes that of the commercial world, with one major exception. Russia is a key growing market for commercial helicopters, but one that is effectively closed for defence sales due to its desire to invest in its own capabilities through state-owned Russian Helicopters.

The country is, however, influencing the rest of the market, as concerns about its intentions in Europe have intensified since the occupation of the Crimea in January. This is being reflected in moves from a number of the countries on Europe's eastern border to replace Soviet-era helicopters with new NATO-compatible platforms.

In October 2013, the Lithuanian Air Force ordered three AS365 N3 Dauphins for SAR missions, with deliveries to be completed in 2015. Meanwhile, the Czech Republic confirmed in April that it was seeking to acquire 16 light/multipurpose helicopters to replace its Mil Mi-24s and Mi-35s.

CHALLENGING MARKET

This is a picture that is familiar to Moulay. 'While we have seen a great success for our commercial helicopter ranges in Russia, in particular with our Bell 429 in the HEMS and VIP segment, we believe that the market for military applications is still a challenging one in Russia for a Western OEM,' he said.

'We are seeing, on the other hand, a growing interest from countries in Central Europe for new helicopter solutions to replace the current ageing Russian-built helicopter fleet which is no longer adapted to the modern type of aerial combat requirements.'

One common feature across the European market is that it continues to be highly cost-aware, and this reflected in demands for reduced platform and ownership costs.

'From a commercial and military standpoint, we are developing products that are more affordable and continue to be long-lasting,' continued Moulay. 'You can see this on the military side in the Bell V-280 Valor and its significantly higher fuel efficiency and high productivity and range.

'The UH-1Y and AH-1Z possess an 85% rate of commonality in maintenance-significant components – this means a reduced deployment footprint, reduced spares and technical support, and overall reduced sustainment and ownership costs.'

While Bell is positioning its H-1 series aircraft for some requirements, it believes that there is a substantial potential demand for lighter and cheaper platforms.

'We believe in particular that our new light attack 407GT will offer the ideal solution in terms of combined performance, efficiency and affordability to replace this old fleet,' stated Moulay, who did not comment on whether Bell was looking to the 407GT for the Czech requirement – it appears to be well positioned to meet it, however.

Europe's helicopter market in 2014 presents a mixed picture overall, but one thing is certain – with fewer major programmes and new entrants in the market, it is only going to become more competitive. ***DH***

NH 90

ONE PLATFORM ALL MISSIONS

200th DELIVERED

Today the only helicopter
able to answer all your battlefield
and support needs.

NHindustries

AgustaWestland
A Finmeccanica Company

AIRBUS HELICOPTERS

Fokker

www.nhindustries.com

AFRICA AEROSPACE & DEFENCE 2014

17-21 SEPTEMBER 2014, AFB WATERKLOOF, CENTURION, CITY OF TSHWANE, SOUTH AFRICA

AAD2014 IS THE PREMIER EXHIBITION OF AIR, SEA AND LAND TECHNOLOGIES ON THE AFRICAN CONTINENT AND AN IDEAL OPPORTUNITY TO NOT ONLY GAIN A FOOTHOLD ON THE AFRICAN CONTINENT BUT TO EXPLOIT BUSINESS OPPORTUNITIES REGIONALLY AND INTERNATIONALLY

defence AMD ARMSCOR

The Hungarian Air Force has seven Mi-17 tactical helicopters obtained from 1989 through to the early 1990s. (Photo: Sandor Vamosi)

With a tender still to be released for Hungary's military helicopter fleet replacement plans, questions remain over which platforms are most likely to be procured, and the time frame involved. **Jim Dorschner** looks at the probable contenders.

Ready or not?

The Hungarian MoD has wrestled with how to execute and pay for a new tactical helicopter procurement programme for the Hungarian Defence Force (HDF) since at least 2010.

The Sikorsky Black Hawk was an early favourite, with multiple reports indicating a deal for the Polish-built S-70i was in the works. However, this never came to fruition, as effects from the continuing global recession squeezed defence funding, concerns rose over adhering to EU procurement standards and policies, and other contenders surfaced.

Such contenders include second-hand early production NH90 Tactical Transport Helicopters (TTHs) from German stocks, choices from AgustaWestland and Airbus Helicopters, new versions of the Mi-17 from Russian Helicopters and the prospect of a mixed fleet with a number of economical UH-72A Lakotas from the US.

ON AND OFF

The result was a series of on-again, off-again efforts that culminated with an announcement by Minister of Defence Csaba Hende in May 2013 that outlined details for a programme with parliamentary support, including a helicopter budget of $443 million and a timeline calling for initial deliveries in 2016-2017.

While there have been some delays and a certain amount of confusion since then, in February 2014 the MoD press office told *Defence Helicopter*: 'Most results of the four-party talks of May 2013 are still applicable for the planned helicopter procurement. In accordance with the roadmap that was presented at these talks, the past months have seen continuous work within the ministry on planning the helicopter procurement.'

With national elections looming, the ministry then deferred a final decision to proceed until the new government had taken office.

Two *Hips* were modernised in 2008, but a recent upgrade contract with Russian Helicopters for the rest of the fleet has been put on hold. (Photo: Sandor Vamosi)

On 6 April, the governing Fidesz party was re-elected, retaining Viktor Orbán as Prime Minister.

In response to a post-election query from *DH*, the press office reported on 5 May that 'preparations for the procurement of helicopters are under way', but added: 'The circa 100 billion HUF [$443 million] project, especially with regards to financing, is subject to further state deliberations.'

Hungarian defence industry consultant Peter Dunai noted: 'My guess is that until 6 June, when the new government officially assumes office with some structural changes, no decision is expected.'

However, Hende's position as defence minister seems assured for now, and Hungary can proceed with developing financing plans and other details related to the procurement, including issuance of a formal tender later this year.

BROAD VISION

The MoD's vision for the programme is fairly broad. 'In addition to meeting military requirements, the [helicopter] capability will also be used by the police, the ambulance service and the counter-terrorism centre, thus providing rotary-wing assets to all organs of the government, as required,' stated the ministry.

'The MoD task force, after discussions with law enforcement institutions and the National Ambulance Service, has established technical-professional requirements based on national and defence-related needs.'

The civilian and military leadership agree that the most efficient way to create this capability is through a 'unified model with unified technical maintenance, hosted on a unified base'.

As a result, the MoD is now focused on procuring a 'national helicopter capability', although whether this means a single aircraft type or a mixed fleet will hopefully be clarified by the tender.

Given that private company Air Ambulance Hungary operates a number of specially equipped EC135 T2s from several bases, and the national police likewise operate MD 500Es, it is

unclear exactly how the new helicopters will fit into the civil support structure.

Presumably the new fleet will be operated by the Hungarian Air Force (HUAF), concentrating primarily on military tasks, while offering the ability to back up the police and Air Ambulance Hungary as required, particularly in response to natural disasters and major incidents.

RUSSIAN PLATFORMS

The HDF currently has around seven operational Mi-17s obtained in 1989. To bridge the capability gap until new helicopters become operational, a pair of 1970s-vintage Mi-8s transferred from Finland in 2011 were joined in April 2014 by three second-hand Mi-8Ts purchased in Russia.

These are intended mostly for crew training and domestic missions, while the surviving Mi-17s support military training, particularly by high-readiness forces.

In 2008, two Mi-17s were upgraded in Ukraine at a cost of $32.2 million, which introduced enhanced avionics and displays with NVG compatibility.

Earlier this year, a deal with Russian Helicopters to upgrade the other five Mi-17s appeared imminent, but is now 'on the back burner', according to Dunai.

The HUAF's sole helicopter unit is the 86th Tactical Helicopter Wing located at Szolnok, which, conveniently, also happens to be the base for Hungary's rapid reaction forces – the 34th 'László Bercsényi' Special Operations Forces Battalion and the 25/88 Air Assault Battalion.

Meanwhile, back-to-back deployments to Afghanistan since 2010 have provided aircrew and technicians with a solid base of combat experience and the opportunity to work closely with partners from Croatia, the Czech Republic, the US and other NATO countries on Mi-17 and Mi-35 air advisory teams.

The final iteration of the latter returned home earlier this year, while the ninth Mi-17 rotation deployed in July. Teams deliver classroom instruction and flying training to Afghan aircrews, including joint combat missions, along with maintenance assistance.

ROBUST FORCE

The list of potential helicopter options has fluctuated over the past few years, but if $443 million is actually applied, the HDF should be able to build a robust tactical helicopter force with around 18 modern aircraft. Sufficient funding should also be available for required infrastructure such as simulators, other training devices and hangars. Specialised weapons and equipment such as FLIR systems, NVGs, ASE suites, secure communications, fast rope kits, hoists and door-mounted machine guns are also required.

In considering its options, Hungary has to take into account geo-political factors beyond the stated requirements, costs and performance.

These include NATO, EU and regional integration, as well as ramifications stemming from strained relations with Russia over Ukraine. For instance, the latter could impact whether or not offerings from Russian Helicopters make the shortlist, while close ties with Germany could make the transfer of used NH90s more attractive and affordable.

Regionally, the selection process may be influenced by Poland's imminent 70+ tactical helicopter order, for which the S-70i is heavily favoured. Hungary is a strong supporter of defence cooperation within the Visegrad Group, also known as the V4, alongside the Czech Republic, Poland and Slovakia.

For example, the latter now looks set to join the Czech Republic and Hungary as an operator of leased JAS-39 Gripen fighters and recent V4 discussions have touched on prospects for joint helicopter and airlift procurement.

STIFF COMPETITION

Both Slovakia and the Czech Republic are also closely following the Polish competition and Hungary's programme as they consider their own future helicopter buys to replace ageing equipment by 2020. Obtaining the same tactical helicopter across the V4 would provide joint training, maintenance and operational opportunities.

While the Sikorsky/PZL Mielec S-70i Black Hawk International has been a consistent favourite based on interaction with US Army UH-60s in Afghanistan and the Balkans, and is in line with Hungary's desire for closer integration with US and NATO forces, stiff competition is expected from AgustaWestland, Airbus Helicopters, NH Industries (NHI) and Russian Helicopters.

While there was speculation that AgustaWestland would offer a choice between the new AW149 and the proven AW139, spokesman Roberto Caprarella told *DH* on 16 May that the company believes

the AW139M could be an ideal solution to meet Hungary's future multirole utility helicopter requirements.

'The AW139M is a very cost-effective platform that has achieved significant success in both military and government markets around the world,' he said. 'Its outstanding performance, even in hot and high environments, versatility, modern design and safety standards have made it the market leader in its class.'

Although less capable than the Black Hawk International in terms of payload, with the right equipment fit AW139Ms could operate effectively across military and civil roles, including covering the key requirement of SOF support.

COST CONCERNS

Given the high costs of its premier EC725 Caracal, Airbus Helicopters may also consider an alternative offering in the form of the less expensive AS532 ALe Cougar. The company delivered the first of the type in March to the Chilean Army and anticipates further orders. This latest Cougar model features the same four-axis autopilot and glass cockpit as the EC225 and offers competitive performance.

While costs may be lower than the EC725, the AS532 ALe unit price may still be more than Hungary is prepared to spend in a single-type scenario, but Cougar affordability and fleet flexibility improves with AS532s serving alongside EC145s or 135s.

The same mixed fleet scenario could well apply should Germany offer to transfer 9-12 early production NH90 TTHs from German Army Aviation stocks, probably through NHI.

These would eventually be replaced in German service with new production, thereby keeping both Germany and NHI happy. Coupled with around six new EC145s or 135s, this is probably the only way Hungary could afford NH90s.

Joining the NH90 club would be advantageous for the country, opening up prospects for increased joint operations, training and support with German Army Aviation and other European operators.

DARK HORSE

A potential dark horse option is the Airbus Helicopters North America UH-72A Lakota as an FMS through the US government. A US-made variant of the EC145, Lakotas alone cannot satisfy Hungarian requirements, but operating alongside a tactical helicopter in a mixed fleet they can economically perform many missions for which a larger and more capable aircraft is not required.

AgustaWestland's AW139M is a strong contender for Hungary's multirole national helicopter programme. (Photo: AgustaWestland)

The most likely match would be with the S-70i. Three Lakotas can be procured for the cost of a single Black Hawk International, with the UH-72A also cheaper and easier to operate and maintain. A force of four to six Lakotas and 12 Black Hawk Internationals would provide the HUAF with potent capabilities for both domestic support missions and demanding military training and operations, including support to SOF and multinational deployments in harsh environments, such as those found in North Africa.

Finally, if alliance concerns over a renewed Russian threat can be overcome, Russian Helicopters is prepared to offer modern versions of the ubiquitous Mi-17s they would ultimately replace in the HUAF. The most likely candidate would be the Mi-17V-5 variant now in production for multiple military customers. Alternatively, Russian Helicopters could offer a model incorporating more advanced features, including higher-rated VK-2500PS-03 engines, composite main rotors and an X-shaped tail rotor or a stronger transmission.

While HDF ground and air crews like the Mi-17, and have accumulated considerable experience on new US-procured Mi-171s in Afghanistan, given current NATO sensibilities amid blowback from the Ukraine crisis a Russian buy appears unlikely.

Hopefully, the Hungarian MoD will release the tender before the autumn, finally allowing the contest to get under way. ***DH***

Tactical helicopter type comparison

Type	Cabin	Range	Cruise speed
AS532 ALe	2+20+2 gunners	450nm (830km)	140kts
AW139M	2+8+2 gunners	600nm (1,110km)	160kts
Mi-17V-5	2+20+2 gunners	350nm (650km)	140kts
NH90	2+18+2 gunners	500nm (925km)	140kts
S-70i Black Hawk International	2+12+2 gunners	300nm (555km)	135kts
UH-72A/EC145	2+8	370nm (685km)	140kts

Wildcat sharpens its claws

The RN will next year introduce the Wildcat HMA2 on the front line. **Richard Scott** visited 700W Naval Air Squadron to discover what tactical development has revealed about the aircraft's potential.

In early 2015 an RN Type 23 frigate will deploy with 201 Flight, parented by 825 Naval Air Squadron (NAS), embarked. This will mark the first time that the navy's new Wildcat HMA2 maritime helicopter has been deployed operationally, and begins a new chapter for small ship aviation in the Fleet Air Arm,

By July 2017, a total of 16 frontline Wildcat flights will be stood up, parented by two squadrons. These will initially be deployed on Type 23 frigates and Type 45 destroyers. From the early 2020s, Wildcat will also operate from the Type 26 Global Combat Ship.

The RN has long recognised the ship's flight as an integral part of the fighting capability of its frigates and destroyers, endowing the host platform with a powerful, organic rotary-wing asset to 'find, fix and strike'. What's more, the embarked helicopter has proven itself to be supremely versatile, turning its hand to tasks such as vertical replenishment, casevac, maritime counter-terrorism (MCT), anti-piracy and force protection alongside more traditional ASW and ASuW roles.

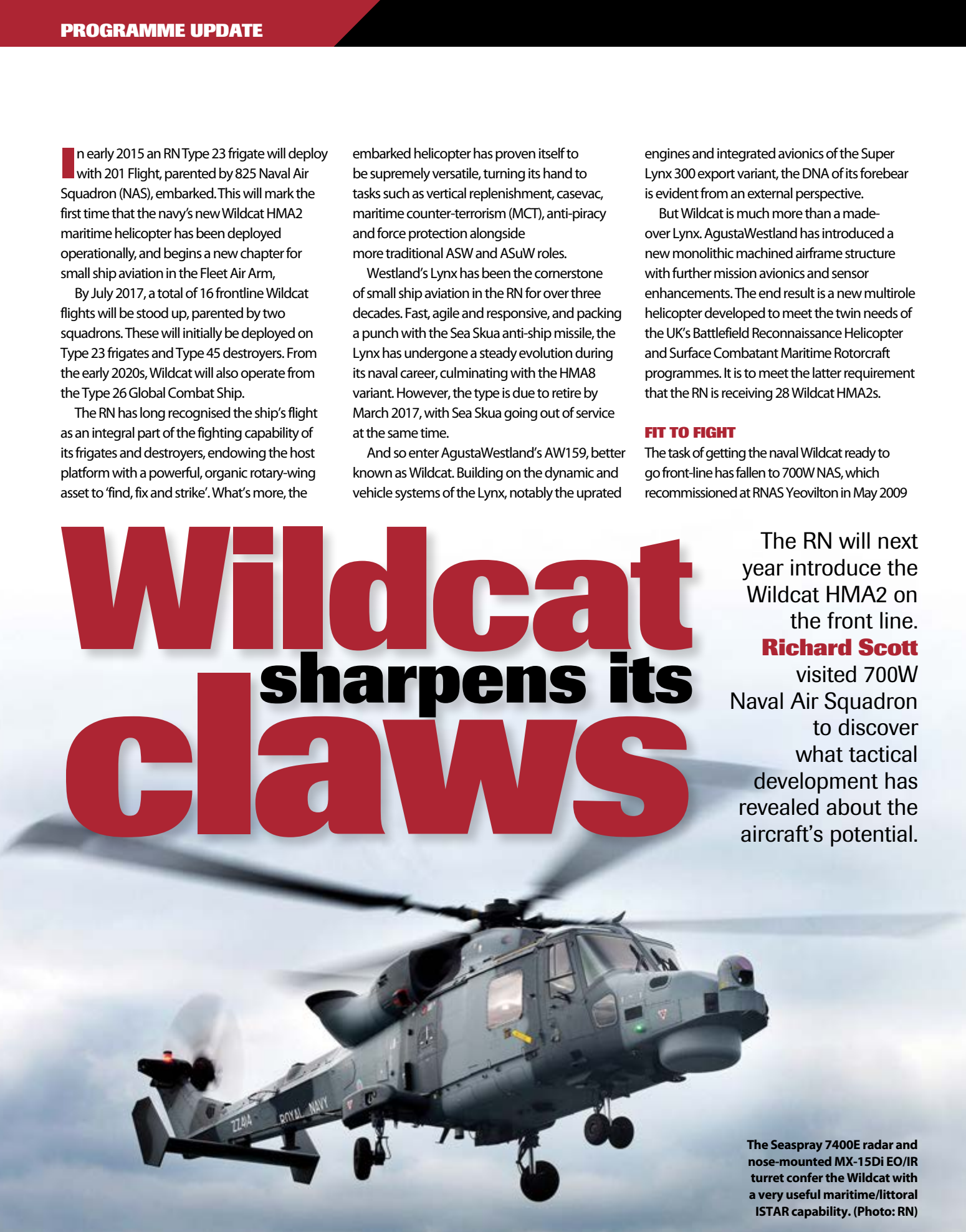
Westland's Lynx has been the cornerstone of small ship aviation in the RN for over three decades. Fast, agile and responsive, and packing a punch with the Sea Skua anti-ship missile, the Lynx has undergone a steady evolution during its naval career, culminating with the HMA8 variant. However, the type is due to retire by March 2017, with Sea Skua going out of service at the same time.

And so enter AgustaWestland's AW159, better known as Wildcat. Building on the dynamic and vehicle systems of the Lynx, notably the uprated engines and integrated avionics of the Super Lynx 300 export variant, the DNA of its forebear is evident from an external perspective.

But Wildcat is much more than a made-over Lynx. AgustaWestland has introduced a new monolithic machined airframe structure with further mission avionics and sensor enhancements. The end result is a new multirole helicopter developed to meet the twin needs of the UK's Battlefield Reconnaissance Helicopter and Surface Combatant Maritime Rotorcraft programmes. It is to meet the latter requirement that the RN is receiving 28 Wildcat HMA2s.

FIT TO FIGHT

The task of getting the naval Wildcat ready to go front-line has fallen to 700W NAS, which recommissioned at RNAS Yeovilton in May 2009



The Seaspray 7400E radar and nose-mounted MX-15Di EO/IR turret confer the Wildcat with a very useful maritime/littoral ISTAR capability. (Photo: RN)

as the Wildcat fielding squadron. In this role it has taken responsibility for operational evaluation, tactical development and training design.

INFORMED JUDGEMENTS

As a long-time Lynx aviator, with experience on both the HAS3 and HMA8, the squadron's commanding officer, Lt Cdr Simon Collins, has found himself well placed to judge the leap in performance promised by Wildcat.

'This is a huge step forward in capability,' he told *Defence Helicopter*, 'and it needs to be recognised that this is not just a Lynx upgrade. We have a brand new air vehicle, albeit with a few donor items. The tactical system and HMI has been designed from the ground up as an integrated system, so it's lower workload, higher output.

'That means we can do so much more than before. Whether it's searching a bigger area, or tracking more contacts. I'd put the ratio at about four to one in terms of productivity in the cockpit.

'And the sensor suite – both the Seaspray 7400E radar and the MX-15Di EO/IR turret – has exceeded expectations in terms of demonstrated performance. You also have AIS built into the system.

'Of course, you are always going to have niggles when bringing a new capability like Wildcat into service. There are some frustrations, as we are introducing an aircraft that is still completing development, so we have some hardware and software configuration issues to deal with. And we have probably been operating at a tempo beyond what was originally envisaged, so sometimes spares support has not been where we'd wish it to be. But you have to see past that. Wildcat's effect is going to be phenomenal.'

700W received its first Wildcat HMA2 in May 2013. The squadron will have eight aircraft on strength by late July, increasing to 12 by the turn of the year.

The main focus of squadron activity over the past 18 months has been on tactical development – characterising the performance of the Wildcat's integrated mission/sensor suite, and developing tactics, procedures and CONOPS to ensure that the aircraft's potential can be fully realised on the front line.

At the same time, 700W has also laid the ground for the start of training (both Lynx conversions and ab initio), and begun preparations for the stand-up of 201 Flight. Initial operating capability is planned for January 2015, at which point there should be one deployable aircraft with logistic support, trained aircrew and ground crew in place.

FASGW(H) – to be known as Sea Venom – will provide Wildcat with a means to prosecute surface targets in the 500-2,000t bracket. (Image: MBDA)

A strip SAR view (left) of RAF Lossiemouth produced by the Seaspray 7400E radar. (Image: RN)

Tactical development is building on experience with the Lynx, while also seeking to capitalise on the additional capability delivered by the Wildcat's mission suite. 'First we needed to make sure that we can do everything that a Lynx can,' said Collins. 'Having done that, now we can look at doing things in a different and perhaps more effective manner.'

While most tactical development flying has taken place in the South Coast exercise areas, 700W has also completed periods at sea on RFA *Argus* and HMS *Dragon* during *Joint Warrior* exercises. 'We've embarked as a small ship's flight to gain experience and support the exercise,' said Collins. 'At the same time we have gained valuable insights and evidence to support the development of procedures, and writing of the tactical manual.'

SENSOR SUITE

Lt Cdr Paddy McWilliams, 700W's senior warfare officer, has the benefit of almost 3,000 flight hours as a Lynx observer. He told *DH* that the sensor suite on the Wildcat has already shown itself to be in a different league from that in the HMA8.

'The Seaspray 7400E gives us active electronic scanning with ISAR [inverse synthetic aperture radar] and SAR [synthetic aperture radar] imaging modes, and brings a significant increase in range over the Seaspray 3030 currently in service on the Mk 8, plus full 360° scan.'

According to McWilliams, the new radar modes are useful tactical tools in littoral

environments that are typically complex, crowded and congested. 'ISAR gives us a reasonable "image" of a surface contact, and we can do a coarse measurement of length to give us a good early indication of what size and type of vessel it is,' he explained.

'We also have AIS integrated into the tactical system, so we can interrogate that radar contact to get the name, course and speed of a vessel. And we can now additionally ISAR that AIS return to verify its identity. It's another string to our bow, allowing us to increase confidence in the track ID without having to go in close.'

Evaluation of the strip and spotlight SAR modes of the radar has been more limited, but participation in Exercise *Joint Warrior* 14-1 in April yielded an opportunity. 'The aircraft release to service [RTS] is currently up to a ceiling of 6,000ft, so that did limit what we could do,' said McWilliams. 'That said, flying around Stranraer and Luce Bay we were able to get good SAR imagery over West Freugh airfield.

'The resolution was sufficient that we could tell that it was being used as a forward operating base for the exercise. We could also pick out six distinct "glints" on the pan onto which we then click the cursor to slave the MX-15Di cameras. These showed those glints to be three Lynx and three Apache helicopters.

'Obviously, at full RTS [10,000ft] we will be able to exploit the SAR mode to the full. What is already clear to us is that we will have to start thinking more about image analysis. That's something we have not previously done.'

OPTICAL EFFECTS

The MX-15Di EO/IR sensor suite also wins plaudits. 'A number of Merlins already have an earlier variant of MX-15, but the Wildcat version is significantly more advanced in terms of its sensor fit,' said McWilliams. 'As well as colour TV and mid-waveband infrared cameras, the turret also hosts a laser rangefinder and laser target designator and a spotter lens. And there is room left to integrate the Active Laser Generation Unit associated with the FASGW (Light) missile.

'We have been getting very good range and resolution from both the daylight and IR cameras,' he added. 'Again, that allows you to achieve good stand-off ranges so as to be able to report back on activity with a high level of confidence. We demonstrated this during *Joint Warrior*, looking into Kinloss barracks from a range of over 25 miles [40km].

'So while we are not an ISTAR platform in the mould of Sentinel or Watchkeeper, and we may not bring the image quality of some other platforms, there is no doubt in my mind that we can offer a very useful tactical ISTAR capability to the maritime or joint force commander. Added to that, we will in time get our full anti-surface weapon set, giving us the autonomy to locate, identify and prosecute targets where necessary.'

For the observer – as the airborne tactician – the new glass cockpit offers a better environment in which to build situation awareness and make tactical decisions. 'The

HMI has been developed in close consultation with AgustaWestland over the last seven years,' McWilliams said. 'There is still a little work to do to modify and finesse in certain areas, and to incorporate some new ideas. Overall it is set up pretty well. That said, it needs to be with just two in the cockpit.'

He added: 'I'm not sure it's any less busy for the aircrew than the Lynx. You still work at the same pace. But the difference now is that you're so much more productive in terms of what you can do.'

There are four 10x8in active matrix LCD displays in the all-digital cockpit, split into pairs for the two crew members. Typically one is set to show air vehicle data to the pilot, with the other three configured as tactical screens.

'Generally the pilot will have a tactical view with the aircraft at the centre of the screen,' McWilliams explained. 'However, I [as an observer] will frequently have my screen centre and tactical view set up to show the picture some way ahead, with my other screen set up for EO/IR.'

Another big plus from the ergonomic perspective is the observer's handgrip controller. 'This allows you to very rapidly manage the sensor presentation,' said McWilliams. 'For example, I can now do "picture and picture", flicking between TV and IR so that I can see what my best contrast is straight away.'

NEW APPROACH?

So in terms of CONOPS, will Wildcat re-use existing Lynx tactics, or is it a case of starting afresh? 'A bit of both actually,' McWilliams said. 'You can't just leave behind all the Lynx experience amassed over the last 35 years, and there is no point in simply re-inventing the wheel. Doctrine and tactics aren't necessarily tied to specific bits of kit.

'At the same time you've got to appreciate that this aircraft can do things so much more efficiently and expediently. The way we use this aircraft will be different because of the capabilities of the avionics, the sensors and, in due course, new anti-surface guided weapons.'

Lt Rob Gleave, one of 700W's pilots, added. 'Wildcat is a bigger and heavier helicopter than Lynx, so you burn more fuel. But you can trade endurance, speed and height. You simply don't need to zoom around at 120kt because you're getting so much better range from your sensors. You don't need to get so close to contacts.'

As regards weaponry, 700W completed firings with the door-mounted M3M heavy machine gun in June. Sting Ray Mod 1 torpedo and Mk 11 Mod 3 depth charge drops are planned for September on the BUTEC range off the west coast of Scotland.

Asked what could be improved, Gleave acknowledged that the absence of a tactical data link in the aircraft is the biggest issue. 'We're still transmitting voice over the radio, and that remains our number one operational constraint,' he said. 'So from a capability perspective, getting a data link is a priority.

'A full-motion video downlink is something else that we aspire to. This would allow us to relay the EO/IR picture in real time.'

A Wildcat HMA2 from 700W NAS seen during embarked flight trials from the Type 23 frigate HMS *Monmouth*. (Photo: RN)

Also eagerly awaited is Wildcat's two-pronged surface attack armoury, coming in the shape of the Light and Heavy variants of the Future Anti-Surface Guided Weapon (FASGW). 'It's welcome news that the two programmes are now under contract and picking up pace,' said Collins, adding: 'We've already had some engagement with AgustaWestland and MBDA to talk through the HMI aspects of FASGW (Heavy), which will be known as Sea Venom in service.'

TRANSITION PLAN

The Lynx Wildcat Maritime Force at RNAS Yeovilton is now starting the transition to a single-type Wildcat force. With the bulk of tactical development complete, 700W NAS will decommission at the end of July. On 1 August 702 NAS, which provides training for the Lynx force, will disband.

825 NAS, the first frontline Wildcat squadron, will then come into being in August, effectively unifying 700W and 702. This will leave 815 as the sole Lynx squadron through to the final retirement of the HMA8.

825 will parent four frontline Wildcat flights (primarily for Type 45 destroyers) alongside responsibility for training both aircrew and engineers. It will, at the same time, continue tactical development.

815 NAS starts its conversion from Lynx to Wildcat in late 2015. Once fully converted, the squadron will consist of 12 single-manned flights at readiness for deployed operations worldwide, and two double-manned MCT flights kept at very high readiness in the UK.

That transition will not be without challenges. 'There will come the point, in early/mid-2016, when we generate a fifth flight and 815 will begin the transition from the Lynx Mk 8 to Wildcat,' said Collins. 'That will require careful and graduated management. You are operating an aircraft near the end of its useful life while at the same time building up with Wildcat, all with a finite resource of people.'

The FASGW (Light) missile system will be closely integrated with the aircraft's sensor turret. (Image: Thales)

TRAINING TASK

The decommissioning of 700W, and stand-up of 825 in its place, signifies a shift in emphasis from tactical development to training. Conversion training (lasting six months) for Lynx aircrew in fact began on 30 June, and the first ab-initio course (50 weeks) will kick off in January 2015.

'We will run both courses start to finish once to see if there any parts of the syllabus that need finessing,' said Collins. 'After that, the momentum builds as we up the tempo of training to ensure we can meet manning requirements. That means conversion courses overlapping at three-month intervals, and ab-initios staggered every six months.

'The important thing is that we use the opportunity we have now to change the way we do business. We need to capture the lessons learned by 700W during tactical development, and get these into the training syllabus.'

Perhaps the biggest challenge for the maritime Wildcat community is getting the rest of the navy to think differently. 'The move from Lynx to Wildcat is more than a generational jump,' said Collins. 'But Wildcat still looks like a Lynx. So for many outside this community, there is an assumption that it does pretty much the same thing.

'In actual fact, you need to look at it as a completely different capability. It's a big part of my job to get out to other parts of navy and defence to change perceptions and educate people as to just what Wildcat can do.' ***DH***

Taking control

Could the concept of an optionally piloted helicopter that provides its passengers with a mission-specific interface become reality over the coming years, and what are the implications for flying in degraded visual environments? **Peter Donaldson** finds out.

If you enjoy the physical process of flying a helicopter and take pride in precise hovers and pinpoint landings, you will probably not agree with Sikorsky chief engineer for autonomy Igor Cherepinsky's vision for the future – one he is actively trying to create. 'Our long-term goal is to take the pilot away from flying stick and rudder and more into mission management,' he explained to *Defence Helicopter*.

'In fact, the eventual goal is to take the stick, collective and pedals out of the aircraft altogether and provide a mission management interface. At that point, it doesn't really matter where the pilot or the operator – the human being – is. There are applications where they can be in the cockpit; applications where they can be in the back; and then applications where they are on the ground or in some other vehicle.'

END RESULT

The logical conclusion of all this is the optionally piloted aircraft, a concept that Sikorsky is realising through Matrix Technology and its Sikorsky Autonomous Research Aircraft (SARA) and Manned/Unmanned Resupply Aerial Lifter (MURAL) programmes. Both are intended to make autonomy in aircraft more capable, reliable and – crucially – safer than before, and have reached significant milestones in recent months.

Additionally, the programmes rely upon and integrate with broad industry and government efforts in the world of open systems through the Future Avionics Capability Environment (FACE) and Joint Common Architecture (JCA), creating an avionics ecosystem more like the one that PC, tablet and smartphone software inhabits, but with certification to the highest levels of safety. In the process, they could fundamentally change the relationship between human and helicopter, creating a sliding scale of autonomy from human piloted vehicle to fully realised robot.

According to Sikorsky, Matrix is an architecture of software apps and hardware components built to enable autonomous execution of complex missions in close proximity to obstacles at a new level of system reliability. In February, the company announced that SARA had entered its second phase of flight testing the S-76 with a fly-by-wire control system, in which the helicopter uses a suite of sensors to detect and avoid obstacles around it in a demonstration of autonomous site selection and landing.

Meanwhile, MURAL is an optionally piloted Black Hawk that successfully conducted its first flight on 11 March when it demonstrated autonomous hover and flight operations under the command of a portable ground control station. Under development since 2007, MURAL

Landing helicopters in degraded visual environments remains a challenge despite technological advances in recent years. (Photo: US DoD)

The MFRF programme is driving the development of RF sensors in an effort to provide new capabilities. (Image: DARPA)

is a cooperative effort between Sikorsky and two US Army organisations – the Aviation Development Directorate, and the Utility Helicopters Project Office.

'The SARA is the technology lead,' explained Cherepinsky. 'That's where we really develop and test all the new autonomy technology that's emerging, and MURAL was one of the platforms we ported a lot of the technology from SARA to.'

FROM AUTONOMY TO DVE

Technologies that enable a robotic aircraft to pick a safe landing site and guide itself into it have obvious resonance with other efforts that are pushing the envelope of avionics capabilities, such as the DARPA/Honeywell Synthetic Vision Avionics Backbone (SVAB) and the US Army/Rockwell Collins Degraded Visual Environment Pilotage System (DVEPS).

'We are aware of both,' added Cherepinsky. 'When we started working on this, we were obviously considering autonomy, but now we have realised that our applications can be really helpful to the manned community. In fact, one of our goals is to spin off everything we do into manned helicopters.'

The DVE connection is particularly strong, and the multi-spectral perception that has just been integrated into SARA is directly applicable, so Sikorsky is demonstrating its capabilities to this community.

'Our approach of using multiple less-expensive sensors – which are fault-tolerant because there is more than one – and the way we do fault detection allow us to provide full perception coverage even with one or two failures,' he continued. 'All the modes we are developing for SARA that allow us to do landing zone selection, approach and landing obviously work in a degraded visual environment. We are sharing all that with the DVE folks and, in fact, we have a solution to that problem.'

Everything in Matrix is designed to meet evolving FACE and JCA standards, both of which underpin high-integrity open software. The difference between them, Cherepinsky summarised, is that the former is a standard for operating systems and application software, while the latter is more concerned with functional partitioning, in which processor time slots and memory locations are strictly allocated among different pieces of software to avoid clashes and crashes – of both computer and aircraft kinds.

In building Matrix to FACE and JCA standards, Sikorsky found that each lacked certain pieces required for autonomous systems, so the company developed those for itself and is working with the consortia responsible for the standards to incorporate that work.

'A tricky phase of any mission, civil or military, could be automated by such an app.'

AN OPEN APPROACH

'Our goal is to have what we do become completely open,' added Cherepinsky. 'We don't want proprietary interfaces – we want to design an open autonomy system where anybody can write apps for our vehicles, or anybody else's vehicles for that matter.'

While the optionally manned helicopter that does away with sticks and pedals in favour of a mission management interface may be some way off, the kind of app that automates a particular segment of a mission is already here in the form of the Rig Approach system for the S-92. Following FAA certification in May 2013, Rig Approach, developed by Sikorsky in cooperation with PHI, was used in the first operational flights to oil rigs off the coast of Louisiana in November.

In principle, a tricky phase of any mission, civil or military, could be automated by such an app. With the software incorporated into a mission-specific interface, the pilot will be able to plan a tasking and let the aircraft fly a particular segment of it automatically to reduce workload and improve safety.

Unlike a conventional autopilot, however, it does not require micro-management, such as worrying whether the heading or altitude hold is engaged and monitoring the numbers, according to Cherepinsky. 'It operates at a much higher level: "I am executing a rig approach;

I am approaching this rig; here is my progress." There are few elements that the operator has to keep an eye on.'

Sikorsky has also looked at the charged issue of carrying passengers without a pilot. 'At this point, it is more of a cultural problem than a technical one,' Cherepinsky observed. 'And that is why we want to give the passengers a mission-specific interface in the back of the aircraft, so that they aren't really just passengers – they can affect the outcome if they want to.'

While the avionics are designed to handle lower-level contingencies such as engine failures autonomously, if something happens that changes the mission, the interface would enable 'passengers' to redirect the aircraft. This idea is an example of that sliding scale in action. Sikorsky does not see autonomy as all or nothing, and wants to build trust for the technology among pilots and passengers as it evolves.

'As people start to trust our systems more and more, they will allow them to do more and more.' To gain that trust, the goal is to demonstrate reliability as good as or better than current manned aircraft, meaning loss rates of approximately one every 100,000 hours, and orders of magnitude better than today's UAVs.

Sikorsky's SARA and MURAL programmes are intended to make autonomy in aircraft more capable. (Photo: UTC)

KIT AUTONOMY

Sikorsky plans to take the A and B kit route to apply autonomy to existing Black Hawks and insert it for customers into new-build aircraft on the production line. Perhaps surprisingly, this will not necessarily add much weight, as Cherepinsky noted that it is comparable to current autopilots and Moore's law keeps shrinking the computers.

Pinning down a weight figure is difficult because it depends on what the aircraft starts with – if it has fly-by-wire controls, he explained, the additional weight amounts to tens of pounds at most. If not, Sikorsky offers a kit to retrofit any aircraft with full-authority fly-by-wire controls and then the weight change depends on the difference between what comes out and what goes in.

'In a lot of cases, we have found that it really is a wash – by the time you are done taking out all the old mechanical push rods and you have added our system, it kind of comes out the same. But it really varies.'

Following the success of the MURAL demonstration with the Optionally Piloted Black Hawk (OPBH) demonstrator – a fly-by-wire aircraft with the Matrix mission manager installed – in scoping out the concept of operations for the US Army, Sikorsky has brought the UH-60A into the programme and is building the first prototype. Although the company is not saying exactly when it will be ready for operations, when SARA was built Sikorsky needed about 14 months between securing internal funding and achieving first flight.

ENABLING BACKBONE

Open systems for avionics took a step forward last year with successful flight tests of the DARPA SVAB with Honeywell's SmartView IR synthetic vision system and a millimetre-wave radar developed under the agency's Multi-Function Radio Frequency (MFRF) programme. Completion of the tests on a Black Hawk was announced on 22 October.

> 'As people start to trust our systems more and more, they will allow them to do more and more.'

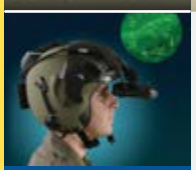
SVAB sensor fusion capabilities also underpin the DVEPS being developed for US Army 160th Special Operations Aviation Regiment helicopters under a three-phase programme to qualify a DVE solution that can be fielded by 2018. Boeing, Sierra Nevada and Rockwell Collins are working on Phase 1 DVEPS contracts.

SVAB uses advanced data processing algorithms to fuse the input from multiple sensors working in any part of the electromagnetic spectrum, providing a reliable picture of the outside world through obscurants.

'The beauty of the SVAB is that it's "sensor-impartial", allowing any number of sensors to provide input into the common sensor interface,' commented Honeywell business development manager Howard Wiebold after completion of the tests. 'This open approach makes way for an efficient upgrade path, especially while research continues into new and improved sensors for use in DVE conditions.'

NEW TOOLS FOR NEW RULES

ANVIS/HUD®
Day & Night



DCoMPASS™
Payload

Visit us at
FARNBOROUGH 2014
Hall 1, Stand C-14

Two Views are Better than One. The ANVIS/HUD®24T.

The new ANVIS/HUD®24T (Tracker) gives helicopter pilots invaluable advantages. Slaving helicopter systems to the pilot's LOS, the system also displays vital flight info and facilitates targeting via the Tracker display. Best of all, the Tracker allows each crew member to track the other's field of view. Especially effective on utility platforms performing SAR missions, the ANVIS/HUD®24T takes crew communication, coordination and situational awareness to new levels.

Elbit Systems

NEXT IS NOW™

www.elbitsystems.com

The Degraded Visual Environment Pilotage System is being developed for US Army special operations helicopters. (Photo: US Army)

The system accurately detected obstacles, terrain and power lines and portrayed them in a realistic 3D view on the Black Hawk's standard cockpit displays. Wiebold emphasised that although the tests were carried out on this helicopter, the intention is to make the technology available for other current and future military rotorcraft, including Future Vertical Lift (FVL) platforms.

SENSORS BEYOND DVE

As an enabling technology for the MFRF programme, SVAB is also enabling technology for an effort that goes beyond take-off, hover and landing aids in DVE to address what DARPA calls 'all elements of combat', including en-route navigation, lethality and survivability.

The MFRF programme is also driving the development of new RF sensors in an effort to provide new capabilities while eliminating many redundant elements of current independently developed 'situational and combat support' systems to provide multi-function sensors that

can accept new mission functions as software upgrades. This, according to DARPA, will reduce the overall SWaP and cost of subsystems, enabling greater mission capability with a smaller vehicle systems integration burden.

In addition to the synthetic vision system for pilots, there is the Advanced Rotary Multifunction Sensor (ARMS) under development – a small and light electronically scanned radar based on silicon tile arrays. ARMS is to be supported by a software development kit (SDK) that will enable the insertion of new modes without hardware modifications. Northrop Grumman and BAE Systems are working under ARMS contracts awarded in 2012.

In addition to the SVAB flights, the first lab tests of ARMS components suitable for flight testing began in FY2013, and development and testing of key subsystem technologies for RF waveform and arrays were completed.

Work through FY2014 is focused on final selection of tile array and backplane technologies that will go into sub-arrays for demonstration in the lab. Plans also call for demonstration of silicon tile sub arrays integrated with the digital receiver/exciter backplane and of the SDK. In FY2015, the kit's usefulness will be put to the test when third-party programmers use it to redefine the functions of the integrated ARMS system.

Completion of ARMS lab testing ahead of flight testing is also slated for FY2015, along with lab demonstration of an integrated system including ARMS, SVAB and the SDK.

TARGETING VISAR

Additionally, DARPA wants a radar sensor that will fit into a standard EO turret and penetrate clouds, rain and dust to produce high-resolution video imagery good enough to engage moving ground targets. Current radar systems penetrate obscurants, but at less than 0.1Hz their frame rates are too low to be useful in this application, according to the agency.

The Video Synthetic Aperture Radar (ViSAR) programme is intended to solve this problem through the development of an extremely high frequency (EHF) targeting sensor that operates through clouds as effectively as EO sensors do in clear weather. Candidate platforms for the spotlight SAR include special operations MH-60s and AC-130 gunships.

L-3 Electron Devices and Northrop Grumman Electronic Systems are working under contracts awarded in July and September 2013 respectively to develop a prototype, with the former leading the effort. Sensor design concepts and the impact of platforms and weather on targeting performance were evaluated in FY2013 and the design and development of transceiver hardware began.

During the current financial year, development of transmitter and receiver components for demonstration should be completed, hardware design for the complete ViSAR system is due to begin and the performance of a laboratory-quality transmitter amplifier should be demonstrated. Plans for FY2015 focus on development of a flight-worthy high-power amplifier.

The promise of open systems for avionics has been tantalising for a while, but now it seems to be on the edge of delivering new capabilities more quickly than ever before, whether they be penetrating new sensors or apps that bring autonomy to the toughest parts of military helicopter missions. ***DH***

ADEX 2014

Azerbaijan Defence Exhibition

1st AZERBAIJAN INTERNATIONAL

DEFENCE INDUSTRY EXHIBITION

11-13 SEPTEMBER 2014

BAKU, AZERBAIJAN
BAKU EXPO CENTER

www.adex2014.com

SUPPORT

MINISTRY OF DEFENCE OF THE REPUBLIC OF AZERBAIJAN

MINISTRY OF THE DEFENCE INDUSTRY OF THE REPUBLIC OF AZERBAIJAN

ORGANISING PARTNER

Iteca

Tel.: +99412 404 10 00; Fax: +99412 404 10 01
E-mail: adex@iteca.az

Smoother, better, faster, stronger

Rotor blade development plays a vital part in the overall evolution of a helicopter's capabilities. **Jonathan Tringham** examines the progress being made by industry to satisfy requirements for more durable, robust and smoother components.

Recent advances in rotor blade technology have redefined the capabilities of modern combat, transport and utility helicopters. Improved design geometry and lighter, stronger composite structural materials have yielded dramatic increases in the lift capacity, fatigue-resistance, strength-to-density ratios and overall lifespan of rotor blades.

The extreme environmental conditions military helicopters operate in have led to ongoing R&D programmes aimed at increasing the performance and survivability of critical components.

The advent of composite building materials, such as glass- or carbon-fibre-reinforced plastics, has allowed the creation of modern composite blades that are superior to their metal predecessors in virtually every metric.

GOING ALL OUT

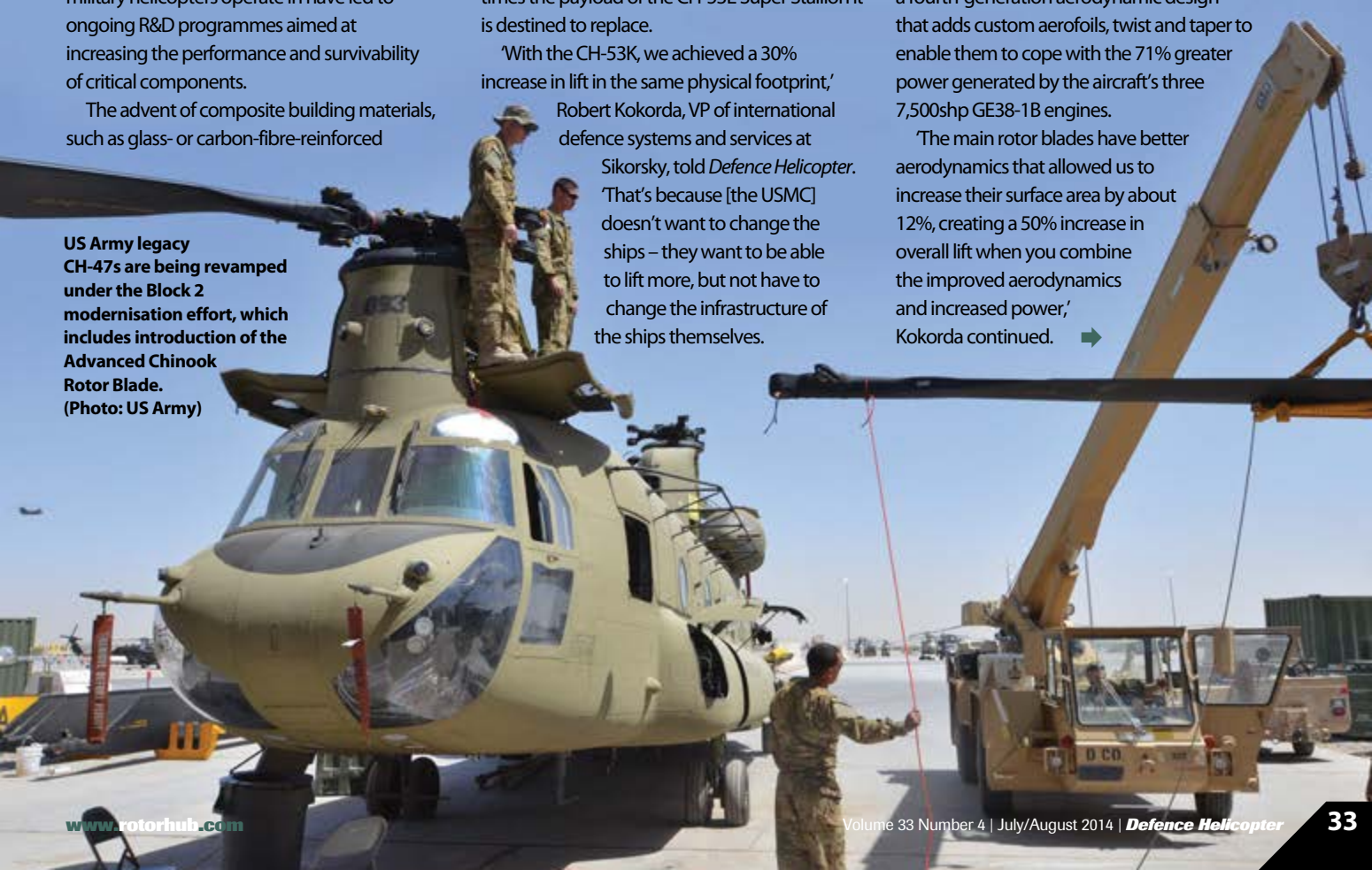
Sikorsky has created an all-composite main and tail rotor for the USMC's CH-53K heavy-lift helicopter programme, which has contributed to the new airframe's ability to lift almost three times the payload of the CH-53E Super Stallion it is destined to replace.

'With the CH-53K, we achieved a 30% increase in lift in the same physical footprint,' Robert Kokorda, VP of international defence systems and services at Sikorsky, told *Defence Helicopter*. 'That's because [the USMC] doesn't want to change the ships – they want to be able to lift more, but not have to change the infrastructure of the ships themselves.

'The critical technologies enabling this were a combination of weight reduction in the aircraft – we went to an all-composite fuselage – a lot more horsepower going through the three engines; and in order to accommodate that power and push it up through the rotor head, we introduced a new split-torque gear box. And lastly of course, the aerodynamics of the [all-composite] blades.'

The CH-53K's seven main rotor blades utilise a fourth-generation aerodynamic design that adds custom aerofoils, twist and taper to enable them to cope with the 71% greater power generated by the aircraft's three 7,500shp GE38-1B engines.

'The main rotor blades have better aerodynamics that allowed us to increase their surface area by about 12%, creating a 50% increase in overall lift when you combine the improved aerodynamics and increased power,' Kokorda continued.



US Army legacy CH-47s are being revamped under the Block 2 modernisation effort, which includes introduction of the Advanced Chinook Rotor Blade. (Photo: US Army)

Helitune's RT2000 tuner system provides portable rotor track and balance capabilities in harsh operating environments. (Photo: Helitune)

REACHING OUT

An advanced blade tip is incorporated into the span length to improve hover performance. In addition, the main rotor blades feature a composite cuff attachment to facilitate rapid installation directly onto an elastomerically articulated titanium rotor head, without the need for specialised tools or multiple redundant fasteners. Attached to the ~9ft (2.7m)-diameter main rotor hub, the blade radius extends to 39.5ft.

'The aerofoil shape is improved – it has a wider coil length, and improved tip shape that reduces losses due to rotor vortices,' added Kokorda. 'The 53E blade had a titanium spar – this has a composite spar.'

According to Sikorsky, the four 10ft-long (3m) CH-53K tail rotor blades have 15% more surface area compared to those on the CH-53E, and collectively produce as much thrust as the main rotor blades on the company's 5t gross weight S-76.

In May, the CH-53K's seven main and four tail rotor blades were attached for the first time to a non-flying prototype called the Ground Test Vehicle (GTV), which has now begun a two-year test programme of the blades, transmission, engines and all subsystems, commencing with a powered 'light-off' testing with the rotor blades spinning.

The GTV will allow ground tests and operational experience to begin accumulating ahead of the four flight test aircraft entering the programme. The GTV can measure and verify the ability of the drive system, transmissions and engines to fly the CH-53K safely and efficiently across multiple flight scenarios up to its 40t maximum gross weight with an external load.

The aircraft is now fully configured to proceed to the next series of system integration tests that will further validate its rotors, drive, electrical, hydraulic, avionics and flight controls – all leading to operational acceptance testing. The preliminary results suggest Sikorsky is on track to reach its target of first test flight in late 2014.

LEGACY UPDATE

Meanwhile, the US Army's legacy CH-47 Chinooks are being revamped under a Block 2 modernisation effort, which includes the introduction of the Advanced Chinook Rotor Blade (ACRB).

Manufactured by Boeing, the ACRB demonstrates a greater service life than existing main rotor blades, and reduces the time taken for rotor track and balance (RTB) tasks. The blades are being adopted for use on 'regular' CH-47s and the MH-47Gs used by the special operations community.

The ACRB is due to make its first flight on a Chinook in the summer of 2015, with production commencing in late FY2016. Tests suggest that its introduction of the blades will allow the CH-47F to carry a 10t payload for 93km, with 4,000ft/35°C high/hot hover performance, to be increased to 6,000ft/35°C over time.

As with the all-composite CH-53K main rotor blades, the ACRB features new aerofoils, increased twist and a redesigned tip, increasing lifting capacity by more than 860kg. However, the overall blade length remains unchanged.

According to Boeing, no detrimental loads have been introduced into the rotor hub or controls, allowing the former to remain unchanged and enabling existing Chinooks to be easily upgraded. By the time the new blade becomes available in 2016, the company estimates there will be approximately 400 CH-47s still in the field.

The US Army's newest AH-64E Apaches have also benefitted from the incorporation of a new composite main rotor blade (CMRB), among a series of other upgrades, which have significantly increased their capabilities.

The development of the CMRB for the Apache has been concluded, with the all-composite blades now fully qualified and delivered on all production AH-64Es.

POWERFUL CORE

In addition to the CMRB, which provides greater lift, the Echo models have a more powerful engine and drivetrain; a more advanced computer processing system to facilitate connectivity to the next generation of networked capabilities; an open-systems architecture to allow the army to incorporate new subsystems more efficiently; and new software that allows pilots to control UAVs and their payloads.

Speaking to *DH*, Lt Col Talmadge Sheppard, US Army product manager for the Apache Longbow, said that while the initial requirement for the CMRB was to improve reliability and durability, as well as provide enhanced field repair capability, the increased performance of the blades also accelerated the development for the AH-64E.

'The composite blades met or exceeded all programme objectives performed during flight tests,' he said. 'The main benefits of switching to carbon-fibre composite blades are maintainability, supportability and performance increases. [In addition], gunfire damage is contained to a smaller area – composites perform better than metal versus battle damage in general.'

Both the legacy blades and CMRBs are protected by an abrasion strip on the leading edge. Maintenance routines typically included paint touch-ups as well as repairs of small scratches and dents, with more complex work conducted at either the OEM's facilities or a depot.

All 69 AH-64Es produced to date now have the CMRB installed. In March, the Echo model Apaches were deployed to Afghanistan by the army's 1-229th Attack Reconnaissance Battalion, and have since completed over 17,000 operational hours at a 'higher operational tempo' (an additional 15 hours per month),

Designed to **Defend**

www.rubbmmilitary.com

Farnborough International Airshow 14-20 July 2014

Rubb Buildings Ltd
Aerospace in Cornwall
Hall 1 Stand C9

Strong Durable Rapid Erect Helicopter Hangars

Rubb's Expeditionary Forces Aircraft Shelter System is uniquely suitable for the military services, designed to be rapidly deployed and erected anywhere in the world. With unmatched relocatable buildings in action across the globe, Rubb has the ideal solution to military requirements.

- Relocatable
- Extendable
- Transportable
- Rapid construction
- 11m - 25m spans
- Multiple door options
- Integral crane
- Quality materials
- Client support

RUBB
Military Buildings

Email: info@rubb.co.uk | Tel: +44 191 482 2211

www.rubbmilitary.com

USMC CH-53Es are to be replaced by the CH-53K, capable of providing nearly three times the lift capacity due to composite rotors, among other improvements. (Photo: USMC)

with missions including escort of CH-47s designated for casevac. With the new rotors, the AH-64Es are now capable of operating at the same speed and altitude as the Chinook – something lacking in previous models.

'The army is also exploring the [composite rotor] capability through an ongoing R&D effort for an Apache Improved Tail Rotor Blade [ITRB],' added Sheppard. 'The ITRB will undergo early flight tests in mid-FY2015.'

BAD VIBRATIONS

With the introduction of composite materials into rotor blade production, OEMs are looking to not only improve reliability and durability, but mitigate the excessive vibration issues experienced with older metal rotor blades. Reducing vibration would in turn improve performance, lessen general wear and tear and remove the need for regular RTB tasks.

'The biggest problem is that basically anything that rotates – even if it's only slightly out of balance – is going to cause vibration, and the problem with vibration is that it breaks things,' explained Paul Hawksworth, sales manager for UK-based RTB equipment manufacturer Helitune. 'On a helicopter, this could be anything from the avionics to causing cracking in the airframe, so it can be quite destructive.'

He explained that while modern composite blades are built to a much higher specification and tolerance level than legacy metal structures, and offer more consistent performance, they have not yet reached the point where vibration is no longer an issue.

'I think the idea was that [OEMs] would be able to produce the blades to such a high standard that there would be no need for rotor track and balance, but that definitely hasn't materialised,' he continued. 'But certainly the modern blades are far better than the metal blades that we used to have – there are much less variances between blades when you fit a set, and they don't suffer from the old problems of moisture absorption, so you get much more reliable results from them.'

RTB equipment is widely used by helicopter fleets worldwide to optimise the operational performance of combat helicopters. Such maintenance is intended to mitigate excessive blade vibration caused by operational fatigue, and rotor damage incurred during firefights or as a result of harsh environmental conditions such as sand, heat and humidity.

CHARACTER CHANGES

As blades wear and get older, they lose their efficiency, and no longer generate as much lift. In desert conditions like Iraq and Afghanistan, blade erosion on the leading edge is also a significant issue. Once a blade has been battle-damaged and repaired, its performance characteristics change, usually with regard to its centre of gravity and mass – and all of these factors increase unwanted vibration levels. The RTB equipment is designed to reduce these levels by balancing the blades.

'Rotor balancing is usually done on an as-required basis as opposed to being a scheduled maintenance task,' added Hawksworth. 'For example, if you're flying a Chinook and it's been doing some heavy lifting, you would typically do an RTB immediately after simply because of the immense strain that's been put on the airframe and the blades.'

However, balance adjustments are required every time a blade is changed; whenever maintenance tasks require the removal of the rotor head, if repairs are carried out on the blades; or if the pilot reports high levels of vibration or track splits.

Hawksworth noted that optimising the vibration levels of an aircraft was dictated by the type of mission it performed. 'For most of the military aircraft that are flying from one place to another as fast as they can, they're trying to optimise the vibration levels to make it as smooth as possible at the forward-flight speeds,' he explained. 'But if it's a SAR helicopter, they are more interested in having it very smooth in the hover condition. So sometimes you might have to sacrifice one end of the flight speed regime for another – it's all about where you want the least vibration.'

COLLECTING DATA

The RTB test is done using an optical device to track the blades when they are spinning. Measurements are taken using accelerometers for measuring the vibration levels, and a camera looks at the blade tips and measures the difference in height between them. Ideally, the tips should all be flying in the same plane, at the same level.

Once the data has been collected, the RTB device provides maintenance crews with a set of adjustments which they must make to the aircraft in order to correct any imbalances. These modifications are performed while the rotor head is stationary.

Depending on the aircraft, there are usually three adjustment types to be performed. Firstly, small weights are added to the blades individually, which will provide lateral balancing, similar to balancing a car wheel. This is usually done at the blade roots rather than the blade tips.

Secondly, pitch links change the angle of attack along the blades across the entire length. Finally, most aircraft have blade tabs – small bendable strips – which will change the way the blade flies with increasing flight speed. The pitch links offer a generic adjustment for all flight conditions, whereas the tabs will change the blade characteristics for specific flight conditions.

'Blades are often balanced statically in the bay before they're issued to the end user and fitted to the aircraft,' Hawksworth concluded. 'But statically balancing is sort of a halfway measure – it's not the same as putting them into a rotor head and spinning them. When you spin the blades and start pushing them through the air, they behave differently. The idea of a rotor tuner is to take out those differences so they all fly equally, and therefore all generate the same amount of lift. It's also to ensure that the blades are all dynamically balanced so they don't cause a lateral vibration.' ***DH***

SHOW THE WORLD WHAT YOU'RE MADE OF

BE PART OF THE SINGAPORE AIRSHOW 2016

If aviation defines who you are, if it is in your very DNA, then Singapore Airshow is the platform to show the world of aviation what you have to offer. The global aerospace community and key commercial, government and military delegations will gather again at the Singapore Airshow 2016. Tap directly into the world's fastest growing region!

Exhibition space is filling fast. Secure your presence now.

75% BOOKED

TO BOOK YOUR SPACE, PLEASE CONTACT:
DANNY SOONG / VIVIAN KOO / CATHRYN LEE
TEL: +65 6595 6123 / 6595 6122 / 6595 6114
EMAIL: sales@singaporeairshow.com

SCAN FOR MORE INFO

SINGAPORE AIRSHOW 2014 ACHIEVEMENTS

- ***1,018*** *PARTICIPATING COMPANIES FROM 47 COUNTRIES & REGIONS*
- ***65 OF THE TOP 100*** *AEROSPACE COMPANIES*
- ***45,152*** *TRADE ATTENDEES FROM 125 COUNTRIES & REGIONS*
- ***274*** *DELEGATIONS FROM 76 COUNTRIES & REGIONS*
- ***CLOSE TO 70*** *CEOs, PRESIDENTS AND CHAIRMEN FROM VARIOUS AIRLINES AND INDUSTRY ASSOCIATIONS*
- ***1,132*** *HIGH-LEVEL MEETINGS TOOK PLACE BETWEEN VIP DELEGATIONS AND EXHIBITORS*

SINGAPORE AIRSHOW 2016

ASIA'S BIGGEST FOR AVIATION'S FINEST

CHANGI EXHIBITION CENTRE
16 - 21 FEBRUARY

SINGAPORE AIRSHOW

Organised by: experia events that influence
Supported by: EDB singapore, ie Singapore, Singapore Exhibition & Convention Bureau
Endorsed by: aif
Held In: singapore, Heart of Aviation singapore

Quest for power

A number of next-generation engines are currently in development that promise significant reductions in specific fuel consumption levels and maintenance costs. **Peter Donaldson** examines some of these programmes.

An aerospace propulsion technician looks through a part of an HH-60 Pave Hawk engine during repair. (Photo: USAF)

Because politics and economics change much faster than engine technology, manufacturers focus on improving their fundamentals – power, weight, fuel efficiency, reliability and maintenance costs.

With new designs, current technologies can be applied throughout the engine in pursuit of dramatic gains, with some feeding back into existing products to produce more modest improvements. Pay-offs from both can come through large fleets and long service lives.

Combined with big data analysis that builds deep understanding of how engines perform and fail, thereby driving maintenance costs down, this approach enables manufacturers to survive the transition from protracted wars to much smaller budgets and smaller, but not necessarily fewer, deployments.

AWKWARD COMBINATION

Philippe Couteaux, Turbomeca's VP of strategy and development, highlighted the awkward combination of shrinking military budgets in the west and the potential for more force projections in 'certain sensitive areas of the world', including parts of Africa, the Middle East and Eastern Europe.

'What the conclusion of all this is, I don't really know,' he told *Defence Helicopter*. 'What we can see is a stabilisation of the current needs for military engines in the short term. But longer term, the natural trend would be for a slight decrease resulting from the reduction in military budgets – and from the fact that helicopters will be more versatile.'

That versatility, he said, is likely to cut the replacement rate for military helicopters from 1:1, down to about 0.7-0.8:1.

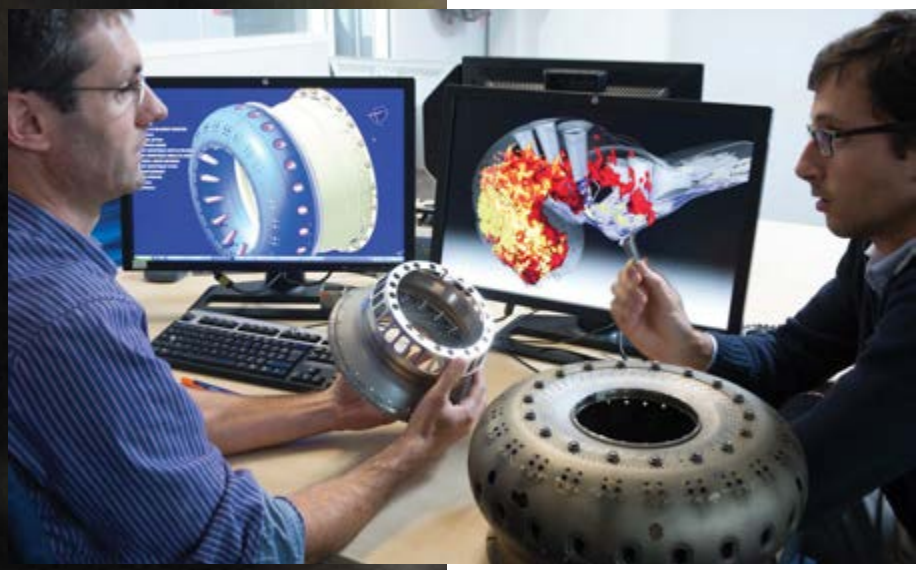
Standard industry practice when pushing for big efficiency gains is to build a risk-reducing technology demonstrator before launching a new engine. Turbomeca's Tech 800 (kilowatts) preceded the new 1,100-1,200shp Arrano, and now the Tech 3000 (horsepower) is set to pave the way for more powerful engines for an anticipated new generation of heavy helicopters. Almost all of Turbomeca's offerings are classified as dual-use (civil/military) items under French export regulations.

READY FIRST

The Arrano, which made its first test run in February, has been designed to achieve a 10-15% reduction in specific fuel consumption (SFC) over comparable in-service engines. Turbomeca is committed to having engines ready for certification for Airbus Helicopters' X4 by 2017. X4 customers will be able to choose between the Arrano and Pratt & Whitney's PW210.

Arrano features a two-stage centrifugal compressor and a single-stage gas generator turbine. 'That architecture already exists on other programmes,' explained Couteaux. 'But it is state-of-the-art technology in the sense that we have reviewed the thermodynamic cycle [and…] a number of materials of the key elements of the engine.'

Reducing direct maintenance costs by 10-15% is also a major goal with Arrano, and Couteaux also emphasised the effort that Turbomeca has put into concurrent engineering of maintenance provisions, including ground support equipment and repair tooling.



Reducing direct maintenance costs by 10-15% for Arrano is a major focus point of current Turbomeca R&D. (Photo: Turbomeca)

'All this is being done upstream at the design stage,' he noted. 'Added to the Tech [3000] programme, this enables us to ensure that when it enters service it is a mature engine. Of course, there will always be teething problems, but this approach enables us to reduce the number of issues we have at the beginning and give confidence to the customers.'

Meanwhile, Tech 3000 development is progressing. 'We have passed through the final design phase of the various parts and modules,' said Couteaux. 'We expect to start testing at the end of this year.'

These will be component assessments, with testing of a complete engine scheduled for next year. Again, Couteaux was cautious about revealing technical details, but confirmed that Tech 3000 will have a multi-stage compressor featuring a combination of axial and centrifugal stages along with a multi-stage gas generator turbine.

'The idea, of course, is to reduce weight, optimise the pressure ratio, the power-to-weight-ratio and the specific fuel consumption,' he continued. 'Power-to-weight is absolutely a fundamental element of the strategy in heavy helicopters.'

READY TO FLY

Elsewhere, GE Aviation is completing the second 1,000-hour missionised durability test on the 7,500shp GE38 for Sikorsky's new CH-53K. This follows 300 hours of cyclic durability testing completed in December of last year – 50 six-hour runs exercising the engine at well above its rated power to subject the turbines to their highest design temperature. This tests the engine as though it were fully deteriorated, programme manager Paul Acquaviva told *DH*. This test also included many full-throttle transients and extended running in harsh conditions.

'This particular test was the most severe for GE in that we ran it for more time at the red line than any other engine we have ever run,' he said. 'The government keeps upping the ante on the requirements because it translates into more durable engines.'

A key measure of that durability is the level of performance it was still producing at the end of the test, which Acquaviva said was effectively as good as new. 'The bottom line is after the test was run we still met new shipment margin for an engine.'

The 1,000-hour missionised durability tests are less severe from a temperature perspective, but subject the engine to many more power cycles. GE completed one of these tests last year, dismantled the engine, fitted a new turbine section and began the second 1,000-hour test. The turbine section also looked good enough to re-use, noted Acquaviva, but a new one was installed to minimise risk. When *DH* spoke to him in late May, the engine was about 100 hours away from completing this test.

The GE38 has also been through altitude testing and validated its power and SFC across the entire envelope – its SFC is 18% better than the T64 that powers current CH-53Es. Over-temperature, over-speed and control fault tests have also been completed, including a power turbine loss of load assessment in which the

GE Aviation is completing the second 1,000-hour missionised durability test on the 7,500shp GE38 for Sikorsky's new CH-53K. (Photo: Sikorsky)

output shaft to the transmission is severed to make sure that the controls can shut the engine down quickly enough.

INGESTION TESTS

'The required ingestion tests have also been done, feeding the turboshaft water, ice, sand and birds. In total, it has undergone more than 4,100 hours of tests, done everything required for flight clearance, and will probably need fewer than 400 more hours to complete qualification testing.

'We have submitted all the reports for flight test and are waiting for just one or two reports to come back from Sikorsky and NAVAIR to be, from our perspective, fully released,' said Acquaviva, who expects this will be in late 2014.

The GE38 is designed as an on-condition engine, although there are life-limited parts that must last 6,000 hours, hence the emphasis on durability. GE has applied experience from the T700 and the T64 to combat the compressor erosion that has been the prime cause of performance degradation in sandy, dusty environments.

'We addressed that by putting on new erosion-resistant coatings throughout the compressor,' said Acquaviva. 'That has really helped keep the airfoil geometry intact.'

Much effort with internal aerodynamics has also gone into keeping the turbine cooling passages clear of sand and dust. However, the most significant strategy for keeping the engine 'on-wing' for as long as possible, according to Acquaviva, is the large built-in temperature margin. When it leaves the factory it runs very cool compared to its temperature limits.

As the company has used the GE38 as a baseline for its work under the US Army's Future Affordable Turbine Engine (FATE) programme, which is looking for an 80% improvement in power-to-weight ratio and similarly impressive improvements in SFC and operating costs, it becomes a technology feeder for GE38 upgrades. 'We have a path to get over 20% more power if needed,' he said. Awarded in 2011, FATE is focused on technologies for engines between 5,000 and 10,000shp.

AFFORDABLE APPROACH

GE's other new turboshaft is the 3,000shp GE3000, which is competing against the HPW3000 by ATEC, a joint venture between Honeywell and Pratt & Whitney. Both engines are being developed under the US Army's Advanced Affordable Turbine Engine (AATE) technology demonstration effort, intended to flow into the Improved Turbine Engine Program (ITEP), the goal of which is to provide a new engine for the Black Hawk and Apache fleets.

'The required ingestion tests have also been done, feeding the turboshaft water, ice, sand and birds.'

The goals are challenging – it must weigh no more than the T700s in service, be 25% more fuel-efficient, last 20% longer and cost between 20 and 35% less to acquire and maintain.

Awarded in 2007, AATE has been extended by 12 months through 2015. Both GE and ATEC have finished the testing of their technology demonstrator engines required by the original agreement. The former company's Mike Sousa told *DH* that it has just finished testing its second engine in the programme, activity that included a performance evaluation, some endurance work plus sand ingestion trials.

Besides ITEP, Sousa is responsible for other advanced turboshaft projects within GE, including work the company is doing to support OEMs in the Joint Multi-Role (JMR) and Future Vertical Lift (FVL) efforts.

'As we extend the programme for the next year, we are going to incorporate some lessons learned during the earlier testing, and we will do a little bit more testing in the middle of next year,' he said, adding that this will enable the team to 'make sure we have incorporated some of the features that we have evaluated as working, but not working quite the way we expected them to'.

DIFFICULT DEVELOPMENTS

He declined to go into detail because of competitive sensitivity, but did provide some insight into the character of this technologically difficult development.

'The goals of the AATE programme are aggressive all the way across the board. If there were only one goal, it would be relatively


the langkawi international maritime & aerospace exhibition 2015
17- 21 MARCH 2015 Langkawi Island, MALAYSIA
where
business is always
a pleasure
As one of Asia's most important business platforms, our focus is to place you at the heart of the vibrant Asian marketplace. With 333 defence and civil delegations, 70 nations, 132 aircrafts and ships on display, more companies are finding the reasons to participate in LIMA very compelling. Nearly 500 in total and growing.
And we assure you it has nothing to do with Langkawi's 99 tropical islands and its pristine beaches...☺
LIMA '15. Delivering Asian Markets.
maritime & aerospace defence
commercial aviation
shipbuilding & shiprepair
MRO
airport equipment
training & simulation
www.lima.com.my
ORGANISED BY:
LIMA '15
Ministry of Defence
SUPPORTED BY:
MOT
Ministry of Transport
Ministry of International Trade & Industry
Ministry of Home Affairs
OFFICIAL MEDIA:
ADJ
Asian Defence & Diplomacy
ASIAN AIRLINES & AIRPORTS

> 'Even with ITEP going forward, the army and navy are going to be operating T700s for decades to come.'

easy to just go figure out a way to meet that particular goal, but balancing all the goals – making sure that you are addressing the weight as well as the fuel consumption – really make it challenging.

'The compressor and turbine aerodynamics are critical,' he continued. 'We've got to have higher efficiencies in each of the components, and using our latest computational fluid dynamics tools to ensure that we meet those performance requirements is a big part of what we have to do.

'We have also pushed the bar up a lot in terms of our cooling configurations, so that we can reduce secondary flows and the losses associated with them, and we are also incorporating some advanced materials. All of those things have to be part of the approach.'

While confirming that the GE3000 has a single-spool core – meaning that all the rotating machinery of the compressor and the gas generator turbine that drives it share a common shaft – plus a free power turbine, Sousa said that the exact number of compressor and turbine stages is, again, competition-sensitive.

This and many other details of both teams' engines are likely to remain classified, at least until the milestone B decision that signals the start of the EMD phase.

'That is the portion of the programme where it gets really expensive for them to keep two competitors going,' he added. 'And so my guess is that they are going to make the downselect right around the time of milestone B.'

POWER PLAYS

While GE's selection by Bell as engine supplier for the V280 tiltrotor was announced last year, the specific powerplant to be used was not identified and remains under wraps at the latter company's request. Sousa did, however, confirm that it will be an off-the-shelf product.

The V-280 is a candidate for the army's JMR Technology Demonstrator (JMR TD), competing against an offering from Sikorsky and Boeing based on the former's X2 technology.

GE has also been selected to power Sikorsky's S-97 Raider demonstrator with a military CT7-8 variant known as the YT706-700R. These aircraft need off-the-shelf engines to meet the 2017 first flight deadline for the JMR TD programme, which will inform the FVL effort, whose requirements have yet to solidify.

AATE and FATE are likely to feed into the engine that powers FVL, explained Sousa. 'Both of those programmes would be completed prior to the launch of what we would expect to build for the FVL programme itself, and so technologies from both would be applicable to what we could offer.'

These advanced efforts will also benefit the T700-701D and the -401C naval engines, as GE is looking to infuse them with some of the resulting technology, an effort that the company calls Tech 700, according to Ed Birtwell, VP and general manager responsible for the company's current turboprop and turboshaft product lines.

'We are talking about a 10% power and 3-4% SFC benefit,' he told *DH*. 'These are not the eye-watering kinds of performance that we are talking about with ITEP, particularly SFC, but they don't cost as much as ITEP to develop. And, in any case, even with ITEP going forward, the army and navy are going to be operating T700s for decades to come.'

BIG BREAKTHROUGHS

In Tech 700, GE is looking at improving the engine's internal aerodynamics with improved aerofoil shapes in the compressor and the turbines, along with advanced materials in the hot section, such as ceramic matrix composites.

'That's a big breakthrough technology that we are using, starting with [turbine] shrouds and other static parts in the hot section, and eventually we will go to rotating parts,' said Birtwell. This will also contribute to fuel efficiency, he explained. 'If you can run the engines hotter, that means you can use less parasitic cooling flow, which improves SFC.'

More immediately, the focus for the T700 programme is on using the power of data gathered in Iraq and Afghanistan to reduce maintenance costs without compromising availability, a thrust known as cost-wise readiness.

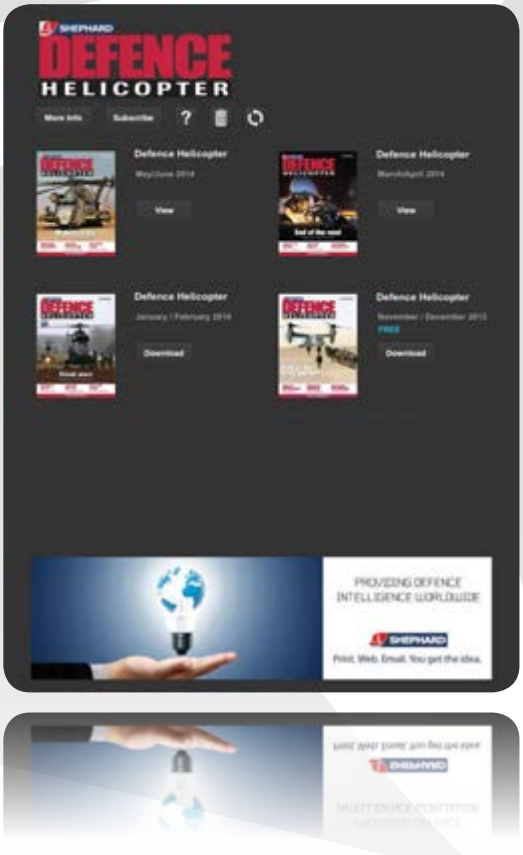
Using the US Army's 2410 database and Reliability Improvement through Failure Identification and Reporting (RIMFIRE) software, GE has concluded that significant savings can be made by exploiting the engine's modularity to the full.

The savings come, according to Birtwell, if maintainers diagnose an engine performance problem in the field and change, for example, a hot section instead of sending an entire engine back to the US. 'You save something like three-fourths of the maintenance cost per engine and per flying hour. What the army is doing now is extending the use of modular maintenance to get at that cost saving.' ***DH***

The GE38 is designed as an on-condition engine, although there are life-limited parts that must last 6,000 hours. (Image: GE)

Don't worry, Be Appy :)

Shephard Media is delighted to announce that our range of defence, aerospace and security magazines are now available through dedicated Apps for both Android and Apple devices.



All magazines in one place

Optimised for mobile viewing

First issue free

View each edition offline

Interactive links

Slideshow galleries

Animations and videos

Available on the App Store

ANDROID APP ON Google play

SHEPHARD

DEFENCE AND SECURITY ON ALL FRONTS

14 - 17
APRIL | 2015
RIOCENTRO
RIO DE JANEIRO | BRAZIL

estaçãobrasil

10th EDITION

LAAD
DEFENCE & SECURITY 2015

NAVY | ARMY | AIR FORCE | PUBLIC SECURITY | CORPORATE SECURITY

WWW.LAADEXPO.COM

Association Support: ABIMDE

Official Publication: Tecnologia & Defesa | T&D Official Show Daily

Media Partner: Shephard Defence Helicopter

Associated with: UBRAFE

Organised by: CLARION EVENTS

Affordable aviation

With the US Army's restructuring plans for its rotary-wing component now fully laid out in public, the battle lines have been drawn and will likely result in some severe political ruptures yet, finds **Tony Skinner**.

Given the pressures on the federal budget that have inevitably filtered down into defence funding and the continued withdrawal of forces from Afghanistan, it is unsurprising that the US Army leadership has taken a wide-ranging review of its aviation force structure.

Somewhat less anticipated was the outcome of this review, with aviation chiefs choosing to retire the fleets of OH-58A/C/D Kiowa Warriors and TH-67s, and transfer all AH-64 Apaches in the National Guard to the active component of the army.

As Gen Raymond Odierno, Chief of Staff of the Army, outlined to the Senate Armed Services Committee (SASC) in April, the leadership realised it simply could not afford to maintain the current aviation structure while also carrying out modernisation efforts and keeping all flying units trained and effective.

'The Aviation Restructure Initiative [ARI] allows us to eliminate obsolete airframes, sustain a modernised fleet, and reduce sustainment costs while maintaining all aviation brigades in the reserve component. However, we will eliminate three full aviation brigades [from 13 to 10] in the active component,' Odierno said in his written evidence to the committee.

CASCADING TRANSITION

Describing the ARI as a 'cascading transition' of aircraft across all three components of the army, Odierno outlined how the service would divest itself of the OH-58 and TH-67, handing the armed scout role over to the AH-64E Apache.

'We have not been successful in developing and fielding a new armed aerial scout aircraft for over two decades. For more than two decades, our interim solution has been the OH-58D Kiowa Warrior. It has served us well but to keep it flying safely for another decade will require a significant investment of billions of dollars. Investing that sort of money in an ageing platform simply does not make sense, if we have an option.'

Under the most recent effort to replace the Kiowa Warrior as part of the Armed Aerial Scout (AAS) programme, an analysis of alternatives determined that the AH-64E teamed with current and future UAS was the preferred option for the scout role.

However, for this to work Apache crews will be expected to control the flight path and payloads of multiple UAS, and pass data

The AH-64E Apache will assume the armed scout role from the OH-58D Kiowa Warrior should the army's aviation restructure progress as planned. (Photos: US Army)

between them and to troops on the ground, while also piloting their own aircraft.

Therefore, the training requirement has become more lengthy and complex – involving Apache-UAS operations at battalion and aviation brigade levels – and is regarded as being beyond the allocated capacity of National Guard units.

'For our aviation brigades, the requirement to conduct reconnaissance and surveillance and air/ground integration requires sustained collective training that is much greater than just maintaining individual pilot or crew proficiency. The collective training between manned and unmanned systems along with coordination with ground forces in order to deliver accurate and effective fires is critical as we build our combined arms capabilities,' Odierno said.

To offset the National Guard's loss of its Apaches, the active army will transfer to it 111 UH-60 Black Hawks (plus 48 more to the US Army Reserve).

Odierno argued that the UH-60s would 'significantly improve' the ability of the National Guard to support combat missions and increase its capacity to assist civil authorities.

TRAINING CHANGES

The final part of the restructure sees the transfer of nearly all the active army's UH-72 Lakotas to Fort Rucker, and the acquisition of an additional 100 of the type to round out the training fleet.

As well as reducing the number of helicopter types in regular army service to just four, handing the training mission to the Lakota allows students to learn on a current-generation, twin-engine aircraft with a glass cockpit, which is more representative of the platform they will transfer to.

Taken as a whole, the changes will result in significant savings, including $12 billion in project procurement costs.

By allocating the scout mission to the AH-64E, the army has removed the need for the OH-58D Cockpit and Sensor Upgrade Program ($3.3 billion) and Service Life Extension Program ($7 billion) and potentially the requirement for a new AAS helicopter as well.

In addition, using an in-service platform, the UH-72, as the new training aircraft at Fort Rucker removes the need to spend $200 million to extend the life of the current TH-67 fleet as well as $1.4 billion for a replacement aircraft acquisition.

The UH-72 Lakota will be transferred to Fort Rucker, Alabama, to take over the training role from the current TH-67 fleet.

The army will also save more than $1.1 billion per annum by reducing the number of helicopters and pilots by 23% in the active army and 8% in the National Guard. Fewer aircraft will result in fewer pilots being trained, saving money at Fort Rucker.

Outlining the plans to the SASC, Odierno made a point of highlighting that the active component would take the brunt of helicopter reductions (687 of 798 aircraft) while the National Guard and reserve only lose 111 machines.

'The active army's overall helicopter fleet will decline by about 23%, and the Army National Guard's fleet of helicopters will decline by approximately 8%. We have already made the decision to eliminate three entire aviation brigades from the active component while we sustain all our aviation brigades in the reserve components.

'The National Guard will also retain all UH-72s, CH-47s and gain additional UH-60s to accomplish state missions while giving up their AH-64s in order for the army to meet critical mission requirements.'

POLITICAL BACKLASH

Such platitudes were not enough to prevent a political backlash over the plans, and the restructure is likely to be delayed by Congress, if not watered down altogether.

Daniel Gouré of the Lexington Institute wrote that, judging by the way the National Guard and its supporters reacted to the proposal, one would think that the army had 'questioned its honour, genetic heritage, family connections, social practices and destination in the afterlife'.

'Basically the National Guard wants to keep virtually all its Apaches and force the active army to take even more cuts in its helicopter fleet. Guardsmen have accused the army of wanting to treat them as second-class citizens, dismissing the service they performed in Iraq and Afghanistan and turning them from gunfighters into truck drivers,' Gouré said.

He argued that the National Guard should instead criticise the executive and legislative branches for the decision to cut defence spending over the next decade by nearly $1 trillion, rather than the army's reaction to this reality.

'This is the real reason the army needs to concentrate all its Apaches in the active component. The guard needs to keep its emotions in check and deal with the facts.'

There is also another factor at play – with the potential of the retired aircraft finding their way onto the international market, the situation is being eyed nervously by market players worried about the adverse effect this might have on the industrial base.

For example, speaking to reporters in May, Bell Helicopter CEO John Garrison said he regarded the potential of OH-58s being made available for foreign sales as a 'very serious situation'.

'Obviously one of our areas of concern is the impact to the industrial base of having 700+ aircraft available as excess defence articles. So this is a very serious situation for the industry – us, the avionics manufacturers, engine manufacturers,' he said.

'So this part of the equation hasn't been thought through yet. The army was dealing with an immediate issue, but now it is time to sit down and come up with a plan that doesn't adversely impact the industrial base as a result of this decision.' ***DH***

IMDEX ASIA
2015 19-21 May

BE AMONG THE HEAVYWEIGHTS OF MARITIME DEFENCE AT IMDEX ASIA 2015

Asia Pacific's Flagship Maritime Defence Show

19 – 21 May 2015
Changi Exhibition Centre • Singapore

IMDEX Asia is the platform of choice for key stakeholders in the international maritime defence industry, offering unrivalled access to network with VIP delegations and establish valuable partnerships. As Asia Pacific's only dedicated maritime defence event, this is your prime opportunity to springboard into the world's second largest naval market.

Book Your Space Now!

Danny Soong/ Vivian Koo/ Cathryn Lee
Tel: +65 6595 6123/ 6122/ 6114
Email: sales@imdexasia.com

www.imdexasia.com

Organised by: experia events that influence

Supported by: DSTA Defence Science & Technology Agency; MPA Singapore; ReCAAP Information Sharing Centre; Republic of Singapore Navy; Singapore Exhibition & Convention Bureau

Endorsed by: aif Approved International Fair

Held in: Singapore

Industrial strength

Dominique Maudet, EVP global business and services at Airbus Helicopters, talks to Tony Skinner about the future prospects for the company's defence product line.

Airbus Helicopters is confident that it has sufficient industrial presence in Poland to secure a contract there for some 70 multirole helicopters, in what is its largest near-term opportunity.

Updating reporters on the company's military business at Eurosatory 2014, Maudet argued that Airbus was the only contender to offer additional local industrialisation.

'Several of the competitors already have an industrial base in Poland, and we have the plan to develop an industrial capability including MRO services and expansion of the Airbus Group into Poland,' he said.

Airbus is offering the EC725 Caracal with its Polish partner Wojskowe Zaklady Lotnicze Nr 1 (WZL-1) and is faced off against Sikorsky subsidiary PZL Mielec with the S-70i and AgustaWestland's PZL-Świdnik offering the AW149.

Airbus announced the signing of industrial cooperation agreements with WZL-1 in 2013 that included the creation of assembly lines within Poland for the EC725 and its Turbomeca Makila 2 engines within the framework of the tender.

RFP RELEASED

Maudet said the RfP had now been released and it calls for a multirole helicopter capable of carrying out tactical transport (36 aircraft), CSAR/SAR (26) and naval (eight) missions.

'The answer is due by the end of September 2014 with a decision that could be very quick. We are offering the Caracal 725 and of course we believe it is the best platform to both answer the Polish need for multi-mission helicopters as well combat-proven helicopters,' he explained.

Following the heavy use of helicopters by French forces across Africa in recent years, Maudet also outlined some of the lessons learned and how the company was responding.

'Globally, the French armed forces operate Caracals, Cougars, Pumas, Gazelles and Tigers in many theatres. They have been to Afghanistan, they are currently in Africa – they have been to Central Africa, to Mali, to Somalia, to Chad – and all the feedback we have had has been absolutely outstanding.

'We had the Tiger for four to five years in Afghanistan, also the Caracal and Gazelle, and currently operations in Mali are progressing, from our perspective, according to plan. There are very demanding missions in Mali, with lots of flights in very dusty environments for the Caracal, together with maximum load each time.'

Company representatives are now working with the French MoD to determine what measures may be needed to mitigate the challenges of operating in such an environment.

'Engine support and engine repair are needed more than usual at the moment, which we are addressing together with the French Army, the French [MoD] and of course Turbomeca and Airbus Helicopters experts, to see how we can develop something that would lower the need for maintenance of the engines, either through engine modifications or air intake improvements, because the sand of Mali is very specific compared to other sands. But of course the 725, like the Cougar, has been qualified and operating in dusty environments for decades so there is nothing of major concern there.'

At Eurosatory, the company highlighted the EC145 T2, which it has sold to German Special Forces Command under a €194 million contract for 15 aircraft. Deliveries will begin in late 2015 and are due to be completed by mid-2017.

NEW DEALS

The company is also close to finalising an agreement with Berlin that will see its order for NH90 TTHs reduced from 122 to 82 aircraft, the Tiger attack helicopter purchase cut to 70 examples and 18 NH90 NFH naval variants purchased to help offset the reductions.

'We now have an agreement with the German MoD and for the agreement to become a formal deal it needs to go through all the parliamentary sessions in Germany and get all the blessings formally. We expect that both the internal German government process and the agency [Organisation for Joint Armament Cooperation/OCCAR] will agree to the changes the second half of 2014,' Maudet said.

Elsewhere, Airbus Helicopters is pursuing a number of opportunities to sell military aircraft, while also placing greater attention on after-market support, according to Maudet.

'The company has grown significantly over the past few years – we are now a €6.3 billion company, tripling our turnover in less than ten years. The need of Airbus Helicopters now is to convert from volume to more customer attention and improve quality and service.

'On the military side, the priority is to deliver and ensure that all NH90 and Tiger customers are happy with the helicopters and prepare the future range of military helicopters. The big military deals are our main targets – Poland, Kuwait, Tunisia, Qatar, Hungary – these are the priority for the military fleet.' *DH*

NATIONAL TRAINING AND SIMULATION ASSOCIATION

THE WORLD'S LARGEST MODELING & SIMULATION EVENT

I/ITSEC | INTERSERVICE/INDUSTRY TRAINING, SIMULATION & EDUCATION CONFERENCE

TRAINED AND MISSION READY: DETER • DEFEND • DEFEAT

ARMY
NAVY USMC
AIR FORCE
INDUSTRY
'14

Why I/ITSEC?

- 14,000 Attendees
- 526 Exhibitors
- 150 Sessions
- 70 Countries, over 1,900 International Delegates

Albania • Algeria • Argentina • Australia • Austria • Bangladesh • Belgium • Brazil • Bulgaria Canada • Chad • Chile • China • Colombia • Costa Rica • Czech Republic • Canada • Denmark Ecuador • Egypt • El Salvador • Estonia • Finland • France • Georgia • Germany • Ghana • Great Britain • Greece • Hong Kong • India • Indonesia • Ireland • Israel • Italy • Jamaica • Japan • Jordan Kuwait • Lebanon • Libya • Lithuania • Malaysia • Mexico • Morocco • Netherlands • New Zealand Nigeria • Norway • Pakistan • Papua New Guinea • Peru • Philippines • Poland • Romania • Russia Saudi Arabia • Singapore • Slovakia • South Africa • South Korea • Spain • Sri Lanka • Sweden Switzerland • Taiwan • Thailand • Turkey • Ukraine • United Arab Emirates • United Kingdom • Uruguay • Yemen

A Proud Affiliate Of NDIA National Defense Industrial Association

WWW.IITSEC.ORG ▶ DECEMBER 1-4, 2014 ▶ ORLANDO, FLORIDA

THINK
SPECIAL OPERATIONS

Armed with cutting edge defense helicopter technology. All-weather capable, unrivalled in the harshest environments, combat proven. Ready for special operations from most remote areas or warships.
EC645 T2 - Deploy the best.

AIRBUS
HELICOPTERS