

Breathing new life into old Hueys

Bell's distinctive UH-1 family of medium-lift helicopters are probably the most famous rotary-wing aircraft of all time. The signature thud from the rotor blades and pug-like nose have been made famous by a military career spanning nearly five decades and countless appearances on the silver screen. However, while fame means the 'Huey' nickname might live forever, the airframes will not, and the type's career has already come to an end in some parts of the world.

In October, the US Army National Guard retired its last example of the UH-1, which has been replaced by the UH-72 Lakota and UH-60 Black Hawk, while elsewhere oil and gas operators are discarding their old Bell 212s in preference for more modern alternatives like its four-bladed development the 412 or the competing AW139. This has left a surplus of airframes simply begging to be re-used and an inventive after-market industry has developed ways to breathe new life into these aircraft, giving them capabilities and performance the original operators could never have dreamed of.

The Huey is a difficult machine to replace. With its large cabin, impressive payload capability and relatively low cost of operation and purchase, there can be no doubt the type remains an attractive solution to many

rotary-wing requirements. It's no wonder that so many ex-military examples have found their way into the fire-fighting and law enforcement roles, particularly in the US. So if a Huey cannot be replaced, the next best thing is to improve on what you have and several companies, including Bell, have set about developing upgrade programmes to enhance the type's performance, reliability and cost-effectiveness. This market has the potential to encompass as much as 50 % of the 10,000 UH-1/Model 205 variants manufactured.

For some operators, the only replacement for a Huey is another Huey (or the same Huey, only better). Tony Osborne examines some of the upgrade packages industry has developed to give this venerable aircraft capabilities it never knew it had.

In fact, there are so many retro-fits and add-ons designed to update the Huey, it would be impossible to mention them all in one feature, so this article aims to focus on the major airframe and powerplant enhancements that have put the Huey firmly back into the spotlight.

Smoothing the flow

Some of the most interesting work on improving Huey performance has been carried out by BLR Aerospace, which worked with NASA's Langley Research Center on a design for dual tail boom strakes.

These simple and cheap aerodynamic improvements help to channel and control rotor wash over the tail boom, reducing turbulence and improving the effectiveness of the tail rotor. The strake installation for the Model 205 was awarded its FAA approvals in March 2001. The modification is sold in kit form and can be

installed 'in the field' within a day using two technicians. It weighs in at 2.5 kg and has been fitted to civil and military Model 205s and UH-1s across the world.

The NASA tests concluded that the strakes also boost altitude performance, pushing the type's operational ceiling by as much as 1,800 m. Other benefits include improved climb rates over unmodified aircraft, and extended service life of components such as tail rotor bearings, pitch change links and tail rotor control rods, all because of the decrease in required pedal inputs by the pilot.

Further research work by BLR saw the development of the FastFin, an enhancement kit which 'cuts away' around a third of the standard Huey tail fin from the rear, and replaces it with a composite fairing that covers the rear of the fin and the tail cone. Once installed – a process that takes between three and five working days – the system can help reduce pilot workload by improving stability, tail rotor margins and wind azimuth tolerance.

Cost benefits

FastFins have been installed by operators involved in the agricultural, utility, fire-fighting and land management

roles and have been in service on Model 205s for the past six years. FAA approval for a Bell 212 FastFin was awarded at the beginning of 2009. Both upgrades (ie strakes and fin) can be applied together.

Dave Marone, VP sales and marketing for BLR, said: 'For operators working to the engine's power limits, the system can increase hover load capability by 4-5 % – this is approximately 225 kg. Above 1,200 m (density altitude) the UH-1 is often tail rotor-limited. For these aircraft, hover improvement can exceed 8 %.'

These simple fixes have changed the way the aircraft handles, and operators are finding they can now get significantly more work done, and make the investment pay for itself in a matter of weeks, depending on the level of usage. Marone explained: 'Operators have reported payback in as little as three weeks. For example, a UH-1 operator with a direct operating cost of \$650 per hour, at 2,000 m, lifting a modest 5 % additional gross weight, can increase his payload by a third.'

'This effectively reduces direct operating costs [DOC] by a third or approximately \$215 per hour. In 150 hours, your investment is returned. If you consider a scenario where the payload is a piece of equipment, say 400 kg, the FastFin may allow you to carry two at a time, whereas without the FastFin you can only carry one – now your DOC is reduced by 50 %. That's an amazing customer value proposition.'

Plus means more

The BLR FastFin and strake kits have been fitted to more than 700 helicopters around the world,

and not just on Model 205s and 212s. Other structural modifications available for the 205 include the Global Helicopter Technology improved vertical fin spar, which eliminates issues associated with the original laminated structure that was prone to cracking, according to operators.

Both of these products are featured in an upgrade developed by Northwest Helicopters, based in Olympia, Washington. The company has more than 20 years of experience in the overhaul and refurbishment of UH-1H/Bell 205 helicopters. During that time, it realised the potentially huge market for Huey upgrades and began offering its own package, known as the UH-1H Plus.

The Northwest offering is one of the most comprehensive available. It involves lightening the airframe to reduce empty weight and increase useful load. The UH-1H's engine is replaced (or upgraded), with an uprated T53-L-703 providing as much as 28 % or 400 shp more power, and the tail boom is modified with a BLR kit. Among the less obvious

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modifications is the installation of an intermediate gearbox from the Model 212 and the oil cooler blower from a Model 209 (AH-1). Northwest can also install other equipment including new avionics or extended height landing gear.

Brian Reynolds, president of Northwest Helicopters, told *ROTORHUB* that interest in upgrading the Huey is constant: 'The market is bigger than I ever thought it would be. We are

busy today and continue to get enquiries on this helicopter, with thousands of UH-1s out there, this could go on for a long time. We seem to have about four Hueys in work all the time as an average.

'For some operators, there is no real alternative. A new \$10 million Bell 412 will not lift what this ship will at altitude for \$2 million. Most of the work they do is in fire-fighting and construction with US commercial operators operating in the "Restricted" category for external load use.'

Reynolds said the market demanded more performance at an affordable cost, and argued that even with all the upgrades there is nothing in its class than can perform in high temperatures and at high altitude as the UH-1H Plus does.

'And certainly nothing nears the price of this helicopter. It delivers hot and high performance above 1,500 m and 30 °C. It really starts to shine at that altitude and above, and the payload is double of what the stock UH-1H is at this altitude.'

Reynolds said that buyers will see reduced costs, with increased time between overhauls (TBO) for key components. The new tail rotors now only require overhaul every 2,400 hours rather than 1,200, while the 212 gearbox installed by Northwest has a 5,000-hour overhaul interval. So far, Northwest has completed 50 upgrades for the civil market and a handful for

Temsco is using its third modified Model 205 for FAA certification flight testing. (Photo: Temsco)



Temsco says its PT6 installation will not require significant structural modifications to the aircraft, and takes only 240 man-hours to complete. (Photo: Temsco)



military customers, although Reynolds sees that market increasing as defence budgets shrink. Examples of the UH-1H Plus have been sold to the air arms of Georgia and Chile while others have been purchased by US federal government and law enforcement agencies.

Patrol package

In Texas, Temsco Helicopters has been quietly working on its re-engining programme for the Bell 205, which involves replacing the Honeywell T53 with the Pratt & Whitney Canada (P&WC) PT6C-67D. The origins of this conversion programme date back to October 1999, when P&WC and Global Helicopter Technology came to an agreement to develop a UH-1H conversion kit for the PT6C. The US Border Patrol agreed to allow the use of one of its Hueys as a prototype and as the basis of the conversion kit's FAA supplemental type certificate (STC) programme.

Currently, there are just three Model 205s modified with the PT6C-67D engine. The original US Border Patrol helicopter continues to operate out of San Diego, while a second PT6 kit was installed by DynCorp into a UH-1H operated by the Georgia Forestry Commission for aerial fire-fighting. The third kit is installed on Temsco's own Bell 205A-1 testbed, currently being used for engine certification.

'Our initial marketing effort has concentrated on commercial 205A-1 owners and operators,' said Schoenberger. 'While we have customer orders for the 205A-1/PT6 conversion kit, we have limited the sales effort until we have a better picture of our FAA certification and P&WC's engine delivery schedule.'

'Our Temsco programme customers are primarily interested in the PT6 engine reliability, P&WC's service and support and the significant reduction in DOC provided by the PT6 conversion.'

The Temsco kit has been designed and certified to be installed by the customer at their



The FastFin modification radically changes the look of the helicopters it is fitted to, including BLR's own Model 212 testbed. (Photo: BLR)

‘Given the enthusiasm that the US Marines Corps are showing for the UH-1Y, it would make sense to assume that a civil version of the Yankee would find a similar reception in the commercial market.’

own facility using maintenance personnel. Most of the major components will be delivered pre-assembled, ready for installation. The kit does not require significant structural modifications to the aircraft, and allows for re-conversion back to the original engine if the customer desires.

‘The primary advantage to the PT6 engine upgrade is the approximately 32-36 % reduction in DOC with the PT6C-67D. This includes engine maintenance cost and fuel consumption savings,’ said Schoenberger. ‘We have estimated the kit will require 240 man-hours for installation on a clean engine deck. This does not include time for normal maintenance activities related to the helicopter.’

Two become one

Bell's Model 212 was the result of lessons learnt during the 205's career, introducing twin-engined performance whilst retaining many of the Huey's characteristics. It might therefore have been considered the next logical step for Model 205 operators looking to upgrade their



The Eagle Single delivers many of the benefits of a Model 212 but at a significantly lower operating cost. So far, seven conversions have been completed. (Photo: Eagle Copters)

fleets, but the costs of running a twin have proved prohibitive. Operators have therefore been demanding 212-style performance at a 205-style price, and one company believes it has found the solution.

Calgary-based Eagle Copters has 30 years of experience with the Bell family of medium helicopters. Their solution, surprisingly, involves stripping the 212 of its PT6 Twin-Pac turboshafts and replacing them with a single Honeywell T53-17.

The Eagle Single, as it is known, has already developed a reputation as an economical heavy lifter. Modified aircraft have an empty weight of just 2,585 kg and an all up-gross weight of around 5,000 kg, giving them a significant lift advantage over the Model 205, but they are cheaper to operate than a twin-engined 212.

Further weight has been saved by eliminating the 212's baggage compartment, and introducing a specially designed fuel control panel, a new circuit breaker panel and a simplified collective head. So far, seven Eagle Single conversions are flying, accumulating some 5,000 flying hours, and the type was certified by Transport Canada in mid-2007. FAA certification was still pending at the time of writing.

The type was primarily designed with fire-fighting, utility and tactical missions, such as law enforcement, SAR and exploration, in mind. Depending on the condition of the 212 being converted, the upgrade process can sometimes take up to 10,000 man hours to complete, and any changes or upgrades currently approved for the 212 can also be incorporated into the Eagle Single, allowing the fitment of specialist role equipment.

OEM solution

Bell's own Model 205 upgrade, the Bell 210, died a death when the company rationalised its product line in 2008, after only four had been completed. Two of those aircraft now operate with Renton, Washington-based WorldWind Helicopters. The 210 offered operators a zero-hour 205 fitted with tougher 212 parts. The installation of an uprated T53-17 engine and 212-style main rotors delivered a 400 hp increase in power and a 290 kg rise in useful load capability.

Bell also claimed significantly lower operating costs. However, programme delays meant that customers who ordered their machines in 2005 did not get them until 2008, after the announced cancellation of the programme.

Bell still offers an alternative, however. The company's Huey II upgrade is in many respects the same as the 210 – factory-fresh, using 212 dynamic components and with an uprated engine. The modification has been created to deliver improved levels of performance.

What it does not have, however, is FAA certification, which means the aircraft is only available for operation under the FAA's 'Public Use' rules, and can only be flown by US government agencies. Bell says it is 'continually assessing the interest of commercial operators in the superior capabilities of the Huey II and their interest in having it developed as an FAA-certified aircraft'.

The Huey II upgrade features the T53-L-703, as used in the AH-1F Cobra, allowing for heavier payload capability, commonality with AH-1F engine supplies, improved reliability and longer component life. The engine delivers a 28 % increase in take-off power. The drive train,

transmission, main rotor hub, blades and tailboom come from the Bell 212 and allow the Huey II to take advantage of the extra power.

Bell said the 212's wider-chord blades improve the anti-torque system and blade aerodynamics. The upgrade also offers benefits in the terms of reduced maintenance and extended aircraft service life.

The new transmission increases the take-off rating by 11 %, while the introduction of multiple chip detectors and debris collectors have allowed the FAA to certify a 5,000-hour TBO rating on the transmission. Furthermore, Bell says that the use of modern high-precision components, with their longer TBO, reduces DOC by over a third. Huey II upgrade work is carried out by Bell affiliate US Helicopter in Ozark, Alabama and takes around 10 months per airframe to complete.

Bell says it is also examining the potential for a commercial version of the recently introduced UH-1Y, utility helicopter, currently serving with the US Marine Corps in Afghanistan.

Built to replace the UH-1N Twin Huey, the aircraft uses a pair of General Electric T700-GE-401C turboshafts as well as introducing new avionics and a lighter airframe. Bell said: 'Given the enthusiasm that the US Marines Corps are showing for the Yankee, it would make sense to assume that a commercial version of the Yankee would find a similar reception in the commercial market. For now, however, we are focused on ramping up our production of Yankees and AH-1Zs to meet the marines' immediate need to replace their aging fleets of UH-1Ns and AH-1Ws.'

Putting Huey on a diet

Even with all these upgrades available, companies are continuing to work on improving the Huey. Northwest's Brian Reynolds believes more weight can be shed from the airframe to deliver improved payload performance.

'We are constantly trying to lighten the empty weight to reduce stress and increase performance,' Reynolds said. 'We have reduced the weight by about 225 kg from the Army UH-1H so far and we are not done yet. A couple more areas that can be improved and that we are working on are the tail rotor gearbox and the air inlet. But there are many more in the hopper. We just have not had time to get to them all yet. The [main rotor] blade programme is the most important thing on our list to get done, and we are into year 4 on that right now. It is a huge undertaking.'

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Northwest has been working on its carbon composite rotor blade project for several years, but the results are looking promising. The company says the blades offer improved hot and high performance, weight savings and improved fuel economy.

Flight testing of the blades began in August using a fully instrumented UH-1H. In the meantime, Temsco is continuing its own work, and is currently studying the potential of applying its PT6C engine kit to the Model 212, but needs to complete the 205A-1 version of the STC effort by the end of 2010 and the 205B shortly afterwards before pushing ahead on other models.

Looking elsewhere

The Huey upgrade market is of course a predominantly North American one, but if your operation falls foul of US government sanctions, then there are alternatives to be found.



The low purchase cost of 'demobbed' Hueys makes them an attractive proposition for US law enforcement agencies, as this Snohomish County Sheriff's Office example, upgraded with the BLR FastFin and strakes, shows. (Photo: BLR)

In Iran, the Iran Helicopter Support and Renewal Company, known as Panha, has developed its own upgrade for the country's fleet of Agusta-manufactured Model 205s purchased before the 1979 revolution.

Little is known about the Panha Shabaviz 2-75, which was first unveiled in 1998, but the type is now entering service with a number of Iranian government agencies, and recent pictures on the Internet show the type in service with the Iranian Red Crescent.

Given the current political situation in Iran, getting details confirmed about such projects is not easy, but a short summary produced by the company in Farsi suggests that they replaced the Lycoming T53-L11s used in the AB205s with the more powerful T53-L13 in order to provide more power. Panha also worked to try and reduce the empty weight of the airframe – the grafting on of a rather odd pointed nose may well be related to this.

It is unlikely that the Panha upgrade will be available to customers outside Iran. However, this programme just goes to demonstrate the continuing importance of the Huey family to both military and civil operators, with work ongoing to improve the type still further. It seems that this amazing helicopter still has a long and prosperous life ahead of it. **RH**

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FastFin boosts Huey IIs in Afghanistan