Saving the situation

Against the background of recent calls for a review of safety procedures by North Sea operators, Peter Donaldson examines the technology that can help crews survive a helicopter ditching.

Aircrew climb into a 12-man life raft during a rough water exercise. (Photo: US Air Force)

If an offshore flight ends with the helicopter in the water, it is already a bad day for everyone on board – passengers and crew alike.

How much worse it then gets depends on many factors, the most critical of which in the first minute or so after impact is getting everyone out, because no helicopter can be guaranteed to remain afloat, despite the fitting of emergency flotation devices.

With the engines, gearbox and rotor mounted on the roof, helicopters have a high centre of gravity that produces a strong propensity to roll over. This can happen extremely quickly, and occupants may find themselves upside down in dark and shockingly cold water with little warning and probably less than a minute's worth of air in their lungs, disoriented and strapped to their seats. Getting out depends heavily on training and equipment – principally emergency breathing apparatus, lighting and immersion suits that are correctly fastened and not excessively buoyant or bulky.

Call for action

Helicopter safety, particularly in the UK sector of the North Sea, is currently as hot a political issue as it has ever been. The crash of CHC Scotia Super Puma G-WNSB off Sumburgh Head on 23 August led to a call by trade unions, including the British Airline Pilots Association, Unite, the RMT and GMB, for a full and independent inquiry into the last five North Sea accidents.

In its 'Back Home Safe' campaign launched on 6 November, Unite called for improved equipment and training, along with an independent review of measures to maximise survival time after ditching.

'More than 1,500 offshore workers have already backed a petition calling for action which will be presented to Oil & Gas UK next month,' said Unite regional officer Tommy Campbell, announcing the campaign. 'Overwhelmingly, offshore workers are demanding action from the industry to improve the safety of offshore helicopter flights – Oil & Gas UK must now act.'

In response, offshore industry body Oil & Gas UK said that it takes these concerns seriously and that it is working closely with Step Change in Safety, a UK-based partnership whose mission is 'to make the UK the safest oil and gas exploration and production province in the world'. Membership includes oil and gas companies, helicopter operators, the UK Health and Safety Executive and the unions.

Several investigations are taking place into the Sumburgh crash by organisations including the UK Air Accidents Investigation Branch (AAIB) and the Scottish police, while the UK and Norwegian civil aviation authorities are cooperating on a broad safety review. Helicopter operators are also reviewing their practices.

Measure of a man

Oil & Gas UK is also working with researchers at Robert Gordon University (RGU) on a project to measure the shape and size of offshore workers, generating information that can be used to improve emergency helicopter evacuation and survival suit design.

The RGU team is taking three-dimensional scans of about 600 offshore workers who ➡

‘Most military agencies carry breathing devices on all helicopters and planes in case of ditching.’

have volunteered to take part in the project, the like of which has not been seen for more than 25 years. An early result of the research is the discovery that a 90kg man wearing a standard helicopter passenger survivor suit occupies 44l more volume than when wearing close-fitting clothing.

While offshore workers’ anatomies may not have been formally studied for years prior to the RGU effort, in-water survival equipment has not stood still over the last decade, and neither have attitudes towards it.

‘In general, there is a much higher level of understanding and acceptance of dry suits and immersion suits as part of the personal safety equipment ensemble for crews and passengers. Manufacturers of these products recognise this as a business opportunity, and are making significant investments in the development of high-performance and cost-effective solutions for operators,’ Mustang Survival’s VP of sales and marketing Geoff Grover told *RotorHub*.

‘More specifically, two of the most important technical advances in helicopter survival equipment have been the inclusion of personal locator beacons [PLBs] and HUEBA/HEED emergency breathing systems [EBS] with most helicopter suit systems,’ added the company’s research and technology manager Wendell Uglene.

Taking the air

One of the latest EBS is the newest member of the Helicopter Emergency Egress Device (HEED) family from Huntington Beach, California-based Submersible Systems.

HEED 3 is based on the Spare Air system popular with SCUBA divers and uses the same always-on regulator and standard mouthpiece that enables the user to breathe as soon as it is in the mouth – without the need to operate controls – and in any orientation, including upside down.

Measuring 22cm long and 6cm in diameter, HEED 3 weighs 690g when the 48l cylinder is full. Rated at 200bar, the cylinder provides the equivalent of about 30 breaths at the surface, says the company.

A larger 85l cylinder is optional, as is an air compressor for refilling cylinders, and an optional adapter allows refilling from a SCUBA tank.

Mustang Survival’s Helicopter Passenger Transport Suit System consists of an immersion suit and a life preserver (pictured), which are meant to be worn together. (Photo: Mustang Survival)

A dial gauge shows pressure at a glance, and the device can be supplied with a holster that may be attached to a Switlik Modular Aircrew Vest, for example. Its operational temperature range is from -30 to +70°C. More than 250,000 HEED units have been sold since 1979, according to Submersible Systems.

The company’s marketing VP, Christeen Buban, expressed concern that the concept is not more widely accepted in commercial aviation.

‘We have been making and selling our emergency breathing devices for over 30 years now and still find the same situation – individually, people want the product, some are even willing to pay for it personally, but companies by and large have not incorporated them into their safety policy,’ she told *RH*. ‘Most military agencies carry breathing devices on all helicopters and planes in case of ditching and have done so for over 20 years.’

In addition to compressed-air EBS such as HEED, there are two further types in use: rebreathers that provide a counter-lung to enable the user to breathe the same air in and out; and hybrid systems that feature a counter-lung and a small supplementary air supply. Only the compressed-air type is considered suitable for deployment under water.

Standard equipment

While a growing number of offshore operators are issuing EBS, their use is far from universal and the UK CAA, for example, takes the view that their adoption has been slowed by the lack of a widely accepted technical and performance standards.

So, with funding from the Health and Safety Executive and Shell Aircraft International, it has developed one that it published in May 2013 and now offers it for voluntary adoption by industry. The new standard identifies two performance categories: Category B EBS are intended for use in ditchings – defined as controlled landings on water – in which there is time to deploy the device before submersion; while Category A systems are designed with the more severe water impact in mind and must be deployable underwater.

Tests with volunteers using a helicopter underwater escape trainer (HUET) contributed to development of the standard, which includes a broad range of recommendations.

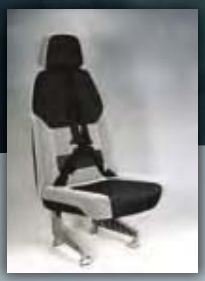
For example, any EBS must be simple and intuitive to deploy with either hand within 20s. It must be possible to deploy a Category A EBS underwater while holding breath within 12s. Components such as mouthpieces should be in a fixed position so that they are quick and easy to locate, while any tamper-proofing features such as stitches or tags must be easy to break in an emergency.

EBS must also be compatible with seat harnesses and minimise the risk of snagging. A cold water test should be carried out at 12°C and include submersion of the head to make sure that the effects of cold shock are experienced, without hood or gloves unless these are routinely worn in flight. It is important to assess endurance and work of breathing with face-down underwater swimming, including at least one turn to assess the risk of the mouthpiece becoming dislodged. Additional buoyancy generated by the EBS must not prevent escape through the smallest of exit windows.

Built to Survive

Fixed-wing A/C
pilot seat

Executive A/C
passenger seat



Light-weight
composite heli seat

Crashworthy seats. Because survivability, comfort and affordability is our business.

- Over 30 years of successful experience in design, certification and manufacturing
- Available for fixed and rotary wing aircraft
- FAR part 23, 25, 27 & 29

www.iai.co.il
iaigolan@iai.co.il

IAI
WHEN RESULTS MATTER

Canadian suits

'In Canada, the new CGSB 65.17-2012 Helicopter Passenger Transport Suit standard has created the most advanced performance requirements in the world', said Mustang Survival's Uglene. 'Evaluation includes intense leakage testing in realistic conditions, actual helicopter egress testing in multiple orientations and new methods of assessing egress buoyancy.'

Published at the end of July 2012, this standard superseded a 1999 edition and adopts new performance-based parameters for marine life-saving equipment and introduces wind machines, wave and rain generators into human performance tests. Tests to the 1999 standard, for example, required a wearer to jump into a calm pool from 3m and swim for an hour to help calculate water ingress into the suit.

In contrast, the new standard mandates that test subjects get out of a HUET and spend an hour in the water in realistic wind and waves.

A more rigorous human-subject thermal test method has also been incorporated. The new HUET test also measures a person's ability to perform such critical survival actions as deploying EBS and releasing the seat harness in cold water.

Submersible Systems produces the HEED family of survival aids, including components based on the Spare Air system popular with SCUBA divers. (Photo: Submersible Systems)

Mustang makes dry suits for helicopter passengers, cockpit crew and rear cabin personnel such as rescue swimmers, which must provide comparable levels of protection for the wearer while meeting very different requirements for mobility and resistance to wear and tear. The company is actively involved with the regulatory standards community and the Canadian

government, and cooperates with helicopter operators to help refine its designs.

'It is not often the case that helicopter manufacturers are able to make significant changes to their core designs to accommodate changes in operation profiles,' said Grover. 'So we tend to work with the operators and end users to seek and develop suit solutions that will work across multiple airframes.'

Mustang works closely with North American oil and gas helicopter operators and with US and Canadian military aviation units involved in over-water missions. This includes the US Coast Guard, whose Alaskan SAR units operate in some of the most extreme weather conditions in the world.

Immersion suit designs have advanced significantly in recent years. Uglene cited material developments such as quick-drying, wicking linings, phase-change materials and ultra-light polymeric materials, which he said are improving comfort in the cockpit and cabin as well as providing increased thermal protection in cold water, while new super-stretch neoprene foam is improving seal fit and making suits easier to put on.

Also, new electro- and photo-luminescent polymers ease underwater escape and visual detection of survivors. However, Uglene reckons there is still room for improvement in fitting, thermal comfort (cooling/heating) and underwater visibility that could come from smart materials and advanced electronics.

'There is always a design balance between safety and comfort, and while safety is always the priority, some passengers are in flight for three hours or more, which makes comfort increasingly important,' Grover told *RH*. 'A comfortable suit will tend to be worn properly and create less stress and exhaustion, both of which contribute to the successful execution of emergency procedures.'

Beacons of hope

All helicopter flight crew operating in the UK offshore sector are equipped with a PLB, and they have been required for passengers since mid-2010, according to Oil & Gas UK. This followed a hiatus in which PLBs were withdrawn from service following a ditching in which interference from them caused a shutdown of the 'smart' long-range beacons aboard the life rafts. They came back into service in February 2010.

In the wake of the raft beacon interference issue, four types of PLB are approved for use by helicopter occupants, two for crew and two for passengers. HR Smith's Series 500-12 is installed in life rafts and worn by some helicopter pilots, while the Series 500-1 is dedicated to pilots.

> 'We work with end users to seek and develop suit solutions that will work across multiple airframes.'

Both are on 406.025MHz for COSPAS/SARSAT location and on the 121.5MHz civil and 243MHz military distress frequencies.

Approved for passenger use are the Rhotheta RT-B77 HELB and the Sea Marshall AU9-HT helicopter transit PLBs – both transmit on 121.5MHz. Neither of these passenger beacons has GPS capability.

It is nearly 70 years since one of the first reported escapes from a submerged helicopter, a Sikorsky R-4 on 1 November 1944. Maximising the chances of survival for passengers and crew, however, still has some way to go. **RH**