



Australian Government

Australian Transport Safety Bureau

Collision with water involving twin-engine EC135 helicopter, VH-ZGA

35 km north-west of Port Hedland, Western Australia, on 14 March 2018

ATSB Transport Safety Report
Aviation Occurrence Investigation
AO-2018-022
Preliminary – 3 May 2018

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*.

Publishing information

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Addendum

Page	Change	Date
12	Clarification that CAO 95.7.3 applies only to single-engine helicopters	30 May 2018
12	Helicopter operator provided additional information about HUET training	30 May 2018

Preliminary report

The occurrence

On 14 March 2018, at about 2330 Western Standard Time,¹ an Eurocopter Deutschland GMBH EC135 P2+ helicopter, registered VH-ZGA and operated by Heli-Aust Whitsundays Pty Limited,² departed Port Hedland Heliport,³ Western Australia to collect a marine pilot from a departing bulk carrier and transfer that person back to Port Hedland.

The flight was being conducted in the charter category, at night under the Visual Flight Rules (VFR). A pilot recently employed by the operator was flying the helicopter, under the supervision of a company training and checking pilot.

At about 2348, while the helicopter was being operated in the vicinity of the bulk carrier, it descended and collided with the water. The training and checking pilot escaped from the helicopter and was rescued a short time later. The location of the other pilot was unknown and a search continued throughout the night and into the following day. On 17 March 2018, the helicopter wreckage was located on the seabed and the missing pilot was found inside.

This update provides an initial summary of the occurrence circumstances and initial investigation activities.

Background and sequence of events

The operator of the helicopter was contracted by the port operator to transfer marine pilots to and from ships that were berthing and departing Port Hedland. The marine pilots were responsible for the safe navigation of those vessels to and from the port.

Although the helicopters were usually operated on a single-pilot basis, the two pilots had been rostered to fly together on a series of flights during the late afternoon on 14 March 2018, and continuing their duty into that night and the following morning. These flights were the recently employed pilot's (pilot under check) first night-time marine pilot transfer flights at Port Hedland. The training and checking pilot was the pilot in command and was sitting in the left (copilot) seat of the cockpit. He was supervising the pilot under check, who as the handling pilot for the flights, was seated in the right (pilot) seat of the cockpit. Both seating positions were fitted with fully-functioning flight controls.

Marine pilots were normally delivered by helicopter to arriving vessels at the boarding ground for the anchorage. When departing, marine pilots were usually collected from vessels in vicinity of the Charlie One (C1) and Charlie Two (C2) channel markers, about 20 NM north-west of Port Hedland.

During the earlier part of evening, the helicopter crew had completed three flights transferring marine pilots. Two of those flights were at night, one to the anchorage boarding ground to an inbound bulk carrier and the later one to a departing bulk carrier at C1/C2. Soon after that flight arrived back at the heliport and the marine pilot had disembarked, the helicopter pilots departed to collect another marine pilot from C1/C2, on what was to be the accident flight.

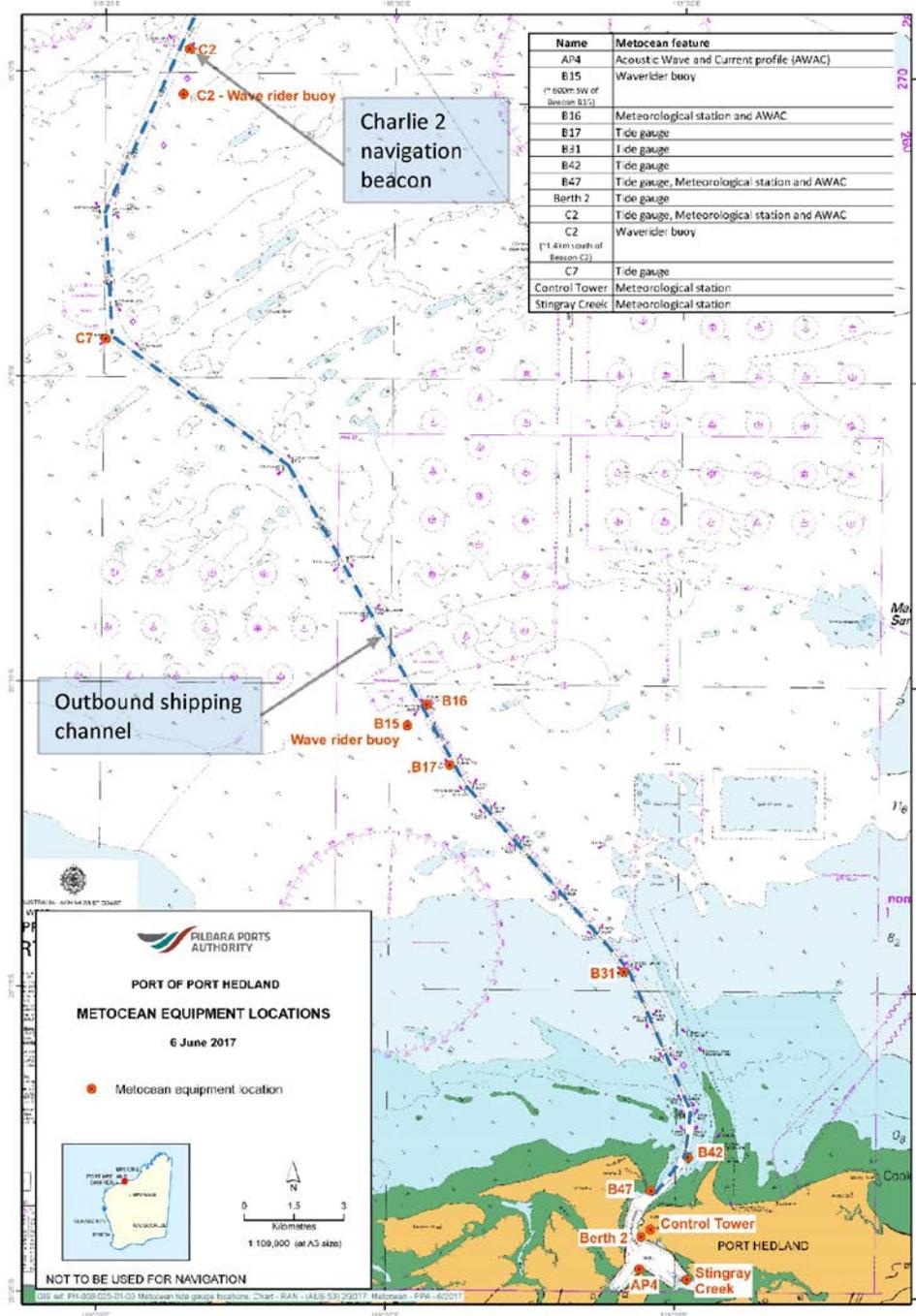
Figure 1 depicts Port Hedland, the shipping channel and the location of the channel marker at C2.

¹ Australian Western Standard Time (AWST): Coordinated Universal Time (UTC) +8 hours.

² Heli-Aust Whitsundays Pty Limited was the holder of the Air Operator Certificate issued by the Civil Aviation Safety Authority, the primary trading name for the operation at Port Hedland was Port Hedland Helicopters.

³ Port Hedland Heliport is located at the seaport of Port Hedland, approximately 5 NM north-west of Port Hedland Airport.

Figure 1: Map showing Port Hedland, the shipping channel and Charlie 2



Source: Pilbara Ports Authority, annotated/modified by ATSB.

The surviving pilot, who was the training and checking pilot, reported that the flights had proceeded normally and that the first two night flights had been without incident. During night operations, it was standard procedure to use the helicopter’s autopilot during climb, cruise and descent and it would remain engaged until the helicopter was stabilised on final approach, with the landing vessel in sight.

The training and checking pilot recalled that the outbound vessel was sighted and was well-lit with floodlighting of the deck and accommodation quarters. The weather conditions were fine, with no cloud, rain or obstructions to visibility. The wind, relative to the deck of the ship was reported to be ‘red 090, 15 kt’, meaning the environmental wind when combined with the forward motion of the ship, was 15 kt from a relative direction, 90 degrees left of the ship’s bow. That wind direction

necessitated an approach to the vessel from its right side, with the helicopter flying a right-direction circuit to land. A circuit was flown around the bulk carrier and the pre-landing checklist was completed, including the arming of the helicopter's emergency flotation system.

The training and checking pilot reported that the approach continued such that the helicopter was aligned on the final approach. The autopilot 'upper' modes were decoupled⁴ and the helicopter passed through the 'entry gate'⁵ with an airspeed of 50-60 kt at 500 ft. Soon after, that approach was discontinued when both pilots agreed that the approach path had become too steep to continue.

The marine pilot awaiting the transfer had sighted the helicopter approaching the vessel. He recalled that there was not a lot of wind, there was no moon but there were stars visible in the sky. The navigation of the shipping channel had been completed and control had been handed back to the ship's crew. After observing the helicopter circle the vessel, he saw the helicopter again fly past the left side of the vessel, consistent with joining the circuit to land on the deck and he started to make his way down the internal stairwell to the ship's deck.

After the first approach, the training and checking pilot reported a standard missed approach was flown, the autopilot upper modes were recoupled and the helicopter was set-up to make another approach. The training and checking pilot recalled that on the second approach, the helicopter was turned inbound on the final approach, the autopilot upper modes were decoupled, they again passed through the entry gate and the deck of the ship was in sight. He recalled that the pilot under check had reduced the power to commence the descent, and again soon after. The training and checking pilot pointed out the descent rate and requested an increase in power, and was satisfied that the necessary correction was being made.

By the time the marine pilot had reached the deck of the ship, he could see the helicopter's anti-collision strobe lights, along with the green navigation light on the right side of the helicopter. He did not recall seeing the red navigation light on the left side of the helicopter, nor the steerable searchlight used by the crew of the helicopter to illuminate the deck of the ship for landing. The marine pilot became concerned about the helicopter's approach path and assessed that the helicopter was descending low on the horizon compared to previous flights.

The training and checking pilot next recalled hearing the radio altimeter annunciating 'check altitude, check altitude'. The radio altimeter was programmed to make this annunciation when the radio altitude reduced below the preselected altitude. It was the operator's standard procedure to set a radio altitude of 300 ft prior to take-off. He stated that he immediately called that he was taking over control of the helicopter and was making a missed approach. He did not recall any alarms or other alerts from the helicopter's warning systems. Soon after, the helicopter collided with the water surface and the cabin immediately flooded and submerged.

The marine pilot had continued to watch the helicopter as it descended towards the water. He recalled seeing a splash of water, that was lit by a flash from the helicopter's strobe light and immediately returned to the bridge to commence alerting action with the port authority.

The recorded ground track of the helicopter outbound from the heliport and to the accident site is shown at Figure 2 and the final ground track in vicinity of the vessel can be seen in Figure 3.

⁴ On the EC135, the autopilot is always 'ON' during normal operations. The 'upper' modes provide typical autopilot functionality for horizontal and vertical control of the aircraft.

⁵ This term refers to a specific airspeed/altitude and assists with maintaining a stabilised approach.

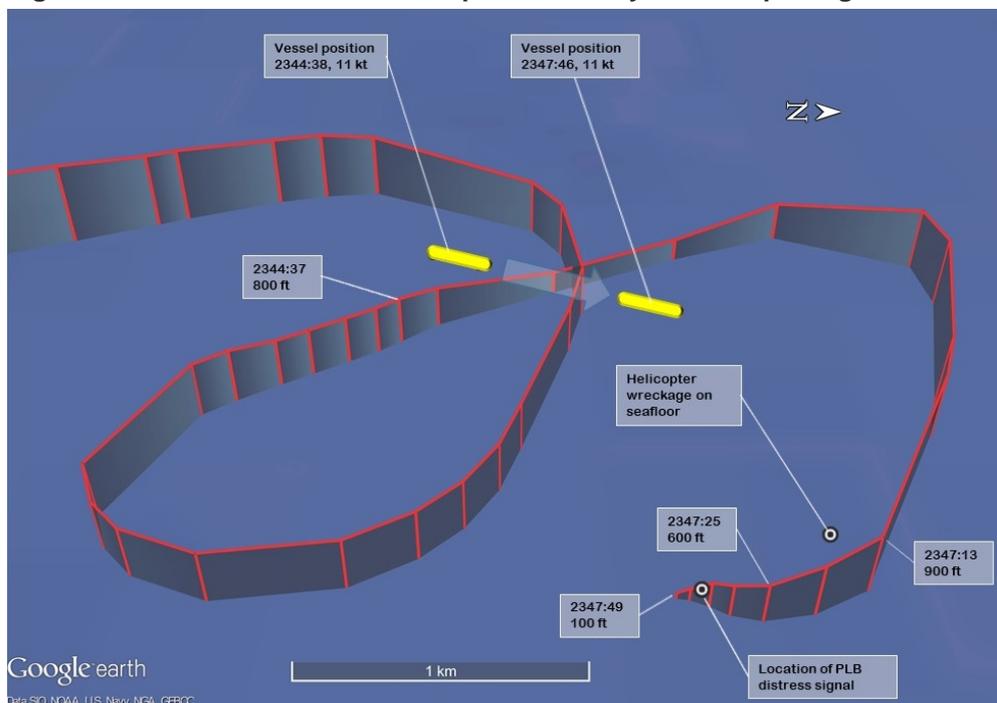
Figure 2: Ground track of the helicopter to collect the marine pilot



The helicopter was fitted with Automatic Dependent Surveillance Broadcast (ADS-B) equipment. That equipment enabled air traffic services and other pilots to track aircraft without using conventional ground-based radar installations. The signals transmitted by the ADS-B equipment can also be received and recorded by other specialised ground-based receivers, such as those operated by flight tracking websites. Those receivers are situated at numerous locations around the world and feed data to centralised computer servers and accessed using internet browsers and other utilities. The image displays the server-recorded ADS-B ground track for the helicopter as it travelled to collect the marine pilot.

Source: Background image GoogleEarth, overlaid with FlightRadar24 ADS-B track data, annotated by ATSB.

Figure 3: Ground track of the helicopter in vicinity of the departing bulk carrier



The image displays the helicopter's ADS-B ground track and pressure altitude (to the nearest 100 ft) while operating in vicinity of the departing bulk carrier. The positions of the distress signal from the PLB and the helicopter wreckage are also depicted. Note that the ADS-B data points are not at regular fixed-time intervals. The vessel location was broadcast by its automatic information system (AIS). Source: Background image GoogleEarth, overlaid with FlightRadar24 ADS-B data, AIS data from Pilbara Ports Authority and annotated by ATSB.

The training and checking pilot recalled that he did not have time to take a breath before the cockpit flooded with water. He was submerged in the helicopter and still strapped into his seat. He tried to operate the emergency door jettison, but had difficulty remembering the action and did not believe that the door had released. He felt around in front of him and to the left identified an alternative exit pathway and used his left hand to keep hold of that pathway. Using his right hand, he attempted to unplug his helmet communications cord. The cord did not easily disconnect, so using the same hand, he released the helmet chinstrap and removed the helmet. He also used his right hand to release his harness, then placed that hand on the opposite side of the exit pathway and using both hands, pulled himself through that opening to escape the cockpit. After vacating the cockpit and still underwater, he felt for the inflation toggle on his personal flotation device (PFD) and activated one chamber. The chamber inflated normally and took him to the surface.

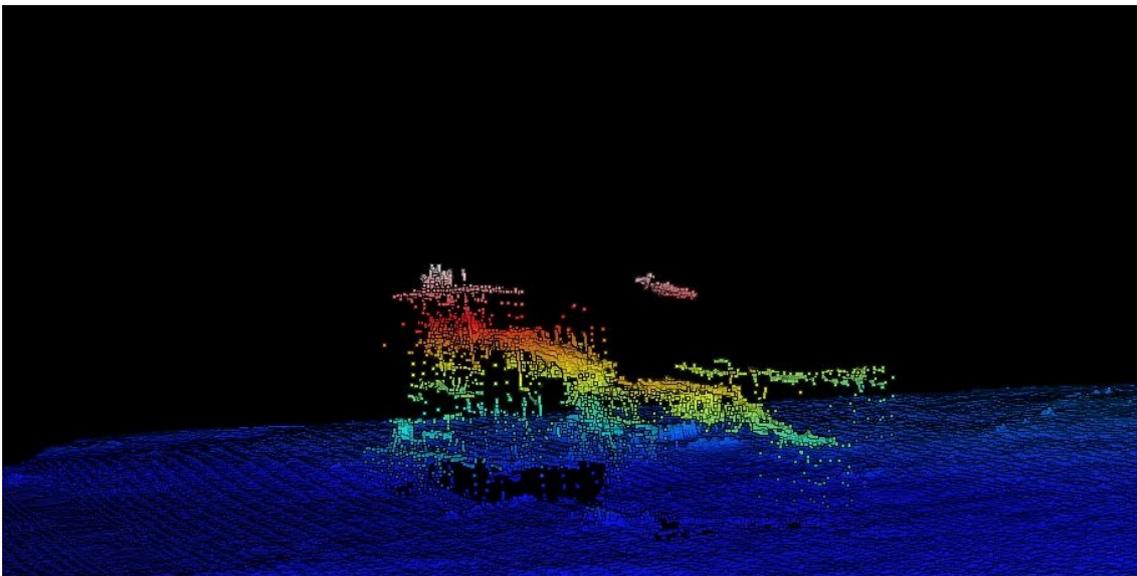
After reaching the surface, the training and checking pilot saw the helicopter was still afloat but inverted, so he clung onto the helicopter's left landing skid. He did not see the other pilot and was unsure of his location. The helicopter emergency flotation system had not automatically activated during the initial collision with water and inversion of the fuselage. After a short time, he recalled that the helicopter's life rafts could be deployed using manual deployment handles mounted on the underside of the helicopter's rear skid cross-tubes. He activated one of these handles and two life rafts deployed. The life raft that deployed from the left helicopter skid was trapped under the skid. The life raft from the right helicopter skid deployed normally and he boarded that raft. The training and checking pilot recalled that the helicopter floated for a period of time before sinking.

The training and checking pilot also remembered that his PFD was equipped with a personal locator beacon (PLB) and he activated it. The PFD was also equipped with distress flares and he used these to visually signal his position.

Nearby vessels responded during the initial stages and as did vessels from the port. The initial response was focussed on the distress position indicated by the PLB and the sighting of the flares. The training and checking pilot was recovered from his life raft about 1 hour after the ditching. He had sustained minor injuries.

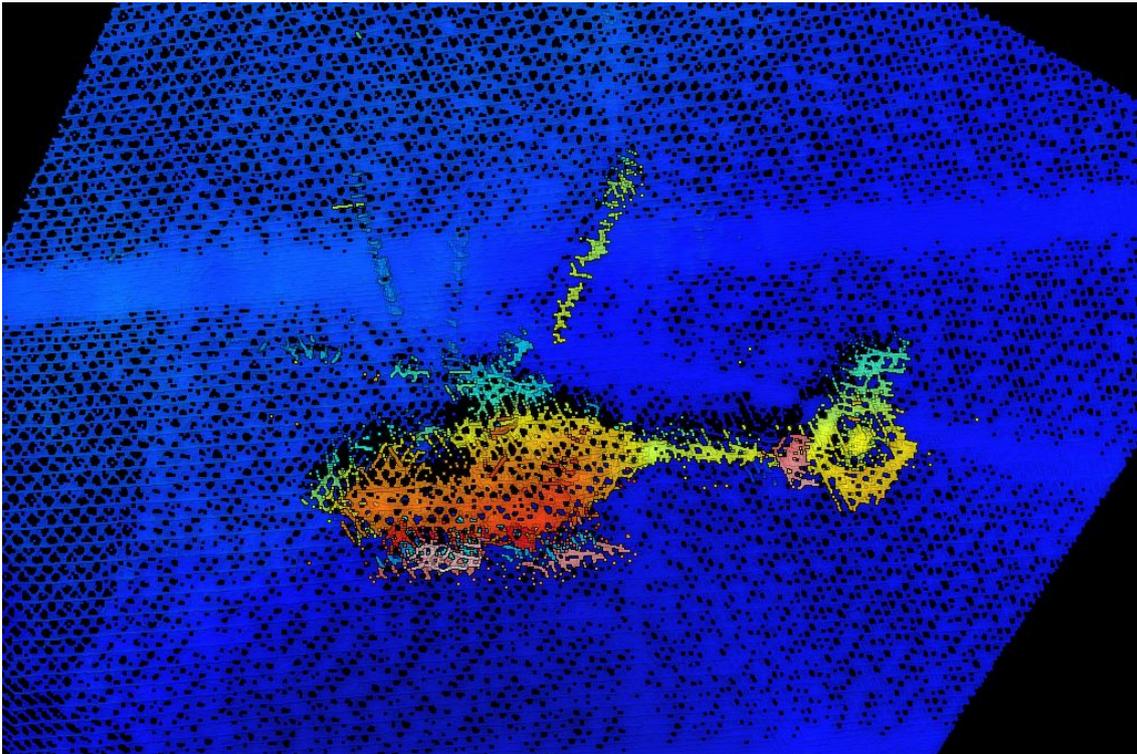
A surface search for the missing pilot and wreckage was initiated and continued during the night and the next two days. A seabed sonar search of the area also commenced with a hydrographic survey vessel. The helicopter wreckage was identified on the seabed on 17 March 2018 (see Figure 4 and Figure 5). It was substantially intact and resting on its right side in about 20 m of water.

Figure 4: Sonar image of helicopter resting on the seabed, on its right side



Source: Pilbara Ports Authority and contractors working on their behalf.

Figure 5: Sonar image of helicopter resting on the seabed, on its right side



Source: Pilbara Ports Authority and contractors working on their behalf.

Divers from the Western Australia Police Force located the missing pilot in the cockpit of the helicopter. At the time of recovery, he was not wearing his helmet, his harness was unfastened and his PFD had not been deployed.

Video taken by the police divers during their initial dives on the wreckage indicated that the emergency jettison for the left copilot's door had been activated, but with the door still remaining with the fuselage. The front left cockpit Perspex windshield was broken.

Wreckage recovery

The Pilbara Ports Authority and their contractors commenced action to recover the helicopter, with the assistance of the police divers. The ATSB placed a Protection Order on the helicopter wreckage and provided the necessary permissions to recover the helicopter and transfer into secure storage.

The helicopter wreckage was recovered from the seabed during 18 and 19 March 2018 (Figure 6). The wreckage was moved into the secure storage area where it was examined by the ATSB.

Figure 6: Helicopter wreckage being lifted onto the dock



Source: ATSB.

Pilot information

Training and checking pilot

The training and checking pilot held a Civil Aviation Safety Authority (CASA)-issued Part 61 Air Transport Pilot Licence – Helicopter (ATPL(H)) and an Air Transport Pilot Licence - Aeroplane. Relevant checks recorded in his company recency record indicated for helicopters:

- an instrument proficiency check on 7 June 2017
- a low-level flight review on 14 October 2016
- an instructor rating on 24 May 2016
- a flight examiner rating on 8 June 2017
- a multi-engine helicopter flight review and EC135 biennial flight review on 27 October 2016
- a base check on an EC135 on 17 March 2017
- simulator training H135 on 17 March 2017
- CAO 20.11 training on EC135 on 17 July 2017
- a line check on 5 April 2017
- a night VFR review on 24 May 2016
- Class 1 pilot medical, valid to 2 October 2018.

The training and checking pilot had last completed helicopter underwater escape training (HUET) on 9 September 2015.

Records indicated that the training and checking pilot had flown to Port Hedland on 5 March 2018 and had been rostered to fly through to 15 March 2018, before flying out from Port Hedland on 16 March 2018. The training and checking pilot had been completing flight reviews and checks on a number of the company pilots in Port Hedland, in addition to a number of days flying with the pilot under check during the accident flight.

Pilot under check

The pilot under check held a CASA-issued Part 61 ATPL(H). Relevant checks recorded in his company recency record indicated:

- a low-level flight review on 16 August 2016
- a base check on an EC135 on 12 March 2018
- CAO 20.11 training on EC135 on 5 March 2018
- a night VFR review on 4 August 2016
- Class 1 pilot medical, valid to 18 April 2018.

The pilot under check had last completed HUET on 9 February 2009.

Records indicated that the pilot under check had completed company induction in Mackay the week prior to the accident and had flown to Port Hedland on 9 March 2018. Those records indicated he was continuing training in Port Hedland until 18 March 2018 and due to commence line operations at Port Hedland from 20 March 2018.

Meteorological information

Meteorological and hydrographic information in vicinity of the accident site was routinely recorded by the Pilbara Ports Authority 'Metocean' equipment. That information comprised data on the sea state, tidal movements, wind velocity and atmospheric pressure.

During the late evening, light seas and a gentle ebbing tide (less than 1 kt) was being recorded in vicinity of the C2 beacon, the closest recording site to the accident location.

At 2350, the wind was about 11 kt from 253 degrees, with gusts to 13 kt. The atmospheric pressure was 1008.5 hPa.

Last light on 14 March 2018 at Port Hedland was 1845. The moon was a waning crescent with 9 per cent of the visible disk illuminated. The moon had set at Port Hedland at 1619 and was due to rise again at 0356 on 15 March 2018. Consequently, there was no visible moon at the time of the accident.

Helicopter information

The helicopter was powered by two Pratt & Whitney PW 206 B2 engines, both with digital engine control (FADEC) systems. The power from the engines was transferred to the main rotor blades by the main transmission, a two-stage flat design gearbox.

The helicopter was equipped with a four-bladed, hydraulically-controlled rigid main rotor. Antitorque was provided by a Fenestron-type system.

The helicopter cabin had two hinged doors for the pilot and copilot seating positions and two sliding doors on either side of cabin. Each of the hinged doors had the ability to jettison the door via pins securing the door hinges to the fuselage. Each of the rear sliding doors had a pop-out emergency exit.

The helicopter was equipped with a three-axis autopilot and a stability augmentation system. Instrumentation fitted to the helicopter cockpit included an integrated primary flight display, a navigation display and a cockpit warning panel. There was also a central panel display system, that comprised the vehicle and engine multifunction and; cautions and advisories displays.

The helicopter was equipped with an emergency flotation system⁶ that comprised skid-mounted inflatable floats. The floats could be manually or automatically activated. Manual activation was using a mechanical handle on the pilot's cyclic control. Automatic activation was via operation of a

⁶ Emergency flotation system: inflatable bags to provide water buoyancy in an emergency.

water immersion switch. Electrical power was required to initiate inflation of the automatic inflation mechanism. The helicopter was also equipped with two life rafts that could be manually deployed using a cockpit handle or external handles fitted to the cross-tubes of the helicopter's landing skids.

Wreckage examination

The helicopter was substantially intact, although the hub of the main rotor and the main transmission had separated from the airframe during the recovery.

Several of the main rotor blades had sustained significant damage near their blade roots during water impact and one of the blades of the main rotor had struck the helicopter tail boom. The flexible coupling of the main gearbox drive output shaft had sheared. The tail rotor blades of the Fenestron antitorque system exhibited evidence of rotational damage.

Figure 7 illustrates the separated main transmission and the damage to some of the helicopter's main rotor blades.

Figure 7: Main rotor blades and main transmission, showing damage in vicinity of the blade roots



Source: ATSB.

The compressors and compressor housings for both engines showed evidence of engine rotation at impact. To the extent possible due to the nature of the accident damage, continuity of the flight controls was established.

The right cockpit door (pilot under check) was still attached to the airframe and the lock wire for the emergency door jettison was still intact. The emergency jettison for that door was functionally tested and was found to operate normally. The left cockpit door (training and checking pilot) did not remain attached to the airframe during recovery. The lock wire to the emergency jettison handle had been broken and the handle was in the forward (release) position.

The helicopter's emergency flotation system had not been deployed. Examination of the panel-mounted cockpit arming switch was consistent with the switch being in the armed position. The immersion switch for the automatic inflation system was functionally tested and found to be

operating normally. Electrical continuity was demonstrated between the circuit breaker panel, the immersion switch and the servo actuator. Examination of the actuator indicated that neither an automatic or manual inflation had been initiated.

The ATSB recovered various electronic components from the helicopter engines and airframe to assess the non-volatile memory contents. Those units included the:

- electronic engine control for each engine
- data collection unit for each engine
- cockpit warning panel
- cautions and advisories display
- vehicle and engine multifunction display.

The ATSB also recovered the linear actuator for the helicopter's emergency flotation system and the flotation arm switch.

Helicopter underwater escape training

Helicopter underwater escape training (HUET) has been in use in one form or another around the world since the 1940s and is considered best practice in the overwater helicopter operating industry. HUET is designed to improve survivability after a helicopter has ditched or impacted into water. Research of accidents into water has shown that occupants who survive the initial impact will likely have to make an in-water or underwater escape, as helicopters usually rapidly roll inverted post-impact. The research has also shown that drowning is the primary cause of death following a helicopter accident into water.

Fear, anxiety, panic and inaction are the common behavioural responses experienced by occupants during a helicopter accident. In addition to the initial impact, in-rushing water, disorientation, entanglement with debris, unfamiliarity with harness release mechanisms and an inability to reach or open exits have all been cited as problems experienced when attempting to escape from a helicopter following an in-water accident.⁷

HUET involves a module (replicate of a helicopter cabin and fuselage) being lowered into a swimming pool to simulate the sinking of a helicopter. The module can rotate upside down and focuses students on bracing for impact, identifying primary and secondary exit points, egressing the wreckage and surfacing. HUET is normally part of a program of graduated training that builds in complexity, with occupants utilising different seating locations and exits. This training is conducted in a controlled environment with safety divers in the water.

HUET is considered to provide individuals with familiarity with the crash environment and confidence in their ability to cope with the emergency situation.⁸ Interviews with survivors from helicopter accidents requiring underwater escape frequently mention they considered that HUET had been very important in their survival. Training provided reflex conditioning, a behaviour pattern to follow, reduced confusion, and reduced panic.⁹

Like other highly procedural and complex skills, if underwater escape is infrequently practiced, skill decays rapidly.¹⁰ In a UK Civil Aviation Authority (2014) safety review of offshore public transport

⁷ Rice E.V. and Greear J.F. (1973) *Underwater escape from helicopters*. In Proceedings of the Eleventh Annual Symposium, Phoenix, AZ: Survival and Flight Equipment Association, 59-60. Cited in Brooks C. (1989) *The Human Factors relating to escape and survival from helicopters ditching in water*; AGRAD.

⁸ Ryack, B. L., Luria, S. M., & Smith, P. F. (1986). Surviving helicopter crashes at sea: A review of studies of underwater egress from helicopters. *Aviation, Space, and Environmental Medicine*, 57(6), 603-609.

⁹ Hytten K (1989) Helicopter crash in water: effects of simulator escape training. *Acta Psychiatrica Scandinavica, Suppl. 355*: 73-78. Cited in Coleshaw S (2010) *Report for the Offshore Helicopter Safety Inquiry*. Report No SC176.

¹⁰ Summers F (1996) *Procedural skill decay and optimal retraining periods for helicopter underwater escape training*. IFAP; Willetton, Western Australia. Cited in Coleshaw S (2010) *Report for the Offshore Helicopter Safety Inquiry*. Report No SC176.

in helicopters for the oil and gas industries, it was noted that although the frequency of refresher HUET is presently every four years in the UK, this is widely regarded by experts as being inadequate.¹¹

In Australia, *Civil Aviation Order 95.7.3* required all flight crew engaged in marine pilot transfers in single-engine helicopters to have completed a HUET course. The order has no requirement for undertaking periodic refresher training. There was no regulatory requirement for multi-engine flight crew to have completed a HUET course. However, requirements for HUET and periods for recurrent requalification were often stipulated in the operator's operations manual.¹²

Operator HUET requirements

The operator's operations manual required all pilots engaged in overwater (offshore) operations to have completed a HUET course with an approved provider during the previous 3-year period. The manual indicated the chief pilot could extend that period for an individual pilot if circumstances arise which preclude that training being done within the 3-year period. In that situation, the period of extension was to be specified at the appropriate time and would normally not exceed 6 months. The training was to be rescheduled as soon as practicable.

Part 3 of the company operations manual in relation to Port Hedland required all pilots and marine pilots to have completed a HUET course before conducting night transfers.

As indicated above (see section *Pilot information*), the last HUET completed by the pilot under check (who had recently joined the operator) was in 2009 and was outside the operator's 3-year recurrent training period. On 6 March 2018, the operator's chief pilot had booked a HUET course for the pilot under check. The training was scheduled for 24 April 2018, a full-day course with a Brisbane-based training provider. The training and checking pilot had completed HUET within the last 3 years.

The operator provided the ATSB with records of HUET course information for 24 other company pilots, all of whom had completed their HUET training within the required period.

Proposed regulations

The proposed *Civil Aviation Safety Regulation Part 133* will apply to Australian air transport operations involving rotorcraft (helicopters, gyroplanes or powered-lift aircraft) that undertake charter passenger or cargo operations under subregulation 206 (1) (b) of the *Civil Aviation Regulations 1988*. A consultation draft of those regulations were made available in June 2012 and the period for receipt of comment closed in August 2012.

The consultation draft issued in June 2012 included the proposal, for all flights where life rafts were required to be carried, that flight crew members had successfully completed training in ditching procedures, underwater escape procedures, and use of life rafts within the previous 3 years.

The CASA website indicated that the draft regulation was being updated prior to a subsequent public consultation, which is planned for mid-2018.

¹¹ Civil Aviation Authority (2014) *Safety review of offshore public transport helicopter operations in support of the exploitation of oil and gas*. CAP145.

¹² The requirement for an operator to conduct their operations in accordance with an operations manual was contained in the *Civil Aviation Regulations 1988, Regulation 215*.

Safety advisory notice

Action number: [AO-2018-022-SAN-001](#)

The Australian Transport Safety Bureau advises helicopter operators involved in overwater operations of the importance of undertaking regular HUET (helicopter underwater escape training) for all crew and regular passengers to increase their survivability in the event of an in-water accident or ditching.

Ongoing investigation

The ATSB investigation is continuing and will include the following:

- Factors associated with the survivability of the accident.
- Various factors associated with the operation of the helicopter during dark night conditions under the VFR.
- Pilot qualifications, training, experience, recency and medical information.
- Operator policies and procedures for training and checking, including normal and emergency procedures.
- Helicopter underwater escape training requirements.
- Analysis of contents of the non-volatile memory from the recovered electronic components.
- Testing of components from the helicopter's emergency flotation system.
- Helicopter maintenance history.
- Operator policies and procedures for management of fatigue and duty time.

The ATSB will continue to consult with the engine and airframe type-certificate holders. In accordance with the provisions of ICAO Annex 13, the Transportation Safety Board of Canada have been provided status as accredited representative to the ATSB investigation as State of Design and Manufacture of the helicopter's engines. The German Federal Bureau of Aircraft Accident Investigation have been provided status as accredited representative to the ATSB investigation as State of Design and Manufacture of the helicopter type.

Acknowledgements

The ATSB would like to acknowledge the significant assistance provided during the initial investigation response by the Pilbara Ports Authority, their contractors and volunteer agencies and the Western Australia Police Force.

The information contained in this preliminary report is released in accordance with section 25 of the Transport Safety Investigation Act 2003 and is derived from the initial investigation of the occurrence. Readers are cautioned that new evidence will become available as the investigation progresses that will enhance the ATSB's understanding of the accident as outlined in this report. As such, no analysis or findings are included.