Australian Government
Australian Transport Safety Bureau

Loss of control and near collision with terrain, Leonardo Helicopters AW139, VH-TJO

26 km east of Goulburn Airport, New South Wales, 24 July 2020

ATSB Transport Safety Report
Aviation Occurrence Investigation (Defined)
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Addendum

Page	Change	Date

Safety summary

What happened

On 24 July 2020, the crew of a Leonardo Helicopters AW139, registered VH-TJO, departed Shellharbour Airport, near Wollongong, New South Wales, with four crew onboard (including a single pilot and aircrew officer). The flight was conducted under the night visual flight rules, with the assistance of night vision goggles, to recover two bushwalkers from the Bungonia National Park, New South Wales.

On arrival at the search and rescue location the helicopter was descended to approximately 240 ft above ground level and reduced speed. The aircraft was then tracked over high ground past the edge of an escarpment, where the terrain dropped away to the valley floor.

During this time an uncommanded, and increasing, rate of descent and lateral drift developed. This was identified by the aircrew officer, with corrective instructions provided to the pilot. During the recovery, the engine power output exceeded airframe limitations, rendering the helicopter temporarily unserviceable.

What the ATSB found

The ATSB identified that the pilot's likely fixation on locating the bushwalkers resulted in them not maintaining an effective scan on the cockpit instruments and outside visual references. This resulted in the loss of hover reference and development of an unintended descent and lateral drift.

In response to the loss of reference, the pilot unsuccessfully attempted to engage the helicopter's auto hover rather than commence an overshoot. A subsequent focus on selecting the automated mode further delayed the resumption of the scan and recognition of the increasing descent rate.

During the event, air to ground communications between the onboard paramedic and ground party hindered communications between the pilot and aircrew officer.

It was also identified that the external aircraft white lighting was inadequate to clearly illuminate the area below and to the side of the aircraft. This delayed the identification and recovery from the unsafe aircraft state.

Finally, the pilot did not announce losing hover reference, delaying the aircrew officer's awareness of the developing situation and support to the pilot. As a result, it was estimated the aircraft came within 20 ft of terrain before the descent and drift were arrested.

What has been done as a result

Following this incident, Helicorp Pty Ltd, trading as Toll Helicopters, made several changes to their procedures and equipment aiming to prevent reoccurrence:

- Aircraft external lighting to be upgraded to include a dedicated high-powered search light.
- Sterile cockpit procedures specific to emergency medical services flights, as well as a specific procedure in the event of a loss of hover references have been amended in the company operations manual.
- Additional human factors training with a focus on spatial disorientation, confirmation bias and communication techniques for all flight and medical crew.
- Pre-flight operational risk assessment approval process introduced specifically for all complex night vision imaging system winch activities.

Safety message

Operations at night in low light conditions can be challenging to even the most experienced crews. Low light conditions reduce available visual cues for maintaining aircraft position and undesired

aircraft states can develop rapidly. To mitigate these risks, crews conducting night operations in such conditions should maintain adequate references, taking into account equipment limitations such as external lighting, and maintain an effective scan to ensure continual awareness of the position and movement of the helicopter.

This incident also illustrates the importance of an appropriate response if an undesired aircraft state occurs.

Contents

The occurrence

At 2000 Eastern Standard Time[1] on 24 July 2020, a Wollongong-based emergency helicopter crew commenced their shift at Shellharbour Airport, New South Wales. The on-call crew consisted of the pilot, an aircrew officer (ACO), a paramedic and a doctor.

The first task of the night was to conduct a patient transfer from Bowral to Sydney, in a Leonardo Helicopters AW139, registered VH-TJO. The crew were unable to complete the task due to fog in the vicinity of Bowral so the aircraft returned to base. At approximately 2145, as VH-TJO was being reconfigured post flight, the crew received notification of another task. A pre-flight risk assessment was conducted by the crew and conditions were assessed as suitable for the flight.

This task was to locate, and extract, two bushwalkers from the Bungonia National Park, New South Wales, who were lost and showing signs of dehydration, exhaustion and exposure to the elements. Initial details on the bushwalkers' conditions were limited, however, when it was suspected one was unresponsive, the helicopter was tasked. The two bushwalkers had separated in an attempt to gain mobile phone reception and raise the alarm, though they remained in the same search area.

The crew had been passed a position of the bushwalkers' approximate location and were also notified that each of them had a source of white light. The location of the bushwalkers was in the low ground off the edge of an escarpment. The crew conducted a pre-flight briefing, noting it would be an unlit scene with the moon at less than 20 per cent illumination.

The crew configured the aircraft, with the pilot on night vision goggles[2] (NVG) in the front right seat and the ACO on NVGs in the rear cabin adjacent to the right door. The paramedic and doctor were also in the rear cabin with the paramedic on NVGs. Lighting in the cockpit and cabin was NVG-compatible, with two steerable landing lights and a handheld light operated by the ACO that supported the night vision imaging system[3].

VH-TJO departed the Wollongong base at 2234, transited to the site and arrived over the search area at about 2255 (Figure 1).

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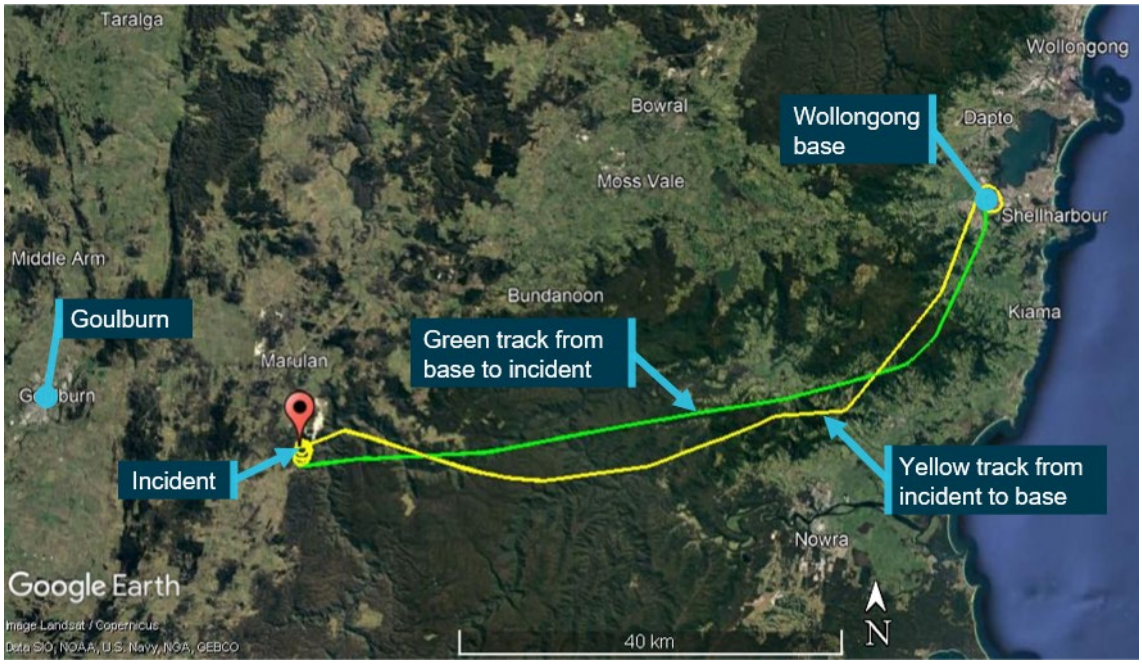
1 Eastern Standard Time (EST): Coordinated Universal Time (UTC) + 10 hours.

2 Night Vision Goggles (NVG): A helmet mounted binocular device that intensifies ambient light, providing flight crew with improved vision at night.

3 Night Vision Imaging System (NVIS): a system of internal and external lighting, combined with night vision goggles, which provides enhanced vision to crew for operation at night. See the section titled *Night vision imaging system* for further detail.

Figure 1 - Flight path from Wollongong base to search area and return

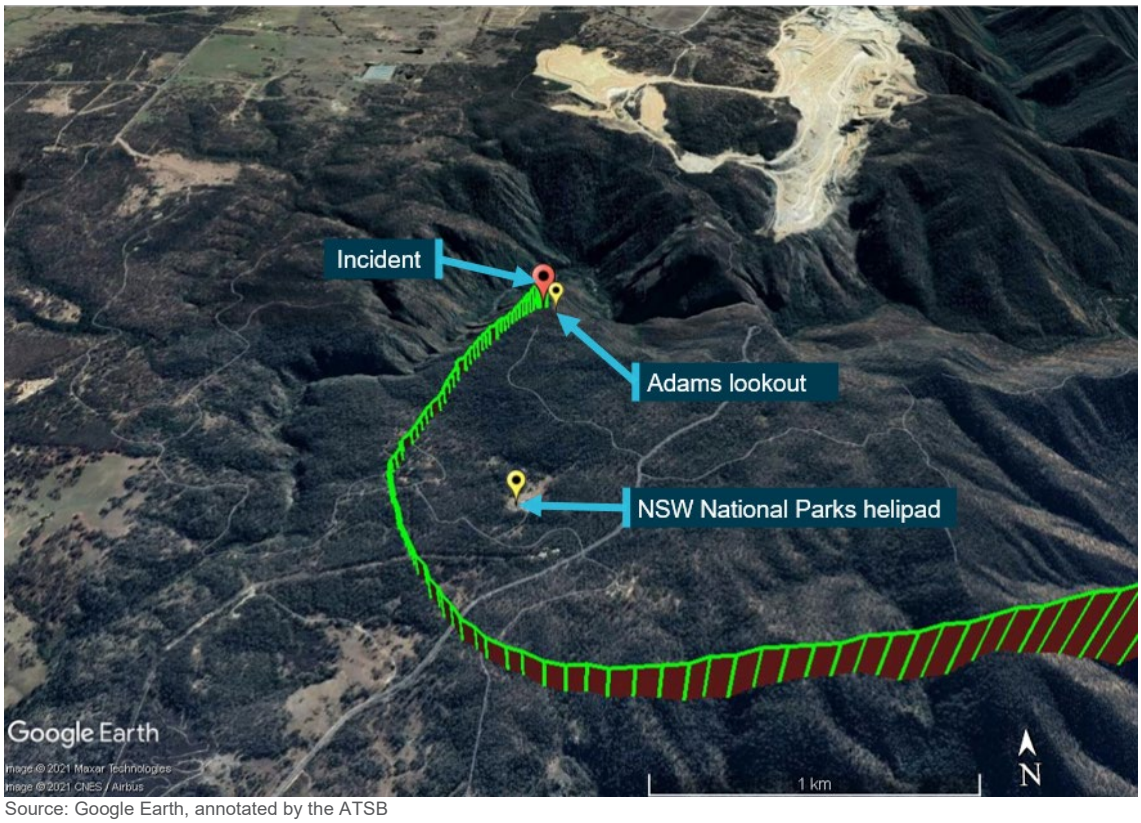


Source: Google Earth, annotated by the ATSB

On arrival at the search location the pilot disengaged all the helicopter's flight director modes (see the section titled *VH-TJO*) and manually descended the helicopter overhead the escarpment to approximately 240 ft above ground level (AGL). The pilot also reduced the aircraft's ground speed below 40 kt. They also selected a predominantly northerly approach direction for the initial search, as this provided an assessed headwind component based on the northerly winds experienced during the transit to the location. This approach direction resulted in the helicopter overflying high ground, off the edge of the escarpment and over the valley in the vicinity of the two bushwalkers.

Once below 240 ft, the pilot turned on the right moveable landing light and the crew attempted to identify several features of the area. The crew intended to track the helicopter past a New South Wales National Parks and Wildlife Service helipad then onto the bushwalkers' location (Figure 2). However, the crew were unable to identify this helipad, but positively identified the area where the rescue services were set up on the ground, as well as Adams Lookout due to vehicle and personnel lights on the ground (Figure 2). This lookout had been mentioned during police communications with the crew in reference to the bushwalkers' location, which was reported to be near the lookout but in the lower ground off the edge of the escarpment.

Figure 2 - Flight path of helicopter on approach to the incident location



Source: Google Earth, annotated by the ATSB

At 2257 while the aircraft was still over the escarpment, the ground party made an initial radio call to the paramedic in the helicopter (Figure 3). The paramedic responded to the ground party and two-way communication commenced, discussing the bushwalkers. This communication continued throughout the incident.

The helicopter continued forward, at approximately 15 kt ground speed, 84 per cent torque, and with a 9° nose-up attitude, past the edge of the escarpment. At this stage the pilot was flying with visual reference to the lookout, which was on a spur of high ground to their right. The terrain below the aircraft dropped away into the valley beyond the range of the landing light, however the spur of high ground to the right remained visible. The pilot described the perspective as looking 'into the black abyss that was … the valley floor.'

At 2258:02 recorded flight data (see the section titled *Recorded data*) indicated that the nose of the helicopter was raised to approximately 16° nose-up while engine power was reduced to approximately 78 per cent. The data also recorded a rate of descent increasing past 160 ft/min (Figure 3). The ACO stated that he felt the aircraft had come to a high hover at that point.

Figure 3 - Flight path leading up to incident with time stamps

Source: Google Earth, annotated by the ATSB

At 2258:07 the rate of descent increased above 500 ft/min as the aircraft passed a radio altimeter[4] (RADALT) height of 304 ft AGL.

At 2258:11 power increased to 91 per cent, however the rate of descent continued to increase, passing 608 ft/min. In addition, a drift to the right commenced.

At 2258:13 both the ACO and the pilot verbalised that they could see a white light source at the bottom of the valley. The light source was in the vicinity of the described location for bushwalker 1.

With the bushwalker sighted, the pilot then looked right in the direction of the lookout and identified that the terrain was no longer visible. The pilot did not verbalise they had lost sight of the lookout.

During that time, the ACO observed the light source of bushwalker 1 disappear behind the nose of the aircraft, however, did not verbalise this to the pilot, or question the apparent movement of the helicopter, due to the ongoing radio communications between the paramedic and the ground party.

As a result of losing sight of the terrain, the pilot selected the helicopter's auto-hover function. However, it did not engage, as indicated by the lack of a confirmatory auditory tone. Consequently, the pilot looked inside the cockpit and visually confirmed that the auto hover had not engaged. The pilot then attempted to troubleshoot the failure.

During this time the ACO's scan moved between the bushwalker's light and the ridgeline to the right of the aircraft. The aircrew officer identified that the ridgeline was starting to disappear up through their goggles, indicating that the helicopter was descending, and did a quick scan up and down to confirm this.

[4] Radio altimeter (also known as a radar altimeter): a device that detects phase shift between a transmitted and a reflected radio signal, to calculate the height of the aircraft from terrain directly below it.

Air to ground communications continued between the paramedic and the ground party during this time period.

At 2258:15 the ACO called ‘descending, descending’ over the intercom, to which there was no verbal acknowledgement from the pilot. At this point the power was approximately 88 per cent with a rate of descent of 768 ft/min descending through 246 ft AGL.

At 2258:17 the rate of descent reached a maximum of 896 ft/min. Power then increased by 10 per cent and the rate of descent reduced, but the descent and aircraft’s right drift continued.

At 2258:18 the ACO called ‘no further right no further right,’ however the pilot later reported that they only heard part of the transmission. Specifically, the pilot advised only hearing the words ‘right’, which did not align with their situational awareness of the terrain being to the right and so did not make a control input. At that time the rate of descent was approximately 768 ft/min passing through 199 ft AGL.

At 2258:20 Aircrewman called ‘left, left, left, move left.’ The rate of descent was approximately 544 ft/min, passing 159 ft AGL. The pilot responded with a left bank and increased power.

At 2258:23 the rate of descent reached zero and a climb was commenced. The minimum recorded RADALT height was 97 ft AGL. However, due to the positioning of the RADALT antenna towards the nose of the helicopter, and the steep terrain rising behind the tail of the helicopter, this value does not indicate the closest point of terrain to the aircraft. The ACO estimated that the aircraft came within about 20 ft of the terrain to the right of the helicopter.

At 2258:24 the paramedic became aware of the descent and questioned the crew about it.

At 2258:49 the helicopter was established in a steady hover at approximately 285 ft AGL, and the hover mode engaged without issue.

During the recovery the pilot recalled seeing red on the power index, however, they did not recall an exact figure. A red figure on the power index indicated an over torque condition, however there was no visible record of the magnitude of the over torque once the power was reduced.

The crew conducted three orbits of the area whilst debriefing the incident and decided to end the mission and return to base noting the likely power exceedance. The requirement to return to base was communicated via radio to all relevant authorities involved in the search.

Once back at the base, the aircraft was assessed by maintenance personnel and removed from service due to a torque exceedance.

Context

Personnel

Pilot

The pilot had over 20 years of experience flying helicopters, including military aircraft, and held an Airline Transport Pilot (Helicopter) Licence that was issued on 27 August 2017.

The pilot's logbook showed a total flying experience of 4,676 hours and 322.8 hours using NVGs to the last recorded flight on 24 July 2020. The pilot's total flying experience on the Leonardo Helicopters AW139 was 735.9 hours. In the previous 90 days, they had flown 45.3 hours on type, and in the previous 30 days the pilot had flown 13.1 hours on type.

The pilot held a valid instrument rating with an expiry date of 28 February 2021. They also held a valid night VFR rating, with an expiry date of 31 July 2021 and a low-level rating, valid until 10 October 2021.

The pilot held a Class 1 aviation medical certificate valid to 19 August 2021 and a Class 2 valid until 2022, with nil restrictions noted.

Aircrew Officer

The Aircrew Officer (ACO) had over 14 years experience crewing helicopters and over 11 years crewing search and rescue (SAR) and emergency medical services (EMS) helicopters. Their total crewing experience was over 2,600 hours.

The ACO was night vision imaging system (NVIS) (see the section titled *Night vision imaging system*) and winch current, having undergone an NVIS currency check and crewman line check in the previous 12 months.

The operator's AW139 ACOs all completed a pilot's ground school course for the aircraft type. The ACO was trained and competent in front seat cockpit duties and rear cabin activities. The ACO was rated as a Level 1 NVG crewmember within the operator's system. The ACO had over 10 years NVIS experience and was part of the team that first integrated NVIS operations into the New South Wales Ambulance contract with another operator.

Paramedic and Doctor

The paramedic role included rescue crew officer duties, down-the-wire duties and inter-hospital operations. The paramedic and doctor had both undergone the operator-required Aeromedical Resource Management course, however they were not expected to be involved in the operation of the aircraft.

Aircraft information

General

Leonardo Helicopter's AW139 is a medium-sized, twin-engine helicopter powered by two Pratt & Whitney PT6C-67C engines. The combined maximum power output of both engines is greater than the main gearbox's allowable power limit. Therefore, over torque of the transmission can occur when a pilot demands excessive engine power with both engines operative.

VH-TJO

AW 139 serial number 31740 was registered in Australia on 17 August 2017 as VH-TJO, and at the time of the occurrence had flown 1,887.3 hours. The helicopter was certified and maintained for IFR and NVIS operations.

The helicopter was fitted with a 4-axis enhanced flight director (FD) capable of controlling the helicopter's movement in the pitch, roll, yaw, and vertical axis. The installed version of the FD had additional functions including Hover (HOV) mode and Transition Up (TU) mode.

Auto-hover

HOV mode incorporated two systems to hold the aircraft at a point in space selected by the pilot. The first system controlled the pitch and roll of the aircraft to maintain a zero ground speed in all directions. The second used the barometric altitude or RADALT information to maintain the altitude or height above ground selected by the pilot.

Aside from the panel-mounted autopilot controller, the pilot could activate both hover systems with the centre of the pitch/roll beep trim selector switch on the cyclic, known as the fifth position of the switch. The system could be engaged when the airspeed was below 75 kt, the ground speed below 60 kt and when an operating height was between 15–2,000 ft above ground level. Engaging the system instructed the autopilot to make control inputs to bring the aircraft to a hover at the height shown on the RADALT at the time the pilot selected the mode.

The helicopter manufacturer advised that there was no vertical speed limit to engage HOV mode. Though the manufacturer did not intend for HOV mode to be engaged with a high vertical speed, it did not preclude a pilot from doing so. If engaged with a high vertical speed, the system would show as engaged and the autopilot would make adjustments as necessary to attain the height designated by the pilot. If there was a rate of climb or descent present at the time of engagement, this would induce a magnitude of overshoot whilst the system gradually reduced the vertical speed to zero at the selected RADALT height..

Flight crew configuration

Civil Aviation Order 82.6 was in force at the time of this incident and stated that the minimum crew for NVIS operations must not be less than the highest requirement for NVFR, or IFR, specified in either:

- the aircraft's flight manual
- the operator's operations manual acceptable to CASA
- Australian civil aviation legislation, including this Order, that applied to the aircraft.

Flight crew configuration for EMS helicopter operations was in accordance with the approved rotorcraft manual.

Supplement 24 of the AW139 rotorcraft manual detailed the minimum flight crew required for night visual flight rules operations as one pilot, unless otherwise required by operating rules.

Supplement 60 of the AW139 rotorcraft flight manual detailed the minimum flight crew required for night vision goggle operations and was to be read in addition to supplement 24 for EMS operations. This supplement allowed for the minimum flight crew to be a single pilot and an additional NVG-equipped crew member during take-off and landing on unimproved sites to assist with obstacle identification and clearance.

Communications

The communications system onboard the aircraft included five separate radios and the internal communications system (ICS). The ICS consists of five ICS audio control panels. The pilot, ACO and paramedic were all connected to separate ICS panels during the flight. Each ICS panel was set independently of the others, with radio channel selection, channel isolation and volume adjustable at each panel.

During the incident neither the pilot nor ACO had chosen to isolate themselves from the ongoing communication between the paramedic and the ground party on the government radio network (GRN) channel. The pilot stated that they did not isolate the GRN because it was the only radio in

use at the time and the ACO stated it was a normal time for the paramedic to be communicating on the GRN and the crew considered the search to be a low workload phase of flight.

When transmitting on any radio, the intercom was muted for that user. In the case of this incident, when the paramedic was transmitting on the GRN, the ACO's emergency calls over the intercom during the incident would have been muted for the paramedic. It is also possible that the paramedic had prioritised the volume of the GRN over the ICS and other radio channels.

Night vision imaging system

To improve vision during night operations, the helicopter crew utilised a night vision imaging system (NVIS). The operator was experienced in the application of this technology and trained their own crews and offered NVIS training to other operators.

The operator's NVIS comprised:

- AN/AVS-9 green phosphor Night Vision Goggles (NVG)
- NVG-compatible cockpit and cabin lighting
- ACO-controlled steerable winch and handheld light
- two pilot-steerable white landing lights on the underside of the aircraft.

External white lighting

The use of white light was fundamental to the operator's NVIS usage strategy. VH-TJO was fitted with the standard external AW139 lighting detailed above. The winch light pointed directly downward from the aircraft to illuminate the winch site, with illumination supplemented by the ACO's handheld light. Low level operations (search and rescue/hover/winching) were conducted by the operator using a combination of references viewed both with and without the NVGs.

The pilot described the landing light as not having a significant range and being ineffective at the height the aircraft was operating at when the incident commenced.

Several other operators conducting similar night search and rescue, hover and winching operations, had modified their aircraft to include high-powered search lights and additional external aircraft white lighting.

Meteorological information

Forecast weather conditions

The flight from Wollongong to the search area and return occurred within the Graphical Area Forecast[5] New South Wales – East (GAF NSW-E). Within the GAF NSW-E there were two subdivisions affecting the flight. The section of the flight to and from Wollongong to the search area was located in subdivision A, and the search portion of the flight was located in subdivision A2. The GAF NSW-E was valid from 2100 to 0300 on 25 July 2020, with forecast conditions including:

- average conditions of greater than 10 km visibility, with broken[6] stratus cloud 2,000 to 3,000 ft above mean sea level (AMSL) in A2
- 500 m visibility in isolated fog over the land with associated broken stratus 100 – 1,000 ft AMSL.

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[5] Graphical Area Forecast (GAF) provides information on weather, cloud, visibility, icing, turbulence and freezing level in a graphical layout with supporting text. These are produced for 10 areas across Australia, broadly State-based.

[6] Broken cloud cover indicates that more than half to almost all of the sky is covered with cloud

The Grid Point Wind and Temperature forecasts did not have wind information for 1,000 or 2,000 ft altitudes. The 5,000 ft altitude wind was forecast to be 4 kt from 040°.

Goulburn Airport observations

The Bureau of Meteorology provided the ATSB with METAR[7] data from Goulburn Airport at the time of the accident. Goulburn Airport was located 26 km to the west of the incident location and was the closest airfield with recorded meteorological observations. For the duration of the flight automatic recordings of weather conditions at Goulburn included wind speeds of less than 2 kt, greater than 10 km visibility and nil cloud detected.

Witnesses

The pilot and crewman of VH-TJO stated that before departure from Wollongong they were given an appreciation of the weather in the search area by the police officers on the ground who reported clear skies with no fog and no cloud. The pilot stated that they encountered those described weather conditions on arrival at the search area. The pilot also noted that it was very dark, with no moon and little cultural lighting in the area.

The pilot described the winds during transit to be approximately 10 – 20 kt from the north and at ground level at Nowra and Wollongong the wind was negligible.

Recorded data

VH-TJO was equipped with a Penny & Giles Aerospace Limited Model D51615-142 solid-state Multi-Purpose Flight Recorder (MPFR). The MPFR recorded up to 600 flight parameters and audio on four separate audio channels. The recorded audio tracks related to pilot, co-pilot and cabin intercommunication system, as well as the cockpit area for the last 120 minutes.

The audio data was not recovered from the MPFR for this incident. However, the recorded flight data information and time stamps from the MPFR have been used for analysis and throughout the report.

The MPFR data was sent to the manufacturer for download and analysis. Leonardo Helicopters produced an analysis report which stated that, while the status of the push buttons to engage HOV mode were not recorded, there was no temporary HOV mode activation before the event. This would have been indicated by the ground speed velocity references being set to zero knots if the HOV mode was successfully engaged.

Leonardo Helicopters also noted that before the event all flight parameters were valid and within the limits for HOV mode engagement. The proper functioning of the system was confirmed when, after the event, the crew were able to successfully activate the HOV mode. It could not be established why the HOV mode did not engage when the pilot first attempted to engage the system.

Also onboard the aircraft was an additional video and audio recording system specifically introduced by the operator as part of the aeromedical fit out for the AW139. It consisted of three cameras, two of which were in the cabin and one fitted to the right side fuselage below floor level focused downward on the winch site.

The rest of the system consisted of a power control module, an audio mixer and interfaces with the existing aircraft audio panels. Video and audio files were recovered from this system. Audio was recorded from several inputs, however the separate inputs were combined and recorded into one audio file. This file recorded all channels at a nominal volume and was not specific to the settings the crew had on their individual ICS boxes.

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[7] METAR: A meteorological report for an aerodrome issued at a routine time (half hourly) when conditions are better than specified thresholds.

Operational information

Operator flight manual

Sterile cockpit procedure

At the time of the incident company procedures for helicopter operations during critical phases of flight included a section for sterile cockpit procedures. Part of these procedures allowed for conversation during sterile cockpit environment when it was specific to the phase of flight concerned.

The Toll fitted audio recording system was used to confirm the focus of the air to ground communications during the incident and confirmed that the paramedic and ground party were focused on locating the bushwalkers, which directly related to the current phase of flight.

Lost visual references procedure

The operator's procedures included guidance for actions in the event of inadvertent instrument meteorological conditions, loss of visual reference such as brownout or white out and attitude upset situations.

Recovery procedures from loss of visual references are designed to minimise the likelihood of an aircraft striking obstacles. The procedure was to be initiated by any crewmember that lost visual references calling 'lost reference' immediately. The pilot flying was then to commence a restricted visibility take-off profile, using the available visual and instrument attitude and rate of movement cues.

In discussing this procedure with the pilot after the incident, the pilot indicated that in this incident their first reaction was to go for the HOV mode. However, they also stated that, in hindsight, they should have conducted an overshoot.

Related Occurrence

AO-2018-039

On the evening of 13 May 2018, the crew of a Leonardo Helicopters AW139, registered VH-YHF, departed Darwin, Northern Territory, to search for an activated emergency position-indicating radio beacon (EPIRB). The crew flew under night visual flight rules with support of an NVIS.

During an approach to a potential EPIRB target, the pilot lost visual references and engaged HOV mode with a high rate of descent. Due to the additional lighting installed on the aircraft, the ACO could see the ground below and provided corrective actions to the pilot. The pilot regained control with a rehearsed emergency recovery drill. During the recovery procedure, the applied engine power exceeded the airframe limitations.

Safety analysis

The occurrence

During the visual search phase of the flight an unidentified rate of descent and lateral drift commenced. This was likely due to the pilot's scan focusing largely outside the cockpit in search of the bushwalkers rather than on the cockpit instruments and the ridgeline to the right of the helicopter.

Detection of the uncommanded movement was hampered by limitations with the aircraft's external lighting. Specifically, at the operating height the external aircraft white lighting was inadequate to illuminate the terrain below the aircraft, resulting in the pilot not identifying the developing rate of descent while searching for the bushwalkers. While the pilot had been using a terrain reference to the right of the aircraft during the initial part of the search, no other terrain was illuminated by the landing lights.

After the pilot and ACO visually identified the bushwalker, the pilot looked back to the three o'clock for the hover reference, but it was no longer in the pilot's field of view. This was a result of the helicopter's continued forward movement while the crew were focused on locating the bushwalkers. As the external aircraft lighting did not illuminate the terrain below the aircraft the pilot had no other visual hover references. As a result, the pilot attempted to engage the automated hover mode rather that commence an overshoot. Had the pilot commenced an overshoot when visual references were lost, the severity of this incident would probably have been reduced.

When the auto hover failed to engage the pilot focused their attention on trying to rectify the issue. During this time the rate of descent increased and drift continued unnoticed until recognised and announced by the ACO.

Communications

The pilot did not announce losing references during this incident. Had this been verbalised to the crew, the ACO would have focused their attention solely on assisting the pilot to maintain aircraft position. This likely would have resulted in the rate of descent being identified earlier and reduced the recovery time. That said, given how close the helicopter came to the terrain during the recovery manoeuvre, the ACO's detection and response to the situation probably prevented the helicopter colliding with terrain.

Throughout the incident there was continual communications between the onboard paramedic and the ground crew. Despite that, neither the pilot or ACO isolated the air to ground radio channel. This was primarily because all other radios were quiet and the crew did not feel they were in a high workload phase of flight.

When the ACO identified the light source of bushwalker 1 disappear behind the nose of the aircraft, this was likely their first identification of the helicopter developing the drift and descent which led to the unsafe aircraft state. However, due to the ongoing communications between the paramedic and ground party the ACO did not verbalise this to the pilot and confirm the pilot's intentions. Had there been no other communications at the time, the ACO would have verbalised the observed movement and it is likely that the pilot would have responded and recovered the descent and drift sooner than otherwise occurred.

The sterile cockpit company procedures at the time did not prevent the paramedic speaking to the ground party during this phase of flight. While it could not be established exactly why the pilot did not clearly hear all communications from the crewman, the continual air to ground communications may have hindered the communication between the pilot and the ACO once the undesired aircraft state had developed, possibly delaying the recovery further.

Findings

ATSB investigation report findings focus on safety factors (that is, events and conditions that increase risk). Safety factors include 'contributing factors' and 'other factors that increased risk' (that is, factors that did not meet the definition of a contributing factor for this occurrence but were still considered important to include in the report for the purpose of increasing awareness and enhancing safety). In addition 'other findings' may be included to provide important information about topics other than safety factors.

Safety issues are highlighted in bold to emphasise their importance. A safety issue is a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operating environment at a specific point in time.

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

From the evidence available, the following findings are made with respect to the near collision with terrain, VH-TJO, that occurred 26 km east of Goulburn Airport on 24 July 2020.

Contributing factors

- It is likely that the pilot's fixation on locating the bushwalkers resulted in them not maintaining an effective scan. This resulted in the loss of hover reference and development of an unintended descent and lateral drift.
- During the incident, air to ground communications between the paramedic and ground party hindered communications between the pilot and aircrew officer. This inhibited the aircrew officer's ability to verify with the pilot whether the observed initial movement was intentional, preventing recovery from the initial drift and descent.
- In response to the loss of hover reference, the pilot unsuccessfully attempted to engage auto hover rather than commence an overshoot. Subsequent focus on selecting the automated mode further delayed the resumption of the scan and recognition of the increasing descent rate.
- **The external aircraft white lighting was inadequate to effectively illuminate the area below and to the side of the aircraft. This delayed the identification and recovery from the unsafe aircraft state**. **(Safety issue)**
- The pilot did not announce losing hover reference, delaying the aircrew officer's awareness of the developing situation and support to the pilot. As a result, it was estimated the aircraft came within 20 ft of terrain before the descent and drift were arrested.

Other findings

- The aircrew officer's detection of the undesired aircraft state and response probably prevented the helicopter colliding with terrain.

Safety issues and actions

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues. The ATSB expects relevant organisations will address all safety issues an investigation identifies.

Depending on the level of risk of a safety issue, the extent of corrective action taken by the relevant organisation(s), or the desirability of directing a broad safety message to the aviation industry, the ATSB may issue a formal safety recommendation or safety advisory notice as part of the final report.

All of the directly involved parties are invited to provide submissions to this draft report. As part of that process, each organisation is asked to communicate what safety actions, if any, they have carried out or are planning to carry out in relation to each safety issue relevant to their organisation.

The initial public version of these safety issues and actions will be provided separately on the ATSB website on release of the final investigation report, to facilitate monitoring by interested parties. Where relevant, the safety issues and actions will be updated on the ATSB website after the release of the final report as further information about safety action comes to hand.

External aircraft white lighting

Safety issue description

The external aircraft white lighting was inadequate to illuminate the terrain below and to the side of the aircraft at the required operating height., This delayed the identification and recovery from the unsafe aircraft state resulting in the pilot not identifying the developing rate of descent during the incident, delaying the recovery from the descent.

Issue number:	AO-2020-038-SI-01
Issue owner:	Helicorp Pty Ltd
Transport function:	Aviation: Air transport
Current issue status:	Open – Safety action pending.
Issue status justification:	To be advised.

Proactive safety action taken by Helicorp Pty Ltd

Action number:	AO-2020-038-PSA-04
Action organisation:	Helicorp Pty Ltd
Action status:	Monitor

Response by Helicorp Pty Ltd

Helicorp Pty Ltd identified in its post-incident investigation report that a high-powered search light could have been of benefit in this incident in helping to establish visual cues.

The report also suggested that the high-powered search light project should be fast tracked to the extent reasonably possible.

Helicorp Pty Ltd reported it is improving search light capabilities across its fleet of AW139 helicopters, specifically through a modification project to fit the A800 Trackkabeam to the fleet. The first aircraft fitment commenced in October 2021 and the project is due to be complete across the fleet in September 2022.

In addition, complex missions requiring winching will be prioritised with regards to available aircraft fitted with the A800 Trakkabeam.

Response by ATSB

The ATSB welcomes the operator's safety action and considers that, once fully implemented, it will address the safety issue.

Safety action not associated with an identified safety issue

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Additional safety action by Helicorp Pty Ltd

Helicorp Pty Ltd advised they have taken the following proactive safety action in response to this occurrence:

- Sterile cockpit procedures have been amended and specifically introduced into the helicopter emergency medical services volume of the company operations manual. The procedures include a minimum height and speed above which the aircraft needs to be for general discussions between the crew to occur and for when air to ground radio communications are permitted. In addition, prior approval should be sought before the paramedic transmits on role radios. If the PIC approves the transmission, flight crew are to isolate role radios.
- A new procedure has been introduced into the operations manual clarifying that hovering is a visual manoeuvre that requires adequate references to maintain position. It also details the actions required if, upon termination of an approach, adequate hover references are not available.
- Additional human factors training with a focus on spatial disorientation, confirmation bias and communication techniques, including silent cockpit adherence has been introduced for all flight crew and medical crew.
- Pre-flight Operational Risk Assessment process has been amended to include a specific mission oversight approval process for all NVIS complex winch activities.
- Additional NVIS training program was introduced, including initial complex winch training. Additional NVIS winching flights were also added after a subsequent occurrence.
- Additional procedures for the use of auto-hover were introduced.

General details

Occurrence details

Date and time:	23 July 2020 – 22:58 EST	
Occurrence class:	Serious incident	
Occurrence categories:	Near collision with terrain	
Location:	26 km east of Goulburn Airport (Bungonia National Park) New South Wales	
	Latitude: 34º 47.807' S	Longitude: 150º 0.48' E

Aircraft details

Manufacturer and model:	Leonardo S.P.A Helicopters AW139	
Registration:	VH-TJO	
Operator:	Helicorp Pty. Ltd.	
Serial number:	31740	
Type of operation:	Aerial Work - EMS	
Activity:	Commercial air transport – Non-scheduled medical transport	
Departure:	Wollongong Airport	
Destination:	Wollongong Airport	
Persons on board:	Crew – 4	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Glossary

ACO	Aircrew officer
AGL	Above ground level
CASA	Civil Aviation Safety Authority
EMS	Emergency medical services
EST	Eastern standard time
FD	Flight director
GAF	Graphical area forecast
GRN	Government radio network
HOV	Hover mode
ICS	Internal communications system
MPFR	Multi-purpose flight recorder
NVG	Night vision goggles
NVIS	Night vision imaging system
RADALT	Radio altimeter
SAR	Search and rescue

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the helicopter crew
- Helicorp Pty Ltd
- Civil Aviation Safety Authority
- Leonardo Helicopters
- video footage of the incident flight from internal cameras
- recorded data from the multi-purpose flight recorder onboard the aircraft
- Bureau of Meteorology

Submissions

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the following directly involved parties:

- the helicopter crew
- Helicorp Pty Ltd
- Civil Aviation Safety Authority
- Leonardo Helicopters
- Bureau of Meteorology

Submissions were received from:

- the helicopter pilot
- Helicorp Pty Ltd
- Civil Aviation Safety Authority

The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

About the ATSB

The ATSB is an independent Commonwealth Government statutory agency. It is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers.

The ATSB's purpose is to improve the safety of, and public confidence in, aviation, rail and marine transport through:

- independent investigation of transport accidents and other safety occurrences
- safety data recording, analysis and research
- fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia, as well as participating in overseas investigations involving Australian-registered aircraft and ships. It prioritises investigations that have the potential to deliver the greatest public benefit through improvements to transport safety.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, international agreements.

Purpose of safety investigations

The objective of a safety investigation is to enhance transport safety. This is done through:

- identifying safety issues and facilitating safety action to address those issues
- providing information about occurrences and their associated safety factors to facilitate learning within the transport industry.

It is not a function of the ATSB to apportion blame or provide a means for determining liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner. The ATSB does not investigate for the purpose of taking administrative, regulatory or criminal action.

Terminology

An explanation of terminology used in ATSB investigation reports is available on the ATSB website. This includes terms such as occurrence, contributing factor, other factor that increased risk, and safety issue.