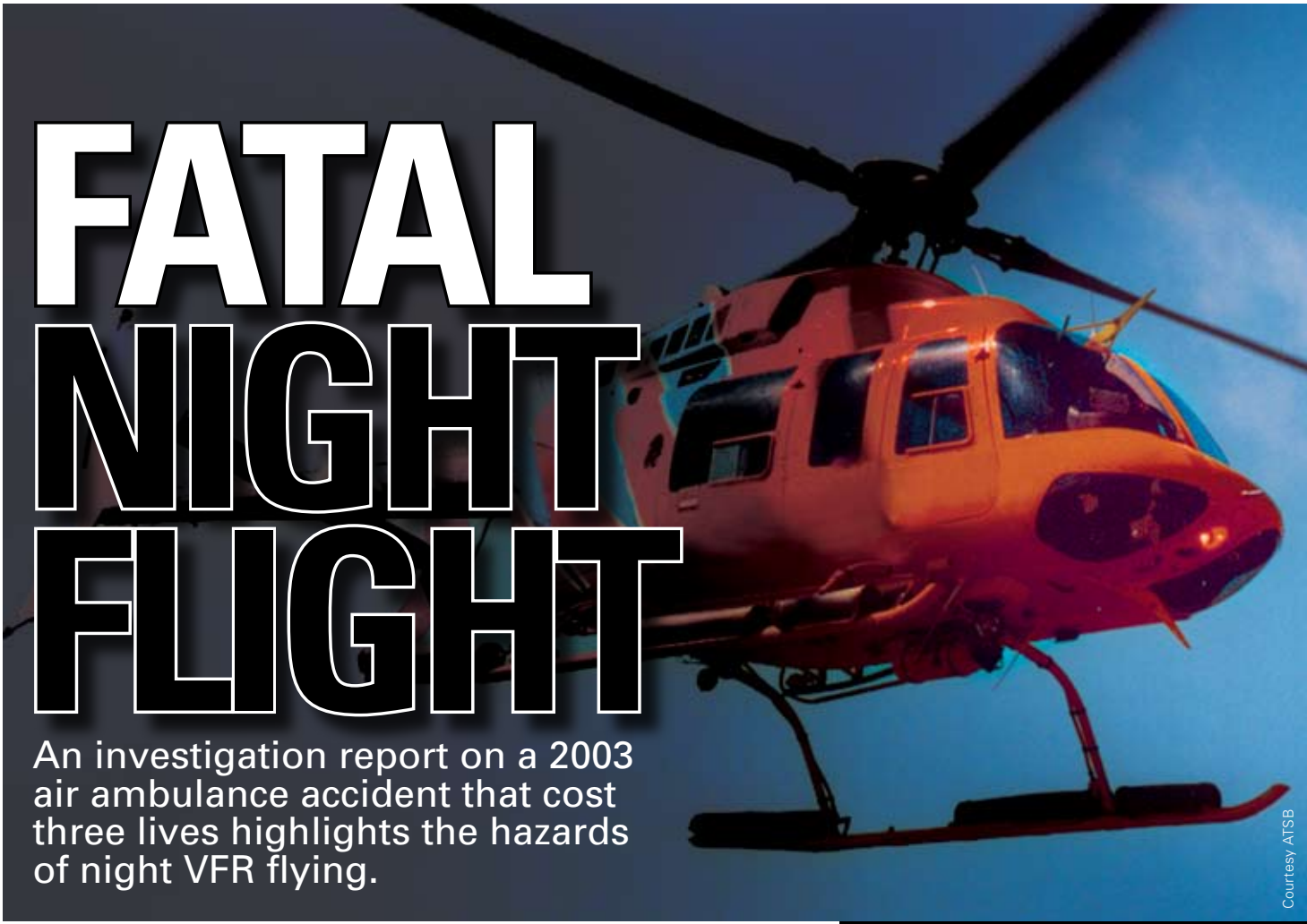
FATAL NIGHT FLIGHT

An investigation report on a 2003 air ambulance accident that cost three lives highlights the hazards of night VFR flying.



Courtesy ATSB

Critical clues: VH–HTD plunged into the ocean near Mackay Queensland. Examination of recovered wreckage and research into similar accidents provided clues to the possible causes.

At 2132 (EST), October 17, 2003, a Bell 407 helicopter, VH-HTD carrying a pilot, a paramedic and a crewman, left its base in Mackay, northern Queensland, to collect a patient from Hamilton Island. The flight should have taken about half an hour, but when the aircraft failed to arrive 35 minutes later, staff on Hamilton Island contacted the Ambulance Coordination Centre.

After repeated calls to the helicopter went unanswered, Australian Search and Rescue (AUSAR) dispatched a BK117 helicopter from Hamilton Island to investigate. About 3.2 nm east of Cape Hillsborough, Queensland, the crew found floating wreckage that was later confirmed to be from the Bell 407. There were no survivors.

Following 12 days of side scan array sonar searches, underwater diving and trawling, Australian Transport Safety Bureau (ATSB) investigators found the main impact point and location of heavy items of wreckage. Examination of the wreckage by investigators and specialists from the engine and airframe manufacturers found no pre-existing mechanical problems.

In the week following the accident, ATSB investigators flew with a commercial instrument flight rules (IFR)-rated pilot to simulate the path of VH–HTD as closely as possible. The forecast weather was similar to conditions on the night of the accident. The investigators discovered that although the conditions met the regulatory requirements for flights under night visual flight rules (NVFR) and the flight was conducted clear of cloud, it was not possible to maintain a visual reference to the horizon.

Not being able to maintain visual contact with the horizon meant that the helicopter was effectively in IMC.

The ATSB report also notes that before the accident, the pilot had not recently documented any instrument flying. He did not have a Command Instrument Rating, which meant he was prohibited from flying in instrument meteorological conditions (IMC) as pilot in command (PIC). Therefore, his previously completed instrument flying was most likely conducted with an instructor as PIC, and in VMC (visual meteorological conditions). If he had inadvertently entered IMC conditions during the flight, this lack of documented instrument flying proficiency may have affected his ability to recover the helicopter from an unusual attitude.

VFR flight into IMC causes many spatial disorientation accidents, when the pilot becomes confused about the aircraft's position, motion or attitude because of dark or cloudy conditions obscuring the ground and sky.

International research: Turning to international research which might have a bearing on the accident, ATSB investigators found that there were at least 83 accidents involving spacial disorientation in fixed and rotary wing VFR flights into IMC in the United States between 1994 and 2003. Non-instrument rated pilots were involved in 83 percent of these. Although most of the hours were

flown in daylight, almost half (47) occurred during night flights.

In the 1980s, the US Federal Aviation Administration (FAA) found that 67 per cent of all fatal emergency medical services (EMS) helicopter accidents were weather-related and that 71 percent of those occurred at night.

A review of aeromedical transport published by the American Air Medical Physician Association in 2002 warned that "even on the clearest night with VFR conditions, a pilot can come close to IFR operations if there is no moon and/or no ground lights to establish a horizon reference ... However, the real "killer" lurking in the night sky is unseen cloud.

"Clouds disappear easily in the dark and you can fly into one without seeing it coming. Accordingly, the prudent aeromedical pilot must be proficient in keeping the helicopter upright by reference to instruments, even if he's not instrument rated," the review said.

This was also noted in a 2003 New Zealand Transport Accident Commission report into a helicopter EMS night VFR controlled flight into terrain accident. The report said visibility challenges at night made it imperative to determine a minimum safe altitude for the route before flying. It also called for instrument flying ability, so that inadvertent flight into cloud can be managed without difficulty or danger.

Night flying: The difficulty of night flying was highlighted in an incident that occurred a few weeks before the accident, when the pilot of the fatal VH-HTD flight conducted a patient transfer under conditions similar to the night of the accident, flying from Mackay to Hamilton Island and return.

As the helicopter was climbing after take-off from Hamilton Island, the runway lights were turned off immediately, instead of 30 minutes later, as required by CASA. About a minute after the lights were extinguished, the pilot asked whether the crewmember could see the runway lights, and was told they could not.

The pilot continued the climb and commenced a left turn, when he asked the crewman again if he could see the island surface or ground-based lights. The crewman reported that the pilot's voice was noticeably anxious.

The crewmember said the pilot seemed to "settle down" once he found the ground lights and the flight continued uneventfully. In an informal de-brief after the flight, the pilot was said to have explained that he "lost reference [during the departure from Hamilton Island] and had to get comfortable again".

The left turn completed by the pilot during this event was contrary to the published circuit direction, was towards the high ground of the island and required him to look across the cockpit to reacquire the lights of the built-up area of the island.

The ATSB report concluded that the pilot's limited instrument flying experience and his previous marine pilot training on how to react to unexpected entry into IMC, or to disorientation, might have contributed to his actions.

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The US research reviewed by the ATSB highlighted the importance of pilot decision-making and helicopter EMS risk management. The FAA noted in guidance material produced for EMS operations that "managerial control of risk through the systems approach provides an optimal set of checks and balances that assures risk reduction".

Organisational complexity: A US National Transportation Safety Bureau study outlined the potential conflict that can exist when a pilot is employed by the helicopter operator, but works at a remote base and has greater day-to-day contact with the EMS program management. "Conflict in this situation can occur because pilots are required to make judgements that directly influence the safety of every EMS flight, yet if they make a judgement that displeases the hospital administrator ... it could be used against their employer when the contract is renewed."

A factor considered by the ATSB investigators was the complexity of the organisational framework of the EMS helicopter operation, which contributed to a diffusion

AERO MED SERVICES RISK FACTORS

The circumstances of the accident combined most of the operational and organisational risk factors associated with helicopter Emergency Medical Services (EMS) accidents. These included:

- The pilot was inexperienced with over water night operations out of sight of land in Bell 407-type helicopters.
- The pilot did not hold an instrument rating, had limited instrument flying experience and limited experience in the helicopter type.
- The pilot was new to the organisation and emergency medical services (EMS) operations.
- The accident occurred on a dark night with no celestial or ground-based lighting.
- The flight path was over water with no fixed surface lit features.
- Forecast weather in the area of the helicopter flight path included the possibility of cloud at the altitude flown.
- A number of different organisations were involved in providing the service. There was no single organisation with the required expertise with oversight of operational safety.
- The operation was remote from the operator's main base.
- Actual or perceived pressures may have existed to not reject missions due to weather or other reasons.
- There was an apparent lack of awareness of helicopter EMS safety issues and helicopter night VFR limitations.

of overall safety oversight. Responsibility for safety oversight was divided between the Queensland Department of Emergency Services Aviation Services Unit, Central Queensland Helicopter Rescue Ltd and the operator. The report noted that safety systems are strongest when one organisation has overall responsibility.

An independent post-accident review of the Queensland aeromedical and air rescue helicopter network stressed that it was important that decisions made by the pilot to accept or reject a flight were fully supported by the organisation. Documented operating procedures should outline how tasks can be refused without fear of retribution or job loss.

The independent review warned of the possibility of a conflict of interest arising between management and operations related to sponsorship. The review recommended that operators make it clear that there is no pressure on a crew to accept a task against their better judgement.

The ATSB report noted that the personnel operating VH-HTD were required to submit a voyage report to management noting any flight cancellations and the reasons for them.

The pilot had recently been employed and was under probation. The ATSB report said that this factor, along with the requirement to document all cancelled flights and report them to management, may have placed additional pressure on the pilot to complete the flight.

AAP Image/the Daily Mercury/Peter Holt

Flotatation devices attached to the helicopter wreckage assist recovery.

Courtesy ATSB

Main parts of the wreckage are hauled aboard the recovery vessel.

UNDER CONTROL AT NIGHT

One of the requirements for the issue of a night VFR rating (other than for Night VFR in balloons) is to show that the applicant can safely control the aircraft solely by reference to instruments in the following manoeuvres:

- Recovery from unusual attitudes.
- Normal turns of at least 180 degrees left and right.
- Climbing turns to a pre-determined altitude at a constant speed.
- Descending turns to a pre-determined altitude at a constant speed.
- Straight and level flight.
- Climbing and descending.
- In the case of single engine helicopters, autorotative flight with power recovery.

NVFR pilots are required to demonstrate a high degree of competence in flying an aircraft solely by reference to instruments because visual reference to the natural horizon can never be guaranteed when flying at night, even in VMC conditions.

Moreover, trying to use visual reference to control an aircraft at night can quickly lead to pilot disorientation and loss of control. Visual disorientation is a distinct possibility on dark nights or away from areas of extensive ground lighting. Disorientation can be caused by sudden loss of visual reference such as when turning away from a well lighted area towards an area without ground lighting. It can even be caused by confusing stars with lights on the ground or vice versa. Cloud layers and mountains can also obscure or give false visual impressions of the natural horizon at night. During take off, loss of visual reference occurs during rotation and from this point on control of the aircraft should be maintained solely by reference to instruments.

While aircraft control is being maintained on instruments, visual reference is used as required for positioning the aircraft in the circuit, looking out for other traffic, and for navigation.

Therefore, it is imperative that Night VFR pilots are competent and current in instrument flight.

Instrument rated pilots flying under the IFR are required by the Civil Aviation Orders to have recent experience in flying by reference to instruments and even though there is no similar requirement for night VFR pilots, currency in instrument flying skills is equally important.

Before any kind of night VFR flight, even local flying in the circuit, the pilot should ask the question "Am I in sufficient current practice to be confident that I can maintain control on instruments without outside visual reference?". If the answer is not a definite yes, go and get some refresher practice in instrument flying first.

While the ATSB was unable to conclusively determine the cause of the Mackay accident, it found that the circumstances of the accident were consistent with loss of control due to spatial disorientation of the pilot in command.

The ATSB also found that there was an apparent lack of awareness of EMS unique helicopter operational safety issues and diffused oversight for ensuring safe operation of the helicopter.

As a result of the ATSB investigation, the Civil Aviation Safety Authority advised it would:

- Develop competency standards based on night VFR requirements for inclusion in Civil Aviation Safety Regulation Part 61's manual of standards along with a new requirement for a biennial flight review of the night VFR rating in Part 61 itself.
- Consider a requirement in Part 133 for night helicopter EMS operations to be conducted by two-pilot crews.
- Issue a civil aviation advisory publication (CAAP) to summarise safety guidelines for use by operators and pilots in command involved in helicopter EMS operations.
- I ssue a CAAP to clarify safety guidelines for night VFR operations.

Adapted from Aviation Safety Investigation 200304282 *published by the Australian Transport Safety Bureau, March 2005: www.atsb.gov.au/aviation/occurs/occurs_detail.cfm?ID=547*

ATSB investigators piece the wreckage together.

Senior air safety investigator, Sam Webb, looks over recovered parts.

HELICOPTER EMS ACCIDENTS

24 JULY 2000

A Bell 206L-3 helicopter was operating a night VFR medical evacuation flight to Rockhampton Hospital in Queensland.

During the flight, the pilot became aware that the helicopter was low on fuel and decided to divert to Marlborough.

But by the time the helicopter reached the alternate landing spot, the area was covered with fog.

After overflying the landing area three times while the fog was thickening, the helicopter lost power and crashed into the ground.

All five people on board were killed. The ATSB investigation concluded that the most likely reason for the engine power loss was fuel starvation. Once power had been lost, the pilot was unable to land safely in the fog.

– ATSB occurrence number BO/200003130

2 MAY 1997

At Tartrus Station, Queensland, a pilot was preparing a Bell 206L helicopter for the next flight when he turned on the valve for the medical oxygen system. Witnesses heard a loud bang and gas escaping as the pilot was thrown clear of the helicopter. The aircraft caught fire and burned.

The pilot received ear and chest injuries in the blast. The investigation found that there were significant deficiencies in the control, design, construction, installation and maintenance of medical oxygen systems for use in aircraft.

– ATSB occurrence number BO/199701421

2 MAY 1993

A Bell 206L helicopter was operating a night VFR medical evacuation flight to North Fraser Island, Queensland, when it was forced to descend to about 1000 ft to remain below the cloud layer.

As the helicopter approached its destination, it encountered rain and the pilot commenced a descent.

The rain became heavier and the pilot lost sight of all but one of the three light sources at the landing point.

The helicopter hit some trees and began to vibrate.

The pilot closed the throttle and flared the helicopter, which came to rest upright about 400 m short of the intended landing point.

The aircraft was substantially damaged. Fortunately none of the occupants of the helicpter were injured.

– ATSB occcurrence number BO/199301330