



Australian Government
Australian Transport Safety Bureau

Collision with water in dark-night conditions involving Robinson R22 helicopter, VH-YLY

6 km south of Cape Tribulation, Queensland | 7 April 2016



Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation
AO-2016-031
Final – 18 December 2017

Cover photo: Stacey Maisel

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

Publishing information

Published by: Australian Transport Safety Bureau
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Addendum

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Safety summary

What happened

On 7 April 2016, the pilots of two Robinson R22 helicopters flew from Mossman, Queensland to various fishing locations to the north with a passenger in each helicopter. Late in the afternoon, the pilots commenced the direct return flight to Mossman. However, the pilots encountered weather and winds that slowed their progress and required them to refuel at Cooktown.

The pilots departed Cooktown at last light intending to track via the coast to Mossman. As the flights progressed, the light available from the sun continued to decrease and there was no moon. There were also patches of cloud and rain in the general area.

Shortly after passing Cape Tribulation, in dark night conditions, one of the helicopters, registered VH-YLY (YLY), collided with the sea. The passenger was injured in the accident but was able to reach the shore and notify emergency services. Unaware of the accident, the occupants of the other helicopter continued to Mossman.

A search was initiated and the missing helicopter was located on 9 April 2016 in about 400 m offshore in about 10 m of water. The pilot was not located.

What the ATSB found

The ATSB found that the pilot of YLY, who was only qualified to operate in day-VFR conditions, departed on a night flight and continued towards the destination in deteriorating visibility until inadvertently allowing the helicopter to descend into water.

The ATSB also identified the following other factors that collectively increased risk:

- an unapproved modification attached to the skids of YLY
- exceedance of weight and balance limitations
- non-carriage of life jackets
- incomplete operational information
- overdue calibration checks of the helicopter pitot-static system and altimeter.

Safety message

To avoid the usually fatal consequences of losing visual reference, day-VFR pilots need to plan to arrive at their destination at least 10 minutes before last light and to have a realistic 'plan B' to use when it becomes apparent that the intended flight cannot be completed in daylight. A further consideration for pilot decision-making about flying conditions is the degree to which passengers are also exposed to risk.

Key messages from the ATSB *Avoidable Accidents* series report No.7 highlight that some nights and some terrain are darker than others, and inadvertently flying into instrument meteorological conditions is also harder to avoid at night. Pilots need to be mindful of similar messages provided in pilot operating handbooks that refer to risks associated with loss of visibility and night flight in bad weather.

The occurrence

On the morning of 7 April 2016, the pilot of a Robinson Helicopter Company R22 helicopter, registered VH-YLY (YLY) flew from Mareeba to Mossman, Queensland, to join the pilot of another R22 for a fishing trip (Figure 1). Both pilots were qualified to operate the helicopters on private-category operations by day under the visual flight rules¹.

The two pilots departed Mossman at about 0800 EST² with a passenger in each of the two-seat helicopters. The pilots tracked north to Cooktown to refuel then continued northward to Pipon Island, landing at various coastal locations so they and the passengers could do some fishing. At one of the landing sites the pilots were able to fill the helicopter fuel tanks from a drum of fuel.

By the time the helicopters arrived at Pipon Island, the occupants had caught between 20 and 30 kg of fish, which were carried in a non-standard container attached to the left skid of YLY. After spending some time at Pipon Island, the pilots departed separately somewhere between 1600 and 1700 to return to Mossman. The pilots had used GPS route information and local weather conditions, rather than the required aviation Area Forecast,³ to decide that they had sufficient fuel and daylight to make it to Mossman, a direct-track distance of 148 NM (274 km).

Figure 1: Location of Pipon Island with Cooktown and Mossman destinations showing position of VH-YLY accident site south of Cape Tribulation. The inset shows Cape Tribulation relative to far north Queensland.



Source: Google Earth and modified by ATSB

¹ Visual Flight Rules (VFR) are a set of regulations which allow a pilot to only operate an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going.

² Eastern Standard Time (EST): Coordinated Universal Time (UTC) + 10 hours.

³ Area forecast (ARFOR): routine forecasts for designated areas and amendments when prescribed criteria are satisfied. Australia is subdivided into a number of forecast areas.

During the return flight, squalls and headwinds of about 20 kt were encountered that slowed progress and necessitated a landing at Cooktown to refuel. Relative to the other helicopter, YLY was slower likely due to the aerodynamic drag of the skid-mounted container, the additional weight of the fish, and doors-off operation.

Recorded fuel transaction information showed the time of fuel uplift at Cooktown occurred at 1836. Given last light for Cooktown was calculated to be 1838 (based on ideal conditions), night conditions existed by the time the pilots were ready to depart. Neither pilot was qualified to fly at night or in low visibility conditions that would require instrument flying. Additionally, the helicopters were not equipped with an artificial horizon instrument and lacked other equipment required for flight at night under Australian regulations.

The passenger in YLY reported he was concerned about the available light and weather conditions and queried the pilot's intention to continue the flight after Cooktown. Without elaborating, the pilot indicated he intended to continue and the flight (direct-track distance of 60 NM) would only take 45 minutes. None of the pilots or the passengers reported any specific reason to arrive at Mossman that evening. The pilots did not discuss staying in Cooktown.

Both helicopters departed Cooktown at about 1840. A witness who observed the departure reported it was getting dark, which was consistent with it being after last light and no moonlight (local moon-set was 1811). Due to the slower speed of YLY, the other helicopter drew ahead. Every 10 minutes or so, the pilot of the lead helicopter, who was the more experienced pilot, checked in with the pilot of YLY by radio.

According to the pilot in the lead helicopter, and as had been discussed, they flew close to the coast intending to keep an outline of the mountains as a visual reference. In 'bad conditions', the proposed method was to ensure the altimeter was accurate relative to sea level and use it to fly not below 250 ft above the water. If the conditions got 'really bad', in that it got too dark and the outline of the mountains or sight of the water was being affected, the plan discussed between the pilots was to land on a beach. The pilot of the lead helicopter advised they had done this on previous occasions due to bad weather, though only in daylight.

The coastal route between Cooktown and Mossman has few settlements and from halfway, most of the coastline is part of the Cape Tribulation section of the Daintree National Park. It is a remote area and, as such, there is little or no ground lighting.

Initially, the weather conditions were reported to be clear but about 15-20 minutes into the flight, the pilot of the lead helicopter encountered small squalls with a bit of cloud. After passing Cape Tribulation, the pilot of the lead helicopter radioed the pilot of YLY who advised he had just passed the cape and did not report any difficulties.

The passenger in YLY recalled that at one stage the helicopter descended close to the water before the pilot corrected and climbed. He further stated that visibility decreased until it was dark and the pilot dimmed the cockpit lights to reduce glare off the windscreen. The passenger recalled passing the Cape Tribulation campgrounds and was aware that there were people on the beach as indicated by campfires and a spotlight being waved at the passing helicopters.

To the passenger, it got 'really dark' and concerning so he suggested landing on the beach. The pilot did not respond verbally but it appeared to the passenger that they might be descending to land. Suddenly the passenger saw the ocean more clearly followed almost immediately by a 'massive bang' as the helicopter impacted the water.

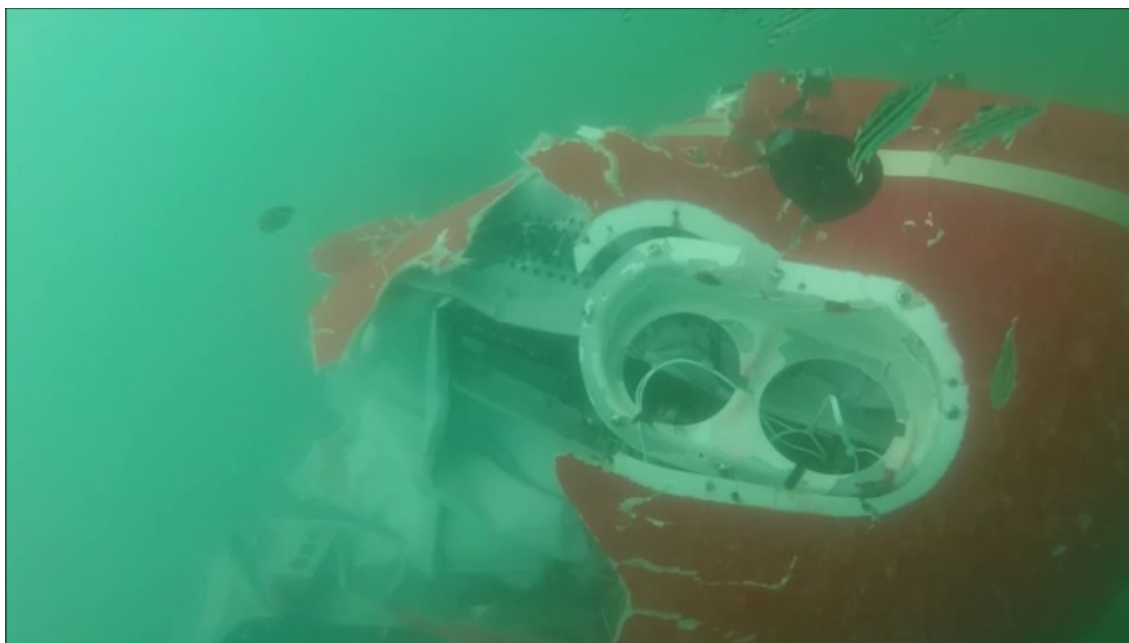
When the passenger regained consciousness, he was strapped into the helicopter on the ocean floor. He was able to release himself, reach the surface, and tread water in a heavy swell. Injuries to a leg and arm restricted swimming but the tide carried him to the beach where he was able to make contact with campers and notify the authorities. Campers had heard an impact and already reported it to police.

About 10 minutes after the radio call near Cape Tribulation, the pilot in the lead helicopter tried unsuccessfully to contact the pilot of YLY. He recalled that, at the time, there was light cloud, mist, showers, and strong winds. The lead pilot said he was concerned about YLY and wanted to turn back but was prevented by limited time, strong winds, and marginal visibility. So the pilot continued to Mossman.

A search was mounted but the missing pilot was not found.

Queensland Police with the assistance of specialist divers located the empty wreckage about 400 m seaward of Noah Beach. The wreckage was not recovered but divers examined the wreckage and recorded underwater video imagery, which was provided to the ATSB (Figure 2).

Figure 2: Underwater image of VH-YLY showing significant damage to the nose and belly panel of the helicopter particularly to the right forward section and loss of the cockpit upper portion



Source: Queensland Police

Extensive damage to the right side of the helicopter, including the pilot's seat belt fitting found torn from its mount, indicated a significant right-side impact with the water. The main rotor blades and transmission were present and similarly damaged. The tailboom was not identified in the footage and it likely became detached during the accident sequence. The damage to the helicopter and rotor system was consistent with powered flight into the water.

A maintenance release had been issued for YLY authorising VFR Day operation only. A check calibration of the aircraft pitot-static system and altimeter was due in October 2015 and had yet to be certified as complete. As such, the accuracy of the airspeed indicator, vertical speed indicator and altimeter was not assured. A review of the helicopter logbooks did not find any reference to installation of the container to the left skid.

Based on the reported loading of YLY, on departure from Cooktown for Mossman the helicopter was estimated to be at least 35 kg over the maximum gross weight limitation. Although there was no weight and balance data for the skid-mounted container, the longitudinal and lateral centre of gravity were estimated to be outside limits on departure or as fuel was consumed.

Although some of the flying that day included flight over water, the pilots and passengers did not wear life jackets. This was contrary to the regulatory requirement for the occupants of single-engine aircraft being operated beyond gliding/autorotation distance of land and while below 2,000 ft.

According to the applicable area forecast required for flight planning, in the area of operation east of the ranges and coast, there would be isolated showers with associated low cloud and reduced visibility. The wind was expected to be from the east to south-east at 15 to 20 kt. From 2300, isolated areas of low cloud were expected east of the ranges and coast. This was broadly consistent with the aerodrome forecasts for Cooktown and Cairns, except that the showers and low cloud were due at Cairns from 1700.

The closest official weather observation site to the accident location was at Low Isles, 15 NM (28 km) to the south. At the approximate time of the accident, the wind was from the south-east at 20 kt. No precipitation was recorded during the hour before and after the accident. The extent of cloud coverage was not measured at the site.

The recorded imagery from the Cairns weather radar showed a small area of light rain inland near Cape Tribulation and patches of light to moderate rain off the coast no closer than 15 NM (28 km).

For aviation purposes, night is defined as the period of darkness from last light (end of evening civil twilight) to first light (beginning of morning civil twilight). At last light, in ideal conditions, there will be enough light from the sun for large objects to be seen but no detail. As time passes, light from the sun further diminishes to reach a point where it is insufficient to allow a horizon to be seen at sea level. This point (end of evening nautical twilight) at Cape Tribulation was calculated to be 1919 but high terrain to the west would tend to make it effectively earlier.

The time of the accident was estimated to be 1930, which was about 10 minutes after end of evening nautical twilight.

Safety analysis

The pilots of the two helicopters conducted a series of flights to various fishing locations without incident. However, on the return trip from Pipon Island to Mossman late in the afternoon, the progress was slower than the pilots expected in part due to the prevailing weather conditions. The pilots diverted to Cooktown to refuel and landed about 10 minutes before last light.

As the pilots were only qualified to fly during daylight hours in VFR conditions, there was insufficient time for the pilots to conduct the flight to Mossman within the regulatory requirements and with an appropriate level of risk. Despite that, the pilots departed Cooktown just after last light for the nominally 45-minute flight to Mossman.

Influences on pilot decision-making are complex and the decisions by both pilots to depart Cooktown after last light are not analysed in depth. In simple terms, the pilots were motivated to reach the intended destination and either did not perceive the high level of risk, or had a high tolerance of that risk.

It is noted that both pilots had reportedly completed other flights in low visibility conditions, including landing on a beach when the conditions required. This may have provided a level of confidence in their ability to conduct the flights at night, which would be misplaced if it was based on their experience in daylight. In response to a draft of this report, the surviving pilot advised that he did not believe the flight was high-risk or that their 'plan B' was unrealistic.

As the flights progressed down the coast, the natural light was reducing. By 1919 (local end of nautical twilight), at low level over water and without moonlight or significant artificial lighting, the horizon would technically not be visible. Other factors adversely affecting visibility in the southward direction of flight were the high terrain to the west and potentially cloud and/or rain. In response to a draft of this report, the surviving pilot reiterated that he was able to see the horizon at all times and had sufficient light.

By the time YLY passed Cape Tribulation, the pilot was operating in dark night conditions with little to no terrestrial lighting. When the passenger expressed concerns to the pilot about variations in the helicopter's height relative to the water, there was no apparent consideration of landing. It is likely that the prospect of landing in an unfamiliar area in darkness and windy conditions was not a favourable option for a pilot operating with minimal visual references. At this point, YLY was over halfway to the destination and turning back to Cooktown in the prevailing conditions was unlikely to be viewed as a realistic option. The pilot may also have been influenced to continue by the progress made by the more experienced pilot ahead of him.

It is not clear how the pilot of YLY was maintaining control of the helicopter. Without an artificial horizon instrument and the training to use it, the pilot was reliant on external reference to a natural horizon or surface features. As the horizon became less distinct during the flight, the pilot presumably maintained visual reference to the coastline and surface of the water. When the pilot dimmed the instrument panel lights to reduce internal glare and reflections, this was apparently necessary to assist with external reference.

Although the method proposed by the pilot of the lead helicopter to maintain height at low level was to use the altimeter, it would have been difficult for the pilot of YLY to monitor the instruments (including the vertical speed indicator) with dimmed cockpit lighting as well as scanning the surrounding surface features. This would be made more difficult by the windy conditions and inherent instability of helicopters.

Shortly after passing Cape Tribulation, the helicopter collided with water in a right skid-low attitude. Given the passenger account that the helicopter was operating normally and the accident occurred without warning, the pilot was probably unaware of the proximity of the water and/or was in the process of losing control of the helicopter. In the dark night conditions, the pilot could have also encountered an area of cloud and/or rain that wasn't evident in the weather radar image.

The ATSB found that the pilot of YLY, who was only qualified to operate in day-VFR conditions, departed on a night flight and continued towards the destination in deteriorating visibility until inadvertently allowing the helicopter to descend into water.

It is concerning that some day-VFR helicopter pilots continue to operate illegally and unsafely by flying at night. Although pilots have done this with mixed outcomes, as the two pilots involved in this occurrence experienced, the risks of such operation are extremely high.

This was demonstrated on 24 April 2011, when an R44 registered VH-RUR, collided with the sea while on approach at a reduced airspeed to a helicopter landing site. The helicopter was being flown after last light by a pilot who was not approved, nor was the helicopter equipped to fly at night. The ATSB found that the flight was commenced with insufficient daylight to complete the planned flight under the day visual flight rules. Although the pilot survived, they had no visual reference with the sea surface immediately before the helicopter inadvertently descended into the water (ATSB Transport Safety Report AO-2011-051⁴).

In similar circumstances to this occurrence, on 25 August 2014, the pilots of two R22 helicopters were delayed and were operating in dark night conditions to reach the planned destination. One of the pilots inadvertently allowed the helicopter to descend into terrain and was fatally injured (ATSB Transport Safety Report AO-2014-144).

The ATSB *Avoidable Accidents* series report No. 7 refers to accidents and the risks associated with visual flight at night. One of that report's key messages was that some nights and some terrain are darker than others, and inadvertently flying into instrument meteorological conditions is also harder to avoid at night.

The helicopter manufacturer, Robinson Helicopter Company (RHC), included safety notices in the R22 Pilot's Operating Handbook that target specific risks relating to loss of visibility (RHC Safety Notice SN-18) and night flight in marginal weather conditions (RHC Safety Notice SN-26). Copies of the safety notices referenced in this section are available on the RHC website⁵.

To avoid the often fatal consequences of losing visual reference, day-VFR pilots need to plan to arrive at their destination at least 10 minutes before last light and to have a realistic 'plan B' to use when it becomes apparent that the intended flight cannot be completed in daylight. A further consideration for pilot decision-making about flying conditions is the degree to which passengers are exposed to risk.

In addition to the night flying risks, the ATSB identified the following other aspects of the operation that were not considered to be contributing safety factors but collectively increased risk:

- The unapproved skid-mounted container increased the aerodynamic drag of the helicopter, increased capacity for overloading, affected lateral balance, and had implications for skid down-load and vibration-related loading (RHC Safety Notice SN-13 discusses the risk of attaching items to the helicopter skids).
- The weight and balance of the helicopter during parts of the flight exceeded the limitations with associated adverse effects on handling, performance and component fatigue (RHC Safety Notice SN-37).
- For over-water operations, non-carriage of life jackets compromised survivability following an accident involving a collision with water (such as this occurrence) or a ditching.
- The pilots made operational decisions without taking aviation forecasts and reports or the availability of celestial or terrestrial lighting into account.
- Operation of YLY with overdue calibration checks of the pitot-static system and altimeter increased the risk of unreliable instrument indications that could be problematic in low visibility conditions.

⁴ Available on the ATSB website at www.atsb.gov.au

⁵ Robinson Helicopter Company Safety Alerts are available at www.robinsonheli.com

Findings

From the evidence available, the following finding is made with respect to the collision with water of a Robinson Helicopter Company R22 helicopter, registered VH-YLY that occurred near Cape Tribulation, Queensland, on 7 April 2016. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing factor

- The pilot of YLY, who was only qualified to operate in day-VFR conditions, departed on a night flight and continued towards the destination in deteriorating visibility until inadvertently allowing the helicopter to descend into water.

General details

Occurrence details

Date and time:	7 April 2016 1930 EST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain (water)	
Location:	6 km south of Cape Tribulation helicopter landing site, Queensland	
	Latitude: 16° 8.278' S	Longitude: 145° 27.346' E

Pilot (VH-YLY) details

Licence details:	Private Pilot (Helicopter) Licence, issued December 2014
Ratings:	Single engine helicopters; R22 and R44 type ratings
Medical certificate:	Class 2, expires August 2016
Aeronautical experience:	About 250 hours
Last flight review:	April 2015

Aircraft (VH-YLY) details

Manufacturer and model:	Robinson Helicopter Company	
Year of manufacture:	2010	
Registration:	VH-YLY	
Serial number:	4491	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 1
Injuries:	Crew – 1 fatal	Passengers – 1 minor
Damage:	Destroyed	

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- surviving occupants of the two helicopters
- Cairns Forensic Crash Unit, Queensland Police
- the Bureau of Meteorology
- the Civil Aviation Safety Authority (CASA)
- Airservices Australia
- Geoscience Australia

References

ATSB (2013), *Avoidable Accidents No. 7. Visual flight at night accidents: What you can't see can still hurt you*, ATSB, Canberra, Australia.

Robinson Helicopter Company (Rev. 1994), Safety Notice SN-13 *Do not attach items to the skids*.

Robinson Helicopter Company (Rev. 1994), Safety Notice SN-18 *Loss of visibility can be fatal*.

Robinson Helicopter Company (Rev. 1994), Safety Notice SN-26 *Night flight plus bad weather can be deadly*.

Robinson Helicopter Company (2001), Safety Notice SN-37 *Exceeding approved limitations can be fatal*.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the Australian Transport Safety Bureau (ATSB) may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act 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 other R22 pilot and CASA.

Submissions were received from the other R22 pilot and CASA. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

The ATSB is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: 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 that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

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

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine 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.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report Aviation Occurrence Investigation

Collision with water in dark-night conditions involving
Robinson R22 helicopter, VH-YLY, 6 km south of Cape
Tribulation, Queensland, 7 April 2016

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Final – 18 December 2017