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Australian Transport Safety Bureau

Collision with terrain involving a Robinson R44, VH-YMD

near Alice Springs, Northern Territory, 09 January 2015

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Aviation Occurrence Investigation
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Addendum

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Collision with terrain involving Robinson R44, VH-YMD

What happened

During the morning of 9 January 2015, the pilot of VH-YMD was operating in support of the Northern Territory Police. As part of the operation, the pilot conveyed two passengers to a site on the Todd River, just north of Alice Springs. The pilot landed on the sandy surface of the river bed where the passengers disembarked, then flew the helicopter from that location to a local landmark known as the Telegraph Station, about 3 km away. The pilot then conveyed another two passengers from the Telegraph Station to the site, and again landed on the sandy surface of the river bed, facing in a westerly direction (Figure 1).

Figure 1: VH-YMD landing site on the river bed

Source: Northern Territory Police

Soon after, the pilot was asked to convey three passengers back to the Telegraph Station, as a continuing part of the police operation. When all three passengers had boarded the helicopter, the pilot lifted off from the river bed. Lift-off was normal, and the pilot commenced departure in a southerly direction over the river (Figure 2) to follow what he assessed to be the most clear and suitable departure route from the river bed. As the helicopter climbed away from the river bed, the pilot became aware that the main rotor RPM was decaying. In response, he overrode the governor and applied full throttle.

The pilot needed to maintain height to clear the rocks and shrubs on the southern side of the river, but was acutely aware that rotor RPM would be further compromised by the application of more collective.[1] The pilot carefully managed the collective and the helicopter cleared the rocks and shrubs, but with decaying rotor RPM, he realised that continued climb was not possible. The pilot steered the helicopter toward a flat area, just above the river bed on the southern side of the river, and conducted a run-on landing[2] (Figure 3).

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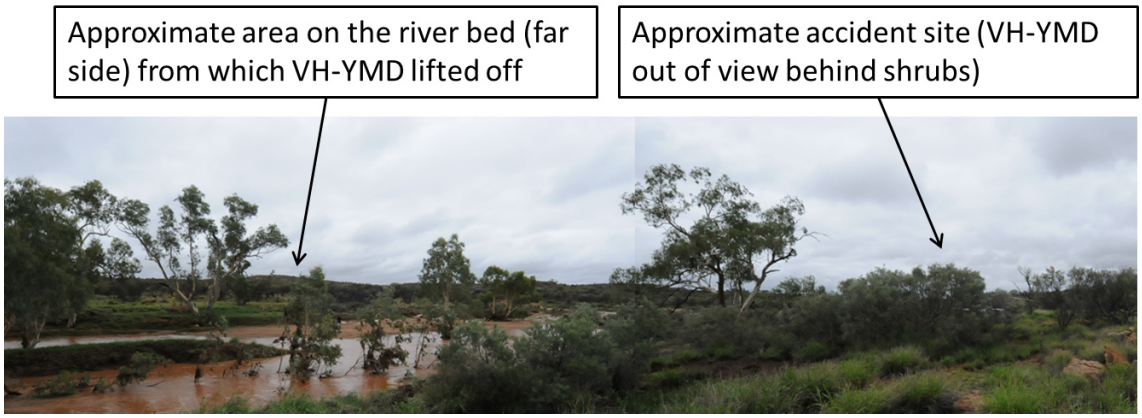
1 The collective is a primary helicopter flight control that simultaneously affects the pitch of all blades of the lifting rotor. Increasing collective increases blade pitch, which increases the lift force generated by the blades. Increasing the collective also increases drag on the rotor blades, which can only be overcome by increasing power.

2 A run-on landing is a landing where the helicopter lands with forward speed.

Figure 2: Photograph taken from left side of VH-YMD as it crossed the river

Source: Northern Territory Police

Figure 3: Take-off and landing area

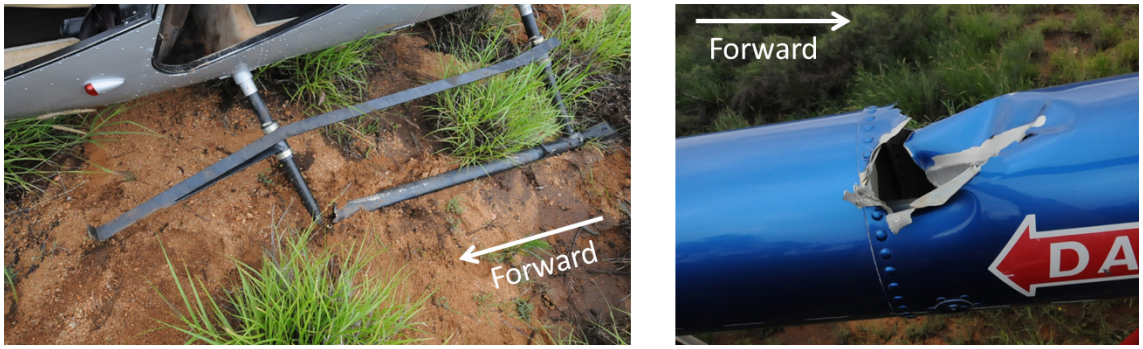


Source: Northern Territory Police (two photographs joined and edited by the ATSB)

During the run-on landing, the left skid sank into mud and struck a rock. The left skid was substantially damaged by the impact (Figure 4) and the helicopter tipped precariously. As the helicopter came to a stop, it was on a substantial lean. The pilot reported that he considered the situation to be unsafe, so he immediately lifted off again and repositioned the helicopter on the ground with a level attitude. During the second lift off, a passenger recalled that the main rotor of the helicopter struck the limb of a tree, and that this was when damage to the tail boom occurred[3] (Figure 4). The pilot then shut down the engine and the passengers evacuated the helicopter.

[3] Damage to the tail boom is consistent with damage that could be expected if the main rotor struck the tail boom.

Figure 4: Damage to VH-YMD skid (left) and tail boom (right)



Source: Northern Territory Police (edited by the ATSB)

Weather conditions

At the time of the accident, weather conditions were overcast, with showers in the area and a temperature of about 25 °C. The wind at Alice Springs Airport (about 18 km to the south) was from the north-west at about 15 kt, and the QNH[4] was about 1003 hectopascals. While the pilot was aware that the wind was generally a north-westerly, he assessed the wind at the site as relatively light and variable. The relative humidity at Alice Springs Airport was around 80%, and the pilot reported humid conditions at the accident site.

Pilot comment

The pilot commented that he believed that the accident resulted from a combination of a relatively heavy take-off weight, the prevailing conditions, and limited departure options because of surrounding terrain and obstacles. The pilot indicated that, with the benefit of hindsight, he should have taken two trips to move the three passengers, rather than attempt to take off with three passengers on board. He believed that he would have been able to complete the departure safely at a lower take-off weight.

Power required and power available

A number of factors related to the power required and the power available warrant consideration in understanding the probable reasons for which the pilot experienced decaying main rotor RPM during departure from the river bed, as the helicopter moved out of ground effect[5] and transitioned into forward flight. These factors include density altitude, take-off weight and the wind component.

- ***Density altitude***. Increasing density altitude adversely affects helicopter performance through the combined effects of reducing the power available and increasing the power required. Considering elevation and temperature, and barometric pressure in the area, the density altitude at the accident site would have been around 4,000 ft. High relative humidity would have had the effect of further increasing the density altitude.
- ***Take-off weight***. Increasing the take-off weight increases the power required. The greater lifting force demanded of the main rotor, and the requirement to counter the associated increased torque effect[6] with the tail rotor, both contribute to an increased power requirement. The pilot estimated the weight of the helicopter at the time of the accident to be less than the maximum permitted take-off weight, however subsequent calculations by the operator using actual data, indicated that the take-off weight was marginally above the maximum permitted take-off weight.

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4 QNH is the altimeter barometric pressure subscale setting used to provide an altimeter indication of height above mean sea level in that area.

5 Ground effect refers to the apparent improvement in helicopter performance near the ground which results from a modification of the airflow through the main rotor due to the interaction of that flow with the ground beneath.

6 In this context, torque effect is the reaction of the helicopter to the torque applied by the main rotor. This effect is countered by the tail rotor.

- ***Wind component***. Taking off with a tailwind component increases the power required because of the diminished or delayed influence of translational lift.[7] Additionally, a tailwind or crosswind component may require greater tail rotor force to maintain directional control during departure, which places an increased power demand on the engine. Although the pilot commented that the wind seemed light and variable prior to departure, the helicopter may have encountered a tailwind component as it climbed away from the river bed during the accident flight.

The following references discuss factors affecting helicopter performance, and provide some guidance to pilots regarding the associated considerations:

- A 'Good Aviation Practice' booklet titled *Helicopter Performance,* produced by the Civil Aviation Authority (CAA) of New Zealand. The booklet is available via the CAA website: www.caa.govt.nz/safety_info/good_aviation_practice.htm
- The Federal Aviation Administration (FAA) *Helicopter Flying Handbook* (chapter 7 deals with helicopter performance). The handbook is available on the FAA website: www.faa.gov/regulations_policies/handbooks_manuals/aviation/helicopter_flying_handbook/

Safety message

The Robinson R44 Pilot's Operating Handbook includes a number of important safety tips and notices. Pilots (particularly those who fly Robinson helicopters) are encouraged to carefully reflect on these safety tips and notices – the tips are suggestions intended to improve safety, while the notices have been issued as a result of various accidents and incidents. The safety tips and notices are available in the R44 Pilot's Operating Handbook on the Robinson Helicopter Company website (www.robinsonhelicopter.com) under the Publications tab. Two Safety Notices with relevance to this accident are Safety Notice 10 (*Fatal accidents caused by low RPM rotor stall)* and Safety Notice 24 (*Low RPM rotor stall can be fatal*). One safety tip with particular relevance to this accident is:

> Never allow rotor RPM to become dangerously low. Most hard landings will be survivable as long as the rotor is not allowed to stall.

Three other ATSB investigation reports that identified helicopter performance and low main rotor RPM as possible factors include AO-2013-203, 200600979 and 199900833. These investigation reports are available on the ATSB website:

- www.atsb.gov.au/publications/investigation_reports/2013/aair/ao-2013-203.aspx
- www.atsb.gov.au/publications/investigation_reports/2006/aair/aair200600979.aspx
- www.atsb.gov.au/publications/investigation_reports/1999/aair/aair199900833.aspx

This accident provides a reminder of the effect on helicopter performance of density altitude, weight, and possibly wind. Pilots are encouraged to carefully and accurately assess these factors before committing to any departure. Careful assessment of these factors is essential to ensure that an adequate performance margin is maintained, particularly under high density altitude conditions, when the helicopter is near its maximum take-off weight, or where the direction of departure is downwind. When performance is likely to be adversely affected by a combination of these factors, extreme caution is warranted.

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[7] Translational lift is the additional lift resulting from induced airflow through the main rotor as a result of forward airspeed (oncoming flow of air through the main rotor).

General details

Occurrence details

Date and time:	09 January 2015 – 1120 CST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	8 km north of Alice Springs, Northern Territory	
	Latitude: 23° 38.8' S	Longitude: 133° 53.5' E

Aircraft details

Manufacturer and model:	Robinson Helicopter Co R44	
Registration:	VH-YMD	
Serial number:	1887	
Type of operation:	Aerial work	
Persons on board:	Crew – 1	Passengers – 3
Injuries:	Crew – Nil	Passengers – 1 (minor)
Damage:	Substantial	

About the ATSB

The Australian Transport Safety Bureau (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; and 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 fare-paying passenger operations.

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.

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

About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.