Australian Government
Australian Transport Safety Bureau

Collision with terrain involving Robinson R44, VH-MNU

Moreton Island, Queensland, 17 May 2017

ATSB Transport Safety Report
Aviation Occurrence Investigation
AO-2017-054
Final – 5 September 2017

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

Publishing information

Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office: 62 Northbourne Avenue Canberra, Australian Capital Territory 2601
Telephone: 1800 020 616, from overseas +61 2 6257 4150 (24 hours)
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117, from overseas +61 2 6247 3117
Email: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

Addendum

Page	Change	Date

Collision with terrain involving Robinson R44, VH-MNU

What happened

On 17 May 2017, the pilot of a Robinson Helicopter R44 II, registered VH-MNU, was conducting aerial work at Moreton Island, Queensland with one passenger on board.

The pilot completed one flight without incident and, after refuelling, departed for a second local flight at about 1005 Eastern Standard Time (EST). At the start of the flight, the wind was from the east-north-east at about 5–6 kt, but increased to about 10 kt.

At about 1130, the helicopter was approximately 50 ft above ground level and tracking in a north-westerly direction at an airspeed of about 10 kt (and groundspeed of about 20 kt), when the pilot commenced a right turn.

The pilot felt a loss of tail rotor effectiveness (LTE) as the helicopter continued to yaw to the right and reported that they were unable to arrest the yaw with left pedal input. The pilot applied forward cyclic to try to increase the helicopter's forward speed, and some right cyclic to try to follow the turn. The pilot hoped the tail rotor effectiveness would return as the helicopter turned back into wind, but as it rotated through about 110 degrees, the rate of yaw started to increase. The pilot then raised the collective in an attempt to increase the helicopter's height above trees, which further increased the yaw rate due to the increase in torque.

The helicopter completed about two full rotations and reached about 80 ft above the ground, when the low rotor RPM warning horn sounded. The pilot immediately lowered the collective and the helicopter descended. The pilot stated that they were going down, and the passenger braced for the impact.

As the helicopter neared treetop height, the pilot deployed the emergency floats. As the floats contacted the trees, the pilot raised the collective to cushion the impact. The pilot and passenger sustained minor injuries and the helicopter was substantially damaged (Figure 1).

Figure 1: Accident site showing damage to VH-MNU

Source: Pilot

Use of emergency floats

The pilot commented that the company pilots had previously discussed the use of the floats in case of having to conduct a forced landing over a treed area. The pilot assessed that the floats would increase the surface area, therefore slowing the helicopter's descent.

Helmet

The pilot was wearing a helmet at the time of the accident. Although the helmet's visor caused the pilot's nose to bleed, the helmet sustained impact and scratch damage that probably prevented the pilot sustaining more serious injuries.

Performance

The helicopter departed for the flight about 36 kg below the maximum take-off weight and had been operating for about 30 minutes using about 30 L of fuel at the time of the accident, and was therefore more than 60 kg below the maximum take-off weight at the time of the accident.

Operator report

The helicopter operator conducted an investigation into the accident and provided the ATSB with a copy of their investigation report. The operator's findings included the following.

- The pilot wrote down their risk considerations prior to the flight and included LTE, but did not include the recovery technique. When the helicopter encountered the initial weathervane LTE, the correct recovery procedure of full left pedal, forward cyclic was not observed.
- Although the pilot had the required training for low-level operations, they had not received specific training for the task.
- The pilot's scan during low-level operation may have been affected by focusing on the map, depicting drop locations.

Loss of tail rotor effectiveness

The United States Federal Aviation Administration (FAA) Helicopter flying handbook

The FAA Helicopter flying handbook chapter 11: Helicopter emergencies and hazards stated that loss of tail rotor effectiveness (LTE) is an uncommanded rapid yaw towards the advancing blade and is an aerodynamic condition caused by a control margin deficiency in the tail rotor. Tail rotor thrust is affected by numerous factors, including relative wind, forward airspeed, power setting and main rotor blade airflow interfering with airflow entering the tail rotor. Several wind directions relative to the nose of the helicopter are conducive to LTE, including the following:

- 120–240º, in which the helicopter attempts to weathervane its nose into the relative wind. The Handbook states 'If the pilot allows a right yaw rate to develop and the tail of the helicopter moves into this region, the yaw rate can accelerate rapidly.
- 285–315°, which can lead to turbulent airflow from the main rotor disc interfering with the tail rotor.
- 210–330°, which can lead to the development of unsteady airflow through the tail rotor.

The FAA handbook warns that a combination of factors in a particular situation can lead to more anti-torque required from the tail rotor than it can generate. In addition, low speed flight activities are a high risk activity for LTE. The FAA handbook advises pilots (among other things) to avoid tailwinds below an airspeed of 30 kt. In addition, it provides the following recovery technique for a sudden unanticipated yaw:

- apply full left pedal while simultaneously moving cyclic control forward to increase speed
- if altitude permits, reduce power
- as recovery is effected, adjust controls for normal forward flight.

Robinson Helicopter Company safety notice SN-42: Unanticipated yaw

The Robinson Helicopter Company advised that to avoid unanticipated yaw, pilots should be aware of conditions that may require large or rapid pedal inputs. They recommend practising slow, steady-rate hovering pedal turns to maintain proficiency in controlling yaw.

Low rotor RPM recovery

The Robinson Helicopter Company R44 II Pilot's operating handbook stated 'To restore RPM, immediately roll throttle on, lower collective and, in forward flight, apply aft cyclic.'

Findings

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

- The combination of low airspeed and turning right with a tailwind contributed to a loss of tail rotor effectiveness. The pilot's response was ineffective at recovering control of the helicopter, particularly given the operation at low height above the trees.

Safety action

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.

Helicopter operator

As a result of this occurrence, the helicopter operator has advised the ATSB that they are taking the following safety actions:

- Company pilots are to be briefed and trained on task specific operations.
- A presentation on LTE has been given to all company helicopter pilots.
- The operations manual has been amended to highlight and add more detail to specific task training and pilot limitations.
- Training items have been updated to incorporate scenario/task training flights.
- Company pilots were required to re-read the operations manual, with a focus on the planning section (Part D).
- Company pilots will complete cockpit resource management (CRM) training.

Safety message

LTE

The FAA handbook states: 'In order to avoid the onset of LTE in this downwind condition, it is imperative to maintain positive control of the yaw rate and devote full attention to flying the helicopter'.

Effectiveness of helmets in helicopter operations

The United States Army referenced two United States Army Aeromedical Research Laboratory studies of helmet effectiveness in USAARL report 93-2. The first study from the period 1957–1960 found that fatal head injuries were 2.4 times more common among unhelmeted occupants of potentially survivable helicopter accidents than among occupants wearing the army's APH-5 helmet. The second study from the period 1972–1988 found that the risk of fatal head injury was

6.3 times greater in unhelmeted occupants of potentially survivable helicopter accidents than among occupants wearing the army's SPH-4[1] helmet.

In a separate study (report 98-18) the Army Aeromedical Research Laboratory reviewed 459 accidents in the period 1990–1996 where helmet visor use was verified. They found that visor use was attributed to preventing facial injury in 102 accidents (22.2 per cent) and reducing injury in 13 accidents (2.8 per cent).

This accident highlights the effectiveness of wearing a helmet to prevent a more serious injury. ATSB report AO-2014-058 provides an account of a serious head injury to an R22 pilot who was not wearing a helmet. In a later ATSB report, AO-2015-134, the operator commented that the pilot of an R22 accident would have suffered more serious head injuries if they were not wearing a helmet.

General details

Occurrence details

Date and time:	17 May 2017 – 1130 EST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	near Bulwer/Moreton Island (HLS), Queensland	
	Latitude: 27° 04.00' S	Longitude: 153° 22.00' E

Helicopter details

Manufacturer and model:	Robinson Helicopter Company R44 II	
Registration:	VH-MNU	
Serial number:	11964	
Type of operation:	Aerial work	
Persons on board:	Crew – 1	Passengers – 1
Injuries:	Crew – 1 Minor	Passengers – 1 Minor
Aircraft damage:	Substantial	

[1] SPH-4 was the newer model helmet in use at the time period of the second study.

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 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.

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.