Australian Government

Australian Transport Safety Bureau

Loss of control involving Robinson R22, VH-HGI

Adelaide River Station, 19 January 2013

ATSB Transport Safety Report
Aviation Occurrence Investigation
AO-2013-021
Final – 17 May 2013

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

Loss of control involving Robinson R22, VH-HGI

What happened

VH-HGI

Source: Aircraft Owner

On 19 January 2013, at about 1200 Central Standard Time[1] a Robinson R22 Beta II helicopter, registered VH-HGI (HGI), departed from a station homestead, located 10 km to the east of Manton Dam, Northern Territory. On board the helicopter were a pilot and a passenger.

At about 1220, HGI was returning to the homestead and approaching the landing area located nearby (Figure 1). As the helicopter approached the landing area and, prior to terminating in the hover[2], the pilot turned the helicopter to face a northerly direction.

The pilot reported that he had difficulty maintaining control of the helicopter in the hover and he elected to conduct a go-around. As the pilot had previously turned the helicopter to face the north, his departure path was not the usual one he used and required a steeper profile to clear trees located near the landing area.

At about 40 ft above ground level, and at an airspeed of between 25 to 30 knots, the helicopter suddenly yawed to the right and completed 3 to 4 revolutions before impacting trees. The helicopter came to rest inverted and was seriously damaged. The pilot was able to exit with minor injuries and assisted the passenger, who was seriously injured, to exit the helicopter.

Pilot information and comments

The pilot held a Private Helicopter Licence and had about 186.5 hours total time, all of which was in Robinson R22 Helicopters.

The pilot commented that he had returned earlier than planned, as he did not want to get caught in wind or rain. Also, during the final stages of the approach the 'helicopter moved excessively and did not feel right'.

The pilot reported that if he was unsure of the wind, he would overfly the airstrip and confirm the direction of the wind via the windsock, as the windsock was not visible on approach to the homestead. The pilot commented that during the wet season the wind was always from the north-west and he did not overfly the airstrip windsock on the day of the accident.

Weather

Local observations were obtained from Batchelor Aerodrome. Batchelor Aerodrome was located approximately 17 NM to the south-west of the accident site.

The following conditions were observed:

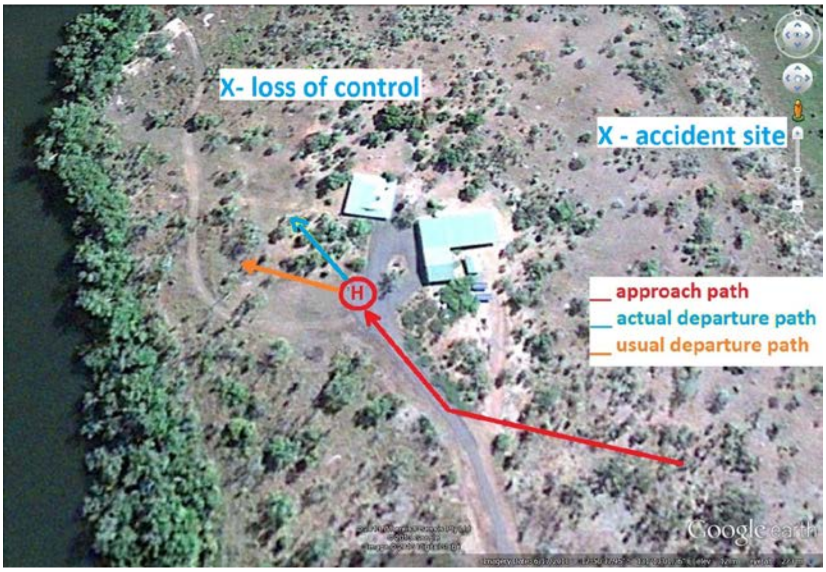
- At 1200 - The wind was 280° at 7 kt
- At 1230 – The wind was 280° at 5 kt
- At 1300– The wind was 280° at 3 kt

[1] Central Standard Time (CST) was Coordinated Universal Time (UTC) + 10 hours.

[2] Most takeoff and landings are carried out in a helicopter via the hover as the aircraft is in equilibrium, with the heading, position and height over the surface constant.

The Berrimah weather radar return at the time depicted a number of light to moderate showers in the area at the time of the accident.

Figure 1: Approach and departure paths



Source: Google Earth

Tail rotor anti-torque system

On United States designed single rotor helicopters such as the Robinson R22, the main rotor rotates counter clockwise as viewed from above. The torque to drive the main rotor causes the fuselage of the helicopter to rotate in the opposite direction (nose right). The anti-torque system (tail rotor) provides thrust, which counteracts this torque and provides directional control while hovering.

Loss of tail rotor effectiveness

Loss of tail rotor effectiveness (LTE) attributed solely to aerodynamic phenomena may occur in varying degrees in all single main rotor helicopters at airspeeds less than 30 kts. It affects the tail rotor's ability to provide directional control about the vertical axis.

LTE is not necessarily the result of a deficiency in the control margins established during certification. These have been determined to adequately provide for the approved sideward and rearward flight velocities plus counteraction of gusts of a reasonable magnitude. The testing however is predicated on the assumption that the pilot is knowledgeable of the critical wind azimuths for the type of helicopter operated and maintains control of the helicopter by not allowing excessive yaw rates to develop.

The results of flight and wind tunnel testing identified three critical relative wind azimuths that either singularly, or in combination, can increase the risk of LTE by allowing the development of accelerating right yaw rates:

- wind from the left front of the helicopter at between 285° to 315° relative to the nose of the helicopter (Figure 2).
- left crosswind between 210° and 330° relative to the nose of the helicopter (Figure 3).
- tailwind from 120° to 240° relative to the nose of the helicopter (Figure 4)

It was also established that exposure to those relative winds did not result in aerodynamic stall of the tail rotor.

Figure 2: Main rotor disc vortex interference

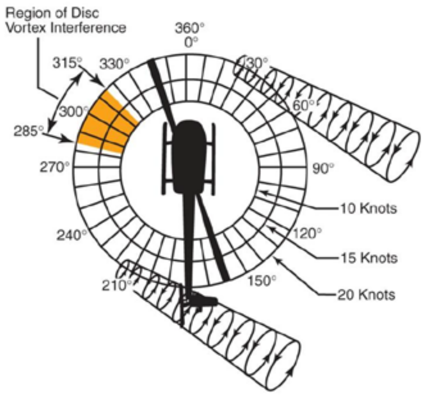
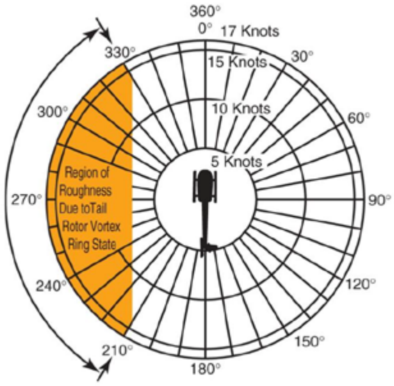
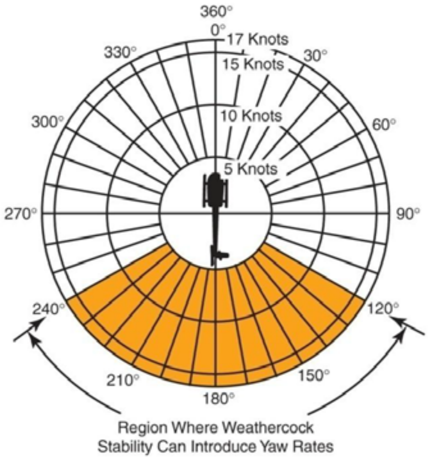


Figure 3: Tail rotor vortex ring state



Source: FAA AC 90-95

Figure 4: Weathercock stability



Source: FAA AC 90-95

ATSB comment

Any manoeuvre which requires the pilot to operate in a high-power, low-airspeed environment with a left crosswind or tailwind creates an environment where unanticipated right yaw may occur. During the go around, the pilot may have inadvertently placed the wind relative to the helicopter in the critical azimuth area, between 288° and 315°, where main rotor vortices may interact with the tail rotor, increasing the likelihood of LTE.

Safety message

In helicopters, wind will cause anti-torque system thrust variations to occur. Certain relative wind directions are more likely to cause tail rotor thrust variations than others. Knowing which direction the wind is coming from is critical – especially in light wind conditions. By maintaining an awareness of wind and its effect upon the helicopter, a pilot can significantly reduce the exposure to LTE.

Federal Aviation Administration (FAA) Advisory Circular AC 90-95 advises of conditions that may result in unanticipated right yaw on counter-clockwise single main rotor helicopters and the recommended recovery actions.

FAA AC 90-95 is available here:
rgl.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/aba9e26c4d43dfab86256
9e7007463bf/$FILE/ac90-95.pdf

The following reports provide further information of accidents involving LTE.

- ATSB Investigation – AO-2008-043
  www.atsb.gov.au/publications/investigation_reports/2008/aair/ao-2008-043.aspx
- NTSB Investigation - FTW03LA203
  dms.ntsb.gov/aviation/AccidentReports/fifkgt555wwis545b2ywfr551/X02212013120000.pdf
- AAIB Investigation - Robinson R44, G-SYTN
  www.aaib.gov.uk/cms_resources.cfm?file=/G-SYTN_11-05.pdf

General details

Manufacturer and model:	Robinson R22	
Registration:	VH-HGI	
Type of operation:	Private	
Primary occurrence type:	Loss of control	
Occurrence category:	Accident	
Location:	Adelaide River Station, Northern Territory	
	Latitude: S 12° 50.63	Longitude: E 131° 13.01
Persons on board:	Crew – 1	Passengers - 1
Injuries:	Crew – 1 (minor)	Passengers – 1 (serious)
Damage:	Substantial	

About the ATSB

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The Bureau 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.