Australian Government
Australian Transport Safety Bureau

Collision with terrain involving a Bell 412, VH-EMZ

12 km WSW Horn Island Airport, Queensland, 13 June 2013

ATSB Transport Safety Report
Aviation Occurrence Investigation
AO-2013-099
Final – 17 September 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

Addendum

Page	Change	Date

Collision with terrain involving a Bell 412, VH-EMZ

What happened

On 13 June 2013, at about 1924 Eastern Standard Time,[1] a Bell 412 helicopter, registered VH-EMZ (EMZ), departed Horn Island, Queensland on a training flight to Prince of Wales Island, Torres Strait. On board the helicopter was the pilot flying (PF) who was under instruction, a training pilot, and a crewman. The purpose of the flight was to conduct several practice approaches using the 'Nightsun'[2], which was used to illuminate the ground below the helicopter. Each approach was to be conducted to about treetop height, from where a go-around was to be commenced.

VH-EMZ

Source: Helicopter operator

Earlier in the day, during daylight, the crew conducted a flight to the same location. There the training pilot demonstrated the planned Nightsun approach to the pilot under instruction (PUI). They also positioned a strobe light so the target location would be visible on the night flight.

It was a dark night with a small crescent moon and no discernible horizon. At about 1940, EMZ was flown over the strobe light at 2,000 ft and outbound for about 3.2 NM then turned inbound to conduct a practice approach. The crew commenced a 500 ft/min descent from 3 NM, at about 60 kt indicated air speed (IAS), to achieve a ground speed of 45 kt. The approach was reported as stable.

At 1,000 ft above ground level (AGL), the crewman opened and secured the cabin door. Due to the wind rush he did not look outside continuously until reaching about 400 ft AGL.

At 400 ft AGL, and about 0.6 NM from the targeted landing area, the training pilot noted that the IAS was 60 kt with a 500 ft/min rate of descent and the GPS showed a ground speed of 45 kt. The PF looked outside to confirm that the profile and sight picture were correct for a visual approach and adjusted the Nightsun beam onto the landing site. This required the PF to remove his hand from the collective control. He could see the strobe light, which was the target for the approach. The training pilot asked the PF if the sight picture looked correct and if he was okay to continue a visual approach, to which the PF responded that he was.

The training pilot looked out of the cockpit and confirmed that the profile and sight picture were correct to continue a visual approach. When the training pilot looked back inside the cockpit he observed a high rate of descent of about 800 ft/min and he called 'rate of descent'. The training pilot also observed that the IAS was below 35 kt and called 'go around'. The training pilot reported that there was no immediate response so he repeated the call to 'go around'.

The PF reported commencing a go-around and responded 'going around'. The training pilot reported that he felt the collective move. The crewman observed that the helicopter was descending rapidly and approaching the trees and called 'climb, climb, climb'. The descent continued and he again called 'we are going backwards, trees, climb, climb, climb'.

---

1 Eastern Standard Time (EST) was Coordinated Universal Time (UTC) +10 hours.

2 The Nightsun is a 30 million candlepower search light used for visual searches at night or night approaches to non-illuminated areas. It is attached under the nose of the helicopter, and is remotely controlled from within the helicopter by a four way switch fitted to the pilot's cyclic control.

The training pilot reported that he took the controls to assist with the go-around and then became aware of the trees in his peripheral vision. The training pilot called 'brace, brace, brace' as the helicopter descended into the trees. The helicopter impacted the ground heavily and remained upright. The crew shut down the helicopter. To assist the rescuers in locating the helicopter, the crew discharged flares from the accident site. The crew were uninjured and the helicopter was substantially damaged.

Figure 1: Helicopter at accident site

Source: Helicopter operator

Pilot comments

The PF made the following comments:

- He had conducted Nightsun approaches in the past with a different operator.
- The pre-flight briefing was very comprehensive.
- Everything during the flight was normal until the training pilot called 'rate of descent' and then everything happened very quickly.
- On the ground when the flares were used, the smoke from the flares went up to about 200 ft AGL and then could be seen going toward the direction of the landing area. He believed that a tail wind had existed at this height and may have contributed to the accident.
- Night vision goggles may have assisted in conducting the approach.

The training pilot made the following comments:

- He believed that the PF lost situational awareness and as the training pilot, he did not take over control of the helicopter quickly enough.
- A Nightsun approach was demanding and required a high degree of precise flying. It was a two-crew procedure where the non-flying pilot would read the distance and altitude off the instruments every 500 ft and provide information to the flying pilot to maintain direction, a 500 ft/min rate of descent, and a 45 kt ground speed. The flying pilot would make the necessary adjustments to maintain a stabilised approach. A visual approach to the landing area would be commenced at about 500-400 ft AGL, with the non-flying pilot monitoring the instruments.

- The approach had been stable and it had deteriorated very quickly. He believed it was about 5 seconds from when the time he resumed his cockpit scan to being at tree height.
- The helicopter was maintaining about 60 kt IAS and a 45 kt ground speed up until 400 ft AGL and he believed that if a tailwind developed after this point it would not have been more than 5 kt.
- Night vision goggles may have assisted in conducting the approach.

The crewman's role was to provide instructions to guide the pilot to the landing area once the PF lost sight of the strobe beneath the helicopter. His role in providing guidance to the PF normally commenced closer to the landing area and below about 200 ft AGL.

The crewman reported that when he looked out at about 400 ft AGL, the picture did not appear correct. The trees and the ground appeared to be moving forward and to the left, indicating that the helicopter was moving back and to the right. When the go-around was commenced he reported that the backward movement of the helicopter was mostly arrested, but the sideways movement was not.

Operator investigation

The helicopter operator conducted an investigation and determined that:

- The pre-flight briefing was conducted using an uncontrolled and unapproved Standard Operating Procedure.
- The radio altimeter warning alert was not set.
- A combination of task fixation induced loss of situational awareness, a visual illusion effect and spatial disorientation occurred after the helicopter descended through 400 ft which resulted in a high rate of descent and decreasing indicated airspeed.
- The absence of visual aids such as night vision goggles (NVGs) reduced the pilot's ability to avoid the visual illusion effect and spatial disorientation.
- The high rate of descent and decreasing airspeed is hypothesised to have resulted in the onset of an incipient vortex ring state (VRS) in the final stages of flight.
- Due to task fixation induced loss of situational awareness, the pilot flying did not respond to the first go-around call.
- Due to degraded situational awareness, the training pilot did not assume control of the aircraft with sufficient time and height to effectively recover the aircraft from the incipient VRS it had entered.

Vortex ring state

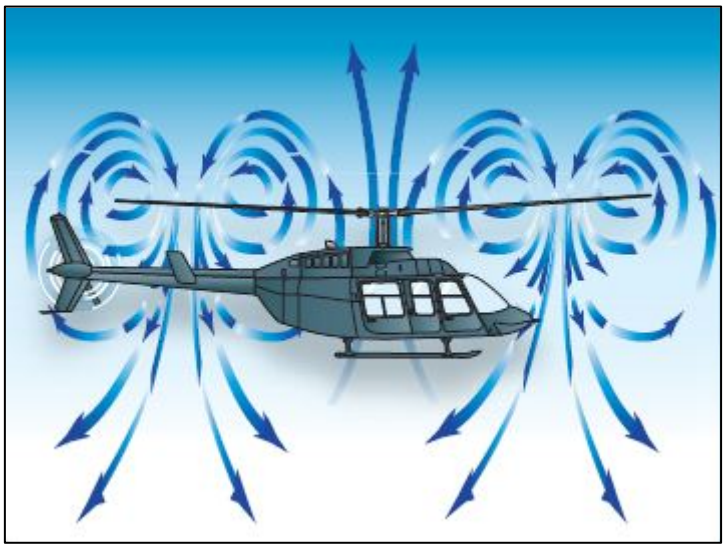
The FAA handbook www.faa.gov/regulations_policies/handbooks_manuals/ describes the vortex ring state or settling with power, as an aerodynamic condition in which a helicopter may be in a vertical descent with 20% to maximum power applied and little or no climb performance.

The following combination of conditions is likely to cause settling in a vortex ring state in any helicopter:

1. A vertical or nearly vertical descent of at least 300 fpm. The actual critical rate depends on the gross weight, rpm, density altitude, and other pertinent factors.
2. The rotor system must be using some of the available engine power, between 20 and100 per cent).
3. The horizontal velocity must be slower than effective translational lift.

A fully developed vortex ring state is characterized by an unstable condition in which the helicopter has uncommanded pitch and roll oscillations, little or no collective authority, and a descent rate that may approach 6,000 feet per minute (fpm), if allowed to develop (Figure 2).

Figure 2: Vortex ring state



Source: Helicopter operator

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:

- A Flight Safety Instruction (FSI) is under management review to prohibit unaided (non-night vision goggles) remote landings at night.

Safety message

In the ATSB investigation AO-2007-028, the pilot of the helicopter lost situational awareness during a night approach and allowed the forward speed of the helicopter to decrease to zero. The helicopter developed a high rate of descent and, during an attempt to arrest the rate of descent the helicopter was subjected to an over-torque condition. The investigation report is available at

www.atsb.gov.au/publications/investigation_reports/2007/aair/ao-2007-028.aspx

A selection of articles regarding night operations is collated in the Night Operations edition of the Canadian Directorate of Flight Safety On Target magazine and is available at:

publications.gc.ca/collections/collection_2010/forces/D12-14-2010-eng.pdf

Research conducted into situational awareness is available at:

pdars.arc.nasa.gov/publications/20051025102856_Newman_AvPsyc03.pdf

General details

Occurrence details

Date and time:	13 June 2013 – 1938 EST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	12 km WSW Horn Island Airport, Queensland	
	Latitude: 10° 37.55' S	Longitude: 142° 11.08'E

Aircraft details

Manufacturer and model:	Bell Helicopter Company 412	
Registration:	VH-EMZ	
Type of operation:	Flying training	
Persons on board:	Crew – 3	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
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 helicopter 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.