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Australian Transport Safety Bureau

Collision with terrain – Guimbal Cabri G2, VH-ZZT

Camden Airport, New South Wales – 13 April 2012

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Collision with terrain – Guimbal Cabri G2, VH-ZZT

AO-2012-055

What happened

On 13 April 2012, at about 1440 Eastern Standard Time¹, a Guimbal Helicopters Cabri G2 (Cabri G2) helicopter, registered VH-ZZT (ZZT), collided with terrain at Camden Airport, New South Wales. On board the helicopter was an instructor and a student.

The Guimbal Cabri G2 is a two-seat helicopter manufactured in France. It features a 7-bladed fenestron² in place of a conventional tail rotor and a 3-bladed main rotor which rotates clockwise when viewed from above. The torque produced by the main rotor causes the fuselage of the helicopter to rotate in the opposite direction (nose left). The anti-torque system comprises a shrouded tail rotor or fenestron. The fenestron provides thrust, which counteracts this torque and provides directional control while hovering. It received the European Aviation Safety Agency's (EASA) Type Certificate in December 2007. ZZT was the first of type to be registered in Australia.

VH-ZZT



Source: Helicopter operator

The student was undergoing type endorsement training on the helicopter. The student had conducted a flight of about an hour's duration earlier that morning with the Chief Flying Instructor of the school. After the flight, another instructor was assigned to complete the student's training.

A short briefing was performed by the second instructor, which included the characteristics of the fenestron anti-torque system.

The student and instructor departed Bankstown Airport for Camden Airport due to the amount of traffic at Bankstown. At Camden, circuits were not available due to traffic and ZZT was confined to operations not above 200 ft within the confines of grassed runway 10/28.

The instructor simulated a jammed right yaw control pedal³ forward emergency from the hover and demonstrated the recovery procedure. The student then attempted the exercise.

The instructor simulated a jammed right pedal by placing his foot against the right anti-torque pedal and holding it in a forward position. The helicopter began rotating to the right, the student increased collective⁴ and the rotation stopped. The height above the ground increased as a consequence of the increased collective input. The student then wound off throttle to decrease the rotor revolutions per minutes (RPM) slightly to initiate a descent. The student then assessed the rate of descent to be too high and instinctively increased the collective lever again to arrest the descent. The helicopter rotated left between 45 and 60 degrees and momentarily stabilised before continuing to rotate to the left for a number of rotations.

The instructor took control and recovered the helicopter.

The instructor landed the helicopter and discussed with the student the recovery procedure. The instructor then re-demonstrated the recovery procedure to the student.

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

² Helicopter tail rotor with numerous blades rotating in a short duct inset into the fin.

³ Yaw control or anti-torque pedals controls yaw about the yaw axis by simultaneously varying pitch on the fenestron blades.

⁴ A primary helicopter flight control that simultaneously affects the pitch of all blades of a lifting rotor. Collective input is the main control for vertical velocity.

With the helicopter aligned with runway 10 and the instructor the only person on the controls, a simulated jammed right pedal forward emergency was initiated. The instructor increased collective to increase torque and the rotation stopped. The helicopter's height above the ground increased slightly higher than the previous occasion. The instructor wound off the throttle slightly to initiate a descent. The instructor assessed the rate of descent to be too fast and attempted to abort the manoeuvre by; increasing collective, applying full throttle to increase the rotor RPM and full right pedal to counteract the increasing left yaw rate.

The helicopter rotated to the left through several full rotations. The instructor was unable to recover the rotor RPM, nor arrest the left yaw or left roll that subsequently developed.

The helicopter collided with terrain in a left skid-low, nose-high attitude, and came to rest on its side. Both occupants exited the helicopter. The instructor was not injured, however, the student sustained some minor soft tissue injuries. The helicopter was seriously damaged (Figure 1).

Figure 1: VH-ZZT



Source: *Helicopter operator*

Weather

The METAR⁵ issued for Camden Airport around the time of the accident, reported the weather to be fine and the wind as light and variable, with the following conditions observed:

- 030° at 5 to 8 kts, at 1400
- 360° at 5 to 8 kts, at 1430
- 080° at 4 to 9 kts, at 1500

Pilot information

At the time of the accident, the instructor held a Commercial Pilot (Helicopter) Licence and a Grade 2 Instructor Rating. The instructor had about 750 hours total time and 200 hours on type.

The student held an Air Transport (Helicopter and Aeroplane) Pilot Licence with 4,018 hours total time, of which 1,300 hours were on helicopters. Of this, 30 hours were in piston-engined helicopters similar to the Cabri G2.

⁵ Routine aerodrome weather report issued at fixed times, hourly or half hourly.

Type endorsement requirements and yaw control emergencies

The requirements for the issue of a type endorsement were found in Civil Aviation Order (CAO) 40.3.0 at Appendix II. Training shall include:

All other emergency procedures specified in the Flight Manual⁶

The helicopter's flight manual listed yaw control as an emergency and prescribed the following for loss of yaw control while hovering:

Land immediately,

Lower the collective slowly enough to land smoothly, while rolling-off throttle to reduce yawing nose to the right.

Instructor comments

The instructor commented that there are a number of different ways of dealing with a right yaw control pedal jam in the hover. The following was the technique being demonstrated prior to the accident;

- The collective lever was increased until torque and anti-torque provided by the fenestron equalised and the rotation ceased.
- Due to the increased position of the collective lever, the helicopter's height above the ground increased. In order to descend the helicopter without lowering the collective lever, the throttle was wound off slightly. The rotor RPM decreased, and consequently, total rotor thrust and the helicopter's height above ground level decreased until the helicopter could be landed safely.

The instructor acknowledged that the trans-cockpit authority gradient⁷ between himself and the student was quite flat with the student having significantly more experience than he did. However, the instructor added that it was not unusual for him to fly with more experienced pilots and it was his usual practice to reaffirm during the pre-flight briefing that he was the pilot in command.

Student comments

The student commented to the instructor at the time, that he had previously been taught to deal with this scenario by opposing the direction of rotation with pedal, closing the throttle, and performing a hovering autorotation⁸.

The student also acknowledged that the trans-cockpit gradient may be an issue. In an attempt to address the authority gradient between the instructor and himself the student emphasised to the instructor during the pre-flight briefing, that he only had a limited amount of piston engine helicopter time.

During the flight, the student again emphasised to the instructor not to be reluctant to take control if at any stage he was uncomfortable.

Manufacturer comments

The manufacturer noted that the recovery procedure used was not in accordance with the helicopter's flight manual. The manufacturer also added, that the recovery procedure used was not suitable for the Cabri G2 as:

⁶ CAO 40.3.0, Appendix II, 2(b) (xvii).

⁷ Studies of accidents involving crew members with comparable experience levels (especially high levels) indicate that crew interaction and supervision tend to diminish once individual members assume that other crew are fully capable of conducting safe operations and as a result the type of detailed assistance and/or supervision that they might normally provide to less experienced crew members is not required.

⁸ This maneuver is used to land a helicopter from the hover without engine power.

- the helicopter featured a high inertia rotor system, and rotor RPM would take longer to decay and conversely longer to recover;
- as rotor RPM decreased, the main rotor efficiency would initially increase before decreasing; and
- decreasing rotor RPM would decrease fenestron efficiency leading to a reduced anti-torque capability.

All of the above elements were likely to result in a high vertical descent rate, an increase in workload associated with the emergency procedure, and generally, an increase in the risk associated with its performance.

Manufacturer's service letter

On 22 June 2012, Guimbal Helicopters published Service Letter (SL) '12-001 - Yaw control in approach'. This SL was issued in response to two previous accidents that occurred on approach. The SL highlights handling characteristics that are specific to Fenestron equipped helicopters.

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.

Operator

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

Supervision of low time instructors

The helicopter training school has advised that they are in the process of amending their operations manual to:

- improve the supervision of low time instructors by the Chief Flying Instructor
- amending the endorsement training syllabus

Safety message

This accident highlights, that different helicopter types have their own specific handling characteristics; and that pilots should also be familiar with the emergency procedures prescribed by the flight manual and the immediate actions to be performed to ensure a successful outcome.

The following publications provide useful information:

- Eurocopter Service Letter, 1673-67-04, is a reminder concerning yaw axis control for all helicopters in some flight conditions
www.eurocopter.com/site/docs_wsw/RU_B_36/1673-67-04en.pdf
- AAIB investigation: Guimbal Cabri G2, G-UIMB
www.aaib.gov.uk/publications/bulletins/march_2012/guimbal_cabri_g2_g_uimb.cfm
- AAIB investigation: SA341G Gazelle 1, G-HAVA
www.aaib.gov.uk/publications/bulletins/february_1998/sa341g_500862.cfm

Aircraft details

Manufacturer and model:	Guimbal Cabri G2	
Registration:	VH-ZZT	
Type of operation:	Flying training	
Location:	Camden Airport, New South Wales	
Occurrence type:	Collision with terrain	
Persons on board:	Crew – 2	Passengers – Nil
Injuries:	Crew – 1 (Minor)	Passengers – Nil
Damage:	Serious	

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.