Australian Government
Australian Transport Safety Bureau

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ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation. AO-2008-017
Final

Collision with terrain – 7 km NNW Hornsby, NSW
1 March 2008

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Abstract

On 1 March 2008, at about 1300 Eastern Daylight-saving Time the pilot of a Bell Helicopter 206B Jetranger III was flying over a property on a private flight with four passengers. Witnesses reported seeing the helicopter flying over the property at about 100 ft above ground level. At the completion of one pass, the helicopter was observed by witnesses on the ground to bank steeply to the left, roll out and descend into surrounding trees. The helicopter impacted the trees and was destroyed. One of the occupants was discovered outside the helicopter and all sustained serious injuries.

Examination of the wreckage did not indicate any mechanical defects that would have affected the safe operation of the helicopter.

FACTUAL INFORMATION

History of flight

On 1 March 2008, at about 1300 Eastern Daylight-saving Time[1], the pilot of a Bell Helicopter 206B Jetranger III was flying over a property on a private flight with four passengers. Witnesses reported that the helicopter was making low-level passes, at about 100 ft above ground level over the property. At the completion of one low-flying pass, the helicopter was observed by witnesses on the ground to bank steeply to the left, roll out, and decend into surrounding trees. The helicopter impacted the trees and was destroyed. One of the occupants was discovered outside the helicopter's cockpit/cabin area. All of the five occupants sustained serious injuries.

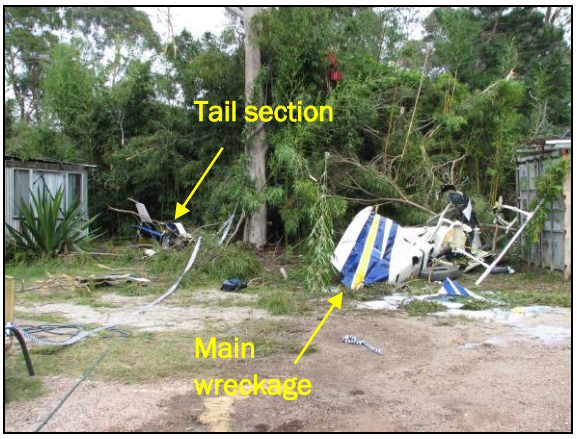
The helicopter had been hired by the pilot at Bankstown Airport, NSW, and flown to the property to conduct joy flights at a friend's birthday party. The helicopter was reported to be fully fuelled before departing the airport with the pilot and four passengers on board. The flight duration to the property was about 20 minutes. Enroute to that destination property, the pilot landed the helicopter at another property to wait until all guests had arrived at the party. The helicopter's engine was shut down and the helicopter was on the ground for about 30 minutes before the passengers and pilot boarded it for the flight to the destination property. The weather was fine and not considered a factor in the accident.

Wreckage information

The helicopter cockpit, cabin and fuselage were destroyed by impact with the trees and resulting dynamic forces. The helicopter cabin was severely damaged by the initial impact and separated into several sections (Figure 1).

1 The 24-hour clock is used in this report to describe the local time of day. Eastern Daylight- savings Time is Coordinated Universal Time (UTC) + 11 hours.

Figure 1: Main wreckage



The main rotor head, with parts of the blades attached, had separated from the transmission and main rotor mast and was lodged in the trees. The main rotor blades were destroyed by impact with the trees. That damage was indicative of the blades operating at significant RPM. Reconstruction of the main rotor blades indicated that the blades were intact prior to impact with the trees. The tail section, with the tail rotor gearbox and tail rotor still attached, was separated from the fuselage (Figure 2). The tail rotor blades had sustained impact-related damage.

Figure 2: Separated tail section

None of the occupants' seat belt attachment fittings were damaged. Examination of the wreckage did not indicate any mechanical defects that would have affected the safe operation of the helicopter.

Witness reports

At interview, the pilot reported that there was a 'silence' in the helicopter following the left banking turn and that the helicopter then fell rapidly into the trees. He also reported that it was possible that the front-seat passenger had pushed the collective control down. The front-seat passenger advised that he was wearing a headset and could not recall anything from the accident. He remembered flying over the property but his next recollection of the situation was when he 'woke up on the ground'.

Two witnesses on the ground working at another nearby property, reported that the helicopter was low flying. One of the witnesses on the ground at the property had made a video recording of the flight of the helicopter using a camcorder. The video confirmed witness reports of low flying prior to the helicopter impacting the trees. Another witness at the party took a photograph of the helicopter while it was turning prior to the low-flying pass (Figure 3).

Figure 3: Photograph of helicopter turning

Injuries

All five occupants sustained varying degrees of serious injuries. At least one of the occupants was ejected from the helicopter during the impact sequence.

The pilot reported that he had briefed the passengers on seat belt usage before departing Bankstown and that he believed that all of the passengers had secured their seat belts. A passenger on the flight confirmed that the pilot and passengers had all secured their seatbelts before departing Bankstown.

The passenger advised that he had difficulties buckling his seatbelt and did not secure his seatbelt on departure from the property before the accident. He advised that only one rear seat

passenger secured their seatbelt for the flight from the intermediate stop to the destination property. The pilot confirmed that he was wearing his seatbelt.

Civil Aviation Safety Authority (CASA) Civil Aviation Regulation (CAR) 251 regarding the use of seat belts and safety harnesses stated:

> (1) Subject to this regulation, seat belts shall be worn by all crew members and passengers:
>
> (a) during take-off and landing;
>
> (b) during an instrument approach;
>
> (c) when the aircraft is flying at a height of less than 1,000 feet above the terrain; and
>
> (d) at all times in turbulent conditions.

Pilot information

Table 1: Pilot's licence and experience

Type of licence	Private Pilot (Helicopter) Licence issued 23 November 2004
Medical certificate	Class 1 valid issued 14 January 2008
Flying experience total hours	323.6
Endorsements	Robinson R22, R44, Bell Helicopter 206 on 2 January 2005
Hours on type	139.2
Hours flown in the last 90 days	11.8

The pilot had hired the helicopter for the private flight from a local helicopter charter operator. The pilot had previously hired helicopters from the operator and had successfully completed a check ride with the operator's personnel. The pilot was not endorsed for low-flying operations.

The Civil Aviation Safety Authority advised that the pilot's licence has been suspended after the accident pending a review by the Authority.

Helicopter information

The helicopter, serial number 4185, was manufactured in the US in 1991. At the beginning of the day's flying, it had accumulated 3,701.0 hrs total time in service (TTIS). It was equipped with a Rolls Royce Corporation model 250-C20J engine. The last maintenance to the helicopter was completed on 9 October 2007 at 3,633.9 hrs TTIS, with maintenance to the main rotor system. The last inspection was completed on 5 July 2007 at 3,623.6 hrs TTIS, with completion of a 100/300 hourly inspection.

The helicopter manufacturer's maximum take-off weight (MTOW) for the helicopter was 1,451 kg. The investigation calculated the helicopter's take-off weight at departure from Bankstown Airport as about 1,509 kg or 57 kg in excess of the MTOW[2]. The helicopter's calculated gross weight at the time of the accident was about 1,479 kg or 28 kg in excess of the MTOW. The requirements of CAR 235(4) stated that:

> The pilot in command of an aircraft must not allow the aircraft to take off if its gross weight exceeds its maximum take-off weight or, if a lesser weight determined in accordance with a direction under subregulation (2) is applicable to the take-off, that lesser weight.

One of the passengers reported that they were not weighed prior to departing Bankstown airport. Civil Aviation Advisory Publication (CAAP) 235-1 (1) addressed standard passenger and baggage weights. Rather than use the standard passenger weight of 77 kg, CAAP 235 recommended using 86 kg for adult passengers for light aircraft and helicopters with less than seven seats to avoid overloading.

Regulations regarding low flying

CASA CAR 157 *Low flying* states:

> (1) The pilot in command of an aircraft must not fly the aircraft over:
>
> (a) any city, town or populous area, at a height lower than 1000 feet; or
>
> (b) any other area at a height lower than 500 feet...
>
> (3) A height specified in subregulation (1) is the height above the highest point of the terrain, and any object on it, within a radius of:
>
> (a) in the case of an aircraft other than a helicopter—600 metres; or
>
> (b) in the case of a helicopter—300 metres;
>
> from a point on the terrain vertically below the aircraft.

2 The body weights of the occupants were calculated using 77 kg per occupant and not confirmed by actual weighing.

VORTEX-RING STATE

Vortex-ring state is the operating state of rotorcraft (especially helicopter) main rotors, in which direction of airflow through the rotor is in the opposite sense to relative vertical flow outside the rotor disc and opposite to the rotor thrust. This can occur in auto-rotative landings and with the main rotor under power if the rate of descent equals rotor downwash velocity.

ANALYSIS

Examination of the wreckage did not indicate any mechanical defects of the helicopter, rotor system or engine that would have resulted in loss of controlled flight. The examination also confirmed significant rotational RPM of the main rotor blades at the time of impact.

When the helicopter executed the steeply banked turn to the left at low forward airspeed, the inertia in the main rotor blades and corresponding main rotor RPM would have decreased, resulting in less main rotor efficiency and loss of altitude. In order to maintain altitude, the pilot would have had to react quickly to increase both collective pitch and engine power, to prevent a loss of altitude. If the pilot did not react rapidly to this condition, or if the front seat passenger had pushed the collective control down, the result would be a loss of altitude. Regardless, in either circumstance, the helicopter was being operated at a height from which recovery was not possible.

The investigation also considered that during the last stages of the flight, prior to impact with the trees, the helicopter was entering vortex ring state, which also reduced the helicopters performance.

The injuries to the occupants may have been reduced if all had been their wearing seat belts.

The pilot's action to conduct low flying did not comply with CASA CARs. In addition, the helicopter was operated at a gross weight in excess of the helicopter manufacturer's maximum take-off weight, which also did not comply with the CARs. The operation of the helicopter in this configuration limited the controllability of the helicopter during the flight.

Had the helicopter been operated within the manufacturer's weight limitations and at 500 ft or more above ground level, the pilot would have had more time to assess and react to the situation. The operation of the helicopter outside of those parameters exposed both the helicopter's occupants and observers on the ground to a hazardous situation.

Given the circumstances surrounding this accident, the Australian Transport Safety Bureau determined that the safety benefits of further investigation did not warrant the commitment of resources compared with other priorities.