

**Aviation Safety Investigation Report
199904632**

**Bell Helicopter Co
Bell 212
Aerospatiale
Squirrel**

24 September 1999

Readers are advised that the Australian Transport Safety Bureau investigates for the sole purpose of enhancing transport safety. Consequently, Bureau reports are confined to matters of safety significance and may be misleading if used for any other purposes.

Investigations commenced on or before 30 June 2003, including the publication of reports as a result of those investigations, are authorised by the Executive Director of the Bureau in accordance with Part 2A of the Air Navigation Act 1920.

Investigations commenced after 1 July 2003, including the publication of reports as a result of those investigations, are authorised by the Executive Director of the Bureau in accordance with the Transport Safety Investigation Act 2003 (TSI Act). Reports released under the TSI Act are not admissible as evidence in any civil or criminal proceedings.

NOTE: All air safety occurrences reported to the ATSB are categorised and recorded. For a detailed explanation on Category definitions please refer to the ATSB website at www.atsb.gov.au.

Occurrence Number: 199904632 **Occurrence Type:** Serious Incid.
Location: Rees River/Hunter Stream Junction
State: Other **Inv Category:** 4
Date: Friday 24 September 1999
Time: 0230 hours **Time Zone** UTC
Highest Injury Level: None

Aircraft Manufacturer: Bell Helicopter Co
Aircraft Model: 212
Aircraft Registration: VH-HHW **Serial Number:** 30983
Type of Operation: Miscellaneous Media Operations
Damage to Aircraft: Minor
Departure Point: Earnslaw NZ
Departure Time: 1330 UTC
Destination: Earnslaw NZ

Crew Details:

Role	Class of Licence	Hours on	
		Type	Hours Total
Pilot-In-Command	ATPL	600.0	13167


Aircraft Manufacturer: Aerospatiale
Aircraft Model: AS.350B2
Aircraft Registration: ZK-HNE **Serial Number:**
Type of Operation: Miscellaneous Media Operations
Damage to Aircraft: Minor
Departure Point: Unknown
Departure Time: 1330 UTC
Destination: Unknown

Crew Details:

Role	Class of Licence	Hours on	
		Type	Hours Total
Pilot-In-Command	Commercial	800.0	11000

Approved for Release: Friday, July 28, 2000

The pilots of a Bell 212 helicopter (VH-HHW) and an Aerospatiale AS-350B2 Squirrel helicopter (ZK-HNE) were engaged in aerial filming for a motion picture sequence above the middle of Rees Valley in the Southern Alps of New Zealand.



The pilots were very experienced in aerial filming, and conducted a thorough pre-flight briefing for the "point in space filming sequence". The briefing included flightpaths, airspeed, altitude, emergency actions, abort procedures, clearance distance and weather minima. The location features provided few peripheral visual cues for hovering and judging the rate of closure and distance between the helicopters.

The Squirrel was in a hover facing North-West or upstream towards the mountains at 2,500 ft above ground level (AGL) filming the Bell in a fly-by manoeuvre. The filming sequence required the Bell to descend from 3,500 ft AGL at 70 knots towards the Squirrel passing by the right side of the Squirrel (North-West to South-East) and then continue flying straight ahead. The Australian company Operations Manual (Section D4.1-Still and Motion Photography) required the pilot of the Bell to maintain "normal separation" with another aircraft involved in an aerial filming sequence. This separation was defined by the Chief Pilot as 150 m.


During this manoeuvre, the second run for the day, the main rotor blade of the Bell struck the top of the vertical fin of the Squirrel. The pilot of the Squirrel reported some moderate wake turbulence from the rotor tip vortices of the Bell during this pass but neither pilot realised the helicopters had collided. Consequently, the minor damage was not discovered until the helicopters returned to Queenstown at the end of the day's filming.

Inspection found that the top of the Squirrel's vertical fin had been struck by the Bell's main rotor blade. There were two small dimple indents on the leading edge of the main rotor blade cap and some paint scratching in from the end of one main rotor blade. The first dimple was 146 mm from the blade tip and the second dimple was 57 mm from the blade tip.

The investigation revealed that the "point in space filming sequence" manoeuvre can induce a "rejoin illusion" in pilots that limits their ability to accurately judge closure rates. In particular, the pilot of the Bell may have initially experienced an apparently very slow closure rate on the Squirrel followed by a rapid, difficult to judge, increase in apparent closure rate from approximately 100 m to run. The closure rate of the Bell was approximately 120 ft per second. The rejoin illusion is more marked with higher closure rates and the smaller the aircraft being approached. In addition, the black paint scheme of the Squirrel against the relatively dark background of the terrain may have made it even more difficult for the pilot of the Bell to judge the position of the other helicopter. This poor visual contrast had been discussed in the pre-flight briefing.

In addition, the investigation found that the workload of the Squirrel pilot was very high which may have precluded his ability to detect the impending collision and to call an abort. The Squirrel pilot was the aerial director of the film sequence and was subject to additional airborne communications and the professional pressure required to produce quality direction as well as maintain the helicopter in a 2,500 ft AGL hover in strong winds with limited visual cues. Furthermore, it is possible that the Squirrel pilot may have drifted laterally towards the Bell 212 because it is very difficult to maintain an exact stationary hover at altitude with limited visual references.

The absence of a clear and specific quantitative definition for "normal separation" in the Operations Manual for the Bell 212 (Section D4.1- Still and Motion Photography) represented a latent failure in the operator's procedures. Following this incident, the Operations Manual was amended to clarify the definition of "normal separation". In addition, company pilots involved in New Zealand operations were issued with an Operational Memo that imposed a specific quantitative interpretation of "normal separation".



The operator of the Squirrel amended their procedures to stipulate that camera helicopters in high hovers without nearby visual references were required to maintain a minimum indicated airspeed of 10-15 knots to reduce the possibility of subtle lateral drift. In addition, the operator documented specific lateral clearance limitations between helicopters engaged in aerial filming sequences.

Organisational and regulatory issues that became apparent during the investigation included separation distances between aircraft in close proximity and the definition of formation flying. The Australian Civil Aviation Regulation 163 AA states that aircraft must not be flown in formation unless each of the pilots in command has been approved by the Civil Aviation Safety Authority (CASA) to fly in formation and the formation is pre-arranged between the pilots in command. For the purposes of the regulation, two or more aircraft are considered to be in formation if they are flown in close proximity to each other and they operate as a single aircraft with regard to navigation, position reporting and control. In addition, aircraft are considered to be in formation during join-up and breakaway (CAR 163 AA 5(b)). New Zealand CAR 91.227 has similar provisions.

The New Zealand Civil Aviation Authority (CAA) legislation was the relevant legislation in force at the time of this incident and CAR 91.227 stated that no pilot shall operate an aircraft so close to another aircraft as to create a collision hazard. Formation flight is defined as more than one aircraft which navigate and report as a single aircraft; and are no more than one nautical mile laterally and within 100 ft vertically from the formation leader. The aircraft were flown so close to each other as to create a collision hazard. Close formation flying training and certification may have assisted the pilots to avoid a collision on this occasion. Both CAA and CASA are currently reviewing and developing the safety requirements, advisory material, and acceptable standards for operations where aircraft are flown in close proximity to each other in a commercial operation, such as aerial film making.

The organisational and regulatory issues have been addressed in greater detail in the Civil Aviation Authority of New Zealand Aircraft Accident Report 99/2768.

