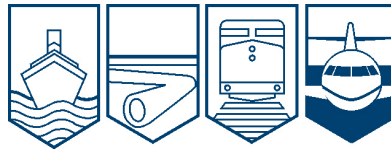


Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

**AVIATION INVESTIGATION REPORT
A08P0035**



LOSS OF VISUAL REFERENCE / COLLISION WITH TERRAIN

**SEQUOIA HELICOPTERS LIMITED
BELL 212 (HELICOPTER) C-GERH
GOLDEN, BRITISH COLUMBIA, 9 nm W
07 FEBRUARY 2008**

Canada

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Aviation Investigation Report

Loss of Visual Reference/Collision with Terrain

Sequoia Helicopters Limited
Bell 212 (Helicopter) C-GERH
Golden, British Columbia, 9 nm W
07 February 2008

Report Number A08P0035

Summary

During the approach to a landing site to drop off skiers at approximately 1454 mountain standard time, the Bell 212's (registration C-GERH, serial number 30768) main rotor blades struck the mountainside. The helicopter remained upright, but the main rotor separated from the helicopter and struck the fuselage. The pilot received fatal injuries and the ski guide seated in the front left seat received serious injuries. The guide and skiers seated in the rear of the helicopter were uninjured. The uninjured guide shut off the fuel valves and turned the battery switches off. There was no fire. The survivors were evacuated using local helicopter operators.

Ce rapport est également disponible en français.

Other Factual Information

History of the Flight

The helicopter operated by Sequoia Helicopters Ltd. was being used to transport skiers for Purcell Helicopter Skiing (PHS) near Golden, British Columbia. At 1027 mountain standard time ¹ on the morning of the accident, the helicopter departed PHS's lodge, located approximately one nautical mile (nm) east ² of Golden, for its first flight of the day. A total of 28 flight legs were flown before the accident occurred at 1454. The flights consisted of transporting three groups of skiers from the lodge to an area near the headwaters of Canyon Creek, approximately nine nm west of Golden. Throughout the day, the groups of skiers were repeatedly dropped-off at the top of three ski runs and picked up at the bottom of those runs.

On the accident flight, two guides and seven skiers boarded the helicopter at Serenity Cabin, located at approximately 7000 feet above sea level (asl) near the Canyon Creek valley bottom. Three skiers previously with the group remained at the cabin. The intention was to take the skiers to the Dawn Mountain ski run, approximately 0.8 nm north of Serenity Cabin, but a snow squall at the drop-off site was causing poor visibility. As a result, the decision was made to take the skiers to the Whitehorn ski run, approximately 0.4 nm northeast of Serenity cabin, where visibility appeared better. The Whitehorn drop-off site, marked with four flagged poles (also referred to as pins or stakes), was located on a bench ³ at approximately 8100 feet asl, several hundred feet above the treeline and approximately 300 feet below the ridgeline. Terrain above the treeline was predominantly snow-covered, but included some areas of exposed rock, including one such area immediately behind the accident site and another immediately below the flagged site.

The helicopter was equipped with a GPS-based tracking system. It was configured to transmit data, including the helicopter's position, speed, heading, and altitude via satellite phone link about every 60 seconds. The system was designed such that if data could not be transmitted (as would be the case if the satellite phone link reception was temporarily lost), the data would be stored in the unit and sent after reception was re-established. Post-crash inspection of the unit showed that the last nine minutes of data was stored and had not been transmitted. It was not determined why the data had not been transmitted.

¹ All times are Mountain standard time (Coordinated Universal Time minus 7 hours).

² All directions and headings in this report are expressed in degrees True.

³ A level strip of land, bounded above and below by steeper slopes.

The data indicate that the route flown on the accident flight (see Figure 1) was similar to the routes flown between Serenity Cabin and the Whitehorn drop-off site on three flights completed earlier in the day. All of the approaches to the landing area were made from the southeast, across the mountainside. However, the helicopter's rate of climb during the enroute part of the accident flight was greater than on previous flights and the approach to the drop-off site was flown at a slightly lower altitude. The last GPS data indicate that the helicopter had slowed to 30 knots (ground speed) when it was approximately 30 feet above and 900 feet southeast of the flagged site. On the previous flight to Whitehorn, the helicopter had slowed to 25 knots while approximately 95 feet above and 600 feet southeast of the flagged site.

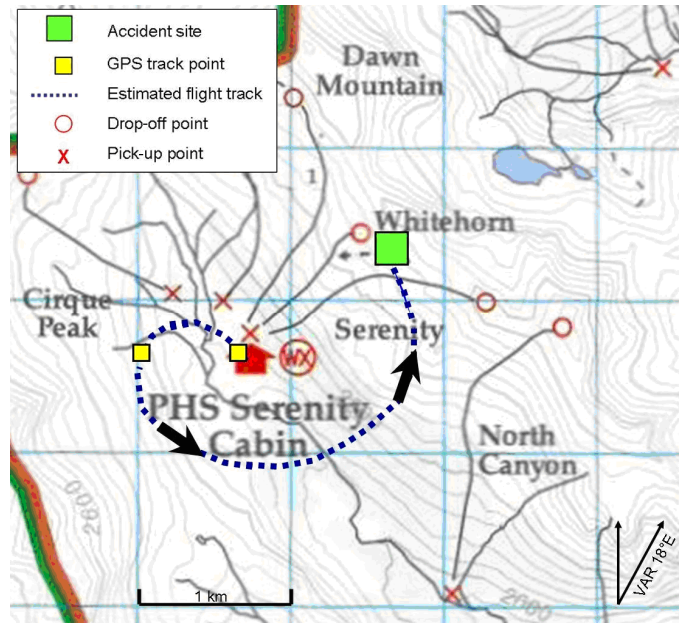


Figure 1. Helicopter flight path

In the Bell 212, translational lift occurs at approximately 20 knots. If the helicopter slows below that airspeed in level flight, the rotor's efficiency is reduced and the helicopter will descend unless more power is applied. Just as the flagged site came into view at about their altitude, engine power was increased and light turbulence was experienced just before the helicopter's rotor blade struck the mountainside. It is normal for the engine power to increase as a helicopter's forward and vertical speeds are arrested prior to landing.

Impact forces during collision with the mountainside were low enough that the impact felt like a hard landing. No indication was found of forward motion of the helicopter after the skids contacted the snow. The helicopter remained upright and oriented towards the flagged site, which was located approximately 600 feet across the mountainside (northwest) and 100 feet higher than the accident site. The rotor and main rotor gearbox separated from the helicopter. The rotor mast fractured just below the main rotor hub and the main rotor blades struck the tail rotor 90° gearbox and the forward fuselage roof.

The pilot, seated in the right front seat, was struck by a rotor blade and received fatal injuries. The ski guide seated in the left front seat received serious injuries. The skiers and guide seated in the aft cabin area were uninjured. Fuel from fractured fuel lines began leaking down into the cabin. The uninjured ski guide pulled the emergency T-handles to shut off the fuel valves and turned the battery switches off in accordance with the annual training he had received from Sequoia Helicopters Ltd. and PHS. The fuel leak stopped and there was no fire. The uninjured guide also radioed for assistance and the PHS emergency response plan was implemented. Medical attention was immediately provided to the injured guide and the pilot by a medical doctor on board the accident helicopter; however, the pilot succumbed to his injuries. The guides and skiers were evacuated from the site by local helicopter operators.

Pilot

Records indicate that the pilot was certified and qualified for the flight in accordance with existing regulations. He had accumulated nearly 8000 hours flying helicopters, of which more than 1500 hours were accumulated flying Bell 212 helicopters. He had flown for PHS for several winters and was familiar with the Canyon Creek area and the Whitehorn ski run. The pilot was wearing a helmet as well as shoulder and lap restraints. The pilot had two weeks off from the 14th to the 28th of January 2008. He had flown every day from January 29 until the day of the accident. He flew 13 hours in this 10-day period.

Aircraft

A review of the technical records indicated that the helicopter was serviced and maintained in accordance with existing directives. There were no outstanding or deferred defects recorded in the technical records and a post-accident examination of the helicopter did not reveal any pre-accident defects that would have contributed to the accident. Approximately 400 pounds of fuel was found on board the helicopter after the accident. The fuel sampled was of the proper grade and quality and contained no contamination. The helicopter weight was approximately 2200 pounds below maximum gross weight and was within balance limits. Examination of the main rotor blades and main rotor gearbox showed damage consistent with high engine power being delivered at the time the main rotor blades struck the mountainside. Separation of the main rotor gearbox from the helicopter damaged the fuel/oil heat exchanger on the number one engine and the fuel control unit on the number two engine, allowing fuel to leak through the fuselage roof and into the aft cabin.

Meteorological Information

There is no official weather recording station at the accident site. However, weather conditions in the Canyon Creek area were recorded by the PHS guides throughout the day. Weather conditions were also recorded at the Kicking Horse Mountain Resort (KHMR) weather station, located at 8038 feet asl (approximately four nm southeast of the accident site), as well as at the Golden Airport (CYGE).

The wind was consistently from the west-southwest throughout the day, varying between 214° at 0900 and 240° at 1500. Wind from this direction would have blown predominantly uphill at the accident site. Wind speed increased substantially throughout the day. Between 0800 and 1500, recorded wind speed at the KHMR increased from 4 knots to 13 knots and gust speed increased from 8 knots to 23 knots. At 1500 the temperature was at -13°C at the Whitehorn drop-off site and the altimeter setting at CYGE was 29.68 inches of mercury (in Hg). Calculations show that density altitude at the Whitehorn drop-off site (8100 feet asl) would have been approximately 6950 feet.

Broken cloud conditions were present until approximately 1400, after which the conditions were overcast. Localized snow showers occurred periodically, including immediately prior to the accident flight when a snow squall obscured visibility over the Dawn Mountain ski run drop-off site 0.8 nm from the accident site. The flags at the Whitehorn drop-off site, located approximately 600 feet across the mountainside from the accident site, had come into view

moments before the accident occurred. Visibility is often obscured for several seconds during landings on dry, light snow because of the snow being blown up by the rotor downwash. In these conditions, flagged poles often provide pilots with their only visual references at landing areas.

Analysis

Examination of the helicopter did not reveal any defects that would have contributed to the accident. The helicopter was carrying three fewer passengers on the accident flight than on previous flights and had minimal though sufficient fuel, thus decreasing the helicopter's gross weight. The density altitude was lower than the actual altitude and the prevailing wind was blowing strongly uphill. The combination of helicopter gross weight, density altitude, and wind would have increased the helicopter's performance including its rate of climb on the accident flight.

The pilot was familiar with the Whitehorn ski run and had flown to the drop-off site three times earlier in the day. Although the enroute flight path during the accident flight was similar to the paths flown on earlier flights, the approach to the drop-off site was flown at a lower altitude than on the previous flight, resulting in a flatter approach profile.

Visibility above the treeline varied. The accident flight destination was changed because a snow squall obscured visibility at the original drop-off site. The sky cover was overcast, a condition creating a uniform, diffused (flat) light that, particularly on monochromatic and relatively featureless surfaces such as snow, provides no shadows or reflections that can be used as visual references. As well, blowing snow may have obscured ground features. The flags at the drop-off site, 600 feet ahead of the helicopter, were visible moments before the accident. However, it is not known if visibility towards the featureless, snow-covered mountainside adjacent to the helicopter was compromised by flat light and blowing snow. It is also not known why the approach on the accident flight was flown at a lower altitude than on the previous flight. It is possible that, due to poor visibility, the pilot was not aware of the helicopter's proximity to the mountainside.

The helicopter's forward and vertical speeds were very low when it contacted terrain, consistent with a normal landing. The helicopter did not slide forward after the skids contacted the snow; it remained upright and oriented in the direction it had been travelling. The low vertical and forward speeds at touchdown are consistent with the pilot intentionally landing the helicopter at the accident site. It is possible that, due to a lack of visual references and to blowing snow from the rotor downwash, the pilot was unaware that the helicopter was close enough for the rotor blades to strike the mountainside.

Wind direction had remained steadily uphill (approximately 90° to the flight path) for several hours prior to the accident, but wind and gust speeds had increased substantially. The upflowing air would have provided lift, allowing the helicopter to operate using less power than would have been required in still or downflowing air. It is possible that a decrease in the upflowing air caused a momentary decrease in lift and the helicopter descended into the mountainside before adequate additional power was applied. As well, if the helicopter's airspeed had been allowed to decrease to below 20 knots, the resulting reduction of rotor efficiency may have caused the helicopter to descend into the mountainside.

The ski guide's shutdown of the helicopter's fuel and electrical system after the accident prevented injury to the passengers from leaking fuel and may also have prevented fire. The implementation of Purcell Helicopter Skiing's emergency response plan also reduced risk of further injury to the survivors.

Finding as to Causes and Contributing Factors

1. The helicopter's main rotor blades contacted the mountainside during the landing in poor visibility for undetermined reasons. The main rotor separated and struck the fuselage.

Other Finding

1. Further injury was reduced by the ski guide's shutdown of the helicopter's fuel and electrical systems and by implementing Purcell Helicopter Skiing's emergency response plan.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 04 November 2008.

Visit the Transportation Safety Board's website (www.bst-tsb.gc.ca) for information about the Transportation Safety Board and its products and services. There you will also find links to other safety organizations and related sites.