Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT

A04A0111

LOSS OF CONTROL - COLLISION WITH TERRAIN

CANADIAN HELICOPTERS LIMITED

AEROSPATIALE AS-350D C-GVHB

NAIN, NEWFOUNDLAND AND LABRADOR, 45 nm NW

31 AUGUST 2004

Canada

Aviation Investigation Report

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Summary

The Canadian Helicopters Limited AS-350D (registration C-GVHB, serial number 1297) was being operated under CAR 703, Air Taxi, in support of a geological survey crew, 45 nautical miles northwest of Nain, Newfoundland and Labrador. At approximately 1600 hours Atlantic daylight time, the pilot of the occurrence helicopter picked up a team of geologists and proceeded to reposition them 1.5 kilometres further along the ridge line they had been sampling. While on short final for the landing site, the helicopter's rate of descent increased, and the pilot was unable to arrest the descent. The helicopter struck the ground in a gully, just left of the intended touchdown point. The helicopter came to rest on its right side, facing the direction of approach. The pilot and two passengers escaped with only minor injuries. The helicopter was substantially damaged, but there was no post-crash fire.

Other Factual Information

The pilot had been conducting multiple flights in support of a geological survey team based at Kingurutik Lake, Newfoundland and Labrador. On the day of the occurrence, the survey crew was working at an elevation of 2000 feet above sea level (asl) along a ridge line 10 km northwest of the lake. Although this is not very high in relation to some mountainous areas of the country, it was not flat terrain. The elevation changes were quite dramatic; in some places 1800 feet in the span of one kilometre. Approximately three minutes before the accident, the pilot conducted an approach and landing to a rocky outcrop 1.5 km east of the crash site to embark two members of the survey crew. This approach was flown on a westerly heading, parallel to the ridge line. The wind at the time was light and blowing from the west. The pilot departed the outcrop and flew in a westerly direction along the ridge line at approximately 200 feet above ground level (agl). One passenger was sitting in the front left seat and the second was sitting in the left rear seat.

The intended landing site was on the west side of the same ridge, approximately 300 feet higher in elevation than the previous site. The western edge of the ridge was L-shaped with the base of the L oriented north-south, and the stem oriented east-west. The base of the "L" was on the west side of the stem (see Appendix A). The top of the ridge line was 2100 feet asl and the landing site was located at an elevation of 1900 feet asl in the bowl formed by the two sides of the L. The prevailing winds were from the west and crossed the ridge at an angle of 90 degrees. The approach was flown directly into the centre of the bowl, without a reconnaissance pass.

The initial stage of the approach was normal with respect to airspeed, aircraft attitude, and descent angle (moderate to flat). On short final to the landing site, the helicopter's rate of descent increased suddenly despite collective (power) application by the pilot. There were no control difficulties or buffeting experienced. The pilot steered the helicopter toward a gully on the left side of the intended landing site to avoid hitting the outcrop. The helicopter struck the ground in an upright position, pivoted vertically onto the nose, and then rotated 180 degrees in a clockwise direction before coming to rest on its right side facing the direction of approach. The pilot shut down the engine and electrical power, and then followed the passengers through the forward passenger door. A satellite phone was used to advise operations of the accident, and a company helicopter arrived within 30 minutes to effect evacuation. The pilot and front seat passenger were flown to Goose Bay for medical examination, and the rear seat passenger was transported to the clinic in Nain because his injuries were minor.

The helicopter was functioning normally with no indication of power loss or control problems. Both the main and tail rotor assemblies were turning with considerable power at the time of impact. The pilot shut down the engine following the impact. The tail rotor assembly and driveshaft showed torsional shearing at the point of impact. A review of the helicopter technical logs and maintenance records indicates that the helicopter was certificated and maintained in accordance with existing regulations and required standards. The helicopter was in standard configuration, and the weight and balance were within limits.

The Global Positioning System unit was removed from the helicopter and forwarded to the TSB Engineering Branch for examination. No useful data on the helicopter's flight path could be retrieved.

Weather in Nain at the time of the accident was reported as follows: wind 130° True at 11 knots; visibility 15 statute miles (sm); clouds 3500 feet asl broken, 8500 feet asl overcast; temperature 15°C; dew point 7°C; altimeter setting 29.87. Weather in the area of Kingurutik Lake was partly cloudy with sunny breaks, temperature 15°C to 20°C, and winds light westerly to southwesterly. Scattered rain showers and high cloud were moving in from the southwest. Weather conditions in mountainous valleys are difficult to predict; each valley can have noticeably different conditions depending on its orientation and elevation. Winds will generally parallel the direction of the valley and can be strong due to the funnelling effect created by the valley shape. Shortly after the accident, the winds were light, but blowing more from the southeast (up slope from the left of the approach path flown).

Vortex ring state (VRS) is described as a condition in which a helicopter descends through its own downwash. It is generally accepted that three conditions are required for the onset of VRS: zero or near-zero airspeed, powered flight (induced airflow passing downward through the disk, with higher power settings being more critical), and a rate of descent between 300 and 600 feet-per-minute. Under these conditions, a helicopter may start to descend rapidly. If a pilot then applies more collective pitch to slow the descent, more rotor downwash is created, which intensifies the recirculation and increases the rate of descent. To recover from VRS, a helicopter must exit the disturbed column of air that is being produced, either by entering autorotation or by gaining clear undisturbed air by displacing the cyclic forward to regain airspeed. A significant amount of altitude may be lost during a recovery attempt, and recovery at low altitude may not be possible.

Mountainous terrain presents unique risks for low-flying helicopters. Wind direction and strength can be quite variable depending on the steepness and orientation of the ground. Wind striking 90 degrees to a ridge line will flow smoothly up-slope to the top of the ridge with the airflow becoming turbulent as it breaks away from the top of the ridge and descends on the downwind side. Depending on the strength of the wind, this downflow can be quite turbulent.

Techniques have been developed over time to minimize the risk for mountain flying operations. These techniques involve reconnaissance passes of the intended landing spot to determine site elevation, wind direction, power available, and approach-path selection. One of the most important criteria for approach-path selection is to maintain a “drop-off” zone to safely fly away from the approach should there be a sudden change in conditions.

Canadian Helicopters Limited provides comprehensive mountain flying training for pilots based in the Rockies. Pilots operating along the east coast of Canada normally do not receive mountain training because of the relatively flat terrain. The company had been considering mountain training for pilots working in Labrador because of the mountainous areas in the northern half of the province. The occurrence pilot had 1840 hours rotorcraft flying time, of which 1300 hours were on type. He had obtained approximately 150 hours of operating experience in terrain similar to that of the accident site. He had never received any comprehensive mountain flying training.

Analysis

Company operations were alerted promptly because of the use of the satellite phone.

The helicopter was operating normally at the time of the occurrence, and the weather was suitable for visual flight rules operations. The analysis will, therefore, focus on possible operational reasons for the sudden descent and crash of the helicopter.

A possible explanation for the sudden acceleration toward the ground is VRS. The difference in elevation between the previous landing site and the intended landing site was approximately 300 feet. The pilot flew from one to the other at approximately 200 feet above ground. In the short distance between the two sites, it is unlikely that the helicopter was able to climb sufficiently high enough to be in a position to execute a steep approach into the occurrence site. The approach flown would not normally put the occurrence helicopter in a position conducive to VRS. A characteristic of VRS is buffeting and poor control response, neither of which was apparent. If VRS was present, it was likely in the incipient stage of development and did not fully develop in the brief period before impact.

The winds were light and westerly throughout the day of the accident. The intended landing site at which the pilot was going to drop the survey crew was 300 feet higher than the take off area and was in a bowl on the lee side of the ridge. Wind conditions are notoriously unpredictable in mountainous regions, and it is likely that the intended landing site was located in an area of down-flowing wind.

The pilot had not completed a reconnaissance of the site to ascertain any changes to wind conditions or power requirements, and conducted the approach in a direction that did not leave an escape route if required. It is possible that the helicopter entered an area of down-flowing air at a point on final approach from which there was insufficient altitude to arrest the descent before impact. However, had the pilot been trained to use mountain flying techniques in the approach to the landing site, the outcome might have been different.

The following TSB Engineering Laboratory report was completed.

LP136/2004 – GPS Analysis

This report is available from the Transportation Safety Board of Canada upon request.

Finding as to Causes and Contributing Factors

1. The reason for the sudden descent of the helicopter could not be determined.

Findings as to Risk

1. Some company helicopter pilots are operating in the mountainous terrain of northern Labrador without the benefit of mountain flying training.

2. The pilot did not fly a reconnaissance of the intended landing site before attempting a landing.

Other Finding

1. Using a satellite phone to speedily notify company operations, greatly improved the survival scenario.

Safety Action Taken

The company distributed a safety alert letter describing the circumstances of the accident and the possibility of VRS as a contributing factor. The letter included educational material about the causes of VRS and preventive techniques.

The chief pilot reviewed training requirements to ensure that pilots are appropriately trained for their operational environment prior to assignment.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 18 MAY 2005.

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Appendix A – Site Map