Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
A07W0138

LOSS OF CONTROL AND COLLISION WITH TERRAIN

PHOENIX HELI-FLIGHT INC.
AEROSPATIALE AS350BA (HELICOPTER) C-FHLF
FORT MCMURRAY, ALBERTA, 35 nm NE
23 JULY 2007

Canada

Aviation Investigation Report

Loss of Control and Collision with Terrain

Phoenix Heli-Flight Inc.
Aerospatiale AS350BA (Helicopter) C-FHLF
Fort McMurray, Alberta, 35 nm NE
23 July 2007

Report Number A07W0138

Summary

The Phoenix Heli-Flight Aerospatiale AS350BA (registration C-FHLF, serial number 1074) was en route from a staging site at Johnson Lake to Fort McMurray, Alberta, with the pilot and four heli-tack firefighters on board. About 20 minutes into the flight, as the helicopter was cruising at about 1500 feet above ground, the pilot initiated a rapid descent to just above the tree tops, and lost control of the helicopter when he attempted to level off. The helicopter rolled right, nosed down, struck the marshy terrain, and rolled over onto its left side. One passenger was fatally injured, and the other occupants were seriously injured. One of the passengers manually switched on the emergency locator transmitter, while another passenger contacted the forestry radio dispatcher on his radio. Rescue helicopters were dispatched immediately and arrived at the accident site within an hour. The time of occurrence was about 2000 mountain daylight time.

Ce rapport est également disponible en français.

Other Factual Information

The pilot arrived at the Phoenix Heli-Flight Inc. (PH-F) hangar, by the Fort McMurray Airport, at about 0900 mountain daylight time. [1] After a pre-flight inspection of C-FHLF, he departed for the Alberta Sustainable Resource Development (ASRD) warehouse, across the airport from the hangar, at about 1000 to pick up a crew of Forest Protection Division (FPD) firefighters. Shortly after 1100, he departed with four passengers and their gear for Johnson Lake, where he landed at the airstrip and refuelled before repositioning to the forestry tower. After standing by all day, the pilot departed the tower at about 1940 with three passengers, and flew back to the airstrip, where he picked up the fourth passenger before departing for Fort McMurray.

The flight initially climbed to, and cruised at, an altitude of about 1500 feet above ground level (agl). About 20 minutes later, the pilot descended to a lower altitude to observe wildlife. He did not notify the unit leader or consult with the passengers. Instead of lowering the collective to descend, the pilot pushed the cyclic forward to lower the nose of the helicopter and increase the airspeed. On reaching an altitude just above the tree tops, the pilot attempted to level off by raising the collective slightly and pulling back on the cyclic. However, the cyclic control could not be moved. As the pilot continued to pull back on the cyclic with both hands, the helicopter rolled to the right, pitched up, then dove into the ground and came to rest on its left side. The passenger in the left rear seat was ejected from the helicopter when his inboard seat-belt attachment failed, and he became trapped under the fuselage.

The helicopter had a Blue Sky flight tracking transmitter on board, which transmitted the flight's position, altitude, and heading approximately every two minutes to the operator's base. The last transmission was at 1956:48, at a position about two nautical miles (nm) northeast of the accident site. This information enabled the rescue helicopters to quickly locate the downed helicopter.

The pilot was certified and qualified for the flight in accordance with existing regulations. He had a total time of about 1800 hours, with about 80 hours on type. The pilot arrived at the airport well rested. After arriving at the staging site, the pilot spent most of the day relaxing and had the opportunity to rest before the return flight.

Awareness of servo transparency and recovery was part of the pilot's initial and recurrent ground training on the AS350 series helicopters. It was reported that the pilot had previously flown in a similar manner on other flights when transiting between bases, with sudden climbs, descents, and pull-ups. Some of the passengers reportedly were discomforted by the manoeuvres; however, no complaints were submitted to the management at ASRD or PH-F.

The terms servo transparency, servo reversibility, and jack stall all refer to the phenomenon whereby the aerodynamic forces on the rotor blades can exceed the opposing power of the hydraulic servos to control the blade pitch. This phenomenon can occur in any helicopter that has hydraulically actuated flight controls. Factors that affect servo transparency are as follows: high airspeed, high collective pitch, high gross weight, high g loads, and high density altitudes. The maximum force the servo actuators can produce is constant, and is a function of hydraulic

---

[1] All times are mountain daylight time (Coordinated Universal Time minus six hours).

pressure, the servo characteristics, and possibly the level of maintenance of the system. All components of the hydraulic system, with emphasis on the servos, were examined after the wreckage was recovered to Fort McMurray. No anomalies were found.

The manufacturer has stated that the transparency phenomenon in AS350s is non-violent and transitory, and normally lasts for a period of two to three seconds. The controls are fully operable throughout the event. However, the force required to move the controls increases significantly, to the extent that an unknowing pilot may think that the controls are jammed. On AS350s with a clockwise main rotor rotation (as viewed from above), the right servo receives the highest load; therefore, servo transparency will result in an uncommanded cyclic movement to the right and aft. This will cause the aircraft to roll to the right and pitch up. Normal recovery procedure is to decrease the aerodynamic load on the main rotor by lowering the collective. Depending on the aircraft weight, speed, and atmospheric conditions, the manufacturer has calculated that servo transparency can occur at g loads as low as 1.5 g.

On 14 May 2007, the Australian Civil Aviation Safety Authority issued Airworthiness Bulletin (AWB) 27-008, based on Federal Aviation Administration Special Airworthiness Bulletin (SAIB) SW-04-35 issued on 19 December 2002. These bulletins reference Eurocopter Service Letters 1648-29-03 for the Astar (AS350) family and 1649-29-03 for the Colibri (EC120) family, and provide detailed information on servo transparency, as well as recommendations to reduce the possibility of encountering the phenomenon.

Weather conditions at the time of the occurrence were recorded at Fort McMurray (approximately 35 nm south of the accident site) and were as follows: wind 240° true (T) at 5 knots, visibility 15 statute miles (sm), temperature 29°C, dew point 11°C, altimeter setting 29.78 inches of mercury (Hg). The cloud composition was few at 9000 feet agl, and a scattered layer at 14 000 feet agl, with 2 octa altocumulus. The occurrence site elevation was 1858 feet above sea level (asl), and the density altitude was calculated to be about 4140 feet.

The passengers and cargo weights were not recorded at the warehouse before departure, and the pilot did not receive a manifest of passenger and cargo weights as required by ASRD Standard Operating Procedure (SOP) 6.11. ASRD had advised the TSB, as per its letter of 11 December 2006 in response to the Safety Action resulting from investigation A06W0104, that an SOP had been implemented for providing accurate weights to the pilot for determining the aircraft weight and balance. ASRD Aircraft Management SOP 6.11, ASRD Representative Responsibility, specifies:

> The SRD representative responsible for a flight (e.g. Crew Leader, Loadmaster, Wildfire Ranger, Forest Officer, etc.) is responsible for providing the pilot with a complete passenger / cargo manifest including accurate weights, and advise the pilot of all dangerous goods being carried. The Passenger/Cargo/Weights form can be used to record the information given to the pilot.

The pilot did not complete a weight and balance report for the flight, and estimated the weights based on previous flights. He used the highest load weight of 860 pounds to informally ascertain whether the helicopter would be exceeding its gross weight. The weight of C-FHLF at

the time of the occurrence was calculated by investigators to be 4389 pounds, and the centre of gravity (CG) was 126.9 inches aft of the datum. Maximum allowable gross weight was 4600 pounds and the CG limits were from 125 inches to 136 inches aft of the datum.

Analysis

The atmospheric conditions, aircraft weight, and the pilot's manoeuvres at the time of the occurrence were conducive to the onset of servo transparency, a phenomenon the pilot was aware of, and had been trained to recognize. He was not able to translate his training into a conditioned response; to lower the collective instead of fighting the cyclic, when the event occurred. The altitude and proximity to the trees at which the pull-up was initiated did not allow sufficient time for the pilot to correct his initial reaction. Servo transparency in AS350s is a well-known phenomenon and the recent service letters and airworthiness bulletins emphasize the need for operators and pilots to be more actively aware of the onset conditions and recovery procedures.

The passengers were not weighed, nor were the weights recorded or presented to the pilot, who did not complete an accurate weight and balance report before departure. These actions created the potential for the weight and balance to be outside allowable limits. This in turn introduces a risk that the helicopter performance could be affected. The gross weight, one of the factors affecting the onset of servo transparency, needs to be closely monitored by the pilot.

Findings as to Causes and Contributing Factors

1. The pilot initiated a sudden high-speed descent, and experienced a loss of control due to servo transparency when he attempted to level off at the bottom of the descent.

2. The pilot did not initiate the correct recovery procedure when servo transparency was experienced and, due to the proximity to the trees, insufficient time remained for the pilot to correct his initial reaction.

Findings as to Risk

1. The pilot had previously initiated sudden climbs and high-speed descents that were not standard operating procedures. These manoeuvres had not been reported to Alberta Sustainable Resource Development (ASRD) or to the helicopter operator.

2. The pilot did not complete a weight and balance report before departure. Therefore, the pilot could not confirm if the helicopter was being operated within allowable limits.

Safety Action Taken

Alberta Sustainable Resource Development (ASRD) amended its Representative Responsibility Standard Operating Procedure (SOP) with the addition of the following:

> 6.5 Passenger and Cargo Weights
>
> The SRD representative responsible for a flight (e.g. Crew leader, Loadmaster, Biologist, Forest/ Fish and Wildlife Officer, etc.), is responsible for providing the pilot with a complete SRD passenger / cargo (including external sling net loads) manifest including accurate weights, and advising the pilot of all dangerous goods being carried.
>
> For flights departing from a permanent facility, (examples Office, Warehouse, Hanger, Air tanker Base, Lookout or Primary Fire Base) passengers and cargo will be weighed, on a scale, at the beginning of the day or first flight of the day. Subsequent flights will have weights adjusted for changes resulting in an increased payload such as wet hose, additional cargo, or additional or switching of passenger numbers, etc. The passenger manifest and total QRD payload on board the aircraft is to be conveyed to the originating radio room or person responsible for initiating flight following. In addition a Passenger / Cargo Manifest / Weights (FP249) form, with all weights recorded, must be retained at the facility for a period of at least 60 days.
>
> For flights originating from remote location (example, MPB crews, surveyors, Crew pick up on Type 3 and 4 fires, from the "line" on Type 1 and 2 incidents) passengers will provide to the pilot their most recent "seat" weight that was measured on a weigh scale. Cargo maybe estimated using weights from the pilot's handbook of actual weights recorded on the equipment The passenger manifest and total SRD payload on board the aircraft is to be conveyed to the radio room or person providing flight following.
>
> For flights on Type 1 and 2 incidents, departing from a helibase or helispot associated with base camp or a line camp, all passengers and cargo will be weighed on a scale and information provided to the pilot on FP249. The passenger manifest and total SRD payload on board the aircraft is to be conveyed to the radio room for the incident. In addition a Passenger / Cargo Manifest / Weights (FP249) form, with all weights recorded, must be retained at the helibase or line camp, and provided to the Documentation unit within 24 hours.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 10 June 2008.