AVIATION INVESTIGATION REPORT
A02P0256

COLLISION WITH WATER

PRISM HELICOPTERS LIMITED
MD HELICOPTERS 369D C-FLDW
PORCHER INLET, BRITISH COLUMBIA
15 OCTOBER 2002

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.

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Summary

The MD Helicopters 369D helicopter, C-FLDW, serial number 280258D, departed Terrace, British Columbia, at 0747 Pacific daylight time and proceeded southwest along the Skeena River, en route to Sandspit. The aircraft did not arrive at Sandspit in accordance with the flight-planned times, so a search was initiated. Department of National Defence search and rescue resources found debris on the western and northern shore of Porcher Inlet, about 22 nautical miles south of Prince Rupert. The debris was positively linked to the missing helicopter. Oil and bubbles observed on the surface of the inlet identified the most likely position of the airframe and engine, in a location where the water was more than 500 feet deep. The pilot, the only person on board, was not found despite a search of the water surface and land areas in the vicinity. Several boats remained in the inlet overnight to watch for fires or flares, but none was seen. The helicopter wreckage was later recovered for examination.

Ce rapport est également disponible en français.

Other Factual Information

The pilot was scheduled to fly the helicopter to Sandspit in the Queen Charlotte Islands in northwestern British Columbia and then to complete two to three days of shake-block operations. This trip had been scheduled in advance and followed three days of off-duty rest time for the pilot.

The pilot had been operating out of Terrace for four years and was familiar with the route to Sandspit and the shake-block operation in the Queen Charlotte Islands. His usual route of flight to the Queen Charlottes was southwest along the Skeena River, south to Bonilla Island light station, and then direct to Sandspit Airport (see route depiction at Appendix A). He filed a flight plan with the Terrace Flight Service Station, giving the route and time for the flight and indicated that he would cross to Sandspit at 1000 feet, weather permitting. The pilot indicated on his flight plan that the helicopter had two hours of fuel on board (a full fuel load) at the commencement of the flight.

The following were the reported weather conditions at locations en route:

Terrace Airport (departure airport)

> 0747 Pacific daylight time:[1] Ceiling 500 feet broken, visibility ½ statute mile (sm) in light drizzle and fog.

Prince Rupert Airport (en route)

> 0800: Wind calm, visibility 1⅛ sm in light drizzle, ceiling zero, temperature and dew point 10°C.
> 0806: Wind calm, visibility 1¼ sm, 100 feet overcast, temperature and dew point 10°C.
> 0817: Wind calm, visibility 2 sm, 100 feet overcast, temperature and dew point 10°C.
> 0820: Wind calm, visibility 1½ sm in light drizzle, 100 feet overcast, temperature and dew point 10°C.

Bonilla Island light station (en route waypoint)

> 0730: Ceiling 400 feet overcast, temperature and dew point 11°C.
> 0800: Sky overcast, visibility 2 sm in light drizzle and fog, wind northeast at 2 knots, seas rippled, low swell.

Sandspit Airport (destination airport)

> 1000: Wind 270° at 9 knots, visibility 20 sm, a few clouds at 3000 feet and 4500 feet, scattered cloud at 21000 feet.

The weather in Terrace at the time of departure required a special visual flight rules (SVFR) clearance for flight within the control zone. The pilot requested and received a clearance to depart the zone under the provisions of SVFR. Along with that clearance, the pilot was passed the latest Terrace weather information.
Once clear of the Terrace control zone, and while operating in uncontrolled airspace, the pilot required a minimum of ½ sm visibility and was required to remain clear of cloud. Specific information about the en route

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

weather for the pilot's selected route is limited, and the appropriateness of the weather conditions throughout the flight would have been based on the pilot's judgement. However, it is known that the weather conditions being reported at Bonilla Island light station and Sandspit Airport were above the minima required by regulation. Operations within the control zone at Terrace Airport required SVFR clearances because of reduced visibility in fog. The Prince Rupert weather had been below the minimum required for visual flight, but the visibility had raised to about 1½ sm by the time the flight reached the Prince Rupert area, near the mouth of the Skeena River. The pilot's planned flight would have kept him clear of the Prince Rupert control zone. The Prince Rupert Flight Service Station did not have any radio communication with the pilot of the occurrence helicopter.

TSB investigators could find no record of the pilot obtaining a formal weather briefing before take-off. The aircraft was equipped with an FM transceiver, allowing the pilot to receive weather information from the continuous marine weather broadcast system. However, none of the radio's pre-set channels corresponded to weather broadcast frequencies that covered the intended route of the flight.

When operating under visual conditions, it is possible for a helicopter pilot to readily detect small changes in flight attitude and helicopter motion and to respond with appropriate corrections. However, if visual reference with the terrain is lost, a pilot's ability to detect a displacement in aircraft attitude is degraded. Under those conditions, by the time the need for a correction becomes evident, a pilot's instinctive tendency is to make a larger and more rapid control movement than necessary. This type of response, when coupled with the inherent instability of a helicopter, usually leads to over-controlling. Unless the pilot can re-establish visual reference with the ground, over-controlling can rapidly develop, to the point where the pilot may lose control of the helicopter.

The occurrence helicopter was certificated only for visual flight. Transport Canada had also authorized low-visibility operations, down to visibility of ½ sm, provided that the pilot had 500 hours of pilot-in-command time, had completed a pilot decision-making course, and had received low-visibility training as outlined in the company operations manual. The occurrence pilot met all of these conditions.

Much of a helicopter's operational flying is carried out close to the ground or water. When operating at low altitude, and especially in reduced visibility, the company practice is to reduce forward speed sufficiently to allow for a quick stop within the visibility distance that is available. This procedure allows a pilot to maintain visual reference with the ground and reduces the risk of inadvertently entering cloud.

Based on sightings of the helicopter en route, and on subsequent calculations of time and distance, the helicopter was travelling at an average speed of about 70 knots. The flight manual for the helicopter lists its best-range speed as 116 to 119 knots for the temperature, weight, and altitude conditions of the flight. The reduced speed noted in the post-accident calculations is consistent with a pilot's typical response to degraded visibility. Operating at reduced speed increases fuel consumption and the flight time to the destination and, therefore, decreases the fuel reserves.

The helicopter was equipped with a VHF transceiver that operated in the aviation band and a VHF/FM transceiver that operated in the marine band. The VHF transceiver was known to have been working at the time the helicopter departed from Terrace. After departure, there were no further reported communications with the pilot.

The Canadian Coast Guard (CCG) provides continuous communication service on VHF channel 16 (156.8 MHz), which has been designated for distress and safety calls. This frequency is monitored by shipping traffic,

local pleasure boats, and personnel at the Bonilla Island light station. In addition to channel 16, the CCG uses channel 22A (157.1 MHz) as a working frequency. There is no known report of any communications with the occurrence pilot on these marine band frequencies.

Radar data is unavailable for this flight. NAV CANADA's aviation radar site covering the north coast region of British Columbia is located at Sandspit; however, it cannot monitor low-altitude flights in the Prince Rupert area below about 1800 feet. The CCG has no ground-based marine radar resources in the north coast region.

"Glassy water" is a natural phenomenon that occurs under certain combinations of wind and lighting conditions. When the water's surface becomes glassy, it loses its visual texture and takes on a mirror-like appearance. Glassy water degrades or removes the normal visual cues that are necessary to allow a pilot to monitor and control the helicopter's height and motion.

Glassy water is normally associated with wind speeds between calm and two knots. Winds greater than two knots cause ripples on the surface of the water, aiding pilots' depth perception. Overcast sky conditions compound these problems by muting the natural light and reducing surface reflections. Although flight at low level over glassy water is possible, the risk of misjudging altitude and inadvertently contacting the water is significant.

Wind in the Prince Rupert area was reportedly calm. Bonilla Island light station was reporting a northeast wind at two knots, with the seas slightly rippled. Porcher Inlet is south of Prince Rupert, between Prince Rupert and Bonilla Island. The inlet is sheltered on three sides by high terrain and was under the influence of the same air mass. All of these factors would increase the potential for glassy water near the occurrence site.

The main part of the fuselage was recovered from about 530 feet of water. The recovered pieces included the passenger compartment, engine, transmission, drive shaft components, main-rotor hub, collective and cyclic linkages, and one main-rotor blade. The instrument panel, various pieces of aircraft equipment, and personal effects were recovered during the initial search. A number of major components, including the tail-rotor section, were found and identified near the wreckage but were not recovered.

The recovered wreckage was examined to the extent possible. Destruction of the forward fuselage and cockpit area prohibited inspection of the pilot's controls. Major fracture surfaces had been contaminated by salt-water corrosion. The drive shafts that connect the engine to the main transmission and the transmission to the tail rotor were broken in torsional overload, consistent with a sudden stoppage while being powered.

The skid gear had been torn off in a rearward direction. A crush line showing a secondary impact with the passenger cabin indicates that the helicopter tipped forward and left after contact with the water. The cockpit section of the helicopter was destroyed back to the bulkhead. The main-rotor blade that was recovered was attached to the rotor hub and bent in overload. The remaining four main-rotor blades had all broken in overload at the main-rotor hub.

Inspection of the instrument panel revealed that the transponder had been selected to code 1200 (normal VFR code). In the event of an emergency, pilots can select other discrete codes to advise air traffic controllers of their situation. The altimeter subscale was set to the Prince Rupert altimeter setting of 30.31 inches of mercury.

Post-accident examination of recovered wreckage also revealed the following:

1. The three lights used for backlighting the transponder panel showed signs of overheating. The light bulb closest to the power switch had the greatest amount of heat damage and had melted (fused) to the plastic of the power selector switch. From the impression left by the bulb on the power switch, heating likely occurred during the last flight.

2. There are indications that two of the four bulbs associated with the tail-rotor chip light were illuminated at impact. Item 2-14, "Chip Detector Caution Indication," of the approved rotorcraft flight manual states in part:

   A caution light on the instrument panel comes on to indicate possible internal deterioration of the. . . tail rotor transmission.
   a. Land as soon as possible if light comes on in flight.

Analysis

The pilot deviated from his flight-planned route at some point between the mouth of the Skeena River and the Bonilla Island light station. His new path diverged west from his flight-planned route, taking the helicopter over the town of Kitkatla, then northwest along the Kitkatla Inlet and, ultimately, north to the occurrence site near the centre of Porcher Inlet.

The reason for the change in routing could not be determined. However, there are indications that this diversion was not related to an emergency event. Specifically, had a critical emergency occurred, the pilot would have landed immediately. No distress calls were received by the Prince Rupert Flight Service Station or the light station at Bonilla Island, and none were reported as being heard by anyone else. Further, the helicopter's transponder was selected to the normal VFR (1200) code rather than an emergency code.

The diversion from the expected routing appeared to be taking the helicopter north on a direct course toward Prince Rupert. That decision to divert was likely based on some combination of the following factors:

1. Fuel consumption would have been higher than originally planned because of the helicopter's slower progress in reduced visibility.

2. The weather and water conditions may not have improved sufficiently for the pilot to make the crossing from Bonilla Island light station to Sandspit as planned. The pilot had indicated when flight planning that he intended to cross to the Queen Charlotte Islands at 1000 feet, weather permitting. However, the most recent coastal weather observations were reporting overcast ceilings between 100 and 400 feet.

3. It is possible that the transponder failed in-flight and involved an unusual smell, fumes, or heat.

4. It is possible that the tail-rotor chip light illuminated, precipitating a decision to divert. This supposition is less likely, because a typical response to a tail-rotor chip warning light would be an immediate landing rather than a diversion.

The diversion toward Prince Rupert took the helicopter over Kitkatla and then north through Porcher Inlet. Although this is the most direct route to Prince Rupert, low-level flight through the Porcher Inlet region would have presented additional elevated risks. Specifically,

1. Low ceilings would restrict the height available to manoeuvre the helicopter and would cause the pilot to operate close to the water.

2. Winds in the region were calm, and because of the surrounding terrain features, it is likely that the sheltered water in Porcher Inlet was glassy.

3. Glassy water degrades or removes the normal visual cues that are necessary for a pilot to monitor and control a helicopter's height and motion.

The event leading to the collision with the water was not determined. The damage to the main-rotor blades and the drive shaft components between the engine, main-rotor transmission, and tail-rotor sections was consistent with the helicopter operating with power at the time of the occurrence. The extensive damage to the cockpit area, the main fuselage floor, and the skid gear indicate that the helicopter was at high speed and in a left-bank, nose-low attitude at impact. The accident was not survivable.

Some insight into an accident can be gained from an evaluation of crash dynamics, wreckage distribution, and damage pattern. In this particular accident,

1. The severe damage to the cockpit area is not consistent with an autorotation event, which typically causes increased crush to the underside of the machine and considerably less damage to the cockpit area.

2. The wreckage distribution is not consistent with an in-flight breakup because most components were near the main wreckage.

3. The probability of a main-rotor blade failure is low. More typically, an in-flight main-rotor blade failure leaves a clean break, perpendicular to the leading edge of the failed blade. The stub section of the failed blade remains attached to the hub, with the remaining blades breaking away in overload. In this instance, the remaining blade was intact and was damaged in overload.

All indications are that the helicopter was serviceable at the time of the occurrence. As well, there is no indication that the pilot experienced some extreme emergency that caused the helicopter to crash. The pilot

most likely inadvertently flew into the water because the glassy water and low cloud made it difficult or impossible for him to judge the helicopter's height above the water. This occurrence is therefore considered a controlled-flight-into-terrain accident. The pilot was possibly distracted by the transponder malfunction or the tail-rotor chip light.

Findings as to Causes and Contributing Factors

1. The pilot most likely inadvertently flew into the water because the glassy water and low cloud made it difficult or impossible for him to judge the helicopter's height above the water—a controlled-flight-into-terrain accident.

Other Findings

1. At some undetermined time, light bulbs on the transponder were subjected to an over-voltage that melted plastic components behind the face plate of the transponder and fused the ON/OFF selector switch to the *altitude* (ALT) position.

2. The pilot was possibly distracted by the transponder malfunction or the tail-rotor chip light.

This report concludes the TSB's investigation into this occurrence. Consequently, the Board authorized the release of this report on 06 November 2003.

Visit the TSB's Web site (www.tsb.gc.ca) for information about the TSB and its products and services. There you will also find links to other safety organizations and related sites.

Appendix A: Flight-Planned Route