



Douglas DC-3 Strikes Hill During Night Cargo Flight

Investigators concluded that the controlled-flight-into-terrain (CFIT) accident occurred because the flight crew conducted a night visual flight rules (VFR) operation beneath a low ceiling and below Canadian obstacle-clearance-height requirements.

FSF Editorial Staff

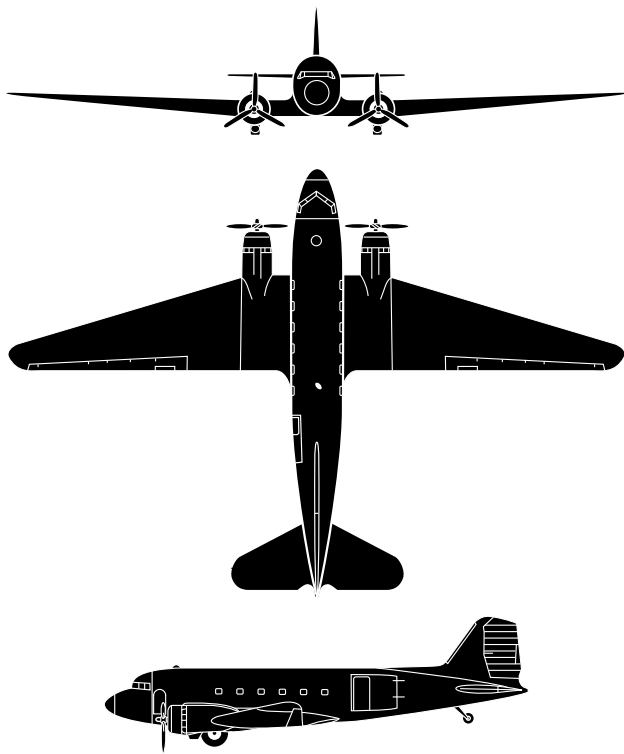
At 0633 local time Jan. 13, 1999, a Douglas DC-3C operated by Kelowna Flightcraft Air Charter on a night visual flight rules (VFR) cargo flight from Vancouver, British Columbia, Canada, to Victoria, struck trees on a hill on Mayne Island, about 14 nautical miles (26 kilometers) north of Victoria International Airport. The initial impact occurred at about 900 feet. The airplane then descended into a valley, struck the ground and burned. Both pilots were killed.

The Transportation Safety Board of Canada (TSB) said, in its final report, that the accident investigation resulted in the following conclusions:

- “The accident flight was not conducted in accordance with the night obstacle-clearance requirements of Canadian Aviation Regulation (CAR) 705.32;
- “The Kelowna Flightcraft company operations manual did not reflect the restrictive conditions imposed on night [VFR] flight by CAR 705.32. Such information might have prevented the accident by ensuring the crew’s awareness of those night obstacle-clearance requirements;



- “As the aircraft approached Mayne Island, it encountered a low cloud ceiling that was based about 800 feet and that reduced visual reference with the surface;
- “When the aircraft struck trees, it was being flown in controlled, level flight at an altitude below the surrounding terrain;
- “The aircraft was not equipped with a ground-proximity warning system [GPWS] or any other similar system that could warn the crew of an impending collision with terrain. Such systems were not required by regulation;
- “Kelowna Flightcraft flight operations personnel were not aware that most of the DC-3 flights were being conducted under VFR;
- “First responders were not aware of the presence of dangerous goods [aboard the aircraft] and were, therefore, at increased risk during their response activities on the site; [and,]
- “Transport Canada officials responsible for monitoring this operation were not aware that most of the DC-3



Douglas DC-3

The Douglas Aircraft DC-3 first flew Dec. 17, 1935. The airplane has accommodations for three crewmembers and 21 to 28 seated passengers, 14 passengers in sleeper berths or 3,725 pounds to 4,500 pounds (1,690 kilograms to 2,041 kilograms) of cargo.

The DC-3 is powered by two 1,200-horsepower (895-kilowatt) Wright Cyclone radial engines. Gross weight is 30,000 pounds (13,608 kilograms). Service ceiling is 20,800 feet. Maximum speed is 192 miles per hour, and maximum range is 1,495 miles (2,405 kilometers).♦

Source: The Boeing Co.

flights were being conducted under VFR at night and below the required obstacle-clearance altitudes.”

For about 10 months before the accident, Kelowna Flightcraft had conducted flights chartered by Purolator Courier to transport cargo between Vancouver, which is on the southwestern coast of Canada, to Nanaimo [about 40 nautical miles (74 kilometers) west of Vancouver on the eastern coast of Vancouver Island]. The accident airplane occasionally was chartered by Purolator to fly cargo to Victoria [about 60 nautical miles (111 kilometers) south of Nanaimo on Vancouver Island].

On the day of the accident, the flight crew was scheduled to fly the airplane from Vancouver to Nanaimo. Because of a delay in the arrival of a Purolator airplane in Vancouver,

however, the route was changed; the DC-3 was dispatched to fly from Vancouver to Victoria and then to Nanaimo.

“Warning of this route change was passed to the crewmembers with their preflight planning package, which included filed instrument flight rules (IFR) flight plans for the Vancouver-to-Victoria and Victoria-to-Nanaimo legs of the trip,” the report said.

The flight crew received the preflight planning package at 0530. Weather information in the preflight planning package included a terminal forecast indicating that ceilings as low as 2,000 feet were expected at Victoria.

The terminal forecast for Victoria was amended at 0550 to indicate that temporary ceilings as low as 800 feet could be expected.

“It was not determined whether the crewmembers received this updated information, because the amendment to the Victoria terminal forecast occurred while they were completing their preflight planning activities,” the report said.

Both pilots held Canadian airline transport pilot licenses and were qualified DC-3 captains. The captain of the accident flight was 55 years old and had 18,000 flight hours, including 9,500 flight hours in type. Before being employed by Kelowna Flightcraft, the captain had owned and operated a commercial aviation business “and was experienced in managing flight operations,” the report said.

The first officer, 50, had 9,000 flight hours, including more than 430 flight hours in type.

“He had acquired about 430 hours on DC-3 aircraft while employed with Kelowna Flightcraft,” the report said. “In addition, he had about six years of previous experience on DC-3s while serving with the Canadian Forces (hours on type undetermined). As a military pilot, he had been involved in maritime [operations] and search-and-rescue operations over his 20-year career and had held positions as a flight safety officer, instructor and instrument check pilot on the DC-3.”

The report said, “Company officials described both pilots as competent, reliable and mature employees who had demonstrated an ability to operate the aircraft in a safe and efficient manner. From all indications, they were both well rested before commencing duty on the day of the occurrence.”

The DC-3 was manufactured in 1944 and was purchased by Kelowna Flightcraft in the late 1980s. The airplane had accumulated more than 20,100 hours of service.

“It was inspected and maintained daily by a maintenance team in Vancouver,” the report said. “No maintenance issues were outstanding at the time of the accident.”

The airplane was not equipped with (and was not required to be equipped with) a flight data recorder, cockpit voice recorder or GPWS. CAR 605.37 requires GPWS in turbojet aircraft over 33,069 pounds (15,000 kilograms) and certified to carry 10 or more passengers.

“GPWS equipment is a recognized defense against CFIT [controlled-flight-into-terrain] accidents,” the report said. “Had this type of equipment been installed on the accident aircraft, the likelihood of this accident occurring would have been reduced.”

[CFIT occurs when an airworthy aircraft under the control of the flight crew is flown unintentionally into terrain, obstacles or water, usually with no prior awareness by the crew.]

The report said, “Between 1976 and 1990, there were 170 CFIT accidents, with 152 fatalities, involving Canadian-registered, commercially operated small aircraft. ... Since GPWS became mandatory equipment on larger passenger-carrying aircraft, the number of CFIT accidents has decreased markedly for these aircraft. However, smaller aircraft do not require this type of warning equipment.

“The Flight Safety Foundation in the United States recognizes CFIT as the single greatest risk to aircraft, crews and passengers. ... The Air Line Pilots Association [International] has expressed similar safety concerns and supports a position that all commercial aircraft should be equipped with some form of terrain [awareness and] warning system, regardless of power plant type.”

[*Terrain awareness and warning system* (TAWS) is the term used by the European Joint Aviation Authorities and the U.S. Federal Aviation Administration (FAA) to describe equipment meeting International Civil Aviation Organization standards and recommendations for GPWS equipment that provides predictive terrain-hazard warnings; enhanced GPWS and ground collision avoidance system are other terms used to describe TAWS equipment.]

The airplane was within weight-and-balance limits. The load manifest indicated that the cargo weighed 5,052 pounds (2,292 kilograms) and included four items classified as “dangerous goods.”

“The dangerous goods had been packaged and loaded by Purolator and were accepted by the crew before the flight,” the report said.

During his first radio communication with air traffic control (ATC), the captain canceled his IFR flight plan and said that the flight to Victoria would be conducted VFR. Vancouver Tower cleared the flight crew for takeoff at 0622.

At the time, Vancouver had 10 statute miles (16 kilometers) visibility, a few clouds at 800 feet, scattered clouds at 1,500 feet and an overcast ceiling at 4,700 feet.

After departing from Runway 26L, the crew conducted a left turn over the Strait of Georgia and flew south toward the Active Pass NDB (nondirectional beacon), which is on the northern end of Mayne Island [about 23 nautical miles (43 kilometers) south of Vancouver].

The captain requested 1,000 feet as the cruise altitude, and ATC approved the request. ATC radar data showed that the airplane climbed to 1,000 feet and accelerated to a groundspeed of 130 knots.

“The aircraft left the Vancouver control zone at 0626 and entered Class E (controlled) airspace,” the report said. “There are no special requirements for VFR aircraft operating within this class of airspace, nor are any specific services required of the [ATC] system.”

The airplane was near the northern coast of Mayne Island when it descended to 900 feet. The airplane passed 0.25 nautical mile (0.46 kilometer) west of Active Pass NDB at 0632. About one minute later, the airplane descended to 800 feet. Nine seconds later, the airplane climbed to 900 feet. The accident occurred soon thereafter.

The airplane struck trees 60 feet (18 meters) above the crest of a ridge on Mount Parke. The diameter of the trees ranged from five inches to 15 inches (13 centimeters to 38 centimeters).

“The swath cut through the treetops was about 200 feet [61 meters] long and 70 feet [21 meters] wide,” the report said. “Aircraft wreckage found at the base of the trees along the crash swath included the following items:

- “The outer portions of the left and right wings, 19 [feet] and 11 feet [5.8 meters and 3.4 meters] long, respectively, including their wing tips and ailerons;
- “Pieces of engine cowl, including cowl flaps;
- “The outboard four feet [1.2 meters] of one horizontal stabilizer;
- “Portions of both elevators; and,
- “Assorted small pieces, such as [Plexiglas].”

The airplane then descended about 600 feet [183 meters] to the valley floor. The airplane was destroyed by the impact and post-accident fire. Debris damaged an unoccupied house and destroyed an outbuilding.

“The initial impact with the trees violated the integrity of the cockpit,” the report said. “The subsequent impact with the

terrain and the post-crash fire are characteristic of an accident that is not survivable.”

Weather conditions at Victoria had deteriorated during the flight. When the crew departed from Vancouver, Victoria ATIS [automatic terminal information service] was reporting a 1,000-foot ceiling and 12 miles (19 kilometers) visibility.

“Other pilots who had flown with this crew reported that the crew’s routine was to tune in to the Victoria ATIS on the ground at Vancouver (before departure) to receive the ATIS message as soon as possible after takeoff,” the report said.

A special weather observation at 0621 indicated that Victoria had 12 miles (19 kilometers) visibility, a few clouds at 400 feet and an overcast ceiling at 800 feet.

“The 800-foot overcast ceiling reported in this observation was worse than the forecast conditions provided in the preflight planning package but was consistent with the amended terminal forecast issued at 0550,” the report said. “Updated weather information for the Victoria airport was available to the crew of the accident aircraft before departure and while in flight from Vancouver Tower, Victoria ATIS, Victoria Terminal, Victoria Tower and any flight service station (FSS) that was within range of their radio transmitters (that is, Victoria FSS, Vancouver FSS or Nanaimo FSS).

“The TSB could find no communication record showing that the crew ... contacted any of these above-mentioned agencies for updated weather at Victoria.”

Based on the special observation at 0621, Victoria ATIS was changed at 0628 to indicate that the ceiling had lowered to 800 feet.

“A professional mariner on a vessel in Plumper Sound [southeast of Mayne Island] reported that the lights on a marine radar tower and a communications tower colocated at the top of Mount Parke ... were obscured by a low cloud layer and, thus, not visible at the time of the accident,” the report said. “In addition, all of Heck Hill, southeast of Mount Parke, was just visible in haze.

“Based on these observations, the ceiling over Mayne Island was estimated at about 800 feet ASL [above sea level].”

The report said that CAR 705.32 requires that night VFR flights be conducted at least 2,000 feet above all obstacles within five nautical miles (nine kilometers).

“The highest obstacle along the accident aircraft’s track to the accident site is 1,040 feet ASL,” the report said.

“Consequently, to comply with this regulation, this crew would have been required to fly at 3,040 feet ASL or above. CAR 705.32 was not being adhered to on the night of the accident.

“A review and integration of NavCanada aircraft-movement reports, recorded radar data and eyewitness statements revealed that the Kelowna Flightcraft DC-3 crews on this route consistently canceled their IFR [flight] plans and proceeded under VFR, as they did on the night of the accident.

“Additionally, based on available information, most night VFR flights conducted by this aircraft over the two-month period preceding the accident were not in accordance with CAR 705.32.”

The obstacle-clearance requirements of CAR 705.32 were not included in Kelowna Flightcraft’s operations manual. The report said that a similar deficiency in a company operations manual was found during investigation of a previous accident.

[The accident occurred about 1817 on Oct. 30, 1997. A Piper Seneca struck terrain at about 1,540 feet during a night VFR charter flight from Fort McMurray, Alberta, to La Loche, Saskatchewan. The pilot and two passengers were killed; three passengers were seriously injured. TSB said, in its final report, that the cause of the accident was the pilot’s “continued flight into adverse weather and lighting conditions, which did not enable him to avoid collision with terrain. Contributing factors to this occurrence were the aircraft’s unserviceability for single-pilot IFR flight and the lack of guidance to company pilots as to weather limits for night VFR flight.”]

The report said that when the Canadian Aviation Regulations (CARs) were introduced in the mid-1990s, Transport Canada (TC) issued a sample company operations manual to Pacific Region air carriers, including Kelowna Flightcraft, to help the air carriers develop operations manuals that complied with the CARs.

“The sample [operations manual] produced by TC did not include references to CAR 705.32 on minimum obstacle-clearance requirements for night VFR operations,” the report said.

“In addition, TC provided advance notice that the generic operations manual would be amended on the next cycle to include all relevant regulations related to night VFR flight by commercial operators.”

The first people at the accident site, including Canadian Department of National Defence search-and-rescue personnel, did not know that the aircraft had dangerous goods aboard.

[The report did not identify the dangerous goods.] The report said that aircraft operators in Canada and the United States transport dangerous goods (called hazardous materials in the United States) according to requirements and procedures established by the International Air Transport Association (IATA).

“In general terms, the [IATA] procedures involved in the transportation of dangerous goods are aimed at ensuring [that] all links in the transportation chain know what dangerous goods they are transporting, how to properly load and handle them, and what to do if an incident or an accident occurs either in flight or on the ground,” the report said. “The accident flight was transporting small amounts of dangerous goods. Although personnel involved in the transportation industry were aware of the items, the first responders were not aware of the presence of the dangerous goods; therefore, they were at an increased risk during their response activities on the site.”

The report said that the following actions were taken after the accident:

- “The Kelowna Flightcraft company operations manual was amended on 14 January 1999 to reflect the restrictive conditions imposed on night [VFR] flight by CAR 705.32;
- “Kelowna Flightcraft issued a memorandum to all its pilots on 15 January 1999 to highlight the minimum obstacle-clearance regulations related to [CARs] Part VII [*Commercial Air Services*] operators. The memorandum additionally stated that, until further notice, night VFR flights are not authorized without the consent of the director of flight operations or the company chief pilot;
- “Kelowna Flightcraft installed an Internet-based flight-monitoring system into its system operations control. This system, called Flight Explorer, allows for real-time monitoring of company aircraft while in flight and displays a number of operational parameters, including ... aircraft type, departure time, route of flight, altitude and estimated time of arrival;
- “[TC] issued *Commercial and Business Aviation Advisory Circular (CBAAC)* number 0153, dated 12 March 1999, reiterating the CARs requirements for night VFR operations and providing advance notice that the generic operations manual would be amended on the next cycle to include all relevant regulations related to night VFR flight by commercial operators;
- “TC issued CBAAC number 0161, dated 31 August 1999, detailing a new requirement for all CARs Section 703 (air taxi), 704 (commuter) and 705 (airline) operators

to undergo mandatory training for the avoidance of [CFIT] accidents;

- “TC raised two notices of proposed amendments to the CARs aimed at restricting night VFR operations for Section 704 and [Section] 705 operators. These notices of proposed amendments are currently being processed through the Canadian Aviation Regulation Advisory Council; [and,]
- “The British Columbia chief coroner held an inquest into the deaths of the two pilots. Recommendations from the coroner have been forwarded to the minister of transport for consideration, and all [recommendations] have received a positive response. One recommendation was that ‘[TC] pursue the requirements of installing [GPWS] in all aircraft operating under CARs 703, 704 and 705.’ In his response to that recommendation, the minister of transport explained the current regulations regarding GPWS and stated that TC is committed to harmonizing its regulations, as much as possible, with the [FAA’s TAWS] final rule.”²♦

[FSF editorial note: This article, except where specifically noted, is based on Transportation Safety Board of Canada Aviation Investigation report A99P0006, *Controlled Flight Into Terrain (CFIT); Kelowna Flightcraft Air Charter Ltd.; Douglas DC-3C, C-GWUG; Mayne Island, British Columbia; 13 January 1999*. The 26-page report contains a map and an appendix.]

Notes

1. Transportation Safety Board of Canada. *Aviation Occurrence Report: Controlled Flight Into Terrain; McMurray Aviation; Piper PA-34-200T Seneca, C-GPRL; La Loche, Saskatchewan, 8 nm W; 30 October 1997*. Report no. A97C0215.
2. FAA on March 29, 2000, published U.S. Federal Aviation Regulations Part 121.354, which prohibits operation under Part 121 (regulations governing air carriers and commercial operators) of a turbine-powered airplane manufactured after March 29, 2002, unless the airplane is equipped with an approved TAWS. Part 121.354 also prohibits operation under Part 121 after March 29, 2005, of a turbine-powered airplane manufactured on or before March 29, 2002, unless the airplane is equipped with an approved TAWS. FAA published similar regulations in Part 91 (general operating-and-flight rules) and in Part 135 (regulations governing commuter operations and on-demand operations).

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