Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT

A01A0058

COLLISION WITH TERRAIN

PIPER PA-31-310 NAVAJO C-GMTT

CHARLOTTETOWN, Newfoundland and Labrador, 1.5 nm W

05 JUNE 2001

Canada

Aviation Investigation Report

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Summary

A PA-31 aircraft, C-GMTT, serial number 31-7712004, departed Charlottetown, Newfoundland and Labrador, on a day visual flight to Sango Bay. Shortly after take-off, the aircraft struck the surface of a gravel road, 1.5 nautical miles off the departure end of the runway. The aircraft then slid off the road and hit a rock embankment. The pilot and two passengers received fatal injuries; the third passenger received serious injuries. The aircraft was destroyed.

Ce rapport est également disponible en français.

Other Factual Information

History of Flight

The flight took off on Runway 22 at Gander, Newfoundland and Labrador, at 1428 Newfoundland daylight time[1] with the pilot and four passengers on board. Their destination was Sango Bay, Newfoundland and Labrador, with an intermediate stop in Charlottetown, Newfoundland and Labrador, to drop off one of the passengers. Radar data show that, on departure from Gander, the aircraft climbed at about 500 feet per minute at 125 knots ground speed to 2500 feet, then descended and proceeded en route to Charlottetown at 1900 feet and 150 knots. The aircraft landed at Charlottetown at 1615. After a brief stop, the flight continued to Sango Bay.

The pilot broadcast his intention to take off on Runway 10, taxied the aircraft to the threshold of the runway, and commenced the take-off roll. Part-way down the runway, the pilot aborted the take-off. He then broadcast his intention to take off on Runway 28. Both radio broadcasts were acknowledged by a local pilot who was approaching the airport to land. Upon reaching the threshold of Runway 28, the aircraft turned and accelerated, without stopping, on the take-off roll. The aircraft lifted off shortly before the runway end and remained near treetop height until disappearing from view.

After lift-off, the stall warning horn sounded intermittently until impact. The aircraft was unable to climb above the hilly terrain and struck the road 1.5 nautical miles from the departure end of the runway. A passing motorist spotted the downed aircraft and notified firefighters and medical personnel who were then dispatched to the scene. The accident occurred at about 1621 during daylight hours, at 58°45' N, 55°66' W, at 440 feet above sea level.

Pilot Information

The pilot held a private licence with a night endorsement and was qualified to fly single- and multi-engine land and sea aircraft under visual flight rules. The pilot's logbook was not found. Based on a review of available records, his estimated total flying time (all types) was 2085 hours, including 185 hours on the occurrence aircraft.

An autopsy performed on the pilot did not reveal any pre-existing medical condition that would have contributed to the occurrence.

Aircraft Information

The pilot had imported the aircraft from the United States, and it was placed on the Canadian registry on 13 July 2000. Records indicate that the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures.

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[1] All times are Newfoundland daylight time (Coordinated Universal Time minus two and one-half hours).

The most significant recent maintenance work was the replacement of cylinders on the left engine. This work was carried out in Florida and was completed 10 May 2001. The aircraft journey logbook was found inside the aircraft; it had not been updated since the engine work.

The aircraft was fitted with vortex generators, which improved the stall characteristics and reduced the stall speed through control of the boundary layer. With this installation, the aircraft's maximum take-off weight increased by 340 pounds to 6840 pounds.

Section 6 of the *Pilot's Operating Handbook* (POH) describes weight and balance factors for the PA-31. Section 6.1 states:

> Misloading carries consequences for any aircraft. An overloaded airplane will not take off, climb or cruise as well as a properly loaded one. The heavier the airplane is loaded, the less climb performance it will have.

The cargo had not been weighed before loading, and there was no indication that the pilot had calculated the weight and balance of the aircraft before flight. Calculations performed after the accident show that, at take-off from Gander, the aircraft weighed approximately 7780 pounds, an overweight condition of 940 pounds. The take-off weight was calculated as follows: basic weight 4485 pounds, occupants 1110 pounds, full fuel load 1127 pounds, and baggage/cargo 1160 pounds (as weighed at the accident scene, plus baggage of the passenger debarking in Charlottetown). Two seats, a table, and a refreshment unit cabinet had been removed, reducing the aircraft basic weight by 100 pounds. The PA-31 centre-of-gravity flight supplement chart for aircraft fitted with the vortex generator kit does not provide data for aircraft weights above 6840 pounds.

According to PA-31 POH performance data, the two-hour flight to Charlottetown would have consumed approximately 320 pounds of fuel; however, some operators allow for a higher fuel consumption. Using the more conservative data, the fuel burned would have been about 460 pounds. The deplaning passenger weighed 185 pounds and took with him 35 pounds of luggage. Therefore, a conservative estimate of the aircraft weight on take-off from Charlottetown is 7100 pounds, 260 pounds over the maximum allowable take-off weight.

According to the POH flight manual supplement for the vortex generators, the short field take-off distance chart does not extend beyond 6840 pounds; however, extrapolation of this chart shows that the take-off distance over a 50-foot obstacle would be about 2300 feet. This distance is based on both engines being set to maximum take-off power before the brakes are released, flaps set to 15°, and a dry, level, paved runway.

The aircraft manufacturer was asked to provide take-off distance calculations based on a take-off weight of 7100 pounds, a temperature of 20°C, and a gravel runway. For the short field take-off technique, the manufacturer calculated a ground roll of 1182 feet and a take-off over a 50-foot obstacle of 2485 feet. For normal technique, the calculations were ground roll 1957 feet and take-off over a 50-foot obstacle 2682 feet. These figures are extrapolations: no charts are available for the take-off weight of the aircraft or for take-offs from a gravel runway.

The pilot did not stop on the runway to run the engines up to take-off power before starting the take-off roll. On gravel runways, operators tend not to apply full power while stopped because of the potential for damage to the propellers; however this practice reduces the total acceleration over a given distance and increases the runway length required. Eyewitness accounts describe

the take-off run as being sluggish and the aircraft lifting off near the end of the runway. Neither the POH nor the flight manual supplement was on board the aircraft.

The manufacturer estimated that, under the existing conditions and with both engines operating normally, no adverse effects should have been encountered but that control response would be extremely sensitive. An analysis of aircraft performance, independent of the TSB, shows that even in the overweight condition the aircraft should have been able to out climb the rising terrain.

Aerodrome Information

Runway 22 at Gander is 10 500 feet long, paved, with no slope indicated, and the departure path is over flat terrain. The Charlottetown airport has one gravel runway, which is oriented 10/28 and is 2500 feet long by 75 feet wide. The airport is in hilly terrain part-way up a hill that rises to the south. Runway 28 is sloped 1.49% downward. The terrain rises to the west of the airport, and the elevation of the crash site, 1.5 nautical miles west of the runway, is 211 feet above runway elevation. The hilly terrain adjacent to and south of the airport causes significant mechanical turbulence when the winds are from the south.

Meteorological Information

At take-off from Gander, the temperature was 17°C, and the wind was from 160° true at 15 gusting to 20 knots. There is no weather reporting facility at Charlottetown. However, residents reported that the temperature was 20°C, the wind was out of the south at 15 to 20 knots, and the ceiling and the visibility were unlimited. At the time of the occurrence, there were reports of moderate turbulence on the departure path of Runway 28.

Wreckage and Impact Information

The aircraft struck the road in a level attitude near, but not aligned with, the centre of the road and skidded on its belly for 70 feet toward the right before sliding off the north side of the road. The aircraft then travelled 100 feet along the road embankment before striking a rock abutment. The aircraft deflected off the rock abutment and travelled another 40 feet before coming to rest against a stand of trees on a heading of 330° magnetic. Small pieces of aircraft fuselage were scattered along the wreckage path. The right wing was torn off outboard of the engine. The left wing was displaced aft at the wing root, disrupting flight controls, fuel controls, and fuel lines to the left engine; the wing, however, remained partially attached. The nose baggage door was torn off, and the contents of the nose baggage compartment were thrown forward in front of the aircraft. No fire occurred.

Propeller strike marks were found from both propellers along the road surface. The left propeller made 10 strikes every 10 feet over a distance of 27 feet before the left engine stopped. The right propellor strike made 8 strike marks every 10 feet over a distance of 17 feet before the right engine cleared the road surface. After leaving the road surface, and just before the aircraft struck the rock abutment, the right propeller struck and cut through a six-inch-diameter tree stump. The extent of damage and the severity of twist to the blades on both propellers were consistent with relatively high rotational speed and high power output.

An examination of the aircraft confirmed pre-impact continuity of the flight control systems. No pre-impact discrepancies were found in these systems that would have affected the aircraft's operation. The aircraft flaps and the landing gear were in the up position. By measuring the exposed threads on the aileron and elevator trim jack screws, it was determined that they were both in the neutral position.

The right engine was removed from the site and transported to the TSB regional wreckage examination facility, where a teardown was carried out. No discrepancies were found that would indicate a problem with this engine. After the teardown, the following right engine components were sent to overhaul facilities for bench testing under the supervision of a TSB investigator: propellor governor, density controller, differential controller, bypass valve, and fuel servo injector. All of these components tested serviceable. The above listed components for the left engine, with the exception of the fuel servo injector, were also sent for bench testing and all tested serviceable. The left engine fuel servo injector had been overhauled after the accident and prior to the components from the left engine being sent for testing.

Survival Aspects

Damage to the belly of the fuselage was minor. The initial impact with the road likely did not cause serious injuries to the occupants. The pilot and passengers likely received most of their injuries when the aircraft struck the rock abutment.

The cargo on board the aircraft, which included a 179-pound tool box, a 45-pound vice, and a 55-pound hydraulic motor, was not restrained. A light cargo net was found; however, it was not damaged, indicating that it had not been used. The fatally injured rear-seat passenger was found bent over with his chest contacting his knees. Cargo was found piled on top of the back of his seat. His fatal injuries were due to broken ribs, which had punctured his heart. The surviving passenger was seated behind the copilots position and was facing aft. This passenger was protected from the unrestrained cargo by the rear-seat passenger.

The emergency locator transmitter (ELT) was activated by impact forces; however, because a passing motorist found the aircraft very shortly after the accident, the ELT was not instrumental in locating the aircraft. The ELT continued to broadcast for several hours, and several high-flying aircraft reported the transmissions. The ELT was eventually disconnected by a local aircraft maintenance engineer.

Use of Private Aircraft for Business Purposes

The pilot was operating the aircraft as a non-commercial pilot under Part VI of the *Canadian Aviation Regulations*. One major difference between private and commercial aircraft operations is that most commercial aircraft operations have a system to ensure that cargo is properly loaded and secured and that weight and balance calculations are completed for each flight. Another difference is that take-off and landing distances are calculated for each commercial flight.

In this occurrence, the pilot was on a personal business trip accompanied by three of his employees (who were being transported to work sites in Labrador). The cargo was to be used for the pilot's business activities. For this flight, the cargo was unsecured, the aircraft weight was over the maximum allowable take-off limit, weight and balance calculations apparently had not been done, and there were no manuals on board for the pilot to calculate take-off distance requirements. The passengers were exposed to risks greater than those that would be present on

most commercial flights. However, as employees of the pilot, they probably did not consider any risk in taking the flight. Transport Canada personnel do not oversee the flying activities and the practices of private pilots and owners to the same degree that they oversee equivalent commercial flights.

Analysis

The aircraft became airborne near the departure end of the runway and remained at treetop level until disappearing from view. Although the exact flight profile is not known, the state of the wreckage and the length of the wreckage trail indicate that the aircraft struck the ground in controlled flight at a relatively low vertical speed. No discrepancies were found with the aircraft or engines that would have contributed to this occurrence.

Runway 22 at Gander is 10 500 feet long, paved, and with no slope indicated. The departure path is over flat terrain. Even in an overloaded condition, the aircraft had ample runway to accelerate to flying speed. After lift-off, the pilot would have been able to keep the aircraft in ground effect over the runway and over the terrain off the end of the runway until the aircraft accelerated and was able to climb out. Radar data show that, once established in the climb with the gear and flaps up, the aircraft was able to maintain an ascent of 500 feet per minute. The successful take-off from Gander and the anticipated weight reduction from fuel burned during the flight and from the passenger drop-off at Charlottetown might have reassured the pilot that it was safe to continue to Sango Bay.

The first take-off attempt at Charlottetown was up slope, and the pilot likely had an early indication that the aircraft was not going to lift off in the runway length available. On the second take-off attempt, the pilot did not stop to run up the engines to take-off power before starting the take-off roll; as a result, the aircraft's acceleration distance increased. The downslope of the runway might have influenced the pilot's belief that the aircraft would be able to reach a safe flying speed in the runway length available.

Factors that probably detracted from aircraft performance were as follows: the overweight condition of the aircraft, improper short field take-off technique, lift-off before reaching sufficient flying speed, turbulence on the lee side of the hilly terrain causing some sink, and improper execution of the best angle of climb speed. Although an analysis of aircraft performance has shown that the aircraft should have been capable of out climbing the rising terrain, the aircraft would have to be flown as close as possible to the best angle of climb speed. In this instance, the aircraft was forced into the air and was near tree top level immediately after lift-off, near the stall speed, and facing rising terrain. This left the pilot with little or no performance margin to increase speed and establish a positive rate of climb, a situation which was exacerbated by the overweight condition and the descending air. The intermittent sounding of the stall warning horn from immediately after take-off until impact indicates that the aircraft was operating at or near the stall speed throughout the flight.

Findings as to Causes and Contributing Factors

1. The aircraft was over the maximum allowable take-off weight throughout its journey, reducing aircraft performance: the pilot apparently did not complete weight and balance calculations for either of the flights.

2. The pilot did not use the proper short field take-off technique, and the aircraft was forced into the air before reaching sufficient flying speed.

3 The best angle of climb speed was not attained.

4. The unsecured cargo, some of which was found on top of the back of the rear passenger seat, most probably contributed to the severity of the injuries to the passenger in this seat.

Safety Action

The forerunner to the TSB, the Canadian Aviation Safety Board (CASB), issued three recommendations in 1985 pertaining to aircraft operating beyond weight and balance limitations (CASB 85-01, 85-02, and 85-25). Transport Canada has also long recognized this problem and has taken regulatory, enforcement, and promotional measures to reduce the frequency of aircraft operating beyond their weight and balance limitations. The disregard for safety whereby pilots continue to operate aircraft over the maximum allowable weight limitation remains a concern.

The TSB sent an occurrence bulletin to Transport Canada about this occurrence and information about another fatal occurrence (A01A0022) involving an overweight Piper Comanche departing from St. John's, Newfoundland and Labrador, on 13 March 2001.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 01 May 2003.

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