

AVIATION OCCURRENCE REPORT

FLIGHT INTO TERRAIN

PIPER COMANCHE PA24-250 N6541P (USA)

PELICAN NARROWS, SASKATCHEWAN

15 JUNE 1996

REPORT NUMBER A96C0092

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

After spending a week's vacation in the vicinity, the private pilot and three passengers were departing from a private airstrip located at the U-Fly-In Camp three miles east of Pelican Narrows, Saskatchewan. The pilot intended to fly to Flin Flon, Manitoba, to top up the aircraft fuel tanks before heading home to Colorado, USA. Shortly after the take-off, the PA24-250 aircraft, serial No. 24-1663, failed to clear a stand of trees, crashed, and came to rest approximately 800 feet off the end of the airstrip. The aircraft was destroyed by the impact and post-crash fire. Two passengers were fatally injured; the pilot was seriously injured, and the third passenger received minor injuries.

Ce rapport est également disponible en français.

Other Factual Information

The grass-surfaced airstrip was approximately 3,000 feet long and 100 feet wide, and was surrounded by poplar and spruce trees 50 to 60 feet high. The runway was oriented 010/190 degrees and had an elevation of approximately 1,000 feet. The surface was slightly bumpy and had a pronounced hump at the 1,000-foot point on runway 01, the take-off runway. The grass was approximately 2.5 inches long near the centre line, and the airstrip was in a slightly soft condition because of recent rainfall. The aircraft tires left 1/8 to 1/4-inch-deep tire indentation marks at the location where the aircraft turned around prior to the take-off.

The local weather was reported by an observer as follows: temperature 13 degrees Celsius (°C), and wind from 325 degrees at 10 to 15 miles per hour (mph). The weather at Flin Flon, approximately 50 miles southeast of the departure airstrip, was as follows: scattered cloud at 1,100 feet above ground level with an overcast layer at 1,800 feet, temperature 13°C, dew point 10°C, and winds 300° True at 10 knots.

The licensed private pilot was rated for single-engine land visual flight rules (VFR) flight, and had approximately 1,800 hours total flying time, with 583 hours of complex/retractable flying time and 540 hours on type. In the last 30 days, the pilot had flown approximately 15 hours including the recent trip from Colorado. The pilot was relatively inexperienced with soft-field, grass-runway take-offs.

The pilot estimated the gross weight of the aircraft to be 2,975 pounds, with the centre of gravity (C of G) within limits. The maximum gross weight for the aircraft was 3,000 pounds, as equipped with tip tanks which were installed under a Supplementary Type Certificate (STC).

Take-off performance calculations for the conditions indicate that a ground run of about 1,400 feet would have been required before the airplane became airborne, and that a total distance of about 2,000 feet would have been required to reach an altitude of 50 feet. The stopping distance required would have been significantly more than the 650 feet indicated in the approved flight manual for landing with flaps down on a hard-surfaced runway; this, in turn, indicates that the safe abort point would have been at about 1,000 feet from the end of the runway.

The pilot reported that the pre-take-off run-up was uneventful. He utilized a soft-field take-off technique and attempted to hold the nose off the runway immediately at the start of the take-off roll. The aircraft was observed to lift off with an abrupt and pronounced rotation after a ground run of about 1,100 feet. The aircraft was then seen to fly 5 to 10 feet above the ground in a nose-high attitude. The aircraft was observed to touch down about 900 feet further down the airstrip. The aircraft lifted off again and flew with a nose-high attitude and shallow climb angle at approximately 60 miles per hour (mph). The pilot decided to continue the take-off, but found that the aircraft would not climb without sacrificing airspeed. The pilot then levelled the aircraft and retracted the gear in order to reduce drag and build up airspeed. An observer reported that the aircraft's engine sound was not as loud or sharp as that of other aircraft of the same make and model. The observer reported that the aircraft cleared lower trees at the end of the airstrip, but that its trajectory was such that it did not appear able to clear higher trees on the rising ground beyond the runway. At the end of the

airstrip, the pilot pulled back on the control column in an attempt to clear the approaching trees and turned to the right towards the lake. The aircraft lost airspeed, stalled, and dropped into the forest.

The aircraft was found in a stand of trees 50 to 60 feet high, about 800 feet beyond and slightly to the right of the runway. The damage signatures on the aircraft and the ground scars showed that the aircraft entered the trees in a right-wing-low attitude. The aircraft's right wing struck the ground first, severing the outboard section. The aircraft then rotated to the right and came to rest on a heading of 220° magnetic. The damage to the surrounding trees indicated that the propeller was producing power until the engine struck the ground. The aircraft was severely damaged by the impact and the subsequent intense fuel-fed fire which consumed the entire cabin area, most of the remainder of the right wing, the inboard section of the left wing, and portions of the tail.

The flaps were found in the up position. The ailerons, rudder, and elevators sustained damage from the impact forces and from the fire; however, all failures and damage in the structure and attachments were assessed to be overload or fire related. The elevator trim was in a neutral to slightly nose-down position. Flight control continuity was established to the extent possible, given the fire damage.

The engine compartment was severely damaged by fire; the carburettor and induction system, accessory section, and both magnetos were entirely consumed. No useful information was obtained from the cockpit instruments because of the fire damage.

Aircraft records indicate that the aircraft's tachometer had been changed to an electronic type in January of 1996. At the time of the installation of the new tachometer, the engine was found to be over-speeding by approximately 300 revolutions per minute (rpm). The maintenance engineer involved in the installation believed that the old tachometer had been indicating approximately 300 rpm low and adjusted the propeller governor maximum speed setting downward accordingly. Subsequent testing of the old tachometer confirmed that at 2,500 rpm it was indicating 300 rpm too low. This indicates that the pilot had been operating the engine in an over-speeding condition for an unknown period of time, during which time the engine had been producing more power than was being indicated by the tachometer.

The propeller governor was tested at two independent propeller overhaul shops and was found to be operating within normal expected parameters. The propeller was dismantled and examination revealed that, at the time of ground impact, the blade pitch mechanism was slightly off the low pitch stop. This is the expected position for a propeller which is operating in flight in the "fine pitch" or take-off position.

Although the temperature and dew point were conducive to carburettor icing, the pilot reported that there were no indications of icing and that engine performance prior to take-off was normal.

The low-wing PA24-250 is equipped with a laminar flow wing. Laminar flow wings have sharper leading edges and are thickest at about 50 per cent of the chord position, whereas conventional airfoils are thickest at about the 30 per cent chord position. The laminar flow airfoil tends to be more efficient in terms of reduced drag, but only over a narrow range of angles of attack, commonly called the "drag bucket." As long as this

airfoil operates within this narrow range of angles of attack, the air flow remains laminar for a much farther distance back from the leading edge than on a conventional airfoil, resulting in reduced and constant drag loads. As the angle of attack is increased, however, a point is reached where the drag increases rapidly and the advantage of the laminar flow air foil disappears. Once the airfoil is operating outside of the "drag bucket," small increases in angle of attack result in significant increases in drag.

Analysis

On the basis of the propeller governor and tachometer test results, the propeller examination and damage signatures, and the lack of any conflicting evidence, it is likely that the engine was producing substantial power at impact. Although a reduction in available take-off power as a result of carburettor icing or other system malfunction cannot be ruled out, the investigation of the evidence available did not reveal any such pre-impact condition.

The cause of this accident likely involves a combination of several factors. The pilot was relatively inexperienced with soft-field grass-runway take-offs. The aircraft was near its maximum gross weight. The pilot may have had an expectation of greater aircraft performance based on the aircraft's past performance when the engine propeller governor was set 300 rpm higher and, therefore, producing more take-off power.

The pilot used a soft-field take-off technique which, in combination with the terrain rise at about the 1,000-foot mark of the airstrip, caused the aircraft to become airborne prematurely at a low airspeed with a nose-high attitude. During a soft-field take-off using such a technique, the aircraft would be operating at a relatively high angle of attack and in a region of the flight envelope where small increases in angle of attack result in significant increases in drag. Because of the characteristics of the laminar flow air foil, the aircraft nose must be lowered substantially before drag is reduced to allow the aircraft to accelerate.

The aircraft touched down again about 900 feet further down the airstrip, at about the safe abort point. Once the pilot continued the take-off beyond the safe abort point, the high drag loads did not allow the aircraft to accelerate sufficiently to climb and clear the obstructions beyond the end of the airstrip. The aircraft stalled when the pilot manoeuvred to avoid impact.

The following Engineering Branch report was completed:

LP 133/96 - Take-Off Performance Analysis.

Findings

1. Records indicate that the aircraft was certified, equipped, and maintained in accordance with existing regulations and procedures.
2. The pilot estimated that the aircraft's weight was slightly below the maximum limit and that the C of G was within the prescribed limits.

3. The pilot was certified and qualified for the flight in accordance with existing regulations.
4. Because of the almost complete destruction of the aircraft by the crash and fire, it could not be determined whether any pre-impact failure or system malfunction contributed to the accident; however, none was identified.
5. There was no evidence of carburettor icing.
6. The tachometer which was removed in January of 1996 was found to be indicating approximately 300 rpm low. The propeller governor maximum speed setting was decreased by approximately 300 rpm when the new electronic tachometer was installed.
7. Having previously operated the aircraft at an engine speed that was 300 rpm higher, the pilot may have had an expectation of greater aircraft performance that could not be achieved on the day of the accident.
8. On take-off, the aircraft became airborne prematurely and maintained a nose-high attitude which prevented the aircraft from accelerating and climbing sufficiently to clear the obstacles.
9. The pilot continued the take-off beyond the safe abort point.
10. The aircraft stalled at an altitude from which recovery was not possible.

Causes and Contributing Factors

The technique used during the take-off from the soft field caused the aircraft to become airborne prematurely and prevented sufficient acceleration to climb and clear the obstacles in the take-off flight path. The aircraft stalled at an altitude from which recovery was not possible when the pilot manoeuvred to avoid impact with trees.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson Benoît Bouchard, and members Maurice Harquail, Charles Simpson and W.A. Tadros, authorized the release of this report on 23 April 1997.