Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT

A03P0068

SPIRAL DIVE - COLLISION WITH TERRAIN

LANGLEY FLYING SCHOOL

PIPER PA-28-140 C-GNUD

LANGLEY AIRPORT, BRITISH COLUMBIA, 6 NM NE

25 MARCH 2003

Canada

Aviation Investigation Report

Spiral Dive - Collision with Terrain

Langley Flying School
Piper PA-28-140 C-GNUD
Langley Airport, British Columbia, 6 nm NE
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Report Number A03P0068

Summary

A student pilot flying a Piper PA-28-140 aircraft, C-GNUD, serial number 28-7525250, departed Langley Airport, British Columbia, for a local solo training flight in the Glen Valley practice area (CYA 126). After take-off, the student departed the Langley control zone and flew northeast to enter the training area at about 2200 feet above sea level (asl). The flight, was observed from recorded radar data. Once inside the practice area, the aircraft manoeuvring involved a number of gentle and medium turns in alternating directions, using between 10 and 30 degrees of bank.

About 30 minutes after take-off, from an altitude of about 2000 feet above ground level, the aircraft completed three level, 360-degree turns to the left, and then abruptly entered a rapid, left-hand descending turn. Air traffic control radar data ceased when the aircraft descended below 1600 feet above ground level. Observers on the ground described the aircraft as being in a steep, left, spiral dive, completing approximately three full turns before striking the ground. There was no recovery from the spiral dive, and the aircraft struck the ground at high speed. The aircraft was destroyed by the collision and a post-crash fire, and the pilot was fatally injured. The accident occurred at 1640 Pacific daylight time.

Ce rapport est également disponible en français.

Other Factual Information

Radio communications between the pilot and Langley tower were routine, and there was no indication of any abnormality related to this flight. There were no reports by other aircraft that were operating in the practice area of any emergency communication on the operating frequency.

The reported weather for the time of the accident was as follows: a few clouds at 5000 feet above ground level, with a scattered layer at 8000 feet; surface wind 090° at 3 knots; and visibility 25 miles.

Examination and analysis of the radar data showed that the aircraft entered a steep turn to the left at a speed of approximately 115 mph. The entry to the manoeuvre was abrupt, with the initial roll stabilizing at about 40-45˚ of bank. The initial turn transited about 80˚ of heading, with a coincidental altitude drop of about 600, feet in about 10 seconds. Observers on the ground noted that the aircraft's bank angle of about 45˚ and downward pitch angle of about 20˚ remained constant throughout the manoeuvre.

The TSB Engineering Facility completed an analysis of aircraft energy in this manoeuvre and determined that the impact speed would have been between 180 - 200 mph.

The Piper Pa-28-140 was certificated under Civil Air Regulations (CAR) Part 3. Based on that standard, "The airplane shall be longitudinally, directionally, and laterally stable." Under the requirements for longitudinal stability, CAR Part 3, paragraph 3.114 requires that when the aircraft is trimmed to a specific speed, a push is required on the controls to maintain speeds above the specified trim speed. When the control force is released, the certification standard requires that "the air speed shall return to within 10 percent of the original trimmed speed. Without some form of control input by the pilot, the aircraft's longitudinal stability should have caused the nose to rise as the airspeed increased from about 115 - 200 mph. The upward movement of the nose of the aircraft, even with a 45˚ angle of bank, should have aided in recovering from the dive and should have been visible from the ground.

Inspection of the recovered wreckage, concentrating on the aerofoil surfaces, aerofoil attachment points, and the aircraft control components, found no indication of any pre-crash structural or control system failure.

Examination of relevant technical documents found that an Airworthiness Directive (AD) 69-22-02 , effective 30 July 1979, addressed a problem related to control wheel cracking in the vicinity of its hub. The AD required either the replacement of the control wheel with an improved metal component or the periodic visual inspection of the older type control wheel to detect cracking near the centre hub of the component. The accident aircraft had the older style control wheels that were receiving the required periodic inspections. Plastic components from the hub portion of the pilot's control column (referred to in AD 69-22-02) were not recovered and were likely destroyed by the post-crash fire.

Recovered portions of the damaged control wheels were sent to the TSB Engineering Branch for further examination and analysis. The engineering examination concluded that the control wheel fragments from the destroyed aircraft indicated the predominant mode of fracture was that of overstress, undoubtedly due to impact. Minimal fatigue pre-cracks were identified

around internal (manufacturing) cavities and were dispersed along the centerline of the assembly. However, based on the laboratory tests, the structural integrity of the wheel was not compromised.

A review of the Transport Canada (TC) service difficulty reporting (SDR) database revealed that 13 control wheel failure events (either cracking or breaking) have been reported since the original issue of the AD. Although most of those failures were cracks that were identified during periodic maintenance inspections, at least five of the SDRs referred to control wheel breaks that occurred during aircraft operations; some of these breaks occurred outside the area being inspected as a result of the AD. This issue has been resolved by Transport Canada and is addressed separately in the Safety Action section of this report.

The pilot of the accident aircraft held a valid student pilot permit and was undergoing training under the direction and supervision of a Flight Training Unit (FTU), and in compliance with CAR 401.19(b).

The accident pilot had completed his initial medical examination in 2001, and the medical records reveal no pre-existing condition that would have adversely affected the pilot's performance. Because the medical category for a student pilot permit is valid for a five-year period, more recent information related to his medical status at the time of the accident is unavailable. Post-mortem and toxicology examinations that were conducted by the British Columbia Coroner Service found no evidence of pre-existing natural disease.

The accident pilot began his training for a private pilot license in May 2001. A review of his training records shows that his initial training sequences and upper air work had progressed normally. These sequences included an introduction on steep turns, slow flying, stalls, spins, and spiral dive[1] recoveries. He then began learning the required traffic pattern sequences and spent the next month of his training (about 20 flight hours) concentrating on those skills. He was issued a student pilot permit on 20 July 2001 and completed his first solo two days later. Following his first solo trip, he spent an additional 7 hours (dual) and 4.6 hours (solo) in the traffic pattern.

On 9 August 2001, the student completed his first dual training trip to the practice area since the upper air sequences had been introduced in mid-June 2001. On that trip the instructor observed that the student was having difficulty performing steep turns. Specifically, he was over-banking (up to 65 degrees of bank) and using insufficient back pressure on the control wheel. The result was that the aircraft's nose would drop and the aircraft would enter a spiral dive. Following the identification of these weak sequences, the FTU provided three remedial dual training trips to ensure the upper air exercises were safe before authorizing the student to conduct his first solo flight to the training area.

In early October 2001, the student took a three-month break from training and returned in January 2002 to complete three flights, logging 1.3 hours dual and 0.4 hour solo. He did not fly again until March 2003.

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[1] A spiral dive is not a normal flight manoeuvre. It could inadvertently develop from an improperly entered steep turn or incipient spin. Spiral dive recovery skills are taught as a normal part of the training syllabus to ensure that students can recognize and recover from one. Many spiral dive accidents involve pilot disorientation after inadvertently entering instrument meteorological conditions.

Breaks in training are not uncommon and are normally beyond the control of the involved FTU. Under the guidance of CAR 401.19, responsibility falls on the involved FTU to review and re-assess previously acquired skills in order to determine a student's level of ability and subsequent course sequencing following an extended break from training.

The student's most recent training, following the year-long break, included a combination of 3.1 hours of dual instruction, conducted by two qualified flying instructors, followed by one hour of solo flight in the traffic pattern; the accident occurred on the following flight. FTU records indicate that during one of the dual flights, on 15 March 2003, the student reviewed steep turns and spiral dive recoveries. In part, that training included left and right steep turns and four spiral dive recoveries, executed by the student under the instructor's supervision. Student performance on both steep turns and spiral-dive recoveries was described in training records as "good", and neither of the two qualified instructors who conducted the most recent dual instruction identified any performance weaknesses that would have affected the safety of the subsequent solo flights.

Analysis

The solo flight had been scheduled as a logical sequence to three dual-training missions following a year-long break from flying. The student was qualified and authorized to complete the occurrence flight in accordance with CARs and the FTU practices.

During the solo training flight, the aircraft entered a spiral dive from which the student did not recover. The reason the aircraft entered the spiral dive and the student's inability to recover from the dive are not known.

The initial roll manoeuvre, as observed on radar, and the subsequent stabilization of pitch and bank at constant angles support conclusions that the aircraft's control system was operating and that the pilot was conscious and manipulating the controls throughout the manoeuvre. Based on the described aircraft motion, it is likely that the student was applying a neutral aileron input and a forward control pressure to counter the progressive aft-movement of the control column, brought on by the increasing speed descent. Based on this analysis, it is likely that the student was attempting to centralize the controls as a element of his recovery procedure.

A review of all the available medical records and reports revealed no indication of any pre-existing medical issue that would have adversely affected the pilot's ability to control the aircraft. However, the five-year medical validity period for the student pilot permit reduces the possibility of on-going early monitoring of a student pilot's medical status that a more frequent medical examination would permit.

Although this student's ability to perform steep turns had been initially documented as weak, additional remedial dual instruction had been given to ensure the student's safe performance of the upper air sequences during solo practice. More recent review and evaluation of steep turns, stalls, and spiral dive recoveries re-affirmed the student's ability to perform these manoeuvres in a safe manner while recognizing that further practice would be necessary to improve the steep turn sequence up to the performance standards required of a private pilot license.

Control continuity and pilot incapacitation have been eliminated as potential causes for this occurrence based on the witness descriptions of constant bank and pitch angles throughout the manoeuvre. Additionally, evaluations of broken control wheel components revealed that

internal manufacturing voids identified throughout the plastic Piper control wheels do not appear to compromise the integrity of the component when subjected to FAR 23 testing. Although not related to this accident sequence, the SDR database shows that at least five control wheel breaks have occurred during aircraft operations; some of these breaks occurred outside the area that is being inspected as a result of AD 69-22-02. Transport Canada's effort to improve this AD have been added to the Safety Action Taken section of this report.

The following Engineering Branch report was completed:

LP 034/03 - *Report on Findings*

Findings as to Causes and Contributing Factors

1. During a student solo flight, the aircraft commenced a descending turn to the left and entered a spiral dive from which there was no recovery. The reason the aircraft entered the spiral dive and the reason that the student did not recover from it were not determined.

Findings as to Risk

1. A five-year medical validity period for the student pilot permit reduces the ongoing early monitoring of student pilot medical status.

2. Although not causal in this accident, the TC SDR database shows that at least five control wheel breaks have occurred during aircraft operations; some of these breaks occurred outside the area being inspected as a result of AD 69-22-02.

Other Findings

1. Manufacturing voids identified throughout the plastic Piper control wheels do not appear to compromise the integrity of the control wheels when subjected to FAR 23 testing.

Safety Action

Safety Action Taken

Transport Canada reports that it has drafted a letter to the FAA highlighting two elements that may further improve the effectiveness of AD 69-22-02 regarding Piper control wheel cracking:

- expanding the area to be inspected beyond the point where the pin enters the control wheel hub; and,

- changing the compliance interval for the inspection.

The subject AD only requires that the inspection of the control wheel be completed within 25 hours time in service from the effective date of the AD and thereafter, every 100 hours since the last inspection. TC notes that many private aircraft operators in Canada do not fly 100 hours in a year and may take up to five years to fly the required hours that would trigger AD compliance. Changing the AD compliance interval, to include both the 100 hours time since the last inspection or annually would help mitigate the risk of a control wheel failure for those private operators.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 25 March 2004.