

AVIATION OCCURRENCE REPORT

LOSS OF CONTROL - SPIN

**TRENTAIR AVIATION LTD.
CESSNA 150 M C-GNCF
PETERBOROUGH, ONTARIO
27 JUNE 1996**

REPORT NUMBER A9600105

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 pilot and passenger departed on a local flight, planned to last one hour. After the aircraft became airborne, it gained altitude momentarily; the pitch angle was then seen to decrease, and the aircraft descended to a height of approximately ten feet above the runway surface. The pitch angle increased again and the aircraft climbed to a height variably described as up to 200 feet above ground level before entering a gentle turn to the left. The angle of bank then abruptly increased, the nose pitched down sharply, and the aircraft descended to the ground in a steep, nose-down, left-wing-low attitude. The pilot was fatally injured, and the passenger received serious injuries.

Other Factual Information

The pilot was certified and qualified to conduct the flight in accordance with existing regulations. It could not be determined when the pilot had last practised, or received instruction pertaining to, precautionary and forced approach procedures or stall recognition, avoidance, and recovery. There is no regulatory requirement for recurrent training or examination subsequent to pilot licensing. There is no evidence that incapacitation or physiological factors affected the pilot's performance.

On 10 June 1996, an instructor and student were flying the occurrence aircraft on a training flight. They reported that while they were in level, cruise flight, the aircraft engine (Continental O-200-A) was running rough and it lost approximately 200 rpm. They returned to the Peterborough airport for an uneventful landing. The aircraft was taken to a maintenance facility and the defect was verbally reported. Maintenance personnel subsequently diagnosed that the carburettor was the source of the problem. They replaced the carburettor, tested the engine, and returned the aircraft to service on 21 June 1996. Because many starts of the engine were conducted while troubleshooting the rough running, the starter clutch began to slip, and the engine starter drive unit was also changed on 21 June. After the starter drive unit was changed, neither the engine oil nor the oil screen was checked for contamination, nor is there any manufacturer or regulatory requirement for the check to be carried out. The occurrence flight was the first since the aircraft was returned to service.

At the accident site, the engine tachometer indicated approximately 2,100 rpm. The TSB's analysis of the instrument revealed that the pointer was captured during the impact sequence by the broken face glass, indicating that the engine was rotating at a minimum of 2,130 rpm. One witness to the accident indicated that, from the time the aircraft began its take-off roll, the engine sounded as though it was not operating smoothly. The Cessna Pilot's Operating Handbook states that "Any sign of rough engine operation or sluggish engine acceleration is good cause for discontinuing the takeoff."

No discrepancies were noted with the airframe, airframe systems, or propeller that would have contributed to the accident. Impact witness marks indicated that the ailerons were deflected in a full right-turn command position. The position of the elevators and rudder at impact could not be determined.

During the field examination of the aircraft, a substantial amount of ferrous material was discovered in the engine oil and engine oil screen. Accordingly, the engine was removed and taken to the TSB Engineering Branch for detailed examination. It was determined that the composition of the ferrous material was consistent with that of bearing material. The starter drive unit which had been removed on 21 June 1996 was examined. It was determined that the needle bearings in the starter drive gear assembly had failed prior to its removal and that wear ensued between the wheel stub shaft and the starter drive clutch gear. This wear produced metal contamination which was carried throughout the engine by the lubricating oil. Further examination of the engine revealed that some of these wear particles from the starter drive unit that was removed on 21 June had become lodged in the hydraulic lifters and rendered four of the eight lifters inoperative. Information from the engine manufacturer indicated that four inoperative lifters on two cylinders may reduce the engine power output by as much as 30 per cent.

The runway at Peterborough Airport was undergoing resurfacing at the time of the occurrence and a portion of it was closed. The take-off run available was 2,400 feet for aircraft operations. Ten degrees of flaps were extended for the take-off. Performance calculations for the aircraft operating at maximum gross weight, with ten degrees of flap extended, showed that, on the day of the occurrence, the aircraft would have required a ground roll of 811 feet, and in excess of 1,524 feet to climb to 50 feet above ground level. The estimated aircraft take-off weight was 1,619 pounds. The certificated maximum take-off weight is 1,600 pounds.

Analysis

The starter drive gear assembly needle bearings in the starter drive unit which was removed on 21 June 1996 failed prior to the unit's removal and allowed wear to occur between the drive clutch gear and the stub shaft. The wear metal contaminated the engine oil system, causing four of the eight engine hydraulic valve lifters to jam, disrupting valve operation and reducing the power output of the engine. The disrupted valve action would likely have resulted in a rough running engine and may have been interpreted by maintenance personnel as a problem with the carburettor. Based on the amount of wear and metal deposits, and the jammed lifters, the engine was probably not running smoothly or developing rated power from the time the power was advanced for take-off.

The pilot extended ten degrees of flaps for take-off, probably in order to shorten the take-off roll because of the shortened runway. The extended flap would have shortened the ground roll, but would have also degraded aircraft acceleration and climb performance after the aircraft became airborne. The engine was developing sufficient power for the aircraft to become airborne and climb slowly; however, once airborne, the pilot maintained a nose-high attitude, which prevented the aircraft from accelerating to a safe indicated climb airspeed. The airspeed continued to decrease to, or just above, the stall speed. Either the pilot began a left turn, or the aircraft yawed to the left because of the nose-high attitude, low airspeed, and engine power. The induced yaw would have caused the aircraft to roll (bank) left, and the pilot likely attempted to level the wings with the application of right aileron. The wing stalled and the aircraft entered an incipient spin at an altitude from which there was insufficient time to recover. The application of aileron control input at the point of stall would have enhanced the aircraft's tendency to enter a spin.

The following Engineering Branch reports were completed:

- LP 91/96 - Instrument Examination; and
- LP 141/96 - Aircraft and Engine Examination.

Findings

1. The pilot was certified and qualified in accordance with existing regulations.

2. There is no regulatory requirement for recurrent training or examination subsequent to pilot licensing.
3. The estimated take-off weight of the aircraft was 1,619 pounds.
4. The needle bearings in the starter drive gear assembly which was removed on 21 June 1996 failed prior to the assembly's removal, resulting in contamination of the engine lubricating oil with wear metal.
5. Wear metal contamination collected in four of the eight engine hydraulic valve lifters and restricted their operation.
6. After the starter drive unit was replaced on 21 June 1996, neither the engine oil nor the engine oil screen was checked for contamination, nor is there any manufacturer or regulatory requirement for the check to be performed.
7. The aircraft engine could not develop maximum rated power as a result of disrupted engine valve operation.
8. The pilot maintained an aircraft nose-high attitude after take-off, which prevented the aircraft from accelerating to a safe climb airspeed.
9. Either the pilot began a left turn or the aircraft yawed uncommanded to the left during climb-out, and the aircraft stalled.
10. The aircraft entered an incipient spin at too low an altitude for the pilot to recover.
11. The pilot likely attempted to correct the left banked attitude using right aileron control, which would have enhanced the tendency of the aircraft to enter a spin at the point of stall.
12. No discrepancies which would have contributed to the accident were noted with the airframe, airframe systems, or propeller.

Causes and Contributing Factors

The aircraft stalled and entered an incipient spin at an altitude from which there was insufficient height to recover. Disrupted engine valve operation caused less-than-maximum engine power output and contributed to the occurrence.

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 25 June 1997.