AVIATION OCCURRENCE REPORT

LOSS OF ENGINE POWER / STALL

CESSNA 177 RG CARDINAL C-GWNW
AIRDRIE, ALBERTA
12 MARCH 1996

REPORT NUMBER A96W0055

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 departed from runway 34, Calgary International Airport, on a visual flight rules (VFR) flight to Villeneuve Airport, Alberta, at about 1100 mountain standard time (MST). He climbed to 4,500 feet above sea level (asl) to clear the zone, and initiated a climb to his cruise altitude of 8,500 feet asl. As the pilot reached about 5,000 feet asl, the engine rpm smoothly dropped to idle. Attempts to regain normal power by movement of engine and fuel system controls were unsuccessful. The pilot declared an emergency, extended the landing gear, and established a 65 mph glide. Air Traffic Control (ATC) advised the pilot that Airdrie, behind him, was the closest airport to his location. The pilot made a left turn back toward Airdrie, but was unable to make it to the airport. The pilot selected a secondary road, running east-west toward Airdrie, for an emergency landing. While banking to the west to align with the road, he noticed a set of power lines and planned to clear them; however, he then noticed a second set of power lines and checked back on the elevator controls. While manoeuvring, the pilot heard the stall horn beeping and noticed that the aircraft was drifting south of his intended landing area. The left wing then dropped and the flight controls were initially unresponsive before the aircraft began a steep descent. The pilot attempted to flare during the dive. The aircraft struck the ground hard in a nose-low attitude, bounced twice, the right main wheel broke off, and the nose gear collapsed. The aircraft left the road and came to rest in the ditch against a barbed wire fence. The pilot sustained serious injuries. He turned off the master switch and called 911 from his cell phone. Police and ambulance personnel arrived shortly thereafter, and the pilot was evacuated to a Calgary hospital.

Ce rapport est également disponible en français.

Other Factual Information

The aircraft fuselage was heavily damaged during the impact, with indications of high vertical loads evidenced by the collapse of the cockpit floor under the pilot's seat. The flaps were found in the retracted position. The pilot was not wearing the shoulder harness installed in the aircraft. There was evidence of rotation on the propeller blades, prior to one blade becoming jammed into the lower cowl. At the request of the injured pilot, the emergency locator transmitter (ELT) had been selected to the manual ON position by a passer-by. The aircraft was reported to have been leaking fuel after the occurrence.

Examination of the aircraft showed that the impulse spring (part no. 10-51324) in the magneto (Teledyne Continental Motors (TCM)/Bendix model D4LN-2021) had broken. The engine (Textron Lycoming IO-360A1B6D) in this aircraft is equipped with a single-drive, dual magneto. The impulse coupling is a spring-loaded device that mechanically retards the spark advance to assist starting. Failure of this spring would allow the common drive of the dual magneto to move in the direction that would retard the spark. This would affect both ignition systems and could cause a significant power loss if the resulting spark timing was near top dead centre (TDC). A search of the Service Difficulty Report (SDR) data base determined there had been 58 other reports of the failure of this spring, five in this model dual magneto, with similar power losses reported. A detailed examination of the broken spring by the TSB Engineering Branch found evidence of an inter-granular pre-crack region, indicating an environmentally assisted fracture. Examination determined that the magneto breaker points were pitted and gapped incorrectly, resulting in weak spark output when the magneto was bench tested, although this is not believed to be a causal factor in the occurrence.

Airworthiness Directive (AD) 78-09-07 R3, pertaining to this aircraft, requires inspection of the impulse coupling for excessive wear at 500-hour intervals. A survey of the aircraft logs and records determined that this AD had never been complied with. The engine log indicated that the engine had accumulated 758.1 hours since overhaul in 1983. The AD requires compliance with Bendix Service Bulletin (SB) 599B, which has been superseded by TCM mandatory SB (MSB) 645. This MSB adds requirements for inspection of riveted impulse couplings at 100-hour intervals, and replacement of the impulse spring if the impulse coupling is disassembled for inspection; inspection is possible without disassembly.

The aircraft was being maintained by a freelance aircraft maintenance engineer (AME), who was a close acquaintance of the pilot. The AME had last certified the aircraft on 03 February 1996, at 2,290.3 airframe hours. The AME indicated that he had obtained a listing of the ADs required for this aircraft from an American aircraft sales publication called *The Aircraft Bluebook*. The book was examined and AD 78-09-07 R3 was not included in the list of ADs for the Cessna 177RG. A disclaimer printed in the lower margin of the AD notes

section of this book reads: "NOTE - this AD note listing is intended as a guide only and should not be relied upon as conclusive evidence of AD applicability on any particular aircraft."

The pilot has held a private pilot licence since 1986 and has flown a total of about 600 hours, 468 hours of which were on type. He had obtained a night endorsement in 1989. The pilot had not performed a forced landing, practice or actual, since his initial flight training. His valid Class III medical required glasses or contact lenses to be worn. Medical examination of the pilot, following the occurrence, indicated crush damage to vertebra that required immediate surgery.

The weather at the time of the occurrence was reported as scattered cloud at 4,000 feet, broken ceiling at 8,000 feet, temperature 5 degrees Celsius, dew point -1 degree Celsius, visibility 40 miles, and the wind from 350 degrees true at 13 gusting to 18 knots. The Transport Canada *Aeronautical Information Publication (AIP)* section AIR 2.1 - Crosswind Landing Limitations chart indicates that, as a general rule, the maximum crosswind component for this aircraft in an 80-degree crosswind is about 14 mph. The pilot felt that local fields were too rough and soft to use for a forced landing, and decided to land on a road. The topography in the area of the occurrence consists of level pasture or stubble fields at an elevation of about 3,648 feet asl. The ground was reported to be soft, from a recent snow thaw, but would have been suitable for a forced landing.

The *Cardinal RG Owner's Manual* supplied by the manufacturer states that the stall speed is 66 mph CAS (flaps UP, power OFF) and 57 mph CAS (flaps DOWN, power OFF). Section III, Emergency Procedures, describes the following forced landing procedure:

> EMERGENCY LANDING WITHOUT ENGINE POWER, if all attempts to restart the engine fail and a forced landing is imminent, select a suitable field and prepare for the landing as follows:
>
> (1) Airspeed---85 MPH (flaps UP) 75 MPH (flaps DOWN)
> (2) Mixture---IDLE CUT-OFF
> (3) Fuel Selector Valve---OFF
> (4) Ignition Switch---OFF
> (5) Landing Gear---DOWN (UP if terrain is rough or soft)
> (6) Wing Flaps---AS REQUIRED (30 degrees recommended)
> (7) Doors---UNLATCH PRIOR TO TOUCHDOWN
> (8) Touchdown---SLIGHTLY TAIL LOW
> (9) Brakes---APPLY HEAVILY

Analysis

A comparison of the forced landing procedure used by the pilot in this occurrence and the procedure recommended by the manufacturer in the *Owner's Manual* indicates that the pilot did not establish the correct glide speed, select flap, or secure the engine following the loss of power. The pilot would have been at about 1,500 feet above ground level (agl) at the time of the power loss, and would have had adequate time to prepare the aircraft for a forced landing. The wing drop, initially unresponsive flight controls, and then a rapid descent are typical of an aerodynamic stall; the possibility of a stall would have been less with flap selected to the recommended 30 degrees. The drift to the south of the selected road on final approach was a result of the crosswind. The successful execution of a power-off, forced landing on a narrow road in gusty, maximum crosswind conditions would likely exceed the skill level of the average private pilot. A forced landing into wind in a level, stubble field probably would have resulted in less damage or injury. The aircraft damage pattern, including the collapsed floor under the pilot's seat, is evidence of the high vertical G impact forces that resulted in the back injuries experienced by the pilot.

The risk of fire would have been reduced had the pilot secured the aircraft fuel and electrical systems prior to ground impact, as described in the Forced Landing section of the *Owner's Manual*. As the pilot did not complete these checklist items, and in consideration of the fuel leak at the occurrence site, the risk of fire was high. Because of the immobility of the pilot, a fire would have had serious consequences.

The failure of the magneto impulse spring resulted in a loss of engine power. Completion of the impulse coupling inspection requirements contained in the missed AD (78-09-07 R3) and the referred SBs probably would have resulted in replacement of the impulse spring, if the coupling was disassembled.

The following Engineering Branch report was completed:

LP 49/96 - Examination of Magneto Impulse Spring.

Findings

1. The pilot was properly licensed and qualified for the flight.

2. The magneto impulse spring failed in flight, which resulted in a loss of engine power.

3. The pilot did not extend the flaps during the forced landing, which would have lowered the stall speed.

4. The aircraft fuel and electrical systems were not secured during the forced landing procedure, resulting in a risk of fire.

5. The pilot stalled the aircraft while attempting a forced landing.

6. The aircraft landed hard and the cabin floor under the pilot's seat collapsed, which resulted in back injuries to the pilot.

7. The pilot was not wearing the shoulder harness installed in the aircraft.

8. AD 78-09-07 R3 had never been complied with.

Causes and Contributing Factors

While attempting a forced landing following a loss of engine power, the pilot stalled the aircraft on final approach. The pilot's failure to maintain adequate airspeed or extend the flaps during the forced landing is considered to be a contributing factor. The loss of engine power was caused by the failure of the magneto impulse spring.

Safety Action Taken

Subsequent to this accident, the TSB forwarded an Aviation Safety Advisory to TC indicating that confusion may exist concerning the compliance criteria of AD 78-09-07. The TSB suggested that TC may wish to request the FAA amend AD 78-09-07 to clearly require compliance with TCM mandatory SB 645.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson, Benoît Bouchard, and members Maurice Harquail and W.A. Tadros, authorized the release of this report on 27 August 1996.