AVIATION OCCURRENCE REPORT

FUEL STARVATION - COLLISION WITH TERRAIN

PIPER PA-28-140 CHEROKEE CRUISER C-GQPI
LITTLE GRAND RAPIDS, MANITOBA 27 nm W
24 APRIL 1994

REPORT NUMBER A94C0065

Transportation Safety Board of Canada | Bureau de la sécurité des transports du Canada

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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Synopsis

The pilot and two passengers were on a flight from the Little Grand Rapids Airport, Manitoba, to Matheson Island when the aircraft's engine lost power. The pilot carried out a forced landing in a marshy area. The aircraft sustained extensive damage and the pilot suffered minor injuries; both passengers were uninjured.

The Board determined that the aircraft's engine lost power because of fuel starvation resulting from rags placed in the aircraft's fuel tanks by a person or persons unknown. Contributing factors were the ease of access by the public to aircraft parked on the ramp, and the lack of security of the aircraft's fuel supply.

Ce rapport est également disponible en français.

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1.0 Factual Information

1.1 History of the Flight

The Piper PA-28-140 Cherokee Cruiser departed Little Grand Rapids, Manitoba, at 1430 central daylight time (CDT[1]) for a business flight to Matheson Island, Manitoba. The aircraft carried a pilot, two passengers, and their baggage.

As the aircraft was climbing through 2,200 feet above sea level (asl[2]), the engine lost power and the aircraft descended and struck a tree. The aircraft's engine regained power and the aircraft resumed its climb. As it was climbing through 2,000 feet asl, the engine again lost power and descended; the pilot carried out a forced landing in a marshy area approximately 27 nm west of Little Grand Rapids.

1.2 Injuries to Persons

	Crew	Passengers	Others	Total
Fatal	-	-	-	-
Serious	-	-	-	-
Minor/None	1	2	-	3
Total	1	2	-	3

The pilot suffered minor injuries; both passengers were uninjured.

1.3 Damage to Aircraft

The aircraft struck a number of evergreen trees measuring between one and three inches in diameter during the forced landing, and sustained extensive damage to its wings, fuselage, landing gear, and engine mountings.

1.4 Personnel Information

	Pilot-in-Command
Age	36
Pilot Licence	PPL
Medical Expiry Date	30 Apr 94
Total Flying Time	317 hr
Total on Type	140 hr
Total Last 90 Days	11 hr
Total on Type Last 90 Days	7 hr
Hours on Duty Prior to Occurrence	6 hr
Hours off Duty Prior to Work Period	10 hr

1.5 Aircraft Information

Particulars	
Manufacturer	Piper Aircraft Corporation
Type	PA-28-140
Year of Manufacture	1977
Serial Number	28-7725048
Certificate of Airworthiness (Flight Permit)	Valid
Total Airframe Time	13,035 hours
Engine Type (number of)	Avco Lycoming USA Model O-320-E3D (1)
Propeller/Rotor Type (number of)	Sensenich, 2-blade Model 74-DM6-0-58 (1)
Maximum Allowable Take-off Weight	2,150 pounds
Recommended Fuel Type(s)	100 LL
Fuel Type Used	100 LL

The aircraft's records indicate that the aircraft was certified and maintained in accordance with existing regulations.

1.6 Meteorological Information

The area forecast for the time of the occurrence called for a layer of scattered cloud based at 3,000 feet, with an occasional layer of broken cloud based at 5,000 feet, and visibility of more than six miles, with localized snow

1 All times are CDT (Coordinated Universal Time (UTC) minus five hours) unless otherwise stated.

2 See Glossary for all abbreviations and acronyms.

showers with visibilities of four to six miles. Isolated towering cumulus clouds were forecast, with visibilities of one to three miles in snow.

A weather observer at Berens River, approximately 40 nm northwest of the crash site, observed the following conditions at 1500 CDT: a layer of broken cloud based at an estimated 2,000 feet, visibility 15 miles, temperature zero degrees Celsius, dew point minus five degrees Celsius, winds 330 degrees true at 10 gusting to 17 knots, altimeter setting 29.91 inches of mercury. The atmospheric conditions were conducive to light carburettor icing at cruise or descent power (see *Aeronautical Information Publication*, Section Air 2.3).

1.7 Itinerary

The pilot had rented the aircraft two days before the accident, and had flown to the Little Grand Rapids area. The aircraft made several flights, and was refuelled once. The pilot used a jerry can for refuelling the aircraft and strained the fuel through a screen into the aircraft fuel tanks. The pilot flew the aircraft about four hours before it was parked on the ramp at the Little Grand Rapids Airport at about 1700 on April 22. It stayed there until the accident flight on the afternoon of April 24.

1.8 Aids to Navigation

The flight was conducted under visual flight rules, and in visual meteorological conditions. The pilot navigated by visual reference to the ground, and did not use any radio aids to navigation.

1.9 Communications

The pilot issued a traffic advisory while taxiing to the active runway at Little Grand Rapids, prior to take-off. After the forced landing was carried out, the front-seat passenger, who was also a licensed pilot, turned on the aircraft's emergency locator transmitter (ELT). When the pilot saw an airliner passing overhead, he called its crew using the aircraft's radio, and passed a message to the Area Control Centre (ACC). The ACC advised a helicopter company working in the area, and a helicopter was dispatched to retrieve the occupants of the accident aircraft.

1.10 Aerodrome Information

Little Grand Rapids is a certified airport located about 148 nm northeast of Winnipeg, Manitoba, and operated by the Government of Manitoba Department of Highways. It is served by an unmonitored non-directional beacon (NDB), which may be used as the navigation aid for a Transport Canada company approved approach, and is a station stop for several regional air carriers.

Transport Canada Publication 312 serves as "the authoritative document for airport specifications" for land airports in Canada. It contains "recommended practices" which are "desirable in the interest of safety, regularity, or efficiency of air navigation, and to which operators will endeavour to conform." Section 8.4.1.2 contains the following recommendation: "A fence or other suitable barrier should be provided on an aerodrome to deter the inadvertent or premeditated access of an unauthorized person to a non-public area of the aerodrome."

The terminal building at Little Grand Rapids is open to the public from 0800 to 1600 Fridays, closed Saturdays, and open from 1300 to 1600 Sundays. While it is open, it is occupied by the airport manager, maintenance staff, and, from time to time, the staff of several regional airlines using the airport. When the terminal building is closed, the door allowing access to the ramp is locked. The runway is unfenced, but a fence extends along two sides of the ramp. The ramp fence has a gate approximately four feet wide, which the operator of the airport leaves unlocked to allow access by tourists, general aviation personnel, and those involved in medical evacuations.

1.11 Flight Recorders

No flight data recorder or cockpit voice recorder was installed in the accident aircraft, nor was either one required by regulation.

1.12 Wreckage and Impact Information

Physical evidence at the site indicated that the aircraft's final descent angle was about seven degrees, and the engine was producing very little power at impact. The aircraft struck a number of trees measuring between one and three inches in diameter and came to rest in a nose-down position in a marshy area. The nose

landing gear broke on impact with the ground, and the left wing fuel tank was punctured.

1.13 Aircraft Systems

The accident aircraft is of low-wing design and is equipped with a carburetted engine and one 25-US-gallon fuel tank in each wing. The aircraft's engine is equipped with a carburettor air heater.

Post-accident investigation revealed that the carburettor heat control cable was partially seized, so that when full carburettor heat was selected, only partial carburettor heat was being applied.

Each fuel tank outlet is at the rear inboard corner, which is normally the lowest part of the tank. The outlet is equipped with a finger type screen which projects into the tank. Each fuel filler cap is at the front outboard corner of the tank, and cannot be locked. The fuel filler neck affords a view of the area immediately below the cap only. No tank baffle or filler neck screen is fitted. The left wing tank was punctured and contained very little fuel. The right wing tank contained about five gallons of fuel.

Fuel is delivered to the engine by one mechanical pump and one electric pump. During examination of the aircraft after the accident, the engine started and appeared to be capable of producing normal power; however, an abnormally low fuel pressure was noted. The fuel pumps were tested and both were found to be serviceable. The fuel lines, filters, and screens were found to be clear. No fuel contamination was found. However, each fuel tank was found to contain a cloth rag about 6 by 14 inches in size. The rags were not apparent on visual inspection with the fuel tanks mounted in the wings, but were discovered when the tanks were removed and inverted. The rags sank when they were placed in a jar of fuel.

1.14 Aircraft Handling

The pilot performed a pre-flight walk-around check of the aircraft. Pilots are directed to remove the fuel tank filler caps during the walk-around and visually check the supply and colour of the fuel.

The pilot's operating handbook (POH) directs that the carburettor heat be checked before flight, and be applied in flight in the event of engine roughness or engine failure. The pilot reportedly checked the carburettor heat on the ground prior to the flight, and found it serviceable. He selected carburettor heat "on" shortly before the first power loss, and left it on for most of the remainder of the flight.

The POH requires that the electric fuel pump be turned on for take-off, and turned off after climb to cruising altitude. The electric fuel pump was reportedly switched on throughout the flight.

1.15 Survival Aspects

The aircraft was equipped with a seat-belt for each of the occupants, and a shoulder harness for each of the front-seat occupants. The rear seat was not equipped with a shoulder harness, nor was one required by existing regulations.

The front-seat passenger was wearing both his shoulder harness and lap-belt during the forced landing. The pilot wore only his lap-belt. The rear-seat passenger wore his lap-belt and used a sleeping bag to cushion his upper body during the forced landing.

The pilot's head struck the instrument panel during the forced landing, and he sustained minor facial injuries. Neither of the two passengers was injured.

1.16 Additional Information

The rags found in the fuel tanks were turned over to the Royal Canadian Mounted Police for use in their investigation.

2.0 Analysis

2.1 Carburettor Heat

The atmospheric conditions were conducive to light carburettor icing at cruise or descent power. As the aircraft engine was operating at either take-off or climb power from take-off until the loss of engine power, the formation of carburettor icing was unlikely.

Even though carburettor heat was not required by the POH, the pilot applied carburettor heat during the climb, shortly before the engine lost power. A slight reduction in rpm was observed, indicating that carburettor heat was reaching the engine. This application of carburettor heat further reduces the likelihood of carburettor icing being a causal or contributing factor in this occurrence.

2.2 Fuel Tank Design

The rags found in the tanks sank when placed in fuel. Since the fuel tank outlets are at the lowest point of the fuel tanks, the rags, when placed in the tank, would have gravitated toward the fuel tank outlet. Given that the filler neck affords a view of its immediate area only, the rags would have been out of the sight of the pilot carrying out a pre-flight check.

2.3 Fuel Starvation

Once the engine was started and the aircraft was moving, the rags would have been drawn to the fuel tank outlets by the additional effects of fuel movement in the tanks and fuel flow out of the tanks to the engine.

The rags collected at the fuel tank outlet and restricted the flow of fuel to the engine, leading to fuel starvation and loss of engine power.

When the aircraft struck the tree after the first power loss, the fuel in the fuel tanks probably moved abruptly, dislodging the rags from the fuel outlets and allowing a temporary resumption of fuel flow and engine power before the rags again migrated to the fuel outlets.

2.4 Aircraft Security

Since the aircraft had been flown about four hours before the accident and the rags sink in fuel, it is unlikely that the rags entered the fuel tanks before the aircraft left its base. As the pilot used no rags while operating or refuelling the aircraft, the rags were probably put in the tanks while the aircraft was parked at Little Grand Rapids.

Since no screens were fitted on the filler necks of the fuel tanks, rags and other foreign objects could be introduced into the fuel tanks. Once in a tank, any object would likely move out of view and would then be undetectable during pre-flight inspection.

2.5 Airport Security

The aircraft was parked on the ramp from 1700 on April 22 to 1400 on April 24. The terminal building was closed from the time the aircraft arrived until one hour before it departed. While the terminal building is closed, no staff are present; therefore, there is no one to observe the movements of persons on the ramp. Since the airport fencing at Little Grand Rapids Airport has an unlocked gate, unauthorized persons may gain unsupervised access to the aircraft parked on the ramp.

2.6 Injuries

Significant reductions in injuries can be achieved by using shoulder harnesses. The pilot's injuries during the forced landing might have been avoided by use of the available shoulder harness.

3.0 Conclusions

3.1 Findings

1. The pilot was certified and qualified for the occurrence flight in accordance with existing regulations.

2. The aircraft's records indicate that the aircraft was certified and maintained in accordance with existing regulations.

3. The aircraft's engine lost power because of fuel starvation resulting from rags placed in the aircraft's fuel tanks by a person or persons unknown.

4. The rags were probably placed in the fuel tanks while the aircraft was parked on the ramp at the Little Grand Rapids Airport.

5. The airport fencing allows public access to aircraft parked on the ramp via a gate and via the runway area.

6. There is no supervision of persons on the ramp area after normal working hours or on Saturdays.

7. The aircraft fuel tank design does not incorporate a lock or filler neck screen, and does not allow easy inspection of the entire fuel tank.

8. The pilot's injuries during the forced landing might have been avoided by use of the available shoulder harness.

3.2 Causes

The aircraft's engine lost power because of fuel starvation resulting from rags placed in the aircraft's fuel tanks by a person or persons unknown. Contributing factors were the ease of access by the public to aircraft parked on the ramp, and the lack of security of the aircraft's fuel supply.

4.0 Safety Action

The Board has no aviation safety recommendations to issue at this time.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson, John W. Stants, and members Gerald E. Bennett, Zita Brunet, the Hon. Wilfred R. DuPont and Hugh MacNeil, authorized the release of this report on 16 January 1995.

Appendix A - Glossary

ACC	Area Control Centre
asl	above sea level
AD	Airworthiness Directive
CDT	central daylight time
ELT	emergency locator transmitter
hr	hour(s)
LL	low lead
NDB	non-directional beacon
nm	nautical miles
POH	Pilot's Operating Handbook
PPL	Private Pilot Licence
TC	Transport Canada
TSB	Transportation Safety Board of Canada
UTC	Coordinated Universal Time