

AVIATION INVESTIGATION REPORT

A02C0124

FUEL EXHAUSTION - COLLISION WITH TERRAIN

KEYSTONE AIR SERVICES LTD.

PIPER PA 31-350 NAVAJO CHIEFTAIN C-GPOW

WINNIPEG, MANITOBA

11 JUNE 2002

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

A Keystone Air Service Ltd. Flight KEE208, a Piper PA-31-350 Chieftain, registration C-GPOW, serial number 31-7305093, was on an instrument flight rules flight from Gunisao Lake, Manitoba, to Winnipeg. One pilot and six passengers were on board. At 0913 central daylight time, KEE208 began an instrument landing system approach to Runway 13 at Winnipeg International Airport. The captain flew the approach at a higher-than-normal approach airspeed and well above the glide path. When the aircraft broke out of the cloud layer, it was not in position to land safely on the remaining runway. The captain executed a missed approach at 0916 and, after switching to the approach frequency from tower frequency, requested an expedited return to the airport.

The approach controller issued instructions for a turn back to the airport. Almost immediately, at 0918, the captain declared a 'Mayday' for an engine failure. Less than 20 seconds later the captain transmitted that the aircraft had experienced a double engine failure. The aircraft crashed at a major traffic intersection at 0920, striking traffic signals and several vehicles. All seven of the aircraft passengers and several of the vehicle occupants were seriously injured; one passenger subsequently died of his injuries. The aircraft experienced extensive structural damage, with the wings and engines tearing off along the wreckage trail. There was a small post-crash fire in the right wing and engine area.

Ce rapport est également disponible en français.

Other Factual Information

C-GPOW was fuelled to its maximum capacity at the company's base in Swan River, Manitoba, the night before the accident. The aircraft was then positioned in Winnipeg to fly a group of fishermen and baggage to Gunisao Lake and to return with another group. The positioning flight, which was flown by another company pilot, took 1 hour and 38 minutes, and the aircraft was not refuelled after arrival in Winnipeg.

The pilot held a valid airline transport pilot licence and medical certificate, and records indicate that his pilot proficiency check and required training were current. He had been flying for 12 years and had about 3000 hours of flight time. Prior to his joining the company, he had been a flying instructor. The pilot had flown with the company for about 16 months, flying both scheduled and charter flights. The pilot had flown many similar flights into Gunisao Lake and was familiar with the routing and flight planning requirements of the trip. He was aware that 100 LL aviation gasoline was not available at Gunisao Lake.

On the morning of the accident, the pilot reported for duty at 0420¹. He checked the weather and noted that instrument meteorological conditions (IMC) existed at Winnipeg and for part of his route. He filed instrument flight rules (IFR) flight plans from Winnipeg to Gunisao Lake and return. The alternate aerodrome that he filed for both flights was Island Lake, located about 258 nautical miles north of Winnipeg. He completed pre-flight and run-up checks of the aircraft and noted that the total fuel was approximately $\frac{3}{4}$ of the total capacity of the aircraft. The pilot accepted seven passengers with baggage for the flight to Gunisao Lake. He did not complete weight and balance or fuel calculations on the operational flight plan and load control form provided in Chapter 8 of the *Keystone Air Service Ltd. Operations Manual*. Based on his belief that a full load of fuel would provide approximately five hours of flight time, he made a mental estimate that there was sufficient fuel to complete the round trip to Gunisao Lake. He estimated that the $\frac{3}{4}$ full tanks would allow him to return to Winnipeg with a fuel reserve of 50 minutes, and he did not re-fuel.

The pilot estimated the flight time from Winnipeg to Gunisao Lake on his operational flight plan as 1 hour 20 minutes. The actual aircraft flight time was approximately 1 hour and 31 minutes. At Gunisao Lake, the seven passengers disembarked with their baggage and the pilot accepted six passengers and 450 pounds of baggage for the return flight. He made no further weight and balance or fuel calculations on the operational flight plan and load control form. The pilot estimated the flight time from Gunisao Lake to Winnipeg on his operational flight plan as 1 hour 20 minutes. The actual aircraft flight time from Gunisao Lake until the overshoot at Winnipeg was 1 hour and 30 minutes.

When the pilot began the approach at Winnipeg, the reported weather for Winnipeg was as follows: winds 200 degrees at 8 knots; ceiling overcast at 300 feet; visibility 1 statute mile in light drizzle and mist; altimeter setting 29.81 inches.

¹ All times are central daylight time (Coordinated Universal Time minus five hours unless otherwise stated)

The PA31-350 uses 100 low lead (LL) aviation gasoline and has a maximum fuel capacity of 192 US gallons² (1152 pounds), of which 182 gallons (1092 pounds) is useable. The pilot's operating manual, which was carried aboard the aircraft, contains the following caveat: "Performance for a specific aeroplane may vary from published figures depending upon the equipment installed, the condition of engines, aeroplane and equipment, atmospheric conditions and piloting technique." For flight planning purposes for the PA31-350, the company used a fuel consumption figure of 240 pound per hour (pph) for the first hour. This figure included a 30 pph allowance for taxi, take-off and climb. For subsequent hours of flight the company used a consumption figure of 210 pph. Notes made by the pilot found in the aircraft indicate that these consumption figures had been communicated to him. The pilot had also noted that flight time to dry tanks was 4 hours and 45 minutes. A review of the aircraft journey log and available re-fuelling records for five days prior to the accident permitted the determination of an average fuel usage of 225 pph for C-GPOW.

Before the aircraft was on approach into Winnipeg, the right engine low fuel pressure light illuminated and the right engine sputtered. Fuel cross feed was selected. The right low fuel pressure light then went out and the engine returned to normal operation. The pilot did not declare an emergency or ask for assistance during the return flight to Winnipeg before executing the missed approach.

The pilot flew an instrument landing system (ILS) approach to Runway 13 at Winnipeg, recognizing that the fuel situation was critical and that engine power loss was imminent. He intentionally flew the aircraft well above the glidepath for the ILS and at speeds significantly faster than normal, in order to have more time to respond to an engine power loss.

The aircraft crossed the missed approach point well above the glide path. The pilot continued to descend the aircraft and was observed by tower controllers after breaking out of the cloud layer at about 200 feet above ground level, with about 3200 feet of runway remaining. KEE208 was not in a position to safely land on the remaining runway and the pilot executed a missed approach, about four minutes prior to the crash.

The pilot attempted to inform the controller during the missed approach that he had an urgent fuel problem; however, the critical information was not received by the controller. During the missed approach, the pilot switched the fuel selector from cross feed and re-selected the main tanks in order to conserve the remaining fuel in the left tank for the left engine. The right engine then lost power and he feathered it. Approximately three minutes before the crash, the pilot advised the approach controller that he would like to expedite and return to the airport as soon as possible. Approximately 30 seconds later, the left engine lost power and the pilot transmitted a "Mayday" call. The aircraft was not in a position to return to any runway and the aircraft crashed as the pilot conducted a forced landing at a major city intersection.

There was a small post-crash fire and the cabin filled with smoke. Bystanders were able to extinguish the fire with hand held fire extinguishers. Several passengers were assisted from the wreckage by other bystanders. Some were trapped in the wreckage for several minutes until rescued by city fire crews.

² Units are consistent with official manuals, documents, reports, and instructions used by or issued to the crew.

Examination of the aircraft wreckage and testing of several components did not reveal any pre-existing mechanical problems with the aircraft. Technical records indicated that the autopilot had been removed from the aircraft on 29 April 2002; however, the appropriate journey log entries had not been made. The propellers of both engines were feathered. (Right engine serial number L1163-68A, left L6295-61A) There was no indication of fuel leaking or venting. The fuel pressure and fuel flow gauges were tested and operated normally. About 8.5 US gallons of residual fuel were drained from the fuel system.

The *Keystone Air Service Ltd. Operations Manual*, Chapter 3, requires that the pilot-in-command of a Navajo aircraft on an IFR flight ensure that there is sufficient fuel to fly to the destination, execute an approach and a missed approach, and then fly to the alternate aerodrome and land with a reserve of 45 minutes. Chapter 2 states that all flights must be authorized by the Operations Manager or Chief Pilot and that a flight release will not be given until the pilot-in-command has completed an operational flight plan. However, company supervisory personnel indicate that, in practice, a flight release is not required and that a pilot self dispatch system is used. Chapter 2 also requires that a weight and balance form be completed for each flight and signed by the pilot-in-command. The Canadian Aviation Regulations (CARs) require that the aircraft be equipped with an auto-pilot for single-pilot IMC operations.

Company supervisory personnel were present, preparing for their own flights on the morning of the accident flight. They were aware, as was the aircraft pilot, that C-GPOW was not equipped with an autopilot and that one was required for single-pilot operations in the conditions of that morning.

Analysis

The pilot's pre-flight fuel estimate, which led to his conclusion that he would have 50 minutes of fuel on arrival in Winnipeg, was incorrect. The total flight time from Swan River to Winnipeg plus the flight plan estimates for the flight to Gunisao Lake and return was 4 hours and 18 minutes. These flights would have used 993 pounds of fuel using the company's guidance of 240 pph and 210 pph for the first hour and second hours respectively. This would have left a reserve of 99 pounds or 28 minutes of fuel, which was not sufficient for the flight to the filed alternate of Island Lake and the required hold time of 45 minutes.

The total actual flight time from the re-fuelling in Swan River until the pilot began the missed approach at Winnipeg was 4 hours and 38 minutes. Since this included three separate flights, the calculation of the expected amount of fuel remaining on arrival at Winnipeg would be approximately 25 pounds or 6 minutes of fuel. The aircraft experienced a complete engine power loss 4 minutes later and, therefore, it is concluded that the power loss was a result of fuel exhaustion.

The pilot's decision to fly the ILS well above the glide path and at a higher-than-normal airspeed resulted in an ineffective approach from which a landing could not be made, although the reported weather at the time of the approach was better than the landing minima for the ILS to Runway 13. The pilot's decision to continue the approach well beyond the ILS missed approach point did not assure obstacle clearance while in proximity to the ground in cloud. His decision to modify the approach reduced, rather than increased, flight safety.

The average fuel usage determined from the journey log for C-GPOW of 225 pph for similar flights was close to the company's guidance. Therefore, the actual fuel consumption rate of C-GPOW was reasonable and close to what would be expected.

Although there were company supervisory personnel present when the pilot began his flight, none took any action when the pilot of C-GPOW began his flight into IMC without an autopilot. The level of supervision that the company should have provided was not achieved on this series of flights. Company practices did not conform to the company operations manual regarding flight release; the operations manual was apparently incorrect with respect to the requirements for flight release.

Findings as to Causes and Contributing Factors

1. The pilot did not correctly calculate the amount of fuel required to accomplish the flight from Winnipeg to Gunisao Lake and return, and did not ensure that the aircraft carried sufficient fuel for the flight.
2. The ILS approach was flown above the glideslope and beyond the missed approach point, which reduced the possibility of a safe landing at Winnipeg, and increased the risk of collision with terrain.
3. During the missed approach, the aircraft's engines lost power as a result of fuel exhaustion, and the pilot conducted a forced landing at a major city intersection.
4. The pilot did not ensure that the aircraft was equipped with an autopilot as specified by CARs.

Findings as to Risk

1. The company did not provide an adequate level of supervision and allowed the flight to depart without an autopilot.
2. The company operations manual did not reflect current company procedures.
3. The company did not provide an adequate level of supervision and allowed the flight to depart without adequate fuel reserves. The company did not have a safety system in place to prevent a fuel exhaustion situation developing.

Other Findings

1. The pilot did not advise air traffic control of his critical situation in a timely fashion.

Safety Action

Transport Canada conducted a post-accident regulatory audit and, at the request of the company, a systems safety review.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 25 March 2003.