

AVIATION OCCURRENCE REPORT

POWER LOSS/COLLISION WITH TREES/TERRAIN

MANAN AIR SERVICES INC.

PIPER PA-31-310 C-FZVC

GRAND MANAN ISLAND, NEW BRUNSWICK

12 SEPTEMBER 1997

REPORT NUMBER A97A0173

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 aircraft departed Grand Manan, New Brunswick, at 1938 Atlantic daylight time (ADT) on a charter flight to Yarmouth, Nova Scotia, with the pilot and five passengers on board. After dropping off the passengers at Yarmouth, the aircraft departed at 2106 ADT for a night visual flight to return to Grand Manan. The pilot was unable to land at Grand Manan off the first visual approach because of low weather conditions and conducted a second visual approach. During the second approach, he noticed that he required increasing right rudder to maintain direction, and that the left engine manifold pressure was low. The pilot feathered the left propeller and, despite the application of full power on the right engine, the aircraft would not accelerate or climb. The aircraft began a shallow descent into a fog layer, and the aircraft collided with some trees, pitched nose-down, and struck the ground. The aircraft was destroyed by the impact and a post-impact fire. The pilot suffered serious injuries, but managed to get out of the aircraft and make his way to a nearby cabin where he was found by a ground search team about three hours later.

Ce rapport est également disponible en français.

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All times are ADT (coordinated universal time minus three hours) unless otherwise noted.

Other Factual Information

The pilot had been flying in the Grand Manan area since 1978 and, over the course of the intervening 19 years, had become familiar with the local area. He was current and qualified on the Piper PA-31-310 aircraft. During his recent pilot proficiency check, engine-failure procedures were assessed as satisfactory. It was determined that at the time of the occurrence the aircraft was approximately 1,200 pounds below its maximum allowable take-off weight of 6,500 pounds, and the centre of gravity was within the permissible limits.

The aviation forecast for the area of Yarmouth and Grand Manan included the possibility of localized ceilings of 500 to 1,000 feet above sea level (asl) with visibilities of two to five statute miles in fog at the time of the occurrence. According to regulations, the weather conditions were marginally acceptable for visual flight rules (VFR) flight in uncontrolled airspace.

Approaching Grand Manan, the pilot discussed the local weather conditions with his wife, by radio. From her vantage point, approximately one mile northeast of the airport, she reported a low overcast ceiling in the vicinity of their home, and she reported being able to clearly see the airport. She stated that the visibility to the northeast was good but that the visibility toward the airport was not quite as good, about four or five miles. The weather as described by the pilot's wife is consistent with the observations of witnesses interviewed in the vicinity. The weather to the west of the airport, in the area of the accident site, was described by search and RCMP personnel as being ground-based, heavy mist or fog, which thoroughly soaked the clothing of search personnel.

When he was approximately 10 miles southeast of the airport, the pilot could distinguish the glow of the airport lighting through a thin layer of fog or cloud. He continued toward the airport and then turned right, to a left-hand downwind leg for runway 24, at approximately 800 feet above ground level (agl). On the downwind leg, the pilot momentarily clearly observed the airport and the rotating beacon, but by the time he had turned final for runway 24, he could no longer see any sign of the airport or its lighting through the cloud. He discontinued the approach and elected to attempt a second approach.

The pilot flew the second approach relying on known landmarks, which were reportedly clearly visible. Approximately one mile from the airport, the aircraft was approximately 1,000 feet asl and the airspeed was approximately 90 knots indicated airspeed (KIAS), with the landing gear down, flaps at 15 degrees, and the landing light off. The pilot then descended to just above the cloud or fog bank. From the outset of the second approach, the pilot never regained visual reference with the airport or with any of its associated lighting.

During the approach, the pilot found he had to add more and more power to maintain airspeed and altitude, to the point where eventually both throttle levers were at maximum travel. Coincidentally, he had to use progressively more right rudder to maintain directional control. The pilot then noted that the left engine manifold pressure was lower than the right. The pilot felt that the pressure was somewhere between 20 and 30 inches while the right engine reading was either 42 or 44 inches. In an attempt to decrease the drag that would be created by a windmilling propeller, the pilot feathered the left engine propeller; coincidentally, the aircraft descended into cloud. The pilot selected the gear up immediately after feathering the left engine and raised the flaps. He does not, however, specifically recall the flap selection made nor banking the aircraft five degrees into

the good engine as recommended in the aircraft's Pilot Operating Handbook (POH). After feathering the left propeller, the pilot did not take further steps to secure the left engine.

The airspeed decreased to 80 KIAS, or slightly less, and never exceeded 80 KIAS thereafter, despite there being full power on the right engine. The pilot eased the nose of the aircraft down and then back up a few times in an effort to trade altitude for airspeed, all the while descending, but the airspeed did not increase. Realizing that an accident was imminent, the pilot advised his family by radio of his predicament. Shortly thereafter, the aircraft struck some large trees, pitched nose-down, and struck the ground. At impact, flames erupted near the right engine. The pilot released his seat belt and crawled out the crew door. The Rescue Coordination Centre in Halifax reported that an emergency locator transmitter (ELT) signal had been heard for approximately 20 minutes by overflying aircraft in the area of the crash before the signal ceased.

Fire destroyed all cockpit instrumentation and radios. The engine control quadrant and fuel selector panel were burned, and it was not possible to determine the pre-impact positions of the controls. The fuselage back to the tail section was destroyed by fire, and both wings were heavily fire-damaged. There was no indication that there was an in-flight fire. Because of the degree of impact and fire damage to the aircraft, the pre-impact condition and position of the flight controls could not be determined. However, continuity of the flight control cables was confirmed. At impact, the flaps and landing gear were retracted and the cowl flaps were closed.

Both fuel shut-off valves and the cross-feed valve were found and examined; however, the degree of damage precluded making a determination of the valves' pre-impact positions. The left and right fuel selector valves and the fuel selector panel were not recovered.

The engines were subjected to extreme heat from the fire, which virtually destroyed all of the accessory components. The left engine and both propellers were transported to the TSB wreckage examination facility in Dartmouth, Nova Scotia, for a detailed examination. The examination of the left engine did not reveal any pre-impact mechanical discrepancies, and it was determined that the left propeller was in the feathered position at impact. It was not possible to determine the blade angle of the right propeller at impact. A number of trees, some as large as eight inches in diameter, were sliced off by the right propeller as the aircraft went through the trees, indicating that the right engine was producing substantial power.

The aircraft's inboard and outboard fuel tanks had been fuelled to capacity, at Halifax, earlier on the day of the occurrence. The pilot stated that he had flown from Halifax to Grand Manan, about one hour in duration, on the outboard tanks. Based on the pilot's estimate of the aircraft's fuel consumption of 200 pounds per hour, the total fuel remaining in the outboard tanks should have been approximately 266 pounds. He then flew from Grand Manan to Yarmouth and returned, about one hour flight time, using fuel from the inboard tanks. Based on the same fuel consumption rate, the total fuel remaining in the inboard tanks at the time of the occurrence should have been approximately 458 pounds.

According to the POH for the Piper PA-31-310, the best single-engine rate-of-climb speed is 94 KIAS, while the best single-engine angle-of-climb speed is 90 KIAS. Following this occurrence, the manufacturer was requested to provide the aircraft's single-engine climb performance given the following conditions; aircraft gross weight of 5,291 pounds, outside air temperature of 17 degrees Celsius, altitude of 800 feet asl, flaps and

gear up, airspeed of 80 KIAS, and the POH procedures followed. The expected single-engine rate-of-climb was calculated to be 495 feet per minute.

The POH provides recommended procedures for dealing with engine failures. For example, if an engine fails at an airspeed above 76 KIAS, the POH suggests the pilot take the time to properly identify the inoperative engine and attempt to identify the nature of the problem. The emergency procedures state the following: 1) check to make sure the fuel flow to the engine is sufficient; 2) if the fuel flow is deficient, turn ON the emergency fuel pump; 3) check the fuel quantity on the inoperative engine side and switch the fuel selector to the other tank if a sufficient supply is indicated; and, 4) check the oil pressure and oil temperature and insure the magneto switches are ON. The POH also states that the pilot apply 5° of bank into the operating engine to assist in controlling the aircraft.

For this aircraft, the airspeed during an approach, as recommended in the POH, should be 100 KIAS or more. The POH states that a missed approach procedure for single-engine flight should be avoided if at all possible, and if a missed approach is unavoidable, that 94 KIAS or higher should be maintained. A warning in the POH states that a missed approach (go-around) should not be attempted if the airspeed is below 90 KIAS, the best single-engine angle-of-climb speed.

In the event of an engine failure in a light, twin-engine aircraft such as the Piper Navajo, accurate airspeed control is critically important to maintain level flight or to establish a climb. The airspeed must not be allowed to decrease below the optimum where drag may become so high that the thrust from the remaining engine is not sufficient to overcome the drag. In this situation, the only way to maintain the airspeed above the stall is to descend, thereby trading altitude for airspeed. This option may not be available when operating close to the ground.

Normally, the need for making a decision during flight is triggered by recognition that something has changed. Recognition of this change provides the pilot the opportunity to make a timely decision to control the circumstances of the flight. If no decision is made and as time and the flight progresses, the alternatives available to the pilot to make changes may decrease or disappear completely.

Analysis

The cause of the apparent engine failure could not be determined. After the left propeller was feathered and the landing gear and flaps retracted, the aircraft should have been able to climb at a rate of 495 feet per minute. The analysis will focus on human performance elements that contributed to the accident and on the single-engine performance demonstrated by the aircraft.

The pilot was aware that it would be dark and that the forecast included the possibility of ceilings of 500 to 1,000 feet asl with visibilities of two to five statute miles in fog at the time of his return to Grand Manan. The weather conditions were marginally acceptable for VFR flight in uncontrolled airspace, and the pilot's decision to undertake the flight, given the weather and light conditions, was considered reasonable.

When the pilot turned final for runway 24 during his first approach, he could not see any sign of the airport or

its lighting, believing that he was flying above a cloud layer which was obscuring his view of the airport. During his second attempt, the pilot never had visual reference with the airport or with any of the associated lighting. Notwithstanding the poor weather conditions, the pilot continued with the approach relying on ground features to align himself with the runway, which he could not see. He was skimming the top of the cloud or fog layer at night, close to the ground, and at an airspeed below the recommended final approach speed. This allowed little or no safety margin in the event of an aircraft malfunction. Continued VFR flight into IMC conditions is a leading cause of Controlled Flight Into Terrain (CFIT) accidents.

By the time the pilot diagnosed that he had an engine problem, the aircraft was in a shallow descent into cloud, relatively close to the ground, and the airspeed had decreased to 80 KIAS or less. Given the low altitude and airspeed, the pilot had to take immediate action in order to reduce the drag caused by the windmilling propeller. However, once the propeller was feathered, the pilot lost the opportunity to troubleshoot the engine problem and was committed to handling an engine-out situation under less than ideal weather and light conditions. An approach airspeed of 100 KIAS or more is recommended in the POH to provide more time, in the case of an emergency, for analysing problems and taking corrective actions before the aircraft reaches a state where it can no longer be flown safely.

It could not be determined why the aircraft would not climb or accelerate after the left propeller was feathered. The manufacturer's calculations indicate that the aircraft should have been able to climb; the fact that it did not climb may have been due to the low airspeed at which the approach was attempted, the pilot's actions in raising and lowering the nose of the aircraft, and the pilot not applying five degrees of bank into the good engine.

The pilot distinctly recalls that he had only flown one hour on the outboard fuel tanks and, based solely on this recollection, the possibility of fuel exhaustion would appear unlikely. However, the engine failure described by the pilot is consistent with an engine stopping because of fuel exhaustion. After the aircraft had been fuelled to capacity, it had been flown for approximately two hours. The pilot considered the fuel consumption rate of each engine to be approximately 100 pounds per hour. Given that the fuel capacity of each outboard tank is 233 pounds, and assuming the pilot had flown with the outboard tanks selected for the two hours, approximately 33 pounds of fuel would remain in each of the outboard tanks. Based upon this approximation of fuel remaining, the possibility of fuel exhaustion in the outboard tanks cannot be ruled out.

Findings

1. The pilot was certified for the flight in accordance with existing regulations.
2. The aircraft's weight and centre of gravity were within the prescribed limits.
3. For undetermined reasons, the left engine lost power during the approach.
4. Because of the low airspeed and height at which the pilot was flying the approach, he had no time to analyse the engine malfunction before feathering the engine.
5. After feathering the left engine, the pilot was committed to conducting a single-engine

overshoot, at night and in cloud. The airspeed was then 80 KIAS, 20 knots below the recommended approach speed.

6. After the apparent engine failure, the pilot did not follow the recommended emergency procedure as outlined in the POH.
7. For undetermined reasons, the aircraft would not accelerate or climb despite full application of power on the operative engine.

Causes and Contributing Factors

The aircraft lost power on the left engine during the approach for undetermined reasons and descended into the ground. The cause of the engine power loss was not determined. The low airspeed, at the time of the engine power loss, decreased the time available to the pilot to secure the emergency in accordance with the POH, and contributed to the poor single-engine performance of the aircraft.

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 16 September 1998.