AVIATION INVESTIGATION REPORT
A02C0105

ENGINE POWER LOSS / FORCED LANDING

UNITED STATES DEPARTMENT OF THE INTERIOR
CESSNA TU206F (AMPHIBIOUS) N753
SWAN RIVER, MANITOBA
27 MAY 2002

Aviation Investigation Report

Engine Power Loss / Forced Landing

United States Department of the Interior
Cessna TU206F (Amphibious) N753
Swan River, Manitoba
27 May 2002

Report Number A02C0105

Summary

The amphibious Cessna TU206F aircraft, registration N753, serial number U20603401, with the pilot and one crew member on board, departed from Runway 20 at Swan River, Manitoba, en route to Dauphin. Immediately after take-off, the aircraft began to vibrate and engine power began to decrease. At this time, the aircraft was at a height of about 75 feet with about 1100 feet of runway remaining. The runway is 4130 feet long, and several ditches and a road cross the runway departure path. Based on his assessment that there was insufficient runway remaining on which to land and that the engine was producing sufficient power to maintain flight, the pilot decided to fly a right-hand circuit away from parked aircraft and terminal area buildings and return to Runway 20. The aircraft was turned to the right and levelled off. Engine power continued to decrease, and the pilot decided to make a forced landing in a plowed field ¼ mile west of the runway. On landing, the aircraft overturned and came to rest in an upright position. After the aircraft came to rest, the engine rpm suddenly increased; the pilot pulled the throttle back and the engine stopped. The pilot and the crew member were wearing their seatbelts and shoulder harnesses, and both exited the aircraft with minor injuries. The aircraft was destroyed by fire. The accident occurred at 1245 central daylight time.

Ce rapport est également disponible en français.

Other Factual Information

The weather in Dauphin, Manitoba, at the time of the accident was as follows: scattered clouds at 1600 feet and 3500 feet, visibility 9 statute miles, temperature 24°C, dewpoint 2°C, wind from 220° at 8 knots, and altimeter setting 29.78 inches of mercury. Weather in Swan River at the time was similar.

The pilot of the aircraft held a valid commercial pilot licence and a second class medical certificate, issued by the United States Federal Aviation Administration. He was instrument rated on single-engine land and sea airplanes. The pilot has held a commercial pilot licence since 1978, with a total of 9000 hours of flight time, including 1500 hours on the amphibious Cessna 206. During the previous 30 days the pilot had flown approximately 45 hours, 4 hours of which were on the day of the accident.

The Swan River airport does not have dedicated airport emergency response services. Witnesses who observed the accident ran or drove to the crash site with fire extinguishers and attempted without success to suppress the intense fuel-fed fire. Several forest fire retardant spray aircraft had been waiting for the accident aircraft to take off. An attempt by one of the spray aircraft to extinguish the fire by discharging its retardant was unsuccessful. The fire was eventually extinguished by the crew of a fire truck spraying water from a nearby pond.

The aircraft, owned by the United States Department of the Interior, was being used to collect waterfowl data in cooperation with the Canadian Wildlife Service. The pilot and the crew member were both employees of the Department of the Interior. The crew member was acting as an observer on the occurrence flight. On the day of the accident, the pilot and the crew member had been conducting low-level waterfowl surveys and were on their way back to Dauphin. En route to Dauphin, the pilot landed in Swan River and uplifted 120 litres of 100 LL fuel in the left fuel tank. Only the left fuel sump was checked before take-off on the occurrence flight, and no contamination was found. The pilot did not perform a run-up before take-off, but no operating anomalies were noted.

During the take-off roll, the engine achieved a maximum of 2700 rpm, and a fuel flow of 23.5 gallons per hour (gph). The *Pilot's Operating Handbook Supplement* (POH) for the Cessna 206 equipped with a TCM 550 engine indicates that maximum take-off rpm is 2700 and maximum fuel flow is 25.8 gph. The Cessna POH provides a landing distance over a 50-foot obstacle of about 1500 feet for a wheel-equipped aircraft.

Examination of the site indicated that the float tips had dug into the ground and then bent up into the propeller arc. Damage to the top of the vertical fin and scratch marks on the upper surface of the wings indicated that the aircraft had overturned on touchdown. The crew member reported seeing a steady stream of fuel coming from the left wing root after the aircraft came to rest. The aircraft was destroyed by a subsequent fire. As a result, fuel samples, fuel filter /sump condition, and instrumentation could not be obtained.

The propeller departed the engine and was found 14 metres ahead of the wreckage. Approximately six centimetres of all three blade tips were sheared off. Both nose-gear legs on the amphibious floats were broken off during the impact, and all four landing-gear actuators were extended. The fuel selector valve was selected to the left fuel tank. A continuity check of the flight controls revealed no pre-impact anomalies. A cargo net was used to prevent the movement of on-board materials.
A fuel sample was secured from the local fuel station from which the aircraft refuelled and was sent to the TSB Engineering Laboratory for analysis. The analysis revealed that the fuel sample consisted of 100 LL aviation gasoline with no contaminants. The fuelling station offered 100 LL aviation gasoline and Jet B fuel from separate tanks, each with its own fuel nozzle. Both fuel nozzles were of the same size and shape. The operator of the fuel station indicated that the fuel tank water separators / fuel filters were replaced two days before the

occurrence and that the operator, flying several aircraft on daily schedules, did not experience any problem with the fuel.

The aircraft's engine and propeller were removed from the site and taken to the regional TSB office for further assessment. The engine was sent to the engine manufacturer (Teledyne Continental Motors) for teardown and examination, with a TSB investigator in attendance. The engine has six cylinders and six fuel injector nozzles. When disassembling the fuel manifold/distributor, the diaphragm steel shaft was extremely difficult to remove. Once removed, it was evident that the steel shaft was coated with rust. The rust was a result of the steel shaft contacting water. Further inspection of the manifold revealed a rust-like stain on the screen. The No. 1 and No. 2 fuel injectors were completely restricted. Initial inspection of the No. 3 and No. 6 fuel injectors suggested that they were partially restricted. However, on subsequent inspection at the regional TSB office, it was determined that they were clear. The cylinders and the pistons did not show any indication that the wrong type of fuel might have been used. No other pre-impact anomalies with the engine were found. The propeller and the propeller governor were sent to a local propeller overhaul facility where teardown of both components did not reveal any pre-impact anomalies.

The fuel manifold and both fuel injectors were sent to the TSB Engineering Laboratory for analysis. The analysis confirmed that the steel shaft was coated with rust. The stain on the manifold screen comprised copper and zinc, the result of corrosion of the screen. The No. 1 fuel injector fuel orifice was restricted with copper and zinc that resembled the elements found on the manifold screen. The No. 2 fuel injector was restricted with a rubbery sealant used on the threads of the injector body. The restriction found in the No. 2 injector was considered to have occurred during disassembly.

Analysis

It is likely that landing straight ahead after the power loss would have resulted in a runway overrun and probable collision with the road or a ditch. The forced landing in the adjacent field provided a smoother landing surface with reduced impact forces. The crew's use of the seatbelts, shoulder harnesses, and cargo net probably prevented more serious injuries.

The pilot elected not to retract the landing gear based on his decision to fly a circuit for an immediate return to Runway 20. Leaving the landing gear down increased drag, making it more difficult to maintain flight. The landing gear in the down position likely contributed to the aircraft pitching forward on landing.

The initial impact bent the forward section of the right float upward and into the arc of the propeller, resulting in the damage to all three propeller blade tips. Separation of the propeller from the engine allowed the engine rpm to run away or increase.

Twisting and distortion of the airframe during the roll-over either dislodged or cracked the fuel line at the left wing root, resulting in a steady stream of fuel. The most likely scenario is that, as a result of the airframe damage, an electrical arc or a heat source (such as the engine exhaust) ignited the fuel leaking from the left wing root.

Water contamination in the fuel resulted in the corrosion of the fuel manifold / distribution screen. Corrosion particles then migrated to the No. 1 fuel injector during operation, restricting fuel flow to the No. 1 cylinder. This restricted fuel flow caused the No. 1 cylinder to stop firing, contributing to the engine power loss. Water in the fuel probably resulted in intermittent fuel delivery to the engine and partial fuel starvation, resulting in deteriorating engine power at take-off. The water was likely in the fuel cells at take-off, but the source of the contamination is not known.

The following TSB Engineering Laboratory reports were completed and are available on request:

LP 055/02	Fuel Analysis
LP 078/02	Fuel Manifold/Distributer & Fuel Injectors Contamination

Findings as to Causes and Contributing Factors

1. The aircraft's fuel was contaminated with water, deteriorating engine power.

2. A restriction in the No. 1 fuel injector resulting from corrosion of the manifold screen caused the No. 1 cylinder to stop firing, contributing to the deteriorating engine power.

3. The aircraft was destroyed by fire, most likely as a result of a fuel leak that started because of airframe damage during the forced landing.

Findings as to Risk

1. The fuel delivery nozzles for 100 LL and Jet B were of the same size and shape, increasing the risk of using the wrong type of fuel.

Safety Action

To prevent misfuelling, the Jet B fuel nozzle at the Swan River airport fuelling station was replaced with a larger oblong nozzle.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 10 June 2003.

Visit the Transportation Safety Board's Web site (www.tsb.gc.ca) for information about the Transportation Safety Board and its products and services. There you will also find links to other safety organizations and related sites.