Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

# AVIATION INVESTIGATION REPORT
# A06W0111

## LOSS OF CONTROL – COLLISION WITH GROUND

## PIPER PA-34-200T (SENECA II) C-GOLY
## EDSON, ALBERTA
## 11 JULY 2006

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.

# Aviation Investigation Report

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## *Summary*

The privately operated Piper PA-34-200T Seneca II aircraft (registration C-GOLY, serial number 34-8170070) departed Edmonton City Centre Airport, Alberta, at 1131 mountain daylight time on a flight to Prince George, British Columbia. While the aircraft was in cruise flight in the vicinity of Hinton, Alberta, the right engine (Teledyne Continental LTSIO-360-EB, serial number 266232-R) lost power. The pilot declared an emergency and attempted a single-engine approach and landing at Edson Airport. On short final for Runway 25, control of the aircraft was lost and the aircraft struck an airport fence, coming to rest just short of the runway threshold. The pilot sustained serious injury and the three passengers sustained minor injuries.

*Ce rapport est également disponible en français.*

# *Other Factual Information*

## *History of Flight*

The pilot planned a direct route for the flight, under visual flight rules, at 8500 feet above sea level (asl). The flight departed the Edmonton City Centre Airport at 1131 mountain daylight time[1] and reached 8500 feet asl nine minutes later. The final radar return from the aircraft was at 1222, with the aircraft at 8500 feet asl on a track of 260° magnetic (M). An on-board global positioning system (GPS) was being used, and track log information showed that, after departure, the aircraft cruised on an average track of 260°M for approximately 50 minutes. The aircraft was above scattered, undercast cloud, which was becoming more solid, and the pilot climbed to get a better view of the weather ahead. At 1234, the aircraft reached 12 700 feet asl then immediately commenced a descent to 10 000 feet asl. The aircraft leveled at 10 000 feet asl at 1238.

After the aircraft leveled at 10 000 feet, the right engine failed. The pilot conducted the actions for an engine failure during flight and feathered the right engine. The GPS was consulted for the most appropriate airport for diversion. The pilot elected to fly Edson, and by 1243, the aircraft had commenced a 180° turn and a descent to Edson Airport.

At 1307, the aircraft was approximately five nautical miles (nm) west of Edson Airport (elevation 3041 feet asl) at 2000 feet agl, tracking 95°M toward the left-hand downwind for Runway 25. The aircraft was descending at 800 feet per minute (fpm) with a ground speed of about 120 knots (surface winds were 313°M at 7 knots). During the next minute, the pilot selected the landing gear down, and 10° of flap.

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[1] All times are mountain daylight time (Coordinated Universal Time minus six hours).

At 1309, the aircraft was abeam the displaced threshold of Runway 25, at approximately 750 feet agl and 104 knots groundspeed. To keep the aircraft from flying over the residential and commercial areas that were in close proximity to the approach end of Runway 25, the pilot made a turn toward the threshold, and reduced the power on the left engine to 15 inches of manifold pressure (see Figure 1). Shortly thereafter, roll and pitch control of the aircraft became difficult, and a high rate of descent developed. The aircraft's flight path was somewhat erratic, and the aircraft was banking side-to-side, while in a steep descending turn. The pilot leveled the wings and increased power on the left engine to approximately 40 inches of manifold pressure; this was near the maximum manifold pressure (power) available. The aircraft flight manual specifies a single-engine, go-around power setting of 40 inches of manifold pressure to prevent overstressing the operating engine.

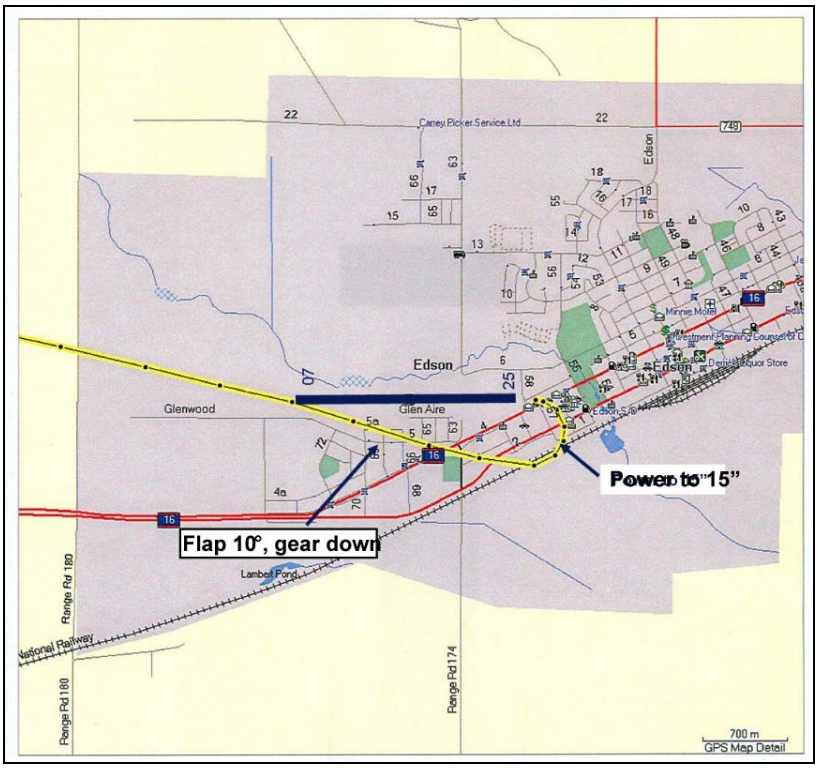


**Figure 1.** Aircraft flight path

GPS track log data reflected an average rate of descent of 1330 fpm and an average rate of heading change of 6° per second while the aircraft was in the turn. The last complete recorded track log data point, at 1309:37, showed the aircraft at 80 feet above ground, at a ground speed of 63 knots, and on a track of 261°M.

The aircraft flight manual emergency procedures section describes the following relating to single-engine landings:

> The landing gear should not be extended and wing flaps should not be lowered until certain of making the field. Maintain additional altitude and speed during approach, keeping in mind that landing should be made right the first time and that a go-around should be avoided if at all possible. A final approach speed of 91 KIAS [knots indicated airspeed] and the use of 25° rather than full wing flaps will place the airplane in the best configuration for a go-around should this be necessary. UNDER SOME CONDITIONS OF LOADING AND DENSITY ALTITUDE, A GO-AROUND MAY BE IMPOSSIBLE, AND IN ANY EVENT THE SUDDEN APPLICATION OF POWER DURING SINGLE-ENGINE OPERATIONS MAKES CONTROL OF THE AIRPLANE MORE DIFFICULT.

The Transport Canada *Instructor Guide — Multi-Engine Class Rating* (TP 11575) describes a single-engine approach as follows:

> The one engine inoperative final approach should be as close as possible to a normal approach. A high-speed/low-power approach (diving) should be avoided. It could result in a long touchdown or porpoising. An approach with low airspeed, high drag, and high power (dragging in) must also be avoided. Such an approach may place the aeroplane in a marginal control situation from which you may not be able to recover.

The first ground impact marks from the aircraft were about 10 feet outside the airport perimeter chain link fence, on a track of 267°M. The aircraft entangled the fence and spun around to the left, coming to rest 75 feet from the initial ground impact marks, on a heading of 050°M. This position was about 20 feet east of the pavement of Runway 25. The right propeller was attached, and the blades were in a near-feathered position. The left propeller was detached, and there were marks from the left propeller along the initial portions of the wreckage trail. Both main fuel tanks contained fuel that was bright blue in colour with an odour consistent with AVGAS. The right fuel tank had ruptured and the left tank was intact. There was no post-impact fire, and no evidence was found of any airframe failure or flight control malfunction before or during the flight.

The front right passenger exited through the front right exit and, with the help of bystanders, assisted the middle passenger and rear passenger out the rear left door. The pilot was able to crawl out the front right door, but was unable to walk due to injuries, and was helped by bystanders to clear the aircraft. The survivable spaces in the aircraft were not compromised. The pilot and front passenger both received facial lacerations from contact with the control column. Everyone was wearing lap-belt and shoulder harnesses, and all seats were forward facing. The front right seat was detached; all other seats remained attached. Baggage in the rear cabin baggage compartment was contained.

The aircraft weight at the time of the occurrence was approximately 4370 pounds (maximum gross take-off weight is 4570 pounds) and the centre of gravity was within limits. The density altitude at field elevation (3041 feet asl) was calculated to be 4441 feet. The best single-engine climb performance at the approximate altitude where recovery was attempted and engine power was applied would have been 250 fpm. This rate of climb would have been possible only if the aircraft was configured as follows: 89 KIAS; 5° of bank into the operating engine; flaps up; landing gear up; operating engine at maximum continuous power; mixture full rich; operating engine cowl flap open; failed engine cowl flap closed; and failed engine feathered.

The pilot had a total flight time of 400 hours, of which 220 were in the Seneca II. Of those 220 hours, approximately 180 hours were with an instructor. The pilot also owned and operated an Aero L39-Albatros high-performance, military-style, single-engine jet trainer. In the 30 days before the occurrence, he had flown the L39 with an instructor for 10 hours and the Seneca II as pilot-in-command for 2.5 hours. Exercises in the L39 consisted mainly of circuit training and engine failures in the circuit. The engine-out circuit exercises in the L39 emphasized the need to keep the pattern fairly tight to ensure a successful engine-out landing on the runway.

## *Maintenance History*

The disassembly of the right engine disclosed a broken crankshaft in the Teledyne Continental Motors (TCM) engine (model LTSIO-360-EB, serial number 266232). The crankshaft was manufactured using the vacuum arc re-melting process. There have been some difficulties with this type of crankshaft regarding composition and processing deficiencies, and TCM *Critical Service Bulletin CSB96-8* was issued, listing the affected crankshafts by serial number. Subsequently, associated Airworthiness Directive 97-26-17 was issued. The occurrence crankshaft serial number was not listed in the bulletin or directive.

An examination by the TSB Engineering Laboratory revealed that the crankshaft failed from the extension in overload of a fatigue crack initiating from an origin subsurface to the fillet radius between the No. 1 rod journal bearing and the No. 2 crankshaft cheek (see Photo 1). The fatigue cracking initiated and grew to critical dimensions under normal service loading.

**Photo 1.** LTSIO-360 crankshaft fracture

In September 2005, the right engine underwent a zero time overhaul at an engine overhaul facility in Edmonton that held an approved maintenance organization rating for non-destructive testing (NDT) of engine components. During this overhaul, the crankshaft underwent an in-house magnetic particle inspection (MPI) and an outsourced ultrasonic inspection as required by TCM. The MPI was performed under the supervision of the company's person responsible for maintenance (PRM), who was certified to Level 2 NDT standards as required by the Canadian General Standards Board (CGSB) under Subsection 571.02 (3) of the *Canadian Aviation Regulations* (CARs). No defects of the crankshaft were noted during the MPI inspection.

The aircraft was returned to service after the engine overhaul on 06 October 2005, and it had accumulated approximately six hours of flight time before it experienced a hard landing that resulted in damage to the right propeller. The engine was removed for a propeller strike inspection, in compliance with TCM *Service Bulletin SB9611*, and sent back to the original overhaul facility for the inspection. On 25 November 2005, an in-house MPI was performed on the crankshaft of the right engine and no defects were noted. The MPI was performed by the same employee who did the previous MPI. This individual was now the new PRM for the company, appointed on 01 November 2005. The new PRM did not have Level 2 NDT certification; however, he had received the required education and experience required by the standard and intended to obtain the certification in the near future. The previous PRM, who held the Level 2 NDT certification, was on the premises but did not supervise the inspection.

The aircraft was returned to service on 28 December 2005 and flew for approximately 26 hours before the engine failure on the accident flight. The TSB Engineering Laboratory report indicated that no evidence was found that either the crack initiation or final separation was influenced by the previous propeller strike. The report also concluded that the high-cycle nature of the fatigue cracking, coupled with the extent of cracking, indicated that the fatigue crack was most probably present at the time of the engine overhaul MPI and propeller strike MPI. Although the crack initiated subsurface, the crack would have penetrated through to the surface of the fillet radius early in the growth phase, and should have been detectable by any MPI procedure.

At the time of both inspections, the MPI equipment in use at the overhaul facility was calibrated and maintained according to CGSB standards.

The following TSB Engineering Laboratory reports were completed:

LP 063/2006 – GPS Examination;
LP 071/2006 – Crankshaft Examination.

These reports are available from the Transportation Safety Board of Canada upon request.

## *Findings as to Causes and Contributing Factors*

1. A surface crack on the crankshaft, which should have been detectable during the magnetic particle inspection (MPI) procedures, went undetected during two separate inspections.

2. The crankshaft failed from the extension, in overload, of a fatigue crack initiating from an origin subsurface to the fillet radius between the No. 1 rod journal bearing and the No. 2 crankshaft cheek, resulting in the total power loss on the right engine.

3. The pilot attempted to perform a single-engine approach in a manner similar to what he recently practiced while flying a high–performance, military style, single-engine jet trainer. This deviation from flight manual procedures and common single-engine approach practices for multi-engine aircraft resulted in the loss of control and impact with the ground.

## *Finding as to Risk*

1. The person responsible for maintenance (PRM), who did not have Level 2 non-destructive testing (NDT) certification, conducted the propeller strike MPI without supervision.

# *Safety Action Taken*

The overhaul facility conducted an internal quality assurance review of its non-destructive testing (NDT) procedures, techniques, and equipment to ensure compliance with existing standards.

*This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 25 April 2007.*

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