Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
A12C0141

COLLISION WITH TERRAIN

AEROFAB INC. LAKE 250, C-GZLC
PICKLE-LAKE, ONTARIO
16 OCTOBER 2012

Canada

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Lake 250, C-GZLC
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Summary

The privately-registered Aerofab Inc. Lake 250 (registration C-GZLC, serial number 87) was being ferried from Lac la Biche, Alberta, to Trois-Rivières, Quebec, with planned stops in The Pas, Manitoba, and Pickle Lake, Ontario. There were 2 pilots and 2 passengers on board. While conducting a visual approach to Runway 27 at Pickle Lake, the aircraft entered a steep descent and struck terrain approximately 1 nautical mile east of the runway threshold. The accident occurred during hours of darkness at approximately 1928 Eastern Standard Time. Both pilots and 1 passenger were fatally injured. The other passenger sustained minor injuries. The aircraft was destroyed by impact forces. There was no post-crash fire. The aircraft's emergency locator transmitter activated on impact. The Joint Rescue Coordination Centre Trenton, Ontario, dispatched a C-130 Hercules, which dropped rescue personnel to the site. The surviving passenger was transported to Winnipeg, Manitoba, treated for minor injuries and released.

Ce rapport est également disponible en français.

Factual information

History of the flight

The aircraft had recently been purchased by an individual who resided in Trois-Rivières (CYRQ), Quebec. The new owner of the aircraft had contracted several individuals from a local air operator to conduct a pre-acceptance inspection on the aircraft and ferry it from Lac La Biche (CYLB), Alberta, to Trois-Rivières. The planned route included a refueling stop in The Pas (CYQD), Manitoba, and an overnight stop in Pickle Lake (CYPL), Ontario. The pilots were not familiar with either airport.

The flight carried 2 pilots and 2 passengers. The pilot-in-command (PIC), who occupied the right pilot seat, was an experienced flight instructor who had a considerable flight time on Lake aircraft. The aircraft maintenance engineer who had performed the pre-acceptance inspection, and who was also a licenced private pilot, occupied the left pilot seat. He was assisting with flying duties in an effort to gain some experience on the Lake 250 aircraft type.

On arrival in The Pas, the crew of C-GZLC noted some problems with the nose gear oleo and had it serviced. The oleo servicing took approximately 1 hour, which delayed their departure. The aircraft was refueled to its maximum capacity and the flight departed The Pas at approximately 1530.[1] The flight from The Pas to Pickle Lake was expected to take approximately 4 hours. Civil twilight at Pickle Lake occurred at 1740 on the day of the occurrence, resulting in a night arrival in Pickle Lake.

The left seat pilot was the pilot flying on the initial part of the flight to Pickle Lake. Before arriving in the Pickle Lake area, the left-seat pilot contacted a Thunder Bay (CYQT) Flight Services Station (FSS) via the Pickle Lake Remote Communications Outlet (RCO) and broadcast a position report. The CYQT FSS requested that the pilot re-transmit as they were having difficulty understanding the transmission. After 3 transmissions by the left seat pilot, the PIC assumed control of the aircraft and made a radio transmission requesting landing information for Pickle Lake. The CYQT FSS replied by providing the current wind conditions (which were calm) and altimeter setting and advised that there was no reported traffic in the area. The information provided by the CYQT FSS was not understood by the PIC and there were several subsequent transmissions between the CYQT FSS and C-GZLC in which the PIC was having difficulty understanding the FSS specialist.

Shortly after those transmissions, the crew of a second inbound flight contacted the CYQT FSS with a traffic advisory [2] for Pickle Lake, indicating that they would be landing on Runway 27 in approximately 5 minutes. C-GZLC was then asked by the CYQT FSS to state their point of departure, intended runway for landing, and estimated time of arrival.

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1 All times are Eastern Standard Time (Coordinated Universal Time minus 5 hours).

2 A traffic advisory is a standardized radio transmission used by pilots prior to arriving at an uncontrolled destination. These transmissions indicate the aircraft's position, altitude, and estimated time of arrival for that destination.

The PIC's answers indicated that again he did not fully comprehend the questions; however, he did advise that the aircraft was 1.5 nautical miles (nm) west of the runway and that it would be landing on Runway 27 in 5 minutes. At this point, 5 microphone clicks were heard on the mandatory frequency (MF), indicating that someone was attempting to activate or adjust the intensity of the automatic remote controlled airport lighting (ARCAL) system. The FSS then asked C-GZLC what his passing altitude was and whether he would approach Runway 27 via a downwind left hand or right hand circuit. The PIC stated that they were at 4500 feet above sea level (asl) and that they would join the circuit via a left downwind leg (refer to Figure 1).

The normal circuit altitude at Pickle Lake is 2300 feet asl. The relative positions of the 2 aircraft resulted in the second aircraft reaching final approach for Runway 27 ahead of C-GZLC. A series of 3 microphone clicks was heard on the MF, and shortly afterward the second aircraft landed on Runway 27 (1927:52). As it turned off the runway lighting, the crew of the second aircraft observed C-GZLC approximately 1-mile on what appeared to be a final approach in steep descent towards Runway 27. Visual contact with C-GZLC was lost as the second aircraft turned on to the taxiway. The last transmission from C-GZLC was at 1928:20 when the pilot called final for Runway 27.

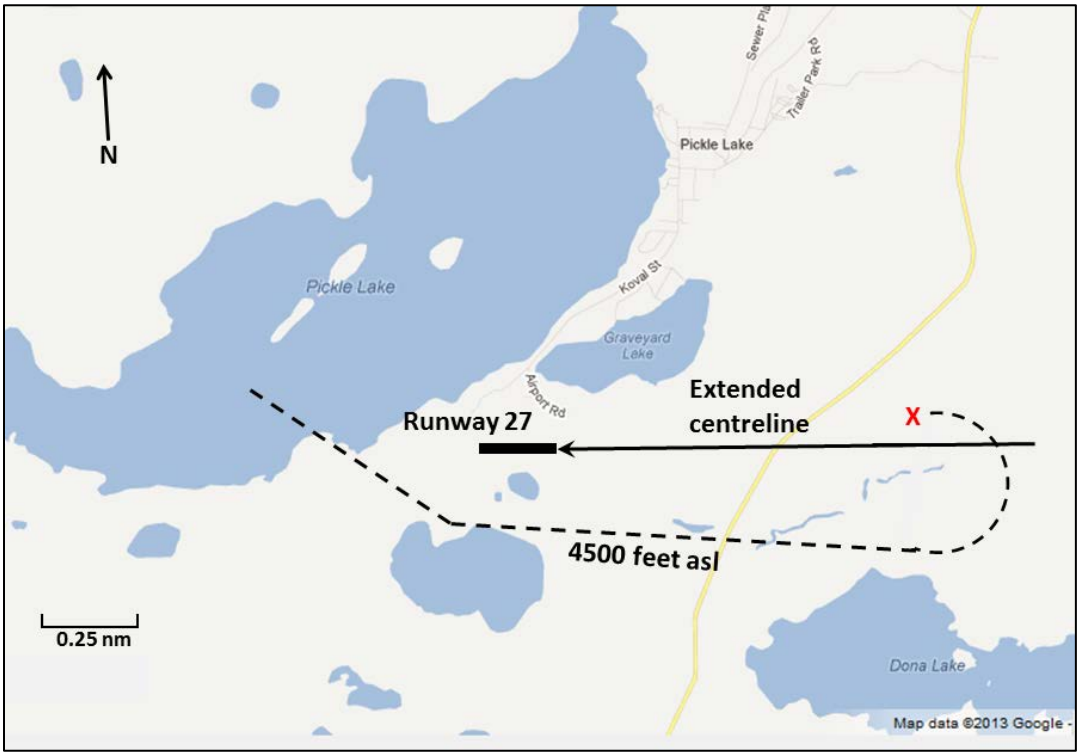

Figure 1. Pickle Lake Airport and estimated flight path (shown by the dashed line); **X** marks the approximate point of impact

On final approach, the landing gear was extended and the associated landing gear lights illuminated, actions that the PIC had instructed the left-seat pilot to perform. The pilots did not appear to be having any difficulty controlling the aircraft; however on final approach, C-GZLC entered a steep descent and struck trees approximately 1 nm short of Runway 27.

A third aircraft inbound to CYPL from the east was in contact with the CYQT FSS and landed shortly after the second aircraft. The CYQT FSS asked the pilot of the third aircraft if C-GZLC

had been seen, and requested a radio search for C-GZLC. The pilot of the third aircraft reported that C-GZLC had not been seen, and no communications from that aircraft had been received.

French-only aircraft operations

The *Canadian Aviation Regulations* (CAR) 401.06(1.1)(b) requires that persons who hold a Canadian pilot licence demonstrate their ability to speak and understand English or French, or both, at the operational or expert level in accordance with the personnel licensing standards.[3] Canada is a member state of the International Civil Aviation Organization (ICAO). ICAO *Annex 1, Standards and Recommended Practices for Personnel Licensing, Section 1.2.9.1* states in part that, "Aeroplane… pilots… who are required to use the radio telephone aboard an aircraft shall demonstrate the ability to speak and understand the language used for radiotelephony communications."

All NAV CANADA air traffic service facilities in Quebec are required to have French-speaking personnel to communicate with French-speaking pilots. Outside of Quebec ,this requirement exists only in Ottawa, Ontario and Charlo, New Brunswick.[4]

Pilots

The PIC held a Canadian commercial pilot licence with an instructor rating, valid for single-engine, land and sea aircraft. He had accumulated approximately 17 000 hours of total flight time, with 2500 hours on the Lake amphibian type. He was qualified to fly at night,[5] but did not hold an instrument rating. Canadian pilots who are qualified to fly at night must have completed 5 night take-offs and landings within 6 months prior to the flight to carry passengers. The PIC last flight at night was on 07 September 2012 in Trois-Rivières, Quebec. Trois-Rivière is a relatively built-up area, with significantly more night-time illumination than the area around Pickle Lake. Illumination in the area around Pickle Lake would have provided fewer visual cues that the area around Trois-Rivières. The number of take-offs and landings completed by the PIC in the last 6 months could not be confirmed. The pilot held a Category I medical certificate and was qualified to act as PIC and to fly the aircraft from the right seat. The pilot was considered to be extremely cautious and knowledgeable. The pilot in the left seat was a licensed private pilot with a Category 3 medical certificate. The investigation determined that there was nothing indicating that the pilots' performance was degraded by physiological factors.

Both pilots French language proficiency had been assessed as excellent. However, their English speaking skills had not been assessed, nor were they required to be assessed by regulations. In this occurrence, the radio communication difficulties experienced were attributed, at least in part, to a lack of English proficiency.

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3 CAR 421.06.4

4 CAR 602.134(1) Tables 1 and 3

5 CAR 401.05(2)(b)(i)(B)

Aircraft

C-GZLC was a Lake 250 Renegade, which is an amphibious aircraft, namely capable of landing on water or land. C-GZLC was manufactured in the United States by Aerofab Inc. in 1989. The engine, a Textron Lycoming IO-540 (SN L-24001-48A), was equipped with an MT model MTU-9-B-C-R(M)CRLD-193-109, 3-blade reversing pusher propeller mounted on a pylon above the wing and rear cabin area. The aircraft was privately registered and had accumulated approximately 1185 hours of total flight time since new. The last annual/100-hour mandatory maintenance inspection before the flight had been completed on 27 June 2012. Records indicate that the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures. The published approach speed for the Lake 250 is 66 knots indicated airspeed (KIAS). A descent rate of 500 feet per minute (fpm) is considered normal during an approach. The throttle for this aircraft is located on an overhead centre console.

Weather and environment

The Aviation Routine Weather Report (METAR) for CYPL at 1900 was as follows: winds calm, visibility 15 statute miles (sm), a few clouds at 4000 feet above ground level (agl), a few clouds at 10 000 feet agl, scattered clouds at 24 000 feet agl, temperature 8°C, dew point 4°C, and an altimeter setting of 29.43 inches of mercury.

Civil twilight at Pickle Lake occurred at 1740 on the day of the occurrence, indicating that the accident occurred during hours of darkness. Moon-set occurred at approximately 1710 and the moon was in a waxing crescent phase, which provided very little moonlight.

Wreckage information and testing

The elevation at the accident site was approximately 1300 feet asl.

Damage to the trees surrounding the point of impact indicated that the aircraft was on a heading of approximately 280°M and in a very steep angle of descent as it struck the trees. The nose section and top of the fuselage were heavily damaged. Both wings were broken outboard of the main landing gear. The aircraft was on the ground, partially supported by the engine and pylon. The 3 wooden blades of the propeller had shattered with only a few inches of each blade protruding from the hub (Photo 1). The high pitch stop nuts on the propeller pitch change rod were contacting the start lock on the front of the propeller hub indicating that the propeller was in high (coarse) pitch. The landing gear was partially extended and the right main gear appeared to be locked down. The flaps were partially

Photo 1. Propeller hub after occurrence; propeller in governing range.

extended. The ballast compartment in the vertical fin was examined and it contained no ballast plates. There was a strong smell of avgas near the site. All of the occupants appeared to have been using the seatbelts and shoulder harnesses.

Examination of the wreckage indicated the following:

- The engine was operating at the time of impact;
- The engine power setting was at approximately 19 inches of manifold pressure and 2200 revolutions per minute (RPM);
- The propeller was in the governing range that corresponded to the power setting;
- The aircraft appeared to be in the landing configuration;
- There were no apparent pre-existing anomalies with the aircraft components.

Further details as to engine and propeller examination are contained in Appendix A.

Aircraft weight and fuel calculations

There was approximately 540 pounds of fuel on board the aircraft at take-off from The Pas. The fuel remaining on board the aircraft at the time of impact, based on data derived from fuel consumption tables, was estimated to have been about 230 pounds (37 US galons). The passengers' weights were estimated by forensic personnel. The cargo was weighed and its position in the aircraft noted. These weights indicated that the aircraft was about 400 pounds over its maximum gross weight at takeoff of 3133 pounds, and approximately 200 pounds over its maximum gross weight at impact. In both the take-off and landing configurations, the aircraft's centre of gravity was slightly forward of the specified limits.

Pickle Lake Airport lighting

The Pickle Lake Airport has a single paved landing strip that can be approached from either end; the runways are oriented 090° and 270° magnetic. Night operations are facilitated by medium-intensity runway edge lights and threshold end lights with 3 variable settings, coupled with 4 light units precision approach path indicator (PAPI). The lighting system is remotely controlled by pilots via a type K aircraft radio control of aerodrome lighting (ARCAL) system. The Type K ARCAL is activated by the pilot pressing the microphone transmit button 7 times within 5 seconds. Lighting features and intensity can also be controlled by pressing the microphone 3 times to set lights to low intensity , 5 times to set lights to medium intensity, and 7 times for maximum light intensity. After the accident, the CYPL lighting system was tested from an overflying aircraft and found to function as specified. In this occurrence, the ARCAL was activated by an unknown aircraft 12 minutes prior to C-GZLC's first communication with YQT FSS.

The airport is approximately 2 kilometers south of the village of Pickle Lake in an area with little or no urban lighting. When flying in a downwind direction away from (in other words, to the east of) the airport, pilots would not have the airport lights in view.

Controlled flight into terrain

The expression "Controlled flight into terrain" (CFIT) describes a condition whereby an aircraft under the control of the pilot is unintentionally flown into terrain. Flight Safety International has determined that the majority of CFIT accidents have occurred when aircraft are on final approach to the runway.[6] Some common causes of CFIT accidents are:

- loss of situational awareness;[7]
- unstable approaches;
- increased pilot workload; and
- poor communications (between crew members and air traffic control [ATC] personnel).

Some recognized procedures to prevent CFIT accidents are:[8]

- perform thorough approach briefings;
- ensure effective communications;
- establish and fly stabilized approaches; and
- cross check visual information with flight instruments indications.

Night-time physiological factors

The topography surrounding Pickle Lake consists of muskeg and bush and is devoid of any lights or distinguishable features that could help a pilot discern a horizon. Darkness and the absence of visual cues make it more difficult to control and navigate an aircraft, and pilots are more susceptible to a condition known as the "black hole illusion". Black hole illusion can create the perception that the aircraft's height above ground is higher than it actually is.[9] A good cross-check of aircraft instruments (altimeter, attitude indicator) is required to prevent a loss of situational awareness.

TSB Watchlist

The TSB Watchlist is a list of transportation safety issues that pose the greatest risk to Canadians. In each case, actions taken to date have been inadequate and concrete steps must be taken on the part of industry and the regulator to eliminate these risks. CFIT is included in the 2012 TSB Watchlist.

The TSB has investigated numerous collisions with land and water, and has identified deficiencies, made findings, and issued recommendations to further reduce CFIT accidents. Collisions with land and water account for 5% of accidents, but nearly 25% of all fatalities.

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6 Flight Safety Foundation ALAR Toolkit

7 A loss of situational awareness occurs when a pilot's perception of his situation differs from the reality of his situation.

8 Information summarized from the Flight Safety Foundation CFIT Checklist.

9 Transport Canada publication number TP 12863E, *Human Factors for Aviation*, Chapters 2 and 6.

Between 2000 and 2009, there were 129 CFIT accidents in Canada, resulting in 128 fatalities. In 2010, there were 13; in 2011, there were 14 and in 2012, there were 5.

TSB Laboratory reports

The following TSB Laboratory reports were completed:

- LP 226/2012 - Analysis of GNS 530 & Instruments
- LP 040/2013 - NVM Recovery

These reports are available from the TSB upon request.

Analysis

The night arrival at Pickle Lake would have increased the difficulty involved in conducting an approach to an unfamiliar airport and made the pilot's workload heavier. The increased workload would have contributed to the pilot's decrease or loss of situational awareness.

There were no reported controllability issues on take-off or landing, therefore it is unlikely that the aircraft's weight or centre of gravity position was a contributing factor in this occurrence.

The information obtained from the wreckage, engine, and propeller examinations indicates that the engine and propeller were operating normally at the time of the accident. Consequently, aircraft component failure is not believed to have contributed to the cause of this accident.

As C-GZLC was approaching the airport, the 3 audible microphone clicks indicated that the runway and PAPI lights were set to low intensity. This would have made visual acquisition of the runway difficult. The dark conditions east of the airport and low intensity runway lighting likely contributed to a black hole illusion. This would have led to a loss of situational awareness with respect to the aircraft's relative position from the runway and the rate of descent, and made it more difficult to manoeuver the aircraft to a safe landing on Runway 27.

A light associated with the landing gear extension had illuminated in the cockpit, and was shaded on the PIC's command. The momentary flash of the light could have impaired the pilots' night vision to a certain degree. The PIC was flying in the right seat while carrying out a left-hand circuit. Looking across the cockpit past the pilot in the left seat would have made visual acquisition of the runway more difficult (Figure 2).

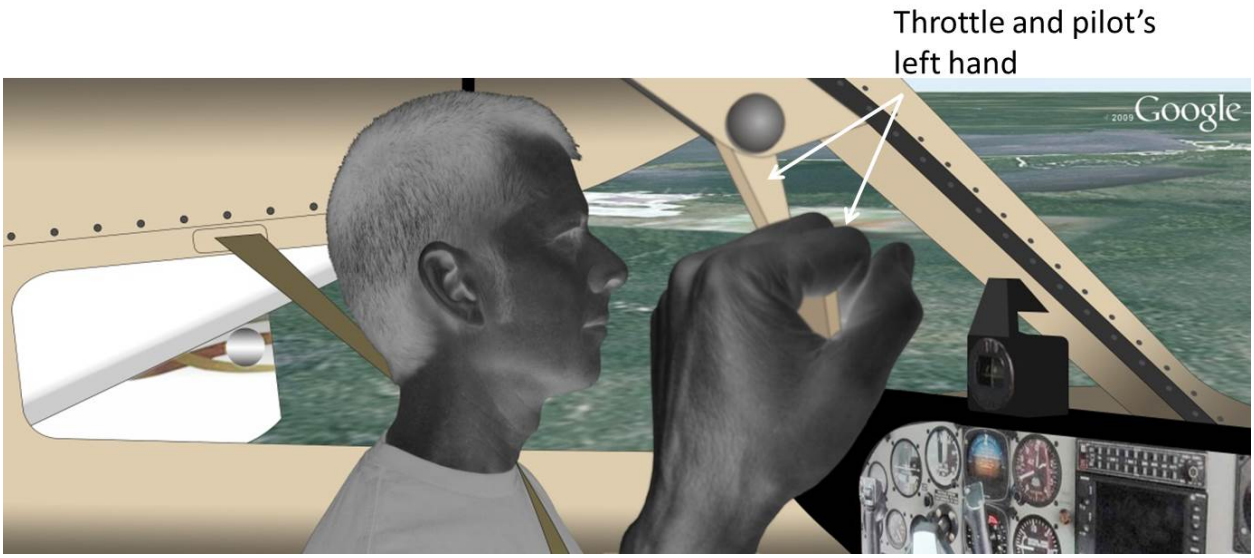

Figure 2. Right seat pilot's view obstructed by left seat pilot.

The occurrence aircraft was flying at an altitude of 4500 feet asl, which was 2200 feet higher than the usual circuit altitude for a visual approach to CYPL. To make a visual approach to Runway 27 from a downwind position at 4500 feet, would require the pilot to make a very steep descent during a continuous turn to join final approach. This type of steep approach would have made visual acquisition of the runway lighting more difficult and would have exacerbated any visual perceptual difficulties the pilot may have been experiencing. The perceptual

challenges posed by black hole illusion would be compounded if the pilot was not current with night landings.

It is not known what rate of turn was utilized to manoeuver the aircraft from downwind leg to final leg. The aircraft descended approximately 3200 feet from the downwind turn to the point of impact. This would require a descent rate of approximately 3000 fpm during the turn. This high rate of descent is consistent with what the crew of the second aircraft observed. A descent rate of 3000 fpm is approximately 6 times the normal rate of descent, and would not be considered a stable approach. Descending at such a high rate would minimize or negate any guidance that could be obtained from the PAPI system because the aircraft would descend through the various approach path indications at an extremely rapid rate.

The dark environment, lack of visual cues and low intensity runway lighting likely led to a loss of situational awareness. This probably contributed to the pilots not taking appropriate measures to correct the aircraft's high rate of descent prior to collision with terrain.

Pilots who hold a Canadian licence must be proficient in either English or French. Under Canadian regulations, these pilots are permitted to operate anywhere in Canada. In this occurrence, neither pilot's proficiency in English had been assessed. Communication difficulties between the pilots and the CYQT FSS personnel were encountered, and were in part attributable to language difficulties. If pilots are not proficient in the language used by air traffic services, there is a risk they may have difficulty communicating with air traffic services or receiving critical information from those.

Findings

Findings as to causes and contributing factors

1. The night arrival in Pickle Lake increased the pilot's workload and the difficulty of an approach to an unfamiliar airport.

2. The dark environment to the east of the airport, the lack of visual cues and the low intensity runway lights likely contributed to a loss of situational awareness with respect to the aircraft's relative position from the runway and the rate of descent.

3. The loss of situational awareness likely contributed to the pilot's not taking appropriate measures to correct the aircraft's high rate of descent prior to collision with terrain.

Findings as to risk

1. If pilots are not proficient in the language used by air traffic services, there is a risk they will have difficulty communicating with air traffic services or receiving critical information from them.

Other findings

1. The engine and propeller were operating normally during the occurrence.

This report concludes the Transportation Safety Board's investigation into this occurrence. The Board authorized the release of this report on 29 January 2014. It was officially released on 27 February 2014.

Visit the Transportation Safety Board's website (www.bst-tsb.gc.ca) for information about the Transportation Safety Board and its products and services. You will also find the Watchlist, which identifies the transportation safety issues that pose the greatest risk to Canadians. In each case, the TSB has found that actions taken to date are inadequate, and that industry and regulators need to take additional concrete measures to eliminate the risks.

Appendices

Appendix A - Engine and propeller examination

Engine run

The engine (Lycoming model IO-540) had sustained minor damage during the accident. The engine driven fuel pump had been shorn off, and magnetos were missing. Information gathered at the accident site suggested that this engine was operational at the time of impact; consequently, investigators chose to attempt to run the engine in a test cell. The engine was prepared and shipped to an overhaul facility where it was mounted on a test stand.

Prior to running the engine, tests were conducted to see if it might incur damage from a test run. It was believed that the engine could be run safely. The following observations were made:

- Compression was found in all cylinders.
- Substitute magnetos and wiring harnesses were installed.
- There was a small crack in the engine sump (sustained during impact).
- Oil was added to the engine, and the engine was spun over without ignition: normal oil pressure was noted.
- Original spark plugs were installed.
- The engine started normally and normal engine parameters were observed throughout the entire range of normal engine operations.
- The engine would have passed an overhaul acceptance test run.

All test run data recorded by the test facility technician were retained by TSB investigators.

The test run indicated that the engine was in operational condition prior to the accident. Wreckage information indicated that it was running at the time of impact.

Propeller and governor testing

There was a concern that a cautionary note in the MT propeller manual may have described a condition that could have led to an uncommanded activation of the propeller beta system (inadvertent activation of zero or reverse thrust on the propeller). The propeller design incorporates safety features to prevent the propeller from reversing in flight (airspeed switch, guarded selector switch, warning light, and 1400 rpm centrifugal safety stop lock). Those features were examined and there was no indication that those safety features did not function as designed.

Initial inspection of the propeller indicated that the blades were in the flight (coarse blade angle) governing range at the time of impact.

The propeller was taken to an overhaul facility and inspected for pre accident anomalies or malfunctions.

The propeller had sustained substantial damage during impact. All 3 blades had been shorn off approximately 8 inches from the propeller hub. Disassembly of the propeller hub revealed strike marks corresponding to varying blade angles. These marks would have resulted from rotational forces derived from the propeller blades striking surrounding terrain at the time of impact. No damage or conditions of the propeller hub assembly that could have caused an uncommanded propeller-reversing operation or blade angle were observed.

The propeller governor was tested separately. Testing of the governor revealed that all components and settings were in the normal range. The governor bench test indicated that the propeller governor was operating normally and would not have caused the propeller to move into an uncommanded blade angle.