Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT

A03O0171

CONTROLLED FLIGHT INTO TERRAIN

BEECH 58TC BARON, N6058T

TORONTO CITY CENTRE AIRPORT, ONTARIO, 3 nm SE

07 JULY 2003

Canada

Aviation Investigation Report

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Report Number A03O0171

Summary

On 07 July 2003, approximately 0958 eastern daylight time, a Beech 58TC Baron aircraft (registration N6058T, serial number TK–110) crashed into Lake Ontario, Ontario, approximately 3 nautical miles southeast of the Toronto City Centre Airport. The privately owned and operated aircraft was carrying out a LOC/DME B instrument approach to Toronto City Centre Airport, after a flight from Lansing Municipal Airport, Chicago, Illinois. When the aircraft did not arrive at the airport and failed to respond to transmissions from the tower, a search was commenced. Patchy fog in the area resulted in ceilings variable from zero to unlimited and visibility from 1/8 mile to more than a mile.

Several hours later, the Metropolitan Toronto Police Marine Unit found debris on the surface of Lake Ontario. The aircraft was located the following day by the Ontario Provincial Police, using a sidescan sonar. The aircraft was essentially intact, resting vertically on its nose at a depth of 220 feet. The deceased pilot was located in the aft cabin of the aircraft. He received minor injuries in the impact but failed to egress the aircraft for unknown reasons and died as a result of drowning. Recovery of the aircraft was technically difficult because of the depth of the wreckage. After some delays in the recovery operation, and under the auspices of the Metropolitan Toronto Police, the aircraft was raised on 21 July 2003.

Ce rapport est également disponible en français.

Other Factual Information

History of the Flight

The pilot was flying to Toronto to attend a business meeting scheduled for the afternoon of 07 July 2003, in downtown Toronto. He got a weather briefing at 2030 central daylight time (CDT)[1] the day before the flight and filed an instrument flight rules (IFR) flight plan for a departure at 0700 CDT the following morning.

On 07 July 2003, the pilot got a weather briefing at 0512 CDT and departed Lansing at approximately 0645 CDT. The aircraft proceeded on a direct route toward Toronto at 13 000 feet, crossed into Canadian airspace in the vicinity of Sarnia at 0900 eastern daylight time (EDT), and received revised routing via the St. Catharines non-directional beacon to the Toronto City Centre Airport (TCCA). At 0917, in the vicinity of London, the pilot began a descent to 7000 feet above sea level (asl) and was later cleared to 4000 feet and to the TILEL fix[2] to hold southeast on the localizer. N6058T reached the holding fix at 0948 and entered the hold, as shown in Appendix A. N6058T was given an expected further clearance time of 1400Z (1000 EDT) because of an aircraft ahead flying the LOC/DME B[3] approach to Runway 08.

At 0950, the aircraft ahead reported on the missed approach. The flight crew indicated that they had visual contact with the airport but were unable to complete the approach because only part of the runway was in sight.

The pilot of N6058T acknowledged hearing this report. Toronto Terminal advised him that the latest weather was visibility ¼ mile with a few clouds at 8800 feet (indicated by an automated weather observation system [AWOS]). The pilot requested an approach to TCCA. Toronto Terminal cleared N6058T for a LOC/DME B, circling for Runway 08, to cross the TILEL fix at 3000 feet asl. As N6058T passed the fix, the pilot was instructed to change to tower frequency. Tower cleared the aircraft to continue the approach and to report the runway in sight or in the missed approach. Three minutes later, the Tower advised N6058T that runway visual range (RVR) was greater than 6000, wind calm, and it then cleared the aircraft to land with the option of landing on Runway 26, 33 or 08. The pilot acknowledged the landing clearance; this was the last transmission from N6058T. After passing the VOKUB 5 DME fix, the aircraft continued inbound on the localizer and continued the descent below the minimum descent altitude (MDA) of 760 feet asl until it struck the water, essentially on the localizer at approximately 3.6 DME.

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1 Times in this report are eastern daylight time (Coordinated Universal Time [UTC] minus four hours) unless otherwise noted. Local time at the point of departure was central daylight time (UTC minus five hours) and is so indicated where used.

2 TILEL is the intermediate fix for the LOC/DME B approach to the Toronto City Centre Airport. It is located over Lake Ontario on the localizer at 15 DME southeast of the airport.

3 A LOC/DME approach uses a localizer for lateral guidance and distance measuring equipment for range, providing the pilot with two-dimensional guidance. It is considered a non-precision approach because it does not provide vertical guidance.

The aircraft was recovered from the lake and a preliminary inspection was conducted. The wreckage was transported to the Transportation Safety Board (TSB) Ontario Regional examination facility for further examination. Technical assistance was provided by Raytheon Aircraft Company, Teledyne Continental Motors and Hartzell Propeller Inc. Various instruments and indicators were sent to the TSB Engineering Branch Laboratory for a detailed examination.

Radar and Communication Data

Data was obtained from a radar located at Toronto/Lester B. Pearson International Airport (LBPIA), 14 miles northwest of the TCCA. Track and altitude derived from the radar data is presented in Appendix A. The aircraft maintained an altitude of 4000 feet asl and an airspeed of approximately 140 knots[4] while entering the hold. When cleared for the approach, the pilot began an immediate descent and airspeed increased to approximately 190 knots. The aircraft crossed TILEL, descending through approximately 3500 feet asl.

At 13.5 DME, the aircraft levelled at 2900 feet and the airspeed decreased to 150 knots. The aircraft resumed its descent at 11 DME, initially with a rate of descent of approximately 1000 feet per minute, then reducing to 600–700 feet per minute with an airspeed reduction to approximately 120 knots. At 6.5 DME, the rate of descent began to increase again and the airspeed increased to approximately 150 knots. According to radar, the aircraft passed the 5 DME fix at exactly 1000 feet. The last radar hit was at 500 feet asl, with a rate of descent of approximately 1200 feet per minute and an airspeed of 150 knots. The geographic position of impact was consistent with the radar data.

Communications records indicate that N6058T was in contact with Cleveland Centre until entering Canadian airspace near Sarnia at 0900. From that point on, the aircraft was in communication in succession with Toronto Centre, Toronto Terminal, and City Centre Tower. On a few occasions, transmissions from N6058T were clipped or broken. Otherwise, communications were normal and the pilot reported no difficulty of any kind.

At 0825, while still in U.S. airspace, the pilot contacted Chicago Flight Watch and received a Toronto weather update. While in Canadian airspace, there was no record of N6058T contacting any flight service station within range for further weather updates. The 0900 (1300Z) weather was broadcast on the automatic terminal information service (ATIS) for the TCCA, but it cannot be determined if the pilot received it.

Pilot Injuries and Survival Aspects

The pilot suffered minor, non-lethal injuries in the impact and died by drowning. There was a contusion on the outside of the left hip, which is consistent with pressure against the lap belt during impact. There were no significant injuries consistent with the pilot striking the control column or instrument panel. Therefore, it was concluded that the pilot's lap belt and shoulder harness were secure at impact. The harness buckle was open, and the pilot was found free of the harness in the aft of the fuselage behind the left, front seat. There was no damage to the

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[4] The airspeeds and descent rates were derived from radar data and meteorological conditions at the time of the accident.

webbing or hardware on the seatbelt, and it was concluded that the pilot unlatched the buckle after the impact. Toxicological examination indicated nothing remarkable.

The right front seat, including the seat rails, was no longer attached to the aircraft structure. The seat had failed from a force directed upward and aft against the seat pan, which indicated damage due to the ingress of water. The left front seat was still attached to the aircraft structure and in a normal position for flight.

Nothing physical was found that would have impeded the pilot's egress through the passenger door, which had opened by itself during the impact. The pilot failed to egress for unknown reasons.

Pilot Information

The pilot held a private pilot licence and instrument rating issued by the U.S. Federal Aviation Administration (FAA). He was originally licensed in 1960. He had owned and operated N6058T since 1992, and had accumulated approximately 700 hours of flight time in it. He had a medical certificate dated 16 July 2002, valid until 31 July 2003. Records indicate that he had a history of atherosclerotic heart disease with a myocardial infarction in January 2000. His recovery was reviewed by an FAA medical specialist, and he was found medically fit for flight. The condition was not a factor in this occurrence. He took some prescription medications, none of which were an influence in this occurrence.

The pilot had flown a biennial flight review and instrument rating proficiency check on 05 July 2003, two days prior to the accident flight. During the check, the pilot flew two instrument landing system (ILS) approaches and one global positioning system (GPS) circling approach, in visual meteorological conditions (VMC). Although the autopilot could have been engaged for the approaches, they were all flown manually. His handling of the airplane was normal, with the exception that he lowered the landing gear and flaps earlier than normal in order to slow the airplane without reducing power and risking shock cooling of the engines. Apart from some minor procedural errors and, on one occasion, poor attention to pitch attitude resulting in slow airspeed, the flight was assessed as being satisfactorily flown.

Records indicate that the pilot flew 15 hours in the previous 90 days. During that time, he did not log any flight time in instrument meteorological conditions (IMC) or any actual or practice instrument approaches. Records back to the beginning of 2002 indicate three encounters with actual instrument conditions, each involving a non-precision approach at Lansing, the pilot's home field. In addition, two instrument training flights were flown in one day, 10 months prior to the accident. These training flights included four ILS approaches at locations near Lansing, and two non-precision approaches at Lansing.

Aircraft Information

The aircraft was a Beech 58TC Baron with Teledyne Continental TSIO–520–WB engines and Hartzell PHC–J3YF–2UL three-bladed propellers. It was equipped with a Garmin 530 GPS, with moving map and integrated navigation and communication radios. The autopilot was a KFC 200 flight director/autopilot; it did not have an altitude preselect feature. The aircraft was not equipped with a radio altimeter, a flight data recorder or cockpit voice recorder; neither recorder was required by regulations. Maintenance records for the aircraft, engines and propellers indicate that the aircraft was maintained in accordance with regulation, and there were no outstanding snags that would affect the airworthiness of the aircraft. The only apparent discrepancy with the aircraft was that the pilot's push-to-talk switch appeared to be intermittent, resulting in clipped transmissions.

The Beech Baron 58TC landing gear indicating system has three green lights that illuminate when the appropriate gear is down and locked. There is also a red light that illuminates any time that at least one gear is in transit or in an intermediate position. When all of the landing gear are up and locked, all of the indicating lights are extinguished. The intensity of the lights is automatically lowered when the navigation lights are turned on. The *Pilot's Operating Handbook*[5] (POH) states that the landing gear position lights may not be visible in daylight when the navigation lights are on; it advises momentarily turning off the navigation lights in order to check the landing gear position.

Damage to Aircraft

Examination of the wreckage indicated that the aircraft struck the water in a wings-level, nose-level attitude. The landing gear was down and flaps were extended to 15 degrees, the approach configuration. The three landing gear detached from the aircraft during the impact. The right-side door of the aircraft was forced open on impact and jammed against the right engine cowl, past the normal open position. Water was able to enter the aircraft through torn floor panels and the open door. The aircraft sank and came to rest vertically, on its nose, at a depth of 220 feet.

The fuselage, wings and empennage received very little damage. There were no indications of pre-impact structural anomalies that would have affected the controllability of the aircraft. All control surfaces were in place with little damage, and all control cables were continuous.

Both engines were damaged as a result of the impact and/or water immersion. There was no indication of pre-impact faults or anomalies that would have prevented the engines from operating normally and producing their rated power. The blades on both propellers were bent aft and twisted toward low pitch, suggesting considerable rotational energy at impact. It was

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[5] Raytheon Aircraft Beech Baron TC 58TC, *Pilot's Operating Handbook,* and FAA Approved Airplane Flight Manual P/N 106–590000–19, December 1978, revised through P/N 106–590000–19A13, September 1998.

not possible to determine precise blade angle or power output at impact, however, the propellers were not feathered. The similarity of damage to both propellers indicated that both engines were developing approximately equal amounts of power at impact.

The airspeed indicator dial face had a paint smear indicating 149 to 154 knots at impact. The vertical speed indicator had two smears, one indicating 1800 feet per minute down and the other 2250 feet per minute down. The altimeter sub-scale was set at 29.90 inches of mercury; the altitude reading at impact could not be determined.

Some abnormal switch, circuit breaker, and light positions and indications were noted. The aircraft battery switch was found on. The left alternator was on, but the left alternator circuit breaker had tripped, and the right alternator was off. Neither of the alternator warning lights showed evidence of being illuminated at impact. Both navigation lights were on at impact, indicating that electrical power was available. The ice light switch was on although conditions were daylight, icing conditions were not present, and all anti-icing switches were off. It is possible that these anomalies were the result of impact forces.

The fuel boost pump switches were both off and the propeller synchrophaser switch was on; these positions are opposite to those called for in the POH before landing checklist. The right cowl switch was found in the closed position, and the left one was found in the open position; both were consistent with the actual position of the cowl flaps. Filament stretching indicated that both engine cowl lights were on at impact, suggesting that both cowl flaps were open. According to the POH, the cowl flaps are closed for descent and landing, and it was known that the pilot was habitually careful to avoid over-cooling the turbo-chargers.

None of the landing gear position lights showed indications of being illuminated at impact; however, the landing gear were in the extended position when they were torn off at impact. The landing gear switch was found in the down position with the lever broken off in an upward direction due to impact, indicating that it had been in the down position prior to impact. None of the related landing gear circuit breakers were tripped. It is possible that impact forces were insufficient to cause filament stretch, with the landing gear indicating lights being illuminated at low intensity with the navigation lights on.

Meteorological Information

The weather was generally below forecast and was dominated by surface-based fog that was variable and patchy.

The flight was planned the previous night based on an outlook of generally visual flight rules (VFR) conditions in the Toronto area, with the possibility of some thunderstorms. When the pilot checked the weather in the morning prior to his departure, a forecast had not yet been issued for TCCA. He was given the forecast for Toronto/LBPIA, which indicated generally VFR with a lowest condition of ceiling 2000 feet and visibility 2 miles in thundershowers and mist. He also received the recent actual weather, which was consistent with the forecast. When issued approximately 30 minutes later, the weather forecast for the TCCA was similar, with a lowest condition of ceiling 2000 feet and visibility 2 miles in thundershowers and mist. Beginning at about 0600, the AWOS at TCCA reported occasional ceilings as low as zero, and visibility

diminished progressively between 0600 and 0700 to just over 1 mile. An amended forecast was issued at 0724, indicating a temporary reduction in visibility to 1 mile in light rain showers and mist with scattered cloud at 200 feet until 1000. N6058T received this forecast from the Chicago Flight Watch at 0825. He also received the 0800 weather for TCCA: visibility 1¼ miles in mist, ceiling 2700 overcast, temperature 20°C.

By 0816, TCCA weather had deteriorated to ceiling zero and visibility ⅛ mile. At 0900, the weather remained ceiling zero, visibility ⅛ mile. This weather was being broadcast on the TCCA ATIS when N6058T arrived in the Toronto area, but it could not be determined if the pilot had obtained the ATIS information. The forecast remained unchanged until 0946, when a new forecast indicated ceiling zero and visibility ⅛ mile, improving between 1000 and 1200 to visibility 2 miles in mist, ceiling 800 feet broken. N6058T was unaware of this forecast.

TCCA control tower personnel observed some improvement beginning at about 0930 when RVR was 2800 feet and the top of the CN Tower was visible. At that time, the aircraft ahead of N6058T began its approach. From 3000 feet in the holding pattern in the vicinity of the TILEL 15 DME fix, the crew of the aircraft ahead had visual contact with the lake surface. After passing the TILEL fix, the aircraft passed through some thin cloud layers and remained above a lower surface-based layer of ground fog. A spit of land at 3 DME, to the right of the approach course, was not visible, but a lighthouse protruded through the fog layer, indicating a fog depth in the order of 50 feet. At 2.2 DME, the crew could see buildings and trees protruding through the fog on Toronto Island and some features of the City of Toronto. They had adequate visual reference to be able to carry out a circling procedure from 2 DME, and cloud layers presented a good horizon. As the crew of the aircraft ahead made their turn onto final approach, the precision approach path indicator was briefly visible and the mid-portion of the runway was visible, but both ends of the runway were obscured by fog, resulting in the missed approach. At that time, conditions appeared to be almost VFR from the perspective of tower personnel, and RVR was 6000. The AWOS issued a special report at 0944, indicating visibility ¼ mile, ceiling unlimited with a few clouds at 8800 feet.

N6058T was given the 0944 weather report by Toronto Terminal before being cleared for the approach. About two minutes before the crash, while N6058T was conducting the approach, the control tower advised the pilot that the RVR was greater than 6000 feet and gave him a landing clearance. One minute before impact, AWOS recorded visibility ¾ statute miles, ceiling 300 feet broken, 8800 feet overcast, temperature 19°C, dew point 19°C, altimeter 29.90. Two minutes later, one minute after impact, an AWOS special report indicated wind calm, visibility 1 statute mile, ceiling 200 feet overcast, 8800 feet overcast. Members of the Metropolitan Toronto Police Marine Unit reported that when they responded visibility was near zero, obscured by fog on the water surface, in the harbour and on Lake Ontario in the vicinity of the point of impact.

Other nearby aerodromes (Toronto/LBPIA and Toronto/Buttonville Municipal) were also operational and had suitable weather for diversion had the pilot of N6058T requested it. N6058T had over 2½ hours worth of fuel remaining on the approach; this was adequate for a safe diversion in the event of a missed approach.

Aerodrome and Navigation Aids

The LOC/DME B approach to TCCA uses the XTC localizer, frequency 110.15, and the ITZ DME, channel 38. The navaids were checked after the occurrence and found to be operating normally and within tolerances. A Notice to Airmen stated that the ITZ channel 38 DME was unusable within 1.0 DME. This affected the LOC/DME RWY 08 approach but had no effect on the LOC/DME B approach. The flight paths flown by the preceding aircraft and N6058T indicate that both were responding to accurate positioning.

The TCCA also has the ILS/DME[6] RWY 08 precision approach to Runway 08. An airspace conflict precludes the use of this approach when the Runway 23/Runway 24 combination is in use at Toronto/LBPIA. Therefore, ILS/DME RWY 08 approaches are authorized only when Toronto/LBPIA is using the Runway 05/Runway 06 combination. As a result, the ILS precision approach was not offered to N6058T. N6058T accepted the LOC/DME B approach without requesting or otherwise indicating a preference for any other approach.

Controlled Flight into Terrain

Controlled flight into terrain (CFIT) is "an occurrence in which an aircraft, under the control of the crew, is flown into terrain, water or an obstacle with no prior awareness on the part of the crew of the impending disaster."[7] This type of accident can occur during most phases of flight, but CFIT is more common during the approach-and-landing phase.

The Flight Safety Foundation[8] noted that CFIT was the leading category of approach-and-landing accidents in a study of airline accidents and the second leading factor in all fatal business jet accidents. Its findings included the following:

- "omission of action/inappropriate action" by a flight crew member was the most common primary causal factor, usually referring to the crew continuing descent below MDA without adequate visual reference, either intentionally or unintentionally;

- "lack of positional awareness in the air" was the second most common factor, generally resulting in CFIT;

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6 An ILS/DME approach uses a localizer for lateral guidance, a glide slope for vertical guidance and distance measuring equipment for range, providing the pilot with three-dimensional guidance. It is considered a precision approach because it provides both lateral and vertical guidance.

7 Transport Canada, TP 1158E, *Glossary for Pilots and Air Traffic Services Personnel*, 08 July 2004.

8 Flight Safety Foundation, "Killers in Aviation: FSF Task Force Presents Facts About Approach-and-Landing and Controlled-Flight-Into-Terrain Accident," *Flight Safety Digest*, November 1998–February 1999.

- 75 per cent of CFIT occurrences were associated with non-precision approaches, primarily when a precision approach aid was not available or was not used;

- significant terrain features were not necessarily a prerequisite for CFIT;

- a majority of CFIT occurrences were during poor visibility conditions;

- disorientation or visual illusions were involved in 21 per cent of occurrences, with a lack of vigilance, inadequate monitoring of primary instruments, and a lack of training and awareness identified as associated factors.

An FAA study[9] into CFIT accidents in general aviation had the following results:

- CFIT comprised almost one-third of general aviation accidents that occur in instrument conditions and cause 17 per cent of all general aviation fatalities;

- IFR-rated, general aviation pilots age 50 and over have significantly more CFIT-type accidents than IFR-rated pilots under age 50;

- differential sensory and cognitive capabilities, low annual flying hours, and inadvertent flight from VMC into IMC seem to contribute disproportionately to CFIT accidents.

The FAA issued an Advisory Circular[10] to promote awareness of CFIT in general aviation operations, citing the following awareness factors for general aviation operations involving IFR flight into IMC conditions:

- increased risk of CFIT with non-precision approaches;
- the importance of situational awareness;
- risk involved when transitioning from VMC to IMC or vice-versa;
- the importance of flying a stabilized approach; and
- additional risks when flying outside the U.S., including language, different depictions of terrain, elevation, and runway data.

Instrument Approach Plate Design

The pilot normally used FAA National Aeronautical Charting Office (NACO) Terminal Procedures Publications for instrument approaches in the United States. For the flight to Canada, he used the *Canada Air Pilot, Volume 4*. *Canada Air Pilot* and the FAA/NACO Terminal Procedures Publications are generally similar in appearance; however, there are minor

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[9] M. Bud, P. Mengert, S. Ransom, and M.D. Stearns. *General Aviation Accidents, 1983–1994: Identification of Factors Related to Controlled-Flight-Into-Terrain (CFIT) Accidents*. Final Report DOT–VNTSC–FAA–97–8 (DOT/FAA/AAR–100–97–2), July 1997.

[10] *General Aviation Controlled Flight into Terrain Awareness*, FAA Advisory Circular AC 61–134, 04 January 2003.

differences, including the presentation of altitudes. The LOC/DME B chart for TCCA shows an altitude of 1000 feet at the VOKUB 5 DME fix. In Canadian approach plates, an altitude displayed without a horizontal line above or below the numerical value means a *minimum* altitude. In FAA/NACO approach plates, this format means a *recommended* altitude; a minimum altitude would have a solid horizontal line beneath the numerical value.

Approach Ban

Canadian Aviation Regulations[11] prohibit pilots from completing an instrument approach (certain circumstances excepted) beyond the final approach fix for a runway served by one RVR, if the RVR value is below 1200. The RVR at TCCA was greater than 6000 when N6058T conducted the approach.

Analysis

The investigation determined that the flight proceeded normally until it descended below the MDA on the approach. Apart from requesting clarification of holding instructions, communications from the pilot did not indicate any mechanical or operational difficulty. The wreckage examination revealed no indication of mechanical or electrical anomalies that would affect the flight characteristics of the aircraft. The altimeter was correctly set and altitudes had been accurately flown, except for the descent through the MDA. The horizontal flight path of the airplane was consistent with the published approach, indicating that the pilot was responding to correct approach guidance displays and that he continued to make appropriate corrections up to the loss of radar data, approximately 15 seconds before impact. There was no indication of loss of control: the aircraft struck the water in a wings-level, nose-level attitude, with its landing gear down and flaps in the approach setting, which is consistent with a normal approach. Both engines were operating and both propellers were in a normal flight range. There was no indication of incapacitation of the pilot or of any influence of his medical history.

The investigation, therefore, focussed on CFIT and on factors that could lead the pilot to descend below MDA, apparently without being aware of the proximity of the terrain. Several factors previously identified as conducive to CFIT accidents were present before the approach began. These were as follows:

- non-precision approach;
- poor visibility conditions;
- transitions from instrument to visual flight conditions and vice-versa;
- IFR-rated general aviation pilot over the age of 50; and
- low annual flying hours and limited recent experience in actual IMC.

The influence of the weather was examined. The weather was below what had been forecast when the flight began, and it had been significantly below the revised forecast for over two hours when N6058T arrived in the holding pattern. A new forecast was issued a few minutes

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[11] Transport Canada, "Canadian Aviation Regulation 602.129, Approach Ban–General," *Canadian Aviation Regulations 2003–2.*

before the approach was begun, but there is no indication that the pilot received that forecast. When the approach began, he was advised that the ceiling was unlimited and, although the AWOS was still reporting ¼ mile visibility, the RVR was indicating over 1 mile. The aircraft ahead had seen the runway, albeit not well enough to be able to land. The information available to the pilot was sufficient to indicate the likelihood of a successful approach.

Based on the weather reports from the airport, the police and the aircraft ahead, conditions, particularly low visibility in fog, were localized and variable. Variable IMC/VMC existed on the approach. It is likely that N6058T transitioned in and out of cloud during the approach. The lake surface beneath the approach path was probably obscured by a surface-based layer that may have been only 50 feet thick, based on reports from the preceding aircraft. N6058T most likely entered the surface-based layer during the latter stages of the approach, after descending below MDA.

Although weather conditions were poor, they are not cause for descending below the MDA. Instrument approach procedures, including the missed approach, are designed to provide an adequate level of safety. On this approach, the aircraft must maintain a minimum altitude of 760 feet asl until the pilot can see enough of the runway environment to permit final manoeuvring to the runway. Otherwise, a climb in accordance with the missed approach procedure must be initiated at the missed approach point.

There were indications that the pilot may have been rushed on the approach. When he received the approach clearance he was close to the TILEL fix, at an altitude 1000 feet above the altitude cleared to for crossing the fix. He began an immediate descent, reaching an airspeed that indicated that the landing gear and flaps were still up at that time. The aircraft passed the fix at 3500 feet asl, rather than the cleared altitude of 3000 feet. Soon afterward, the pilot levelled off and the speed decreased before the descent was resumed. It is likely that the landing gear and flaps were lowered before the descent was resumed. This is a logical point at which to carry out the before landing check.

As the aircraft resumed its descent, airspeed and rate of descent were both initially high, but then decreased until they stabilized at approximately 120 knots and 700 feet per minute, normal values for an approach, for a duration of about one minute. Had the speed and rate of descent been maintained, the aircraft would have crossed the VOKUB 5 DME fix at 1300 feet and reached MDA at 3 DME, 1 mile before the missed approach point. This would have been an ideal location to permit transition either to manouevre for a landing if there was adequate visual reference, or to execute a missed approach if not.

Two miles before the VOKUB 5 DME fix, the rate of descent and airspeed both began to increase. The increased rate of descent resulted in N6058T crossing the VOKUB 5 DME fix at exactly the published 1000-foot minimum altitude, descending at 1200 feet per minute, a significantly greater rate of descent than necessary to reach MDA by the 2 DME missed approach point. This rate of descent continued until impact.

The investigation considered the possibility that the pilot interpreted the 1000 foot altitude at VOKUB as a recommended altitude, consistent with the presentation in NACO approach plates, rather than a minimum altitude in accordance with *Canada Air Pilot* standards, and deliberately increased the rate of descent in order to achieve it. That does not explain why the high rate of

descent was continued after reaching 1000 feet at VOKUB. It is considered more likely that the pilot believed his altitude to be greater than it was and that he was unaware that he was descending through MDA.

During the final stages of the approach, it is possible that something distracted the pilot: uncertainty as to previously incomplete before landing checks, an on-board event such as an annunciator light, or a visual illusion. A thin surface-based layer would be over 400 feet below the aircraft at MDA, giving the impression, or reinforcing an existing misperception, of the aircraft being higher than it was, especially combined with the expectation of being able to see the airport from the missed approach point. These factors, combined with a low level of instrument proficiency and other risk factors as previously stated, would erode the pilot's situational awareness, so that he was unaware of his descent through MDA. Without an altitude pre-select in the flight director, there was no independent aircraft cue to indicate descent below MDA. As a result, the pilot continued to descend in controlled flight without adequate visual reference, unaware of the proximity of terrain, until the aircraft struck the water.

The following TSB Engineering Branch report was completed:

LP 077/03 – Instrument and Warning Light Examination

This report is available from the Transportation Safety Board of Canada upon request.

Findings as to Causes and Contributing Factors

1. During the latter stages of a non-precision instrument approach, the pilot lost situational awareness, specifically of his altitude. As a result, he descended below the MDA and continued a controlled descent in IMC until the aircraft struck the water.

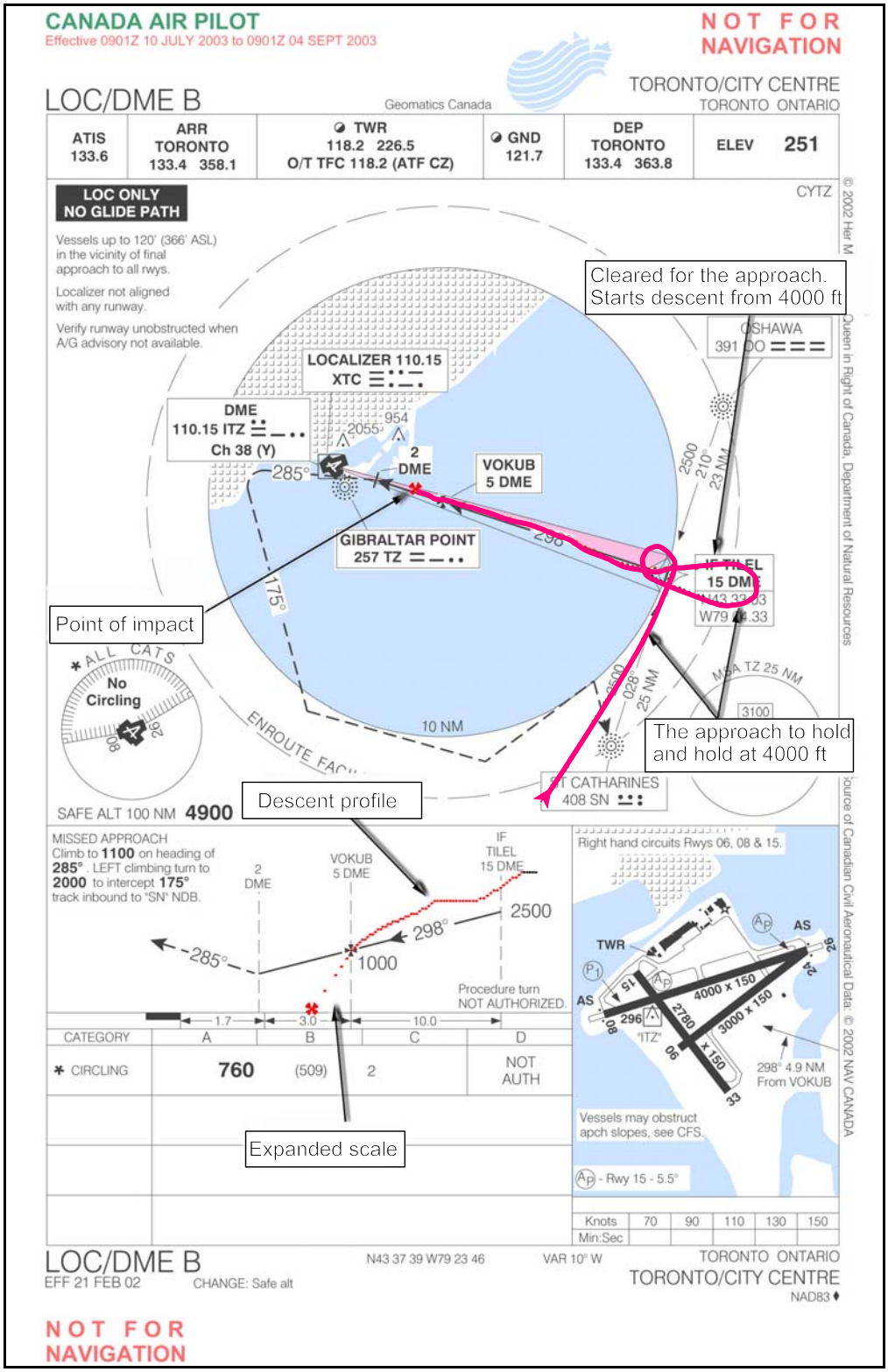
2. Factors that contributed to the loss of situational awareness were non-precision approach, poor visibility, rushed or incomplete checks, level of instrument proficiency and visual illusion created by surface-based fog.

Finding as to Risk

1. Minimum altitudes on *Canada Air Pilot* approach plates are presented differently from minimum altitudes on U.S. FAA/NACO approach plates, which could create confusion and contribute to an unsafe approach.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 07 April 2005.

Appendix A – Flight Path Information



Appendix B – Glossary

asl	above sea level
ATIS	automatic terminal information service
AWOS	automated weather observation system
C	Celsius
CDT	central daylight time
CFIT	controlled flight into terrain
DME	distance measuring equipment
EDT	eastern daylight time
FAA	Federal Aviation Administration (U.S.)
GPS	global positioning system
IFR	instrument flight rules
IMC	instrument meteorological conditions
LBPIA	Toronto/Lester B. Pearson International Airport
MDA	minimum descent altitude
NACO	National Aeronautical Charting Office (U.S.)
POH	*Pilot's Operating Handbook*
RVR	runway visual range
RWY	runway
TCCA	Toronto City Centre Airport
TSB	Transportation Safety Board of Canada
VFR	visual flight rules
VMC	visual meteorological conditions