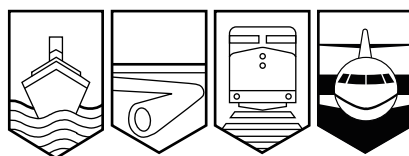


Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada



AVIATION OCCURRENCE REPORT

COLLISION WITH TERRAIN

**INTERLAKE INTERNATIONAL PILOT TRAINING CENTRE
DIAMOND AIRCRAFT INDUSTRIES INC.**

**DA-20-A1 KATANA
KINOSOTA, MANITOBA 3 NM NE
20 FEBRUARY 1998**

REPORT NUMBER A98C0030

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.

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Summary

The Diamond DA-20-A1 Katana, with a flight instructor and a student on board, departed Gimli, Manitoba, on a 118-nm flight to Dauphin. The instructor had filed a visual flight rules (VFR) flight plan with the Winnipeg Flight Service Station (FSS). When the aircraft was overdue at its destination, the FSS conducted a radio search and then contacted the aircraft's operator. The crew of an overflying aircraft reported a signal from an emergency locator transmitter (ELT) along the aircraft's planned flight path, and a military search and rescue aircraft was dispatched to the area. The occurrence took place during daylight hours, at about 1100 central standard time (CST),¹ and the aircraft was located at about 1500. The aircraft had struck the 12-inch-thick ice surface of Lake Manitoba in a nose-down, slightly right-wing-low attitude, at considerable forward speed and at a high rate of descent. There was no evidence of rotation of the aircraft. The aircraft had penetrated the ice up to the leading edge of the wing, and the nose, engine and part of the cockpit were submerged. The two occupants sustained fatal injuries on impact, and the aircraft was destroyed.

Ce rapport est également disponible en français.

¹ All times are CST (Coordinated Universal Time minus six hours) unless otherwise noted.

Other Factual Information

The instructor was certified and qualified for the flight in accordance with existing legislation. He held a commercial pilot licence and a total flight time of 719 hours, 283 hours of which were on the DA-20 Katana-type aircraft. He had undergone some instrument flight training as required for the issue of his commercial pilot licence but did not have an instrument rating. His pilot licence was endorsed with a Class 4 instructor rating on 22 May 1996. The instructor rating was subsequently upgraded to a Class 3 instructor rating, which was valid to 01 November 1998. As of the date of the occurrence, he had accumulated 456 hours since he was hired as an instructor at Interlake International Pilot Training Centre (IIPTC). He was described as a careful pilot and conscientious instructor, and he had completed a Transport Canada Pilot Decision Making course on 13 November 1997.

The student had passed the written examinations necessary for the issue of a recreational pilot permit. According to his logbook, he had accumulated 50.3 hours of flight time, of which 10.4 hours were flown solo. The instructor had completed a form which stated that he had conducted a pre-flight evaluation of all training exercises with the student, and that the student was considered by the instructor to meet the competency standard for the issue of a recreational pilot licence. The occurrence flight was to complete the cross-country requirements for the issue of a recreational pilot permit, and to transport the student to Dauphin to undergo a recreational pilot permit check flight. The chief flight instructor of IIPTC had reportedly arranged the check flight with an examiner at Dauphin.

Weather information at Gimli is gathered by an automatic weather observation system (AWOS). The weather at Gimli in the early morning of the day of the occurrence was generally cloudy, with visibility reduced by fog.

The instructor called the Winnipeg Flight Service Station (FSS) at 0811, advised the FSS specialist that he was planning a VFR flight to Dauphin, and requested a weather briefing. The FSS specialist provided the instructor the following briefing:

"Okay, VFR not recommended until at least after 1200. Currently, Gimli automatic at 0800 wind calm, visibility four miles and ceiling 2,200 overcast, temperature minus four, dew-point minus four, altimeter three zero zero two. Dauphin at 0800 automatic report wind 210 at six, visibility nine miles ceiling 1,800 broken, temperature plus one, dew-point minus two, altimeter 29.98. There are lots of fog patches around this morning; we're an eighth of a mile here in Winnipeg with a vertical visibility of zero and that is pretty prevalent over the Red River Valley. I'm surprised Gimli is improved to what it is. They, just a little while ago, were down to a half a mile or an eighth of a mile. So they could go down again anytime. And the area forecast for southern Manitoba regions in a light southwesterly flow becoming light southerly during the period, airmass moist in the low levels and stable over western regions, becoming patchy moist over the eastern regions and for western regions basically west of the Red River Valley, 2,500 overcast occasionally broken, topped at 4,000 and visibilities more than six except for scattered stratus ceilings 500 to 1,000 and visibilities one to five miles in light drizzle and snow and mist until 1800 zulu [UTC]. Moderate mixed icing in stratus. The freezing level's near the surface, rising to 2,500 feet by 1200, and the outlook for 1800 to 0600 is for marginal VFR ceilings becoming VFR from the west."

The instructor requested the aerodrome forecast for Dauphin and was told: "Dauphin TAF valid from 0500 to 1800 [UTC] wind 230 degrees at seven, visibility more than six and ceiling 2,000 overcast and the wind becoming between 1400 and 1600 zulu 180 degrees at 12 knots."

On the day of the occurrence, Environment Canada prepared forecasts for the Brandon-Dauphin-Winnipeg-Gimli area, and aerodrome forecasts for Dauphin. There were no aerodrome forecasts or weather observations available for points between Gimli and Dauphin, and no evidence was found that the instructor or the student obtained weather information for that area from other sources. The area between Gimli and Dauphin is not densely inhabited. However, there are several villages along the route of flight whose inhabitants were able to provide weather information after the accident. Such information is not readily available to pilots through the FSS. The weather briefing provided to the instructor by the FSS specialist corresponded generally to the reported weather observations for Dauphin and Gimli, the aerodrome forecast for Dauphin, and the area forecast for the route of flight.

After receiving the weather briefing from the FSS specialist, the instructor and the student conferred and decided to wait for conditions to improve. At 0941, the Gimli AWOS reported that the cloud cover had decreased to scattered cloud at 1,900 feet, with a visibility of 2.5 miles. The student filed a VFR flight plan with FSS at 0954, with a planned altitude of 2,500 feet above sea level (asl). At 1000, the AWOS reported that the sky was clear and that visibility had improved to six miles. The instructor and student departed shortly after receiving the 1000 AWOS report.

A printout of weather information from NavCanada's Internet site was found with the student's personal effects in the aircraft after the accident. The information was printed at 0821 on the day of the accident and included the recent weather observations and aerodrome forecasts from Winnipeg, Brandon, Portage Southport, Dauphin and The Pas as well as the forecast upper winds and the area forecast for the period from 0600 to 1800. That area forecast called for cloud ceilings of 2,500 feet asl overcast topped at 4,000, visibility greater than six statute miles, with scattered stratus ceilings 500 to 1,000 feet and visibilities one to five statute miles in light drizzle, snow and mist until 1200. Moderate mixed icing in stratus, otherwise light to moderate rime icing above the freezing level. Freezing level near the surface, rising to 2,500 feet by 1200. Turbulence: light to nil. Outlook: marginal VFR ceilings becoming VFR from the west.

Several ground observers reported that the weather between Eriksdale, 20 nautical miles (nm) east of the accident site, and Vogar, five nm east of the accident site, was low broken to overcast cloud at the time of the flight, with visibility occasionally reduced by fog. Other observers departed from Kinosota, three nm south-west of the accident site, and proceeded on Lake Manitoba to a fishing area about six miles south of the accident site on the morning of the accident. These observers also reported that low cloud and fog prevailed in those areas until noon on that day. Several observers reported that an aircraft which fit the description of the occurrence aircraft flew westbound, on the planned route of flight, over the village of Vogar, at an altitude estimated at 200 to 400 feet, shortly before noon on the day of the accident. The aircraft was observed flying above a low cloud layer and was visible only briefly through breaks in the cloud. The aircraft was described as flying straight and level, and its sound was steady. The ground elevation in the Vogar area is about 840 feet asl.

One witness reported hearing an aircraft flying in the area west of Vogar. The aircraft was not visible, but the sound of the aircraft's engine varied in pitch, in a way that suggested that the aircraft was turning or manoeuvring. As the sound of the aircraft trailed off, a sharp report was heard which the witness believed to be the sound of lake ice cracking. After that sound, the aircraft could no longer be heard. The aircraft was not visible to the observers because of the fog in the area. No witnesses were found who observed the crash. Lake ice reportedly seldom cracks in the relatively warm temperatures prevailing on the day of the accident.

The Canadian Air Regulations (CARs) state that no person shall operate an aircraft in VFR flight within uncontrolled airspace unless the aircraft is operated with visual reference to the surface; and where the aircraft is operated at less than 1,000 feet above ground level (agl), during the day, flight visibility is not less than two statute miles, unless otherwise authorized, and the aircraft is operated clear of cloud. Pilots operating in VFR flight require sufficient ceiling and visibility to orient themselves relative to the ground and to navigate to their destinations. Flight in cloud or areas of low visibility reduces the amount of visual reference available to pilots to enable them to maintain control of their aircraft. The terrain from Gimli to Vogar consists largely of crop land and forest, which provides a visual reference even though the ground is snow-covered. The Aeronautical Information Publication (A.I.P. Canada) states that whiteout occurs over an unbroken snow surface and beneath a uniformly overcast sky, and its effect is that a sense of depth and orientation is lost and only very dark, nearby objects can be seen. Flight over the white surface of a snow-covered frozen lake greatly reduces the available visual reference and increases the chance that the pilot will be affected by whiteout.

The maximum permissible weight of the aircraft is 1,609 pounds. A reconstruction of the aircraft's weight, based on the actual weights of the occupants and baggage found in the aircraft and the reported fuel load, indicates that the weight of the aircraft was 1,637 pounds at take-off and 1,619 pounds at the time of the occurrence. A calculation of the aircraft's centre of gravity indicates that although it was not within approved limits, it was likely not a factor in the occurrence.

The aircraft's log book was with the aircraft when it departed from Gimli. The log book was not recovered after the accident and is believed to have been lost through the ice at the site. The aircraft's records indicate that the aircraft was certified and equipped in accordance with existing regulations. There was no evidence of fire either before or after the occurrence. The engine separated from the fuselage on impact and was found hanging from the aircraft by the engine control cables under the ice. The engine sustained severe damage on impact, and as a result, could not be operated to determine its serviceability. However, damage to the gears of the reduction gearbox and to the aircraft's propeller indicate that the engine was producing power at the time of impact with the ice. The composite wing skins were found delaminated from the wing spars. Examination revealed cracking and wrinkling resulting from an impact to the leading edges of the skins while they were being held in position by the spars. The structure of the aircraft's tail boom failed immediately forward of the vertical stabilizer. The failure mode was consistent with impact forces, and there was no evidence that this structure had failed in flight. Analysis of the aircraft's electrically-powered flight instruments revealed that they were operating at the time of the accident. The aircraft's flight controls and other systems were examined to the degree possible and no evidence of a malfunction was found. The aircraft had

accumulated a total of 1,500 hours of flight time since manufacture. It was not equipped for instrument flight or for flight into known icing conditions. The directional gyroscope was known to precess in flight; however, the unit was still considered to be serviceable.

Several instructors at IIPTC reported that they routinely turned the aircraft's transponder on in flight; however, on several occasions they had found the transponder to be unserviceable. The unit reportedly remained unreliable despite several attempts to effect repairs. A review of radar data records at the Winnipeg Area Control Centre revealed a prime target departing the Gimli area at the time at which the accident aircraft departed. The target followed the planned flight path for several minutes, and then disappeared from view. A prime target may be displayed by radar for an aircraft which does not have a functioning transponder. The transponder system was damaged in the accident and could not be tested. A functioning transponder interacts with radar and results in a secondary radar display. No other low altitude targets were detected by radar in the Vogar-Kinosota area at the time of the accident.

The student was in the left seat, in accordance with normal instructional practice, but the instructor was the pilot-in-command and had the overall responsibility for the safety of the flight. The aircraft's flight instruments are positioned in front of the left seat; however, they can be monitored from the right side. Autopsy results suggest that the instructor was likely handling the controls at the time of the accident. Toxicology test results for the presence of alcohol and other volatiles were negative for both the student and the instructor.

IIPTC had an established training policy entitled "Flight Training Unit Safety Precautions". This publication stated that "These safety precautions have been developed to provide guidance to the student in six specific areas of operation." One of those areas was weather minima for flight operations. On page 5, specific weather limits are provided for solo flights by students. In the case of solo flights by private pilot students, the limits are: Circuits: ceiling 1 000 feet, visibility 5 sm; practise area: ceiling 2 500 feet, visibility 10 sm; solo cross-country: ceiling 3 000 feet, visibility 12 sm. As to flights by students with instructors, the publication states that "In most cases, the instructor will determine whether or not the weather conditions are suitable for dual or solo flight." Interviews with the instructors at IIPTC indicated that they were, for the most part, aware of the provisions of these safety precautions, and that they conducted their operations in compliance with them.

The organizational structure of IIPTC consisted of a chief flight instructor (CFI), an assistant CFI, individual instructors, and students. The CFI was responsible for decisions with respect to flight safety during flying periods, and the overall management of flight training at IIPTC. The assistant CFI supervised the individual instructors and acted as the maintenance coordinator. Except when acting as the instructor on a specific flight, neither the CFI nor the assistant CFI routinely received or reviewed weather reports or forecasts to determine whether the prevailing conditions were suitable for flight operations. Each instructor was responsible for checking the weather before departure. The CFI was in the office on the morning of the accident. He reported that he had checked the AWOS weather report for Gimli and the observed weather at Dauphin before the accident flight departed, but that he had not reviewed the area forecast for the route of flight. On reviewing the area forecast after the occurrence, both the CFI and the assistant CFI indicated that they did not consider the forecast weather conditions to be suitable for the proposed flight. The assistant CFI was not in the office on the morning of the accident.

The student's home was in southern Ontario. During his training at Gimli, he had experienced several delays and postponements of certain exercises as a result of unseasonably cloudy weather. It was reported that the student had planned to depart Gimli for his home on the day after the proposed flight test, and that the instructor, the CFI, and the student were anxious to have the flight test completed before the student's departure. If the planned flight test did not proceed on the day of the accident, it would have been delayed by a substantial amount of time, and further training would probably have been required before a subsequent flight test could have been attempted.

Analysis

Examination of the aircraft wreckage indicates that its structure, engine, and flight control system were serviceable at the time of the accident.

The prime radar target that departed Gimli was probably that of the accident aircraft. The fact that a only a prime target was observed indicates that the transponder was either not functioning or was not turned on during the flight. The practice of the instructors was to turn on the transponder, therefore it is possible that the transponder was turned on but not serviceable during the accident flight. The unserviceability of the transponder made it more difficult for the aircraft to interact with the air traffic control system; however, it did not affect the safety of this flight.

The available information indicates that the instructor and the student obtained the area forecast for the proposed route of flight between Gimli and Dauphin, but did not have specific weather information for the Vogar area available to them during their pre-flight planning and were therefore probably unaware of the fog that prevailed in the area of Lake Manitoba. However, the area forecast predicted scattered stratus ceilings 500 to 1,000 feet, and visibilities as low as one mile, which did not meet the weather requirement of the CARS. The instructor's decision to depart under these conditions left him little margin for any deterioration of the ceilings or visibilities from those mentioned in the forecast.

The student was planning to return home to Ontario on the following day, and the instructor and the student were attempting to complete the flight test before the student's departure. How this may have influenced the decisions made by the student and instructor cannot be ascertained, but it is likely that it would have increased the pressure on the instructor and the student to complete the flight to Dauphin.

The management structure at IIPTC incorporated some supervision of the instructors by the assistant CFI and the CFI. However, it did not provide for routine monitoring of the flight planning process, nor did it assist in regularly evaluating the available weather information. When the CFI and the assistant CFI reviewed the area forecast after the accident, they indicated that they did not consider the weather to be suitable for the planned flight. Had their approval been required before departure, the flight would likely not have been dispatched. The fact that the instructor was aware of the area forecast but chose to initiate the flight into an area of predicted adverse weather, and that the CFI reviewed the observed weather but not the area forecast, indicates that the importance of area forecasts in the flight planning process was not emphasized at IIPTC.

Although the weather at Gimli and at Dauphin exceeded the regulatory requirements for VFR flight, the weather that was observed in the area of the accident site was worse than forecast and did not meet the regulatory requirements for either visibility or ceiling. The local reports indicate increasing cloud cover west of Highway No. 6, and a low ceiling and visibility over the lake in the area of the accident site. The ground observer west of Vogar was able to hear the aircraft but was unable to see it because of fog, so it is unlikely that the aircraft was at that point being operated with adequate visual reference to the ground.

The instructor and student flew toward the area of increasing cloud cover from the east, where the cloud cover was higher and scattered, and where better visual conditions prevailed, in that the vegetation provided visual cues even though the ground was snow-covered. As the aircraft approached Vogar, the cloud thickened and the ceiling lowered. West of Vogar, much of the visual reference with the surface would have been lost as the forested terrain gave way to the frozen lake surface. The steady sound and level attitude of the aircraft as seen between the clouds east of Vogar indicates that the aircraft was, at that point, under control. The low altitude of the aircraft as reported by observers indicates that the aircraft was considerably lower than the planned altitude of 2,500 feet asl. The changing pitch of the aircraft sound, reported by an observer west of Vogar, coincided with the progress of the aircraft from flight over land to flight over the frozen lake. This manoeuvring might have been undertaken in an effort to reverse course, and the sharp cracking sound which followed may have been the sound of the aircraft striking the ice.

The white surface of the lake provided little contrast with the broken cloud and probably removed what little visual reference was available to the pilot of the aircraft. The attitude of the aircraft as it struck the ice indicates that the pilots lost control of the aircraft and entered a manoeuvre from which they were unable to recover in the altitude available. Although the instructor had undergone some instrument flight training, he was not qualified for flight in instrument meteorological conditions, nor was the aircraft certified for flight in such conditions. The pilots probably lost control of the aircraft as the cloud cover increased, and visual contact with the ground was lost in the near-whiteout and low cloud conditions.

The following TSB Engineering Branch Report was completed: LP 22/98 Instruments Examination. This report is available upon request from the Transportation Safety Board of Canada.

Findings

1. The instructor was certified and qualified for the flight in accordance with existing legislation.
2. The aircraft's maintenance records indicate that the aircraft was certified and equipped in accordance with existing regulations, but was not equipped for instrument flight.
3. Examination of the aircraft's structure, flight control systems, and engine did not reveal any pre-crash malfunctions.
4. The aircraft's transponder was possibly not serviceable during the accident flight.

5. The aircraft's weight at take-off, and at the time of the occurrence, was slightly above the maximum approved gross weight for the aircraft type.
6. The area forecast predicted scattered stratus ceilings of 500 to 1,000 feet along the proposed flight route, with light drizzle and snow and mist.
7. The instructor obtained a weather briefing from FSS, and the student obtained the relevant weather information from the NavCanada Internet site.
8. The CFI reviewed the weather at Dauphin and Gimli before the accident flight departed, but did not check the area forecast.
9. The IIPTC safety precautions policy contained specific weather limits for solo flights by students, but no specific weather limits for instructors.
10. The importance of area forecasts in the flight planning process was not emphasized at IIPTC at the time of the accident.
11. The weather conditions deteriorated as the flight progressed west of Highway No. 6, with low ceilings and low visibility in the vicinity of the accident site.
12. As the aircraft approached Lake Manitoba, fog and the frozen surface of the lake offered few visual cues to the pilot, and near-whiteout conditions prevailed.
13. Neither the student nor the instructor was qualified for instrument flight.
14. The aircraft entered a manoeuvre from which the pilot could not recover in the available altitude and struck the ice in a nose-down attitude.
15. The student's planned departure from IIPTC on the day after the accident flight likely increased the pressure on the instructor and student to complete the flight.

Causes and Contributing Factor

The instructor likely lost visual reference in cloud and near-whiteout conditions, and allowed the aircraft to enter a manoeuvre from which he could not recover in the altitude available. Contributing factors were the instructor's decision to continue VFR flight into the deteriorating meteorological conditions west of Eriksdale and a lack of emphasis on area forecasts in the flight planning process.

Safety Action

IIPTC has indicated that it has changed in its flight dispatch procedures. The revised policy provides that the flight planning for every cross-country flight will be reviewed by the CFI or the assistant CFI to ensure that the forecast weather will be suitable for the flight, and that the weight and centre of gravity of the aircraft will be within the approved limits.

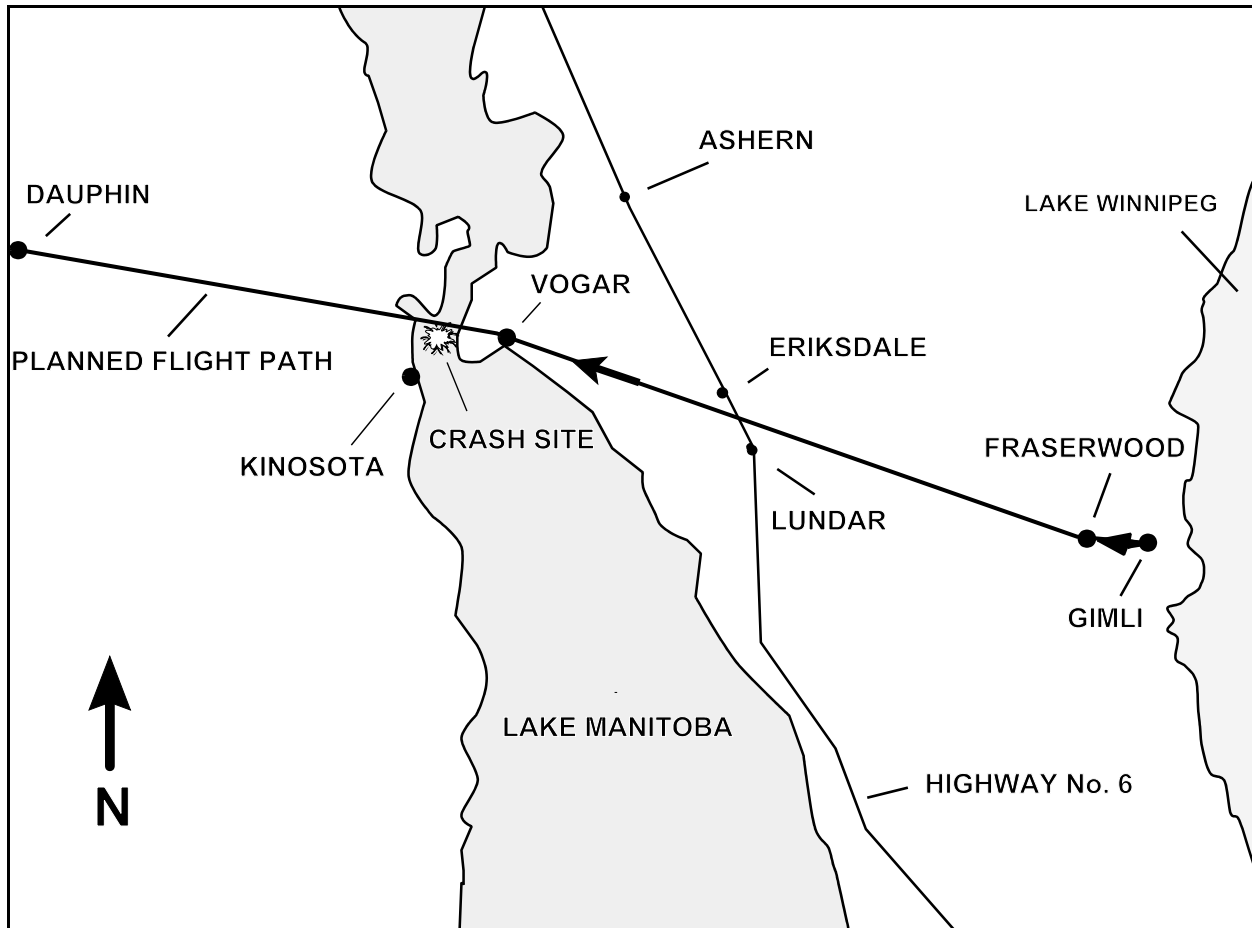
Transport Canada (Prairie and Northern Region) has reportedly changed its pilot and instructor check rides to place increased emphasis on a candidate's ability to correctly interpret weather observations, terminal forecasts and area forecasts.

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 08 January 1999.

Appendix A - Map Showing Planned Flight Path and Crash Site

Distance along the planned route of flight from Gimli to the accident site: 69 nm

Distance along the planned route of flight from Gimli to Dauphin: 118 nm



Appendix B - Glossary

A.I.P.	Aeronautical Information Publication
asl	above sea level
AWOS	automatic weather observation system
CARs	Canadian Air Regulations
CFI	chief flight instructor
CST	central standard time
ELT	emergency locator transmitter
FSS	flight service station
IIPTC	Interlake International Pilot Training Centre
nm	nautical miles
TSB	Transportation Safety Board of Canada
UTC	coordinated universal time
VFR	visual flight rules