Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION OCCURRENCE REPORT

LOSS OF CONTROL - STALL

PIPER PA-23-250 N456MR
ST. JOHN´S, NEWFOUNDLAND
20 MARCH 1998

REPORT NUMBER A98A0038

Canada

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Summary

The aircraft, with a pilot and one passenger onboard, departed Bangor, Maine, at 1905 Coordinated Universal Time (UTC)[1] en route to St. John's, Newfoundland. Approaching St. John's, the pilot requested an ILS (instrument landing system) approach to runway 16 with a continuous descent to minimize the time spent in the icing conditions in cloud. The Gander Area Control Centre (ACC) cleared the aircraft to descend to 2 100 feet above sea level (asl) and vectored the aircraft to the localizer. During the descent, moderate turbulence was encountered and some clear icing developed on the windscreen, but no ice was observed on the wings, which were painted white. When the pilot attempted to level off at 2 100 feet asl, the aircraft continued descending to 1 900 feet asl and, despite full application of power, the aircraft took a long time to climb back to 2 100 feet asl. Once established on the ILS approach, the pilot was able to maintain a 90-knot approach speed and remain on the glide slope until approximately 100 feet above the decision height. At this point the aircraft suddenly rolled left 30 to 45 degrees. The pilot managed to re-establish a wings-level attitude by using aileron and rudder. This was immediately followed by a similar roll to the right, recovery to wings level, then the nose dropped, and the aircraft descended into some trees. The fuselage came to rest in a level attitude approximately 4 100 feet short of the threshold of runway 16. The passenger suffered a serious leg injury and the pilot escaped with minor injuries. The accident happened at 2258 during the hours of darkness.

Ce rapport est également disponible en français.

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[1] All times are UTC (Newfoundland standard time plus three and one-half hours) unless otherwise noted.

Other Factual Information

The pilot held an Israeli commercial pilot licence with an endorsement for flight under instrument flight rules (IFR) and had 5 000 flight hours. Federal Aviation Regulations (FAR) 61.3 requires that a pilot of a civil U.S. registered aircraft possess a valid U.S. pilot certificate when operating the aircraft within a foreign country. The pilot held a U.S. commercial pilot licence valid for multi-engined aircraft; however, the licence was restricted to flight under visual flight rules (VFR) only.

The pilot's flying experience was primarily accumulated in Israel, where, he stated, icing was seldom a concern. He had flown in icing conditions on only about three occasions, encountering light icing in cloud. The pilot indicated that he did not feel he was under any particular pressure to undertake the flight. He indicated that he anticipated encountering some light icing during his descent into St. John's but that, if his time in cloud was kept to a minimum, the icing should not present any significant difficulties. He was surprised at the amount and the effect of the icing.

This was the pilot's first flight into St. John's, Newfoundland. The airport of St. John's is known in the Canadian aviation community to be affected by very demanding aviation weather phenomena. Because of its geographical location, the winds affecting the airfield are particularly troublesome and a cautionary note appears in all approach plates cautioning pilots to anticipate moderate to severe turbulence on the approach.

Records indicate that the aircraft was certified and maintained in accordance with existing regulations. The pilot indicated that the aircraft was functioning properly in all respects prior to the accident. Examination of the aircraft revealed no indication of any pre-impact flight control failure. Inspection of the blades of the propellers revealed that they were bent and twisted in a manner consistent with power being delivered to both propellers at the time of impact. Immediately after the occurrence, a thin layer of transparent, milky-white ice was noted by rescue personnel on the lower third portion of the windscreen and on the leading edge of the horizontal stabilator. The ice was approximately ¼ inch thick and extended back 3 to 4 inches from the leading edges on the upper and lower surfaces of the stabilator. The ice was difficult to discern against the white-coloured background of the stabilator. The leading edge of both wings had been severely deformed as a result of their impact with the trees and no ice accumulation was noted on either wing. The aircraft was not equipped with windshield, propeller, or wing deicing equipment, and the aircraft was not certificated for flight in icing conditions.

Safe, efficient flight is dependent on a smooth uninterrupted flow of air over wings and control surfaces. When this flow of air is disturbed by ice accumulating on the lifting surfaces, the adverse effects on aircraft performance and flight characteristics are generally reflected in the form of decreased lift, increased drag, increased stall speed, and altered stall characteristics and handling qualities. Ice accumulation on propellers would decrease the available thrust. Flight operations in gusty winds and turbulent conditions with ice contaminated lifting surfaces further exacerbates controllability of the aircraft near the stall or the ability to regain control once in the stall. The stall speed is also affected by the weight of an aircraft; the higher the weight, the higher the stall speed.

At the time of the occurrence, the eastern provinces of Canada were under the influence of an extensive weather system with wide ranging areas of low ceilings, reduced visibilities, and freezing precipitation. In the St. John's area, the area forecast (FA) issued at 1130 reported a warm front running east/west approaching from the south, forecast to be within 60 nautical miles (nm) of St. John's by the aircraft's time of arrival. The clouds and weather forecast within 60 nm of the warm front included altocumulus clouds as well as mixed conditions of visibilities as low as ½ mile in light snow, light ice pellets and light freezing rain. Moreover, the FA forecast moderate to severe clear icing below 2 500 feet asl in the freezing rain, moderate mixed icing in the altocumulus cloud, and otherwise light to moderate rime icing in cloud above the freezing level. Moderate mechanical turbulence was also forecast due to strong gusty surface winds.

The aerodrome forecast (TAF) issued at 1105 for St. John's, covering the aircraft's expected arrival time (2300) included forecast visibilities of 1½ statute miles (sm) in light snow and surface winds from the east at 15 knots gusting to 25. According to the TAF, the freezing precipitation was not forecast into St. John's until 0300 at which time the visibility was expected to be 2 sm in light ice pellets and light freezing rain. The regular weather observations taken at St. John's show visibilities of 2 sm or less commencing at 1500 with persistent freezing fog and easterly winds of 15 to 25 knots until 2153. At that time, the aviation weather report (METAR) shows the existence of light ice pellets. This was followed by a METAR at 2300 which reported visibilities of 1 sm in light ice pellets and light freezing rain.

Prior to departure from Bangor, the pilot had visited the Bangor Flight Service Station where he received two detailed weather briefings (at 1307 and 1501) and an abbreviated briefing at 1630. The detailed weather briefings included a review of the above mentioned FA as well as the TAF issued at 1105 and most recent METARs for St. John's with an emphasis placed by the weather briefer on the probability of encountering inflight airframe icing in cloud and in the freezing precipitation. The final briefing at 1630 contained only the current and forecast weather for St. John's.

The pilot departed Bangor in visual flight, and he did not file a flight plan as required by FAR 91.707 - Flights between Mexico or Canada and the United States. This regulation states that, unless otherwise authorized by ATC (air traffic control), no person may operate a civil aircraft between Mexico or Canada and the United States without filing an IFR or VFR flight plan, as appropriate. Once in Canadian airspace, the pilot contacted the Moncton Area Control Centre and indicated his intent of continuing to St. John's VFR while remaining on top of clouds. In light of the IFR weather conditions prevailing at St. John's, the pilot was informed that VFR over the top could not be approved and he was issued an IFR clearance.

During the approximately four-hour flight, the pilot requested and received actual and forecast weather information from air traffic controllers in the Moncton and then the Gander Area Control Centres. For example, a Moncton ACC controller informed the pilot that the forecast for St. John's issued at 1700 included visibilities of ¼ sm in snow and blowing snow between 1700 to 2300 and between 2300 and 0300, the visibility was forecast to improve temporarily to 3 sm. At 2148, the Gander ACC informed the pilot that the 2100 actual weather at St. John's included visibilities of ½ sm in light snow and freezing fog. At 2206, the Gander controller transmitted the 2200 St. John's weather which included ½ sm in light snow pellets and freezing fog. At 2248, while the aircraft was on approach and intercepting the localizer, the controller informed the pilot that the weather remained unchanged.

The St. John's airport is equipped with an automatic terminal information service (ATIS). The ATIS message which was broadcast throughout the time of N456MR's descent and approach to the St. John's airport, "information Quebec" included the 2200 weather observation – visibility ½ sm in light snow, ice pellets, freezing fog, with the visibilities varying from ¼ sm to ¾ sm. In addition, it included the remarks that a Beech 200 had landed on runway 16 at 2200 and the pilot reported that from 5 000 to 2 500 feet asl in the descent he encountered continuous light to moderate chop (turbulence) with airspeed fluctuations of 10 to 15 knots, and from 2 500 feet on down, he encountered a 60-knot headwind. The Aeronautical Information Publication (A.I.P.) urges pilots to obtain arrival/departure and aerodrome ATIS information as soon as it is practicable. In this instance, the St. John's tower controller informed the pilot that "information Quebec" was on the ATIS; however, the pilot relied on the information previously provided to him by ATC controllers and did not listen to the ATIS information.

Flight crews of three commercial aircraft arriving or departing St. John's within one hour of the accident reported encountering light to moderate mixed icing in cloud below 4 000 feet.

At 2016, the Regional Forecast Center in Gander, Newfoundland, issued a warning of potentially hazardous icing conditions in the vicinity of the French island of St. Pierre moving towards St. John's. These warnings, termed SIGMET (significant meteorological report), are commonly coded with a letter and number unique to the SIGMET. Successively higher numbers supersede SIGMETs previously issued by that weather forecast center. In this instance, SIGMET C2 was valid from 2015 to 0015 and warned of moderate to severe clear icing forecast below 2 500 feet asl due to freezing rain and ice pellets. The area of icing extended 90 nautical miles south from a line commencing 30 nautical miles northeast of St. Pierre and running eastwards. The line was moving northeastwards at 10 knots. This SIGMET superseded SIGMET C1 which had been issued at 1718 and was valid from 1715 to 2115. SIGMET C1 warned of the line of freezing precipitation being at St. Pierre running eastwards and moving northeastwards at 20 knots. Neither SIGMET C1 nor C2 was mentioned in the "Quebec" ATIS broadcast.

Air traffic control is responsible for transmitting the SIGMET information to the aircraft in flight. The SIGMET data is placed on a weather circuit by the Weather Centre, and automatically picked up by the area control centre's Operational Display System (OIDS). The OIDS display in front of the controllers's position is an electronic display with a number of display pages available for viewing, some of which are reserved for SIGMETs. On the controller's primary page, one of the information lines is marked SIGMET (in capital letters). When a SIGMET is received by OIDS, the letters WS followed by the page number where the information can be viewed is displayed opposite the line marked SIGMET on the controller's primary screen. The controller must then select the appropriate page number in order to view the SIGMET information. There are no audible or visual alarms to draw the controller's attention to the fact that new SIGMET information has been received by OIDS.

The Gander International Flight Service Station (IFSS), located in the same building as the Gander ACC, has a multi-purpose information display system (MIDS) that automatically receives weather information from the weather circuits. If a new SIGMET is detected by the MIDS, it provides an audible and visual alarm to the operator. This system is not available to controllers in Gander ACC.

Section 162.1 of the *Air Traffic Control Manual of Operations* (MANOPS) specifies how the controller is expected to disseminate the severe weather information. There was no evidence found that this SIGMET information (either SIGMET C1 or C2) had been passed to the pilot of the occurrence aircraft.

The aircraft had recently been purchased by four Israeli citizens and was being ferried to Israel under its American registry. The aircraft registry was to be changed to the Israeli registry after its arrival in Israel. The aircraft had been fitted with a long-range fuel tank system prior to its departure from Bangor. The normal maximum weight of the aircraft is 5 200 pounds. A Special Flight Permit had been issued by the Federal Aviation Administration (FAA) allowing flight 25% in excess of the normal maximum gross weight of the aircraft, giving a maximum weight in accordance with the permit of 6 500 pounds. The aircraft had departed Bangor with a full fuel load with the planned refuelling stop at St. John's. The weight of the aircraft on departure from Bangor was calculated to be 5 938 pounds. The weight of the aircraft at the time of the occurrence, given the normal fuel consumption rate of 180 pounds per hour, was calculated to be approximately 5 218 pounds.

The conduct of transoceanic flights in general aviation aircraft is subject, in part, to *ICAO, Annex 2 - Rules of the Air* and to the *North Atlantic International General Aviation Operations Manual.* The latter outlines the equipment requirement for general aviation aircraft commencing a transoceanic flight from Canadian domestic airspace. Included in these aircraft requirements is the mandatory fitment of a High Frequency (HF) radio capable of transmitting and receiving on a minimum of two appropriate international air-ground general purpose frequencies. The aircraft was not equipped with an HF radio as required by regulations. Moreover, the *North Atlantic International General Aviation Operations Manual* requires that the aircraft carry current aeronautical maps, charts, and approach plates covering the area in which the aircraft might be flown. In this case, two of the three Canadian Low En route Altitude Charts (GPH 206) found in the aircraft had an effective date of 14 November 1991 and the third had an effective date of 4 January 1996. These en route charts are revised every 56 days on dates consistent with the ICAO Air Information Regulation and Control (AIRAC) cycle. Evidently, the charts carried onboard the aircraft and used by the pilot for flight planning and inflight navigation were grossly out of date. These were the only Canadian En route Charts found in the aircraft. There was no copy of the Canada Flight Supplement (CFS) on board. The CFS is intended, in part, to supplement the En route Charts.

The approach charts found in the aircraft were similarly out of date. For example, the chart used to conduct the ILS 16 approach at St. John's had an effective date of 2 February 1995 while the most current chart which should have been used had an effective date of 26 February 1998; the use of outdated IFR charts and/or publications is an extremely dangerous practice.

There are no requirements for operators of light general aviation aircraft departing a Canadian airport to undergo any inspections by Canadian regulatory authorities before attempting an ocean crossing. Such an inspection and authorization procedure had been in effect until 10 October 1996 when it was eliminated as a cost-saving measure.

Analysis

The evidence clearly indicates the aircraft accumulated airframe icing during its descent and ILS approach into St. John's. This is supported, in part, by the pilot's observation of ice on the lower portion of the windscreen during the approach and by the discovery of ice on the horizontal stabilator by rescue personnel immediately following the accident. Although the pilot did not observe any ice on the wings during the descent, it is likely that ice adhering to the wings would not have been discerned by flashlight on the wing's white background. The adverse effect this ice would have had on the aircraft's performance could not be quantified; however, when attempting to level-off at 2 100 feet asl during the descent, the aircraft continued to descend and the 2 100 feet asl assigned altitude was regained slowly despite full application of power. The surface weather observation taken at the time of the accident indicates the initial appearance of freezing precipitation in the form of ice pellets and light freezing rain. Given this information, it is reasonable to conclude that airframe icing would have been more severe as the aircraft continued its descent through this freezing precipitation.

As indicated on the ATIS information, the winds on the approach had been reported as high as 60 knots prior to the accident and were conducive to the moderate and severe turbulence as cautioned in the top left hand of the approach chart. These winds would have resulted in significant airspeed fluctuations for the accident aircraft and would have exacerbated the controllability of the aircraft.

The aircraft control problems immediately prior to the aircraft's descent into the trees are consistent with an aircraft approaching a stall or in a stalled condition. While this could be wholly attributable to airframe icing, it would be more reasonable to conclude that the aircraft stalled because of a combination of the build-up of ice on the lifting surfaces, the moderate turbulence on the approach, and the higher than normal aircraft weight plus the weight of the accumulate ice.

The area forecast for the aircraft's expected time of arrival at St. John's included the possibility of moderate mixed icing in cloud and moderate to severe clear icing in freezing precipitation below 2 500 feet asl. The pilot had received two extensive weather briefings prior to his departure which included the above mentioned area forecast; which highlighted the probability of encountering icing in cloud. Morever, he was aware that his aircraft was not equipped for flight in icing conditions. His decision to undertake the flight and accept the risks posed by a descent through known icing in clouds may have been influenced by his previous successful experience flying in light icing conditions.

It could not be determined why the pilot was not made aware of the SIGMET information which warned of the hazardous icing conditions expected to be in the vicinity of St. John's at the aircraft's expected time of arrival. The display of SIGMET information for Gander ACC controllers is not compelling. Unless they are advised by someone, or happen to be looking at the display, a SIGMET affecting their area of control could be missed. Similarly, it could not be determined what effect this information would have had on the pilot's decision to continue the flight. It is noted, that this SIGMET reflected the contents of the area forecast which had been discussed with the pilot prior to his departure from Bangor.

The absence of HF equipment on the aircraft and the use of outdated IFR charts were not considered factors in the occurrence. When viewed in consideration with other elements of this flight, however, the pilot's understanding of North American and transoceanic flight regulations must be questioned. For example, the pilot's decision to commence the transborder flight without filing an appropriate flight plan, his decision to continue the flight in cloud despite the VFR restriction on his American licence, and his intent to conduct the flight VFR over the top despite the absence of requisite weather suggest the pilot's knowledge of rules and regulations may have been flawed. Because aircraft and pilot inspections are no longer conducted by Transport Canada prior to transoceanic crossings, these shortcomings are less likely to be detected.

The pilot was flying as a single pilot in a newly-purchased aircraft, which was uncertified for flight in icing conditions, at night in adverse icing and turbulence conditions, relying on outdated approach charts to conduct an unfamiliar precision instrument approach. He was unfamiliar with the aviation weather patterns, and was not sufficiently knowledgeable or cautious regarding the detrimental effects of aircraft icing.

Findings

1. The flight was commenced into known icing conditions with an aircraft that was not equipped with windshield, propeller, or wing deicing equipment and was not certificated for flight in icing conditions.

2. The pilot did not file a flight plan as required by regulations.

3. The aircraft encountered clear icing and moderate turbulence during its descent and ILS approach into St. John's.

4. Records indicate that the aircraft was certified and maintained in accordance with existing regulations.

5. The normal maximum weight of the aircraft was 5 200 pounds. A Special Flight Permit had been issued allowing flight 25% in excess of the normal maximum gross weight of the aircraft; the maximum weight in accordance with the permit was 6 500 pounds. The weight of the aircraft at the time of the occurrence was calculated to be approximately 5 218 pounds..

6. The pilot was not licenced for IFR flight in an American registered aircraft.

7. The aircraft was not equipped with an HF radio as required by regulation for transoceanic flight, and the pilot was using outdated charts. The absence of HF equipment on the aircraft and the use of outdated IFR charts were not factors in the occurrence.

8. There are no requirements for operators of light general aviation aircraft departing a Canadian airport to undergo any inspections before attempting an ocean crossing.

9. The SIGMET information was not passed to the pilot nor was it contained in the ATIS.

10. There are no aural or visual alarms to alert the Gander ACC controllers that new SIGMETs have been issued.

Causes and Contributing Factors

The aircraft stalled while the pilot was conducting an ILS approach to runway 16 at St. John's. The cause of the stall was determined to be a result of a combination of the aircraft's weight, airframe icing, and moderate turbulence. Contributing to the occurrence was the pilot's decision to undertake and continue the flight into forecast and known cloud and icing conditions, although the aircraft was not certified for flight in icing conditions.

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 10 December 1998.