Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
A04A0099

COLLISION WITH TERRAIN

PIPER PA31-350 (NAVAJO) C-FTNS
SAINT JOHN AIRPORT, NEW BRUNSWICK
19 AUGUST 2004

Canada

Aviation Investigation Report

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Summary

The pilots flew a Piper PA31-350 aircraft (registration C-FTNS, serial number 31-7652009) from Québec, Quebec, to Saint John, New Brunswick, on an instrument flight rules flight, with Fredericton, New Brunswick, as their alternate airport. On arrival, they flew a radar-vectored, instrument landing system approach in low-visibility conditions to Runway 23 at the Saint John Airport. Radio contact was lost while the aircraft was on the approach and a brief emergency locator transmitter signal was heard at 2234:30 Atlantic daylight time. The aircraft had crashed on final approach, and the two pilots sustained serious burn injuries in the ensuing post-crash fire.

Ce rapport est également disponible en français.

Other Factual Information

History of the Flight

The en route portion of the flight from Québec was uneventful. Approach clearance was given by Moncton Centre for the instrument landing system (ILS) Runway 23 approach to the Saint John Airport (CYSJ). Radar showed that C-FTNS was established on the localizer with a stable flight profile, at least until 1500 feet above ground level (agl) when radar coverage was lost due to terrain interference. The pilot-in-command was the pilot not flying (PNF) and was in the right-hand seat. The other pilot was the pilot flying (PF).

A regional airline Beech 1900 flight crew had attempted an approach on the same runway just before the approach by the occurrence aircraft. The crew members of the Beech 1900 were flying a pilot-monitored approach[1] with the first officer flying. When adequate visual reference with the runway environment was acquired, the captain took control from the first officer and continued the approach down to 100 feet agl. The first officer continued to monitor the instruments and the approach, observed that the aircraft was misaligned with the runway, and called for a missed approach.

Shortly after the Beech 1900 started the missed approach, the PNF of C-FTNS established contact with the CYSJ Flight Service Station (FSS) specialist. The specialist observed on radar that the Beech 1900 was conducting the missed approach, told C-FTNS to stand by and instructed the crew of the Beech 1900 to contact Moncton Centre. Before instructing the crew to contact Moncton, the FSS specialist did not ask the Beech 1900 crew to provide a pilot report (PIREP) on the weather they encountered during their approach and attempted landing, nor did the pilots offer to provide a PIREP. Paragraph 234.1 of the NAV CANADA Flight Service Station Manual of Operations (FSS MANOPS) states in part:

> Solicit PIREP from pilots during a pilot briefing and from aircraft when:
> A. poor weather conditions exist;
> B. necessary to remain aware of flight conditions;
> 234.1 Note: PIREPs contain useful information for aviation forecasters and may be an important factor in another pilot's decision. PIREPs are especially useful when they contain critical information on low clouds, reduced visibility. . . .

The FSS specialist did not advise C-FTNS of the Beech 1900's missed approach, nor was there a requirement to do so, and the pilots of C-FTNS were unaware that the Beech 1900 had not successfully completed the approach.

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[1] During a "pilot-monitored approach," the PNF looking outside for adequate visual references takes control of the aircraft if the approach can be continued safely so that the PF does not have to make the transition from instrument to visual references.

The FSS specialist advised C-FTNS that the reported 2200 Atlantic daylight time[2] weather at CYSJ was as follows: wind 220°magnetic (M) at 13 knots gusting to 18 knots, visibility ½ statute mile (sm) in fog, vertical visibility 200 feet, runway visual range (RVR) 2000 feet with the runway lights on strength five.

Moderate turbulence was encountered by the accident aircraft during the latter stages of the approach to Runway 23. During this encounter, the aircraft went above the glideslope and drifted left of the localizer. The PF, manually flying the approach, corrected for the deviations and continued the approach. A short time later, the PNF called the approach lights coming into view and shortly thereafter called minimums (decision height [DH]). The PF discontinued his instrument scan, observed the runway lights at the two o'clock position in the windscreen, and attempted to correct. The PNF called for an overshoot, but the aircraft continued to descend until it struck the terrain. Because of the absence of radar and flight recorder data, the exact path and correlation of the crew's observations during the approach could not be established.

The last radio transmission from the aircraft was when it was established on the final approach to Runway 23. After the impact, a two-second emergency locator transmitter (ELT) signal was heard by the FSS specialist at 2234:30. Twenty minutes later, an airport fire response vehicle located the aircraft inverted and on fire at the southeast edge of the Clover Valley Road, about one-half nautical mile from the threshold of Runway 23 and 650 feet to the southeast of the extended runway centreline (Figure 1). The pilots had already escaped through the cabin entrance door and made their way to a private dwelling to seek assistance; both crew members had sustained serious burn injuries.

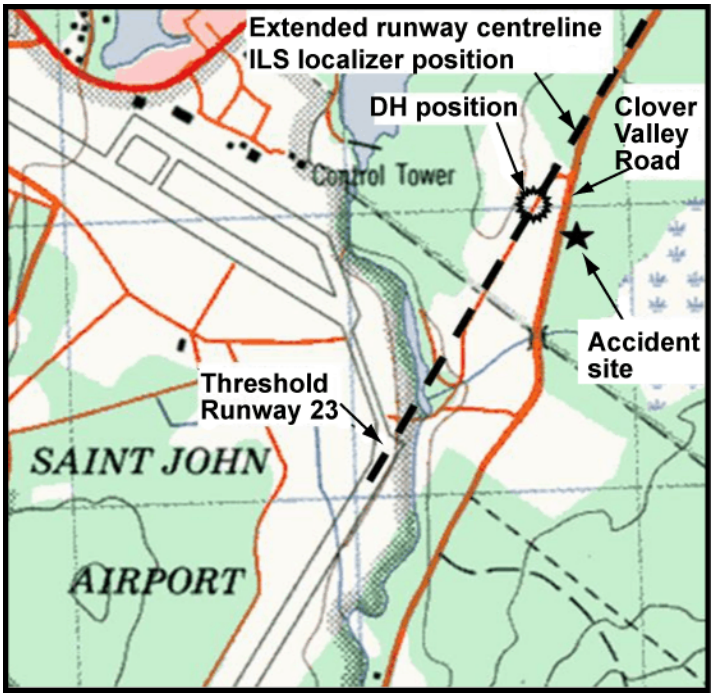

Figure 1. Accident site location

The weather recorded six minutes after the accident was as follows: wind 210°M at 13 knots with gusts to 20 knots; visibility ¼ sm in fog; temperature 17°C; dew point 17°C; and altimeter setting 29.97. Approximately one minute after the crash, the RVR was 1800 feet, and it stabilized at 1600 feet about six minutes after the accident.

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[2] All times are Atlantic daylight time (Coordinated Universal Time minus three hours).

Aircraft Wreckage and Site Examination

The aircraft struck some alder tree-tops, left tire marks on the paved surface of the Clover Valley Road and then entered an area of alder trees and marshy terrain. From the tree and ground marks, it was determined that the aircraft track was about 182°M when it struck the ground, while the extended centreline of the runway was on a track of 230°, a difference of about 50°. It was also determined that the aircraft was approximately 10° nose down and in a three-degree right bank when it struck the tree-tops and crossed the road. The right main wheel contacted the paved road surface, leaving a heavy tire mark. The impact was almost abeam of the DH position. The initial contact contributed to a subsequent left rolling moment and a left-banked attitude of approximately 11° as the aircraft entered the alder trees beyond the road.

The aircraft continued forward, eventually rolling over and coming to rest inverted 650 feet southeast of the localizer. The wreckage trail was approximately 110 feet long. The cockpit and cabin were not initially compromised. A fuel-fed fire broke out a few seconds after the aircraft came to rest (Figure 2). The fire was well developed by the time the two pilots exited through the aft cabin door. The fire consumed about 90 per cent of the fuselage. Both wings sustained severe fire damage, but the empennage remained relatively undamaged.

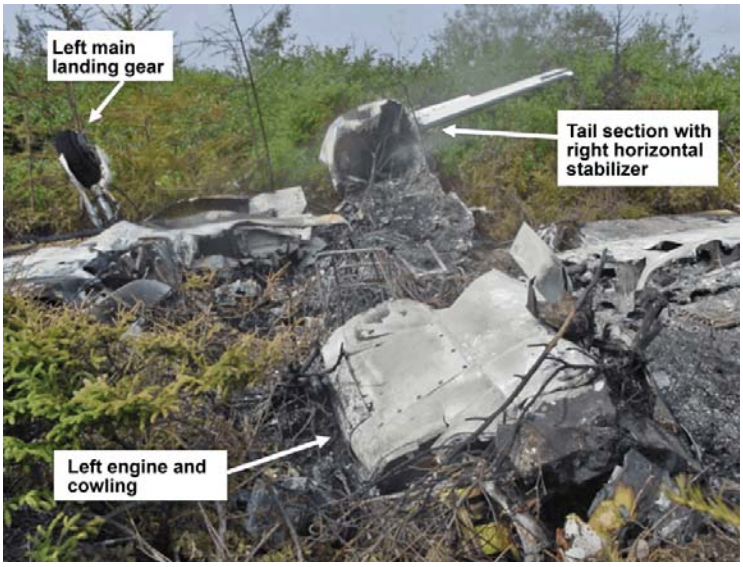

Figure 2. Aircraft wreckage

Both engines were still enclosed in their cowlings and were in good condition except for some impact damage. Both propellers were still attached to the engines, and all the blades were bent rearward about mid-span, suggesting low propeller rpm during impact. Because of the softness of the marshy terrain, it was difficult to determine accurate rpm figures.

Despite the severity of the burn damage to the airframe, continuity of all flight controls and engine controls was confirmed. No pre-impact airframe or engine anomalies were discovered during the wreckage examination.

The Operator

The aircraft had been acquired by the company three months before the accident. It was certified for single-pilot visual flight rules (VFR) and instrument flight rules (IFR) flight. It was privately registered and used for company business travel. Since the aircraft was not being operated commercially, there were no regulatory requirements for the pilots to pass an aircraft proficiency check ride, to have available and use multi-crew standard operating procedures (SOPs), or to complete a formal company training program to operate as a crew. Consequently, the aircraft was flown using only the checklists in the manufacturer's aircraft flight manual.

Pilot Information

The two pilots were licensed in accordance with the *Canadian Aviation Regulations* (CARs). The pilots' flight duty days were within the prescribed regulations and both were considered rested.

The pilot-in-command was a part-time employee of the company and held a valid commercial licence. He had about 4800 total flying hours, with approximately 550 hours on multi-engine aircraft, including 20 hours on the PA31-350. The most recent Group 1 (multi-engine aircraft) instrument rating renewal was completed on 16 October 2003. His total instrument time was reported to be 425 hours with only a few approaches conducted in visibility less than ½ sm or 2600 RVR. The pilot-in-command was retained by the company to help crew the aircraft if particularly long flights or challenging weather conditions were anticipated.

The co-pilot, a full-time employee of the company, held a valid commercial licence with a valid medical. He had about 1400 total flying hours, with approximately 500 hours on multi-engine aircraft, including approximately 170 hours on the PA31-350. An initial Group 1 instrument rating flight test had been completed on 31 January 2004, and since then, the co-pilot had only experienced a few approaches in visibility less than ½ sm or 2600 RVR. He was the company's full-time pilot and normally flew the aircraft as a single pilot under both VFR and IFR conditions.

Aircraft

Records indicate that the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures. This aircraft had an executive seat configuration for seven people. In the commuter configuration, the same aircraft can carry ten people. There was no indication of any failure or malfunction during the flight.

The aircraft was equipped for single-pilot IFR flight and had a serviceable automatic flight control system (AFCS). The AFCS can be operated as a flight director to provide command information to the pilot when hand-flying the aircraft, or it can be coupled to the autopilot for automated flight. All the navigational instruments were located on the left-hand pilot's instrument panel to facilitate single-pilot operation. The PF was not confident using the flight director and did not use it during the ILS approach to Runway 23.

Saint John Airport – Runway 23

Runway 23 is 7000 feet long and 200 feet wide, with a high-intensity approach light system 2400 feet long. The first 1000 feet are sequenced white flashing lights and the remaining 1400 feet are steady, white, runway alignment indicator lights. There are also green threshold lights and variable high-intensity runway edge lights.

Runway 23 was served by a Category I ILS approach. The DH was 200 feet agl with an advisory visibility of ½ mile or 2600 RVR. The ILS provided a standard three-degree glideslope on a final approach course of 230°M. A navigational status report taken at the time of the occurrence indicated that the ILS readings for Runway 23 were normal. The last flight check of the ILS was conducted on 14 May 2004, and the results were within normal parameters.

Approach Considerations

A stabilized approach is a prerequisite to a successful landing. An approach is stable when an aircraft has a constant rate of descent along the approach path, the appropriate airspeed and power setting are stable, and the aircraft is configured appropriately for the approach. Aircraft on ILS approaches are considered stabilized[3] on the approach path when they are flown within "one dot" (half the scale) of the full glidepath or localizer indicator displacement.

The track bar indicator will reach full-scale deflection at 2½ degrees from the centre of the localizer beam. The glideslope indicator will reach full-scale deflection at 0.7 degree from the centre of the glideslope beam. The ILS on Runway 23 at CYSJ DH position was approximately 2900 feet from the threshold (Figure 1) and 200 feet above ground. At this position, the width of the localizer beam is about 475 feet horizontally, while the depth of the glideslope beam is about 45 feet vertically. An aircraft would have to be outside of these parameters to produce full-scale deflection of the indicators.

The Transport Canada Instrument Procedures Manual (IPM) (TP 2076E, January 2000) provides comprehensive guidance to pilots about the aspects of instrument flying. The following is some of the information related to flying an ILS:

> If the aircraft is inbound on the localizer above the glide path, the pilot must use extreme caution, because he or she must follow a non-standard procedure and might require an excessive rate of descent to regain the glide path.
>
> If at any time on final approach prior to DH, full-scale deflection of the localizer occurs, initiate a missed approach. When full-scale down deflection occurs on the GSI, descent to a non-precision minimum descent altitude may be continued without using excessive rates of descent. If full-scale up deflection occurs on the GSI, the aircraft should overshoot since obstacle clearance is not assured.

Runways serviced with an RVR are subject to an approach ban (Section 602.129 of the CARs). This section provides the only visibility-based restriction for the conduct of an approach or landing. This allows a pilot to conduct an approach to a runway anytime the reported RVR is at least 1200 feet. If there is RVR equipment for the runway, but it is not serviceable or the RVR is not provided for other reasons, a pilot is not restricted from flying an approach. Visibility values

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[3] Taken from the Flight Safety Foundation Approach and Landing Accident Reduction Task Force Briefing Note 7.1, Stabilized Approach

provided in the *Canada Air Pilot* (CAP) approach plates are advisory only and, if prevailing at the time of approach, should result in the required visual reference being established and maintained to landing. The advisory visibility for the ILS approach for the Runway 23 ILS procedure at CYSJ was ½ sm or 2600 RVR. A pilot may continue with a landing provided visual contact with the runway environment was made before passing the minimum descent altitude (MDA) or, for a precision approach, DH (see CAP GEN 13).

Canada Air Pilot (CAP) GEN 13

The visual references required by the pilot to continue the approach to a safe landing should include at least one of the following references:

- the runway or runway markings;
- the runway threshold or threshold markings;
- the touchdown zone or touchdown zone markings;
- the approach lights;
- the approach slope indicator system;
- the runway identification lights;
- the threshold and runway end lights;
- the touchdown zone light
- the parallel runway edge lights; or
- the runway centreline lights.

Analysis

The impact and aircraft wreckage analysis showed that there were no pre-impact failures or malfunctions that could have caused the deviation from the localizer and glidepath for the ILS approach to Runway 23. Although there were reports of gusty winds and mechanical turbulence, there were no weather phenomena observed that would have prevented the aircraft from safely completing an instrument approach, or if this was not possible because of low visibility, a missed approach. Therefore, the analysis will focus on the operational aspects of the occurrence.

The crew members were permitted by regulation to conduct the approach in reported visibilities that were below the minimum advisory values published. The pilots were also not required by regulation to have procedures and training to operate as a crew. Furthermore, the PF did not use the AFCS, without which he was denied a valuable command reference for the approach and use of the autopilot. Consequently, his workload would have been unnecessarily high and control of the aircraft more challenging in the conditions of night, low visibility, and mechanical turbulence.

The aircraft was serviceable and under the control of the PF. The aircraft struck the trees/ground almost abeam the DH position, at a distance of 650 feet from the extended centreline of the runway/localizer and on a track 50° off the final approach track. To arrive at that position, the approach would have been unstable as the maximum deflection of the track bar would have been well beyond the half-scale deflections of azimuth and glideslope for a stabilized ILS approach. This indicates that the crew lost situational awareness between the time the aircraft was last seen on radar in stable descent at 1500 feet agl and prior to it reaching the DH position, in that the aircraft was flown into the terrain.

Rather than conduct a missed approach when the approach became unstable and the aircraft was still well above ground level, the PF continued in an attempt to land beyond the point where a missed approach could be executed. It is probable that neither the PF nor the PNF was aware that the aircraft was well off the required heading and track for completion of the

approach and that the aircraft was well below the DH without the runway environment being visible ahead of the aircraft. Certainly, the indications in the cockpit would have been that the aircraft was not on a stable approach.

When the approach lights were sighted, their relative position to the aircraft (two o'clock) was another indication that the approach should have been abandoned. Even though the pilot-in-command realized that the aircraft was not in a position to land and had called for an overshoot, the loss of situational awareness did not permit a timely response by the PF.

Just before the approach of C-FTNS, a regional airline crew flying a Beech 1900 had attempted the same ILS approach and had not been able to land safely because the aircraft became misaligned with the runway during the landing transition after visual references had been acquired. The crew, appropriately, executed a missed approach. The crew members were more experienced, with better training, multi-crew SOPs, and in an aircraft with more advanced navigational equipment. However, they were unable to safely complete the approach, suggesting that conditions were somewhat difficult. Had the crew of C-FTNS been aware of the Beech 1900 missed approach, they may have been more predisposed to abandoning their approach.

Hand-flying an aircraft to maintain a stabilized approach in darkness, cloud, and turbulence is a demanding task for most pilots. However, the task is made easier by following the flight director system or by using an autopilot and flying a coupled approach, monitored by a PNF. Similarly, adequate training and experience in the use of the autopilot and flight director allows pilots to better visualize the approach and maintain their situational awareness and increases their confidence in the equipment.

CARs permit pilots to conduct instrument approaches in visibility less than the advisory visibility published in the CAP, increasing the risk of an ineffective transition to visual flight, misinterpretation of visual references, or the loss of visual references after transitioning to visual flight. A number of occurrences investigated by the TSB have found that inadequate visual references during the final stages of an approach contributed to an accident.

Findings as to Causes and Contributing Factors

1. Rather than conduct a missed approach when the approach became unstabilized, the crew continued in an attempt to land beyond the point where a missed approach could be executed, and the aircraft struck the terrain.

2. The crew members most likely experienced a loss of situational awareness during the latter stages of the approach and, consequently, were unable to fly the aircraft on the required track and descent profile for a safe transition to landing.

3. The crew members were permitted by regulation to conduct the approach in reported visibilities that were below the minimum advisory values published for the instrument landing system approach when they did not have procedures or training to operate as a crew in these conditions.

Finding as to Risk

1. The crew of C-FTNS did not have the benefit of up-to-date, in-flight weather conditions or knowledge that the Beech 1900 had just carried out a missed approach on which to base their approach decisions.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 16 August 2006.

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