

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

AVIATION INVESTIGATION REPORT

A00H0001



CONTROLLED FLIGHT INTO TERRAIN

ATHABASKA AIRWAYS LTD.
PIPER NAVAJO CHIEFTAIN PA-31-350 C-FATS
STONY RAPIDS, SASKATCHEWAN
27 FEBRUARY 2000

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.

Aviation Investigation Report

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Report Number A00H0001

Summary

The Piper Navajo Chieftain PA-31-350, serial number 31-7952072, departed Edmonton, Alberta, on an instrument flight rules charter flight to Stony Rapids, Saskatchewan, with one pilot and six passengers on board. The pilot conducted a non-directional beacon approach at night in Stony Rapids, followed by a missed approach. He then attempted and missed a second approach. At about 2200 central standard time, while manoeuvring to land on runway 06, the aircraft struck trees 3.5 nautical miles west of the runway 06 button and roughly one quarter nautical mile left of the runway centreline, at an altitude of 1200 feet above sea level. The aircraft sustained substantial damage, but no fire ensued. The pilot and one passenger were seriously injured, and the remaining five passengers sustained minor injuries. Canadian Forces search and rescue specialists were air-dropped to the site at 0300 and provided assistance to the pilot and passengers. Local ground search parties later assisted with the rescue.

Ce rapport est également disponible en français.

Other Factual Information

Records indicate that the aircraft was maintained and certified in accordance with existing regulations. Examination of the aircraft did not reveal any mechanical malfunctions that could have contributed to the accident. The occurrence aircraft was scheduled to undergo regular maintenance in Stony Rapids the day after the occurrence. The aircraft had sufficient fuel for the planned trip.

By weighing the contents of the aircraft, it was determined that on take-off the aircraft weight exceeded the maximum allowable take-off weight of 7368 pounds by about 115 pounds. It is estimated that at the time of the crash the aircraft was 225 pounds below the maximum landing weight of 7000 pounds. The pilot estimated the passenger and baggage weights, as no scale was available in Edmonton. The centre of gravity of the aircraft was slightly aft of the rear limit, out of envelope, by about half an inch at the time of the crash.

The airport at Stony Rapids has a single non-directional beacon (NDB) approach with a minimum descent altitude (MDA) of 1500 feet above sea level (asl). The aerodrome elevation is 805 feet asl. The NDB was serviceable at the time of the occurrence. The runway lights were functioning and were turned on at the time of the occurrence. Upon arrival at Stony Rapids, pilots communicated with the Regina Flight Service Station through a remote communications outlet (RCO).

A weather observer at Stony Rapids provides weather reports 24 hours per day. The weather at the time of the accident was reported as follows: ceiling 300 feet above ground level (agl), three statute miles visibility, winds calm, and temperature minus 11 degrees Celsius. A report was taken after the accident, and it indicated deteriorating conditions, with a ceiling of 200 feet above ground and a visibility of one statute mile. The reported weather was a consequence of fog forming over the nearby river, creating a localized phenomenon. The weather at the alternate, Fort McMurray, Alberta, was forecast to be, at 2300,¹ scattered clouds at 7000 and 25 000 feet agl, and visibility of more than six statute miles. No regulation prohibits a pilot from attempting an instrument approach in the conditions that prevailed on the occurrence night at Stony Rapids.

The company's remuneration structure does not penalize flight crew that have to proceed to an alternate, and arrangements can be made to provide accommodation to the passengers and crew in many locations in Northern Saskatchewan. No information indicates that the company exerts pressure on flight crews to influence them to reach their destination when the weather does not allow it in accordance with existing *Canadian Aviation Regulations* (CARs).

The pilot was certified and qualified for the flight under existing regulations. He was experienced flying in the Northern Saskatchewan environment and had approximately 7850 flying hours, including approximately 4370 hours on multi-engine aircraft, 1450 hours on type, and 3370 hours of instrument flying. Prior to the occurrence flight, the pilot had 36 hours off

¹ All times are central standard time (Coordinated Universal Time [UTC] minus six hours).

duty with his family in Saskatoon, including eight hours of sleep the evening before the occurrence. Examination of his flying schedule did not reveal excessive flying activity in the previous months. He was scheduled for an early flight the next day.

The occurrence flight's en route portion was accomplished in visual meteorological conditions. Based on weather information, it was necessary to conduct an instrument approach at the destination. Because of the height of the ceiling, on completion of his first NDB approach the pilot was not able to carry out a visual circling procedure, and land; instead, he executed a missed approach. He indicated to Regina RCO that he would fly to Fond-du-Lac, Saskatchewan, after his second approach if he was not able to land. The pilot knew that he did not have keys for the company accommodations available in Fond-du-Lac.

Following his second approach, he started heading for Fond-du-Lac, but changed his mind when he was able to see the runway momentarily. He then reverted to a visual approach and turned toward the airport in an attempt to fly under the cloud base. In trying to line up for a visual approach for runway 06, he ended up over higher ground in very poor weather conditions. Clouds were becoming thicker and closer to the ground as he was progressing toward the airport. While he was trying to acquire sight of the airport environment, using mainly ground references to provide vertical separation, the aircraft contacted the trees and crashed a few seconds after landing gear down had been selected. Information gathered at the crash site shows that the aircraft was in a descent angle of approximately four degrees when it contacted a stand of small trees.

During flight, at night, in overcast conditions, perception of the horizon may be affected by false visual cues. When flying in conditions where no stars are visible due to overcast conditions, unlighted areas of terrain can blend with the dark overcast to create the illusion that the unlighted terrain is part of the sky. When the horizon is obscured by low cloud or fog, the edge of the clouds tends to be perceived as the horizon; thus it is perceived to be lower on the windshield than it actually is. The tendency is to feel that the nose of the aircraft is too high, and thus lower it.

Approximately 300 pounds of baggage was secured in the aircraft cabin, behind the passengers, by a cargo net to prevent shifting of the baggage in flight. According to the *Navajo Chieftain Pilot's Operating Handbook*, the maximum baggage weight in the rear baggage area is 200 pounds. The forward end of the cargo net was anchored to tie down rings that were fitted to the seat tracks aft of the right rear cabin seat. During the crash sequence, the aft 18 inches of both right seat tracks separated from the floor and failed in bending, causing the seat, its occupant, and the baggage to be projected forward into the cabin. This failure contributed to some of the injuries that were sustained by passengers. Post-crash examination determined that two seat track attachment screws had been missing from each section of the broken seat tracks prior to the accident. A survey of two other company PA-31 aircraft and of several other Chieftains that are used by other air taxi operators identified additional instances of seat track attachment screws missing from the floor tracks.

The stitching failed on the outboard strap of the seat belt that was mounted on the right middle forward facing cabin seat. A 21 January 2000 Airworthiness Notice (AN) No. B050 Edition 1, "Airworthiness of Seat Belts and Shoulder Harnesses", issued by Transport Canada, warns

owners, operators, and maintainers of the possibility of seat belt degradation, mostly due to long-term sunlight exposure. This AN also stresses the importance of examining safety restraint systems.

The aircraft was not equipped with a ground proximity warning system (GPWS) or a radio altimeter. Regulation requires that GPWS equipment be installed in all turbo-jet powered aircraft that have a maximum certified take-off weight greater than 33 069 pounds and a type certificate authorizing the carriage of 10 or more passengers. This regulation does not generally apply to air taxi operations because aircraft involved in these operations do not meet weight or propulsion criteria.

The emergency locator transmitter (ELT) activated on impact and helped in locating the survivors. At 2210, Regina Radio was notified by Athabaska Airways personnel that the signal emitted by an ELT had been picked up near Stony Rapids. The rescue coordination centre in Trenton deployed a C-130 Hercules aircraft from Winnipeg for the search and rescue operation. It was noted that accessing the ELT, in order to turn it on or off, required hand tools to remove the dorsal fin fairing screws. A remote ELT switch was located on the lower left side of the left instrument panel, but was not accessible due to impact damage.

In Stony Rapids, a command post was established in accordance with the company's emergency response plan, and a light aircraft was dispatched by a neighbouring company to assist in locating the missing aircraft. The Royal Canadian Mounted Police were advised, and a Civil Air Search and Rescue Association ground search party was organized. At 0258 the C-130 Hercules located the crashed aircraft, and search and rescue technicians were air-dropped to the scene at 0418. The ground search party arrived on the site shortly thereafter. The pilot and passenger who were seriously injured were airlifted to Saskatoon, and the remaining five passengers were transported to Uranium City for further medical assessment.

Analysis

Examination of the aircraft did not reveal any mechanical malfunctions that might have contributed to the accident. There was sufficient fuel for the flight. At the time of the occurrence, the centre of gravity was slightly aft of limits; it was determined that the aircraft was overweight on take-off. Although these factors did not contribute to the occurrence, the overweight and aft centre of gravity were a risk to safe operation.

During the crash sequence, the ELT activated normally, but its location did not allow easy access for deactivation. Tools were required to access the device. The cockpit remote switch was not accessible due to impact damage. In the event that it had not activated on impact, it would have been difficult to manually activate the ELT because of its restricted access.

During the crash sequence, the anchor points of the cargo net used to secure the baggage failed, causing baggage to be projected throughout the cabin. Such a failure contributed to some of the injuries sustained by passengers. The rear baggage area contained 300 pounds of baggage, 100

pounds more than the manufacturer's limitation. The missing seat track attachment screws combined with the additional loading of the cargo net contributed to the failure of the seat tracks.

Studies and statistics have shown that GPWS and radio altimeters provide a defence against "controlled flight into terrain" accidents. GPWS are designed to provide a warning of approach to terrain and thus enhance safety in high-risk operational environments. Although this equipment is required on larger, passenger-carrying jet aircraft, that requirement does not extend to air taxi operations even though similar risks are associated with visually conducting these flights at night.

The pilot was certified and qualified for the flight under existing regulations. He had appropriate rest before the occurrence flight, had considerable experience flying in this environment, and was an experienced instrument pilot. The pilot was well aware of the prevailing weather conditions at the destination airport; he had obtained weather information at the time of filing his flight plan, as well as en route. During his first approach, he would have become aware of the prevailing ceiling and visibility at the airport.

Upon completion of his second approach at Stony Rapids, as he was proceeding toward Fond-du-Lac, the pilot was able to see the runway momentarily. As a result, he decided to turn toward the airport and conduct a visual approach. As he progressed in the poor weather conditions, trying to visually acquire the runway environment, the visibility gradually decreased. The trees became his main reference, resulting in a lack of awareness of the actual separation between the aircraft and the ground. It is also probable that the pilot perceived the edge of the clouds as the horizon, thus perceiving the natural horizon to be lower on the windshield than it really was. The tendency is to feel that the nose of the aircraft is too high and there is a strong urge to lower it. Subsequently, the aircraft crashed in a relatively flat but higher area covered with small trees.

Information gathered from various company employees confirms that there was no pressure from management to influence the pilot to land at the destination airport. The pilot knew that he had a flight the next day, and he felt the need to reach the destination and be ready for the next day. The fact that the pilot did not have the keys of the available accommodations in Fond-du-Lac was also a factor in his persistence to land in Stony Rapids rather than proceed to his selected alternate. It is also likely that the pilot's decision was shaped by his perception of the low risk involved, his determination to succeed, and the accepted nature of this practice amongst pilots operating in remote communities with non-precision approaches. The scheduled aircraft maintenance was not deemed a factor for the pilot to land at the destination airport.

As individuals gain experience performing tasks, their attitudes and perception of risk regarding those tasks often change. The more they successfully complete the task, the lower they believe the risks to themselves to be. Problems arise when the perceived risks no longer match the actual risks and dangers involved in an activity. As the subjective evaluation of personal risk decreases, the frequency of high-risk practices increases. Also, as group values shift, more adventurous decisions become normal and accepted within a given community. The conduct of

low visibility visual approaches is a well-documented example of a high risk activity which is not uncommon amongst pilots operating in remote locations without the benefit of precision landing aids.

The following TSB Engineering Laboratory report was completed:

LP 23/00 - *GPS Examination*

Findings as to Causes and Contributing Factors

1. The pilot executed a missed approach on his first NDB approach, and, during the second missed approach, after momentarily seeing the runway, he decided to conduct a visual approach, descending below MDA in an attempt to fly under the cloud base.
2. In flying under the cloud base during the visual portion of his approach, the pilot likely perceived the horizon to be lower on the windscreen than it actually was.
3. There was no indication that there was any form of pressure from management to influence the pilot to land at the destination airport. However, the pilot may have chosen to land in Stony Rapids because he had an early flight the following day, and he did not have the keys for the accommodations in Fond-du-Lac.

Findings as to Risk

1. No scale was available to the pilot in Edmonton for weighing aircraft loads.
2. The maximum allowable take-off weight of the aircraft was exceeded by about 115 pounds, and it is estimated that at the time of the crash, the aircraft was 225 pounds below maximum landing weight. The aircraft's centre of gravity was not within limits at the time of the crash.
3. The rear baggage area contained 300 pounds of baggage, 100 pounds more than the manufacturer's limitation.
4. Two screws were missing from each section of the broken seat track to which the anchor points were attached.
5. Cargo net anchorage system failure contributed to passenger injuries.
6. The stitching failed on the seat belt's outboard strap that was mounted on the right, middle, forward-facing cabin seat.

Other Findings

1. Hand tools were required to access the ELT panel, since the cockpit remote switch could not be accessed.

Safety Action

In the magazine *Maintainer* (3/2000), Transport Canada has published an article about the importance of ensuring that seat retention rails are properly attached to the floor, and that no screws are missing where nut-plates are installed in the floor to accept them.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 28 November 2000.