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AIRCRAFT ACCIDENT REPORT

MISSISSIPPI VALLEY AIRWAYS, INC.

JEANVILLAND BHC-6, N956SM

LA CROSSE, WISCONSIN

NOVEMBER 9, 1970

NATIONAL TRANSPORTATION SAFETY BOARD



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MISSISSIPPI VALLEY AIRWAYS, INC.
DE HAVILLAND DHC-6 N956SM
LA CROSSE, WISCONSIN
NOVEMBER 9, 1970

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AIRCRAFT ACCIDENT REPORT

MISSISSIPPI VALLEY AIRWAYS, INC.
DeHAVILLAND OHC-6, N956SM
LA CROSSE, WISCONSIN
NOVEMBER 9, 1970

Adopted: MAY 5, 1971

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D. C. 20591

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NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20591
AIRCRAFT ACCIDENT REPORT

Adopted: May 1, 1971

MISSISSIPPI VALLEY AIRWAYS, INC.
DE HAVILLAND IHC-6, HOQUAM
LA CROSSE, WISCONSIN
NOVEMBER 9, 1970

Synopsis

A Mississippi Valley Airways, Inc., De Havilland IHC-6, HOQUAM, crashed at La Crosse, Wisconsin, on November 9, 1970, at approximately 1503 central standard time while executing a nonprecision instrument approach in instrument flight conditions. The aircraft struck trees approximately 4,000 feet from the threshold of Runway 13 on the approach centerline. The aircraft was destroyed by impact. The captain, first officer, and three of the four passengers sustained serious injuries. There was no post-crash fire.

The National Transportation Safety Board determines that the probable cause of this accident was that for reasons unknown, the captain failed to maintain altitude at minimum descent altitude and allowed the aircraft to descend below the height of trees while executing a nonprecision instrument approach in instrument flight conditions.

Investigation

The La Crosse Municipal Airport is situated on French Island, along the eastern shores of Lake Monona, adjacent to the Mississippi River. The airport elevation is 613 feet mean sea level (m.s.l.); Runway 13-31 is 1,200 feet long and 150 feet wide. The runway is equipped with high-intensity runway lights and the approach end of Runway 13 also has Runway End Identifier Lights (REIL). These identifier lights were not operating at the time of the accident. They had not been in service since August 8, 1970, and a Notice to Airmen (NOTAM) had been issued to that effect.

Instrument approach procedures at the La Crosse Municipal Airport require the use of the La Crosse Very High Frequency Omnidirectional Radio Range (VOR) facility located within the field boundaries. An authorized VOR instrument approach is designated for Runway 13. An appropriate

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NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20591
AIRCRAFT ACCIDENT REPORT

Adopted: May 2, 1971

MISSISSIPPI VALLEY AIRWAYS, INC.
DE HAVILLAND DHC-6, N996CM
LA CROSSE, WISCONSIN
NOVEMBER 9, 1970

Synopsis

A Mississippi Valley Airways, Inc., DeHavilland DHC-6, N996CM, crashed at La Crosse, Wisconsin, on November 9, 1970, at approximately 1603 central standard time while executing a nonprecision instrument approach in instrument flight conditions. The aircraft struck trees approximately 4,000 feet from the threshold of Runway 13 on the approach centerline. The aircraft was destroyed by impact. The captain, first officer, and three of the four passengers sustained serious injuries. There was no post-crash fire.

The National Transportation Safety Board determines that the probable cause of this accident was that for reasons unknown, the captain failed to maintain altitude at minimum descent altitude and allowed the aircraft to descend below the height of trees while executing a nonprecision instrument approach in instrument flight conditions.

Investigation

The La Crosse Municipal Airport is situated on French Island, along the eastern shores of Lake Onalaska, adjacent to the Mississippi River. The airport elevation is 693 feet mean sea level (m.s.l.); Runway 13-31 is 5,298 feet long and 150 feet wide. The runway is equipped with high-intensity runway lights and the approach end of Runway 13 also has Runway End Identifier Lights (REIL). These identifier lights were not operating at the time of the accident. They had not been in service since August 6, 1970, and a Notice to Airmen (NOTAM) had been issued to that effect.

Instrument approach procedures at the La Crosse Municipal Airport require the use of the La Crosse Very High Frequency Omnidirectional Radio Range (VOR) facility located within the field boundaries. An authorized VOR instrument approach is designated for Runway 13. An appropriate

intercepting radial from the Nodine VOR determines the position of the final approach descent fix. Dual VCR equipment is required for the aforementioned descent fix.

The Midway Intersection, the final descent fix for Runway 13, is positioned 5.1 nautical miles from the touchdown zone of that runway. This fix is shown as the intersection of the 069° radial of the Nodine VOR and the 138° inbound radial, to the La Crosse VOR. ^{1/} Pilots are authorized to descend to the minimum descent altitude of 1,040 feet m.s.l., or 388 feet above the touchdown zone elevation of Runway 13, for a straight-in approach, after they cross the VOR at La Crosse.

If visual contact is not established with the runway environment from a position that will permit a normal landing to be effected, the pilot will maintain the minimum descent altitude and execute a missed-approach procedure no later than the aircraft's passage over the La Crosse VOR station.

Following the accident, the navigation facilities at La Crosse Airport were ground checked and flight checked by the Federal Aviation Administration and found to have been operating within the specified tolerances.

The flight, operated by Mississippi Valley Airways, Inc., was operating under the new Part 135 of the Federal Aviation Regulations as a scheduled air taxi/commercial operator.

The flightcrew had originated a series of flights at La Crosse at approximately 455 ^{2/} on the day of the accident. The flight had scheduled stops at O'Hare International Airport, Chicago, Ill., Janesville, Wisc., returning to La Crosse, thence to Winona, Minn., and Minneapolis, Minn.

Weather associated with an extensive low-pressure area had extended over the entire Mississippi Valley Airways route structure on the day of the accident and had necessitated instrument approaches at all of the en route stops prior to the accident.

N956SM, with the radio call sign of VALAIR 106, departed from the Minneapolis-St. Paul International Airport at 1525. The flight was cleared vis Airway Victor 2 to the Winona Airport to maintain 5,000 feet.

On reaching the cruising altitude, VALAIR 106 was flying through the cloud tops of a lower cloud layer. The first officer recalls that a trace of ice was noticeable on the blade arm attachment of the windshield wipers.

^{1/} See Chart, Attachment 1.

^{2/} All times **wed** hours are central **standard** based on the 24-hour clock.

Shortly after the 1525 departure from Minneapolis, the flight was notified that the weather at Winona was below the authorized landing minimums. VALAIR 106 requested an air traffic control clearance to overfly Winona and proceed to the La Crosse Airport. Minneapolis Air Route Traffic Control cleared VALAIR 106, via a Holman transition ^{3/} to the La Crosse Airport. When the clearance was acknowledged, the flight was advised to change radio communications to La Crosse Flight Service Station (FSS). The station responded to the initial radio callup from VALAIR 106 and replied with the 1557 La Crosse weather observation.

The weather report relayed to the flight was an indefinite ceiling, 600 feet obscuration, visibility three-fourths of a mile, light drizzle and fog, temperature 50°F., dew point 50°F., wind calm, and altimeter setting 29.62 inches. During a later interview, neither pilot expressed concern that the reported weather would present a problem during the approach or landing phase.

A special observation taken at 1517, because of this accident, reported the La Crosse weather as indefinite ceiling, 500 feet obscuration, visibility one-half mile, light drizzle, fog, temperature 50°F., dew point 50°F., wind calm, altimeter setting 29.63 inches.

Weather observations are made by FSS personnel certificated by the National Weather Service. The prevailing visibility is estimated by sighting ~~near~~ objects that are a known distance from the observation point. Ceiling observations are made by means of balloon measurements, pilot reports, and the weather observer's estimates. The above ceiling values were estimated.

En route to the Holman Intersection, the flight crossed the Winona VOR facility at an altitude between 3,000 and 4,000 feet, descending. At 1604, the flight reported passing this VOR navigational fix to La Crosse and the aircraft continued to descend.

The pilot-in-command recalls passing the Holman Intersection at 3,000 feet m.s.l. and he also recalls crossing the Midway final descent fix at 2,100 feet. On the approach, the pilot-in-command chose to operate the aircraft without extending the landing flaps and to maintain a 110-knot airspeed during the descent.

The captain stated that on this type of approach, he would normally maintain a 400-to 500-foot-per-minute rate of descent from the final descent fix. He believes that on the approach that resulted in the accident, the aircraft was allowed to descend at the 400-to 500-foot-per-minute rate.

^{3/} See Chart, Attachment 1.

However, the memory of both pilots is spotty for the interval after passing the Midway Intersection, and the interviews with the pilots during their hospital recovery period did not develop any significant facts on the approach phase of the accident flight.

Both pilots stated that during the descent to the minimum descent altitude, they saw a small island which lies slightly to the right of the inbound course to Runway 13. The copilot does not remember specifically calling out the vacated altitudes on the descent, but he said that normally he starts the callout procedure 300 to 400 feet above the decision height and believe; that he did not deviate from his normal callout procedure during this particular approach. However, his last recollection of the flight is sighting the aforementioned island.

The pilot-in-command recalls that the copilot called the 1,100-foot altitude. Additionally, the pilot remembered leveling the aircraft after the 1,100-foot call and, shortly thereafter, the copilot calling out "trees." However, the pilot does not remember the magnitude of the time interval between the 1,100-foot call and the tree warning call.

Both wings, the wing-mounted engines, the left main landing gear strut, and the left horizontal stabilizer separated from the aircraft when it struck the trees.

Two fishermen who were working on a Lakeshore dock about 300 feet north of the crash site saw the aircraft emerge from a fog bank. The noise of the approaching flight caused them to direct their attention toward it. They saw the aircraft emerge from the fog below treetop height and they heard it hit the trees.

Both of the fishermen are well acquainted with the lake's environment; however, when they had returned to the dock about an hour prior to the time of the accident, they had missed their intended landfall by about one-half mile because of the dense fog.

A statement was obtained from a local resident whose home was 75 feet from where the aircraft fuselage came to rest. He stated that he heard the aircraft strike the pond and went outside to assist the injured personnel. He also reported that because of the dense fog, he could not see the tops of the 50-foot trees in the immediate area, nor could he see the trees across the road (100 feet) from his residence.

N956SM was a DeHavilland DHC-6 Twin Otter type aircraft. This model aircraft has a fixed tricycle landing gear and is powered by two Pratt & Whitney PT6-20 turbo propeller engines.

The aircraft was certificated and registered, as required by Federal Aviation Regulations. Aircraft records reflected proper maintenance inspections and there were no outstanding maintenance discrepancies which could be construed as having contributed to the accident. Detailed examination of the aircraft systems, airframe, and powerplants did not disclose any pre-impact failures or malfunctions.

Shop examination and test of the captain's and the copilot's altimeters and both rate-of-climb indicators disclosed the following: 1. The copilot's altimeter and both of the rate-of-climb indicator; functioned normally and were within specification tolerance. 2. The captain's altimeter was stuck at a reading of 8,320 feet. Disassembly of the aforementioned instrument revealed a broken pivot to be the cause of the erroneous reading. Impact deceleration was determined to have been the cause of the broken pivot and the displacement of the altimeter's indicating mechanism.

Flightcrew interviews did not reveal any discrepancies involving the flight operations. During the interviews, the pilots were questioned specifically on the operation and reliability of the aircraft's altimetry during the five approaches they executed that day prior to the final approach at La Crosse. Neither the captain nor first officer had noted any unusual or incorrect altimetry operation that day.

Captain Paul F. Tyvand, aged 27, was employed by Mississippi Valley Airways on October 13, 1969. He holds an Airline Transport Pilot Certificate, No. 1762217, with ratings in airplane multiengine land, commercial privileges, and airplane single-engine land. He is a certificated flight instructor, Certificate No. 1762217, expiration date May 31, 1972.

Captain Tyvand had satisfactorily passed his last examination on May 22, 1970, without limitations, for a Federal Aviation Administration first-class medical certificate.

He had accumulated a total of 2,350 hours, of which 920 hours were in the DeHavilland DHC-6 aircraft. His total instrument time was 143 hours, of which 82 hours were logged while employed by the Mississippi Valley Airways. Following his proficiency flight check and en route qualification check on August 28, 1970, he had served as pilot-in-command for 191.8 hours. His pilot-in-command time in the last 90 days was 189.1 hours. He had flown 6 hours during the past 24 hours and had a 12-hour rest period prior to this flight.

First Officer Bruce A. Warhanik, aged 24, was employed by Mississippi Valley Airways on April 13, 1970. He holds a commercial pilot certificate, No. 1794480, issued August 1, 1969, with ratings and limitations in airplane single- and multiengine land, instruments. He is also qualified to exercise the privileges of a flight instructor until December 31, 1971.

Mr. Warhanik had passed his last physical examination satisfactorily for a Federal Aviation Administration first-class medical certificate with the limitation that the holder shall wear correcting glasses while exercising the privileges of his airman certificate. Mr. Warhanik was wearing corrective glasses at the time of the accident.

He completed first officer flight training on April 25, 1970. He had flown a total of 2,877 hours, of which 577 hours were in the DeHavilland DHC-6 aircraft. His total instrument time was 140 hours, of which 42 hours were logged while employed by Mississippi Valley Airways.

Mr. Warhanik had flown 6 hours in the prior 24-hour period and had a 12-hour rest period prior to the accident flight.

Analysis and Findings

The flightpath of VAI AIR 106 was reconstructed from the flightcrew interviews, recorded radio communications, and witness statements. Based on the information derived from these sources, the flightpath flown during the instrument approach to La Crosse was consistent with the authorized procedures, with the exception that the descent was continued through the minimum descent altitude. The thrust of the investigation was centered on uncovering the reason(s) the pilot continued the descent to an altitude below the height of the trees.

The crew described different Nodine VOR radials which would variously relate the aircraft's position to crossing the lakeshore, approaching the runway, being over the runway threshold, and passing the La Crosse VOR. Several other pilots of Mississippi Valley Airways described using similar VOR radial cross-checks from the Nodine VOR as those reported by the crew of N956SM.

Such procedures, as described above, may imply a technique that accommodates the short takeoff and landing (STOL) aircraft flight performance characteristics of the DeHavilland Twin Otter aircraft and the terrain profile of a nonprecision approach to Runway 13. However, the same authorized minimum descent altitude that limits the descent of the Twin Otter applies to the DC-9 aircraft operating into the La Crosse Airport. Thus, a pilot with moderate experience in the slower and smaller aircraft would not feel uncomfortable descending to a lower altitude in this approach. This would be particularly true over a level surface such as a body of water. A position fix along the flightpath track as the aircraft approaches the pilot's "point of decision," could be used to alert the pilot to either accept a missed-approach procedure, to attempt a "look-see" for the runway threshold, or if approaching rising terrain, to adjust the aircraft's altitude to assure adequate obstruction clearance.

The expanded use of navigational aids not published on the approach chart is a technique that is not unsafe as long as the pilot does not deviate from the authorized approach procedure.

The pilots of VALAIR 106 stated that they normally monitor the aircraft's progress along a 5.1 nautical-mile track from the Midway final descent fix to the La Crosse VOR by utilizing an arbitrary radial from the Nodine VOR. The captain stated that the 090° Nodine VOR radial was selected for reference on this particular approach. This radial is selected to intercept the inbound course at a position that will indicate to the pilot that the aircraft is passing over a point about one-half mile from the threshold of the approach to Runway 13. This point coincides with a ground position where the approach course line and the shoreline intersect.

There is no evidence, in this case, that the navigational aids were misused by the flightcrew; however, the implication is that a reference point relating to the Lakeshore would be assessed by the pilot to decide his further actions before reaching a position over the VOR station.

The pilot-in-command, during interviews, was able to recall many details of the flight up to that point in space where the authorized minimum descent altitude was neared. Then, his statement related only to viewing the obscured outline of the small island to the aircraft's right side, hearing the first officer's altitude callout at "1,100 feet," leveling the aircraft at that altitude, and attempting a pullup of the aircraft when the trees were sighted.

The captain stated that he did not recall seeing the surface of the lake after the aircraft passed the final descent fix.

The copilot, suffering from head injuries incurred from the crash, had no recall of the events immediately preceding the accident.

The ground witnesses on the boat dock saw the aircraft emerge from the fog below the level of the treetops; however, the witnesses were not able to state whether the aircraft was in level flight or was descending.

The factors that would have created an illusion to produce a positive pilot response to descend the aircraft in order to maintain level flight were not present during this approach. However, if the pilot flying the plane were to interrupt his instrument scan momentarily and look outside of the aircraft, the restricted visibility would not have permitted him to recognize an aircraft altitude deviation.

Recognizing that the altimeter installation and calibration errors plus the height of the initial tree impact may account for approximately 28 feet, there remains 300 feet of altitude that is not accounted for.

Without pound reference and with the time interval involved with the descent rate of this type aircraft, an experienced pilot would be unlikely to disregard the altimeter in his instrument scan throughout 300 feet of descent. Turbulence or icing conditions were not present to distract him from his primary approach task, nor was the existing wind a factor to create concentration problems in order to maintain the aircraft on the approach course. In fact, the pilot had departed from the La Crosse Airport twice that day and he had completed the same approach several hours earlier under similar reported weather observations.

Confident of the aircraft performance and anticipating that flight conditions at the runway threshold would duplicate the weather existing on the previous approach earlier that day, the pilot may have intentionally descended below and leveled off at some altitude below the minimum descent altitude. Shortly thereafter, the aircraft descended to treetop level. Apparently, the final descent was gradual, unintentional, and unrecognized.

PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was that for reasons unknown, the captain failed to maintain altitude at minimum descent altitude and allowed the aircraft to descend below the height of trees while executing a nonprecision instrument approach in instrument flight conditions.

RECOMMENDATION

During an analysis of low-visibility approach accidents, where flight-path obstruction clearance was a factor, the Board questioned whether accurate altimetry, illusions of height, and altitude awareness may have been involved in the causal area. The Board believes that this accident, and others which have occurred under similar instrument conditions, may have been averted if both pilots had maintained a continuous cross-reference to their respective altimeters.

The Board recommends to the Federal Aviation Administration that:

Flightcrew techniques be developed for use during the execution of nonprecision instrument approaches that will require continued altitude reference callouts by the non-flying pilot during the time the aircraft is maintaining the minimum descent altitude. These callouts should be made at reasonable time intervals

until the aircraft crosses the runway threshold, or
until a missed-approach procedure is commenced.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED
Chairman

/s/ OSCAR M. LAUREL
Member

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. DURGESS
Member

May 5, 1971.

