

**AVIATION OCCURRENCE REPORT**

**CONTROLLED FLIGHT INTO A TREE**

**AERO ACADEMY LTD.  
CESSNA 172N C-GQVU  
CENTRALIA/HURON AIRPARK, ONTARIO 0.5 nm W  
26 FEBRUARY 1996**

**REPORT NUMBER A96O0034**

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

At approximately 1830 eastern standard time (EST), the student and instructor pilot departed from London, Ontario, to fly night circuits at Centralia/Huron Airpark, about 22 nautical miles northwest of London. The student, who was in the left seat, was practising night visual approaches on his second night flight. On final approach during the third or fourth circuit to runway 10, the aircraft struck a tree. After the tree strike, the aircraft struck the ground in a steep, nose-down attitude and came to rest in an inverted position.

The instructor, who received minor injuries, extricated himself from the aircraft and walked three kilometres to call for assistance.

The student, who was seriously injured, remained in the aircraft until local authorities were able to remove him from the wreckage.

The emergency locator transmitter (ELT) was activated during the impact but was not required by rescuers to locate the accident site.

The accident occurred during the hours of darkness at approximately 1930.

*Ce rapport est également disponible en français.*

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<sup>1</sup> All times are EST (Coordinated Universal Time minus five hours) unless otherwise noted.

### Other Factual Information

Records indicate that the aircraft was certified and maintained in accordance with existing regulations. There were no known or reported discrepancies with the aircraft, and an inspection of the aircraft at the site revealed no pre-occurrence abnormalities.

The Centralia/Huron Airpark is a certified aerodrome and is operated in accordance with applicable Transport Canada standards. The aerodrome is sometimes used for training because of its low traffic volume. The aerodrome elevation is 822 feet above sea level (asl).

Runway 10 is an asphalt runway, 5,012 feet long by 100 feet wide. Medium intensity runway edge lights with three variable settings, runway threshold lights, and runway end lights are available. There is no approach lighting for the runway. The aerodrome is equipped with an aircraft radio control aerodrome lighting (ARCAL) system on frequency 122.8 megahertz. The runway lighting system was serviceable and in use at the time of the occurrence.

The weather was initially clear with unlimited visibility, and the winds were light and variable. During the flight, a high broken to overcast cloud layer formed, which reduced the ambient level of light from the partially concealed moon. The altimeter setting for London was 29.98 inches of mercury, and was correctly set on the aircraft altimeter.

The aerodrome and surrounding terrain is mostly level farmland, at about 825 feet asl, with farm buildings scattered in the area. Visual references in the vicinity of the aerodrome on a dark night are limited to the runway lights. The only other local reference at night is the small town of Crediton, where the instructor made the telephone call for assistance after the accident. The town is situated below the left downwind leg of the circuit for runway 10 but does not provide any useful glide path indication to an aircraft on a final approach at night.

The student had a valid private pilot licence. According to his pilot logbook, he did not fly from August 1979 to May 1995. Between May 1995 and February 1996, the student accumulated 18.3 flying hours, excluding this flight. Between 14 November 1995 and 17 February 1996, the student flew 6.3 hours of instrument training, and acquired 5.0 hours of simulated instrument time. The student completed his first night training trip on 30 January 1996, and flew 1.1 hours in the circuit at London. The runways at the London aerodrome are 200 feet wide, and three of the four runways are equipped with either a visual approach slope indicator (VASIS) or a precision approach path indicator (PAPI) for final approach altitude guidance.

Prior to the accident flight, the student had not flown a night circuit without the visual assistance of approach path/slope indicators.

The instructor held a valid commercial licence and was qualified for the flight in accordance with existing regulations. Prior to this flight, the instructor had flown about 6.8 hours with the student, including the student's first night flight at London. The flight proceeded to the Centralia/Huron Airpark, and the student completed at least two and possibly three circuits prior to the tree strike. The first two approaches were flown with the landing light

on, and the subsequent approaches were flown with the landing light off. During the first approaches, the student brought the aircraft in slightly high; on the occurrence approach, he was attempting to fly a shallower final approach when the aircraft struck the tree.

The tree was about 40 feet high, with branches about three inches in diameter, and it was located about 3,000 feet short of the runway 10 threshold. Impact marks on the tree and aircraft indicated that the aircraft struck the tree with the left wing. The normal height of an aircraft on final approach at this point would be 300 to 400 feet above ground level (agl). During the occurrence approach, neither the student nor instructor pilot noted the aircraft's altitude, or the fact that the aircraft was too low, prior to the collision with the tree.

Transport Canada's *Instrument Flight Procedures Manual* describes a visual illusion known as "black-hole illusion" as follows:

During night visual approaches to runways in dark, featureless areas...the lack of ambient clues to orientation interferes with depth perception. Under these conditions, pilots often overestimate their altitude and, while concentrating on maintaining a constant visual angle of approach, ...[will fly along a descending]...arc which results in premature contact with the ground.

Black-hole illusion was studied, in 1968, by Drs. Kraft and Elworth of the Boeing Aerospace Company. They reviewed the circumstances of a number of major commercial jet accidents that occurred at night between 1959 and 1967, and noted certain similarities. These accidents occurred during night approaches over unlighted terrain or water, toward lighted cities. During their research, a series of night approaches were conducted in simulators without reference to an altimeter. The resulting data indicated that, under certain conditions, during an approach to land over dark terrain, even the most experienced pilots tend to visually overestimate their altitude and fly too low. If the unintended descent were to go undetected, the aircraft would crash short of the runway. The research demonstrated that the most relevant source of visual information for a pilot was the vertical angle subtended at the eye by the nearest and farthest lights. If, during a descent, a pilot were to maintain this vertical angle at a constant value, the aircraft's approach path would follow an arc that would contact the terrain short of the intended runway threshold.

### **Analysis**

The aircraft struck a tree and subsequently the ground while descending well below the correct final approach path in controlled flight.

The ambient conditions and landing environment were such that both the instructor and student were likely affected by the black-hole illusion. The black-hole illusion would influence the pilots' perceptions of the aircraft altitude, and allow the pilots to unknowingly descend below a safe altitude if they did not make appropriate reference to the aircraft altimeter. In addition, the runway was only 100 feet wide, whereas the student had practised

his previous night approaches and landings on a runway 200 feet wide, and the runway had no approach lights or final approach glide path indicator systems.

### **Findings**

1. The instructor and student were properly qualified and fit for the training flight.
2. Records indicate that the aircraft was certified and maintained in accordance with existing regulations, and there was no evidence found of any aircraft malfunctions that could have contributed to the accident.
3. The aircraft struck a tree at low level and crashed during a visual final approach at night to runway 10.
4. The ambient conditions and landing environment were conducive to black-hole illusion on final approach.
5. The final approach was flown without reference to the aircraft altimeter.

### **Causes and Contributing Factors**

Neither the instructor nor the student monitored the aircraft's altitude during the night visual approach, and the ambient conditions and landing environment were conducive to black-hole illusion.

*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 23 January 1997.*