



AVIATION OCCURRENCE REPORT

LEFT WING FAILURE IN FLIGHT

**TIERATORN/TIERRA II (ULTRALIGHT) C-IFHO
BLOUIN LAKE, QUEBEC
04 SEPTEMBER 1994**

REPORT NUMBER A94Q0167

MANDATE OF THE TSB

The Canadian Transportation Accident Investigation and Safety Board Act provides the legal framework governing the TSB's activities. Basically, the TSB has a mandate to advance safety in the marine, pipeline, rail, and aviation modes of transportation by:

- conducting independent investigations and, if necessary, public inquiries into transportation occurrences in order to make findings as to their causes and contributing factors;
- reporting publicly on its investigations and public inquiries and on the related findings;
- identifying safety deficiencies as evidenced by transportation occurrences;
- making recommendations designed to eliminate or reduce any such safety deficiencies; and
- conducting special studies and special investigations on transportation safety matters.

It is not the function of the Board to assign fault or determine civil or criminal liability. However, the Board must not refrain from fully reporting on the causes and contributing factors merely because fault or liability might be inferred from the Board's findings.

INDEPENDENCE

To enable the public to have confidence in the transportation accident investigation process, it is essential that the investigating agency be, and be seen to be, independent and free from any conflicts of interest when it investigates accidents, identifies safety deficiencies, and makes safety recommendations. Independence is a key feature of the TSB. The Board reports to Parliament through the President of the Queen's Privy Council for Canada and is separate from other government agencies and departments. Its independence enables it to be fully objective in arriving at its conclusions and recommendations.



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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Synopsis

The pilot, accompanied by one passenger, took off from Blouin Lake, Quebec, for a pleasure flight. Shortly after take-off, the left wing of the ultralight folded upward and towards the rear fuselage. The aircraft crashed on the west shore of the lake. The two occupants sustained fatal injuries in the impact. The ultralight was substantially damaged.

The Board determined that the left wing of the ultralight failed in flight as a result of a pre-existing structural weakness which could have been caused when the left wing-tip struck the surface of the water shortly before take-off.

Ce rapport est également disponible en français.

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1.0 Factual Information

1.1 History of the Flight

Around 1730 eastern daylight saving time (EDT)¹, the float-equipped ultralight, registration C-IFHO, took off from Blouin Lake, Quebec, for a pleasure flight in accordance with visual flight rules (VFR)². Several persons near the accident site witnessed the last moments of the flight and the crash. They watched for about 45 minutes while the aircraft made several attempts to take off before becoming airborne. On one of the take-off attempts, the right float lifted off first, and the ultralight banked until the left wing-tip touched the surface of the water. The pilot then reduced power; he made a 360-degree turn, then re-applied full throttle and flew in a southwesterly direction. The pilot then flew over the south end of the lake before making a right turn towards the northeast. After flying about half the length of the lake, the pilot executed a left turn and followed the west shore of the lake. At a height of about 400 feet, a sharp noise was heard, and the left wing folded upward and towards the rear fuselage. The ultralight started to descend rapidly and rotate until it struck the ground. The pilot and passenger were killed on impact. The ultralight was substantially damaged.

1 All times are EDT (Coordinated Universal Time [UTC] minus four hours) unless otherwise stated.

2 See Glossary for all abbreviations and acronyms.

The accident occurred in daylight around 1740 EDT at latitude 48°09'N and longitude 077°46'W.

1.2 Injuries to Persons

	Crew	Passengers	Others	Total
Fatal	1	1	-	2

Serious	-	-	-	-
Minor/None	-	-	-	-
Total	1	1	-	2

1.3 Damage to Aircraft

The ultralight was heavily damaged and sustained severe deformation.

1.4 Other Damage

None.

1.5 Personnel Information

	Pilot-in-Command
Age	35
Pilot Licence	PPL - Ultralight
Medical Expiry Date	01 Nov 1994
Total Flying Hours	102+
Hours on Type	90+
Hours Last 90 Days	N/A
Hours on Type Last 90 Days	N/A
Hours on Duty Prior to Occurrence	0
Hours off Duty Prior to Work Period	24

The pilot occupied the left seat. He held a valid private ultralight pilot licence issued on 07 April 1993. The pilot's flying habits and his level of proficiency could not be accurately determined. His pilot log-book was incomplete after 19 December 1993. Up to that date, he had logged 102 flying hours; 90 hours were logged on type, and 23 of those were on C-IFHO. The pilot had flown the Tierra II regularly until the day of the accident.

1.5.1 Passenger Information

The passenger occupied the right seat, and had no aviation experience. He was a friend of the pilot.

1.6 Aircraft Information

Manufacturer	Tieratorm
Type and Model	Tierra II
Year of Manufacture	1984
Serial Number	3457715
Certificate of Airworthiness (Flight Permit)	Not required
Total Airframe Time	approx. 400 hr
Engine Type (number of)	Rotax 583 (1)
Propeller/Rotor Type (number of)	two-blade (1)
Maximum Allowable Take-off Weight	195 kg
Recommended Fuel Type(s)	automotive with 2% oil
Fuel Type Used	automotive with 2% oil

The airframe was constructed of aluminum alloy tubing. The wings and tail section were covered with Dacron fabric. The closed cabin contained two seats placed side-by-side. The aircraft was equipped with floats.

The aircraft was imported from the United States in 1984. The pilot had owned the aircraft since September 1993. The ownership transfer certificate was not completed at the time of purchase. Consequently, the previous owner's name appeared on the registration certificate of the ultralight.

Since the date of importation into Canada, the aircraft had sustained accident damage on three occasions, and had had at least ten engine failures requiring an emergency landing. The last in-flight engine failure occurred in the winter of 1994.

The aircraft had accidental damage when the pilot purchased it. The tail of the aircraft had been damaged in an emergency landing following an engine failure. The pilot repaired the airframe and replaced the complete skin of the aircraft. He also replaced the engine with a more powerful unit.

Contrary to the Canadian nationality and registration requirements of the *Air Regulations*, Series II, No. 1, the aircraft bore no nationality or registration markings.

There were several signs of excessive wear at the structural attachment points. In addition, some assembly anomalies were noted. The

assembly manual for the Tierra II states that the main wing spars should be 2.25 inches in diameter. Examination revealed that the left main wing spar had a diameter of 2.00 inches, and the right main wing spar had a diameter of 2.25 inches. Also, the right main spar had a single tube thickness at the root and the left had a double thickness. It was also noted that the right spar tip consisted of three thicknesses of tube while the left had only two thicknesses.

The two left wing attachment points at the fuselage were not modified to fit the smaller spar diameter as prescribed by the manufacturer. The left wing chord was smaller than that of the right wing.

1.7 *Meteorological Information*

Meteorological conditions were favourable for the visual flight as planned. The regular observation at 1700 EDT by the Atmospheric Environment Service at Val d'Or Airport, Quebec, located about 8 km south of Blouin Lake, reported clear skies, visibility 15 miles, temperature 18 degrees Celsius, and winds from the southwest at three knots.

1.8 *Aids to Navigation*

The use of aids to navigation was not necessary for this flight.

1.9 *Communications*

As the aircraft was not equipped with radios, no radio transmissions were made.

1.10 *Accident Site*

The aircraft crashed on private property about 75 feet from Blouin Lake. The crash occurred in a lightly wooded area.

1.11 *Wreckage and Impact Information*

The ultralight crashed on its left side. The cockpit partly collapsed at impact. Witnesses and the examinations of the engine and propeller confirmed that the engine was functioning at the time of the crash.

Examination of the aircraft revealed that the left wing and its two spars sustained upward and rearward twisting stresses. The wings remained attached to the airframe.

1.12 Medical Information

The pilot's category III medical licence validation certificate was valid and carried no restrictions.

Toxicological test results for the presence of drugs revealed the presence of cocaine and cocaine metabolites in the urine of the pilot. It could not be determined when the pilot had consumed cocaine.

1.13 Survival Aspects

The occupants were wearing their seat-belts. However, they were not wearing helmets as prescribed in the regulations in force at the time of the accident. Survivable space in the cabin was reduced on ground impact.

1.14 Tests and Research

The wreckage was examined at the accident site and subsequently transported to the TSB Engineering Branch Laboratory in Ottawa, Ontario, for more detailed examination. Examination of the flight control systems revealed no evidence of failure prior to the in-flight failure of the ultralight wing. Examination of the debris revealed that all fractures were caused by instantaneous overload. Damage caused by the crash could not be distinguished from that which may have existed prior to the accident. The observed

damage indicates that the left wing failed in flight.

Analysis of the stresses acting on the left wing revealed that the rear spar was possibly deformed when the wing struck the surface of the lake.

Analysis of the aerodynamic forces acting on the wings under normal flight conditions indicates that the left wing must have failed as a result of pre-existing damage.

1.15 Additional Information

1.15.1 Regulations on the Carrying of Passengers in Ultralight Aircraft

The pilot was not licensed to fly with a passenger on board. Air Navigation Order Series V, No. 24, states that carrying a passenger in an ultralight aircraft is prohibited except for the purpose of giving dual flying instruction to that person. The Transport Canada *Personnel Licensing Handbook* states that flying instruction must be conducted under the direct supervision of a qualified instructor.

2.0 *Analysis*

The investigation did not reveal when the pilot consumed cocaine. Therefore, it cannot be established whether physiological factors affected the pilot's performance.

Meteorological conditions were favourable for VFR flight. The aircraft was probably not affected by the weather.

The witnesses observed the aircraft in straight and level cruise flight when the left wing suddenly failed. All fractures occurred as a result of instantaneous overload; examination of the ultralight systems revealed no anomalies. Consequently, the wing failure must have been caused by a pre-existing structural weakness.

Although the left wing struck the surface of the water shortly before take-off, the collision did not cause the damage observed on the front spar. However, the rear wing spar could have been sufficiently deformed to cause damage to the wing structure.

The aircraft had undergone repairs on several occasions following accidents. During one repair job, the left wing main spar was replaced by a spar with a diameter smaller than that specified by the manufacturer, which shortened the left wing chord. The way in which the left wing had to be assembled, given the shorter wing chord and the fact that the wing attachment points at the fuselage were not modified, could have created internal stresses in the structure.

These stresses could have caused overload failure in a wing component when the left wing struck the surface of the water just before take-off, and this would have resulted in structural weakening of the left wing, leading to the in-flight failure shortly after.

3.0 *Conclusions*

3.1 *Findings*

1. The pilot was not licensed to fly with a passenger on board.
2. During an attempted take-off, the left wing-tip struck the surface of the lake.
3. The aircraft was in cruise flight when the left wing folded upward and towards the rear.
4. All fractures occurred as a result of instantaneous overload.
5. The left wing folded as a result of a pre-existing structural weakness.
6. The left wing main spar had been replaced by a spar with a diameter smaller than specified by the manufacturer.
7. The structural weakness could have been caused when the left wing-tip collided with the surface of the lake shortly before take-off.
8. Toxicological test results revealed the presence of cocaine and cocaine metabolites in the urine of the pilot.
9. It could not be determined whether physiological factors affected the pilot's performance.

3.2 *Causes*

The left wing of the ultralight failed in flight as a result of a pre-existing structural weakness which could have been caused when the left wing-tip struck the surface of the water shortly before take-off.

4.0 *Safety Action*

The Board has no aviation safety recommendations to issue at this time.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson John W. Stants, and members Zita Brunet and Hugh MacNeil, authorized the release of this report on 10 July 1995.

Appendix A - List of Supporting Reports

The following TSB Engineering Branch Laboratory report was completed:

LP 142/94 - Left Wing Failure Analysis.

This report is available upon request from the Transportation Safety Board of Canada.

Appendix B - Glossary

EDT	eastern daylight saving time
hr	hour(s)
kg	kilogram(s)
km	kilometre(s)
N/A	not available
PPL	private pilot licence
TSB	Transportation Safety Board of Canada
UTC	Coordinated Universal Time
VFR	visual flight rules
'	minute(s)
°	degree(s)

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