AVIATION OCCURRENCE REPORT

LOSS OF CONTROL ON TAKE-OFF

ZENAIR CH701 C-FFEW
CROCHE LAKE, QUEBEC
19 JUNE 1994

REPORT NUMBER A94Q0114

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

After several unsuccessful attempts, the float-equipped aircraft lifted off with full flaps from Croche Lake, Quebec. After take-off, the pilot maintained the initial climb angle and held speed between 40 and 45 miles per hour (mph) to clear the mountains bordering the lake. The pilot stated that, at an altitude of about 20 feet above the lake, the left wing was lifted by a gust of wind. The aircraft nosed down toward the lake in a steep left-banked turn. The left float struck the water and the tip of the float failed. The floats moved to the underside of the wings. The aircraft remained upright with the cabin half-submerged. The pilot and passenger were not injured, and they climbed onto one of the floats. Thinking the aircraft would sink rapidly, they decided to swim for shore. Neither the pilot nor passenger was wearing a life-jacket. The pilot was able to reach the shore, but the passenger drowned, and was found the next day. The accident occurred around 0845 eastern daylight time (EDT[1]).

Ce rapport est également disponible en français.

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

Other factual information

The pilot had accumulated 32 flying hours on float-equipped aircraft and was certified for the flight. However, he stated that he had limited flying experience. An amateur video taken when the pilot and passenger arrived at Croche Lake two days before the accident shows the aircraft making hard initial contact with the surface of the lake, then bouncing about 20 feet. The lake surface presented glassy water conditions. During the bounce, the angle between the floats and fuselage exceeded 15 degrees. The impact was sufficient to crack the windshield and slightly bend the right rear strut attachment at the float. The pilot did not consider the occurrence unusual. Apart from the float attachment, the pilot noticed no other parts of the aircraft that could have been affected by the water landing.

The pilot indicated that, on take-off from the lake, the aircraft load was 410 pounds. The first take-off attempt was made in a westerly direction with 10 degrees of flap. As the winds appeared to be swirling, he made another attempt toward the east with the flaps extended 20 degrees, but to no avail. The aircraft finally lifted off toward the west with 30 degrees of flap. According to the pilot, the take-off run used up half the lake, or about 2,500 feet.

A weather analysis states that visual flight conditions prevailed in the Croche Lake area. The winds from the north-northwest were estimated to be under 10 knots. Witness statements confirm that the wind was light and changing direction, and produced only a slight swell on the lake surface.

When the right wing lifted, the pilot applied opposite aileron and fully deflected the elevator, but the aircraft nosed down and turned steeply left. The pilot did not use the rudder pedals. The aircraft was not carrying life-jackets as required by regulation. The occupants were using seat-belts with one shoulder strap.

When they swam away from the wreckage, the two occupants were about 200 feet from shore, and the pilot had the impression that the wind was blowing them farther from the shore. He stated that, without a life-jacket and with his clothing weighing him down, he quickly felt his strength diminishing. He felt that a key factor in his survival was the passenger's encouraging words. The passenger, despite his abilities as a swimmer, his appearance of being in control of the situation, and his good physical condition, did not reach the shore. His body was found about 25 feet from shore in five feet of water. The aircraft remained afloat for over six hours.

The owner's manual from the company states that, with wheels fitted, a Rotax 912 engine developing 80 hp, and a weight of 960 lb, the aircraft's stalling speed with flaps (V_{so}) is 30 mph and the optimum angle of climb (V_x) is achieved with half or full flaps at a speed of 35 mph. The manual also indicates that the best rate of climb (V_y) is obtained with flaps retracted at 40 mph. However, the aircraft performance table indicates that a climb rate of 1,300 feet per minute can be achieved at 48 mph.

An information folder shows the aircraft mounted on amphibious floats and a performance table. With the same engine and weight, the rate of climb increases to 1,400 feet per minute. These discrepancies could not be explained by the company.

The climb report submitted to Transport Canada by the owner indicates that the aircraft on wheels had a rate of climb of 666 feet per minute. An instructor who has flown with several aircraft of this type noted the following performance data: stalling speed 35/38 mph and best rate of climb about 500 feet per minute at 50 mph with no flaps. Tests conducted by him on the same aircraft with full flaps and weights under 960 lb produced rates of climb under 300 feet per minute irrespective of speed. At speeds under 40 mph, the rate of climb was approximately nil and the floatplane became very unstable. The instructor also noted that the elevator on this aircraft lost all effectiveness at speeds below 65 mph and an increase in power was necessary to raise the nose. On water, the float tips were almost submerged, and he preferred to use power to keep them out of the water.

The amateur-built floatplane was equipped with a Teledyne Continental 0-200 engine producing 100 hp and a McCauley metal propeller. The company accepts this type of powerplant, but it has no performance data for the aircraft. This engine/propeller combination was 138 lb heavier than the Rotax engine with a composite propeller. According to the company, the lightest aircraft assembled with this engine and propeller weighed 530 lb. The company also mentioned that the weight of the floats, including rudder and mounting struts, is about 95 lb. Removal of the wheels reduces weight by about 34 lb, for a net increase of 61 lb with floats fitted. The company and Transport Canada had authorized an increase in the maximum aircraft weight from 960 lb to 1,107 lb.

The aircraft weight and balance indicates that, with wheels fitted, the aircraft weighed 521 lb, and 568 lb with 81-lb floats fitted, for an increase of 47 lb after the wheels were removed. With floats fitted, only a weight report is provided, with no indication of a shift in the centre of gravity in this configuration. There is no float-mounting report in the aircraft records, and, although the journey log indicates that the aircraft was operating alternately from a runway or a lake, there was no notation regarding the mounting or removal of the floats. The installation of the floats was not mentioned in the annual airworthiness information reports since the aircraft was built in 1989. The float components had been purchased, pre-cut, from Zenair and assembled by the aircraft builder.

Weighing of the aircraft revealed that the engine with propeller weighed 278 lb and the floats weighed 127.5 lb. The total weight of all available aircraft components was 836 lb. As no moment arm was available, balance could not be calculated.

A cross-wind component during take-off can produce additional lift by increasing the velocity of the air flowing over the upwind wing, but it will not cause the aircraft to nose down. The aircraft has a greater keel surface exposed to cross-winds aft of the centre of gravity than

forward. Consequently, it will tend to turn upwind rather than downwind. The lift acting on an aircraft during take-off is increased by ground effect. This effect is eliminated at a height equal to approximately half the wingspan of the aircraft.

Analysis

The pilot was certified for the flight. The take-off technique with full flaps and the speeds used were as indicated in the aircraft flight manual.

According to the builder's weight report, the aircraft weight on take-off was 977 lb. However, as the actual weight of the floatplane was 836 lb, its weight on take-off was 1,266 lb, or 159 lb over the maximum allowable weight, and 306 lb over the weight for which performance data were available from the company.

Although balance could not be calculated, the ineffectiveness of the elevator at twice the stalling speed and the float attitude on the water indicate that the floatplane's centre of gravity exceeded the forward limit. An excessive forward centre of gravity reduces performance. The climb performance of the aircraft, despite 20 hp more power from the engine, was half the published value.

The absence of performance data with a 0-200 engine and the lack of explanations from the company regarding the contradictory data on the best rate of climb invalidate the data for the accident aircraft. The performance values observed by the instructor were used, as they are considered the most plausible; they indicate that the speed of under 45 mph used by the pilot on take-off held the aircraft near the stalling speed. Overloading of the aircraft increased the stalling speed, and the excessive forward centre of gravity diminished elevator effectiveness.

It is plausible that a change in wind speed increased lift on the right wing and caused it to rise; however, weather cocking would have caused the floatplane to turn into the wind and would not have pitched the nose down. The aircraft stalled when it flew out of ground effect. A stall is often followed by a spin when yaw is not counteracted through the rudder pedals. The steep left turn downwind indicates that the aircraft was in the incipient stage of a spin.

The following laboratory report was completed:

LP 134/94 - Log Books Restoration.

Findings

1. The floatplane weight was 269 pounds over the weight reported in the weight and balance report.

2. The forward centre of gravity limit was exceeded.

3. No centre of gravity with floats fitted was indicated on the weight and balance report.

4. The installation of the floats was not recorded in the aircraft log-book and had not been reported to Transport Canada.

5. The climb performance of the aircraft was half the published value.

6. There were no life-jackets on board the aircraft.

Causes and Contributing Factors

During the initial climb, overloading and an excessive forward centre of gravity caused the aircraft to stall at a speed higher than that published by the manufacturer.

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 27 April 1995.