Aviation Safety Investigation Report 199502099

Airborne Windsports Edge

09 July 1995

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Occurrence Number: 199502099 **Occurrence Type:** Accident
Location: Fawcetts Plain, Kyogle
State: NSW **Inv Category:** 3
Date: Sunday 09 July 1995
Time: 0930 hours **Time Zone** EST
Highest Injury Level: Fatal
Injuries:

	Fatal	Serious	Minor	None	Total
Crew	1	0	0	0	1
Ground	0	0	0	0	0
Passenger	1	0	0	0	1
Total	**2**	**0**	**0**	**0**	**2**

Aircraft Manufacturer: Airborne Windsports
Aircraft Model: Edge
Aircraft Registration: T2-2669 **Serial Number:**
Type of Operation: Non-commercial Pleasure/Travel
Damage to Aircraft: Substantial
Departure Point: Kyogle
Departure Time: 0930 EST
Destination: Kyogle

Crew Details:

Role	Class of Licence	Hours on Type	Hours Total
Pilot-In-Command		27.0	140

Approved for Release: Friday, November 22, 1996

History of the flight

The aircraft was one of a group of powered hang gliders operating from a 900-m grass strip aligned east-west. The group had arrived at the strip the previous morning. That afternoon, the pilot flew the aircraft with a passenger on a cross-country flight. Earlier, the pilot took another passenger for a flight which included power-on and power-off stalls. The aircraft performed normally on both these flights.

The group camped at the strip overnight and planned an early morning flight. However, the departure was delayed by fog. The aircraft had been left assembled overnight standing in the open. As a result, the wing had been wetted by condensation to the extent that beads of water had formed. Although the wing was exposed to direct sunlight for about 30 minutes before takeoff, it was reported to have still been wet, although not beaded, when the aircraft taxied for takeoff.

Conditions were suitable for flight by about 0930 EST. The understanding was that each aircraft would take off towards the west and climb straight ahead to 1,500 ft above ground level before flying back across the strip in an easterly direction.

The accident aircraft was the first to take off. The wind was calm. The aircraft became airborne after a normal ground roll and climbed straight ahead. As the climb progressed, the aircraft followed the normal procedure of positioning about 80 ft above the right side of the strip. (This procedure is conducted so that, in the event of an engine failure, the aircraft is in a position to turn left to land back on the strip.)

At an estimated 200 ft above ground level, the aircraft levelled and entered an abrupt right turn to head approximately north. At the same time, the engine noise decreased but then increased again as the aircraft began a shallow climb, still heading north. A short time later, the aircraft rolled sharply right to at least 45 degrees of bank and adopted a steep nose-low attitude. It then spiralled to the ground, completing about one and one-quarter turns before impact. Members of the group were in radio contact with one another. No transmissions were heard from the pilot during the take-off and accident sequence.

Witnesses described the turn onto north and the subsequent turn as unusually abrupt. One witness, who flew a similar aircraft, considered that the turns would have required considerable physical effort from the pilot to manoeuvre the control bar towards his chest and to the left. The pilot was described as confident and reliable. There were no reports of him acting impulsively while flying.

Assuming the aircraft was carrying full fuel for the flight, the calculated take-off weight was 387 kg. Maximum allowable take-off weight for the aircraft was 401 kg.

Wreckage examination

Examination of the wreckage did not reveal any pre-existing fault which might have contributed to the accident. Failures to the mast and front mast brace were caused by overload. A strip examination of the engine did not reveal any fault which may have precluded normal operation. Examination of a section of engine exhaust pipe confirmed that the engine was operating at impact.

Pilot's experience

The pilot had completed a training course on weight-shift aircraft (commonly known as Trike aircraft) about 18 months before the accident. This training was conducted in accordance with the Trike Pilot Training Syllabus issued by the Hang Gliding Federation of Australia (HGFA) and approved by the (then) Civil Aviation Authority. The pilot did not receive any training in recovery from spiral dives; nor did the syllabus include a requirement for such training.

Medical and pathological information

The pilot was reported to have been in good health on the morning of the accident. The passenger was suffering from a cold. Pathological examination did not reveal any pre-existing condition of the pilot or the passenger which might have contributed to the accident.

Extracts from Pilot's Handbook

Section 2, paragraph 2.1 of the Pilot's Handbook for the aircraft lists airspeed limitations including:

"Stall speed 30.3 knots (IAS) max weight (power off)
23.0 knots (IAS) min weight".

Paragraph 2.4, Other Limitations, includes the following:

"The effect of light rain on the aircraft is slight. Heavy rain will cause the stall speed to rise to the point where it is possible to stall the aircraft without banking the wing. Under these circumstances the pilot input for control in the roll axis increases.... Do not use waterproofing agents on the wing as the consequent beading of water droplets can significantly increase the stall speed.

Aerobatic manoeuvres including whipstalls, stalled spiral descents and negative G manoeuvres are not permitted. It must be emphasised that a whipstall, spiral descent or negative G manoeuvre can never be conducted safely. These manoeuvres put the aircraft outside the pilot's control and puts [sic] both the aircraft and its occupants in extreme danger."

Aircraft handling characteristics

As part of the investigation, the Civil Aviation Safety Authority (CASA) was approached for information on the handling qualities of weight shift controlled (Trike) aeroplanes, including the type involved in the accident. As a result, a CASA test pilot undertook a limited flight evaluation and held discussions with experienced Trike pilots.

A test was conducted in which the aircraft was stalled and no roll correction applied. The Trike entered a spiral dive during which roll divergence and nose-down pitch increased. Large out-of-trim forces were felt as speed increased. This caused difficulty in maintaining a nose-up longitudinal control position. Roll control remained effective throughout the manoeuvre although response rate to a given control input decreased as the spiral developed. Rapid recovery from the spiral was achieved by relaxing the nose-up pitch input and rolling wings level.

The test pilot reported that discussions he had with experienced pilots indicated that the spiral dive was not a widely recognised condition among Trike pilots. If a wing drop at the stall was not corrected early, recovery from the spiral dive to normal flight could result in an altitude loss of up to 90 m. The recognition of, and recovery from, a spiral dive was not included in the Trike Pilot Training Syllabus. It was suggested that such training be included in the syllabus.

The test pilot considered that the accident aircraft may have stalled and entered a spiral dive. A reflex action of the pilot may have been to attempt to raise the nose of the aircraft to recover from the dive. However, although this would have involved very high control forces, such an action by the pilot would have maintained the wing in a stalled condition, causing the spiral to continue.

A further flight characteristic of the Trike was that aircraft response to control inputs was slower as speed decreased and aircraft weight increased.

ANALYSIS

The evidence indicates that the aircraft entered a spiral dive which continued to ground impact. Without specific training in this area, the pilot probably did not have the experience or knowledge to apply to recover from the unusual situation the aircraft was in. From the witness reports, it could not be determined if the height above ground of the aircraft when it entered the spiral dive was sufficient to allow recovery to normal flight.

The two abrupt turns made by the aircraft shortly after takeoff cannot be readily explained. The aircraft did not follow the planned departure procedure and there was no radio transmission from the pilot to indicate any problem. Further, the pilot had no record of impulsive behaviour during flight.

It is possible that the pilot was attempting to fly a circuit to land back on the strip, although no reason for such action was established. The take-off weight of the aircraft meant that the stalling speed was high. This may have been increased further by the remaining moisture on the wing. It is conceivable, therefore, that the aircraft stalled during the turn which led to the spiral.

It is also possible that the change in engine noise heard by witnesses when the aircraft turned onto north influenced the pilot's actions. However, the engine noise quickly recovered and there was no evidence of any fault in the engine. The change in noise could be explained by the pilot's foot slipping on the throttle pedal control. These facts weigh against the engine being a factor.

The flight tests indicated that wing drop accompanying a stall could lead to a spiral dive if roll correction was not applied. Although the response rate of the aircraft to control inputs would have been reduced at the operating weight of the aircraft, the pilot had recent experience in flying the aircraft (including stalling) at this weight. The entry of the aircraft into the spiral dive is, therefore, not readily explainable.

CONCLUSIONS

Findings

1. For reasons which were not established, the aircraft entered a spiral dive.

2. The pilot had not received training in recognising and recovering from spiral dives.

3. The height above ground available for the pilot to recover from the spiral dive was probably marginal.

SAFETY ACTION

During the investigation, close contact was maintained with the HGFA. The Federation was also informed of the results of the flight evaluation undertaken by CASA. In response to this information, the Federation issued in March 1996 an amendment to the pilot training syllabus for weight-shift aircraft to include steep turns as a training unit. One of the objectives of the unit is that the student demonstrate skills required to counter the spiral tendency of the aircraft following a stall during a steep turn.

A revised HGFA Weightshift Microlight Flying Instructor's Manual was issued. This included the following:

"Spiral Dive Tendency

Demonstrate the tendency for the aircraft to begin to "spiral" when excessive pitch pressure is applied with a nose down attitude in a steep turn. Demonstrate that the aircraft will recover from the spiral due to its pitch and roll stability, though height loss can be substantial if excessive pitch pressure is held until the aircraft stalls. Demonstrate that reducing pitch pressure and levelling the wings will reduce height loss.

"Demonstrate that though the aircraft's tendency to diverge in roll is slow, it will increase if the aircraft is held in this spiral mode. Demonstrate that the aircraft can be readily rolled level by easing pitch pressure and applying weightshift.

"Ensure that the student is able to recognise the onset of the spiral tendency and is familiar with the recovery techniques".