

No: 9/89

Ref: EW/C1105

Category: 3

Aircraft Type and Registration: Mainair Sports Ltd Gemini Flash 2A (Microlight Aircraft), G-MTYZ

No & Type of Engines: 1 Rotax 503 Piston Engine

Year of Manufacture: 1988

Date and Time (UTC): 24 April 1989 at 1505 hrs

Location: Balne, nr Selby, Yorkshire

Type of Flight: Test

Persons on Board: Crew - 2 Passengers - None

Injuries: Crew - 2 (Fatal) Passengers - N/A

Nature of Damage: Aircraft destroyed

Commander's Licence: Private Pilot's Licence (Group D) with instructor's rating

Commander's Age: 31 years

Commander's Total Flying Experience: 898 hours (of which 584 hours were on the Gemini Flash Type Aircraft)

Information Source: AAIB Field Investigation

History of flight

The Gemini Flash aircraft had received damage to the left-wing earlier in the year, and was repaired by an experienced pilot who was also the owner's instructor. Other modifications were carried out at this time, but the aircraft did not fly again until the day of the accident.

The owner towed the dismantled aircraft to a prepared grass strip at Walden Stubbs (9 miles south of Selby) where he was to meet his instructor and the instructor's brother. En route to the field he had seen a Pegasus XL microlight aircraft in flight, and on arriving at the field, saw his instructor's car and assumed that he had already gone flying. Shortly afterwards the Pegasus landed, and the instructor and his brother disembarked to help re-assemble and rig the Gemini Flash. The instructor then carried out a very detailed inspection of the aircraft, the intention being that he would carry out a test flight, and also demonstrate the handling characteristics of the aircraft to his brother who was due to take a General Flying Test on a similar aircraft. The weather was fine with a light and variable wind, visibility in excess of 6 Km, and cloud base reported as being between 1,500 and 2,000 feet AGL.

After the normal pre-flight checks the aircraft took off to the west and climbed to an estimated 500 feet, before turning right onto an easterly heading. The aircraft was still climbing when it disappeared from the owner's view.

Later, a microlight aircraft was seen by a witness in a farm yard. The aircraft was being subjected to rapid 90° alterations of heading, and heading reversals. A number of manoeuvres were demonstrated to the witness by use of a model, and he identified a "wing-over" as being one of the manoeuvres performed. He then went into his barn and did not see the aircraft in-flight again, although the aircraft subsequently crashed nearby.

A witness to the east of the site heard a bang and looked up to see a "V-shaped" microlight spiralling to the ground. Two other witnesses had their attention drawn to the aircraft by the sound of a very sharp increase in engine RPM. One of these heard a brief "chug - chug" sound and saw the aircraft spiral to the ground. The other saw the aircraft in a steep dive before it entered a spiral descent, and was then lost to sight. Both occupants were killed by impact forces, and there was no fire.

There were no witnesses to the impact, but three workmen in the vicinity saw the wreckage and went across to examine it and the occupants. One of them went to telephone the police and emergency services. They attended promptly, but some difficulty was experienced in approaching the site because of soft ground.

Aircraft information

The Gemini Flash 2A microlight is a two seat (tandem) machine of the weight shift/flexible wing type. The crew, engine, fuel and instruments are all mounted on a tricycle undercarriage triangular framework (trike), which is suspended from the wing pivot point. This triangular framework consists of a vertical strut, a front strut and a keel. Control of the microlight is achieved by use of an "A" frame, the crossbar of which is easily accessible to the pilots. The forward limit of movement of this "A" frame is achieved when it makes contact with the front strut, which is roughly as far forward as can be reached by a secured pilot in the front seat.

The wing framework is constructed from aluminum tubing which is braced, through the "A" frame and a kingpost on top of the wing, by rigging wires. Thus in positive g flight loads are induced in the lower rigging wires, the upper wires primarily sustaining the weight of the wing whilst the microlight is on the ground, although the 'leach-wires' which run from the kingpost to various points on the wing trailing edge afford some support during flight, particularly when the wing is recovering positively in pitch.

The recent maintenance history of G-MTYZ showed that repair work had been carried out within the last six months to the wing and undercarriage, by the two occupants, following an accident which had occurred during landing. The accident flight was its first flight since that work.

Wreckage examination

The microlight had crashed on its left side, and had come to rest on a heading of 035° M on a flat harrowed earth field, bounded by fields of growing crop. For a distance of some 200 m leading up to the main wreckage there was a trail of light debris which included fragments of the wooden propeller and the wing nose cone. From the wreckage examination it became apparent that, before striking the ground, the wing had pitched up relative to the trike to such an extent and with sufficient force, that the crossbar had broken through the front strut, causing failure of both members in bending. In addition, the wing had continued to pitch up until the propeller struck the wing keel. A total of five propeller strikes were apparent on the keel/fin. Structural failure had also occurred to both wing leading edge tube members in a downward (negative g sense) and slightly rearwards direction. The symmetry of these leading edge failures indicated that they had occurred due to in-flight aerodynamic loading. The kingpost had also failed, in compression bending, indicating that this had resulted from an excessive downward loading on the wing.

No evidence was found to indicate that the recent repair work on the aircraft had been a factor in the in-flight structural failure.

All other failures observed were considered to have resulted from ground impact forces.

Additional information

Microlight aircraft are designed to fly 'hands off' at a certain airspeed (*i.e.* the trim speed). Indeed this neutral load condition on the crossbar is the normal situation for non-manoeuving flight. However, some previous accidents to weight shift microlights have been associated with similar structural failures, most of which have resulted from observed steep manoeuvres. In addition, test work carried out by the manufacturer has indicated that as the wing recovers from small negative angles of attack, control forces in excess of 70Kg are required to restrain the wing, as it pitches-up extremely rapidly. The crossbar can then strike the front strut, causing its failure, and allowing the propeller to strike the aft keel/fin area.

This machine is certificated by the UK Civil Aviation Authority to BCAR Section S, but specifically in the non-aerobatic category only. The manufacturer's manual for this aircraft contains a NOTICE that "This flex-wing aircraft is certified for non-aerobatic flight only. Maximum bank angle 60°. Maximum pitch angle 30° up or down. No spins, whip stalls, tail slides or wing overs." The manual also contains a WARNING that steep reverse turns or steep pitch manoeuvres may result in negative loading to the wing and possible loss of control and structural failure. "Positive loading must be maintained at all times."

There has been a great deal of discussion in microlight journals, and between interested parties, of the stalling and control characteristics of trikes when rapid and steep manoeuvres are performed. The maximum bank angle of 60° is, in effect, the maximum bank angle which Section S of the BCAR's requires to be demonstrated. It has not been factored to safely accommodate a variety of combined pitch and rolling manoeuvres.

This accident resulted from an in-flight structural failure of the aircraft which was induced by dynamic overloading of the wing in download. It could not be established whether the overloading was the result of an extreme manoeuvre which was intentional, or of some lesser manoeuvre which could not be controlled.