ACCIDENT

Aircraft Type and Registration:	Pegasus Quasar TC, G-MWSH
No & Type of Engines:	1 Rotax 503-2V piston engine
Year of Manufacture:	1991
Date & Time (UTC):	6 April 2007 at 1710 hrs
Location:	Shifnal microlight site, near Telford, Shropshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Fatal) Passengers - N/A
Nature of Damage:	Substantial
Commander's Licence:	Private Pilot's Licence (Microlight)
Commander's Age:	58 years
Commander's Flying Experience:	315 hours (of which 1 hour was on type) Last 90 days - 8 hours Last 28 days - 3 hours
Information Source:	AAIB Field Investigation

Synopsis

The pilot, flying a flex-wing microlight, completed one circuit during which he appeared to have some difficulty in controlling the aircraft and which resulted in a go-around. On the second approach he was low on the final approach and collided with a hedge. The pilot was fatally injured in the impact.

History of the flight

The owner, who was not a qualified pilot, purchased the microlight in March 2007. On the day of the accident the owner asked a friend, who was a qualified pilot, to familiarise himself with the aircraft by flying a couple of circuits before taking him flying.

The weather conditions were generally good with a light northerly airflow. The pilot, assisted by the owner, rigged the aircraft during the morning. At one stage in the process, he went to look at the wing of a similar aircraft, apparently to check on which side the red and green tipped wing battens should be fitted. The rigging process took some time; a securing pin was missing and the pilot had to return to his home to find an alternative pin. By the time the aircraft was rigged and ready for flight, thermal activity and associated turbulence had developed making the weather conditions far from ideal for flex-wing, weightshift microlight flying. The flight was therefore delayed until conditions improved; meanwhile, the pilot completed several flights in a 3-axis type, Ikarus C42 microlight.

At around 1745 hrs the weather conditions became calmer so the pilot prepared to fly G-MWSH. He taxied out from the parking area and completed some taxi runs along Runway 36; a grass strip 300 m long and 30 m wide. During these runs the aircraft was seen to "hop" into the air once or twice, but only to a height of 1 to 2 ft.

The aircraft then took off from Runway 36, getting airborne approximately halfway along the runway. Two witnesses described its climb rate as "poor" relative to other aircraft types that fly from the airfield. One witness described the climb as stopping at around 100 ft before recommencing. Other witnesses saw the aircraft on its subsequent approach to Runway 36. They described it as flying erratically and approaching at a height close to the top of a prominent hedge located on short finals. As the aircraft crossed the runway threshold it was seen with the left wing low and close to the ground. Power was then applied and, instead of flying along the runway as expected, it turned to the right. It was described as 'wobbling' in flight with the pod moving from side to side. The aircraft flew low over another aircraft, which was waiting some 50 m to the right side of the runway, before it turned to the left and climbed to follow the normal circuit pattern for Runway 36.

The second circuit was carried out at low level and the aircraft was positioned on the approach to Runway 36. Witnesses described seeing the aircraft through the hedge rather than above it, and said that it was rocking or "wobbling" in flight. The aircraft was then seen to descend directly into the hedge; some witnesses described a nosedive. At around the same time the engine was heard to go to high power. Several witnesses went over to the hedgerow in an attempt to assist the pilot but he had suffered fatal injuries in the impact.

Accident site

The aircraft had struck a hawthorn hedge and trees located 65 m from the threshold of Runway 36. The hedge, which ran perpendicular to the runway, varied in height along its length. Embedded within the hedge, mainly to the west of the approach path, were several trees that exceeded the height of the hedge (see Figure 1). The lack of any ground marks prior to the hedge indicated that the aircraft had not contacted the ground before striking it.

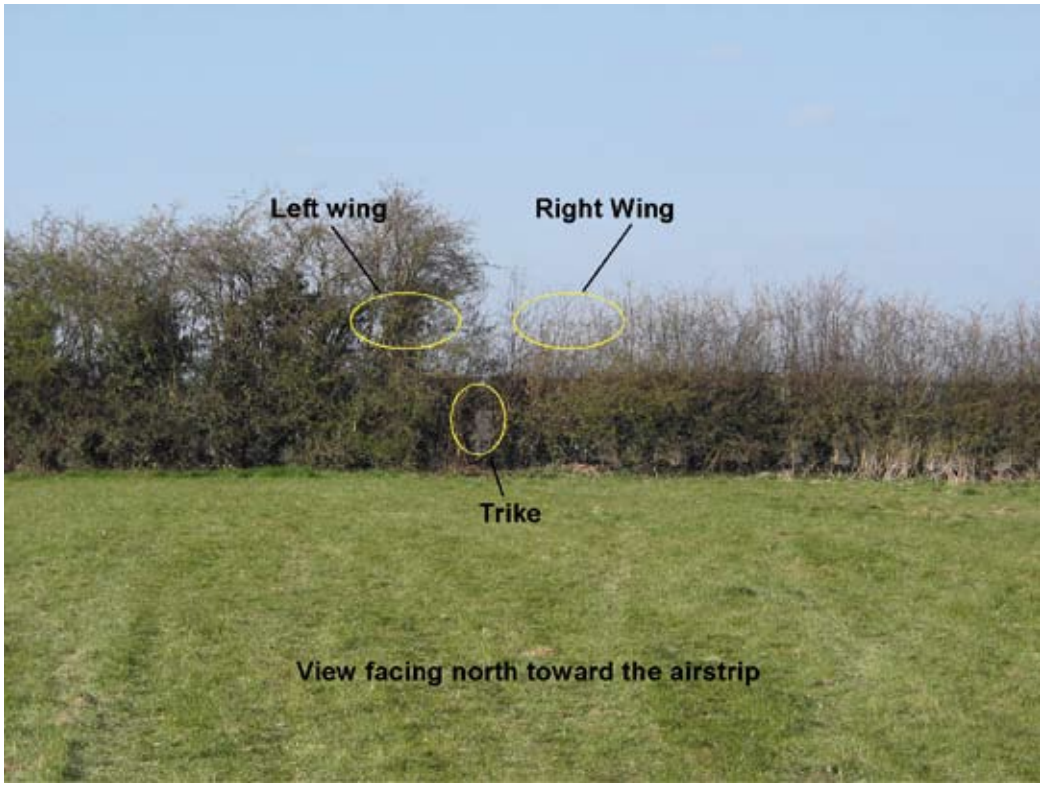

Figure 1

Hedge and tree damage after the recovery of the aircraft

Damage to the hedge and trees were consistent with the aircraft impacting it in a wings level attitude with the trike about 1 m above the ground. It was not possible to establish the exact pitch attitude at impact.

The leading edge of the left wing had initially struck a tree that had grown to a height above the hedge; the right wing did not strike anything significant except for small branches extending upwards from the hedge. The trike had continued to move forward and into the hedge, under its own engine power. The tree had restricted the wing from moving further forward, causing the trike to rotate about the hang point, before pulling forward against the wing structure, fracturing the wing keel in two places. Additionally, as the A-frame was still attached to the wing, as the trike moved forward in relation to the wing, the pilot became trapped between the lower bar of the A-frame and the trike's seat back. When the trike's rear wheels came into contact with the hedge the trike was brought to a halt.

Damage to the tips of the three propeller blades indicate that the engine was under power at the time the trike struck the hedge.

Examination of the aircraft at the accident site revealed that all the flying wires, king post and luff lines were correctly attached and secure. Additionally, the rigging wires for the wing cross-boom were correctly installed, tensioned and on the restraint cable stud with the securing pin still in place. All the wing battens were in place and secured by a single loop of a bungee. The wing fabric was still intact although some tearing had taken place as a result of the accident and the subsequent attempts by the emergency services to remove the pilot. The fuel tank had remained intact, despite severe crumpling, and there was no fire. About 36 litres of fuel were drained from the fuel tank.

Aircraft information

The Pegasus Quasar weightshift microlight, a flex-wing aircraft type, was first flown in 1989. The wing shape is maintained by battens which are held in place by double looped bungees. There is provision for a pilot to make small adjustments to the handling characteristics of the aircraft by changing the profile of the battens, thereby altering the shape of the wing. Each batten can be adjusted up to a limit of 15 mm; guidance as to the method and amount of adjustment is given in the operator's handbook, supplied with the aircraft. The pilot manoeuvres the aircraft by positioning a crossbar in front of him. Pitch and roll control inputs on this bar have the opposite effects to conventional 3-axis type controls; pushing the bar forwards causes the aircraft to pitch up and moving the bar to the right causes the aircraft to turn to the left.

Aircraft examination

The aircraft was recovered from the field and taken to the AAIB facilities at Farnborough for a detailed examination.

Weighing the aircraft showed it to have an empty weight of 197.7 kg; the maximum authorised empty weight is 180 kg. With 36 litres of fuel this would have given a weight without the pilot of 223.25 kg. The maximum all up weight allowed for the aircraft was 381.6 kg, thus for this flight, with only one pilot on board, the weight would have been well below the maximum.

The pitch of the propeller blade as fitted was found to have been correct at 15°. A replacement propeller was fitted to the aircraft and the engine was started and run using the fuel previously drained at the accident site. The engine started normally, using the electric start, and responded smoothly to the hand and foot throttle. The engine also continued to run normally when operated

independantly on either of the two ignition systems. Full engine power of 6,800 rpm was achieved during the static engine run.

A check of the batten profiles for the wings revealed that the correct battens had been used during the rigging of the wing. However, a comparison of the batten profile against the profile drawings supplied by the aircraft manufacturer revealed that although the left wing battens matched the profile drawing, the right wing battens were significantly different. The outer batten, number 11, had been damaged during the attempts to recover the pilot, however batten numbers 6,7,8,9 and 10 had significant over-camber when compared to the drawing. Batten number 10 showed the greatest deviation, with an additional 46 mm to the camber, (see Figure 2).

Despite some tearing of the wing fabric, a Bettsometer test of the wing sail fabric was satisfactory. (A Bettsometer test is designed to check for any degradation of fabric wing surfaces.) The mylar inserts for the wing leading edge showed signs of crumpling although it was not known if this occurred prior to, or as a result of, the accident.

As a result of the discovery of the altered batten profiles on the aircraft, a series of test flights was carried out on a similar aircraft by the manufacturer. The battens were set to the same profile as found on G-MWSH and the handling characteristics were assessed. The flight test showed that the aircraft had a tendency to turn to the left and required 1 to 2 kg of right roll effort on the bar to fly in a constant direction, although the test pilot assessed the effect as 'not severe'. Other flight characteristics were not significantly affected and the test pilot noted that the aircraft would have been acceptable for a Permit to Fly (PTF) revalidation except for the tendency to turn left. The manufacturer also advised that although the bungees should have been secured by a double loop, a

Figure 2

Wing batten profiles as found following the accident flight

single loop arrangement should not have significantly affected the flight characteristics.

Aircraft history

The aircraft, manufactured in April 1991, had nine previous owners. The last PTF was issued in June 2006. During the PTF renewal the BMAA inspector checked the wing batten profiles against the batten profile drawing. He also test flew the aircraft which did not show any abnormal handling characteristics. After the PTF renewal the aircraft flew on eight occasions with the last recorded flight on 2 July 2006. At the time of the accident G-MWSH had completed 543 airframe hours.

The aircraft was sold on in October 2006 to a new owner, who intended to use it to learn to fly. He stored the de-rigged aircraft in a shed with the wing and its battens stored in their protective bags. He then sold the aircraft without ever rigging or flying the aircraft.

The current owner bought the aircraft in March 2007. He made the purchase after having been to view it accompanied by the pilot involved in this accident, who had provided advice regarding its condition and suitability. After the purchase he transported it to his garage for storage. The owner took the aircraft to Shifnal a week prior to the accident, but due to unsuitable weather, the pilot decided not to rig it. The wing was left, de-rigged in its bag, in a hangar at the airfield, whilst the trike was taken back to the owner's garage. On the morning of the accident the trike was transported back to Shifnal for rigging. This was the first occasion that the aircraft had been fully rigged since October 2006 and the subsequent flight was the first since July 2006.

When the current owner took possession of the aircraft he was handed a series of documents. Despite several manufacturer's drawings and the operator's handbook being included in the package, the manufacturer's batten profile drawings were missing.

A review of the aircraft logbook indicated that it had been inactive from July 2001 to March 2004 and from June 2005 to June 2006. A more significant gap in the logbook was during the period July 1994 until September 1999. The PTF records for the period revealed that it had accumulated 423 airframe hours at a rate of just less than 100 hours a year.

Several modifications had been incorporated into the aircraft, the majority of which were installed prior to 2001 and had not been recorded in the aircraft logbook or recorded with the BMAA. The only recorded modifications were the installation of strobes in May 1993 and a fuel gauge in May 2005.

The aircraft had been weighed in 2004; at that time the empty weight was 180 kg, which was the maximum authorised.

Pilot information

The pilot had been flying microlight aircraft for ten years. He had first learned to fly in a flex-wing type and then in 2001 had converted to a 3-axis type. In 2001 he bought a Thruster 3-axis aircraft, which he kept at Shifnal; at the time of the accident he had recorded 200 hours of flight in this aircraft. In the six months prior to the accident his only recorded flight time was in an Icarus C42, a 3-axis machine. Since the end of 2001 he had recorded only one flight in a flex-wing type, a flight of 20 minutes in a Quasar in April 2003.

The owner of G-MWSH noted that in a conversation prior to the flight the pilot had said that he would need to be careful not to put in the wrong controls, because he had not flown a flex-wing for some time. It was reported

that it had been the pilot's intention to fly G-MWSH on a regular basis, both to regain his familiarity with and to maintain flying practice on a flex-wing type.

The pilot had been appointed as a BMAA inspector on 15 August 2006. He was qualified to carry out inspections on 3-axis and flex-wing aircraft types for PTF renewals, but was not qualified to conduct the PTF flight tests.

Meteorological information

The flight conditions at the time of the accident were described by another pilot who was flying at the time as being a little turbulent but quite manageable. There was a northerly wind of around 10 kt, with good visibility and no low cloud. The meteorological report from RAF Cosford, 3 nm from the accident site, recorded at 1655 hrs was: surface wind from the north at 9 to 13 kt, visibility 5 km, scattered cloud at 3,600 ft, temperature 15ºC, dewpoint 3ºC, and pressure 1025 hPa.

Aerodrome information

The Shifnal microlight site is a grass airfield with two runways, Runway 10/28 and Runway 18/36. The circuit direction for Runway 36 is to the left; shortly after takeoff the climb out path crosses a railway line running in a cutting. There are local instructions for the circuit regarding noise sensitive areas; within the circuit there are a number of open grass fields with hedgerows between and several areas of farm buildings. There is a line of telegraph poles carrying power lines some 45 m to the left of the final approach path for Runway 36. There is a tall hedgerow which has to be crossed 65m before the threshold of Runway 36.

In northerly wind conditions it was reported that this hedgerow, together with the surrounding terrain profile, can give rise to some localised turbulence on the southern side.

Medical information

A post-mortem examination was carried out on the pilot. There was no evidence of any pre-existing disease or condition which could have had a bearing on the accident. The cause of death was a result of injuries sustained to the pilot's chest.

Survivability

The pilot was wearing a crash helmet and a lapstrap. The seats had been fitted with seat belts; the rear passenger seat had a lap strap and over shoulder harnesses, whereas the pilot seat only had a lap strap. The harness did have a provision for a diagonal shoulder strap for the pilot but this had not been fitted.

The fatal injuries suffered by the pilot were consistent with crushing between the A-frame and the pilot's seat back. Examination of the seat revealed that repairs and modifications had taken place around the pilot's seat back. The seat back and post had been modified with the addition of an inner sleeve of metal within the seat post. There was also evidence that the seat back had been removed and refitted to the seat post. The fibreglass seat had been subjected to repairs in the past due to cracking. However, additional packing had been added within the recess in which the seat post would sit. The packing consisted of a crushed metal bar secured in place by fibre-glass, using a pink coloured resin, (see Figure 3).

The only record of a repair to the seat was in May 2005. The owner at the time, who also carried out the repair, does not recall ever fitting a metal packer into the recess of the seat. Similarly the BMAA inspector that carried out the PTF renewal in June 2006 also does not recall seeing the seat back packer.

Examination of the seat after accident indicated that bending had occurred to the seat post and that it had

Figure 3

Seat back repair

reacted against the packing in the seat recess. A dent to the plastic outer sheath of the seat post was consistent with a large rearward force being applied. The seat also exhibited cracking to the sides of the seat and behind the recess, again indicative of a large rearward force on the seat post.

There is no requirement for the pilot's seat back to collapse when a rearward force is applied, however had the seat back given way in this accident then the injuries may not have been fatal

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A seat back that does collapse when a rearward force is applied, would not be beneficial in many situations, as for example, in the case of a heavy landing where the seat back collapses and results in the pilot not then being able to control the aircraft.

Witness information

A relatively inexperienced pilot, who was flying at a height of 500 to 600 ft in the circuit at the time, watched G-MWSH as it flew the circuit and he described the flight pattern as "unusual". This was because it was flying a tight circuit at a considerably lower height.

Some of the witnesses were also microlight pilots. One watched the whole flight from a distance of about 400 m from the accident site and he reported that the aircraft did not appear to climb well after takeoff and never got above a height of about 300 ft. His impression was that the aircraft seemed to be flying too slowly and, as a result, there was not enough control available during the first approach. He, along with several others, described it as being low on the second approach; he then saw it nose-dive into the hedge.

Analysis

The pilot rigged the aircraft himself, with the owner's assistance. He also checked it again immediately before he flew it. His depth of knowledge on how to rig this particular wing type is uncertain, although as a BMAA inspector he should have had sufficient knowledge to determine whether the aircraft was in a suitable condition to fly.

However, it is known that at one stage in the rigging process he went to look at the wing on a similar aircraft, apparently to see on which side the red and green tipped battens should be fitted. The owner fitted the bungees to the wing battens himself. These were secured with a single loop as opposed to double looped; he did this under the direction of the pilot, who was therefore presumably satisfied with the arrangement. During the subsequent investigation the manufacturer advised that although the bungees should be secured by a double loop, a single loop arrangement should not have significantly affected the flight characteristics of the aircraft.

The unusual batten profiles, found after the accident, should also not have affected the aircraft's handling such that it was unmanageable by an experienced pilot. The air tests carried out by the manufacturer showed that the aircraft was flyable in the configuration in which it was rigged. However, less than ideal or unusual handling characteristics could have contributed to a difficulty for a pilot who was not in current practice on a flex-wing aircraft.

The weather conditions for the flight were adequate, as demonstrated by the fact that a relatively inexperienced pilot was flying a flex-wing aircraft in the circuit at the same time, without difficulty. However, the high hedge on the final approach could have given rise to disturbed air and turbulence on the downwind side in the northerly wind.

The flight did not appear to follow a normal circuit pattern; the circuits were described as being low and the flight path erratic. It seems likely, therefore, that the pilot was experiencing some difficulty in flying the aircraft. If the problem had been severe, or if there had been a major failure, it is probable that he would have attempted to land in one of the available fields around the airfield. The fact that he continued in the circuit suggests that his problems were neither severe nor unmanageable.

The pilot had only one flight of 20 minutes duration in a Pegasus Quasar aircraft recorded in his logbook, and that had been carried out four years prior to this flight. In the intervening four years he had flown only 3-axis types and in the previous six months only one type, the Ikarus C42. The handling and performance characteristics of the Quasar would have been completely different from those of the 3-axis C42, the type on which all of the pilot's recent experience had been attained and which he had flown several times on the day of the accident. In particular the roll and pitch control inputs required to manoeuvre the machine would have been in the opposite sense. These differences, which can be overcome if a pilot is in regular practice on the different types, could have caused some confusion. It is therefore considered likely that the pilot's lack of recent experience on this type of aircraft gave rise to his difficulty in flying it successfully around the circuit.

The combination of an aircraft that was not performing particularly well, as a result of the characteristics of its wing, and a pilot who was not in recent flying practice on a flex-wing aircraft could have caused the erratic flight

described by the witnesses. Furthermore, being low on the final approach would have compounded the problem by placing the aircraft into an area of turbulence created by the northerly wind. However, a medical problem affecting the pilot, or some other undetermined event, cannot be excluded.