

**INCIDENT**

<b>Aircraft Type and Registration:</b>	Pegasus Quantum 15-912, G-BZMI	
<b>No &amp; Type of Engines:</b>	1 Rotax 912 piston engine	
<b>Year of Manufacture:</b>	2000	
<b>Date &amp; Time (UTC):</b>	13 September 2008 at 1820 hrs	
<b>Location:</b>	7 miles East of Sandy, Bedfordshire	
<b>Type of Flight:</b>	Training	
<b>Persons on Board:</b>	Crew - 2	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Front strut upper supporting bracket failed and monopole bent	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	54 years	
<b>Commander's Flying Experience:</b>	1,300 hours (of which 1,250 were on type) Last 90 days - 58 hours Last 28 days - 21 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and AAIB inquiries	

**Synopsis**

The bracket which secures the front strut to the monopole had been orientated upside down. It subsequently failed in flight, causing the monopole to bend rearwards at the overcentre catch location. The pilot made a successful precautionary landing in a field.

**History of the flight**

The aircraft was kept in the hangar at the airfield with the wing removed from the trike. On the morning of the incident the aircraft was rigged and flown by two different instructors on six trial lessons and two training flights. During the eighth flight the instructor and student had performed six to seven 60° banked turns and

the aircraft was in a 30° banked turn to the right when they heard a loud 'bang'. The instructor reported that he could see that the bracket securing the top of the front strut to the monopole had failed and that the trike had adopted an attitude approximately 10° more nose-down than normal. He took control of the aircraft from the student and made a precautionary landing in a field.

**Engineering investigation**

The bracket<sup>1</sup> which connects the front strut to the monopole consists of a 'U' channel which is attached

**Footnote**

<sup>1</sup> Front strut channel upper ZCH-011.

to the monopole by an 8 mm (M8) bolt. The front strut is secured to the bracket by a keep pin and locking ring, and an over-sleeve assembly connects the bottom of the front strut to the lower strut assembly. To enable the wing to be fitted to the monopole, the monopole can rotate about its connection point on the trike keel. Once the wing has been fitted to the aircraft, the monopole is locked in position by an overcentre catch at the top of the seat frame.

On the incident aircraft both side faces of the bracket had failed where they join the rear face (Figure 1). The rear face of the bracket had also failed across the M8 securing bolt hole. The distortion of the bracket and the direction of failure of the side faces indicated that the bracket had been orientated upside down and had been pulled away from the monopole. There was also a dent in the rear face of the monopole adjacent to the overcentre locking catch and the monopole had bent

rearwards, about this point, by approximately 2°. The securing holes in the front strut and over-sleeve were all slightly elongated.

When the microlight is correctly rigged the front strut is aligned with the upper bracket (Figure 2).

When rigging the aircraft it is possible for the upper bracket to rotate about the M8 securing bolt, such that the bracket is then orientated upside down. During the investigation a bracket on another Quantum aircraft was orientated upside down and an attempt was made to fit the front strut without the wing attached to the monopole. With the bracket in this orientation the distance between the keep pin holes in the bracket and the lower strut assembly was greater than when the bracket was correctly orientated and it was not possible to fit the keep pins. However, the manufacturer has stated that with the wing fitted to the monopole, the



**Figure 1**  
Failed front strut bracket on G-BZMI

structure can flex sufficiently to allow the pins to be fitted with the upper bracket orientated upside down. In this configuration the front strut would then be subject to a tensile preload when the monopole overcentre catch is moved to the engaged position.

### **Loading in front strut**

On the Pegasus Quantum, the Centre of Gravity of the trike is forward of the monopole and in flight the lift loads from the wing are shared between the front strut and monopole, such that there is a tensile load in both of these structures. If the front strut should fail in flight, the front of the trike will drop and a rearwards bending moment will be applied to the monopole, causing it to bend rearwards at the overcentre catch location.

### **Previous occurrences**

#### *Bracket failure in flight*

In 2006 a similar incident occurred in Australia when the bracket which secures the front strut to the monopole on a Quantum 912 failed whilst the pilot was carrying out steep turns. The pilot carried out a precautionary landing. The only other damage to the aircraft was to the monopole which had bent rearwards.

The aircraft manufacturer investigated the failure and concluded that the bracket had been fitted upside down. During that investigation, load tests were carried out on two brackets: one was incorrectly fitted and the second was fitted in the correct orientation. On the bracket which had been fitted upside down the rear face started to bow when a load of 310 kgf was applied and there was evidence of cracking along the side faces when the load reached 610 kgf. Both side faces



**Figure 2**

Correct orientation of bracket

subsequently failed when the load reached 640 kgf. On the bracket which had been correctly orientated there was evidence of very slight bowing of the rear plate when the load reached 750 kgf. However, at a load of 1,100 kgf, which was the maximum that could be applied by the test rig, there was no evidence that the bracket was about to fail.

The damage to the brackets which failed during the manufacturer's testing was very similar to the damage on the bracket which failed on G-BZMI.

#### *Incorrect fitting of bracket*

Following this incident the British Microlight Aircraft Association (BMAA) was informed by one of their members that he had also fitted and flown his Quantum with the bracket orientated upside down, although on that occasion the bracket had not failed. The AAIB was informed of other occasions when individuals had incorrectly orientated the brackets on the Quantum and other models of flexwing aircraft, but it had been noted by instructors and corrected before the aircraft were flown.

**Safety actions**

Immediately following this incident, the BMAA advised their inspectors and members owning Quantum aircraft of the consequences of flying with the front strut upper bracket orientated upside down. The aircraft manufacturer is considering introducing a modification to prevent the aircraft from being rigged with the bracket incorrectly orientated.

**Comment**

The evidence indicates that the incident occurred as a result of the aircraft being flown with the bracket orientated upside down. Calculations and tests by

the aircraft manufacturer have shown that a correctly orientated bracket can sustain a load 2.25 times greater than a bracket that has been fitted upside down. When fitting the front strut it is likely that an additional tensile load was introduced into the incorrectly orientated bracket. It is probable that this additional tensile load, when combined with the flight loads, caused the bracket to fail in flight.