Pegasus/Flight Design CT2K Microlight, G-CBWA

AAIB Bulletin No: 6/2003	Ref: EW/G2003/02/14	Category: 1.4
Aircraft Type and Registration:	Pegasus/Flight Design CT2K Microlight, G-CBWA	
No & Type of Engines:	1 Rotax 912ULS piston engine	
Year of Manufacture:	2003	
Date & Time (UTC):	18 February 2003 at 1650 hrs	
Location:	Wycombe Air Park	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Nose wheel and propeller	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	47 years	
Commander's Flying Experience:	1,194 hours (of which 55 were on type)	
	Last 90 days - 55 hours	
	Last 28 days - 23 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

History of the flight

The aircraft had been used throughout the day for the purposes of training, covering a mixture of exercises including an hour of circuit flying in the morning. This flight was a short air experience flight which was conducted in the local area. The final approach to Runway 07L was made in conditions of smooth air, with 75% flap, and an approach speed of 55 kt. The touchdown was smooth, with the nosewheel being held off in the normal manner and the aircraft was slowed with the minimum of braking as the pilot intended to vacate the runway at its northerly end. Nothing abnormal was noted whilst on the runway. The aircraft was then taxied onto the grass in the direction of the parking area and, after approximately 50 metres taxing over the fairly rough surface, the aircraft suddenly pitched forward. This was accompanied by a loud 'cracking' noise and the propeller stopped after contacting the ground. The fuel and magnetos were switched off, as were the electrical services, immediately after informing the tower of the accident. The occupants were uninjured and evacuated the aircraft via the normal exits.

It was immediately evident that the nosewheel had failed and that the nosewheel forks had contacted the ground, and that this had caused the nosegear strut to be bent backwards.

Nosewheel design

The nosewheel comprises two aluminium alloy wheel halves, which are attached to either side of a centrally located steel hub by five M6 allen-head bolts. These are secured with 'Nyloc' nuts. The hub,

which contains the wheel bearing, is mounted on a 15 mm diameter plain shank bolt which passes through the nosewheel forks and forms the nosewheel axle. The wheel is held centrally between the forks by tubular spacers on either side of the hub. In addition to the holes for attaching the wheel halves, the hub also has five 10 mm diameter lightening holes which have the same spacing and pitch circle diameter as the 6.5 mm holes used for mounting the wheel, as shown in Figure 1.

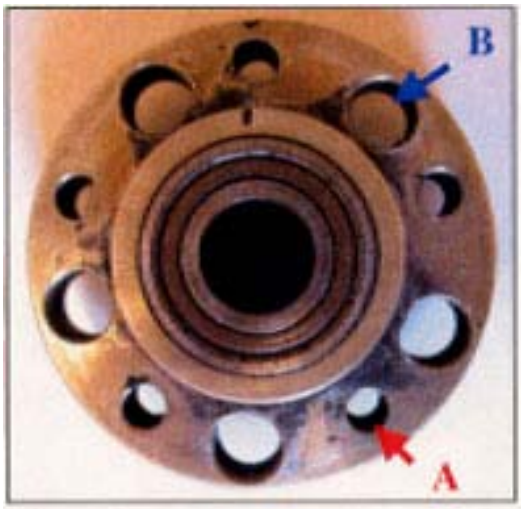

Figure 1:

Wheel hub showing wheel mounting holes (A) and lightening holes (B)

Figure 2:

Undamaged wheel half overlaid on top of hub, showing alignment of holes in wheel with holes in hub. (Alignment mark on wheel rim was made subsequently by the AAIB)

Figure 3:

Failed wheel half showing typical overload failure originating at edge of wheel mounting hole

Engineering investigation

Examination of the damaged wheel halves showed that they had been drilled with ten 6.5 mm diameter holes, the arrangement of which was such that they lined up exactly with the ten holes in the hub, as shown in Figure 2. Once the wheel halves were placed in position prior to inserting the attachment bolts, it was difficult to ascertain which were the correct holes for the wheel attachment bolts in the hub and which were the lightening holes. It was also noted that the bolts used for attaching the wheel were threaded along their entire shank, rather than having a more suitable plain shank with a threaded end, but this was not considered to have been a significant factor in the failure.

It was evident from the nature of the damage to the wheel halves and bearing hub that, during assembly, the wheel mounting bolts had been inadvertently inserted through the lightening holes instead of the intended wheel mounting holes. This meant that the wheel halves relied solely on the friction induced by the clamping force of the bolts to keep the nosewheel firmly fixed to the hub. However, this clamping force had clearly not been sufficient to prevent the wheel halves from moving relative to the hub, as evidenced by the elongation of, and the deep impressions from the threads of the bolts in the bores of, the lightening holes. The wheel halves were also heavily fretted around the bolt holes from motion of the washers as the bolts moved around in the hub. The nosewheel had ultimately failed due to overload failures in one of the wheel halves at multiple locations in the mounting bolt holes, as shown in Figure 3, and this allowed the wheel to separate from the hub.

The nosewheel had been replaced by the owner some 30 flying hours previously, following a puncture. As there are no written instructions for changing the nosewheel and, given the configuration and location of the lightening holes in the hub and the lack of any alignment markings on the wheel or hub, the potential for incorrect assembly is relatively high. Interestingly, the new replacement wheel halves had only five holes drilled in them, which reduces this potential, but still does not eliminate the risk of inserting the bolts into the wrong holes in the hub when assembling the wheel. Also, the holes in the replacement wheel halves were found to be inaccurately drilled, and it was therefore difficult to line up the holes in the wheel halves with the correct holes in the hub. These were more easily aligned with the lightening holes.

Conclusion

The nosewheel failure was caused as a result of the mis-assembly of the nosewheel. The wheel mounting bolts had been inadvertently inserted into the larger lightening holes in the wheel hub instead of the correct wheel mounting holes. Causal factors were the design of the wheel, which allows the possibility of mis-assembly, and the absence of written instructions explaining how to change the nosewheel.

Safety Recommendations

The findings of this investigation show that the design of the wheel assembly is such that it is very easy to assemble incorrectly. For this reason the following Safety Recommendation is made:

Safety Recommendation 2003-33

It is recommended that the aircraft manufacturer, Pegasus Aviation, should modify the nosewheel assembly to minimise or eliminate the possibility of incorrect assembly by insertion of the wheel half mounting bolts in to the wrong holes in the nosewheel hub.

Safety Recommendation 2003-34

Given that there are currently no written instructions available to owners on replacing the nosewheel, the following Safety Recommendation is made:

It is recommended that the aircraft manufacturer, Pegasus Aviation, should issue written instructions to owners of the CT2K microlight explaining how to correctly install the nosewheel assembly.

Safety Recommendation 2003-35

Given the fact that an incorrectly assembled nosewheel can be operated for some time before failure, the following Safety Recommendation is made:

It is recommended that the aircraft manufacturer, Pegasus Aviation, should take appropriate measures to ensure that recently replaced nosewheel assemblies have been correctly installed.