

LAA/AWA/18/08
27th September 2018

High Wing Piper Aircraft

Inspection of Rudder Hinge Assembly

Regular readers of Safety Spot will know that we've been highlighting a hinge failure incident that's recently caused the loss of in-flight rudder authority on an early Piper Cub aircraft.

What appears to have happened is that the top hinge pin, along with the tubular bushes that are normally fixed in place within the hinge's knuckle, have become loose and fallen out.

This complete failure of the top hinge assembly allowed the rudder to flail about violently, damaging the elevators and causing an overload failure of the bottom hinge; the rudder only remaining attached by the control cables.

Perhaps naturally, the investigating engineers felt that this complete assembly failure wouldn't have happened over a single flight and that the failing hinge wasn't spotted during the preceding pre-flight inspections: this suggestion was strongly refuted by the pilot who insisted that he was very diligent in this regard.

Though this was the first record of a failure like this, the failure did highlight a previously un-spotted failure mode - note that the head of the hinge pin is smaller than the inside diameter of the knuckle but larger than the inside diameter of the bush (Fig. 2), so the only thing holding the hinge assembly together is the friction in the interference fit between the bush and the knuckle; lose this friction for any reason and the hinge can eventually fail.

Fig. 3 shows a simple 'fix' that will prevent the complete failure of this assembly – a thin washer fitted to the top and bottom of the pin so that even if the bearing does become loose the hinge pin cannot fall out.

LAA Engineering has written to the owners of all potentially affected Piper types in its fleet to ensure that they all know about this failure and suggesting that, if it looks like this failure 'mode' could affect their aircraft, 'safety washers' are fitted before further flight.



Fig. 1 A pilot of a J3 Piper Cub, whilst flying in the area of Leeds East (Church Fenton) airfield, started to feel a vibration through his rudder pedals, this was shortly followed by a bang and the aircraft pitched nose down. The throttle was closed and, with heavy stick forces, the aircraft was recovered back to level flight. The aircraft landed safely soon after; the picture above shows the damage caused to the elevators after this partial loss of control incident.



Fig. 2 (Left) shows that, under some circumstances, the head of the hinge pin can be smaller than the inside diameter of the hinge knuckle, this means that the hinge pin is only retained in place by the interference fit of the bearing (not visible). Fig.3 (Right) shows a simple 'fix' which will prevent the assembly failing should the bearing become loose; note the thin washer under the head and between the knuckle and the securing split pin.