



With Malcolm McBride
Airworthiness Engineer

THE IMPORTANCE OF A GOOD INSPECTION

Finding issues before they turn into problems during flight
is at the heart of the LAA inspection programme



(Left) The new owner of a Shadow noted that the fuselage needed some attention and spent some time in his workshop getting this part of the airframe in tip top condition. When he was happy all was well, he fitted the wings and went off flying. After a few sorties he, and he's not sure why, decided to look closely at the strut/wing connection; he nearly had a heart attack when he saw this crack... a very lucky escape.

(Photo Malcolm McBride)

(Right) Taking a closer look at the failed Shadow top strut I hope that you can see that this part has been bodged by somebody in the past, notice the centre punch mark and the generally poor condition of this critical part.

(Photo Malcolm McBride)



Extract about
'Wing Strut Cracking'
from **Light Aviation**
magazine (June 2016)

SHADOW SERIES CD

I have to say, not normally being lost for words, that I've been staring at the file on this event for ten minutes. I am still flummoxed how a wing strut attachment could be cracked through about 50% of its effective diameter and not have been spotted during a number of different earlier inspection points.

You have, no doubt, looked at the pictures of the offending crack, and yes, most probably the aircraft to which this strut was affixed had been flying around like this for some while. So we, perhaps most especially the pilot, have to thank our joint lucky stars that the connection held together even though it is nearly cracked through. Perhaps the fact that it didn't completely fail is more a testament to the aircraft's excellent design rather than good inspection practice.

This particular aircraft looks to have been originally built as a demonstrator by the kit's manufacturer, Suffolk based CFM Metal-Fax. In 1987 it was shipped to Italy where it stayed for ten years. Since the aircraft's return to our shores the aircraft has enjoyed giving pleasure to a number of owners, operating with a BMAA administered Permit to Fly.

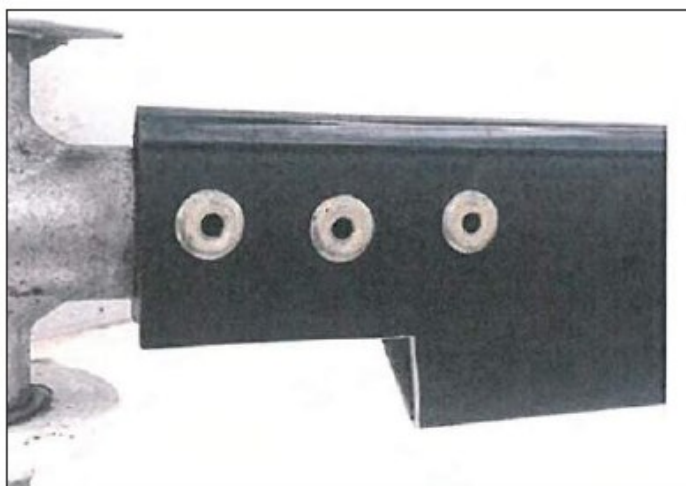
Sadly, there's no reliable airframe hours figure available, the last record being made in 2010 showing about 600 hours total time, though very recently the aircraft was converted to a single-seat machine and was therefore able to be, indeed must be, converted to a de-regulated microlight.

The SSDR (Single Seat DeRegulated) Shadow came into the possession of a very experienced and competent LAA member

Safety Spot

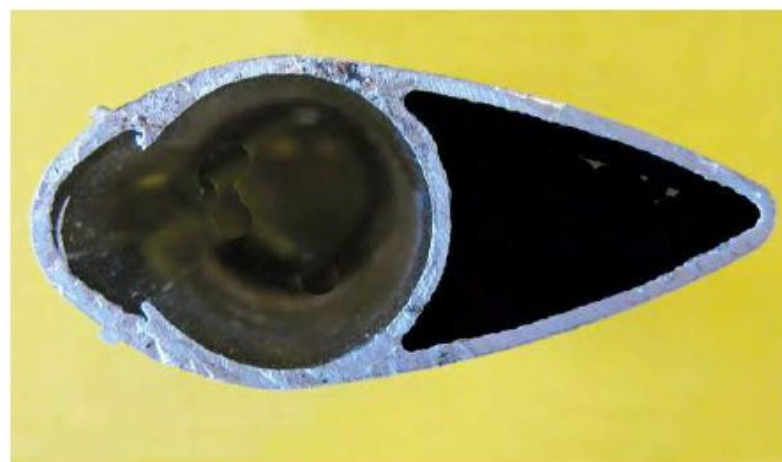
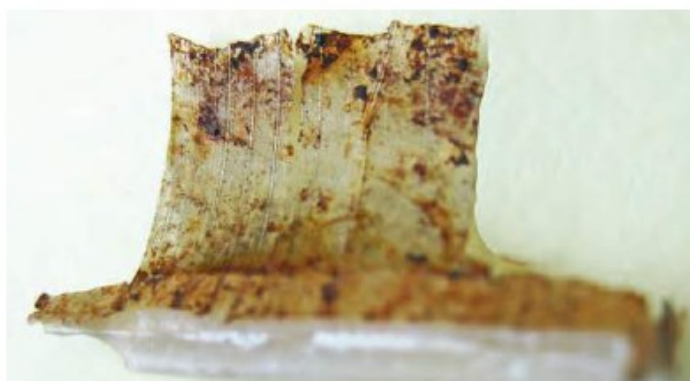
(Right) Working with Shadow expert Fiona Luckhurst and the BMAA technical office, it became clear that the failed strut had not been made to drawing. The top picture is correctly made... but notice the horribly sharp corner in the cut-out which is far from good engineering practice, especially in highly stressed areas of a component. The lower picture, from the BMAA library, shows a small crack emanating from the same, albeit slightly tidier, corner.

(Photo Fiona Luckhurst/BMAA Technical Office)



(Above and below) When we received the Shadow strut-end here at Turweston, we drilled out the rivets and dismantled the assembly. The two parts needed some persuasion to come apart but, when they did, the method of construction became clear. The pictures show the two components and the end fitting is both glued (epoxy) and riveted in place. The problem with this is that corrosion products from the steel fitting have broken the joint's adhesion over time and, because ferrous oxide occupies a greater volume, increased the stresses in the aluminium strut.

(Photo Malcolm McBride)



(Above) The Shadow strut is manufactured from an extrusion and, thinking of introduced stress caused because of an over-tight end fitting, I decided to measure the items. The picture above shows the cut end of the strut. I noticed immediately that the strut end fitting wouldn't slip inside the extrusion and measurement showed why – the inside diameter of the extrusion was 0.22 mm smaller than the cleaned strut end! *(Photo Malcolm McBride)*

who, deciding that the aircraft was a 'basket case of errors' and needed some considerable attention, set about refurbishing the fuselage.

He explained, "I have no idea why I didn't look at the wings. During the renovation I recovered the fuselage and inspected every part, replacing many items, and she looked great when I'd finished."

He continued, "I only bought the thing for a bit of fun. I have other aircraft that I can fly and was quite attracted to the fact that, as an SSDR, I wasn't answerable to anybody. I nearly fainted when I first saw the state of the wing fittings. They've clearly been bodged-up by somebody, goodness knows why they're in the state that they are. I couldn't believe that I'd failed to spot this crack before I went flying. Thank goodness that I didn't hit any real turbulence."

The LAA looks after about 60 Shadow aircraft though four machines have been modified to single-seaters and have left our continuing airworthiness system, preferring to go it alone. We've written to all LAA Shadow owners letting them know directly what's been found and have worked with the BMAA to create a BMAA Service Bulletin requiring immediate inspections. Again, there's an Airworthiness Alert on our website offering a link to the other associated information.

So, what's happened here? Well, working backwards, the aircraft had flown as an SSDR on a number of occasions post-refurb, but clearly no thorough pre-flight checks had been carried out. The owner agrees that, had they have been, he would have spotted the cracks in the strut fitting.

Back one more step, clearly the new owner should have conducted, or employed somebody to conduct, a full airworthiness review of this aircraft after its release from its period of refurbishment. As an SSDR this isn't a legal requirement but, if it were an LAA machine, then a Permit Maintenance Release (PMR) would need to have been raised by an LAA inspector before a test flight.

Any inspector, before raising this PMR, would have required sight of all the worksheets connected with the maintenance or refurbishment of the engine, propeller and airframe, including evidence of initial and

duplicate inspections of disturbed control systems.

Because the Shadow is a de-riggable aircraft and quick release devices are employed to connect the wings and tail surfaces, there is no requirement for an inspection by an LAA inspector after rigging. Perhaps this is an even better reason for having a very good pre-flight inspection before a flight after any maintenance. Personally, I've always employed a 'check twice' routine if an aircraft has been, or even may have been, re-rigged. Once to check the rig and then again to check the rest of the aircraft (including the rig!).

I am absolutely certain that these bodged fittings wouldn't have passed muster had this particular owner seen them, regardless of whether they were cracked or not. For some reason in the past, though not recorded in the airframe logbooks (not much was), somebody with no engineering knowledge at all was let loose with a drill, a junior hacksaw and a pop rivet gun.

This was a very lucky escape and the owner assures us that, even though others have decreed that this aircraft can operate as an independent, he's going to treat it just like all the rest from now on. After all, the most important things in the aircraft are the people and a crash in an SSDR is just as horrible as it would be in a bigger machine.