THE CASE OF THE EXPANDING HOLE

This month we close the mysterious cases of a Pioneer 300's oval wing spar bolt holes and the strange sounds in an RV4

THIS month we look at everything from seriously fascinating to seriously worrying; from a wonderfully inciteful and memorable day at the Rolls Royce Heritage Collection with 28 LAA members, to wondering how on earth a potentially critical problem with the wing spars of a Pioneer 300 could have occurred. Thankfully, following a meeting with our Chief Engineer, Francis Donaldson and the Chief Engineer from Alpi's design office, a bulletin has been sent to all owners regarding the issue. Read all about the discovery over the page.

Another story that reached the LAA offices started off quite dramatically, in the head of LAA member Steve Sampson. Steve was having his two-yearly flight review when he heard some worrying noises coming from his aircraft. The story ends with little more than a red face...

Rolls Royce Heritage Collection

VERY occasionally, and I mean very occasionally, I get an offer I cannot refuse. Calm down at the back, this isn't one of those articles. I talk about an offer, made by East Midlands Strut Chairman and EC member, Stewart Jackson to visit the Rolls Royce Heritage Collection in Derby. Yours truly, along with some 28 LAA members from all over the south and middle England, turned up at 09.00 sharp to take a look around Rolls Royce's Old Foundry site in Osmaston Road, Derby a few weeks ago. This visit was arranged by both Stewart Jackson and Mike Stewart, both Rolls Royce 'old boys', for LAA members with a special interest in aero engines. Mike Stewart was a Production Engineer at the Hucknall site, famous for 'special' projects.

As I drove into Osmaston Road I could feel its historic atmosphere oozing though the fresh air vents – wow, what a place! In its heyday one side of the road housed Rolls Royce Engines and the other was the domain of the Midland Railway Carriage and Wagon works. One chap told me that at it's peak, in the 1930s and 40s, there were thirty thousand employees one side of the road and the same number on the other... that's a lot of push bikes to negotiate on the way home. The Rolls Royce Heritage Trust occupies all of the Old Foundry site and contained somewhere within its walls there is an example of pretty much everything Rolls Royce Engines has produced since the turn of the last century.

We were shown around by volunteers from the Trust, all of whom were ex-Rolls Royce employees; these chaps were able to answer every question fielded and I felt privileged to be in their care.

There's no doubt in my mind that Britain's industrial base has been virtually destroyed over the last twenty to thirty years by well-meaning idiots, mostly occupied in the banking and political sectors of our Great Isle. Thankfully Rolls Royce Engines bucks this trend and, even though they have passed through some considerable turbulence, are still producing the world's finest aero engines. Thanks so much for the invite guys. I had a fantastic time and left feeling privileged, and proud to be involved in British aviation.

Rolls Royce-engineering at its very best

LAA members enjoy a day at The Rolls Royce Heritage Collection

Zenair wing attachment issue solved by Chief Engineer on his drive to work

PHOTOS www.airteamimages.com

Engineer in Zenair epiphany

REGULAR readers will recall that the Zenair CH601XL has been grounded in the UK since the end of last year due to concerns about wing flutter leading to structural failure. LAA's flight tests with a modified example have now borne fruit – CAA has agreed to the LAA findings and by the time this magazine hits your doormat, all Zenair CH601 XL owners will have received full details of how their aircraft can be cleared for flight again. I will leave it to Francis to give you the full story on this, as I'm off on my summer hols, hopefully taking my boat across 'La Manche'.

In closing though, two lasting memories from this Zenair project. Firstly, Francis coming in one morning saying he'd been thinking about the Zenair wing attachments during his forty minute daily drive to Turweston, and had an idea that a particular pair of bolts might be overloaded at high G due to a couple of hitherto unforeseen effects 'stacking up'. He had worked out the load in these bolts and the strength of the fittings roughly in his head and found not much, if any safety margin. This was the trigger that set our Contract Design Engineer, Nigel Bamber, off on a long train of detailed investigation which eventually resulted in a meeting in Paris with the designer, Chris Heintz, and LAA reinforcements to the structure. Which just goes to show there are some benefits from the daily commute after all – the Chief Engineer gets a chance to ponder on things and practise his mental arithmetic.

Secondly, the excitement in the office when the first sets of accelerometer plots from the flutter testing came up on Nigel Bamber's lap top, showing us just what was going on, including Fourier analysis revealing all the components of the complex vibrations of the Zenair's wing. There was a gaggle of enthusiastic Engineers craning over the screen firing opinions aplenty. Very interesting stuff, and a great example of LAA Engineering in action, supporting owners in keeping their flying safe.

Steve Sampson has a headset emergency

I RECEIVED an interesting email from LAA'er Steve Sampson the other day. Steve read last month's Safety Spot ('How things stack up') where I talked about changing the operating environment by changing headsets.

Let me, or rather Steve, explain: "I had arranged for my two yearly flight review and flew up to meet the examiner. We were well along with the review when I heard a worrying noise. I blurted: "Did you hear that?!" with some degree of concern. My immediate thought was that I had lost something on the air intake side or perhaps an exhaust tail pipe. We had some height, and the nearest airfield was where we had started from, so on very low power I turned towards it and started to coast down hill.

All the way back I was puzzling what was wrong. Imagining flames in the lower cowl, but no smell, I commented "...more vibration than usual," thinking perhaps the spinner had thrown a screw, though puzzled how it could create such a sense of noise and vibration. Every gauge was exactly as it should be. The examiner was aware I was genuinely concerned but said he was a stranger to an RV4 and his hearing was past TBO.

'My immediate thought was that I had lost something on the air intake side'

"To cut the story short I put it nicely on the grass and looked and looked and looked. Nothing. I decided to do run ups and see if all was as normal and at this point as I turned on my newish Beyerdynamic headset and realised the batteries were on their way out!

End of problem. Yes, a different noise cutting in and out, but no vibration except in my imagination. Whoops!"

Thanks Steve for taking the time to write into Safety Spot. And the gumption to admit such a 'user error'! The problem of changing the battery in a headset is rather swamped by the problem that the owner of a Pioneer 300 I went to look at the other day had. Turn over for the full story...

SAFETYSPOT

With Malcolm McBride
Airworthiness Engineer

A worrying problem found with Pioneer 300 spar plates

LET me start this tale from the beginning. I received a telephone call from a very worried inspector, Simon Westley, who had removed the wings of a Pioneer 300 in order to transport the aircraft to his workshop and fix a damaged nose gear assembly. When he took the main spar bolts out he was surprised to find that the drilling was a little less than Rolls Royce quality. Concerned that this might indicate a serious safety problem with one of our most popular kits, I took a ride over to Simon's strip near Cranfield with Francis Donaldson, the Chief Engineer, to take a look.

We were so worried by what we saw that we immediately contacted the agent, Frank Cavaciuti, to find out what could have happened. He got in touch with the design office at Alpi who sent over their own Chief Engineer, Corado Rusulan, to have a look.

Corado found it difficult to see how this damage could have occurred. He explained that the holes in the spar plates were jig-drilled to very high tolerances at the Alpi factory and that the company also trial-fitted all wings and spar plates before the kits are released, so there was no reason for the holes to have been interfered with.

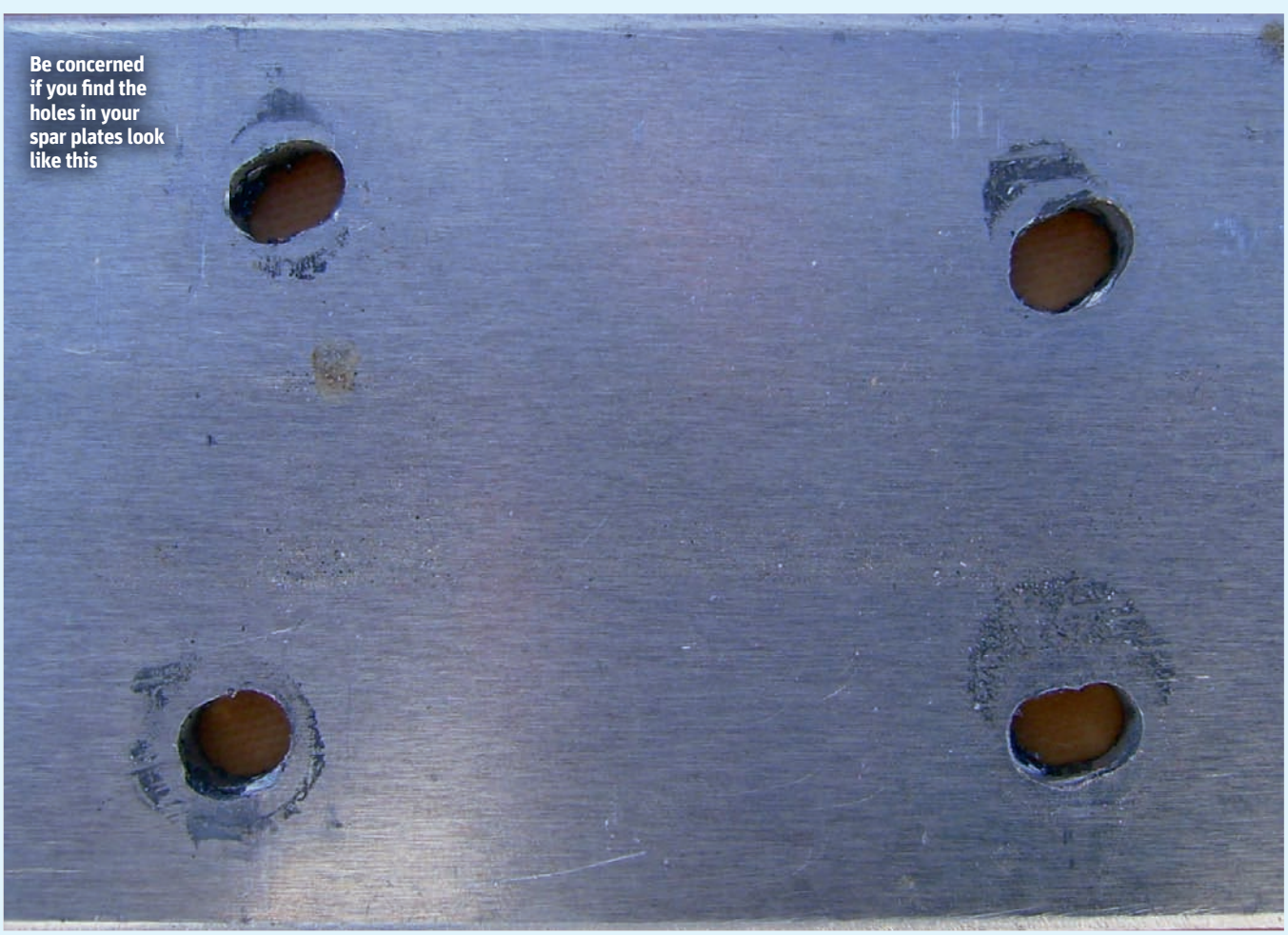
As it transpired, some owners have found the wings a tight fit and difficult to push fully into place so that the factory jig-drilled bolt holes lined up. Incredibly, some have solved the problem by pushing a drill through the bolt holes to 'stretch' the holes rather than devising a means to pull the wings that last smidgen into the proper place.

This is an absolute no-no with critical aircraft structures. Bolt holes must be round, the right size and free from stress-raising burrs. Bodging a hole means that bolts in a group will not carry the load evenly, some may carry more than their fair share of the load causing them to break, subsequently overloading the remaining bolts, which in turn will also inevitably fail if the situation is not dealt with. This is what's called a 'zip-fastener' type failure. Alternatively cracks may start to manifest in the plate under tension due to the stress concentrations caused by the burred holes. These will grow quietly in length until one day the plate will fall in half and the wings separate from the fuselage.

'Bodging a hole means that bolts in a group will not carry the load evenly'

When this came to light, we in LAA Engineering were so concerned about the safety implications for other Pioneer 300s that we had to invoke the Instant Airworthiness Response procedure. This allows us to issue a mandatory bulletin in a matter of days rather than waiting to discuss the matter at one of our monthly Airworthiness Review Meetings when all the Engineering staff chew over a batch of airworthiness issues at length. A bulletin was sent out to all owners straight away requiring urgent inspections of the wing spar plates and replacement of any that had been mis-drilled. As a result, several more cases came to light. Luckily, replacing the plates is not too difficult or expensive a job.

If you ever find yourself poised with drill in hand, about to match up two holes that don't line up, STOP! Put the drill down, step away from your aircraft, have a cup of coffee, figure out why the holes aren't lining up (especially if they did before) and consider how you should cure the disease rather than just treat the symptom. Bolt holes must be round, not oval. Never rely on the bolt clamping up an airframe joint, it's the shank in the hole that does the job.



Be concerned if you find the holes in your spar plates look like this