



Safety Spot  
By Malcolm McBride

# SPORTCRUISER NOSELEGS, GROPPO TRAIL WING-BOLT LIFE & RV-9/RV-10, CH 601 UL AND EV-97 TAILPLANES

The latest LAA Engineering topics and investigations

**H**ello again and, as always, the warmest of welcomes to this edition of *Safety Spot* – naturally, I hope that you and those that help to create the framework for your life are in good order, or at least not too dishevelled after the awful period of weather we've all suffered. Saying that, one of our Association's more affluent members, who enjoys a second home in Florida, recently returned to the UK moaning that over the – normally lovely – US winter, he wasn't able to enjoy two days together without rain. He needed a dry spell to paint his shed, so it wasn't just us hunkering inside with our noses pressed up against the windowpane, thinking of balmy conditions!

I've just put down my copy of the Stampe Club newsletter, which arrived this morning. It's a very welcome and enjoyable quarterly which, like this edition of *Safety Spot* (and, perhaps, too many conversations), starts with the weather...

If the Stampe Club newsletter is to be believed, "Apparently, a less stormy pattern will take hold over western Europe over the next few months, allowing unseasonable warmth to build from Spain into France and then up into northern Europe."

Rather cheered by that news, I continued reading: "In fact, long-range forecasts talk about unusually warm weather."

With that, my mood improved still further and I thought it a good time to get on with my day job, and start filling up a few pages with some of the continuing airworthiness tales that cross our desks here at LAA HQ.

As usual, when it comes to assembling *Safety Spot*, the first thing I put together are the pictures and their captions – yours truly finds that this is a good initial exercise, as it forces me to focus my otherwise rather wayward mind. The pictures normally form part of an airworthiness 'event' file so, at the end of this exercise, I end up with a pile of them, and that's where I am now.

This month I'm amazed to see that I'm confronted with six individual *Safety Spot* case files – a thicker pile of paper than normal, it must be said. Firstly, perched on the top, rather precariously, there's a very thick file which contains much of the history of the problems that some LAA SportCruiser owners have suffered with the noselegs on their aircraft. Now, we've chatted in *Safety Spot* about this subject many times before, so I can be fairly brief in this edition. I'll just describe what we've put in place to, hopefully, reduce the risk of future problems.

The next file down? Well, that's about a change in the way that LAA Engineering mandates the life of a critical bolt in the wing



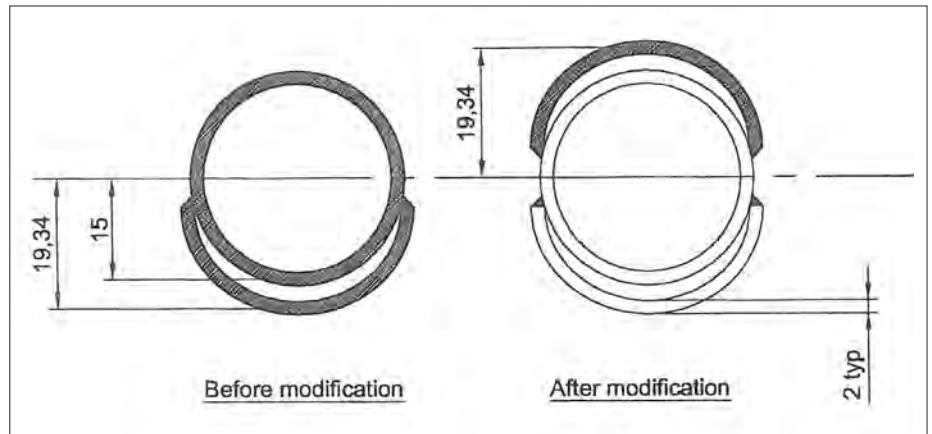
(Above) This is a sight that no aircraft owner wants to see. This failure of a noseleg on a SportCruiser is one reason why the LAA has brought the issues surrounding the design and maintenance aspects of this component out of the locker and back onto the table. Luckily, the noseleg failures we've suffered on LAA SportCruisers haven't led to any physical injury but, as we've learnt from other types, when it occurs there can be serious consequences. The LAA has recently issued a comprehensive Airworthiness Information Leaflet (AIL), listing the approved components and formally laying-out the maintenance/inspection rules for SportCruiser noselegs.

(Photo: David Pitt)

attachment system on a Groppo Trail – during this investigation we came up with a couple of gotchas so it's worth passing on. Next, there's the sorry tale of an un-split-pinned control nut on a EuroStar. And finally, a recent *Bulletin* from Van's alerting us to a potential situation where the elevator on post-2012 RV-10 aircraft could jam. The next three files are, meanwhile, pretty much, about tailplanes and control systems – there's a story about smoking rivets on another Van's type, this time an RV-9, and a very similar tale involving a Zenair CH 601 UL – what a 'happy accident', I can turn six files into three stories!

## SPORTCRUISER NOSELEG: MANDATORY INSPECTION

Our attention has recently returned to the management of the issues surrounding the noseleg on SportCruiser aircraft, following a failure on a Piper Sport (PS) Mk I belonging to a member. It was very worrying that this particular aircraft had been well maintained and the noseleg itself was being managed using the recommended 25hr close inspection schedule so, strictly speaking, it shouldn't have failed. You'll have read all about this in the April edition of *Safety Spot* which, >



(Above & above right) This picture and the drawing show what LAA Engineering considers to be the 'gold standard' SportCruiser noseleg. Effectively, it's an original CZAW design that's been 'improved' by changing the design of the spindle housing (plus increasing the size of the spindle itself) and adding a strengthening strap along the top of the leg. The spindle change is mandatory on all UK SportCruisers, but the leg strengthening, because the failure mode is a slight bending (set) of the leg rather than catastrophic, is just highly recommended. (Photo/diagram: Feroz Wadia/Tony Palmer)

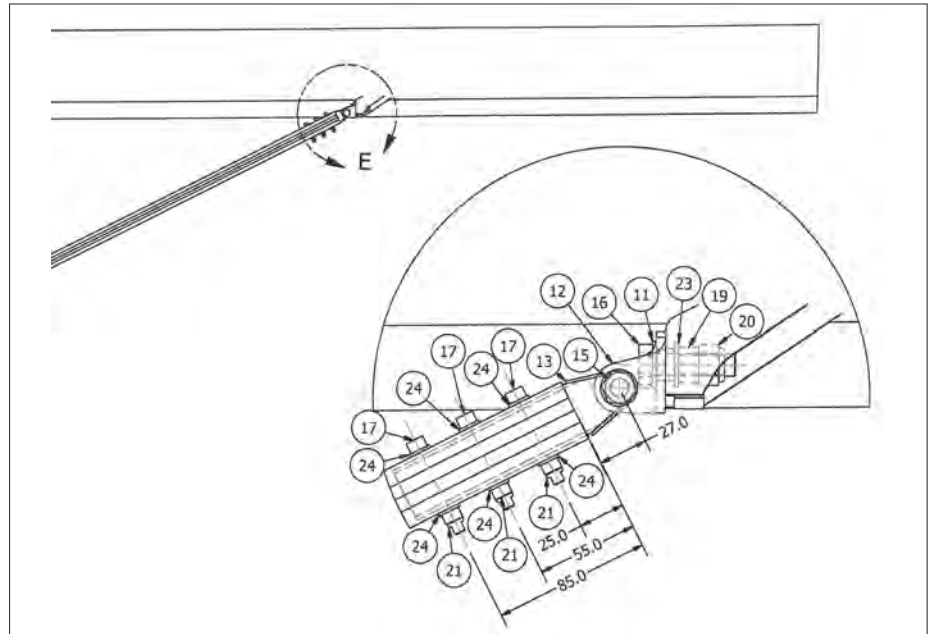
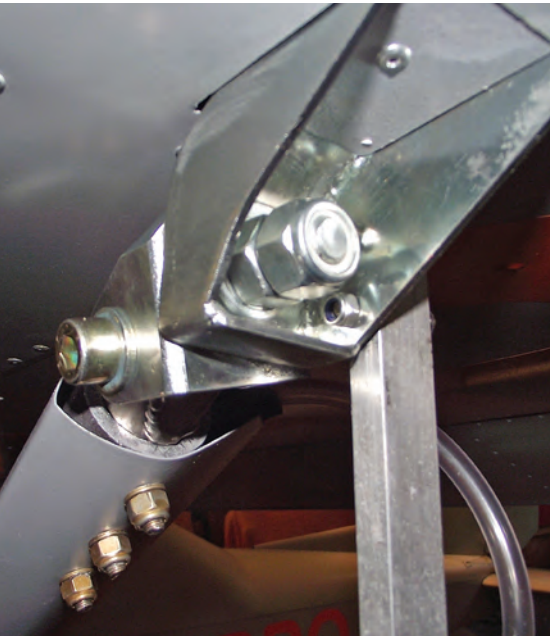


(Below & bottom) LAA Engineering recently wrote to all operational SportCruiser owners, asking them to let us know what type of noseleg, and the respective modification state, was fitted to their aircraft. At the time of writing, just over fifty per cent of owners have responded, which isn't particularly healthy, taking into account the importance of the subject. Nonetheless, our letter has generated a sufficient data for us to make what we hope are sensible and proportionate changes to the noseleg system and required maintenance instructions. The first picture shows a nose undercarriage spindle – effectively, the hinge-pin between the nose leg itself and the nosewheel fork. Notice the horrible, and dangerous, corrosion this component has suffered. The second picture reveals why this type of surface corrosion, which will include pits, is so dangerous – the micrograph shows a crack crossing between two tiny pits, and eventually this will lead to a component failure. This type of cracking, often occurring deep inside a metal structure, is sometimes described as Stress Corrosion Cracking (SCC). (Photos: Martin Ferrid/David Hoepfner)

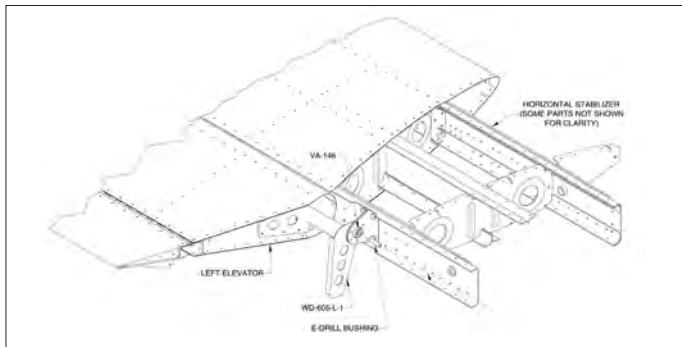


(Above middle & above) The first picture shows another perennial problem with the SportCruiser nose leg assembly – you can see the residue from the Inspector's dye penetrant test, though the crack itself is easy to spot. The second picture, meanwhile, shows a prototype 'three-leafed' alternative, which has now been approved by the LAA. The problem of cracking around this attachment has been known for some time and regular inspections have been mandated by an AIL. Although we expect this redesigned fork to be far more robust than the original 'two-leaf' component, the updated AIL covering the SportCruiser's noseleg issues still requires regular checks to be carried out. Note that the 1/8in rivets holding the leaves together are sequentially replaced with a combination of bolts and 5/32in rivets during final assembly, before fitting. (Photos: Graham Smith/John Tiley)

## SAFETY SPOT

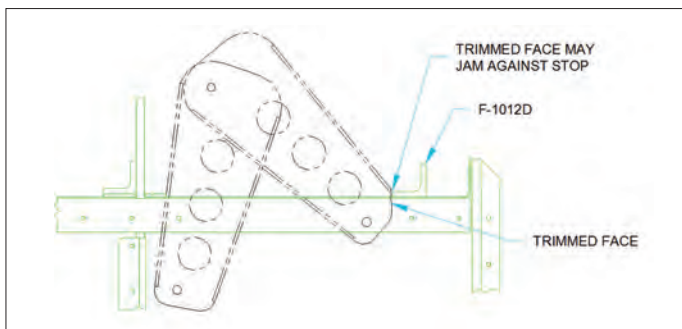


(Above & above right) Over the years, there have been many attempts at designing a quick and effective wing-folding system for sports aircraft. The first sensible system I came across as an engineer was that used on the de Havilland DH60 aircraft – I remember being very impressed by the ‘mechanics’ of the system but did wonder about the change in load paths between the folded wing and the fuselage connections. Though generally not used all the time, a wing-folding system can be a good idea but, as with most design solutions, there are both up- and down-sides. These pictures show the wing-to-wing strut connection on the folding-wing Groppo Trail – you’ll probably need to refer to them when you read the main text about the Groppo Trail, which discusses the reasons why we’ve changed the management of this component’s life. (Photos: Graham Smith/LAA Library)

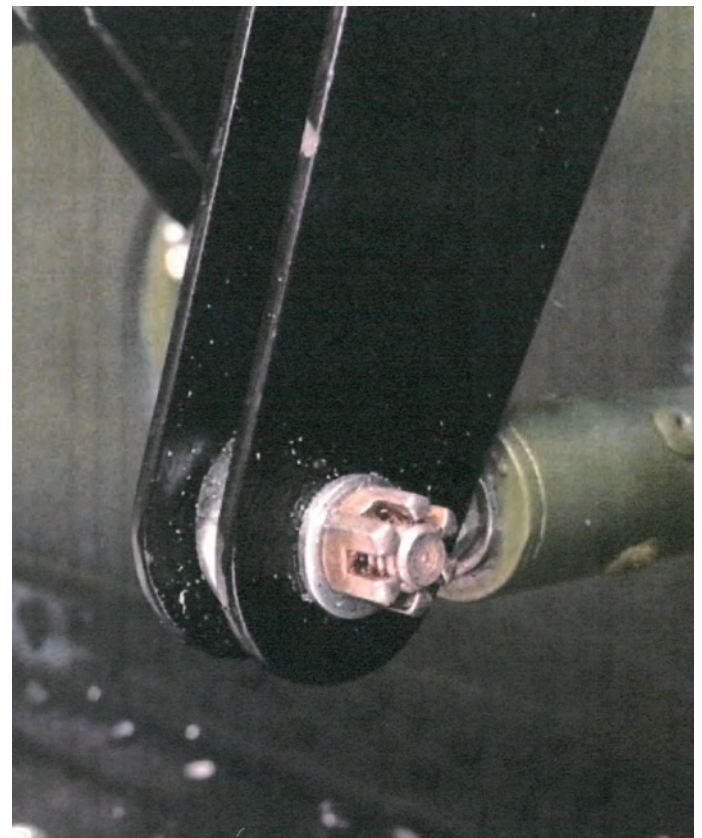


(Below) LAA Inspector, Toby Wilcox was carrying out a fairly extensive set of repairs on an accident-damaged EV-97 EuroStar when he came across this elevator connection with a nut and bolt that wasn’t split-pinned. Actually, there were quite a few other control system issues with this airframe and Toby felt that the previous annual inspections couldn’t have been very thorough. Toby points out that, if you’re signing for a job, must make sure you complete it. A control system inspection is just as it says, an inspection of the control system, including the attachments, fittings, connections, cables, fairleads and ranges. Yes, it’s a long list, but of the many things that can go wrong in an aircraft during a flight, a control system becoming disconnected has to rank as one of the worst.

(Photo: Toby Wilcox)



(Above middle & above) Engineering has recently written to the owners of LAA-administered Van’s RV-10s, letting them know that the manufacturer has issued a *Service Bulletin*, asking owners of examples built after 2012 to check that the elevator on their aircraft can’t accidentally jam. The problem arose because the design of this part, which is common to all Van’s types, was changed in 2012 by removing the lower aft portion of the elevator horn. On other types this portion of the horn restricted elevator movement, but with the RV-10 it’s possible that it could create a jam (see drawing above). This is just the sort of issue which should be ‘looked-for’ during an inspection of the control systems on any aircraft, and one of the reasons why most aero engineers would consider it impossible to completely check a flight control system without a competent assistant (sometimes two!). (Images: Van’s Aircraft)



as I expect you know, can be downloaded from the 'Alerts' section of the LAA's website.

In brief, we've seen problems with SportCruiser noseleg assemblies since the aircraft was first introduced – the first issue that surfaced related to a number of spindle failures. As you can see from the pictures, the spindle is effectively the hinge-pin or pintle, around which the wheel and fork assembly rotates. It was clear that the failures were due to the spindle (pin) being subjected to hidden corrosion within its housing.

This spindle situation was further complicated because of a misunderstanding in the kit instructions, as owners thought that the pre-assembled noseleg had been correctly lubricated and pre-loaded by the manufacture. That wasn't the case and many noselegs entered service without any lubrication or corrosion protection, as well as incorrectly pre-loaded – a surefire route to disaster.

After much work by the UK's SportCruiser agent, LAA Inspector Graham Smith, a modified spindle assembly was designed, manufactured and introduced. This modified spindle assembly became known as the 'Dover spindle mod'. One other group devised a similar modification and an aircraft was fitted with this redesigned spindle – this second design became known as the 'Derby spindle mod'!

In short, all of the suspect spindles were removed from service and, so far at least, we've not seen another failure. Although the original CZAW noseleg still stands up well, over many landings, owners have noticed the leg itself bend slightly, a situation which can be prevented by adding a strengthening strip along the top surface of the leg. The LAA has now turned all these changes into a series of *Standard Modifications* which can be made without HQ consultation.

An alternative approach authorised by LAA Engineering, and taken by a few SportCruiser owners, was to completely replace the leg with an uprated, EASA-approved, factory-supplied assembly. This leg has become known as the PS Mk I leg but, unfortunately, in few instances, it has also subsequently failed. The mode of failure in this leg, as described more fully in the April edition of *Safety Spot*, involves a failure of the weld joint between the leg and the spindle housing.

After due consultation, it's now been decided that this type of leg must be withdrawn from service and, meanwhile, require regular pre-flight inspections with the spat removed. Fortunately, the PS Mk I leg has been redesigned by the manufacturer and is now badged as the PS Mk II. As a factory-approved component, LAA Engineering has accepted this Mk II leg as an approved replacement on the kit-built aircraft in our fleet.

We've created a *Safety Alert* listing the new rules-of-engagement regarding noselegs as fitted to LAA SportCruisers (*LAA AWA 18 03 – CZAW SportCruiser – Noseleg*) and have mandated the required changes using an *AIL*. The *Alert* can be found in the Engineering section of the website (look for ALERTS) and a link to the specific *AIL* in the SportCruiser TADS in the 'Aircraft Datasheet' portion of the Engineering section of the website.

Although there can be no question that there were design flaws in this noseleg assembly, it'd only be fair to say that ineffective maintenance and inspection

practices have played their part in the failures we've investigated. Also, it must be remembered, by owners of all aircraft fitted with this type of noseleg design, that it's easy to damage the assembly by asking too much from it. Pilots who learn to keep the nosewheel off the ground for as long as possible, both during take-off and landing, seem to keep clear of expensive trouble. Also, this type of castoring-fork avoids the complication of a steerable nosewheel but, especially with heavy-footed, asymmetric braking, the point loading can be very high. Just recently, I saw a chap here at Turweston with one foot hard on a brake and the engine revving nearly flat out, all in an attempt to line up with a parking slot – "expensive", I thought.

### GROppo TRAIL: WING ATTACHMENT BOLT LIFE

During your – hopefully, fairly regular – perusal of the LAA website's ALERTS page, you'll doubtless have noticed we've added an *Alert* which offers a link to an *AIL* which changes the way that the Groppo Trail wing attachment bolts are lifed. I expect that, if you aren't a Trail owner or aficionado, you'll be thinking, "Well, I didn't know that they were!" Normally, this sort of type-specific detail doesn't warrant a public broadcast, the information remaining within the realms of the LAA Inspectorate and, naturally, the type's owners. However, in this case, there are lessons lurking in the shadows.

At this point it might be worthwhile for you to look at the picture and drawing of the wing-to-wing strut connection (*opposite page, top*), so you can get an idea how the designer of this fabulous, light-tandem, two-seat, high-wing monoplane, Nando Groppo, arranged its clever wing-folding system. We've got 24 of these aircraft on our books – 17 flying and the rest still under construction. The importer of this Italian kit, LAA Inspector Graham Smith, explained that he's actually sold thirty examples, although he knows that some of them still remain boxed – we look forward to helping to get the unused parts morphed into something that flies!

The original kit design fell short of the CS-VLA requirements in a number of ways and our Chief Engineer, Francis Donaldson, worked closely with Nando and Graham to modify the UK prototype so it could meet the very high standards required. All the mods requested were integrated into the design, the prototype received its first *Permit to Fly* in 2012, and the aircraft type has enjoyed an excellent safety record since then. Following the Type Acceptance programme, one thing that remained troubling, from a design/Certification engineer's perspective, was the unusual load paths through the wing-fuselage strut assembly caused by the wing-folding system. The wings on the Trail can fold flat alongside the fuselage, which is useful as it allows trailer transport and reduces the hangarage footprint (and, possibly, cost).

One bolt in particular caused concern – this is marked as No 16 in the drawing. If you can picture the wing-to-strut joint, in your mind's eye, you'll see that to afford the wing rotation to the vertical position and then rearward fold-back, the joint needs to be free to rotate about two axes. And the normal flight loads through bolt No 16 are, in effect, trying to rip its head off – that isn't a technical

description, but I hope you can see what I mean. For that reason, at the time the Trail was first cleared by the LAA, this bolt was given a very conservative in-service life of one operational year, simply as a means of allaying any concerns in this area and allowing the Type Acceptance process to proceed unhindered.

Certainly, it's true that calendar life is an important factor in all things – after all, we live and work within a universe where entropy rules – but the technical worry over this particular joint centred around local fatigue, particularly between the bolt's head and shaft. Fatigue is quite a difficult thing to predict, but it's well known that, with a fluctuating load, the closer to the material's limit-load parts are required to operate, the fewer fluctuations they'll be able to resist.

Further consideration has now been given to this bolt so, with a good dose of safety factor, its life has now been re-defined as 200 flight hours, subject to a special check, at the initiation of this life, that the bolt is new and has been properly installed.

"Why all that work," you may be thinking, "surely this is just an inexpensive bolt, why not just change it?" Well, that's a good question, but I'll end this short story by making a simple statement, namely whenever you interfere with a properly installed part you introduce risk. Of course, that doesn't mean you shouldn't conduct maintenance, there's a risk in everything, but why introduce it when it isn't necessary to do so?

What stimulated our design chaps to re-evaluate this joint wasn't just the steady stream of moans from owners who'd only completed a few hours but reached the bolt's previous calendar limit. Rather, it was one scary report about an annual bolt change which had led to the assembly being put back together with the new bolt incorrectly installed. Had it not been spotted, this incorrect re-assembly could've led to a catastrophe. We live and learn.

### VAN'S RV-9 & RV-10, ZENAIR CH 601 UL AND EV-97 EUROSTAR TAILPLANES

So, what have all the aircraft featured in this rather long heading got in common? Yes, it's problems with their tailplanes. The issues raised in the individual events, discussed under the relevant attached pictures, all happen to involve tailplanes but, when you think about it, the relevance of the stories could easily be extended to any part of the airframe – and perhaps, with a bit of give, even the powerplant installation.

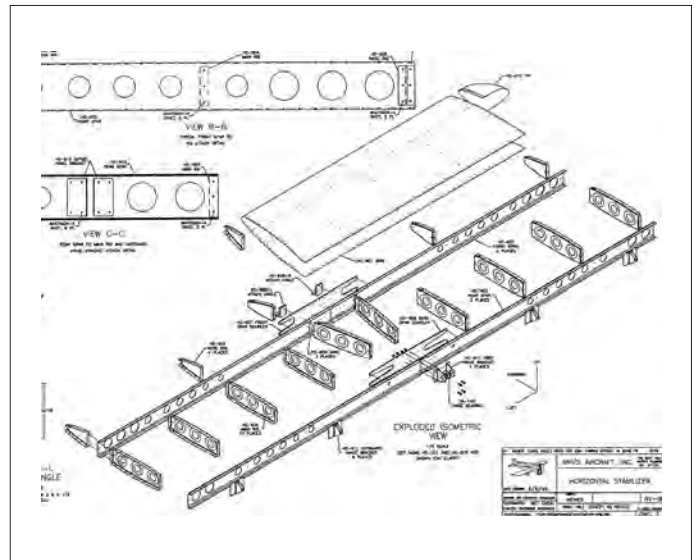
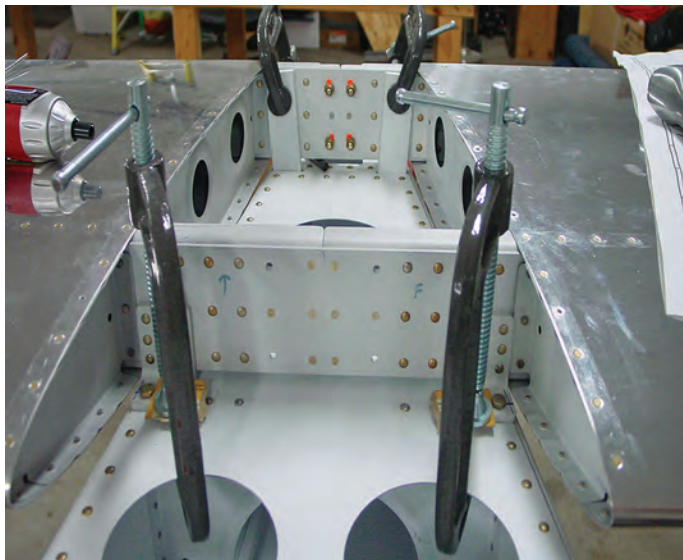
Let's work backwards along the list that's pretending to be a section sub-heading. I've made the point under the picture of the 'unsafe' elevator control attachment bolt that if you, as the owner, or the aircraft's Inspector, are signing for something, then it's essential you're one hundred per cent sure that 'what you're signing for' exists in reality. Toby, who works with Roger Targett in his hangar at Nymphsfield, came across this scary find while repairing a damaged EV-97. Personally, I can't think of anything worse than losing an elevator control while flying an aircraft – controlling the pitch using the longitudinal trim might be okay, in theory, but, well, I'm sure you get the point...

This failure occurred because a series of errors – perhaps oversights – have 'lined up the holes in the cheese'. Firstly, at the point

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*(Left)* What's this? I'll give you a bit of spatial assistance: imagine that a green RV-9's tail is on a trestle in your hangar and you, the viewer, are looking at the junction between the tailplane and the rear fuselage – any help? LAA Inspector, Nick Seymour, who quite rightly doesn't like the owners of aircraft in his camp to clean their machines before they're presented for their annual inspection, immediately realised these marks indicated that all isn't wasn't as it should be, regarding the joint between the tailplane and the fuselage. Engineers sometimes describe this staining as the joint 'smoking' – most likely, the bracketry has come loose and the metal surfaces were rubbing together. Of course, this is a sign of a problem which must be investigated so, if you see any signs of 'smoking' on your aircraft, don't just wipe off the evidence, check out the mechanics of what's actually going on. Well, where there's smoke... *(Photo: Nick Seymour)*



*(Above & above right)* These pictures of the centre section of a Van's RV-9 should orientate you still further. This time you're looking at the centre-section of a tailplane during its construction – though the clamps are rather in the way I hope you can see the two tailplane attachment brackets riveted to the tailplane's main spar. *(Photo/image: US Builder 'Josh/Vans Aircraft)*



*(Left)* After removing the RV-9's tail, it was clear that the riveted joint attaching the tailplane attachment bracket to the spar had come loose and that was the reason for the joint 'smoking'. This picture shows the elongation caused by the fretting between the loose rivets and the structure of the spar. It may be that oversized rivets will need to be used during re-assembly, but before this design change can be incorporated as a repair it'll be necessary to contact LAA Engineering to check on the correct procedure as, from a design point of view, this might be more complicated than it may seem. Note: Also see the 'smoking' between the spar's forward flange and the fuselage skin – it looks like another part of the structure is showing signs of movement. *(Photo: Ian Dunn)*

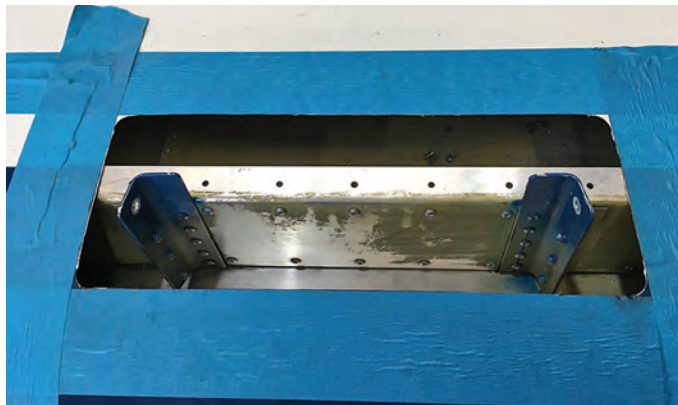
of initial assembly, there's the initial control inspection, then there must be a second independent inspection (sometimes called the duplicate). The point is that two people should've checked this attachment if it'd been in any way disturbed, and clearly this wasn't done, which isn't good. Secondly, this aircraft must've been Inspected for its annual Permit renewal, and that requires a complete control check – again, signatures are required.

We aren't expecting to hear we've an RV-10 fitted with a potentially jammable elevator, even taking into account the above, although it must be remembered that, during normal maintenance checks – especially of the 'panels-off', annual variety – an Inspector should watch the control's individual components operating through their range, ideally with an assistant simulating flight loads. That should take three people. If you really want to be sure the attachment fittings are all in really good order. Wiggling the controls and ticking the box doesn't constitute a full control system check.

Well, what's interesting about the RV-9 and the CH 601 story? Both issues involved the structure of the aircraft starting to show signs of distress and although they weren't shouting out loudly, astute and diligent Inspectors picked up the earliest signs of trouble – well done to them. Also, although this may put the cat amongst the pigeons, both aircraft had recently been sprayed with ACF-50.

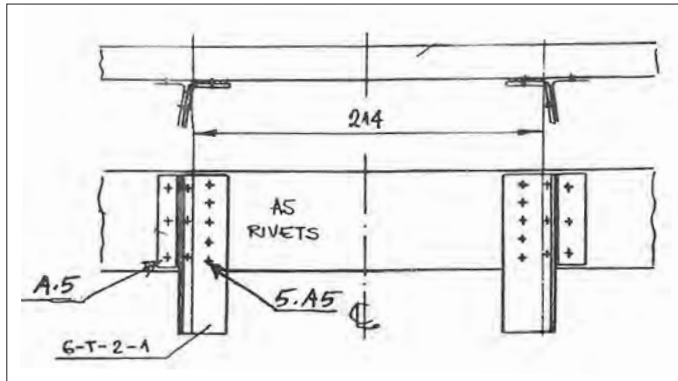
Interestingly, both owners said that they might've gone a bit 'over-the-top' with the amount they squirted into the airframe – could the penetrating and lubricating properties of this corrosion-preventer be allowing riveted structures to loosen? I don't know, but it's certainly a point to consider when deciding how much to apply. Fair winds... ■

(Right) This Zenair CH 601 UL two-seat microlight looks absolutely first-class, though built in 2002 and with just over 1,600hr on the clock, it'll be necessary to include regular 'deep' inspections to ensure it stays looking this brilliant. LAA Inspector, Neil France, noticed that the tailplane felt 'different' one side from the other, so he asked the owners to take a closer look. (Photo: Wikimedia)



(Left & below left) The tailplane attachment fittings on a Zenair CH 601 UL can be inspected via a small cut-out in the tailplane's top skin, but it's impossible to replace suspect rivets through this tiny orifice. Once it had been established that the reason for the excess asymmetric tailplane movement was due to a number of loose Avex rivets, a 'factory-approved' access panel had to be cut out.

(Photos: Neil France/ LAA Library)



**LAA ENGINEERING CHARGES – PLEASE NOTE, NEW FEES HAVE APPLIED SINCE 1 APRIL 2015**

**LAA Project Registration**

Kit Built Aircraft	£300
Plans Built Aircraft	£50

**Issue of a Permit to Test Fly**

Non-LAA approved design only	£40
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**Initial Permit issue**

Up to 450kg	£450
451-999kg	£550
1,000kg and above	£650

**Permit Renewal (can now be paid online via LAA Shop)**

<b>Up to 450kg</b>	<b>£155</b>
<b>451-999kg</b>	<b>£200</b>
<b>1,000kg and above</b>	<b>£230</b>

**Factory-built gyroplanes (all weights) Note: if the last Renewal wasn't administered by the LAA an extra fee of £125 applies**

**Modification application**

Prototype modification	minimum £60
Repeat modification	minimum £30

**Transfer**

(from C of A to Permit or CAA Permit to LAA Permit)	
Up to 450kg	£150
451- 999kg	£250
1,000kg and above	£350

**Four-seat aircraft**

Manufacturer's/agent's type acceptance fee	£2,000
Project registration royalty	£50

**Category change**

Group A to microlight	£135
Microlight to Group A	£135

**Change of G-Registration fee**

Issue of Permit documents following G-Reg change	£45
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**Replacement Documents**

Lost, stolen etc (fee is per document)	£20
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Latest SPARS – No 17 April 2018