

SAFETY SPOT



With Malcolm McBride
Airworthiness Engineer

HIDDEN DEPTHS

SOME PROBLEMS ARE BURIED DEEPER THAN OTHERS, IT'S IMPORTANT TO CONSIDER THIS IN YOUR TAILORED MAINTENANCE SCHEDULE

Welcome to the April 'Safety Spot', I hope you are in fine form and are happier now that the length of the day exceeds the length of the night. I know that most people would put spring on the top of any list of favourite seasons and who can blame them, the world is full of new life and I shall just wiggle my arms a bit in anticipation... there's every chance that the weather's going to be flyable soon.

There can be no doubt though that it's difficult at the moment to find anything much to smile about and this feeling of doom is not reduced by the newspapers (and the TV... and the Radio...) letting us all know the hows and whys of, in their view, the fact that the world is falling apart and everything is horrible. I'm very glad to say that, in general anyway (judging by the numerous conversations I have with many of you), LAA aviators seem to see things slightly differently; there's an awful pleasure in performing a perfect landing (is there such a thing?) or creating the perfect scarf joint in a section of ply... little successes.

It's amazing really just what can bring you down and, conversely, cheer you up. Take last night for example; I had to attend a rehearsal for a musical thing I'm involved in. I arrived at the venue as a small dance troop was just finishing. Some of the members of this troop appeared very young, perhaps six

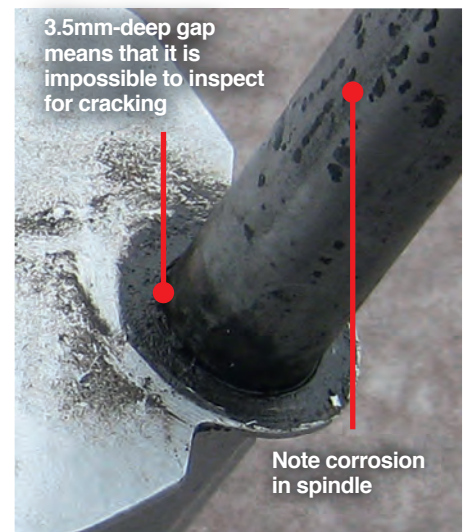
or seven, and I happened to eavesdrop on a conversation between a couple of these younger dancers. I have to say that I wasn't in the best frame of mind, perhaps 'grumpy old git' would be an accurate description. One lass said to her friend, "Well, thank goodness that's over, what are you going to do later." The younger one replied with an unsettling confidence. "Mm, I'm going to have some chocolate, then I'm going to watch the Simpsons, then I'm going to have a good stretch..." My gloom disappeared like a sudden dawn and I've been smiling ever since. Lesson one, often forgotten, keep it simple!

In last month's 'Safety Spot' I featured an Alert, issued by the American FAA, concerning corrosion in steel tubular airframes; thanks to all of you who took the time to send me better pictures of problems you've had like this. Certainly, some of our aircraft are getting pretty old now and whilst they might look pretty good on the outside it is certainly worth building in a 'deep' inspection every few years... my recommendation for this would be every three years but, if you own an LAA Permit aircraft you automatically become the aircraft's maintenance manager so the 'whens and wheres' is a decision you'll need to discuss with your inspector when you create your Tailored Maintenance Schedule (TMS).

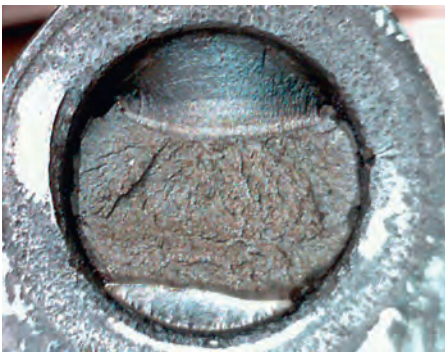
In this 'Safety Spot', I've featured an Auster that developed a bit of a rash on its tailplane and the inspector decided to look inside with a borescope; it was lucky he did because by dealing with the early signs of a problem the inspector probably saved the owner a great deal of cash. Before I get into this interesting tale though, I ought to bring you up to date with the results of our investigations surrounding the failure of the nose undercarriage spindle on an LAA SportCruiser back last year.

CZAW SPORTCRUISER NOSE UNDERCARRIAGE FAILURE UPDATE

Regular readers of 'Safety Spot' and CZAW SportCruiser owners will be aware that LAA Engineering has been investigating potential reasons why LAAer Neil McAllister's nose leg failed shortly after a normal landing at Skegness; we reported this particular incident in 'Safety Spot' back in October 2012. Since then we've issued a couple of Airworthiness Information Leaflets (AILs) requiring close checks of both the spindle itself and the attached undercarriage fork. The spindle check AIL required an inspection within five flying hours from receipt of the Leaflet and the worksheets; we asked that the worksheets, describing what was found at the inspection, be sent to us here at Turweston for evaluation.



Here's a picture of the CZAW SportCruiser nosewheel fork assembly that's causing us, and some owners, sleepless nights. The real problem with this design, and the reason why the LAA has decided to withdraw the component from service, is that it's impossible to check for cracks. (Photo: Malcolm McBride)



The photo above you've seen before, it's the fracture face from Neil McAllister's SportCruiser after the initial 'Skegness' failure. This rather simple fracture face is actually deceptively complex and, what initially looked to be a straightforward fatigue failure has all the hallmarks of stress corrosion cracking, almost impossible to predict. The picture below is the photo of a spindle failure in the US and you don't have to have studied Metallurgy to see the similarities. What really worries us at HQ is that should this Spindle fail at high speed the rest of the undercarriage could be driven into the cockpit area with terrifying results. (Photos: Malcolm McBride)



Above is Mike's photo of the rust 'staining' on the outside of the fabric; you're looking at the elevator's leading edge. Just because the paint looks good...! (Photo: Mike King)



When Mike removed the fabric for a closer look he discovered some serious surface corrosion starting to form around the hinge; luckily for the owner, it cleaned off easily and Mike considered the component serviceable after re-protection. (Photo: Mike King)

It became quite clear as the worksheets started to arrive that there was a fleet-wide problem with corrosion within this component and the spindles on some of our members' aircraft were in such poor shape that the LAA Inspectors involved were forced to ground the aircraft until replacement parts could be sourced. I should mention here that we've got 74 SportCruiser aircraft on our books, of which 46 are fitted with this type of spindle assembly. Another problem that soon became apparent was that it was impossible to check the spindle itself around the area of maximum bending moment because the spindle is hidden within the attachment at this point. In effect, the most important part of this assembly cannot be inspected effectively.

Because LAA Engineering has got serious concerns about the suitability of the CZAW design of nosewheel spindle it has taken the decision to withdraw this item, as soon as is practical, from service.

Naturally, we've been trying to come up with a solution that avoids members being stuck on the ground because of safety fears. Bearing in mind that the manufacturer, CZAW,

“There was a fleet-wide problem with corrosion within this component”

no longer exists, various member replacement options have been discussed. Our primary requirement, apart from the obvious strength and durability needs, is that this spindle must be 'inspectable' and, if subsequently found to be corroded or cracked, easily replaced. At the time of writing, two home-grown design options have been submitted to our Design Department for their consideration and, hopefully, approval once flight tests are complete, but right now, the only approved replacement is the very expensive CSA PiperSport nose-leg assembly.

AUSTER J1 AUTOCRAT SERIOUS TAILPLANE CORROSION

As I mentioned earlier, last month's 'Safety Spot' feature, about the FAA Alert discussing hidden corrosion within tubular steel airframes, stirred a few of your pens into action; here's an email from LAA Inspector Robin King who, with his dad Mike, operates Sky4Aviation at Branscombe Airfield in Devon:

*Morning Malcolm,
This Auster flew in for its renewal, we all knew it was touch and go as far as a full recovery was concerned so off I went through the maintenance schedule; I was reasonably happy with the general airframe and couldn't find any good reason why it shouldn't fly.*

While checking the paperwork, I noticed the regular checks on the tailplane attachment points and the owner asked me to take the tailplane off to check them. The stubs are in great condition as is the fuselage however, looking closely, I noticed there was some staining of the fabric over the leading-edge tubes so I decided to take a closer look through

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Thanks to re-build specialist, Miles McCullum, for sending this picture of the Vagabond back end. Miles said, "This Vagabond exhibited classic Piper rot. However, what was not apparent until the fuselage frame was blasted and inspected inch by inch was that the entire longeron up to the strut mount was rotten, as evidenced by a pinhole in the tube about every 18in.

"I would think that in such cases, further investigation is necessary – perhaps drill holes to verify tube thickness/condition (which can simply be welded shut) – also the area around the strut fixing is quite susceptible to similar rot if the frame hasn't been protected with corrosion proofing. I believe there is a requirement for external pitting to be not more than 5% of tube wall thickness, presumably if it affects more than a certain percentage of area.

"I take quite a conservative view here, and for instance find that Auster rear window lower tubes and the rear floor cross tubes and corner plates are often badly corroded – I'm sure that there is a certain amount of 'That'll be OK' attitude out there because of the cost (the last two airframes I've done needed an average of £4,500 of welding repairs done to them)." (Photo: Miles McCullum)



Even tucked up in the hangar with hardly a foot to spare, Roy's new Midget Mustang looks great. (Photo: Roy Holder)

our borescope. It was clear in inspection that the staining was oxidation seeping through cracks in the paintwork on the stabiliser.

Naturally I removed all the fabric from this flying surface and you can see from the attached picture that most of the tube work is in pretty good condition, the area under the staining is in a poor state but, fortunately, appears only to be surface corrosion and is cleaning off fairly easily.

As far as why this area was so badly affected I am fairly certain it all came down to preparation from the previous restorer. The steel was painted using Cellulose, which offers only little protection from moisture, the frames were then covered (quite nicely) and painted in a 2K Acrylic finish. The Acrylic was put on quite thickly and with no plasticiser. I think that this finish started cracking not long after recovering and the airframe soon became no longer watertight. The water simply tracked through these cracks and the Acrylic paint held the water in against the frames, oxidation did the rest!
Regards Robin.

It is certainly clear that a heavy coat of paint may look the business but may not be the best option for lightweight aircraft structures where both protection and flexibility are primary requirements. From an inspector's point of view, a heavy coat of paint on almost any surface can be a nightmare; LAA aircraft rebuilders and inspector Miles McCallum, who sent a couple of brilliant pictures of some severe tube corrosion explains, "The problem with a lot of these older machines is that they look fine on the outside but when you look inside the tube (and you need to do this) the inner surface may be completely rotten. When you think about it, where is the water going to go?"

Miles continued with some good advice. "What I do is push a centre punch into the tube's outer surface with the palm of my hand.

"A heavy coat of paint may not be the best option for lightweight aircraft structures"

If you can, push the point into the material you need to investigate further. I've lost count of the times that I've had to condemn some or other part of an airframe because of internal corrosion." I described Mike King's Auster tailplane problem and asked Miles whether he thought that this would be a common issue with Austers. Miles explained, "Just the opposite in fact – not that you can be complacent. When the Austers were made, the engineers at the factory poured linseed oil into the airframe and sloshed it about, apparently they used to pour off the excess and then weigh the frame to make sure that an appropriate amount of oil remained inside the tubework. Piper Aircraft Corporation didn't do this, which I guess is why it's the old Pipers that suffer internal tube corrosion the most."

Certainly, this is a pretty hot topic and, if you take the time to look at the pictures from Miles, I think that you would agree, quite worrisome. Linen fabrics, even when well protected, had a fairly short natural life, perhaps ten or so years. This meant that the internal structure would be fairly regularly inspected and replaced as necessary. Modern fabric systems on the other hand are so good that they still look brilliant after twenty-five years... but what's going on underneath? Remember, most of the steel

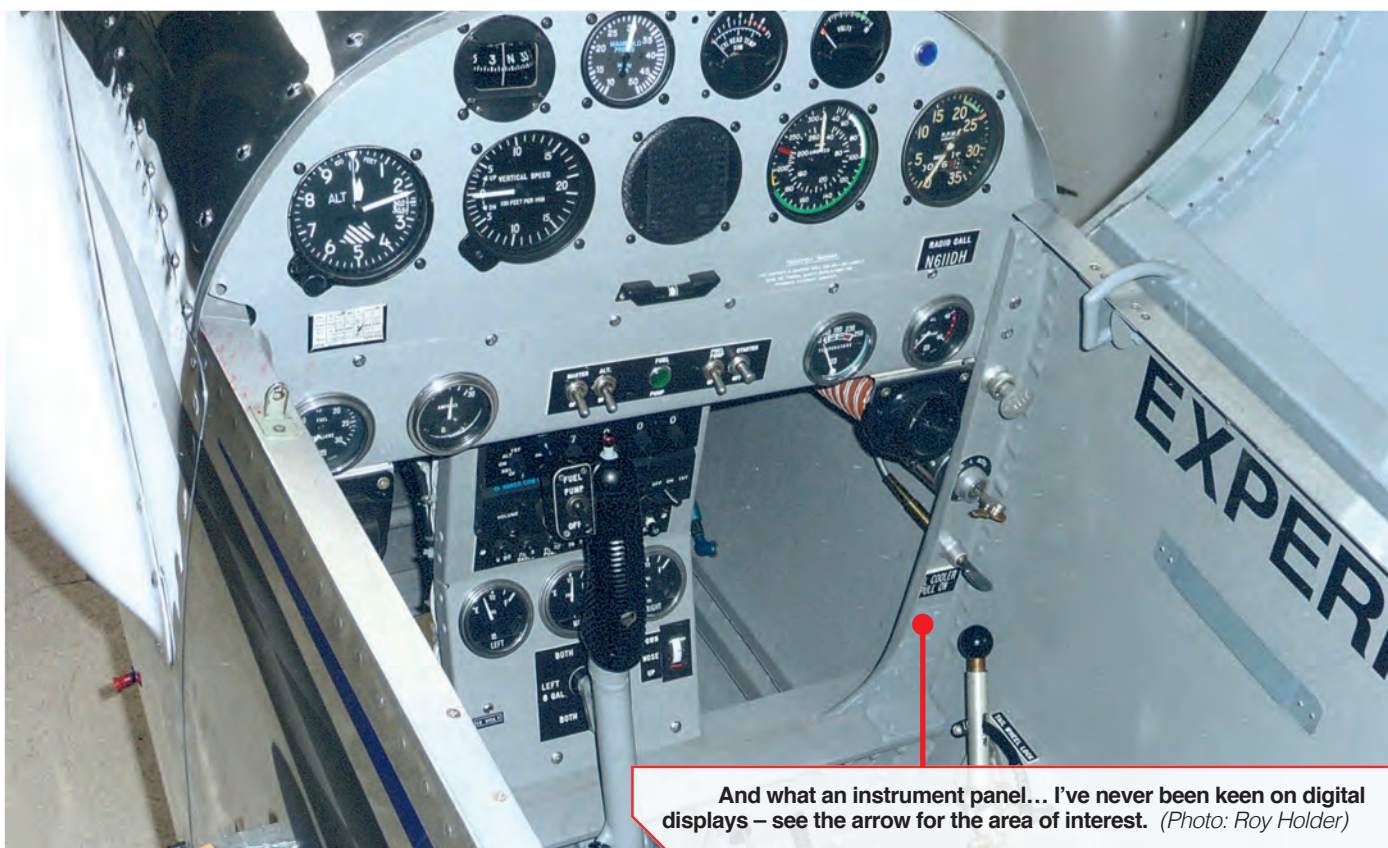
tubular structure only started out about forty-thousandths of an inch thick, it doesn't take a huge amount of corrosion to eat through that!

MIDGET MUSTANG HIDDEN WING-MOUNTING CRACKS

Francis Donaldson came into the office with a wry smile; he's generally a pretty cheerful chap but, as he pulled up a seat he looked like a cat that's just found the cream. Francis lent forward and passed me the featured picture of a horrible crack in the frame supporting the forward wing attachment of a Midget Mustang. We call this sort of find a 'spot' in the trade, and always feel rather self-satisfied when we find a good one. Not that Francis was pleased that the aircraft was cracked of course – his smile signified his intense relief that the checks needed before a Permit to Fly is issued had succeeded in apprehending the aircraft, and that his instruction to remove the doublers, based on a hunch after several weeks of worrying about it, had not been misplaced.

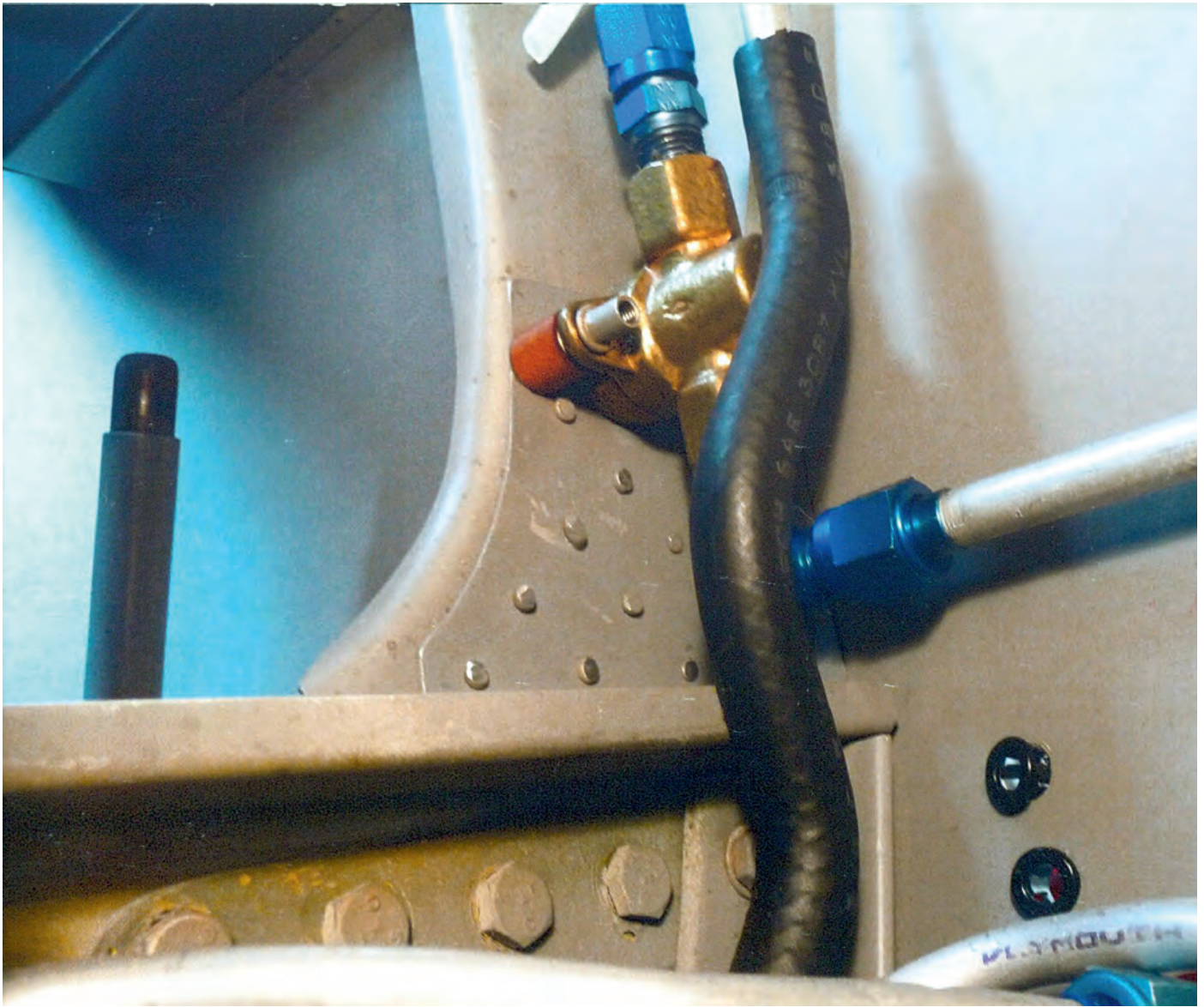
Francis certainly gets top marks for spotting this crack as it had been completely hidden behind a riveted-on strengthening plate. I asked Francis what made him think of asking for this plate to be removed so that he could get a closer look. He explained that, firstly, he'd seen problems in this area on a Midget Mustang before and had approved a repair on another machine a few years back... that's experience. Also he added, "To be honest, I just didn't like the quality of the riveting, which was a fair way from perfection in this critical area, and well below the standard of the rest of the aircraft." That's fastidiousness, a very good quality in an Aero Engineer.

I spoke to the owner of this lovely machine, LAAer Roy Hodder, to ask him if he minded me featuring this spot in 'Safety Spot'. He said, "Far from it, I'm very happy that Francis found this defect, the Midget's a pretty hot ship after all and I'm looking forward to rolling her." I >



And what an instrument panel... I've never been keen on digital displays – see the arrow for the area of interest. (Photo: Roy Holder)

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This picture of the wing forward attachment was taken from the foot pedals so you're looking at the inside of the bracket. This riveting is definitely below par and needs to be replaced. (Photo: Roy Holder)



When Roy drilled out the rivets he was aghast to find that the frame had cracked through; note the stop drill at the end of the crack – clearly the engineer who did this was rather behind the common sense curve. (Photo: Roy Holder)



should say here that Roy's other machine is a Pitts Special. Roy is just going through the acceptance process for an imported homebuilt, necessarily very thorough, and that's why Francis was involved in some hands-on inspection work. Roy bought this 1998 US-built machine because, and I'll get as close as I can to his actual words, "I fell in love with the type when I saw the first example at the 1979 Cranfield PFA rally and I knew I just had to have one. Sadly my field is only 550 yards long, which was just too short for the Midget. Luckily, I've just managed to lengthen the strip and I've now got 750 yards, which is just right."

Certainly, I think that it is a very good idea to conduct a 'fingertip' search for defects when you acquire a new machine and, if you do find a problem, don't brush it under the carpet.

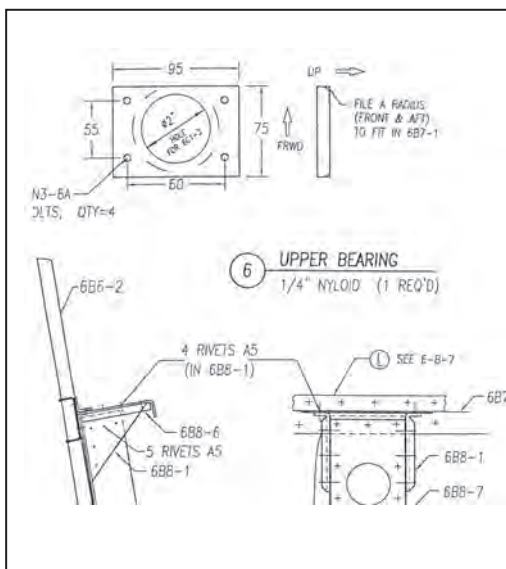
ZENAIR CH601XL NOSE LEG ATTACHMENT CRACKS – POOR QUALITY BUILD

Well, I expect that you've noticed that my writing style is falling to bits, the reason being that I've just come down with 'Man Flu'. It's been hovering behind the clouds for a couple of days now and, along with a couple of other staff members here at Turweston, I've finally succumbed. Oh well.

Before I finally collapse I would like to carry on with this month's theme concerning the need to build 'deep' inspections into your Tailored Maintenance Schedule.

LAA Inspector Pete Murray, who hails from north of the border, called a while back and explained that he'd found a crack on a local CH601XL and asked I thought that it was repairable; he sent down the picture that I've featured, showing what he'd found. My first thoughts were that this looked eminently repairable but, because I hadn't seen a crack in this position before I asked Pete to dig a bit deeper to find out what may have caused this failure. After some to-ing and fro-ing the owner of the aircraft, LAAer Larry Johnson asked LAA Inspector Sandy Hutton, to take a look and gave him the drawings of the assembly.

I've featured the relevant part of the drawing and, as I hope you can see, there's quite a big difference between what should be there and what is. I'm going to take up Larry's suggestion when I told him that I was coming down with something... "Get yerself ta bed laddie, and tack a hot toddie..." Actually, I'm going to eat some chocolate, watch the Simpsons and, well you know the rest. Fair winds. ■



One of the important functions of an inspector signing off an aircraft for its first flight is that the machine is built to the drawings. Any deviation from the design is a good reason not to sign off the aircraft as even the smallest changes might cause trouble later on. In this picture of the upper nose undercarriage attachment fitting of a Zenair CH601XL, you can see that the four attaching bolts form a rectangle. Take a look at the picture of the fitting that cracked on Larry Johnson's machine and it's difficult to find a match! Sandy Hutton, Larry's inspector, thinks that the reason for this crack is that the aluminium support below the plate was not accurately radiused. (Photo: LAA Library)



Here's a picture showing the dimensional differences between the drawing and real life. When you buy a second-hand aircraft never assume that all's well – check, check, check. (Photo: Pete Murray)

LAA ENGINEERING SCALE OF CHARGES

LAA Project Registration

Kit Built Aircraft	£300
Plans Built Aircraft	£50
Issue of a Permit to Test Fly	
Non-LAA approved design only	£40
Initial Permit issue	
Up to 390kg	£320
391 - 499kg	£425
500kg and above	£565
Three seats and above	£630
Permit renewal	
Up to 390kg	£105
391 - 499kg	£140
500kg and above	£190
Three seats and above	£210
Modification application	
Prototype modification	£45

Repeat modification £22.50

Transfer

(from CofA to Permit or CAA Permit to LAA Permit)

Up to 499kg	£135
500 kg and above	£250
Three seats 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

Replacement Documents

Lost, stolen etc (fee is per document) £20

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