With Malcolm McBride
Airworthiness Engineer

IS IT TIME TO CONSIDER A 'DEEP INSPECTION'?

Problems with iPads, but that's not the real theme this month. It's the underlying issues which call for an occasional major inspection

Hello, and welcome to this, 'I can't believe that it's August already,' Safety Spot. Where is this year going? I know, as I'm sure you do, to the same place as all the rest, into our memories! Anyway, what about today? Well, I've got a particularly full desk at the moment as you would expect for this time of year. Thank goodness, by the way, that the weather has at last settled down into a more flyable mood although, and I'm a bit reluctant to say this in case the weather gods are listening, it's been a little too hot for the northerner in me.

In this Safety Spot, as in all Safety Spots, I will be sharing with you some of the safety issues that we come across in HQ engineering. In some respects, the stories of the events that find their way into the mag choose themselves. However, we do try to think about a general theme for the overall 'Spot' in the hope that, even if you don't actually own an aircraft in the 'feature' list, the tale itself will give you something to think about which, in turn, should make you a safer pilot or engineer.

Zenair CH 601 XL flyer, Jeff Ellwood was flying with his partner Rosie recently over Pilling Sands, the well-known microlight destination in Lancashire; I asked Jeff whether Rosie was a flyer herself when he mentioned that she was flying the aircraft, Jeff explained that Rosie had just retired from the captain's seat of a 747, which rather put me in my place! During the flight they became aware of a kite flying nearby and, naturally, took avoiding action. After they landed they were surprised to find that the wing had been damaged as it had flown through Kevlar kite string. Jeff was surprised at this as they were flying, at the time of the impact, at a little over 700 feet above the ground. They both shot off to Pilling Sands by car but the kite flyers had scarpered. As you can see from Jeff's picture, the string acted like a cheese-cutter but it fortunately broke before doing any catastrophic damage.

I checked with the Kite Society of Great Britain and they explained that in their rule book that the ANO states that 'a Kite shall not be flown more than 60 metres above ground level' and this reduces to 30 metres within an Aerodrome Traffic Zone. I suppose the lesson here is 'always expect the unexpected'! *(Photo Jeff Ellwood)*

I personally believe that the best overall improvement in aviation safety, surely something we all seek, comes about by reinforcing a good safety culture. The power source for these 'reinforcements' comes, naturally, from actual events and, sadly sometimes, accidents that befall some of our members.

So, what's the theme this month? Well, first we have a short tale about an instrument failure that, because the chaps involved did everything right, didn't even rank as an event… though a good lesson, one I hadn't learnt, was flagged-up. More about this in a minute.

Another item, again in a way instrument related, concerns engine temperature measurement on the Rotax 912 and 914 series engines. Don't get too beguiled into thinking that this episode is just about instruments… they're just 'bit players'. We have bigger fish to fry.

Later, we'll continue our ongoing theme about the importance of managing a sensible inspection schedule, a schedule appropriate to your particular flight operation. To do this I'll use, as an example, two aircraft types where worrying cracks have recently been found in their primary structure. In both cases, the structure has clearly been failing for some time, yet the first signs weren't spotted during routine inspections. Regular readers, and all LAA Inspectors, will know that the type of schedule we recommend as best suited for our Permit to Fly aircraft is the Tailored Maintenance Schedule and, pleasingly, many owners are adopting this as the primary maintenance 'task-driver' for their aircraft.

One reason for the LAA adopting this approach is that the kind of maintenance approach taken on a particular machine will inevitably change as the aircraft ages. Of course, up to a point, this is obvious and we're hearing rumblings from some manufacturers suggesting that, at some point, their aircraft may need to be completely stripped down so that a very deep inspection of the structure can be made. The great problem faced by us all is when should these big inspections be carried out? Some suggest hours, others years, it's an ongoing dilemma and, perhaps especially in our enormously varied fleet, we're aware that one size very definitely isn't going to fit all.

In the commercial world, this inspection, often completed by the manufacturers themselves, has a number of names but the one I remember from my short time in the airline sector, is the 'major' inspection. If you haven't ever seen an airliner undergoing one of these inspections I think that you would be surprised at just how detailed they are. Of course airline bosses know that they cannot take any chances with the structural integrity of their aircraft. These days many operators use this point in the aircraft's long- term maintenance schedule to update and refurbish the whole aeroplane; in effect, giving the aircraft a second life.

Before we get started with the instrument related story, I'd just like to offer another little nudge towards our goal, almost achieved, of having a seamless Permit Renewal process. Regulars will remember that a couple of Safety Spots ago I asked that when you apply to renew your Certificate of Validity that you please ensure (by checking the latest edition of this mag, normally at the end of Safety Spot) that you are paying the correct fee and, most importantly to avoid delays, put the right value postage stamp on the envelope.

If an envelope is what the Post Office call 'underpaid', perhaps because it is too big, too thick or even too heavy, it can take over a week before it arrives here at HQ and, to rub in some salt, we have to pay a fine! Anyway, the number of errors like these two have dropped to an all-time low, so very well done and thank you. Please keep it up!

Related to this, in last month's Spot I coughed up to not being perfect; thanks, incidentally for your kind comments about this. If you don't remember the confession it concerned me getting out of the habit of checking an applicant's weight and balance date. We all slip into bad habits now and again and, as habits go, this one wasn't too catastrophic.

Well, I have to report that I am now, at least in this respect, a reformed character and I check this section of the form with more diligence now. I mention this to you because I now notice that some, actually just a few, are not filling in the full date, preferring instead to put just the year.

As I say, just a nudge, but this date is important because it demonstrates that there is a weight and balance report in force. This is an ANO requirement, it also shows that the inspector signing-out the aircraft for the following year has seen the schedule with his or her own eyes. Now I've pulled my socks up… well, you get the message I hope.

'THREE EUROPAS TO GIBRALTAR' OR, THANK GOODNESS FOR CHARTS

I received a timely email from LAA Europa flyer Bob Hitchcock. I say timely because I had literally only just left a meeting where the issues surrounding the presentation of data to the pilot was being looked at and discussed. Two NATS airspace experts were discussing, with the LAA's safety team, the pros and cons of the various ADS-B devices around on the market these days. I was really happy when I heard them explain that in their view a good look-out was by far the best way of avoiding a near-miss or worse still an in-flight collision.

Anyway, Bob explained that he had just returned from an adventure where three Europas, one of them his, had flown to Gibraltar and back. The other pilots involved were LAA'ers, Alistair Milne and David Park, both experienced flyers. Bob, incidentally, has written-up the full story of their trip for Light Aviation and I'm sure it will feature in a future edition.

The trip, overall, was very successful, though he wanted to let me know about a safety issue that cropped up during a sector across Spain which could easily have caught out the group. It concerns the danger of using uncertified GPS equipment as the primary navigational tool during a day/VFR flight, without having a back-up plan. I asked Bob to put a few words down on paper for Safety Spot and here's Bob's cautionary tale:

DEAR MALCOLM,

I hope this is what you were looking for. I am just an ordinary pilot, sharing an experience. I do not purport to be an expert in the field but I do think there should be more discussion of the topic.

I am aware, anecdotally, that there are pilots who do not have access to alternate Garmin GPS equipment as we did. And worse still, do not do proper pre-flight planning, carry paper maps and "look out of the window", preferring instead to rely totally on electronic plotters, often hand-held devices based around mobile telephone technology.

In a recent formation flight of Europas from the UK to Gibraltar, unexpected shut-down problems were experienced with iPads and iPhones operating SkyDemon software. After the shutdown the flight continued safely by using the primary navigation tool known as the Mk.1 eyeball, plus paper maps.

After we landed at our destination we began some research into why our portable devices had failed; though we didn't know this beforehand we learnt that these types of device change their operating behavior when the ambient temperature exceeds about 35°C. It does this to protect its circuitry from the effects of very high temperature.

During our flight we were flying in temperatures of about 40°C and, shortly after encountering these unusually high temperatures, our navigators sequentially switched themselves off.

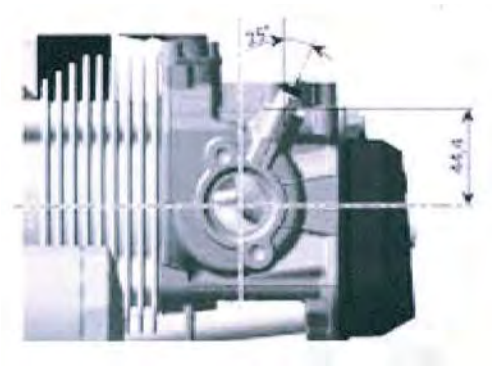
Since returning from our trip I've found out that this is a known issue with these portable devices, though I had never heard of this happening before. Can you share this lesson with other LAA flyers?

Before flying, Bob and his pals sat down and created a proper pre-flight plan. They carried marked-up, up-to-date charts and did a few sums before they left. He mentions in his letter the pilot's number one safety tool, the Mk1. eyeball but, for this to be of much use it needs to know what it's looking out for during a trip. This requires pre-flight planning and, to do it properly, a bit of mental rehearsal.

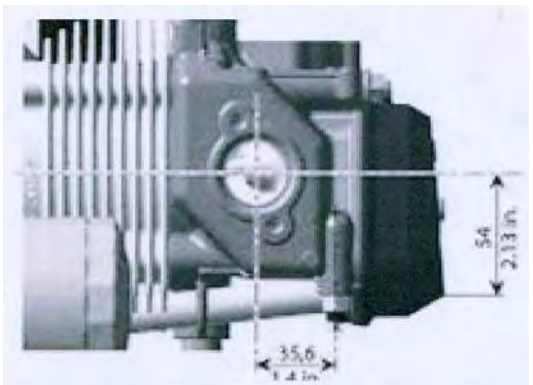
There's a bit of a debate going around the flying community at the moment which I'm just rubbing along the outside of. One side of the argument goes, that because over 80% of a recently reported batch of airspace infringements were apparently committed by pilots not using a GPS unit, the number of infringements could be reduced if more people carried a GPS. I do get this and there's some power behind the argument. Certainly, as an aid to the sports pilot you can't beat these devices but, and it's a big but, I think that if many private pilots are relying solely on their GPS as the primary navigation tool, we're in danger of completely de-skilling pilots in basic navigational techniques.

Who's to say that the trusted accuracy of these GPS navigators hasn't meant that pilots are taking too many risks and getting themselves too close to busy airspace. I've flown recently with a chap who felt that it was alright to fly with the little aircraft on the screen just skirting the airspace boundary line on the electronic map. I wondered whether he'd have done this if he was following a heading or a line feature and using a stop watch. After all, this close to the dark side it would only take a moments distraction and pop, there'd be another edge infringement.

No doubt this debate will go on and I'm looking forward to hearing all the points raised. Certainly, I've got a GPS system in my boat, though I don't turn it on often. As an invention it has to be one of the cleverest things to come out of this century. However much a purist he or she might be, I cannot see any reason why a modern pilot wouldn't carry a GPS unit as a back-up. Once a pilot has mastered the basics of flying the aircraft, learning how to navigate has to be one of the best things a person can do, why on earth would anybody want ›



(Above and right) **This drawing and picture show the positions of the temperature sender units on later (post 2013) Rotax 912 and 914 cylinder heads. These units extend into the water jacket and are therefore measuring the coolant temperature (CT) at this point in the circuit; as you can see, the units face upwards.** *(Photo BRP-Powertrain/Malcolm McBride)*



(Above and right) **In this drawing and picture the older type of 912 and 914 cylinder head (roughly pre 2013) is shown; these units, facing down, are screwed into the aluminium head itself and are therefore measuring cylinder head temperature (CHT)** *(Photo BRP Powertrain/Malcolm McBride)*

(Above and right) **It is essential that a pilot is presented with appropriate and accurate information about the engines performance and, most importantly, its temperature relative to its operating maximums. We've come across examples in our fleet where a sender is measuring water temperature but the gauge fitted was marked-up as a CHT gauge.** *(Photo BRP-Powertrain/Malcolm McBride)*

(Left) **EASA has issued an Airworthiness Directive requiring owners and operators of 912 and 914 engines to check that their engine temperature gauges are marked-up correctly. The AD requires that, if the engine is fitted with the newer types of cylinder head, then an 01 mark must be added to the engines designator. This, in some cases, would mean that the engine would need to be removed to get access to the plate. The UK CAA is, at the time of writing, just about to issue an MPD requiring similar checks; however, the LAA and the BMAA have negotiated that the plate mark-up, when needed, can be deferred until the engine needs to come out for other reasons.** *(Photo BRP-Powertrain McBride)*

their mobile phone to take charge?

In this instance, because of proper pre-flight planning, there wasn't really even an event after the equipment failure, so well done to Bob and his pals. I'm glad that their trip was successful and that they had a great time. In aviation, a lesson learnt should be a lesson shared. I hope that you are looking for that chinagraph pencil!

ROTAX 912 AND 914 (SERIES) ENGINES – ENGINE TEMPERATURE MEASUREMENT

This is one of those stories that seem to have been going on forever, but I've looked at my file on the subject and have found that, for me at least, the story started in December 2014 whilst reading through the list of 'running' modifications for the 912 and 914 engine series.

Since then there's been a whole raft of paperwork from manufacturers and the various authorities. The issue itself is very straightforward and relates to engine temperature measurement. Stimulated by EASA issuing an Airworthiness Directive on the subject, the CAA is putting together a Mandatory Permit Directive requiring owners and operators of aircraft fitted with a Rotax 912 or 914 engine to check that their engine temperature measuring system is fit for purpose. We've issue an Airworthiness Information Leaflet (AIL) on the subject which is available to download from an Airworthiness Alert on the LAA website.

Basically, a design change in the cylinder heads of Rotax 912 engines was introduced in March 2013 which meant that the measurement of engine cylinder temperature changed from the measurement of the temperature of aluminium head itself (CHT), to the measurement of the temperature of the coolant (a water-glycol mix) in the water jacket. Though, in most respects, the temperature gauges and the sensors themselves are very similar, there is a difference in the permissible maximum indicated temperature.

Of course, it is essential that a pilot is presented with appropriate and accurate information about the engine's performance and, most importantly, its operating temperature relative to the maximum allowable operating temperature. BRP Rotax has issued a Service Bulletin, also available from the Airworthiness Alert, listing the serial numbers of engines that have been affected by this change (SB-912-066 and SB-914), though it's possible, if a cylinder has been changed for any reason, that and affected engine could fall outside the serial number range published.

To be honest, I did think that all this was rather theoretical but, in the course of checking a nearly brand new aircraft recently, I noted that the aircraft's gauge was incorrectly marked. Naturally I informed the owner of the machine who was, quite rightly, somewhat shocked. Our AIL requires all 912 and 914 owners to check their systems, it isn't rocket science and the pictures attached pretty much say it all. Just in case a cylinder is changed on a machine after this has been checked, which may introduce an error, we've asked that this check be carried out at each annual inspection. If, when you check your installation, you do find anything amiss, may I ask that you let us know about it, this type of feedback is often very useful.

IKARUS C42 – SERIOUS CRACKING FOUND IN THE MAIN FUSELAGE STRUCTURE

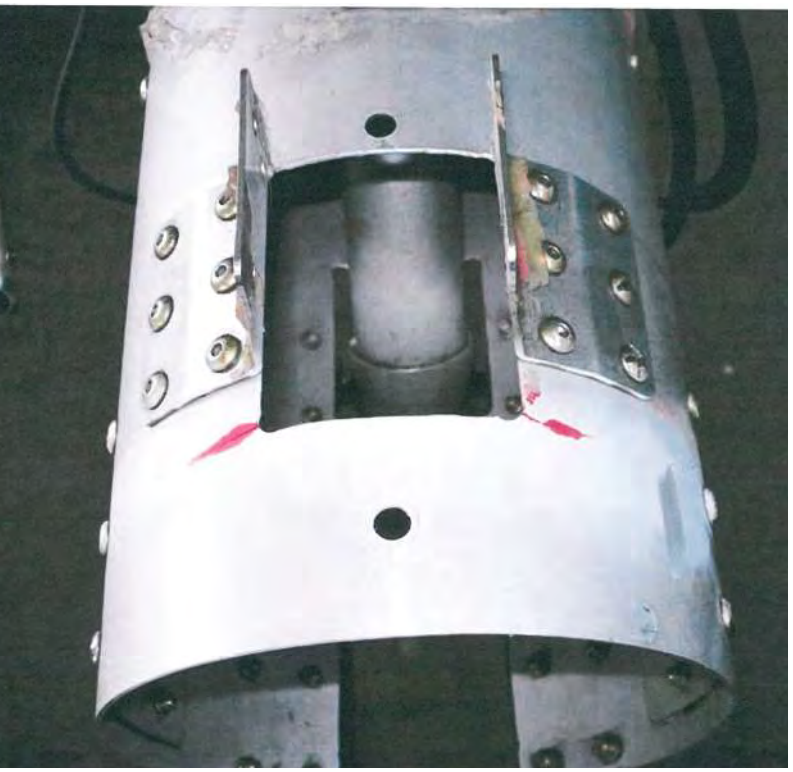
The Ikarus C42 is a lightweight high-wing, strut-braced microlight aircraft seating two side-by-side in an enclosed cockpit. The wings are of 'ladder' type consisting of two tubular aluminium spars braced by a truss formed of tubular aluminium compression struts and stranded steel drag and anti-drag wires. The wings are covered by a pre-stitched reinforced polyester envelope.

The tail surfaces are of simple aluminium tube construction, strut braced and covered by pre-stitched reinforced polyester envelopes. The fuselage consists of a large diameter central tubular aluminium boo and an aluminium tubular frame forming a cockpit cage, the whole structure being enclosed within a non-structural fibreglass shell which provides the external shape and ›

This picture shows an early example of the very popular Ikarus C42 side-by-side two seater microlight. The example shown is a 2002 kit built aircraft, although most machines are factory built and so fall within the BMAA's bailiwick. With a first look you wouldn't be criticised for thinking that the fuselage was a one-piece fibreglass construction like so many of the more modern types flying today but if you look deeper you will see that under the non-structural skin, the construction method is more similar to the very early microlights… aluminium alloy tube.
(Photo LAA Library)

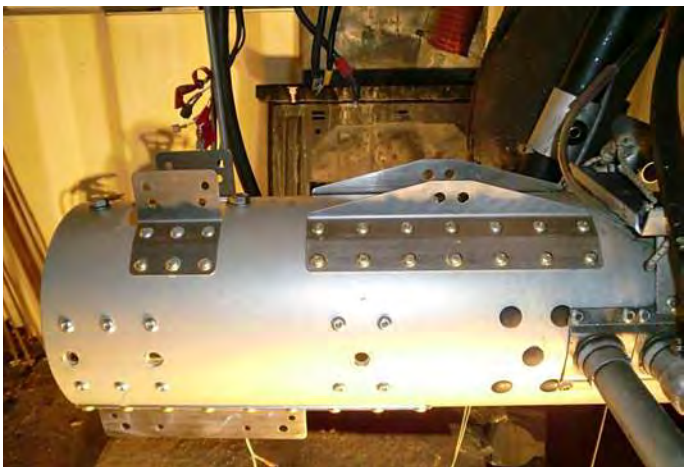
Here's a picture of the C42 during its build and before being fitted out with its full wardrobe; as you can see, the fuselage structure is centred around a beefy fore and aft. main boom. It looks like fun to fly just as it is! The area where cracking has been discovered on one high-hour BMAA training machine is the connection between the main fuselage boom and the leading edge wing strut. You can see that a complete failure of the connection at this point would lead to a sudden increase in angle of attack which could precipitate a total in-flight structure failure.
(Photo LAA Library)

(Left **This worrying crack wasn't spotted during the aircraft's regular maintenance checks because at this point the boom is covered with a glued-on insulating foam covering. This area of the fuselage structure is working hard because it has to resist the loads from the nose undercarriage and thrust forces from the engine. Picture:** *(Photo Red Aviation)*

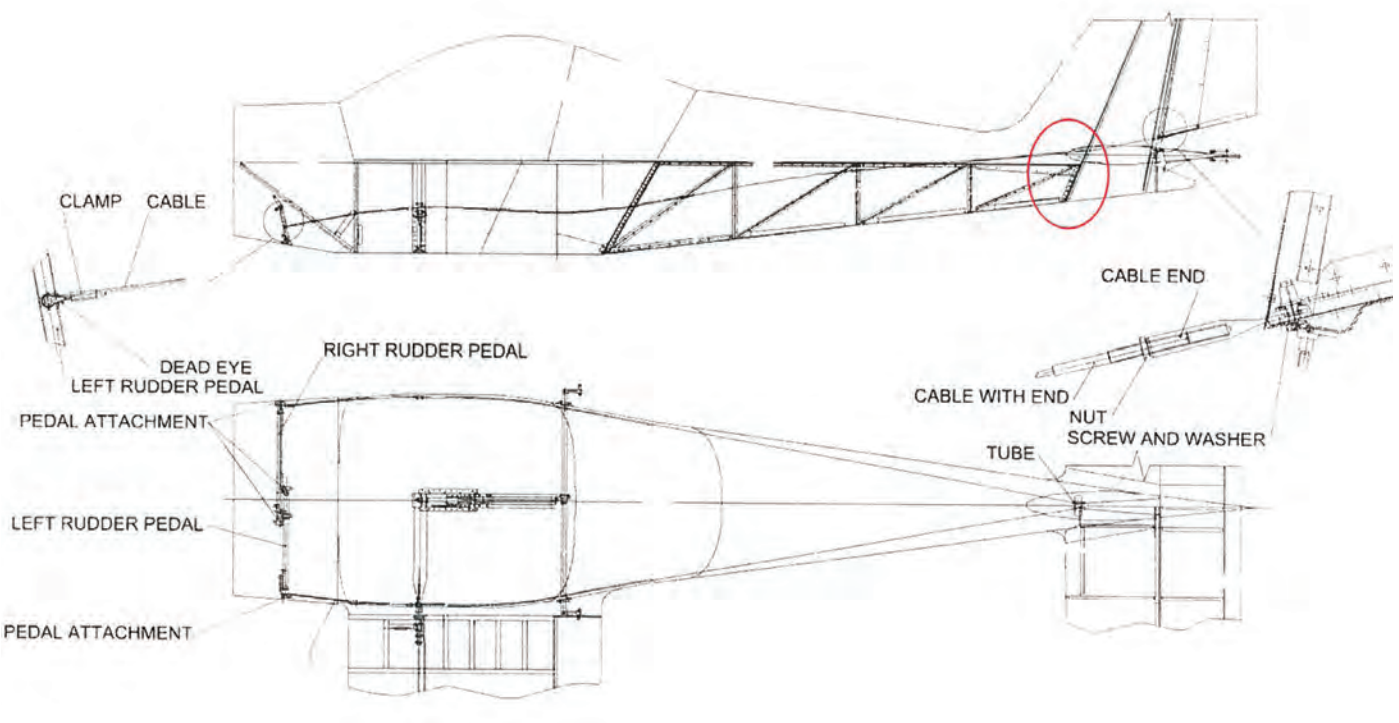


Over the years, inspectors and owners have noticed that the main boom on the C42 is prone to cracking at the corners of a cut out for the forward strut connection. Red Aviation, the aircraft's importers, have added a doubler inside the tube to strengthen the area though, as no LAA aircraft have been affected, this BMAA mod has not yet been cleared through the LAA system. *(Photo Red Aviation)*

"Covering the fuselage has benefits but some of the structure is difficult to inspect properly"



This is the forward end of the main boom on a later version of the C42 without the main engine mounting assembly fitted; notice that, in this example, the top rear bracket has been enlarged considerably, as you can see. There's a lot going on in this area of the fuselage structure but much of it is hidden and difficult to inspect; that's why it is essential, from time to time during the life of any aircraft, to carry out in strip inspections so that every part of the aircraft's structure can be thoroughly checked. *(Photo Red Aviation)*



(Above) **The recent Light Sports Aviation Service Bulletin requiring checks of the rear fuselage and the CAA's Emergency Mandatory Permit Directive enforcing it was written after a serious crack in the rear bulkhead of a relatively high hour example of an Evector EV97 Eurostar. Like the recent problem affecting the C42, this area is very difficult to inspect properly without dismantling the airframe; the drawing above shows the general arrangement of the aluminium structure, the red ring highlights the area of particular concern.** *(Photo LAA Library)*

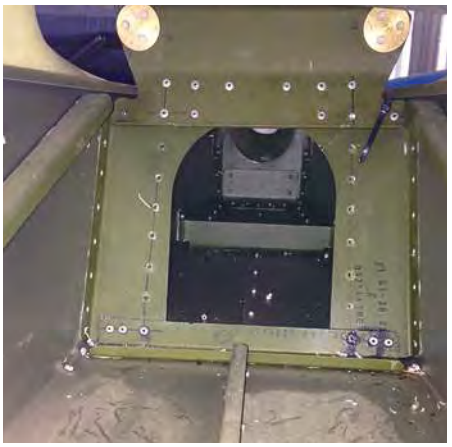
occupant protection from the elements. In this regard the aircraft looks quite modern but, with its clothes off, the type is designed in a similar way to many of the simplest microlights from the 1980s and 90s.

Covering the fuselage like this clearly has great benefits, but it also introduces a problem in that some of the structure is difficult to inspect properly.

Interestingly, the CAA database shows that there are just over 200 C42s registered in the UK, most operating under a BMAA flag as factory-built machines. We have 36 aircraft on our books, the first joining our fleet in 2001 and the last kit finally being finished-off in 2010. Learning of a serious crack in the main boom of a high-hour BMAA C42, we spoke to our BMAA colleagues, asking them whether they had seen any other issues like this in their fleet. After all, they have more experience with the type as, in the BMAA system, these machines are used widely as training aircraft. Rob Mott, the BMAA's Chief Inspector, explained that this aircraft type had an excellent track record with quite a few of their fleet still flying with more than 4,000 hours on their clocks.

Rob explained that, in some of the earlier airframes, small cracks had been seen emanating from the corners of the cut-outs in the main boom, particularly around the area of the nose undercarriage. The BMAA, along with the aircraft's importer, has developed a mod which strengthens up this area of the structure. We've no record of problems like this on LAA administered machines thus far but we've issued an Airworthiness Information Leaflet (AIL) asking owners to conduct checks on their airframes.

The airframe with the far more serious cracking shown in the accompanying pictures has flown something like 4,500 hours in a training role, and most of this has been flying off a grass strip, so we're cautiously optimistic that with an LAA fleet all being relatively low hours (our fleet average is nevertheless a creditable 758 hours per airframe) we shouldn't be seeing any such problems just yet.



LAA Inspector Chris Theakstone has specialised in the maintenance and repair of EV97 aircraft took this picture of another example of this aircraft in his workshop. To gain sensible access, he's removed the 'turtle' deck and the tailplane and elevator completely. The two round discs at the top of the photo are the forward tailplane attachment points so, as the CAA's emergency MPD points out, 'Cracks and sheared rivets [in this area] may result in the failure of the integrity of the tailplane and/or loss of control in flight'. *(Photo Chris Theakstone)*

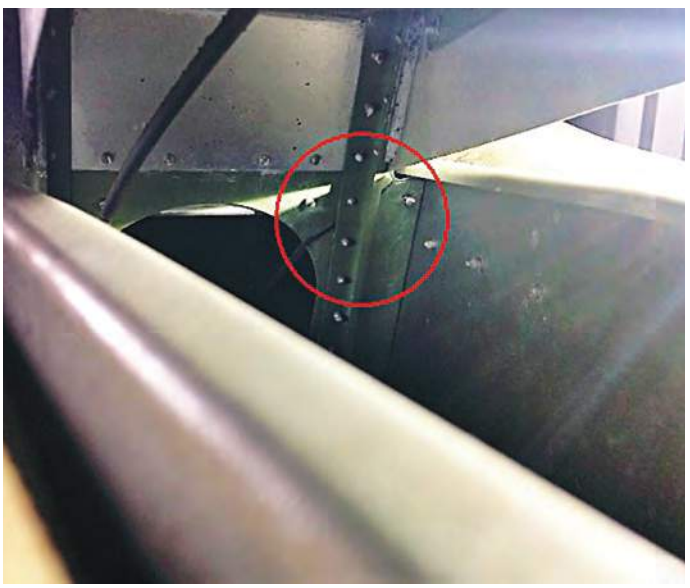
That said, this dangerous cracking hasn't happened overnight and without doubt this aircraft has been flying around for some time in a very dangerous state. This area of the main boom not only resists engine loads but also acts as an anchor for the leading edge of the mainplane via the forward strut. If the boom let go suddenly, goodness knows what might happen to the rest of the structure, especially if the aircraft was flying at a high speed at the time.

The CAA has issued an emergency MPD requiring inspections in this area and, naturally, we've let all our C42 owners know directly that there's been a specific problem with this airframe type. In our view, this is exactly the type of problem that would have been spotted had the operators adopted a maintenance and inspection regime that requires, through the life of the aircraft, regular 'deep' inspections of the whole airframe, not just the parts that are easy to see.

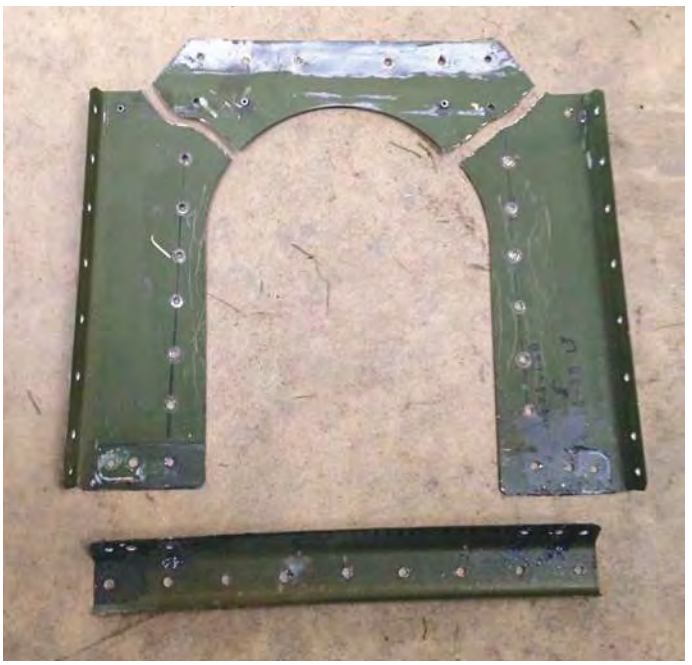
EV-97 EUROSTAR – STRUCTURE CRACKING AT THE REAR FUSELAGE BULKHEAD

At the time of writing we've just become aware that a relatively high hour EV-97 microlight aircraft has been found with a serious crack to the structure that compromises the physical attachment of the tailplane. Unfortunately, due to a number of summer holiday related communication breakdowns, we didn't hear about this serious event until we were sent a draft of the local importer's Service Bulletin requiring checks. This SB was shortly followed up by a CAA Mandatory Permit Directive effectively mandating checks on high-hour aircraft.

Naturally, as nearly half of the UK's Eurostar fleet (191 aircraft on the CAA Type Database) operate within the LAA's continuing airworthiness remit, we started an LAA investigation. As is normal in such circumstances, as soon as we heard that there had been a structural problem with the type, we got in touch with the LAA's Eurostar specialist inspector, Chris Theakstone who, naturally, knew all about the issue and was a bit surprised that we weren't in any of the reporting loops. The Aerotechnik EV-97 Eurostar is a single-engined two-seat monoplane design of all-metal construction. ›



This picture shows the cracked bulkhead on a 4,000+ hrs EV97 training aircraft as spotted using a small camera. Certainly, boroscopes, cameras and even mobile phone technology can be very useful for looking into areas of a structure that have limited access. It's always better though to do a close visual inspection, if necessary by removing flight control surfaces, seats, panels, tanks or other assemblies, to gain access. *(Photo Chris Theakstone)*



Though just a small crack could be seen during an initial close inspection, this is what was found when the frame was completely removed. As you can see, the structural integrity of the main connecting structure to the forward tailplane attachment has been completely lost. *(Photo Chris Theakstone)*

The horizontal tail is a conventional one-piece tailplane/elevator fitted with a trailing edge trim tab.

My experience of the type can be summarised I think in a simple phrase: I wish I had designed and built the machine. OK, the machine itself looks a little 'Fred Flintstone', with its large bubble canopy and rather stubby, at least from the side, appearance. I almost expect a couple of legs to pop out of the bottom of the aircraft to start propelling the aircraft forward. But the aircraft, in all its forms, flies beautifully and has an exceptional performance; a credit to the manufacturers, Evektor. As a fleet, I'm sure that the LAA machines will not have anything like the average hours that the many BMAA aircraft will have accrued - that's the nature of training, it eats up airframe hours.

The UK importer of the Eurostar, which holds type responsibility for the factory-built examples, considers that immediate visual checks to this rear bulkhead are necessary before further flight on aircraft that have more than 1,000 hours flight time. For aircraft that haven't reached this hours total, the check can be carried out at the next service interval.

At the time of writing, LAA Engineering hadn't decided on its response but I feel sure that we will be looking at a scheduled inspection sooner than this (500 hours has been discussed) and the recommendation from our inspection team is that the tailplane will have to be removed (a simple job) to carry out this inspection properly.

By the time you read this, the LAA's Airworthiness Information Leaflets connected to this failure event will have been published and we will have had an opportunity to align these with the CAA's MPD. The best place, incidentally, to find the latest AIL issues, as I mentioned earlier, is in the Engineering section of the LAA's website. Look for Alerts!

So, we can be thankful that all of the issues discussed in this month's Safety Spot didn't lead to an accident and, as ever, well done to those owners and LAA Inspectors who brought these issues to light before an accident occurred. *Yubba dubba doo*… sorry Fred. Fair winds. ■

(Left) **Here's a picture showing one tell-tale sign that all is not well with a riveted joint, notice the black powdery substance surrounding the third rivet up. This normally means that the rivet has become loose and therefore stopped working. This bracket, this time from the real tail attachment of a fairly high-time EV97, attaches the threaded steel plate holding the horizontal tail surfaces in place.** *(Photo Chris Theakstone)*

(Above) **Recently, during the inspection of an EV97, the rudder was moved from side to side to check for freedom of movement. The engineer was surprised to find that the rudder, quite literally, came off in his hands. The EV97's bottom rudder hinge uses a fixed pin (right above) through a bearing (left above). The pin is threaded to take a washer and a nut which are intended to locate the rudder and prevent any end-wise movement. As you can see, the bearing is so worn that the inner ball has been able to slide out of the outer race and, because the washer behind the securing nut was smaller than the race's inner diameter there was nothing to hold the rudder in place after the bearing came to pieces. Evektor, the aircraft manufacturers, specify checks specifically for excess rudder end float so that any excess wear can be picked up before it becomes critical.** *(Photo Chris Theakstone)*

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
Initial Permit issue	
Up to 450kg	£450
451-999kg	£550
1,000kg and above	£650
Permit renewal	
Up to 450kg	**£155**
451-999kg	**£200**
1.000kg and above	**£230**
Modification application	
Prototype modification	minimum £60
Repeat modification	minimum £60

Transfer		
(from CofA 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
Replacement Documents		
Lost, stolen etc (fee is per document)		£20

Latest SPARS - No.16 February 2015