



SAFETY SPOT

Malcolm McBride
Airworthiness Engineer

For an aviation enthusiast of limited means, a job working for the LAA could be described as a Godsend; apart from the 'total immersion' in matters aeronautical there are other, perhaps many, less obvious benefits. One of these is access to just about every airplane magazine going ... free of charge. Of course there is a hierarchy, you show me a place where *Homo Sapiens* have the whip hand where there isn't, but even a lowly Airworthiness Engineer can eventually get his/or her hands on these little plumbs of journalistic excellence. You may wonder "where is this bloke going"? And I wouldn't blame you ... just bear with me a minute or two.

I've been getting moaned at by a few sales types for mentioning their aircraft in *Safety Spot*; the general view seems to be that, in the world of aircraft sales, nothing negative must be mentioned about a machine ... or a component ... or an instrument ... or anything else for that matter. I am not a great reader of magazines and newspapers (except, of course, *Light Aviation*) but, for the reason that I mention above, I read more than my fair share these days, and I am beginning to detect a pattern, it's probably nothing new ... it's just that I've just noticed it ... never criticise, everything's brilliant, all aircraft fly beautifully, even vices (vices!) are an essential part of an aircraft's character and should be written about in glowing terms. I understand the subtle feedback pressure that could cause this viz; "you don't write good stuff, and I'll send the boyz rawnd" ... probably a bit strong, but you get the drift I'm sure.

The problem with all this positive feedback is that the pressure to improve a product is reduced. Sure, a bit of praise goes a long way, ask any school teacher, but if something's not right it needs to be pointed out. This is especially true with regards to aircraft, where lives are at stake. I got to fly an aircraft the other day with Andy Draper, for an initial airtest for Permit, I do not need to mention the aircraft type because this is irrelevant. Ok then, it

was a Tecnam Sierra. I must say (looking over my shoulder!) the aircraft was a pleasure to fly and it did everything it said it would 'on the can' (no pun intended!). In fact, I think the performance was a little bit better than book but, as I have already said, this is irrelevant. Why? Because Safety Spot is here to tell people the bad things about an aircraft, it's not intended to be an extended sales brochure. It's my job to pick holes in things and to let everybody know when somebody else has found a hole (and, possibly, fallen through it).

The cockpit of this aircraft was filled with gizmo's, flat screen this and that, all, in my opinion, a bit over the top, but they looked great ... if you like that sort of thing. I was very concerned about the instrument layout and general ergonomics of this machine, but you will have to wait for comments about this as we need to fly the machine again (after we have read the manuals!). I will just say this for now, and please forgive me if I sound pompous, too many instruments may lead the unwary into trouble ... There are many differences between flying a flight simulator in one's study and the real thing, and the biggest of these (many) differences is ... you can get hurt in the real thing. More to follow. For now, let's look at a few things that have been happening in the world of stress and strain!

MCR-01 UPDATE

I am very pleased to announce that Dyn Aero have been able to provide a route by which the remaining nine MCR-01 aircraft can get airborne. By the time that you are reading this I know that at least one of these aircraft will be back 'in the air'. Regular readers will know that there are two big differences in the brackets that connect the tailplane to the fin on these aircraft; replacement of the Type 2 brackets was fairly straightforward requiring only a change from an aluminium lug to one made of stainless steel. We were able to get these aircraft flying again quite quickly after Dyn Aero came up with some stronger lugs. It has been more complicated to solve the problem of replacing, or modifying, the Type 1 lugs because the design of these lugs is completely different. Dyn Aero has come up with a way of modifying the tailplane so that it can accept Type 2 lugs; unfortunately, this requires the whole tailplane to be shipped back to the factory to be completed, as I have said, one owner has done this and is back in the air. The LAA has published an Airworthiness Information Leaflet (MOD/301/020 issue 2) explaining the procedure.

Dyn Aero has designed a 'loop' type support as an alternative to the factory fix so that owners can upgrade their tailplanes themselves; this modification

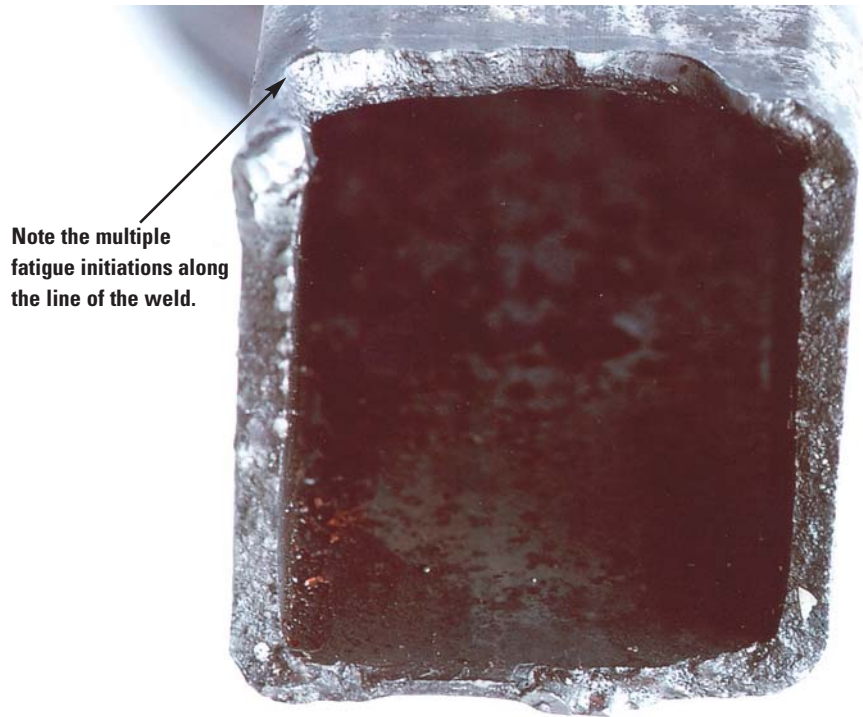
► has been successfully load tested and, at the time of writing, kits are being supplied to customers. This latter upgrade has not been approved by the LAA as yet, we have only just received the manufacturer's fitting instructions; we need to go through the procedure on a Guinea Pig aircraft before this modification is approved as there appears to be some accurate fitting required.

Noselegs

We have had a few problems associated with undercarriages over the last year or so and I think that one or two of these problems are worth discussing here. Before I describe the particular, individual items, I would like to remind readers that the two bits of a small aeroplane that have to work very hard, pretty much every flight, are the engine/propeller combination and the undercarriage. Pilots often take a great deal of interest in the former and completely forget the latter; I can understand this, when you have just spent all that money on the fancy flying suit, the last thing that you want to do is start grovelling around on the ground looking at undercarriages. There is also the phenomenon of 'out of sight ... out of mind' to be considered. Regular readers will know that propeller problems feature quite regularly in Safety Spot, I've got one or two for you later in this issue, for now, let's talk gear.

Pulsar

We have just issued an Airworthiness Information Leaflet (AIL) requiring an inspection of the nose undercarriage drag brace on Pulsar aircraft. This is in response to an accident at Popham last year when the nose undercarriage failed during the landing; Popham's runway is pretty smooth, the pilot had made a good landing, so the only real damage was the loss of the propeller and the failed undercarriage component. After an AAIB investigation, it was shown that the undercarriage drag brace support had failed at the point that it was welded to the engine mount frame. I have discussed before how a material can change in the area of a weld; local, unresolved internal stresses coupled with a change in temper can initiate fatigue foci. The AAIB kindly supplied some photographs



Note the multiple fatigue initiations along the line of the weld.

Photograph: H. T. Consultants

Pulsar Nose Undercarriage failure

of the failed component which I am happy to share, note the multiple fatigue initiations. This component had been about to fail for some time and an earlier *Spot* may have prevented an expensive (unexpected) propeller change and a trailer ride home.

As a point of interest the Pulsar aircraft was originally designed by Mark Brown in the early 90's; the aircraft was a derivative of his earlier single seater, the Starlight. I've had the pleasure of discussing (and flying) Pulsars with Mark and I recall him saying that the aeroplane was definitely not designed for rough field operation.

Aircraft are generally designed to a set of requirements, for the sports aviation community designers must meet the requirements of CS-VLA, there are stringent (and complicated) tests required on undercarriage components and these may include a drop test. As I have said before, passing a drop test is one thing, in-service conditions are another. In the above case the failure was probably due to cyclic bending loads at, or about, the limit load for the material in the component that failed.

I learnt to fly on taildraggers and I can remember the problem of, and definite need to, keep the stick hard back when taxiing. Manoeuvring on the ground was a skill that had to be learnt ... throttle, stick, brakes; three things, two hands. Couple this with no forward

visibility, wet grass and a fickle wind and ... well, you could start breathing again when your wheels finally left the ground. You've heard the terms 'black-out' and 'red-out', I've invented a new term, 'blue-out'! The point is that each aircraft has it's difficulties of operation and these areas of difficulty need to be respected by the pilot. Very Light Aircraft, in particular, need to be respected on the ground.

Alpi

Some time ago I received a report of some fairly serious cracking on the main legs of a Pioneer 300 aircraft. This aircraft had a fair number of hours on it and had recently been taken on by a new, and no doubt very proud, owner. There were a number of issues about this particular undercarriage which were unusual, and I won't bore you with these but, when both legs end up cracking in the same place, at the same time, then fatigue needs to be considered. Later legs are of a slightly different design, and Alpi has supplied this customer with new main undercarriage legs free of charge, which says a lot about Alpi's commitment to continuing customer support. Alpi has now called for a repetitive inspection on these legs by issuing a Service Bulletin; these cracks were entirely visible and should have been spotted earlier. Unlike the Pulsar



Photograph: Malcolm McBride

Pioneer 300 Main Undercarriage Crack

aircraft above the Alpi Pioneer 300 was designed as a tricycle type, and don't forget that it is a retractable. I note that the later Hawk has a beefed-up nose undercarriage which increases its max all up weight a bit; this new undercarriage is retrofitable onto the older Pioneer 300's.

Vans

Those that follow such things will know that Vans aircraft have been suffering a few nose undercarriage issues of their own; the LAA will be issuing an AIL shortly describing changes that need to be made to Vans nosewheel aircraft before the issue of the next Certificate of Validity. Vans aircraft are normally designed as either tailwheel or tricycle configuration and Vans always make the point that the aircraft must be landed on the mainwheels. The first major accident in the UK involved an RV-7A (the 'A' means nose wheel type) one afternoon in June 2007. The aircraft landed normally with two occupants in good weather. During the landing roll the aircraft encountered a series of undulations in the runway surface and the nose wheel fork dug in, the aircraft pitched over and came to rest on the runway inverted. There is a good picture of this unhappy situation in Ken's accident summary in the April edition of *Light Aviation*, if you're interested.

Later that month the National Transportation Safety Board (Office of Aviation Safety) published a study of a similar 'flip-over' type incident, involving an RV-9A, that occurred in Alaska in August 2005. This study focussed on the RV-9A case but also used data from eighteen (yes, that's 18) similar incidents involving tricycle RV's. Later, in September, another RV-9A 'flipped-over'; this time in the UK after a heavy landing. Because of these incidents Vans has issued a Mandatory Service Bulletin (07-11-09) requiring updated nosewheel

forks to be fitted at, or before, the next annual inspection. This modification increases the distance between the fork and the runway by about an inch and, so far, there have been no 'dig-in' incidents involving modified nose forks.

The LAA has been holding back on issuing an Airworthiness Information Leaflet about this as one of our members, Bill Knott, has been coming up with a mod of his own. Bill's mod uses a UK manufactured fork which he has designed to accept a big tyre (5.00 x 5), this actually increases the fork-to-ground dimension by two inches. This extra ground clearance has to be a good idea in the UK where the airfields can get a bit on the bumpy side. The Bill Knott 'big tyre' mod. has now completed flight testing and is fully approved by the LAA; if you're a Vans owner you should have received the AIL explaining your options by the time you're reading this. The only down side, as far as I see it, to Bill's mod. is that the spat will need to be increased in size to accommodate the larger wheel ... small beer, I suppose, if you've built your own aircraft; remember, Vans recommend that their aircraft should not be flown without a spat. These nosewheel mods only effect kits supplied before February 2005, more information can be found on the Vans website if you're interested.

Van makes some interesting points in his Service Bulletin and, to quote ... *"The nose gear on tricycle gear aircraft are not intended nor designed to sustain 'landing' loads. The nose gear is not a landing gear and is intended for*

Bill Knott's 'Big Wheel Mod' under development



Photograph: Bill Knott

► *ground manoeuvring after touchdown and deceleration.*" I suppose there may be some comments about this statement flying around the aviation/design approval community but, my advise to pilots, for what it is worth, is to always be mindful of nose undercarriage loads, for example: Consider the aircraft's centre of gravity, work it out (?), try to avoid a very forward CG condition; aircraft normally fly more efficiently with aft. CG anyway! Try to keep the stick back whilst taxiing, it's a habit that has been largely forgotten. Take a pride in keeping the 'nose up' after landing for as long as possible, get used to looking down the side if you get a little uneasy about lack of forward viz. Avoid heavy braking, especially brake 'pumping', this just loads the nosewheel up and can start oscillations which, especially on bumpy ground, can be difficult to manage. One last thing regarding the aircraft's operation, and I am a little embarrassed to remind you of this, keep the tyres pumped up!

One thing that has happened over the last few years is that builders are putting bigger and bigger engines in their aircraft; the difference between a Lycoming O-320 and an IO-360 is about 40 lbs and, when you take into account the inevitable VP propeller ... Well I shall leave you to do the math. Talking about VP propellers...

Airmaster AP332

We have had a report of a cracked ferrule on an Airmaster 332 that has been operating with a Jabiru engine which we are a little concerned about. Airmaster propellers are mostly fitted to Europa aircraft which are generally powered by the Rotax 912/914 engines; these engines are fairly high revving four-strokes and use a gearbox to reduce propeller RPM. This gearbox has the effect of damping out, or at least limiting, peak loads from the engine to the propeller hub. We have had no reports of problems with the AP332 coupled to a Rotax and only one reported problem with the Jabiru. The Jab engine doesn't use a gearbox and so the propeller hub takes all the loads directly and runs at a generally higher RPM. Peak power on the Jab 3300 (120 Hp) is at 3300 RPM, which is the prop speed; Rotax 912 peak (80 – 100 Hp.) is 4800 RPM through



Photograph: Bill Knott

Airmaster AP332 Ferrule Crack

a gearbox (various ratio's often 1:2.27) which relates to a prop RPM of about 2100 RPM.

The Airmaster 332 is a fully feathering propeller that uses an electric motor to adjust the pitch of the blades in flight, Airmaster us Warp Drive carbon fibre blades and, so far at least, these blades have demonstrated a good service history. Where possible, the LAA always likes the manufacturers to issue Service Bulletins to cover in-service problems, we might back this up with an Airworthiness Information Leaflet. I am in negotiation with the Airmaster factory at this moment regarding the cracked ferrule on the Europa propeller, I know that Martin Eskildsen, the Airmaster boss, is in the process of testing the hubs on Jabiru engines. One thing that Martin

highlights is that there is already a 25 hr/50 hr/ 100 hr inspection routine and owners should be mindful that inspections called by component designers are particularly important and shouldn't be missed out.

Woodcomp Effic

Last, but not least, please take a look at the crack emanating from the rivet that was put in place to assist in securing a metal leading edge 'protector' on this woodcomp Effic propeller. I do not intent to harp on about this bit of design brilliance ... Suffice to say that there were two propellers with this improvement (?) operating in the UK on SportCruiser aircraft ... They aren't any more! With that gem ... *Fair Winds!* ■

Woodcomp 'Effic' metal leading edge failure



Photograph: Graham Smith