



Inspectors gather for annual seminar

More than 100 LAA inspectors meet for an update on issues and to discuss a range of technical matters cropping up in the field

➤ IT'S three o'clock in the afternoon and a Bank Holiday weekend looms menacingly above the horizon. The weather is looking like it's working up for a fight, with the final showdown set for Bank Holiday Monday. What's new about that? I notice the BBC has decided it is now unnecessary to give a wind direction during the weather forecasts; perhaps our great leaders believe that compasses and magnets and stuff like that are a bit too difficult for the average punter. Or, could it be some subtle trick to 'up' their accuracy statistics? If they don't state the wind direction they can't be accused of getting it wrong... clever!

Anyway, weather aside, we've all (that's the LAA Engineers) been under a bit of pressure this last couple of weeks as Ken Craigie, the LAA's Chief Inspector – he who must be obeyed – decided to change the date of the Annual Inspector Seminar from the, more normal November, to the middle of May. No matter that it is our busiest time for Permit Renewals... "it's character building".

For those of you not aware we hold an Annual Inspector Seminar, let me say this, we do, and this year it was a real success. I was so enthralled by the various speakers that I forgot to take any photos. Peter Harvey, our Chief Executive brought his camera too but, perhaps for the same reason, didn't take any shots either. I mention this before you say, "Well, where's the picture then?" Please

accept my apologies and, trust me, the event happened.

The first half of the seminar was taken up with Company Business, so to speak. 'Pat on the back' from the Chief Exec Peter Harvey, and the Chairman Roger Hopkinson, warm hugs from Ken and a slap on the wrist from me.

The Chief Engineer explained some of the problems he, and the rest of the Design Team, have to deal with during the application process for a 'First Issue'.

One particular problem causing delays is that applicants are not using an up-to-date 'Completion' pack. Maxine Oades, the LAA's Engineering Administrator, asked me to mention this. So, when nearing completion of your 'new build' please contact the office for a current 'Completion' pack. If you don't do this there will be delays in getting your first Permit to Fly.

The Deputy Chief Engineer Jon Viner, nearly no

'Steve reminded us that mass is different from weight (stay awake at the back of the class)'



PHOTO Mark Miller

This close up of a crack in a Moth flying wire shows clearly the 45° failure often found when torsional stress/strain is involved. Corrosion pits combined with vibration are a bad combination.

longer the new boy, gave us a fascinating insight into the workings of EASA (European Aviation Safety Agency) and some of the changes to aircraft maintenance and certification happening now and expected in the future. 'Hats Off' to Jon for turning what I would describe as a less than interesting subject into an edge-of-the-seat performance.

It was the afternoon talks that the Inspectors (over a hundred in all) were waiting for, starting with Steve Fail from PlaneWeighs, who talked about the science behind aircraft weighing.

I spent a bit of time during a rather misspent youth flying a small floatplane that had been fitted with a proton magnetometer. This device measured the very small changes in the Earth's magnetic field in 'real time'. To get my current job, I had to do 'a couple of courses', as they say, and know that gravity is different from one place to another. Steve reminded us that mass is different from weight (stay awake at the back of the class), but, as the lecture progressed, I could see some of the inspectors scratching their heads, perhaps thinking that the whole basis of their existence was being undermined, the idea of wobbly gravity being far too much to cope with.

Next up was Mark Miller, the Chief Engineer of De Havilland Support, who gave a brilliant lecture on inspecting old wooden types. Mark spent some time explaining the problems of determining the acceptability of old wood, especially after accident damage. Check out the excellent picture of a longeron that had to be changed on his Rapide.

As many of you will know, there have been a few well documented cases of flying (and actually landing) wire failure on these types. Mark explained that most of these wire failures looked as if they had come about because of fatigue cracks originating from corrosion pits. Regular readers should be becoming aware of the ubiquitous nature of fatigue. I talk about it often enough so it was good to hear somebody else 'banging on' for a bit.

The final talk of the afternoon was given by Rob



PHOTO Mark Miller

This longeron, from a de Havilland Rapide, has reduced in size from 1in to 3/4in. As a lower longeron, at the rear corner of a sloping cabin floor, it was subject to a lot of water soakage. Each time the wood got wet it expanded, crushing the fibres. When the wood dried the attachments became loose and engineers tightened them. In effect the wood ratcheted down to a smaller size.

Midgley, Technology Manager from Shell Aviation. Rob works in the Aviation Fuels Division and knows all there is to know about Avgas.

Starting with the history of aviation fuel, he took us on a journey through time, outlining the principle changes to the fuel from its early beginnings to the present 100LL.

Regular readers will know that we've been having a few problems with modern car fuel in many of our aircraft engines, Rob did a brilliant job of explaining why.

Aeroplane fuel is one of those fantastic subjects that encompass pretty much all of the components of our complex society.

By this I mean it's not just a technical subject; during any sensible discussion about aeroplane fuel one must also consider the ethical, medical and, never overlooked of course, political dimensions that surround the subject.

Rob made a good case for not using motor car fuel in aeroplanes. His view, that the only truly consistent fuel available is 100LL, has some considerable merit. But leaded fuel has been

'Lead is very poisonous to humans and is known to cause irreversible damage'

banned in most fuel applications since 1996. Since, in fact, dangerously high levels of various lead compounds were found in the environment.

Lead is very poisonous to humans and is known to cause irreversible neurological damage. Avgas, commonly known as 100LL (100 octane, Low Lead) contains far more lead than motor fuel (for the road anyway) ever did. Avgas is not all good news, but at least you know what you're getting.

During the meeting the boss of Skydrive (UK distributor for Rotax engines), Nigel Beale, explained that 100LL is not good for Rotax engines for all sorts of reasons, the biggest being that the lead forms various post-combustion

compounds which remain in the engine. These deposits, which Nigel later describes to me as resembling a 'custard-like sludge', are a problem for engines with slipper clutches, like the 912 and 914 flat-fours. But piston rings and valves get gummed up too.

Another inspector commented that 100 octane fuel could damage an engine that was originally designed to run on lower grade fuel. Rob explained that an octane rating, over and above that required to prevent detonation, is actually just wasted and doesn't, in itself, do harm. He went on to argue that the correct selection of engine oil, that is, one that can absorb the lead deposits, should cure the problem of 'lead sludging'.

I could see from Nigel's body language that he wasn't convinced.

Rob did a brilliant job of covering this complex issue. I am still trying to work out the maths with regard to the differences between MON and RON... when I do I will let you all know about it. But, for goodness sake, don't hold your breath!



PHOTO ConAir Sports

Lead compound build up on this 912 poppet valve. This will have a negative effect on gas flow and could eventually prevent the valve from closing fully.



PHOTO ConAir Sports

When slipper clutches get contaminated with lead they stop working correctly. This will lead to rapid engine wear.

A few tips about Mogas

➤ I DON'T think the only problem aviators have with Mogas is the alcohol content – the pros and cons of adding alcohol have been well-aired. The real problem is that fuel is blended at the distribution depots in so many different ways, fuel companies are naturally reluctant to give away 'octane' for nothing. Recent changes to UK fuels by the addition of alcohol (an octane booster) means that the raw fuel used can be pretty poor stuff.

Automotive fuel, blended at the distribution point, is expected to be sold within two weeks and used within four. Any kind of chemical stability after this is unnecessary as far as a retailer is concerned. Try putting three-month-old fuel into a high performance outboard engine, I have, it won't start – the izz goes out of the fizz! So, tip one if you use Mogas – buy it and use it asap.

One of the problems that has always been associated with Mogas has always been its lower vapour pressure in relation to Avgas. The thing about vapour pressure in an aircraft is that, if

you're flying around, and the ambient pressure drops below the fuel's vapour pressure, then the fuel will change phase from a liquid to a gas in the fuel pipe and the engine will stop. Remember, pressure acts equally in all directions so the pressure of the liquid fuel will equal the pressure surrounding it. This problem goes away in the pressurised sections of fuel systems.

Vapour pressure is not a big deal in most modern cars. The fuel is designed for their fuel systems because cars form most of the market, but it's a big issue in aircraft fuel systems, particularly the gravity fed section of a system. Tip two, if you use Mogas: make sure the

'Try putting three-month-old fuel into a high performance outboard - it won't start'

system on your aircraft operates at a high enough pressure to keep the fuel in its liquid phase. Vapour pressure varies inversely with temperature, ie, the higher the fuel temperature the lower it's vapour pressure so, try to avoid excessive ground running causing heat soak in, and around, the engine.

If you have been stuck on the ground for any reason, and you're concerned that everything could be getting a bit hot, give the engine a full power check before committing to flight - any sign of rough running and return to the pan. I know some Europa owners actually turn off their engines if it looks like they're in for a long wait.

One last thing about vapour pressure which I'm a bit embarrassed to mention, well, considering the readership, is that the higher you go, the bigger the problem. Remember, one of the biggies in the design criteria for Avgas was vapour pressure. It's not a big deal in cars, so, vapour pressure of the fuel may vary between suppliers. In other words, one day no problemo, next day no engine.



MCR- Sloshing compound contamination 1

I RECEIVED a letter back last year from LAA member Alan Coatesworth about a problem that was encountered by his flying partner during a trip to France. I've been waiting for an opportunity to show you the results you can get because of the variability of motor fuels from one place to another and here's my opportunity.

I touched on this 'variability' issue earlier in the article. There's a lot more specific chemistry going on in motor fuel than there used to be; some of the chemical species used are extremely reactive.

We know that alcohol is a polar solvent and we've got a test to see whether there is any in the fuel we buy. Remember, it is illegal to use fuel containing alcohol in all aeroplanes except microlights in the UK at this time even if the engine manufacturer approves the use of such fuel. As far as we are able to tell it wasn't alcohol that caused the problem in this MCR-01 fuel system.

Alan's flying partner, David Walsh, was on a trip to Southern France in his MCR-01 and dropped in to Montpassat, which, so Allan informs me, is France's largest ULM base. He noticed the throttle 'didn't quite feel right', then it started sticking. Subsequent investigations revealed a brownish deposit inside the carburettor – take a look at the photographs.

David, and the French engineers thought the brown 'substance' looked suspiciously

like sloshing compound. A later spectrographic analysis confirmed this. It looks like something in the fuel reacted with this sloshing compound. It

hadn't happened before on this aircraft and, so far, it hasn't happened since. All I can say about this is, keep a close eye on your fuel system components.



PHOTO David Walsh

In some mysterious way, perhaps a strange combination of temperatures and pressure, the fuel changed its chemistry and attacked the fuel tank. This brown deposit was later analysed and found to be fuel tank sealant. It's not just the engine that needs to be assessed for Mogas suitability.

RV - Sloshing compound contamination 2

WELL-known RV enthusiast, Nigel Reddish, sent us a Van's fuel tank inspection cover he found in his workshop. I took some pictures and thought you

would like to see them. They tell their own story really, so I won't go on about it.

Suffice to say the aircraft that this plate was fitted to had 'suffered engine problems' for years

before this blocked (nearly completely) vent pipe was discovered. The vent pipe needs to 'breathe' easily to equalise the pressure in the tank and let fuel flow.



PHOTO Malcolm McBride

This Van's fuel tank was leak proof – problem was it was airtight too!



PHOTO Malcolm McBride

Ringed area on pic left shown above. Only these slots remain open.

GT and Airmaster AP332 propeller problems

REGULAR readers will know we've had a few problems with internal cracking of the blade securing ferrules on the Airmaster AP332 Variable Pitch Propeller when fitted to direct drive engines.

The problems with this propeller seemed to be confined to Jabiru 3300 engines as fitted to some Europa aircraft.

The AP332 design uses an electrically driven pitch change mechanism married to a Warp Drive blade. The blade itself is secured using a ferrule which is, in effect, a four-piece clamp. This clamp acts as a bearing surface which permits free rotation of the blade around its axis and secures the blade into the hub. Cracks have been found between the bearing surface and the clamping portion of the ferrule.

Airmaster produced a factory bulletin requiring an increase in the check frequency to each 50 hours last year but this crack was not found during one of these checks. It was noted by the pilot, LAA member Bob Knapton, as "an increase in vibration and a general feeling all was not well. The vibration went away with a small reduction in manifold pressure".

Thank goodness for Bob's acute senses!

I'm not sure exactly what's going on here, and couldn't know without sectioning the crack and conducting a full analysis, but it's looking like a fairly straightforward case of fatigue failure.

Whether the fatigue is being caused by high stress within the clamp during assembly (ie pre-load) or unusual harmonics focussing stress into a particular section of the ferrule, we may never know.

More likely, it will be a combination of the two stresses. Propellers contain many examples where materials have to withstand high cycle stresses. To achieve a reasonable fatigue life in this environment the material used must be relatively lightly loaded, but this is difficult to achieve in a propeller blade root.

One saving grace, with this particular design, is that it is readily inspectable. The LAA will be decreasing the time between inspections and decreasing the ferrule life.

One of the problems with establishing the structural suitability of propellers is that they are dynamic devices and blade behaviour is almost impossible to predict on paper.

The material the blade is made from plays a big part in the equation. A propeller blade may be likened to a tuning fork with metal blades producing quite pure, reasonably predictable, tones. A better analogy might be a flute – a non-complex tone with few overtones.

'A propeller blade may be likened to a tuning fork with metal blades'

Wood and composite blades have more complex vibrational behaviours, a bit like a tenor sax with a jazz mouthpiece. "Hey, listen to those overtones, man!"

One thing you don't want is a blade failing and leaving the hub. Ask Malcolm Ducker, the present developer of the Phillips 'Speed Twin'.

During a recent test flight a starboard propeller blade left the hub, went straight through the fuselage (narrowly missing the pilot's feet) and hit the propeller on the port engine which, naturally, didn't do it any good!

Fortunately, after a good bit of flying, nobody was hurt and the aircraft doesn't appear to have suffered further damage. You couldn't make it up!

Naturally, the parts are all with the boffins at Farnborough so we'll have to wait and see what they find.

For now, Fair Winds.



PHOTO Mark Collier

Fatigue cracks like this mean that the load passing through the component are no longer supported by the material. This forces the load to find a new path which will, almost certainly, place other material in an overload situation.



LAMBERT MISSION M108
the affordable 2-seat top quality sportplane

- excellent handling, easy to fly
- large cabin (43"), adjustable seats
- very large baggage area
- ideal aircraft for short grass strips
- full dual controls, manual flaps
- very robust tube & fabric airframe
- wing folding in under 5 min
- 85 kt cruise on 82 HP
- 5+ h endurance at avg. 14 lit/hour
- 600 kg MAUW, 280 kg useful load
- LAA kit aircraft with extensive factory assistance to reduce assembly time

UK Sales and Service Center

Hyperlite Ltd
2A Burford Avenue
Salisbury, SP2 8AG
email: hyperlite@hotmail.co.uk
www.HYPERFLITE.co.uk



WWW.LAMBERT-AIRCRAFT.COM
Whatever your mission, always fly Mission®