With Malcolm McBride
Airworthiness Engineer

Van's RV10 - Nose Undercarriage Mount Cracks

It certainly pays to keep your eyes on undercarriages, they do, after all, an awful lot of work and, in aeroplanes, they are always built down to a weight. I was very surprised though to hear about cracking on, Roger Hopkinson's nearly new RV10 which has just completed its annual check and Permit renewal inspection as the aircraft hasn't yet completed 150 hours. Actually, I think Roger deserves the prize for Spot of the Year and, if there was such a thing, he would get my vote. But, as the LAA's Chairman, I don't expect he would be eligible – sorry Roger, it's tough at the top.

The discovery of this crack is a good example of why we have an annual check on light aircraft. During an annual the maintenance engineer will be taking a very close look at individual components in an assembly – generally not the priority, unless specifically specified, during routine maintenance.

In this example Roger, with his maintenance hat on, was tasked to remove and replace the oil filter. This is a fairly straightforward maintenance operation: remove top engine cowl – cut the filter's wire locking – place small drip tray under filter – remove and drain residual oil from filter – check new filter has correct part number – inspect filter attachment – lubricate new filter oil seal – fit filter to engine and tighten appropriately – re-do locking wire to filter – refit top cowling – ground run engine to temperature – remove top cowling and check for leaks – check/top-up engine oil level – refit top cowling. Did I say straightforward?

When you break any task down to individual operations you can see why it's necessary to focus on each task specifically. In the example of an oil filter change just listed the engineer has to complete about fifteen fundamental tasks; only one of these is actually an inspection task (checking the attachment). The job's not finished though because there are a few more inspection tasks to perform. For a start, the work done on the engine needs a final inspection... this can be done by the pilot/owner but he or she will need to put their inspector's hat on to do it.

The old filter needs to be checked for contaminants. In this case both hats need to be worn. First, the filter needs to be cut open and the filter material laid out. This is a maintenance engineer's task. The actual inspection of the filter material, well, that's the job of the inspector. Different hat, different job, different way of thinking about things.

All this probably seems rather simplistic and, once you've bought into the concept that inspection and maintenance are different things, it is. But you'd be surprised by the number of maintenance-related problems that pass across my, or for that matter the Chief Inspector Ken Craigie's, desk, that have at their core the inability to see the difference.

The specific problem with the RV10 noseleg would be almost impossible to see with the oil filter in place so it made sense to Roger, after filter removal, to put his inspector's hat on and carry out an annual inspection of the components that make up the top of the nose leg assembly. This was when he spotted the signs of cracking. Andy Draper, who acts as Roger's inspector as well as being an LAA Design Engineer here at HQ, could see that this cracking was the result of the repeated flexing of the flat plate as the elastomer ring bears up against the landing/taxiing loads. Van's are working on a small design change here to prevent further cracking and Roger will be keeping an eye on this crack. LAA engineering has decided that this crack doesn't merit an immediate grounding as the primary load path is not affected. The repair itself will be quite a big job as the engine and engine mount frame will need to come out to accomplish the repairs and modifications.

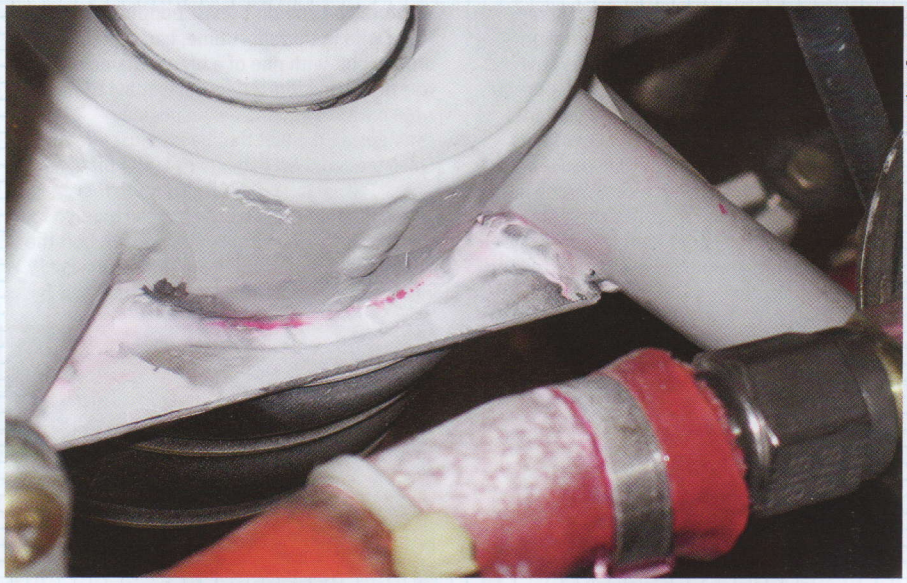

PHOTO Roger Hopkinson

This would have been a difficult crack to spot if the access was easy. As it was, it was only seen because of a focussed inspection of the undercarriage support. Noticed that the crack is easier to see now that 'developer' has been sprayed over the area. The developer used here is essentially a fine chalk suspension, when the solvent evaporates an ultra fine layer of chalk remains which subsequently absorbs the previously applied dye penetrant left in the crack.

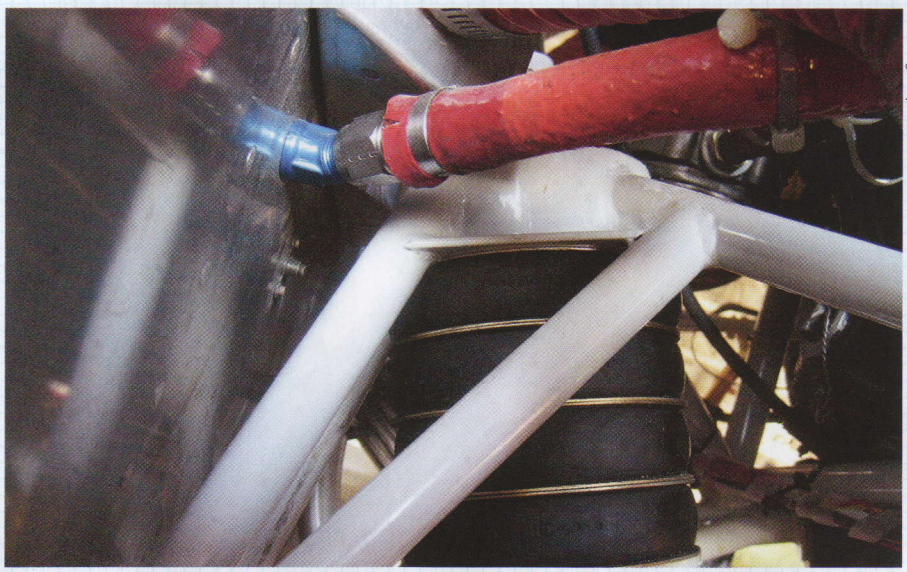

PHOTO Roger Hopkinson

The RV10 employs rubber 'elastomer' blocks to provide energy absorbsion. It needs to be fairly firm as it has to take the weight of the (in our terms) huge Lycoming IO-540 six-cylinder engine. Van's engineers are coming up with a fix for the cracks found in Roger's machine which they think were caused by rocking within the elastomer separation plates.