



SAFETY SPOT

Malcolm McBride
Airworthiness Engineer

Longer Evenings

I am never sure whether February should be considered the end of something or the beginning of something else; ok, the nights are drawing out, but the winter weather is still here. It's getting a bit warmer, but there is always the threat of snow. Christmas is behind us but it is a long pull to the next holiday; perhaps I should just jump in the lake No don't do that, spring's just around the corner.

Here at LAA headquarters we've hardly had time to catch our breath; I'm told that this is normally a quiet time, not too many Permit renewals, hardly any flying etcetera. The change of name has meant that every spare second has been taken up with quote "administrative duties" so no quiet time for the Engineers at the LAA this year!

The LAA year hasn't started well for other, clearly more serious, reasons. We have had three fatalities in PFA/LAA

aircraft, and two chaps have been seriously injured, in three separate incidents over the last few weeks. Officially, they will become last year's statistics as they all occurred in December but we have to deal with the consequences now. Firstly, our thoughts go to the families of the bereaved and 'best wishes for a speedy recovery' go to the two members that are at the time of writing still in hospital.

As a brief aside, I should perhaps remind all aircrew that all aircraft accidents which involve loss of life, injury or damage either to property or the aircraft must be reported to the Air Accident Investigation Branch (AAIB) as soon as practically possible. Ken Craigie, the Chief Inspector for the LAA, has recently written a Technical leaflet (TL 2.16) entitled 'Accident Reporting' which you can download from the LAA's website (in the Engineering section); it's worth a read.

All the accidents are still under investigation by the AAIB and we are waiting to hear whether there are any airworthiness implications for aircraft on our fleet; when the cause(s) have been fully established I shall let you all know the findings.

In my personal experience accidents rarely involve only one factor, and often, perhaps even generally, an unpleasant incident will be the result of many, often completely unrelated, events. This is why it is important to fix the small things, never allow yourself to get into the lazy habit of 'carrying' a lot of defects; each defect may contribute in some 'impossible to predict' manner. I had one instructor years ago who used to swear by the "hair on the back of the neck" method of decision making; if he got a tingling sensation he knew "something was up" somewhere ... he was generally right.

All Noise and No Go

Over the years I've got used to towing things around behind my car, there was the dingy, then various gliders, then trike



The location of the Leadscrew in the propeller hub

units, then my trusty 'Sorcerer'. I have even, and you may have a bit of trouble with this one, pulled a Piper Seneca along behind the car; admittedly in this last case it was in bits and the engines were somewhere else.

All those who have ever done this, and you can include boats and caravans, will know that it puts a bit of a strain on the old vehicle, and I can (almost) guarantee that you will have felt that (previously mentioned) 'tingling' sensation when the engine note didn't feel quite right ... clutch slip. It is a horrible sensation, you have the power but you just cannot get it to the wheels. A similar thing happened to one of our

The screw must be removed for cleaning, inspection and lubrication every 50 hours.



members recently in his aircraft, I shall say quickly that he wasn't towing anything at the time, or, at least, I don't think he was! I can almost hear you thinking "how can this be, what is he talking about? Let me tell you the story, are you sitting comfortably?"

Imagine this; you are the proud owner of a Europa Tri-Gear climbing away from your own private airstrip (the airstrip is

▶ situated on an island in the Orkneys), the aircraft is fitted with a variable pitch propeller, so, quite normally, you select 'climb' mode on the CSC -1/G constant speed controller; you might look to the right, smile at your passenger and think that you are lucky indeed to be able to enjoy the majesty of flight. You begin a roll onto heading when you notice that the engine RPM is actually increasing, and not, as you would expect when going uphill, settling back to climb RPM. Smile gone, you increase the power, but all this does is increase the engine RPM, you note that your climb has turned into a two hundred feet per minute decent and your landing options are very limited. At this point you would normally wake up in bed sweating, a dream that turned into a nightmare.

Actually, this in-flight emergency actually happened and, to the great credit of the pilot, a superb out-field landing was made on what purports to be a beach up there, coming to rest only 20 metres from the oggin. A flapless landing was made and the occupants walked away from the incident without injury; unfortunately, as is often the case with outfield landings, all three undercarriage legs were badly damaged. So what happened?

The short answer is that the pitch change mechanism in the variable pitch propeller failed and it found its own pitch, which in this case was very fine indeed. For those that are unsure of the advantages of a variable pitch propeller or how they work I shall give a brief overview here. Please note that there are a number of different systems about, some using hydraulics, some engine oil pressure, some even use pneumatics to adjust the pitch of the propeller. Most of the systems that seem to be coming available to the sport pilot, which are especially suitable for use with the Rotax and Jabiru engines, use electrical power through some sort of hub-located gearbox.

Without going into the aerodynamics of propellers too far, variable pitch propellers give a great advantage to the operator of an aircraft because they increase the propeller efficiency. In a nutshell, this increase in efficiency serves to increase the width of the aircraft's velocity envelope, increases climb rates and can reduce overall fuel costs. Because the correct pitch for the particular mode of flight can be used, rather than a compromise, short field performance is often enhanced. The

downside is that systems tend to be expensive, need extra maintenance and usually carry a weight penalty.

A propeller blade can to some degree be likened to a wing, and just like a wing the forces acting on the blade can be broken down into the well known thrust, drag, lift and weight vectors most of us will be familiar with. With propeller blades it is important to remember that they rotate so that there are other forces at work, one of these forces, known as the Centrifugal Turning Moment (CTM), has the effect of fining-off the blade. In opposition to this, the Aerodynamic Turning Moment (ATM), coarsens the pitch; balancing these forces is one of the reasons why propeller design is often considered an art rather than a science, although I expect I shall get some horrible emails from propeller designers explaining why, in this computer age, this is not so!

In our Europa failure above the CTM was larger than the ATM and when the mechanism failed the blade went 'super fine' and, with nearly no angle of attack, the blade could produce almost no lift and we have our incident. Before we look at the Engineering implications of this failure I would like to point out that, even with the mechanism failure, this 'super fine' condition should not have occurred so, harking back to earlier in Safety Spot; most accidents are the result of often unconnected events...

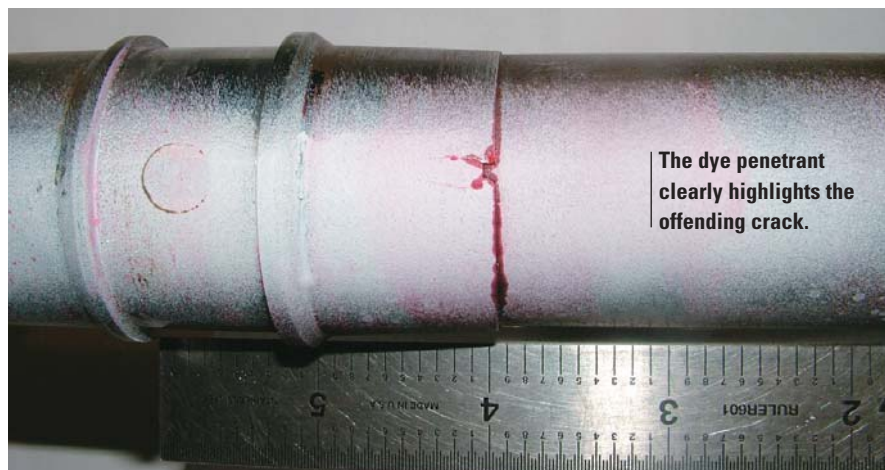
Let us cut to the chase with this, the reason for the propeller failure was that the lead screw that acts like a worm gear and drives the propeller pitch change mechanism failed. It failed through lack of lubrication. The reason why the propeller went to super fine pitch is that stops in the system (the fine pitch stops) were incorrectly set. Either one of these things on their own could

have caused an incident; both together, an accident. The reason that both these things were wrong is that propeller maintenance had not been carried out to the manufacturer's instructions. I wonder if this constitutes a shot in the foot as really this is only one thing!

The propeller type in question is the Arplast PV50 and the LAA Engineering department is working with Jerry Davies of Lyndhurst Touchdown Services on a fix so the above situation cannot happen again. With regard to the Lack of lubrication, the LAA has produced an Airworthiness Information Leaflet which highlights the service intervals for the propeller. In effect the lead screw in this mechanism needs to be removed each 50 Hrs, cleaned, inspected and lubricated. Full instructions for doing this are available from Jerry. With regard to the lack of the fine pitch stop there is a fix available for this, also available from Jerry. Because both the inspection/lubrication and fine pitch stop setting requires the propeller mechanism to be disassembled there will need to be some inspector involvement and a Permit Maintenance Release will need to be signed before flight.

Noselegs

Imagine this; you have been flying around quite happily re-familiarising yourself with your beautiful Bolkow Junior Keep the ball in the middle, little high you get the picture. You haven't flown for a while and decide to return to the airfield for a few 'touch and go' landings; the first one goes well and round the circuit you go, "Bolkow final to roll" (I know but I'm too old to change), good landing, off you go quite happily climbing away when the radio chirps into life "Bolkow, ehmm, your nose



The dye penetrant clearly highlights the offending crack.