With Malcolm McBride
Airworthiness Engineer

A GOOD PRE-FLIGHT ROUTINE

Another year and we've made it through – in the final Safety Spot of 2013, we look at the importance of a thorough pre-flight routine

Welcome to the last Safety Spot of 2013; it doesn't seem possible but, yes, I've made it through another year… at least I think I have. You may know differently of course, I am writing this in mid-November and, well, anything can happen. Of course, the fact that you're reading this means that you made it too – well done to you for that… let's hope there are many more years in the fuel can for both of us!

I think I should be OK health-wise, at least for the next few days; I've just had my annual medical and the practitioners (various) were very complimentary that I'd managed to get my weight down a bit… actually I have dropped a bit, but only a few pounds. What they were really pleased with was the huge drop in my Body Mass Index (BMI), which is some kind of ratio between height and width, which in my case now sits exactly on the line between 'Satisfactory' and 'Overweight'; a status much improved over last year's results where my records showed my BMI as being well into the red.

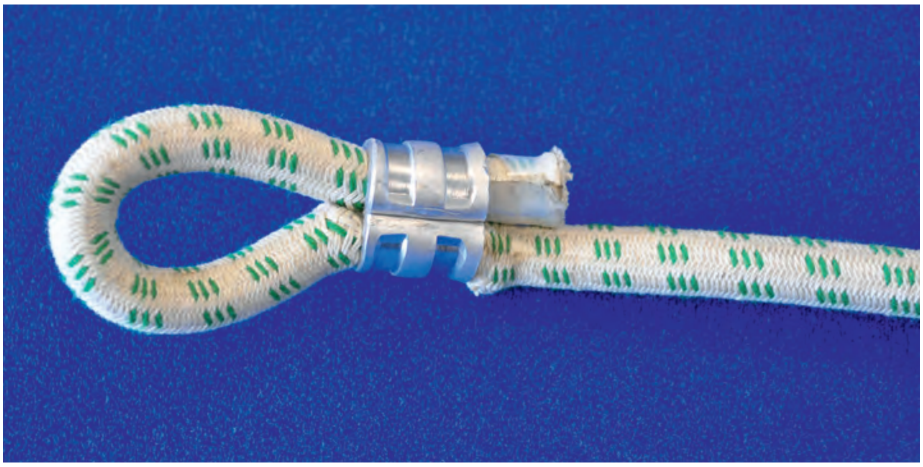
Mind you, I noticed, when taking a surreptitious look over the nurse's shoulder at the computer screen, that during their 2012 checks they had recorded my height as 5ft 3in! Clever as they no doubt are, they haven't noticed that I've had a recent growth spurt to 5ft 11in. Just goes to show you, the old rules are the best ones: 'Measure twice – cut once!' Still, it's always good getting a compliment (especially if you weren't really expecting one).

I did notice that the nurse charged with the responsibility of collating all the various tests seemed rather under pressure; I got the impression that a recent time-and-motion study had suggested to her manager that she could fit a couple of extra patients in. "She just needs to type a bit quicker and… well, how can I put this, get rid of the small talk. It's not about building a relationship with the patient, sorry, client, it's about getting the numbers."

There are of course times when doing things by numbers works; I'm sure we've all had jobs where a regular routine has meant that practice effect takes over, at least for some of the time. In some activities I think that this is fine, in fact it can be quite pleasurable running on semi-automatic but (and there's always a 'but' somewhere when looking at human factors) there are times when it's good to break a routine and slow down a bit.

In the context of aviation safety, one behavioural area that a pilot can easily 'slick-up' is the routine (key word!) pre-flight inspection; with practice, you'll look pretty cool from the aerodrome café: "That chap knows what he's about," exuding, with a well-practiced air, competence with each wiggle of the aileron and surreptitious look at the audience through the main gear. But a pre-flight inspection is not about looking cool, it's about discovering problems with the aircraft whilst safely on terra firma, and this is especially true for the pilot/owner, a status that many of you reading this will fall within.

I shall begin this Safety Spot with an example where a good pre-flight almost certainly saved an aircraft from becoming seriously damaged during the following landing and, just to balance up the narrative, a couple of examples where owners didn't spot problems and weren't quite so lucky; first the good-news tale:



Once LAA Inspector Colin O'Neil had got the bungees off, it was easy to see how the failed bungee could get through an initial inspection – although a closer look would soon tell you that all's not well with this component. *(Photo: Malcolm McBride)*

DENNEY KITFOX II – UNDERCARRIAGE FAILURE

I've got quite used to arriving at my desk here at LAA Engineering HQ and finding that in my absence, somebody has deposited a bit of broken (or about to break) aircraft component. Quite often there's no accompanying note and I have to wait until I've got the computer started to access my email… 'Dear Malcolm, You weren't about so I left this interesting bit on your desk, I hope you don't mind!' I always reply, being a bit of an anorak when it comes to failed components, that of course I don't mind, far from it… it might have been a teensy weensy bit better if you'd drained the oil out first, but never mind!

I wasn't surprised therefore when one Monday morning recently I arrived to find two undercarriage bungees resting on my keyboard without a note. I took a quick look at the two very new looking items to try to see what might be wrong whilst my mailbox went through its opening routine. Mm, it was clear that the crimp which turned a length of 10mm bungee cord into a component had, during the crimping process, cut the bungee and caused it to fail. Take a look at the accompanying pictures and you'll see what I mean. Each length of bungee was terminated at each end by a two centimetre (inside diameter) loop and it was clear that the rubber strands had failed at the crimped connection at all four ends.

Once my mailbox had opened, I noted that there wasn't anything in it connected with the bungees and nobody in the office had a clue as to their origin. Ken, the LAA's Chief Inspector (and a regular parts contributor to my desk) was away carrying out a regular inspector audit, so I put the damaged components to the side to await his reappearance.

"Ah yes, they're off an Irish Kitfox," explained Ken on his return, "I bumped into Colin O'Neil

You can see from this picture of a sectioned ferule that the ferule itself has cut through the shock cords that make up the bungee. What may have happened here is that the wrong swaging method has been used; my guess would be that a Nicopress hand swaging tool has been used when the ferrule was designed to be used with the Tallurit system. Both systems, incidentally, were originally designed for use with steel cables, not bungee cord. *(Photo: Malcolm McBride)*

Above is a picture showing the very nearly failed suspension bungee from a Kitfox II. A spot like this reminds us all of the great importance of a thorough pre-flight inspection – this bungee would probably have failed during the next landing. There's another lesson here; these bungees were nearly new and probably wouldn't have been high on the pilot's list of things to worry about. *(Photo: Colin O'Neil)*

Here's a picture of a Nicopress swaging tool, along with a copper alloy swage… notice that the swage is marked with the company's name. *(Photo: Nicopress)*

(who, as well as being a commercial pilot, is a busy LAA Inspector) and he thought we'd be interested in these failed undercarriage bungees." Now knowing their origin, I gave Colin a call at his Newtownards base.

Colin explained,"This owner doesn't fly the aircraft much at the moment because of other commitments, so I take her up now and again to blow the cobwebs out. She's recently undergone a bit of a refurbishment but, because she doesn't fly much, I always give the machine a really good 'going over' before committing to aviation."

I agreed that this was always a good idea with 'Hangar Queens' and asked whether the aircraft sat OK on the tarmac. Colin replied, "Absolutely, in fact the actual ferrules sit up inside the airframe and I wouldn't have spotted this, or should I say these, failures had I not been so thorough."

I decided to section the crimped ferrule and, as I hope that you can see from the photos above, almost all of the rubber strands have been sheared by the ferrule itself; this was most likely to have occurred during the component's manufacture. I asked Colin if he knew where the parts had originated and he explained that the owner had bought them from the Kitfox agent in the US some time ago and that these parts had served less than five hours in service. Well done Colin for an excellent spot.

It's not much fun completing a good landing only to find the undercarriage letting go during the process; after all, nobody would believe that you'd completed a greaser now would they? Undercarriage failures happen though, with what seems like an increasing frequency; I have five recent files on my desk where undercarriages have suffered a structural failure of one sort or another.

What I mean by this is simply that there's been a materials failure which has led to undercarriage collapse (as opposed to a failure due to incorrect adjustment… another regular culprit). Let's see, there's a Luscombe with a broken axle, I'll maybe feature that as a picture in a later issue. A Lazer Z200 that's lost a wheel, I'll save that for next month as I need to carry out a couple more tests. A Lancair 320 whose operating arm has failed… that's for next month too… and a couple of tailwheel failures, both on Pitts Specials; let's start with one of the Pitts Specials.

PITTS S-1S – TAILWHEEL CONTROL FAILURE

We received an email from LAA Inspector and Jabiru engine expert, Gary Cotterell; he's very recently completed the total rebuild of a Pitts Special that had been very badly damaged in a nose over landing accident some years ago and, to use Gary's words, when he was "just getting comfortable in it." The email simply confirmed what we'd heard on the grapevine. Gary's email read, 'I've called the AAIB to let them know that I've crashed the Pitts; I had a heavy amount of tailwheel shimmy, the right hand steering link broke and the aircraft turned sharp left into the boundary fence.'

I gave Gary a call, partly to commiserate (I know how much effort he's put in over the last year or two), but also to find out what had gone wrong – we'd had a report that a tyre had burst. I know that Gary has done a fair amount of flying in this machine and that 'feet-trouble' wasn't a likely cause.

Gary explained. "I knew what had happened as soon as I was able to get a look at the tailwheel control cable… the connecting link, which looks like a small Carabina, had failed. I will send you the bits. The day started well, but 3,000 hours of work over 3½ years came to nothing when this two quid component gave way."

Gary said that he'd recovered the aircraft back to his workshop and that he'd already started to write-up the damage report and would be submitting an LAA MOD 8 (Repair Approval) form shortly.

Looking at the component it's clear that the threaded part of the locking turnbuckle has pulled free from the barrel. My guess is that this part has been coming loose for some time; the threads are all still in place and, although the actual fit is very loose, I › couldn't pull the thread from the barrel so the thread itself hadn't failed. It may be that the barrel has become unwound slightly and the resulting vibration in the component caused significant wear… take a look yourself at the picture showing the broken connector.

Shimmy is another name for a relatively low-frequency oscillation within a mechanical system; in an aeronautical sense it is a word associated with nose-wheels and tail-wheels where the wheel and fork assembly vibrate fairly rapidly from side to side. If you have never seen shimmy, pop along to your local supermarket and watch the behaviour of the shopping trolley wheels if you try a high speed pass between the aisles… especially before you've loaded-up the basket with your weekly shopping. Shimmy can be reduced primarily by increasing the system friction in some way; some systems employ damping devices (some oil based, some friction-plate based), others by employing mechanical locks. Naturally, by increasing the friction you are decreasing the steer-ability of the aircraft.

I've spoken to many tail-dragger pilots over the years about this and they all have different ideas about the best set-up to avoid shimmy and retain good control during both the landing phases and the taxi stage. My personal view is that runway control (take-off/landing) is best done using rudder and that tailwheel steering should only be used for taxying – on the tailwheel machines I've flown, that's how I liked the system to be adjusted.

As I've mentioned, there's often a compromise between stiffness and control-ability but, whatever set-up a pilot prefers, there's often a point during the landing phase where the pilot loses full rudder authority but still has a relatively high rolling speed. Hopefully, if he or she's got the landing right, they'll be straight down the runway and the machine can be brought to a gentle halt using the brakes; I'm not keen, as I've said, on getting too used to tail-wheel steering to keep straight at this point in the landing run. In this example, the failure of a two quid part has, for one reason or another, cost a great deal. In this next failure I think the basic reason for the failure is probably very similar but, sadly, the resulting damage was quite significant.

(Above) **After 3,000 hours rebuilding this Pitts Special, LAA'er Gary Cotterell was naturally very upset when he ended up in a ground-loop shortly after landing. One experienced tail-dragger pilot I spoke to when discussing this incident says, "Well there's those that have – and those that are going to." In truth, Gary was lucky that the damage was not more extensive (main undercarriages don't like sudden side loads) and he walked away without a scratch. Gary considers that the primary cause of this ground loop was the failure of one of the steering links (see below) although the general consensus amongst tailwheel experts is that the actual steering effect on a tailwheel through this link would (or, at least, should) have been minimal and this component's failure wouldn't result in a ground-loop. The tailwheel steering system works through springs primarily to limit the potential load through the system generated by rudder action; at best, steering can be accomplished at low speeds with this system; at high speed, rudder should be used to keep the aircraft straight. When this becomes less effective as the aircraft slows, appropriate application of differential brake should be used.** *(Photo: Gary Cotterell)*

(Left) **I hope you can see that this component wasn't really designed to take huge loads. It's not possible to know whether this component failure was the cause of the accident or broke as a result of it. The bottom item is the assembled link and the top item shows how the link has pulled straight when the threaded barrel has worked itself undone. Opinions vary about how the spring tension should be set-up to give optimum steering, but one thing is for sure, operating with very tight springs will mean that there will be (potentially) much higher loads in the attachments.** *(Photo: Malcolm McBride)*

PITTS S-1S – TAILWHEEL CONTROL FAILURE II

Tailwheel shimmy is nothing new. In fact the problems of shimmy relate closely to a primary structural conundrum faced by all aircraft designers, that being the structural stiffness, in other words, the ability for a structure to yield under load and ultimate strength. All mechanical systems, however stiff, will have a number of naturally occurring resonant frequencies and tail wheels are no exception. Given the right input, any system will vibrate.

I spoke to the owner of another Pitts who had very recently become a passenger during a landing when the aircraft developed 'an uncommanded turn to the right'. The pilot applied right rudder to counter the turn with no effect and the right turn accelerated to the point where the tailwheel unlocked. The aircraft then rapidly pirouetted through 180° collapsing the landing gear and striking the left wing on the runway. The pilot vacated the aircraft, recovered his composure and took a look at the tailwheel assembly to see whether it offered up any clue as to why steering authority had been lost; it didn't take him long to see that the link connecting the control cable to the tailwheel spring was missing… you can see what the pilot found in the accompanying picture.

Unfortunately, despite a thorough search, the missing link wasn't found and so we're never going to know the exact failure mode. What we do know is that the pilot was concerned that a small change he had made to the system had led to the components failure; I discuss the possibility of this under

A closer look at the threads from the failed steering link shows the effects of wear; notice how the threads themselves are rounded. It's possible that shimmy has exacerbated this wear… note that there are actually only a couple of threads engaged when fully assembled.
(Photo: Malcolm McBride)

Here's a close-up of the threads from the 'un-failed' link. Notice that there are a lot more threads engaged although this thread is also badly worn.
(Photo: Malcolm McBride)

the accompanying photos. From my own personal experience (and having spent quite a time chatting to tailwheel experts), I feel I'm on fairly safe ground with my comments earlier in this piece – that it's unwise to expect the average tailwheel steering system to be able to cope with forces involved during high-speed direction changes on take-off or landing; that's a job for the rudder or the independent main-wheel brakes. And certainly, no mechanical system will last for long if it's suffering shimmy.

CZAW SPORTCRUISER – ENGINE FAILURE AFTER TAKEOFF

I received a telephone call from LAA Inspector and SportCruiser expert, Graham Smith. Graham had just had a couple of exciting days trying to reposition a SportCruiser for her new owner. After quite a bit of to-ing and fro-ing, Graham has finally established what went wrong with this particular engine and, in doing so, may have opened up a box of problems for Rotax 912 series engine operators. Intrigued? Let's let Graham tell the story from the beginning:

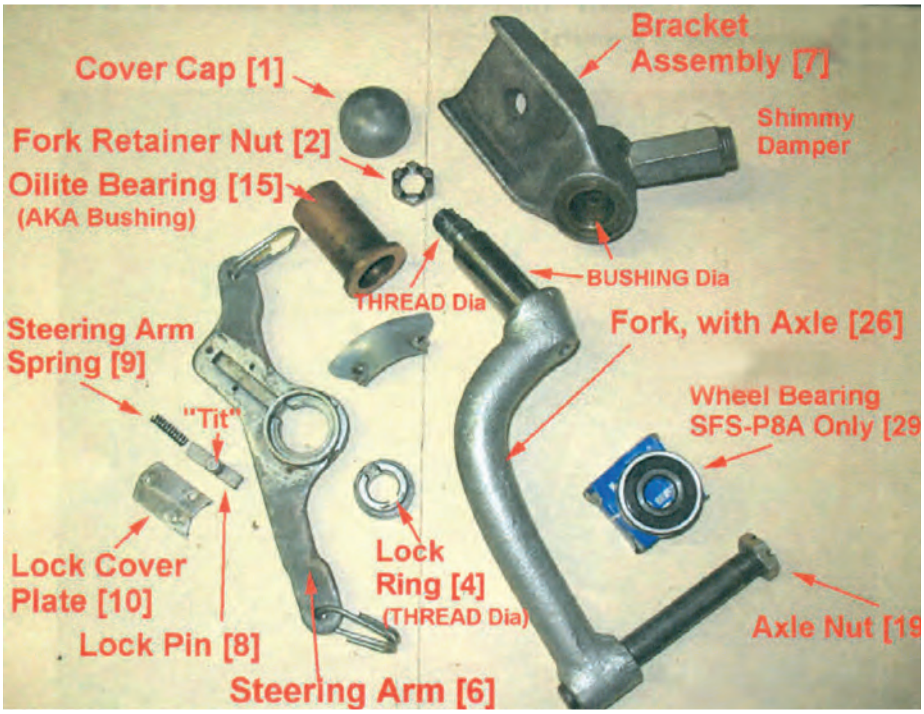
Dear Malcolm
Here is a short report on the incident at Leeds Bradford with a SportCruiser.

I was asked to sit in with a new owner on the collection flight of a SportCruiser from Leeds to Biggin Hill. I did a quick pre-purchase inspection for the new owner, removed the cowls to do a visual inspection of the engine and fuelled up for the flight home.

The power checks were normal so we lined up on Runway 14 and set off for Biggin, I was in command sitting in the left hand seat. After take-off (at approximately 350ft agl) the engine developed severe vibration and lost power. I immediately closed the throttle, made a quick radio call as I turned the aircraft onto a reciprocal heading (as there were no suitable landing spaces ahead and I had plenty of height).

There was a Ryanair 737 just about to take-off and he was told to hold position giving us a free hand to land anywhere we wanted. We were probably only in the air for about one minute before putting the aircraft down back on Runway 32. I had no tools with me so was unable to do any diagnostic work on the engine, but the circumstances appeared to be similar to problems I have encountered with the Rotax 912 when one carburettor becomes blocked (normally by rubber

This photo comes from another example of a Pitts ground-loop. This time the owner was not so lucky and the sudden swerve did break one of the main undercarriage supports. You will notice that the spring is connected in this case using a simple one-piece link… one of which has failed. Another thing to notice is that this system uses a compression type of spring (they pull from the inside and can compress fully if not correctly set up – this in effect means that the sprung connection becomes a solid one). This type of Maule tailwheel has a massive trailing angle and therefore naturally wants to go straight if set-up correctly; the Pitts has a maximum rudder angle of ±30°. Even at full rudder deflection the turning force to the wheel is miniscule compared to the forces keeping it straight.
(Photo: Supplied)



Above is a picture of a dismantled Maule tailwheel assembly. Notice that the steering arm is connected to the fork assembly through a spring-loaded lock pin; this allows the pilot to perform gentle turns using rudder and tight turns using differential brake. A good shove on the side of the fuselage will (or should) unlatch this type of tailwheel which allows ground personnel to push the aircraft backwards. *(Photo: Drew Fidoe)*

***(Left)* Here's a picture of an installed AC mechanical fuel pump that's being withdrawn from use by Rotax although the service history of this pump in the UK has shown that it works well. Interestingly, Rotax suggests that all mechanical fuel pumps should be replaced after five years, although operating under the LAA's 'On-Condition' scheme, the LAA has examples of pumps lasting many years longer. The pumps originally fitted were manufactured by Pierburg – when these became unavailable Rotax swapped to a Bing (AC) pump. It's these pumps that Rotax wants to replace. The latest pump is manufactured by BCP Corona and produces slightly more pressure and this increase in fuel pressure has led to some problems with some installations, primarily carburettor flooding. Strangely, some manufacturers have advised owners not to use their auxiliary (electric) fuel pumps during take-off because of reported rough running. LAA advice is that if the engine runs roughly during normal operation, the cause needs to be established and the issue resolved. In general, adjustment of the fuel system pressure can be accomplished by adjusting the size of the flow return restrictor. LAA Inspector and Conair boss Conrad Beale suggests, "Ideally, the system should be set up so that the pressure falls midway between minimum and maximum permitted fuel pressures; this works out as about 0.3 bar. On most installations this needs a 0.35mm restrictor – although systems vary".** *(Photo: Skydrive)* *particles from the inside of the fuel hoses loosened by barbed hose tails). I agreed to go back at a later date with some tools to take a look and correct the fault.*

A few days later I went back to Leeds with a suitcase of tools and stripped down the fuel system, expecting to find debris contamination, but found nothing. The fuel system was spotless and I was very confused. I rebuilt the carbs using new gaskets and carried out fuel flow checks which were OK. The fuel delivery at minimum inlet pressure was more than 50 litres/hr. As I was unable to find any faults, I decided to ground run the engine but this produced no symptoms and a quick check circuit was also normal. I loaded my tools in the aircraft and again booked out for Biggin Hill. On take-off the fault occurred again at approximately 350ft but being one up the forced-landing was much easier this time.

At this point I decided to really look at the aircraft to see if any maintenance had been done between the last successful flight and the problem flight. The aircraft had completed about 80 flight hours without a problem but the fuel pump had been changed for the later type before the first problem flight. A phone call to the UK Rotax agent suggested that some examples of over-pressurisation of the fuel system had occurred with the new pump. The point was also made that it was important to have the correct type of vapour return restrictor fitted as this was factored into the fuel pump performance. I knew the SportCruiser aircraft mostly have the CZAW type restrictor fitted so a Skydrive replacement was ordered and delivery arranged for the following morning.

The next day, I decided to carry out return fuel flow tests using the old CZAW restrictor and then the Skydrive replacement. The CZAW unit delivered 2.4 l/ hr which I would normally consider a bit low. Once fitted, the Skydrive restrictor yielded 7.2 l/hr.

I decided to ground-run the engine to full power and compare the fuel pressure between the new restrictor and the old CZAW restrictor; the engine behaved itself normally with the fuel pressure (at full power) dropping from 5.5psi (c. 0.4 bar) to 3.5psi (c.0.3 bar) after fitting the Skydrive restrictor.

I believe there is good evidence that the engine failures were caused by an increase in fuel pressure which the carburettors could not cope with. The vapour return line restrictor which has thousands of hours of reliable operation is not compatible with the replacement pump.

ATB
Graham

So, to summarise, two consecutive engine failures shortly after take-off, followed by the replacement of the fuel vapour return restrictor which dropped the fuel pressure slightly. Actually, Graham subsequently re-flew the aircraft with the new restrictor and all was well with the aircraft for its trip to its new home (and continues to be so).

Firstly, very well done to Graham for pulling-off two successful landings after an engine failure just after take-off. I will give the usual health warning about the very great dangers involved in turning-back after losing an engine after take-off. Certainly, this is normally considered a 'no-no' manoeuvre (you'd fail your GFT immediately if you tried it) but clearly, as in Graham's case, there will be a height where this could be an available option. The very great danger in the 'turn-back' comes about because a sudden engine failure in the climb is very likely to result in a rapid decrease in speed and, at this lower speed, any turn could, and has sadly many times, ended up with the aircraft ending up in a spin. Even if a hot-shot pilot could coax an aircraft round this almost inevitably low-level 180° turn, it is very likely that a huge amount of height would be lost in the manoeuvre and, even if successful, the pilot would be faced with a downwind, engine-out landing, some distance short of the airfield. So, normally, engine failure after take-off means lower the nose, maintain airspeed and land safely ahead.

That said, I'm still a bit mystified as to why the carburation system should fail with a slight increase in fuel pressure; the initial pressure, with the CZAW restrictor, was measured as 0.4 bar. This was the maximum fuel pressure allowed admittedly, but even if on the high side, it was still in the green and should have been OK. In fact, Rotax engines, perhaps because they were aware that the replacement fuel pumps do give a slightly higher pressure, have increased the maximum allowable system pressure to 0.5 bar.

I decided to chat this issue through with Rotax guru, LAA Inspector, Nigel Beale. He explained, "You'll remember that we spoke about applicability of the Service Bulletin issued by Rotax recommending that owners should replace their Bing (AC) fuel pumps as soon as practicable."

I said that I did remember this, recalling that we spent some time trying to understand why these pumps should need to be changed. Nigel, at the time, was mystified as they seemed to have a good safety record, at least in the UK. He'd not been able to get any information relating to failures from Rotax themselves.

Actually, Rotax were clearly worried enough about these Bing pumps to offer a free of charge replacement service for pumps supplied after 2008, even if they weren't able to be open about the reason. Readers should be aware that Rotax considers that the safe life for all mechanical fuel pumps is five years, hence the free-issue date limit.

Nigel continues, "Since this summer we've exchanged over 250 pumps; it's been a massive job and so far we've not had any official reports of any problems with the exchange."

I asked Nigel what he meant by 'official'. "Well, if people have problems with their engine we ask that they fill out an incident form, the problem is that nobody can be bothered to do this."

Skydrive's problem is really that Rotax won't talk about an issue unless one of their incident forms is filled in… "You see the problem!" exclaimed an exasperated Nigel. I did, but as Nigel is a long term LAA'er I didn't need to explain that, in the LAA, we have a very informal reporting system that works very well indeed.

I asked whether he'd heard about any problems unofficially and he said that he'd

Nigel Beale of Skydrive decided to check at what over-pressure the float valve opened. The new limit for fuel pressure is 0.5 bar. Nigel checked a number of carburettors (some pretty well-used!) and none opened below 0.8 bar. This is a creditable test although it's only realistic up to a point. It may be that vibration energy will significantly affect this figure. *(Photo: Mark Beale)*

(Left) **Whilst the LAA isn't aware that the Bing (AC) fuel pumps have been causing problems, some BMAA flyers have reported issues. One reported involved a failure of the internal valve assembly, where one of the valves came loose in its housing.** *(Photo: Mark Jackson)* heard of a few issues affecting the EuroFOX post pump change and that he's heard a rumour that a Sting had had issues but, as I said, nothing official.

Nigel went on to say that he'd done a bench test on several Bing carburettors from Rotax 912 engines, selected at random, which showed that if the fuel pressure was purposely raised above the normal maximum permitted value of 0.5 bar, the float valves weren't forced open until the pressure reached 0.8 bar, which seemed on the face of it to indicate a very satisfactory safety margin. This would be expected to avoid problems even if the return line was blocked altogether – which seems to make sense as many of the early Rotax 912 installations didn't even have vapour return lines.

After thanking Nigel I decided to give the EuroFOX importer's principal engineer, LAA Inspector, Adrian Lloyd a ring.

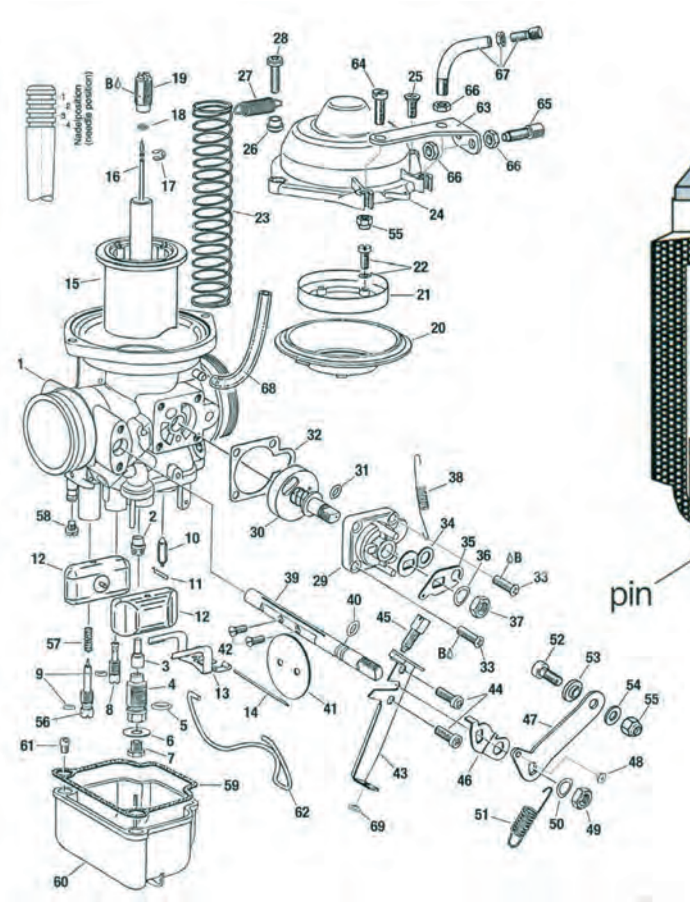
"I was expecting a call," Adrian exclaimed, "you've been speaking to Graham Smith haven't you?"

I explained that I had and asked, "What's all this about unreported engine failures on EuroFOX aircraft?"

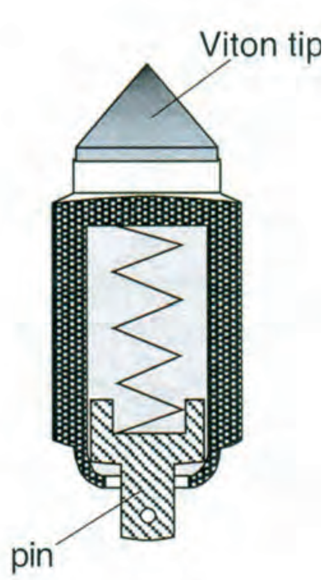
"Chinese whispers," replied Adrian continuing, "Yes, we've had a problem with some of the machines during idle and it appears that the slightly higher pressure from the new pump is able to force fuel past the float valve. We've fixed the problem by changing the float valve to one with a slightly lower spring tension. I think that there's a resonant frequency at idle that the carburettors just can't handle."

This sounded reasonable to me and after a few more phone calls I was satisfied that this was not an issue that was going to lead to a quarter of the LAA fleet ending up in fields the length and breadth of the UK.

Nonetheless, Graham's engine failure has flagged up one or two important issues about the set-up of the Rotax 912 fuel system and, perhaps, the very great need to be able to monitor fuel pressure during engine operation; certainly I was quite surprised to find that some aircraft don't have a fuel pressure gauge. We're in the middle of investigating this story so I would be pleased to hear from you if you've had problems with any of the Rotax-supplied fuel pumps… especially if your tale relates to over-pressure.



The Bing constant depression carburettor is a complex device as can be seen by studying this parts drawing; the needle valve is there to keep the fuel level correct in the float bowl. Should this level change for any reason, it may result in a change to the fuel/air mixture to the engine – when the bowl completely floods, neat fuel will be ingested into the respective cylinders and the engine will run very roughly or possibly even stop.
(Photo: Rotax Engines)



(Above) **A close-up of a sectioned float needle; notice that the Bing valve is sprung loaded. One operator has chosen a valve with a lower spring tension and this has solved the problem of flooding at idle. This may demonstrate that vibration as well as pressure can affect this component.**
(Photo: Rotax Engines)

Don't forget, if you're going to make changes to the fuel system on your aircraft make sure that you chat the change through with your LAA Inspector before you do anything – he or she will be able to offer advice as to whether a mod needs to be raised to cover the change. I'll discuss some of these issues under the accompanying photographs – right now I've got the Editor banging on the door: "Haven't you finished that Safety Spot yet?"

Just enough time then to wish you a Happy Christmas and a safe and successful 2014. If my BMI, whatever it is, stays in the green, I hope to see you there.

Fair Winds. ■

LAA ENGINEERING SCALE OF CHARGES

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 390kg	£320
391 - 499kg	£425
500kg and above	£565
Three seats and above	£630
Permit renewal	
Up to 390kg	£105
391 - 499kg	£140
500kg and above	£190
Three seats and above	£210
Modification application	
Prototype modification	£45
Repeat modification	£22.50
Transfer	
(from CofA to Permit or CAA Permit to LAA Permit)	
Up to 499kg	£135
500 kg and above	£250
Three seats 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.15 April 2009	