Australian Ultralight Federation Inc
ARBN 070 931 645
U35/59 Wollongong St
PO Box 1265, Fyshwick ACT 2609
Ph: 02 6280 4700 Fax: 02 6280 4775
Email: tech@auf.asn.au

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LEAD REPLACEMENT PETROL (LRP)
CASA ADVICE ON EFFECT ON SEALS

A report has been received by CASA advising of severe fuel leaks in the Repco fuel pump of Skyfox (aircraft, not engine fuel system) thought to be caused by the effects of Shell Optimax on the seals inside the pump. This is being investigated by CASA and a report is attached.

Members are well advised to read it. Unfortunately it was received by FAX and has been copied in PDF format so an acrobat reader is required (downloadable from the Airworthiness Page)

Background

No doubt all members are aware that the use of lead is being phased out of automotive fuels and that it is being replaced by a different product to suit engines now requiring leaded fuel. This fuel is called Lead Replacement Petrol (LRP).

LRP is being gradually introduced into the consumer market across the country and some of its side effects are really yet to become known.

All fuel companies recommend against using motor fuel (mogas) in aeroplanes and their objection to it is no doubt loud enough to clear them from liability associated with any problems in aircraft. They produce special, certificated fuel for aeroplanes: AVGAS.

Most of the aeroplanes in the AUF are fitted with engines whose manufacturers recommend against the use of leaded fuels which means that unleaded MOGAS is used although in some cases, because of suspicion over octane ratings of unleaded fuel, availability etc, leaded mogas is sometimes used in ultralight aircraft. The introduction of LRP presents many unknowns and the AUF advises caution in its use.

Advice has been received from Mobil that LRP has a problem if it is exposed to light in that manganese oxide can precipitate out of solution. This has the potential to block fuel filters as well as causing engine damage and power loss through the loss of octane created by the fall out. See the article on LRP in the General Alerts Section (below where you selected this) in the airworthiness page (select it from there) or if you are reading this in word or HTML, from the following links:word www.auf.asn.au/airworthiness/lrpmobiladvice.doc or in HTML, www.auf.asn.au/airworthiness/lrpmobiladvice.PDF

R Hewitt-Cook
Technical Manager

CIVIL AVIATION
SAFETY AUTHORITY
AUSTRALIA

Our Reference: F88/0598GJC
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Attention: Certificate of Registration Holders
Skyfox C25, C25N aircraft

FUEL LEAK EVENT - ELECTRIC FUEL PUMP

CASA was recently advised of a severe fuel leak on a Skyfox C25N aircraft. The leak occurred from the electric fuel pump, part number 51ML1 and resulted in a large pool of fuel under the aircraft. A review of the CASA defect report database showed that no other fuel leaks have been reported to CASA. The aircraft was operated on automotive gasoline (Mogas).

Investigation into the leak identified that all the seals in the pump had swollen considerably which may possibly be attributed to changing from standard unleaded Mogas to Shell Optimax. The leakage occurred within a few flying hours of changing from standard unleaded to Optimax. The pump had operated around 600 hours. A number of these pumps have operated for significantly higher hours.

The electric fuel pump is an automotive pump manufactured in New Zealand and is used in carburetted motor vehicles worldwide. The seals in the affected fuel pump are manufactured from Nitrile, a common seal material in automotive applications with moderate resistance to aromatics. In general premium unleaded Mogas has a higher level of aromatics than the standard unleaded. It should be noted, however, that some unleaded fuels have a significantly higher level of aromatics than Shell Optimax.

Nitrile seals have a good service history with both standard and premium unleaded fuels. The improved premium unleaded grades of fuel, such as Shell Optimax have been on the market for about 18 months and have not exhibited any problems with fuel system component seals. During that period it can be reasonably assumed that Nitrile seals have been exposed to Optimax.

The manufacturer of the pump advised it has given excellent service for the past 25 years of operation worldwide, even during in the mid-90's in New Zealand when some problems occurred following the introduction of premium unleaded fuels in that country.

Seals from the defective pump when soaked in Optimax exhibited a significant increase in "swell" relative to that associated with standard unleaded. Excessive seal swell will inhibit the performance of the seals under pressure thereby creating a higher potential for fuel leakage. Testing of the seals with other high aromatic fuels did not produce excessive seal swell.

The Skyfox flight manual specifies 100LL Avgas or unleaded automotive gasoline with a minimum octane rating of 90 RON as the approved fuels for the aircraft. Standard unleaded Mogas in Australia satisfies the minimum 90 RON requirement. Premium unleaded automotive fuels are approximately 96 RON v(Optimax is around 98 RON) and are, therefore, approved for use in the Skyfox. While the new "lead replacement" fuels are technically unleaded fuels and have a RON value >90, they have not been approved for aircraft use.

CASA is currently in discussion with Shell to determine the level of compatibility of Shell Optimax with Nitrile material. Shell's position is that the fuel leak should not be attributed to Optimax by itself. Other factors (such as operating on fuel containing alcohol) may have caused deterioration of the seals. Shell will undertake further experiments to ensure Optimax has no adverse effects on automotive fuel system components.

Until such time as a final conclusion can be drawn, CASA recommends owners of Skyfox aircraft only use standard unleaded Mogas or 100LL Avgas in their aircraft. If any owners have used premium unleaded Mogas, in particular Shell Optimax, in their Skyfox aircraft, CASA would appreciate feedback on their experience.

Additionally, owners need to be aware that high aromatics and other additives used in Mogas, can cause accelerated deterioration of seals in other fuel system components and flexible fuel hoses. As such, CASA also recommends owners maintain a heightened awareness for potential fuel leaks throughout the aircraft fuel system. Compliance with the fuel system flow check specified in the Skyfox Maintenance Manual at maintenance check periods will help to detect deterioration in flexible rubber lines. Consideration should also be given to replacement of flexible fuel lines at intervals of about 5 years.

The purpose of this information is to alert Skyfox owners to the reported fuel leak and provide recommended action to minimise the potential for a similar problem to occur on other Skyfox aircraft. CASA will continue to monitor the situation and will advise owners of the results of this investigation and welcomes feedback from operators who have used Shell Optimax in their aircraft.

Yours faithfully

Eugene Holzapfel
Section Head, Systems
Certification Standards Branch

cc. All CASA Airworthiness Team Leaders
Rod Lowther - Shell Australia
Australian Ultralight Federation