Title: Use of alternate fuel in aircraft holding an EASA Certificate of Airworthiness

1. Introduction

This Notice gives guidance to owners/operators of aircraft, holding an EASA Certificate of Airworthiness, about the use of alternate fuel to power their aircraft.

2. References

This Advisory Memorandum supersedes and replaces Airworthiness Advisory Memorandum 01-14.

3. Approved Fuel

Before an aircraft is granted a Type Certificate, it must be demonstrated that the aircraft, including its engine(s), complies with the applicable airworthiness requirements. The aircraft or engine designer will normally define, by reference to a recognised specification, the fuel or fuels used when showing compliance.

The fuel(s) approved for use in an aircraft/engine combination is often listed in the Type Certificate Data Sheet and/or Aircraft Flight Manual, or equivalent. Use of fuel types approved in this manner does not require any further action.

4. Use of alternate fuels

Similar to any other deviation from the Type Certificate Holders' data, using a fuel other than that approved by the Type Certificate Holder requires a change/modification to be applied to the aircraft. Any change or modification applied to the aircraft must be recorded in the aircraft's continuing airworthiness records system and be in compliance with Annex (Part 21) to Regulation (EC) No 748/2012. Modifying the aircraft to permit the use of an alternate fuel requires the embodiment of an approved modification e.g. Service Bulletin, EASA STC or Modification approved by a Part 21 organisation, or equivalent. Such EASA approved STCs are available commercially.

Airworthiness Advisory Memorandum (AAM) 02 'Aircraft Design Changes – Guidance on the approval of Modifications and Repairs' provides clarification regarding design changes and modifications.

Owners/Operators of aircraft approved for the use of Unleaded Motor Gasoline should familiarise themselves with the recommendations in Appendix I to this notice.

Appendix I – In relation to the use of alternate fuels

Recommendations for owners/operators using Unleaded Motor Gasoline (Mogas) on an accepted engine/aircraft combination.

As Unleaded Motor Gasoline (Mogas) is the most common alternate fuel used in aircraft and carburettor icing has been identified as a contributory factor in a number of events in Ireland, the Appendix gives information to the user of precautions which should be taken when using Mogas.

1 Precautions

1.1 - The fuel must not be rendered unfit by storage, contamination etc.

1.2 - Use only freshly obtained supplies. Avoid long storage periods in the aeroplane fuel tank or in containers.

1.3 - The fuel must be checked for the presence of water and alcohol prior to the first flight of the day. (Refer to EGAST Safety Promotion Leaflet 'Piston Engine Icing', SFAA Special Airworthiness Information Bulletin CE-07-06)

1.4 - During the daily check and other maintenance inspections, pay particular attention to non-metallic fuel pipes and seals for signs of leakage or deterioration.

1.5 - Pay particular attention to the serviceability of carburettor heating (if fitted). If carburettor heating is selectable, ensure that a satisfactory RPM drop is obtained when heating is selected on during pre-take-off checks.

Note: If there is an increase above the original engine speed afterwards, it shows that ice was already present when heating was selected on. During flight make regular selections of full carburettor heat lasting at least 15 seconds duration; longer if your engine is particularly prone to carburettor icing.

1.6 - The ability to maintain take-off power must be verified before the aircraft is committed to completing a take-off.

1.7 - Please report any problems encountered involving Mogas to the IAA Airworthiness Standards Department and the AAIU, as applicable.

1.8 - Remember, Carburettor Icing and Vapour-Lock are more likely to be encountered when operating on Mogas.

2 Carburettor Heating

Carburettor icing is more likely when using Mogas because of its volatility and water content. If no carburettor heating is available and reliance is placed on 'under-cowl temperature' for carburettor ice protection, ensure that under-cowl temperatures are not being accidentally reduced due to loose or worn baffles, air seals etc. Where possible, it is recommended that a carburettor heater is fitted.

3 Potential adverse effects of operating on Mogas.

1. The stability of Unleaded Motor Gasoline (Mogas) in storage is not as good as for Avgas. Consequently, over time Mogas may suffer a loss of octane rating and form gum deposits that can cause intake and exhaust valves, and fuel metering valves to stick. The additives in the fuel are also chemically different and those in Mogas can cause corrosion and increase the amount of water in the fuel.
2. Lead additives are normally used to control the rate of combustion but in unleaded fuels these have been replaced with other components, such as aromatics. If the engine is not designed to operate on unleaded fuel then the different speed of combustion can result in hotter exhaust gasses, which can damage the crown of the pistons, the exhaust valves and their seats. Aromatics can also damage seals in the aircraft and engine fuel systems.
3. Mogas has a relatively high vapour pressure (the ease at which liquid turns into a gas) and is therefore much more susceptible to causing vapour lock in aircraft fuel systems, particularly at elevated temperatures and higher altitudes. So, although an aircraft may be able to operate on Mogas, other aircraft components have to be considered because of the potential for vapour lock within the fuel system, as well as potential adverse effects on seals and components. Therefore, approval to operate on Mogas is required for both the aircraft and engine.
4. Carburettor icing is more likely when using Mogas because of its volatility and water content.

The IAA takes no responsibility for infringement of manufacturer's warranty, accelerated deterioration of the engine or airframe components, or any other long term deleterious effects of using alternate fuels.

4. Unleaded Motor Gasoline (Mogas) containing alcohol

The use of Mogas containing alcohol is not permitted, unless expressly stated in the Aircraft Flight Manual or equivalent.

In accordance with published European and National legislation, promoting the use of biofuels for motor transport, the percentage of alcohol contained in Mogas is due to increase. Users of Mogas must remain vigilant in verifying that the fuel does not contain alcohol.

1. Most Mogas contains alcohol (ethanol) which can adversely affect seals and elastomers; it also affects the fuel's vapour pressure leading to an increased probability of vapour lock.
2. The ethanol absorbs water which increases the likelihood of carburettor icing.
3. An engine will use more fuel as the percentage of added alcohol increases. An approximate figure is that the engine must burn 3% more fuel to give the same power output if the fuel contains 10% ethanol.
4. Ethanol mixed with water is somewhat corrosive and may attack parts of the fuel system e.g. composite fuel tanks. In long-term storage, ethanol may oxidise with exposure to air. This process produces a mild acid solution which can attack fuel system fittings. Damage caused by this mild acid solution may cause fuel starvation and engine failure.
5. Long term exposure to ethanol damages some types of plastics (elastomers); therefore items such as flexible fuel lines are subject to increased deterioration. Some of the elastomers used in old aircraft models and which are otherwise compatible with Avgas may deteriorate on contact with ethanol.