JABIRU AIRCRAFT PTY LTD

P.O. Box 5792
Bundaberg West
Queensland, Australia.

Phone: +61 7 4155 1778
Fax: +61 7 4155 2669
Email: info@jabiru.net.au

SERVICE LETTER: JSL 007-3

Issue: 3

Date: 5th Nov 2009

Subject: Alcohol, Lead, Compression Ratio: Fuel Guidance

Issue	Reason for Issue	Revision Status
1	Original Issue	CANCELLED
2	New Information Added	CANCELLED
3	Title changed, "High Lead" Avgas notes added	CURRENT

1 Applicability

All Jabiru Aircraft and Engines.
Note: for LSA category aircraft, this Letter is equivalent to a Manufacturer's Safety Direction.

2 Background

2.1 Issue Notes

- Originally this Service Letter was intended to provide operators with basic guidance information for operating their aircraft and engines on fuels containing alcohol.
- Issue 2 was produced to include additional information about the combustion chamber, compression ratio and suitable fuels.
- Issue 3 includes operating information on fuels with a higher lead content. At the same time, the technical content of the letter has now moved so far beyond alcohol limits that the title of the Service Letter has been changed to better reflect it's content.

2.2 General

- Current Jabiru 2200 and 3300 engines are designed to use Australian Aviation Gasoline (AVGAS) or Australian Premium Unleaded Motor Spirit (MOGAS) of at least 95 octane RON.

- Over time Jabiru Engines have used several different compression ratios and combustion chamber arrangements. Section 3 gives details on the different combinations produced and discusses suitable fuels for each.

- Worldwide, the most common type of AVGAS is 100LL – where "LL" means "Low Lead. In some areas AVGAS 100 - which contains significantly more tetraethyl lead – is also available. Section 4 gives details of the different fuels and discusses their different operating and maintenance effects.

- Recently it has become common for automotive fuels to contain alcohol. Many automotive fuels now contain 5, 10 or higher percentages of alcohol – typically Ethanol. Octane boosters also often contain alcohol. Section 5 has been prepared to guide owners and operators on some of the effects of using a fuel containing alcohol in a Jabiru Aircraft or Engine.

- An automotive fuel's anti-detonation performance is usually measured in Australia using RON (Research Octane Number). MON (Motor Octane Number) or AKI (Anti-Knock Index) are sometimes also used. RON is always a higher number than both MON and AKI. As a general rule, RON can be estimated by adding 5 to a fuel's AKI (i.e. a fuel with an AKI of 89 will have a RON of approximately 94, and so must not be used.).
- The recommendations given in this letter are applicable for Jabiru Aircraft and Engines as noted – including older variants. While older Jabiru Engines have a different combustion chamber shape which demands the use of a fuel with 100 Octane RON or higher the presence of alcohol in the fuel (within the limits noted) is not a problem for these engines.

3 Compression Ratio / Combustion Chamber Shape

3.1 Compression Ratio

- At Manufacture the compression ratios of Jabiru Engines were as listed:
  - 1600 All S/No. 9.3:1
  - 2200 S/No. 1 – 106 9.3:1
  - 2200 S/No. 107 – 127 9.3:1
  - 2200 S/No. 128 – 831 7.8:1 or 8.3:1
  - 2200 S/No. 832 – 1003 7.8:1 or 8.3:1
  - 2200 S/No. 1004 Onwards 8:1
  - 3300 S/No. 1 – 223 7.8:1 or 8.3:1
  - 3300 S/No. 224 Onwards 8:1
  - 5100 All S/No. 8.5:1
- Where two ratios are listed those engines fitted with shims between the cylinder barrel and the crankcase have the lower ratio, engines without shims the higher.
- Note that the details given above apply to each engine as it was produced. As many of the older engines are now more than 10 years old and have been overhauled in the meantime, operators must be aware that the engine's current configuration may be different from that given here.

3.2 Combustion Chamber Shape

- Older Jabiru Engines had a combustion chamber shape which demands the use of AVGAS or 100 Octane RON fuel. Details are given below.
- Note that the details given above apply to each engine as it was produced. As many of the older engines are now more than 10 years old and have been overhauled in the meantime, operators must be aware that the engine's current configuration may be different from that given here.
- The following engines were manufactured with combustion chamber as shown in Figure 1.
  - 2200 S/No. 1 - 1003.
  - 3300 S/No. 1 - 223
  - All Jabiru 1600 engines.

Figure 1 – Early "High Octane" Combustion Chamber

- The “High Octane” chamber can be modified as shown in Figure 2.

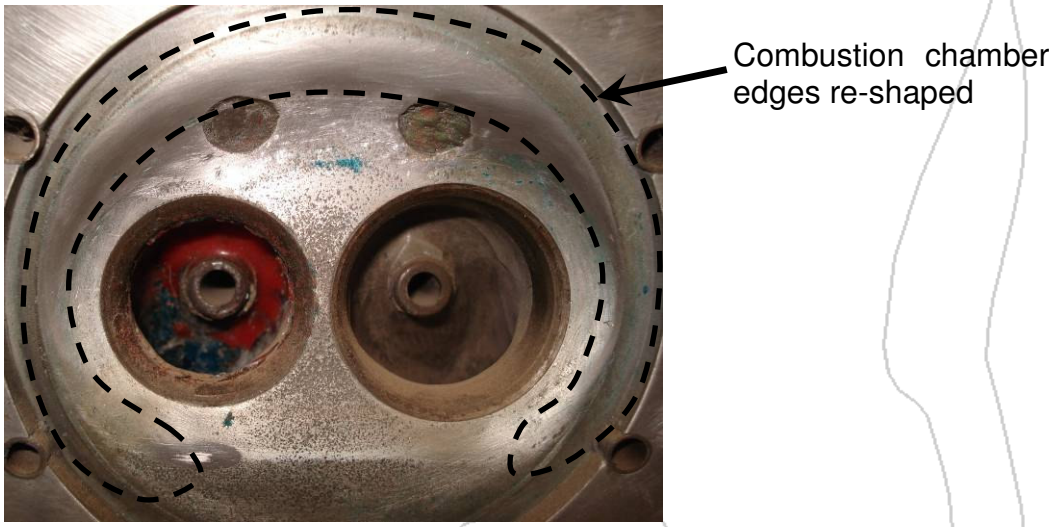

Figure 2 – Re-Worked “High Octane” Combustion Chamber

- Engines with Serial Numbers higher than the range listed above were manufactured using variations of the combustion chamber shown in Figure 3.

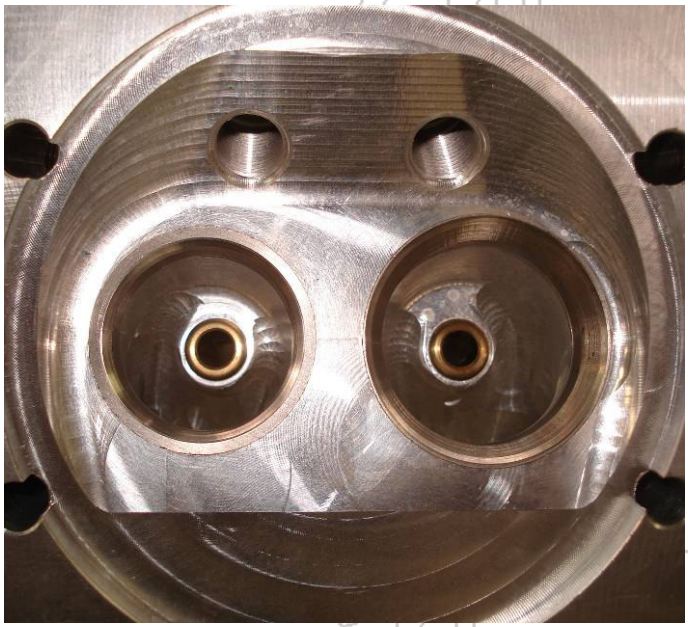

Figure 3 – Current “Wedge” Combustion Chamber

3.3 Fuel Octane Rating Requirements

- All 2200B, 2200C and 3300L engines may be operated using 95 Octane RON (or higher) MOGAS or AVGAS fuels. The fuels may contain alcohol to the limits listed in Section 6.6.
- Table 1 can be used to find which fuels should be used for a given engine. Example: 2200 engine, S/No. 800 with no shims fitted and therefore compression ratio of 8.3:1 (Section 3). Combustion chambers have been re-worked to Figure 2. Read the table as marked with the arrows, to the grey-shaded cell: the engine may use 95 Octane MOGAS.

Table 1 – Chamber / Compression Matrix

Compression Ratio:	"High Octane" Chamber	Modified "High Octane" Chamber	"Wedge" Chamber
9.3:1	100 RON or higher	100 RON or higher	N/A
8.5:1	N/A	N/A	100 RON or higher
8.3:1	100 RON or Higher	95 RON or higher	N/A
8:1	N/A	N/A	95 RON or higher
7.8:1	95 RON or Higher	95 RON or higher	N/A

- Any of these engines may use fuels containing alcohol up to the limits given in Section 6.6.

4 Fuel Containing Tetraethyl-Lead

4.1 General

- As noted above, worldwide AVGAS 100LL is the most common grade of aircraft fuel available.
- The "LL" designation indicates that the fuel contains a "Low Lead" level when compared to AVGAS 100 (which may also be known as AVGAS 100/130). Typically, AVGAS 100LL contains less than 0.56grams/litre while AVGAS 100 contains less than 0.85g/L. AVGAS 100LL is dyed blue while AVGAS 100 is dyed green.
- Generally, AVGAS blends store well and do not tend to degrade to a lower octane value over time.

4.2 Tetraethyl Lead – Good Points

- Tetraethyl Lead is an additive which is included in fuels to help suppress knock or detonation. Generally, detonation is the name given to a process where the fuel / air mix in the cylinder ignites too early. It produces very high pressures inside the engine which can easily cause severe damage. Aircraft engines are particularly vulnerable knock because they operate at higher power settings and temperatures than most other types of engine.
- Tetraethyl Lead also has some lubrication properties which helps to reduce wear to valve guides etc.
- The combination of benefits given by tetraethyl lead have proven to be hard to produce any other way which has made it difficult to develop a replacement fuel which will operate correctly in aircraft engines – particularly older types or high-powered turbo types.

4.3 Tetraethyl Lead – Bad Points

- By-products produced when a fuel containing tetraethyl lead is burnt are well known pollutants. Because of this, automotive fuels etc are now "unleaded" types – AVGAS is the only fuel containing lead still available in most parts of the world.
- High tetraethyl lead levels in a fuel can produce combustion chamber deposits. These deposits can affect piston ring sealing and valve sealing and also inhibit heat transfer from the combustion chamber to the head. They can also cause detonation – small pieces can become very hot and act like a glowing ember inside the combustion chamber. This "ember" then ignites the fuel before the spark plug has discharged.

4.4 The effect of Lead Content

- Modern, high-octane MOGAS burns very cleanly in a Jabiru engine. It leaves no or minimal deposits inside the combustion chamber. A fuel containing lead will leave deposits approximately proportional to it's lead content – i.e. higher lead equals more deposits.
- Compared to AVGAS 100/130, AVGAS 100LL produces around 25% less combustion chamber deposits. This reduction in deposits can significantly improve overhaul life in certain engines by reducing valve and cylinder head deposits and well as reduce spark plug fouling.
- Note that there is generally a maximum practical limit for the thickness of lead deposits inside a combustion chamber – they do not keep on growing thicker and thicker indefinitely. This means that when using AVGAS 100 the deposits reach this thickness and then stabilise more quickly than when using AVGAS 100LL.

4.5 Lead Content Recommendations

- Jabiru Aircraft have no objection to operators using AVGAS 100/130 or AVGAS 100LL.

5 MOGAS

5.1 MOGAS – Good Points

- MOGAS is cheaper than AVGAS and is more widely available
- MOGAS burns cleanly and produces combustion chamber deposits at a much slower rate than AVGAS.
- Fresh MOGAS of the correct octane rating produces the same engine performance as AVGAS.

5.2 MOGAS – Bad Points

- The single biggest drawback with MOGAS is Quality Control – quality control for MOGAS is very much poorer than for AVGAS. Fuel sold from automotive service stations may often be stale, contaminated or diluted. The busiest service station in town is most likely to have fresh, clean fuel and getting to know the station operators is also a good idea.
- Many automotive MOGAS blends rely on highly volatile components to produce the proper power etc. During storage these volatiles can be lost rapidly and the fuel's performance can degrade significantly in a relatively short period of time. Always using fresh fuel is strongly recommended.
- This needs to be stressed to operators as it is entirely possible for MOGAS loose several points from it's Octane rating while stored, leaving the engine vulnerable to detonation. In addition, long-term storage of MOGAS in an open-vented fuel system like a Jabiru's can encourage the formation of gums and other varnishes or solids which can then block the lines or filters.
- Automotive fuels are generally more prone to vapour-lock than AVGAS. Testing has shown that Jabiru Aircraft meet certification requirements for the prevention of vapour-lock when using MOGAS, however issues can be provoked by poor operational procedures. The following are recommended when operating on MOGAS:
  i. Avoid running the engine for extended periods on the ground – this causes heat-soak into the engine bay which increases vapour-lock risk.
  ii. Use the back-up electric fuel pump for all critical modes of flight – generally any time the aircraft is on the ground or within 1500 feet of the ground. Jabiru Aircraft have no objection to operators running the electric boost pump continuously.

5.3 MOGAS Usage Recommendations

- Use fuel which is as fresh as possible.
- Be aware of the potential issues arising from using MOGAS
- Follow the storage recommendations given below.

5.4 MOGAS - Storage

- Do not leave small amounts of MOGAS in the tank as it will be relatively highly exposed to air and may form gums, varnishes or other solids. Gum formation is caused by a chemical reaction within the fuel. The reaction speeds up as temperature increases so it is a particular problem in warmer climates. Aside from gum formation, the fuel's octane rating will also drop with time.
- Do not leave a tank full of MOGAS as it will loose volatiles over time, reducing it's octane rating. A full tank is somewhat less prone to forming solids than a nearly empty one because a smaller percentage of the fuel is exposed to the air, but after a month or two the entire contents may have lost so many octane points that it should not be used in the aircraft. Disposing of a large quantity of stale fuel then becomes a major problem.

- Do not drain the tank but leave MOGAS in the carburetor – as the fuel evaporates from the carburetor it will tend to form varnishes which will block jets etc.
- Do not block the tank vents to prevent evaporation: as the temperature around the aircraft rises and falls during the day and night the contents of the tank expand, contract and give off gases. If the vents are blocked these effects can easily rupture the tank.

5.5 MOGAS Storage recommendations:

- Leaving the tank and carburetor full of AVGAS or
- Running the carburetor dry by turning off the fuel tap and running the engine until it stops, then draining all MOGAS from the tanks.
- Note that the storage methods currently outlined in Jabiru Technical Manuals generally presume that the aircraft is being operated on AVGAS – which generally suffers far less from the problems noted above. The "safe" amount of time that MOGAS may left in the tank depends on the exact recipe of the fuel, where the aircraft is stored and ambient conditions like temperature etc.
- Commercial fuel additives and stabilizers are available which are designed to allow MOGAS to be stored for longer, however Jabiru Aircraft have not tested their efficacy or their effects on other parts of the fuel system. Jabiru Aircraft does not currently endorse or approve their use.
- Several different fuel blends are sold at the bowser throughout the year. "Winter" fuel, "Summer" fuel and "Alpine" fuel (and many other sub-divisions) are sold depending on the time of year and the location of the fuel station. These fuels all have slightly different recipes designed to provide the right vaporization, octane number etc for an engine operating in the given environment. Fuel bought at the top of a snow-covered mountain in winter is not suitable for use at sea level during a summer heat wave. This is another reason why long-term storage of MOGAS for aircraft use is not recommended.

6 Alcohol

6.1 General

- Worldwide, debate on using Ethanol as an aircraft fuel continues. The problem is that while it is a good fuel while the engine is running, it becomes a significant maintenance and storage issue whenever the aircraft is parked. These issues must be addressed if an aircraft is to operate safely on a fuel containing alcohol.

6.2 Alcohol – Good Points

- Alcohol is a renewable fuel which (arguably) produces less carbon dioxide than fossil fuel.
- Alcohol burns cleanly and has an octane boosting effect.

6.3 Alcohol – Bad Points

- Ethanol is hygroscopic (i.e. it will mix with water). This can be water vapour from the air, condensation inside tanks or free water. While very small amounts of water can be absorbed without significantly affecting combustion, at higher levels the mixture will not be combustible. In addition, because this incombustible fuel is formed from a mixture of the Ethanol in the fuel and the water it can have a large volume – so a small amount of water will result in a much larger amount of incombustible Ethanol/water mix. This may give false readings in the fuel tank sumps or exceed the volume of the sump altogether.
- As noted above, Ethanol is an Octane booster and can be absorbed by water. Because of this, mixing a fuel with water can effectively wash the Ethanol out of the fuel resulting in a significant drop to the remaining fuel's Octane rating.
- If an Octane Booster containing alcohol is used the operator must ensure that the maximum alcohol content of the resulting fuel / booster mix does not exceed the limits given below. Due to the fact that their composition varies widely between brands Jabiru Aircraft recommend avoiding the use of octane boosters wherever possible.
- The engine will use slightly more fuel as the percentage of added alcohol increases. As an approximate rule of thumb the engine must burn 3% more fuel to give the same power output if the fuel contains 10% Ethanol.
- Ethanol mixed with water is somewhat corrosive and may attack parts of the fuel system.
- In long-term storage, Ethanol may oxidise with exposure to air. This process produces a mild acid solution (effectively vinegar – the effect is the same as when the seal fails on a bottle of wine) which can attack fuel system fittings.
- Long term exposure to Ethanol damages some types of plastics. The flexible fuel lines used by Jabiru Aircraft have been chosen with Ethanol use in mind and are designed to be safe when replaced at the intervals specified in the aircraft Maintenance Manuals. However increased monitoring during servicing is recommended when using an Ethanol blend.
- **Note** that flexible fuel lines are available in a wide range of colours. Generally the colour of the line is a dye only and has no bearing on the line's ability to operate in contact with alcohol – though some fuel line manufacturers use different colours to designate different products. Jabiru Aircraft have used blue fuel lines and (at the time of writing) orange lines. Both are acceptable for use with fuels containing alcohol.
- Some fuel testers (including the type supplied by Jabiru Aircraft at the time of writing) have a scale on their side which allows the Ethanol content of a fuel to be checked & assessed.
- Several Australian Civil Aviation Safety Authority (CASA) documents discuss Ethanol use in aircraft. Jabiru Aircraft strongly recommend that owners considering using an Ethanol fuel

blend read and understand this information before using a fuel of this type. The following CASA document is current at the time of writing: Airworthiness Bulletin AWB 2828-003003

- **Important Note For Jabiru Aircraft:** Only aircraft with white coloured fuel tank sealant can use fuel containing alcohol. Earlier tanks use a caramel coloured sealant – this sealant is soluble in alcohol & must not be used with an alcohol blend fuel. Fuel tanks with caramel-coloured sealant may be re-sealed with white sealant – contact Jabiru Aircraft or our local representative for details. Figure 4 shows the sealant colour as seen through the filler.

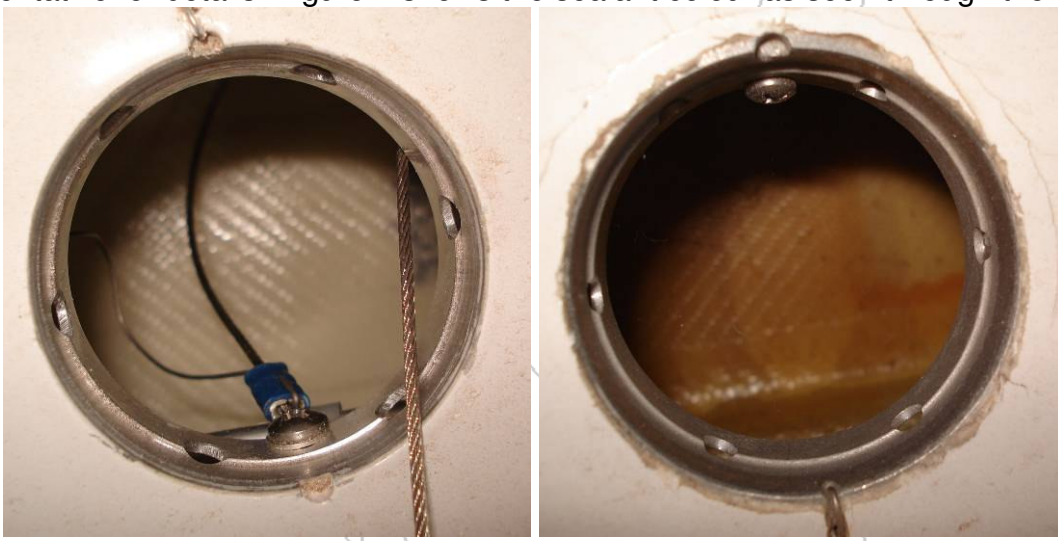

Figure 4 – Fuel Tank Sealant Colours (White on Left)

6.4 Individual Items[1]:

- **Carburettor:** Suitable for use with fuels containing alcohol.
- Carburettor inspection recommended after 200hrs (or 6 months) using fuel containing alcohol
- **Mechanical Fuel Pump**: Suitable for use with fuels containing alcohol.
- No additional maintenance required for up to 10% alcohol
- The pump manufacturer does not recommended using fuels containing more than 10%.
- Operational experience with fuels containing higher percentages has shown that the mechanical fuel pump is tolerant of higher levels of alcohol.
- **Carburettor Connection:** Suitable for use with fuels containing alcohol.
- **Electronic Fuel Pump:** Suitable for use with fuels containing alcohol.
- **O-Rings:** Suitable for use with fuels containing alcohol.
- **Black Fuel Hose:** Suitable for use with fuels containing alcohol.
- **Blue Fuel Hose:** Suitable for use with fuels containing alcohol.
- Maintenance & inspection requirements increased for fuel containing more than 10% alcohol.
- **White Coloured Fuel Tank Sealant:** Suitable for use with fuels containing alcohol.
- **Caramel Coloured Fuel Tank Sealant:** Unsuitable for use with fuels containing alcohol.
- **Combustion Chamber Shape:** All combustion chamber shapes are compatible with fuels containing alcohol. However, the Octane rating of the fuel used must be selected to suit the combustion chamber design.

6.5 Testing for Alcohol

- Using a clear jar of about 100-200 ml capacity (ideally a long and narrow jar) add about 10% by volume of water and mark the level of the water on the jar.
- Add a sample of the fuel to be tested to the jar so that the relative volumes are about 10% water/90% fuel

[1] Details applicable for OEM parts from Jabiru Aircraft Australia only

- Shake the sample vigorously and then allow the sample to settle
- Check the level of the "water"
- If the level is the same as previously marked on the jar, no alcohol is present in the fuel.
- If the level of "water" increases, alcohol is present in the fuel

6.6 Alcohol Usage Recommendations

6.6.1 General:

- Where possible Jabiru Aircraft recommend using AVGAS. This is a fuel specifically designed for aircraft use and is subject to very strict documentation and quality assurance. This is simply the safest fuel available.
- Because it has a higher compression ratio the Jabiru 5100 engine must be operated using AVGAS or other fuel with a RON of 100 or higher.
- Where a Jabiru Engine is installed in a non-Jabiru airframe the operator must comply with the airframe manufacturer's approved fuel recommendations.

6.6.2 Automotive Gasoline:

- Jabiru Aircraft has no objection to operators using automotive gasoline in Jabiru Aircraft or Jabiru Engines. For most engines the use of fuel with RON of 95 or above is adequate, however older engines must use a fuel which meets the Octane rating requirements of their combustion chamber (See Section 3 above).
- Note that different Jabiru Airframes can have different maintenance requirements. For example, the CASA-Certified J160-C must be operated and maintained in accordance with the CASA-Approved procedures given in it's Flight and Maintenance manuals – which do not allow the use of fuels containing alcohol (but do approve the use of suitable MOGAS).
- Operators wishing to use automotive gasoline but wishing to avoid using alcohol should obtain Technical Data Sheets for the Gasoline they are using. Regular testing as detailed above should also be carried out to ensure the fuel does not contain alcohol.
- Operators using Octane Boosters and wishing to avoid introducing alcohol to their fuel systems must ensure that their chosen octane booster does not contain alcohol.
- Maintenance for the engine and airframe is to be carried out in accordance with the standard schedules detailed in the Instruction and Maintenance Manuals of the engine and airframe manufacturers.

6.6.3 Use of Automotive Gasoline Containing Up to 10% Alcohol:

- Jabiru Aircraft has no objection to operators using gasoline containing up to 10% alcohol in Jabiru Aircraft or Jabiru Engines except as limited by the aircraft's certification basis. For most engines the use of fuel with RON of 95 or above is adequate, however older engines must use a fuel which meets the Octane rating requirements of their combustion chamber (See Section 3 above).
- **Only those Jabiru Aircraft with white coloured fuel tank sealant can use fuel containing alcohol.**
- No modifications are required for Jabiru Engines to use fuel containing 10% alcohol.
- Where a Jabiru Engine is installed in a non-Jabiru airframe the operator must comply with the airframe manufacturer's approved fuel recommendations.
- Clear fuel hose should be monitored for hardness, brittleness and loss of colour. Lines must be inspected regularly and renewed if any sign of deterioration (such as brittleness or cracking) is found. In addition, at the time of writing Jabiru Aircraft recommend that all flexible fuel lines be replaced at 2 year intervals. While this is considered adequate while

using a fuel containing alcohol, operators choosing to use these fuels are encouraged to be especially pro-active and exacting in their fuel system maintenance.

- It is recommended that after the first 200hrs (or 6 months) of operation on fuel containing alcohol the carburettor be disassembled for a one-off inspection. Components must be checked for damage, i.e. excessively soft or hard rubber parts, swelling of rubber components, corrosion of metal components. Replace parts if damaged or in doubt.

6.6.4 Use of Automotive Gasoline Containing Between 10% and 20% Alcohol:

- Jabiru Aircraft does not recommend that operators use any fuel containing between 10% and 20% alcohol in Jabiru Aircraft or Jabiru Engines.
- Operational experience has shown that operating Jabiru Aircraft and Engines with a fuel containing 10% – 20% alcohol is safe and does not introduce excessive maintenance requirements. However, formal testing has not been carried out and this level of alcohol content exceeds the maximum safe recommendations for some fuel system components.
- Operators using such fuel must understand that they operate entirely at their own risk. Clearly such operations can only occur in categories such as the "Experimental" category where all aircraft occupants & operators fly at their own risk.
- **Only those Jabiru Aircraft with white coloured fuel tank sealant can use fuel containing alcohol.**
- No modifications are required for Jabiru Engines run using fuel with 10% - 20% alcohol.
- Where a Jabiru Engine is installed in a non-Jabiru airframe the operator must comply with the airframe manufacturer's approved fuel recommendations.
- The ongoing maintenance requirements of a Jabiru aircraft or engine using this level of alcohol are currently unknown. The following points are recommended, however they are intended as a basic guide for operators and may not address all issues found when operating on these fuels. Operators must develop their own ongoing maintenance and inspection scheme suitable to their fuel and useage.
  i. Clear fuel hose should be monitored for hardness, brittleness and loss of colour. Lines must be inspected regularly and renewed if any sign of deterioration (such as brittleness or cracking) is found. It is recommended that all flexible fuel lines be replaced at 1 year intervals when using fuels containing 10% – 20% alcohol.
  ii. At every 200hrs (or 6 months) of operation the carburettor be disassembled and all components checked for damage, i.e. excessively soft or hard rubber parts, swelling of rubber components, corrosion of metal components. Replace component if in damaged or in doubt.
  iii. At every 200 hours (or 6 months) of operation the mechanical fuel pump be disassembled and all components checked for damage, i.e. excessively soft or hard rubber parts, swelling of rubber components, corrosion of metal components. Replace component if in damaged or in doubt.

6.6.5 Use of Automotive Gasoline Containing More Than 20% Alcohol

- Use of fuel containing more than 20% alcohol is not recommended.

6.7 Checks When Changing to a Fuel Containing Alcohol

- Fuel filter and carburettor bowl should be checked for sediment and clogging after 10 hrs (or 1 month) of use.
- It is recommended that fuel lines be renewed before switching to a fuel containing alcohol.

7 Fuel Summary

★★★★★ The Perfect Fuel (mythical beast – does not exist)

★★★★☆ The State of the Art (best fuel available for Jabiru Engines)

★★★☆☆ Quite Suitable (A good fuel with some relatively minor negatives)

★★☆☆☆ Suitable (A good fuel but which has operational, maintenance and legal requirements the operator must be aware of)

★☆☆☆☆ Marginal. (Should only be used when the operator has no other suitable choice)

☆☆☆☆☆ UNSUITABLE for use with Jabiru Engines.

Fuel	Pro	Con	Rating
AVGAS 100LL	- Availability (varies) - Quality assurance - Designed for aircraft. - Ease of storage	- Availability (varies) - Lead content - Price	★★★★☆
AVGAS 100	- Availability (varies) - Quality assurance - Designed for aircraft. - Ease of storage	- Availability (varies) - Lead content - Price - Maintenance may be higher	★★★★☆
Other AVGAS Blends with Higher Lead Levels	- Availability (varies) - Quality assurance - Designed for aircraft. - Ease of storage	- Availability (varies) - Lead content - Price - Maintenance may be higher	★★★☆☆
95+ Octane RON MOGAS	- Availability (varies) - No lead - Price - Clean burn - Good Octane when fresh	- Availability (varies) - Does not store well - Lower quality controls - Not designed for aircraft	★★★☆☆
95+ Octane RON MOGAS Containing Alcohol	- Availability (varies) - No lead - Price - Clean Burn - Good octane when fresh	- Availability (varies) - Does not store well - Lower quality controls - Extra alcohol-related maintenance required. - Not designed for aircraft	★★☆☆☆
Lower Octane Fuels with Octane Booster Added	- Availability (varies) - Price - No lead - Clean burn	- Availability (varies) - Unknown octane rating - Lower quality controls - Does not store well - Unknown octane booster content - Extra alcohol-related maintenance required. - Not designed for aircraft	★☆☆☆☆
Lower Octane fuels	- None Applicable	- Unsuitable - Will damage engines - May write engine off completely.	☆☆☆☆☆

8 Contact Information:

Preferred Method of Contact: email info@jabiru.net.au

Postal Address: Jabiru Aircraft P/L
PO Box 5186
Bundaberg West, 4670
QLD, Australia