

- March 2024 -



February is normally a great time to ski Big White Mountain in BC with blue skies and cold clear days, but the unusual weather this year has changed it to warmer days and low-level clouds that envelope the mountain on an almost daily basis. The south-facing photo above taken from our living room, shows the Monashee Mountains in the distance on one of the few clear days that we have had this winter. At least the 1.75 metre base is skiable. Many of the ski areas in BC and Ontario have suffered a lack of snowfall or even bouts of rain with the abnormally warm temperatures.

President's Message

What happened to winter in Ontario? 😊

I know I asked that same question last month, but the extended warm spell seems to have continued well into February. Things are not much different here in BC. It has been unusually warm here too for almost the entire time we have been out here skiing. We did get a bit of snow, but it's certainly a few degrees above normal and we have been in the clouds a lot, with very little sunshine on the mountain.

In this issue I mention that the certified world has been trying to find a replacement for 100LL for over a decade now. I explore an issue in more detail that will be affecting a large segment of the amateur-built and owner-maintained aircraft world. Until last year you could buy ethanol-free gasoline in 89, 91 and

93 octanes, but now Mogas has had up to 10% ethanol mixed into it regardless of grade. Next year that percentage will increase again and by 2030 Mogas will be 15% ethanol as per Ontario regulations. How will it affect our engines, which were designed for ethanol-free gas? Is there anything we can do about it?

I sent inquiries to Shell Canada, Rotax and a few others to determine the impact to those of us burning automotive gasoline in our planes and share their responses with you.

I will try again next month to get the update on the ADS-B situation in Canada into the next issue.

2024 is going to be a great year for KWRAA.

- Dan

Corn-fed Aircraft Engines???

Who doesn't enjoy a feast of corn-on-the-cob? Maybe a nice thick prime rib from a corn-fed cow or a thick, juicy breast from a grain-fed chicken?

What about a nice flight in a plane powered by a corn-fed aircraft engine? As part of my research on ethanol blends in automotive fuel, I learned that it is not uncommon in Europe to burn E85 in Rotax 912 engines, designed for zero ethanol. E85 is up to 85% ethanol and 15% unleaded petroleum-based fuel. More on this later.

According to the US Department of Energy, "most ethanol in the United States is produced from starch-based crops by dry- or wet-mill processing. Nearly 90% of ethanol plants are dry mills due to lower capital costs. Dry-milling is a process that grinds corn into flour and ferments it into ethanol with co-products of distillers' grains and carbon dioxide." In Canada we also use canola. Some other countries use sugar cane.

The ethanol is shipped in trucks and railcars to the traditional refineries to be mixed with petroleum-based gasoline in the legislated proportions mandated by the various state and provincial environmental laws.

Canada is addressing the need to reduce emissions by implementing a number of initiatives including the "Carbon Tax" and the "Clean Fuel Regulations". The Clean Fuel Regulations can be found at:

<https://www.canada.ca/en/environment-climate-change/services/managing-pollution/energy-production/fuel-regulations/clean-fuel-regulations/about.html>

Ontario will be on the leading edge of this attempt at reducing emissions, but it's not all roses and sunshine.

A recent press release says the 15 per cent target is expected to reduce greenhouse gas emissions by one megatonne annually, or the "equivalent of taking 300,000 cars off the road every year".

As with every action, there are pros and cons that must be weighed or at least understood to minimize the negative impacts of these actions. I will attempt to cover some of the key issues impacting amateur aircraft builders and owners.



Look at the signs on your local pumps now. (91 octane used to be ethanol-free, but no longer.

Does all gas in Canada contain ethanol?

Yes, all of our grades of pump gas, including our Ultra 94 high octane fuel, contain up to 10% ethanol content. This is required by federal and provincial regulations and known as E10 fuel.

One exception is 100LL avgas, but the certified world has been seeking a replacement for years. Most Rotax owners know about the lead accumulation issues and are reluctant to use it.

Modern automotive engines and the Rotax, 912/914 series engines will burn E10 with no significant issues. According to the Rotax Service Instructions for the *selection of suitable operating fluids for ROTAX® Engines Type 916 i (Series), 915 i (Series), 912 i (Series), 912 and 914 (Series)*, fuels that contain more than 10 % ethanol blend have not been tested nor are they permitted for use.

ROTAX urges owners to confirm with their airframe manufacturer that ethanol blended fuels of up to 10% (E10) are compatible with all fuel system components.

As an amateur aircraft builder, it is your responsibility to ensure the tank, fuel lines, valves, pumps, etc. are all compatible with ethanol-based fuels or changed out regularly.

Can cars or planes run on 100% ethanol?

Pure ethanol (E100) could theoretically be used to power cars, but generally is not because of the negative impacts including poor cold-starting, because it doesn't burn as quickly as gasoline. It

has a higher octane and is blended into lower grades to create higher octane grades. Nonetheless, pure ethanol would be useless as fuel in the winter months.

Older aluminum carburetors tend to suffer from the corrosive effects of ethanol much more than newer ones, which are made out of more resistant alloys. Corrosion can block tiny orifices, causing hard starting and rough running. This has the classic car community on edge. Many owners of these restored vehicles are concerned about the legislated changes to the levels of ethanol in pump gasoline and what it could do to their most prized possessions.



The effects of ethanol are most noticeable when the fuel sits for long periods of time, allowing the fuel and water in the ethanol to separate.

Luckily, most modern vehicles are designed to run quite well on fuels up to E15, or 15% ethanol in gasoline.

Does ethanol shorten engine life?

"Ethanol has inherent properties that can cause corrosion of metal parts, including carburetors, degradation of plastic and rubber components, harder starting, and reduced engine life," says Marv Klowak, global vice president of research and development for Briggs & Stratton, the largest manufacturer of small engines.

Does ethanol really damage gasoline engines?

Ethanol blended gasoline can cause serious engine damage to small engines when used regularly and even when not used for long periods between uses. It is corrosive and highly water soluble, often leading to storage problems. If left, water in the fuel system can cause rusting, fuel degradation and other problems. Ethanol

fuel is also associated with microbial contamination.

Ethanol contains significantly less energy per gallon than gasoline. Ethanol is hygroscopic, meaning it absorbs water out of the air, which means it can damage engines due to excess water content if not handled carefully or left too long before using it. The high content of water in ethanol fuels also will swell the paper filter media found in fuel filters not designed especially for ethanol-blend and flex-fuel operation.

Water in fuel systems also leads to water contamination and/or fuel phase separation. If contaminated or separated fuel gets into the engine, serious and sometimes irreparable harm occurs in the engine.

Gasoline mixed with ethanol has a shorter shelf life and goes stale quickly. Ethanol is highly corrosive. It helps rust to form wherever air meets metal once submerged in it. Ethanol is also a solvent and it will disintegrate fiberglass, plastic, and rubber.

How much ethanol is safe for most engines?

Paraphrasing from Alex Knizek, auto engineer at Consumer Reports, "Most automotive manuals say 15 percent ethanol is the maximum percentage you should be putting into those cars. Additionally, ethanol is not as energy dense as regular gasoline so you will see worse fuel economy with E15 gas."

Does ethanol make your engine run hotter?

The amount of heat generated within the engine using ethanol-blended fuel can be 20° to 25° C higher depending upon the blend. This "extra" heat has a tremendous impact on all of the parts of an engine if not properly cooled.

Does ethanol cause spark knock?

Compared to gasoline, ethanol is more knock resistant at low engine speeds due to the lack of active low-temperature auto-ignition chemistry, but could be more knock prone at high speeds due to its high sensitivity to the increase in wall temperature and dynamic heating. Proper cooling systems can be more critical when using ethanol blends and higher grades of octane can somewhat compensate for this.

What are the other disadvantages of ethanol and why is the use of ethanol as a fuel controversial?

The production of ethanol requires large amounts of water and energy, which can contribute to water and air pollution. In addition, the crops that are used to produce ethanol require fertilizers and pesticides, which can harm the soil and enter nearby waterways, and the runoff of fertilizer contributes to algae blooms in lakes and rivers.

Critics believe that widespread production of ethanol will result in more land being used to grow corn for fuel rather than for food for people and farm animals. They also believe that producing and using ethanol actually does more harm to the environment than good.

Here is a link to a page that explains some of the ethical and financial issues surrounding growing corn to make ethanol vs. using it for food. <https://www.motherjones.com/wp-content/uploads/images/the-ethanol-effect-630.jpg> I won't go into this in detail as I am focusing on how it impacts us as owners of aircraft using ethanol-blended fuels in our engines.

According to Syngenta Canada, a division of the multinational biotech and chemical company, 90% of the ethanol used in Ontario, about 1.2 billion litres, is produced in the province. That represents about 110 million bushels of corn or about 3 million metric tonnes of corn destined towards annual ethanol production in the province. That figure represents over a third of the province's entire annual provincial corn harvest.

Elsewhere, India banned the use of 'sugarcane juice and sugar syrup' for ethanol production in the 2023-2024 supply years, in order to maintain adequate sugar availability for domestic consumption and to keep prices under check.

Seven Steps to Avoid Ethanol Fuel Problems in Your Classic Car, Boat or Aircraft

1. Use ethanol-resistant hoses or nylon tubing to replace any plastic or rubber fuel lines.
2. Replace fiberglass fuel tanks with aluminum or stainless-steel tanks.

3. Use a water separator filter in the fuel line leading to the carburetor. Since water collects in the filter, you can easily remove it. In aircraft a gascolator serves this purpose, so check and clean it regularly.
4. Change out any O-rings in the fuel system to ethanol compatible rings.
5. A carburetor fogging solution may prevent condensation from filling fuel bowls.
6. Use a flex-fuel-compatible fuel filter as it stops degradation of the fuel filter media.
7. Use a non-alcohol-based fuel treatment to prevent excessive water collection in your fuel. Ethanol-based fuel treatments worsen problems caused by E10 gas. Do not use them.

Does ethanol really improve air quality?

Ethanol helps to reduce ozone precursors that contribute to smog in urban communities. Thanks to ethanol, there's less toxic, dirty stuff in your fuel, and in turn, in our air.

Does ethanol cause carbon build up?

Ethanol is also an excellent solvent, reducing carbon build-up in the engine ports and combustion chamber. There are several videos on-line that demonstrate that the difference in carbon build-up is negligible.

Does ethanol give more horsepower?

The higher-octane rating of ethanol-blend fuel allows for more aggressive timing and increased boost levels in turbocharged engines, which can result in increased horsepower (HP) and torque compared to running on regular gasoline. However, engines left with regular timing designed for non-ethanol blends, will find a slight reduction in power levels.

Fuel Type	Energy BTU/gal	Amount needed for equal energy to 1 unit of gasoline
Gasoline	115,000	1.000
Ethanol	75,700	1.519
E10	111,070	1.035
E15	109,105	1.054
E20	107,140	1.073
E85	81,595	1.409

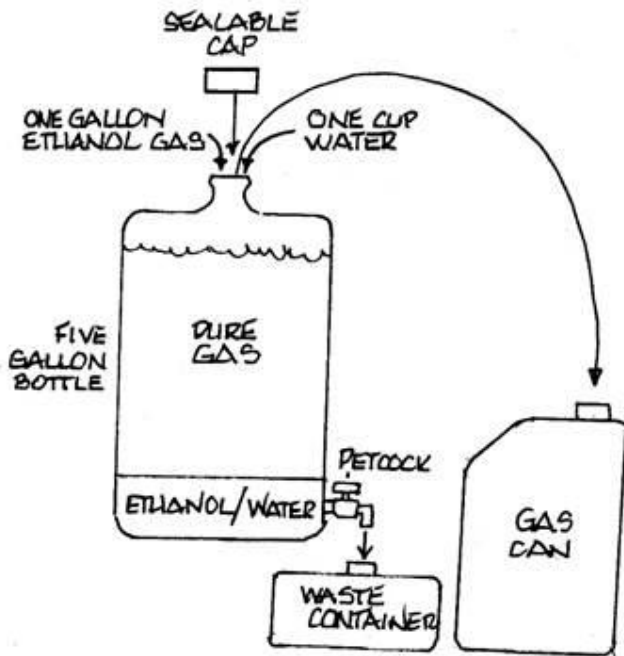
Can I get ethanol-free gasoline at the pumps?

Not likely; although the Clean Fuels Act has legislated that retailers sell blended fuel only, there may be a few select stations that have not fully switched over, but they are few and far between.

Can I remove the ethanol from pump gas?

It is possible to remove ethanol from blended fuel, but the process is tedious for large quantities and must be done in a well-ventilated area because of the volatility of gasoline. Here is a link showing the process.

<https://www.wikihow.com/Remove-Ethanol-from-Gas#Using-a-Separatory-Funnel>



I don't recommend doing it, but it is possible. It is likely better to ensure your aircraft components are compatible with E10 and eventually E15.

What about Additives?

There are a number of additives available that claim to remove the ethanol or at least reduce the harmful effects. Many of these have been tested, but their effectiveness is still in question. It may be worth further investigation, but I have not found anything in my research that is proven to work better than just making sure your aircraft has compatible components for ethanol blends.

Is there anything we can do to limit the regulated amount of ethanol blended into our fuel in Ontario?

There is currently a petition on the government website that was set up by the classic car community in which they are attempting to get ethanol removed from higher grades of fuel such as 91 and 93 octane fuel. I have signed it. It can be found here:

<https://www.ourcommons.ca/petitions/en/Petition/Details?Petition=e-4735>

I am uncertain why COPA has not been lobbying for this same consideration for aircraft engines, but I suppose most COPA members likely use 100LL aircraft fuel, which is unaffected so far.

There is some leeway in the legislation for retailers who can deduct volumes of gasoline if they expect it is being used to generate power in:

- aircraft
- marine vessels or marine equipment
- off-road vehicles or off-road equipment
- vehicles manufactured before 1980; or
- motorized snow vehicles

Volumes of mid- and premium-grade gasoline (gasolines with octane levels of 89 or higher) can also be deducted.

A fuel supplier can deduct volumes of diesel if they expect it is being used to generate power in:

- an aircraft; or
- a furnace or boiler to produce heat

The trick here is how the retailers determine the use of the fuel? Are they going to install another underground tank with ethanol-free fuel and track users that meet the criteria above? I doubt this will happen, but there is still the option of limiting ethanol-free gas to higher grades, but ethanol is a cheap way for the suppliers to increase the octane levels, so it's doubtful this will happen either. To figure out why the ethanol was accepted so quickly and what will likely happen in the future, just follow the money, I suppose!

It seems there is no way to stop the fuel suppliers from increasing the ethanol in all grades, so what do they have to say about it and what does Rotax say about it?

I sent a request for information from Rotax and from Shell Canada and received the following responses:

Response from Rotax:

Hi Dan,

The official position on ethanol is written in [Service Letter SI-912-016](#) (attached). This SI will be revised if the allowable ethanol content percent is increased.

From testing we know that ethanol does not harm the 9-series engines.

Note: Airframe components are not tested by Rotax.

Rotax is also aware that field experience in Brazil, where they have used 80-90% ethanol for many years, does not seem to have any negative impacts on the engine.

Best regards,

Robert Seaton

Director

I have reviewed the service letter mentioned and there is no reference to ethanol-based fuels, however it appears to be a performance-based document that sets the operating parameters.

Perhaps Rob meant this document, which defines the ethanol limit as 10% in 912 series engines.

https://legacy.rotaxowner.com/si_tb_info/serviceinfo/si912i001r1.pdf

Response from Shell Canada:

Enquiry: RE: Ethanol in Gasoline

Response:

Hello Dan,

Shell Premium Fuel V-Power 91, 93 and 87 Octane Ethanol in the province of Ontario, Canada.

Starting in 2022, all gasoline grades sold in Canada will be blended with ethanol, including premium gasoline (V-Power 91, 93) according to proposed regulations (10% ethanol Federal Clean Fuel Regulation for 2022, Low Carbon Fuel Requirements and need to reduce the carbon intensity of fossil fuels, which ethanol is one mechanism to reduce carbon intensity). All the

provinces are switching slowly, and if you see the label at the pump, "Gasoline may contain up to 10% Ethanol," it is already happening.

It is still during converting to Ethanol and some of the terminals they source from haven't converted yet. As such you would see a mix of sites that have Ethanol, and some does not have yet but will over time as the product is available. The non-Ethanol or free ethanol stickers at gas pumps means the stations have 0% ethanol free gasoline at each site and will be mounted once up to 10% appropriate changed.

Thank you.

Kindest regards,

Jeampy Keto.

Shell Canada, Technical Support

Conclusion:

It would appear that the chances of getting non-ethanol gasoline at any pump in Ontario is going to be challenging at best and likely impossible going forward.

It does create some interesting legal challenges:

- For STC'd aircraft, ethanol is not allowed. Any pilot who flies with fuel containing ethanol is outside his type certificate, so the flight is illegal. Therefore, if there is an accident, the insurer will not have to pay. Whatever TC does in a case like this is hardly worth worrying about. The insurance is the real problem.
- For amateur-built aircraft flying with Rotax 912 series engines, until Rotax revises the Service Letters to include higher level of ethanol, there could be a lot of planes grounded for the same reason... Insurance risks.
- Rotax allows 100LL but only with caveats about more frequent oil changes. Rotax owners don't want to pay for 100LL anyway.

Let's hope the classic car, boaters and other petitions regarding no-ethanol blends for higher grades get some reaction in parliament.

Ethanol blends are potentially another nail in the coffin for recreational aircraft in Canada unless we get more answers soon!

- Dan

HELP WANTED

The Youth Aerospace Program is expected to resume in April and we are looking for instructors to assist with the program. We could use instructors for the Airframes and Forces of Flight class as well as an instructor for the Engines and Propulsion class.

These are fun demonstration-style sessions with grade 6 students eager to learn about airplanes and flight. The aforementioned classes happen once a week, for three short sessions that day, between 10 am. and 2 pm.

For more information, please give me a call on my cell at (226) 218-9260. – Dan O.

Upcoming Events in 2024:

- *Highlighted lines are KWRAA Events**
- *Bolded Lines are KWRAA Fly-ins* (More details on fly-ins coming in the new year.)*
- *Fly-in Data Sheets are available on the KWRAA website at www.kwraa.net*

March 21	-	KWRAA Monthly Meeting – Cadet Youth Dev. Centre at CYKF
Mar 28-Apr 2	-	Sun-n-Fun 2023
April 18	-	KWRAA Monthly Meeting – Cadet Youth Dev. Centre at CYKF
May 16	-	KWRAA Monthly Meeting – Cadet Youth Dev. Centre at CYKF
June	-	KWRAA Fly-Ins - TBD
July	-	KWRAA Fly-Ins - TBD
July 24-July 30	-	Oshkosh Air Venture 2023
August	-	KWRAA Fly-Ins - TBD
August 16-18	-	UPAC Convention 2023
August 31	-	Damascus Field Fly-in CDF6 - (date to be confirmed)
September 19	-	KWRAA Monthly Meeting – Cadet Youth Dev. Centre at CYKF
October 17	-	KWRAA Monthly Meeting – Cadet Youth Dev. Centre at CYKF
November 21	-	KWRAA Monthly Meeting – Cadet Youth Dev. Centre at CYKF
November 29	-	KWRAA Christmas Party – Runways Café at CYKF

* KWRAA events are fly-in and/or drive-in.

KWRAA monthly meetings will be on the **third Thursday night of each month** next year unless we hear otherwise from the Cadet Youth Development staff, since we are using their building and working around their schedule for our KWRAA meetings.

If you know of other aviation events in Southern Ontario advise me and I will append the list.

KWRAA Executive Contact Information:

Due to an increase in spam emails, please reach out to me directly for the latest contact information for the KWRAA Executive members. Thank you, Dan Oldridge (519) 651-0651.
