

Monthly Newsletter of the Kitchener-Waterloo RAA

- November 2021 -



The weather was exceptional for the Damascus fly-in on the Labour Day weekend and the turnout of aircraft was as good, or better, than any in the past, likely due to pent up demand for such an event. After a long summer without any fly-in being sanctioned by KWRAA due to the pandemic, Roger went ahead and held a private (by invitation only) event. There were a number of infection control measures in place and the event was held strictly outdoors to minimize exposure to the Covid-19 virus. Additionally, by the time of the fly-in, most of our members had already had two doses of the vaccine, protecting themselves and others. In the photo you can also see that most of the attendees stood 2 metres from each other while visiting, reducing the chance of spread even further. Using this event as a baseline, the Largo Woods went ahead two weeks later as a KWRAA-sanctioned event, using similar protocols and measures to ensure risk of spreading Covid-19 were an absolute minimum.

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President's Message

Finding time to write a monthly newsletter can be challenging to say the least, especially when you have a number of projects on the go. Life has gotten so busy for me and in a couple of months it will be 10 years since my wife Chris first said to me, "You need to learn how to retire". By this time 10 years ago she will have been retired for several months already and was settling in to a life of leisure, something I have still yet to master.

I read a couple of decades ago that Capricorns never retire; they just change employers. I'm not really much into Astrology, but it rang true for my father and time seems to have shown that I am following in his footsteps. I willingly admit that I like to stay busy, but I also like the fact that I get to choose how that happens and assign my own timeline to projects I take on.

The newsletter is just one of those labour of love items that seem to make sense to me. I'm not really a writer, but I do like to share my experiences and hear what my friends are up to. I guess that's why I really appreciate it when our KWRAA members take the time to share something that's important to them by sending me photos and story ideas.

This month's newsletter has a great article from Lee and some of the photos from the 2021 fly-ins at Damascus and Largo Woods.

Please take a few minutes out of your own busy lives to jot down a couple of ideas you can share in the newsletter and take a couple of photos to go along with them. Anything aviation related is appreciated and welcomed by your friends here at KWRAA.

Gary Wolf is always looking for good ideas and stories for the Recreational Flyer Magazine too. Whether it stays local or goes national, it's your choice and always appreciated either way.

2022 is going to be a great year for KWRAA!

Fuel Contamination of Searey C-GJIB

Fuel contamination can happen in many forms in an airplane, especially when using automotive fuels. I didn't know how many ways until I unleashed the ugly beast in August



Police say the plane was amphibious and house-built. (Source: Wellington CLOSE X

20th 2019. That was the day I inadvertently left the landing gear down during a water landing, resulting in an ignominious mixing of waters and airplane parts.

The windshield was flushed off and the water dominated most of the fuselage, avionics and fuel system. But this wasn't just cleansing water, but a nutrient rich mix of crap that was barely suitable for human use. Luckily for the environment, the fuselage fuel tank didn't leak out, but absorbed the water mix. I pumped out the tank and Mr. Funnel found about 60:40 mix of fuel and water. I thought that was going to be the end of the contamination, but a more insidious mechanism was found much later, during flight testing, not necessarily related to the original incident.

The repair of the aircraft would take some time as a lot of non-structural parts were needed to reconstruct the fuselage nose, windshield and replace almost all of the avionics. After about 12 months of sourcing parts and finding expert support, the Searey was ready for an engine start.

The annual inspection items were started and revealed some serious warning signs. First, black crusty corrosion was found at the bottom of the gascolator bowl. This is the lowest point in the fuel system but cleaning still left some pitting in the aluminum bowl.



The next item was the fuel sender. All my engine gauges were compromised by the water, so I had replaced the six electrical meters with an MGL Engine Management System (EMS) and its associated remote sender (RDAC).



The full tank level indicator showed full scale but a little bit of troubleshooting resulted in the conclusion that the fuel tank sender was open circuit. I did not realize how susceptible these fine wire sensors are to water corrosion. I replaced it with an automotive universal long arm sensor and did an initial calibration. The conclusion is, don't use these sensors in any water.

Next, the Rotax 912 carburetor bowls were checked prior to start and weren't too bad. They weren't as clean as previous years, but OK enough for further testing.

The good news was that the electric fuel pump ran but on the downside it didn't suck up any fuel. There was a black crud at the inlet and more of that corrosion which meant I should be

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replaced. It took me a while to find the right pump for flow and pressure, as the original Facet pump didn't have a part number on it.

This is at the point where I noticed that the automotive flexible fuel lines seemed a bit stiff. I replaced the pump and the flexible fuel lines I could get at. This led me to the carburetors again and replaced the black fuel lines. I followed that up with a flow test to ensure that the fuel flow is adequate if the engine mechanical pump failed. The test proved new pump was able to pump enough litres into a small container to be 153% of the 912ULS full power flow requirement of 27 litres per hour.

This is when I noticed more of the black crud showing up and decided to put in a fuel flow sensor. Why not; the EMS had a connection for a fuel flow input and I could detect any flow reductions, right? I quickly found out that fuel flow sensors are not cheap. Mine was \$268, and I was warned that sometimes they could actually clog up and restrict fuel flow. Furthermore, there are strict mounting requirements to avoid bubbles and debris. Anyway, the ability to monitor fuel flows and verify fuel consumed/remaining was just too intriguing. Besides, the manufacturer assures us that the sensor will not restrict fuel flow, if installed properly. I mounted the sensor on top of engine to avoid turbulence from the pumps and wired it back to my EMS sensor unit (RADC).



What remained was to check for further contamination and fire up the engine.

There seemed to be small black particles in the carburetor bowls again, so those were cleared

out. The engine had not been run for over a year so I followed an engine misting procedure using ACF-50. The engine started fine but there were a whole bunch of EMS setup problems to get a few of the parameters correct, including the rpm. After considerable tweaking, I finally established that the fuel flow gauge was not working. I expected the worst and presumed the sensor would have to go back to the manufacturer for a costly inspection.

I took the sensor off the airplane, ready to send it back for repair. Upon a closer look, the ugly truth was revealed. There were a lot of familiar little black bits in the sensor impeller.



It took a few tries to get it all out. So where was all this crap coming from? The input to the mechanical fuel pump seemed to be clear but the line out of the pump looked like chopped liver. I presume that some tubing bits got chewed up in this pump. Luckily, not much of this made it to the carburetors. After replacing the line, from here on in it would require vigilant monitoring of the bowls and the gascolator to get ready for flight.

The first flight was met with some trepidation, compounded by more calibration problems with the EMS engine instruments.



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A very high and erratic oil pressure indication took most of my focus on this very short flight. A little rewiring and calibration brought this under control. My next flight took me further afield, in fact to a water landing where all of this mess started.

I dropped in on Tom Mills at Conestoga Lake, with smiles on both of us. Tom had led a small group of people to pump out and recover the airplane a year before. This was a symbolic threshold for both of us and a long time coming.



After a little chin wag I taxied for takeoff and everything seemed to be going great. The plan was to takeoff towards his cottage and head south over the shoreline. Ironically, as I got to about 100 ft above the lake, the engine lost power. Immediately I turned away from the shoreline looking for a place to splash down. I reduced the throttle and the engine seemed to be relatively happy at idle. After straightening up for a splash, I applied the throttle and it responded smoothly. At that point. I shuttled up to a safe altitude and continued on my travel without further incident. That doesn't mean I was comfortable with the situation, expecting an engine failure at any time. There was something else going on.

Before and after each flight I monitored the fuel gascolator samples and noticed some interesting trends as I used up my "old" fuel. This incident repeated itself one more time, again at worst time, right after take-off.

At the start of the COVID crisis in March 2020 I started buying 91 Octane fuel at bargain prices at my local PetroCan.

I thought I would be flying in a few months and would need this for my usual travels. The reality was that my engine start wouldn't happen till 6 months later. Further, there were no usual travels in 2020, for anyone. As I used the fuel, I noticed that the colour of the fuel samples would change.



As you can see from the samples shown above, there is severe discolouration for the older fuels on the left, and yes there is some contamination. The most dramatic change occurred when I switched to Shell 91. Not only was it "fresh" but it had no ethanol added.



I had not been too concerned about the use of ethanol up to this point but there was "clearly" something to this. My Rotax 912 engine manual allowed up to 10% ethanol and I have been using automotive hoses and gaskets that should be rated for ethanol. What more could there be? An internet search quickly pointed up some facts that I didn't know.

The following tables show some of the things I learned about ethanol fuels and some of the things I did to address the various fuel contamination issues I experienced as I tried to restore my fuel system back to its normal operating condition. Hopefully, you will find this information as useful as I did.

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Ethanol Facts

Ethanol Fact Sheet:				
Shelf Life:	1 to 3 months for 10% ethanol to maintain octane. 1 month for PetroCan 91 (Mogas has a shelf life of at least 6 months if no ethanol, even longer with a fuel stabilizer) (100LL shelf life is at least 2 years – ASTM)			
Ethanol is Hydrophilic ("water-loving")	It will readily absorb any water or humidity in a sealed container resulting from condensation, causing both moisture contamination of the fuel and the eventual separation of the fuel into distinct gas and ethanol layers			
Effect on Rubber Compounds	Ethanol dries out the rubber components in a fuel system. This leads to cracking and brittle fuel lines, floats, seals and diaphragms.			
Effect on Fuel Handling	It is corrosive when in contact with certain materials in fuel storage and delivery systems, including some rubber compounds and the zinc and aluminum alloys used in carburetors.			
Discolouration	If the gas is significantly discoloured (i.e., the color of milk chocolate or rust) or contains sediment or sludge, it has been contaminated by moisture or the solid by-products of oxidation, respectively.			

Summary of Fuel Contamination Failures

Item	Fault	Action
Electric Fuel Pump No fuel, Black crud at inlet		Replace pump & fuel lines
Gascolator	Black corrosion, particles	Clean and reuse
Fuel Sender	No output, fine wire sensor open	Replace fuel sender
	circuit, clogged with black particles	
Carb Bowls	Black corrosion, some small	Clean and reuse
	particles	
Flexible Hoses	Hardening & embrittlement	Replace with resistant hoses
Fuel Samples	Discolouration, black particles,	Change the fuel type – No
	globules	ETHANOL
Power Interruptions	Sudden loss of power, 2 times	Start cleaning again.
Contaminated	Corrosion & deposits to inhibit fuel	Pump out and FLUSH with clean
(Water in fuel)	system operation	fuel, followed by fresh stabilized fuel.
Flexible hose	Hose can break up and produce	Replace flexible fuel lines with high
hardening	blockages	quality ethanol resistant lines.
		Fuel senders can actually help to
		detect large contamination.
Fuel break- down	Moisture contamination and	Observe fuel shelf life time:
(discolouration)	corrosion, reduced octane	-1 to 3 months for mogas
		-Frequently use fresh fuel to offset
		older fuel already in the plane
		-use fuel stabilizer prior to long term
		shutdown (3 months)
		-Possibly use 100LL only for the last
		fill-up and flight before winter
		-DO NOT USE ETHANOL BASED
		FUELS as they have severely
		reduced shelf life and cause many
		rubber materials to become brittle.

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Conclusions

The major thing is that the fuel system should have been flushed out immediately after the incident. This would have reduced the corrosion. Maybe 100LL fuel would make some sense as it is has a shelf life of at least 2 years (ASTM standard). I don't like using this fuel in the Rotax as the lead can deposit as a sludge in the gear box and put lead film on the pusher propeller. By the way, Mogas has a 3 to 5% higher power efficiency than 100LL and doesn't deposit lead in the environment.

The rubber hoses should have been replaced more often. Rotax recommends 5 years. I'm not sure I've complied for all of the fuel system components. I thought this recommendation was just for exposed fuel lines on top of the engine where they were exposed to heat from the engine and UV rays from the sun, making them prone to drying out.

My fuel choices going forward will be different. I will continue to use 91 Mogas primarily, but I will be more careful not to leave fuel sitting for over 3 months, especially without adding a fuel stabilizer. I will always try to add significant amounts of fresh gas when I go flying and always check the sump for contamination.

Rarely will I use 100LL avgas, but there is no choice at most airports. The lead in 100LL aviation fuel forces more oil changes and cleaning in Rotax 912 engines and gearboxes. I will periodically check for the presence of ethanol in the fuel I purchase, but going forward, I will buy 91 octane ethanol free 'premium' Mogas wherever I can.

"Let us be filled with hope, and be fueled by the results of wise decisions." - Lee Coulman

References:

The Value of Heeding Directions - By Marc Cook, Kitplanes,- June 15, 2020

Pick the Best Rubber Hose for Your Fuel System - By Jon Crocke, Kitplanes, September 14, 2020

The Problem with Ethanol in Gasoline - By Richard Russell, Globe and Mail, March 22, 2016

10 Mogas Myths

- By Kent Misegades, GA News, March 16, 2011

Solved! How Long Does Gasoline Last? - By Manasa Reddigari and Bob Vila, www.BobVila.com

Roger Deming's Damacus Fly-in 2021

Here is just a taste of what you missed if you didn't get to Roger's fly-in on September 4th.

If you made it there, maybe you'll find yourself in one or more of the photos.



Scott Neufeld flew his C150 to the event with his daughter Emily, who has been attending fly-ins with him for a few years now. I expect to see one of them as KWRAA president someday... my money is on Emily. ;) LOL.



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It was a beautiful day and the turnout was great for Roger Deming's fly-in at the Damascus Field CDF6 just a few kilometers north-east of Arthur ON.

From trikes to RV's there were biplanes, high wings, low wings, and chicken wings... or was that burgers... regardless, it was a great aviation event with friends, fun and food! Thank you Roger and all who attended.

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Largo Woods Fly-in 2021

The risks that would have had to be assumed during the early stages of the pandemic meant that the 2020 fly-ins were all cancelled. Even during the early summer of 2021, there were limited numbers of people who had been fully vaccinated against Covid-19 and the reported case numbers were just starting to come down.

Thankfully, by late summer, the risk of catching the virus at a social gathering using social distancing and other safety protocols had declined to the point where KWRAA executive felt it was safe to sanction a fly-in. Using Roger's fly-in two weeks prior as a template, we made a couple of small changes and held the event at Largo Woods, thanks to Cam and David Wood and their families.

There were only two aircraft the made the flight there due to a number of factors including cross winds and very all corn on either side of the narrow runway. In spite of that, the turn-out was still good with our members driving in to the event.

The tall corn is evident in this picture provided by Mac and Colin as they landed at Largo Woods in the Tecnam.

"Social Distancing" was the order of the day and evident in many of the photos of the event.

Lee flew his Searey there raising the number of planes arriving at Largo Woods to two!

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Although it was mostly sunny, it was a cool day, but not so much that a light jacket would not do the job.

Thanks again to the Wood families for their hospitality in opening up their property for our fly-in.

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Upcoming Events in 2019: (Highlighted lines are KWRAA Events*)

November 8	-	November Meeting at 7:30 in the Cadet building at CYKF
November 12	-	KWRAA Christmas Party – Runways Café at CYKF
December 13	-	December Meeting at 7:30 in the Cadet building at CYKF (TBD)

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

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FOR SALE:

I have a large quantity of Sika spruce available. Many pieces are cut to a taper from end to end for the spars of a Tern sailplane project; all are either rough sawn to 1" or a little more or planed to 7/8".

It was sold to me as spar grade.

I looked at all the pieces a few weeks ago to verify grain direction and ring count. I did a few density and moisture content measurements and all were well within MIL-S-6073.

I also have 22 full 4' x 4' sheets of 1/16" fir plywood plus some odds and ends.

Present retail price is about \$40 per board ft. for 7/8 sitka and \$60 per sheet for plywood. I am open for offers, but I would especially like someone to buy the whole lot! The sitka is presently in a shipping crate about 28' long by 10" square section and could be moved onto a trailer in this box fairly easily.

A complete listing of material is available from Dan Oldridge or me, Bruce Clift (519)395-3144 or blairskids@hotmail.com.