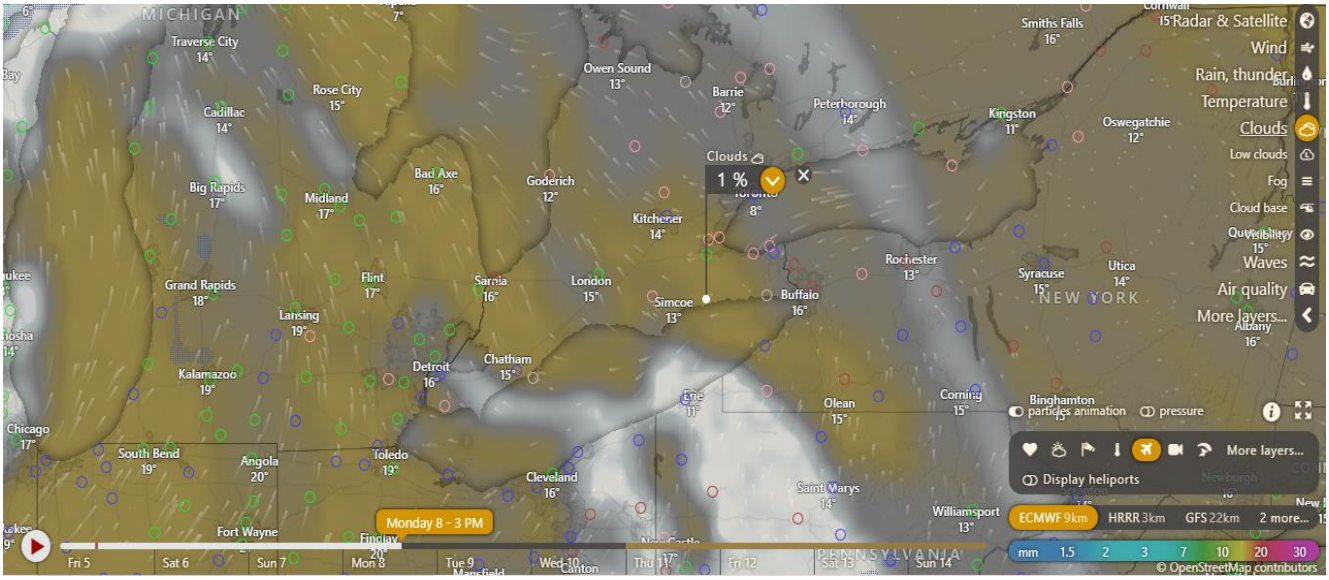
RECREATIONAL AIRCRAFT ASSOCIATION
RÉSEAU AÉRONEFS AMATEUR CANADA

The Leading Edge

Monthly Newsletter of the Kitchener-Waterloo RAA

- April 2024 -



As of Friday, April 5, 2024, no one is certain of the cloud cover for Monday's total solar eclipse. So far, it looks like it will be clearer than the average cover for April 8th, but we won't know until it's over. Windy.com shows only 1% cloud cover on the north shore, but other predictions are not so rosy! I plan on taking my chances and head down to Lake Erie to witness the event, likely to be the last one in our part of Canada in my lifetime. This on-line map tool shows the exact amount of totality for any location on the planet. You can expect to see just over 3 minutes of total darkness mid-day at Long Point. http://xjubier.free.fr/en/site_pages/solar_eclipses/TSE_2024_GoogleMapFull.html?Lat=42.57802&Lng=-80.42233&Elv=172.0&Zoom=9&LC=1

President's Message

Well, in spite of having a great time at Big White this winter again and then Hawaii for a week, it's good to be back home.

Thankfully, I have been able to complete my annual inspection of C-FDFD and even flew it for about an hour already. In spite of the gas price hikes from the carbon tax, I still plan on flying as much as I can this year. Most of the older pilots I know quit flying by the time they were 80, so it appears I only have another decade if my health holds out and obviously less if it doesn't.

Lee Coulman has been a big help in stepping up to run the monthly meetings in February and March while I was away. He has also submitted this month's lead article in the newsletter, as well as an article on the improved electrical connectors he found to use in his aircraft. It's great to have an executive group in the chapter that can get things done while I'm away. It really took the pressure off, so I could enjoy my vacation without worrying about how the chapter is doing without me.

Besides Lee's work, Mike has the chapter report submitted, Mac has some fly-ins planned, David has continued to get minutes and notices out to me to include on the website. Is it any wonder that I continue to claim that we have the best RAA chapter anywhere!

2024 is going to be a great year for KWRAA.

- Dan

Interference and Performance of Antennas

- by Lee Coulman

At the February KWRAA meeting we discussed some radio problems associated with antennas, coaxial cable and bonding. We had a lively discussion and were able to view a few videos and talk about my coaxial tool collection.

The first video was about a noise problem that happened after some engine work. There was noise in the VHF radio when the engine speed was increased. The transmit appeared to be ok. The VHF antenna was inspected for corrosion.

The antenna was bonded to the metal fuselage by the 4 mounting bolts and they were partially corroded where they connected the backing plate to the doubler. The coaxial security was also checked. The remotely located transceiver module was attached to the panel, which was not was not fully bonded to the fuselage ground.

AC43.13 recommends bonds like these be in the milliohms range. The author had experienced similar issues on another airplane which were caused by the magnetos. He inspected the new magnetos and found a greasy film that he cleaned off. He also replaced the capacitor. He then noticed that the P leads where not optimally grounded.

He removed unshielded sections of the P-leads and shortened the screen bonding wires to a total of about of a foot! That is a lot of radiating surface! All these actions resulted in a reported 99% success rate. There remained a clicking sound which was originating with the transponder. (I have this same problem on my aircraft.)

Interference on trig TY 91 VHF radio, investigation and rectification (youtube.com)

Don't forget about **AC 43.13-1B - Acceptable Methods, Techniques, and Practices – Aircraft Inspection and Repair**. There are some good pointers especially for inspection of coaxial connectors and signs of corrosion and lack of bonding. However, some of it may appear out-of-date.

12-9. INSPECTION OF AVIONICS SYSTEMS. Check for poor electrical bonding. The bonding requirements are specified by equipment manufacturers. Installation cabling should be kept as short as possible, except for antenna cables, which are usually precut or have a defined length specified at installation. Proper bonding on the order of 0.003 ohms is very important to the performance of avionics equipment.

b. Inspect antennas for:

(1) broken or missing antenna & insulators*	*(2*) lead through insulators,*
(3) springs,*	*(4*) safety wires,*
(5) cracked antenna housing	*(7) correct installation*
(8) signs of corrosion, and	*(9) the condition of paint/bonding and grounding*
(10) Check the bonding of each antenna from mounting base to the aircraft skin	*. Tolerance: 0.1 ohm, maximum*

*These items are more applicable to HF and old ADF sense antennae

There are some further tidbits about the ELT antenna and coaxial cable. We are warned of retracting center pins on the coax and of overly tight bends. One of the videos suggested that a coaxial cable should not be bent any tighter than the outside of a pop can (6:1 radius).

Also check the ELT installation to make sure that the antenna is located in the most crash worthy portion of the aircraft and that the antenna system and cable will not be severed in a "typical" crash. Further, always use WDG Adel type clamps to secure the coax to avoid pinching (dielectric deformation). The ELT can affect the pattern of the VHF system so look out for blind sectors around the antennae. The ELT system can also be damaged by a VHF transmitter. For example, after I moved my VHF antenna to the wing root area above the wing, about a foot away from the ELT antenna, I kept having ELT transmitter failures. To start, I got a few years of trouble-free operation until I moved to CYKF where the ground frequency is 121.7MHz. It took me to two expensive replacements until I figured out that 121.5 MHz ELT transmitter had little protection, especially when it wasn't powered. This was when I saw the light and moved the ELT antenna to the rear turtle deck and secured the coaxial cable through the main support "boom tube". This location allowed me to put the new 406/121.5 antenna in a location that would at least survive a flip-over accident. According to the TSB, most ELT "antenna system failures" occur because of the coaxial cable being severed or damaged in a survivable crash. Always check your manufacturer's specific instructions for the "best compromise" ELT antenna location.

Again, From 43.13…

> *12-21. EMERGENCY LOCATOR TRANSMITTERS (ELT). Antenna location should be as far as possible from other antennas to prevent efficiency losses. Check ELT antenna installations in close proximity to other VHF antennas for suspected interference.*
>
> *Remove all interconnections to the ELT unit and ELT antenna. Visually inspect and confirm proper seating of all connector pins. Special attention should be given to coaxial center conductor pins, which are prone to retracting into the connector housing.*
>
> *bb. Ensure that RF cables, e.g., coaxial and triaxial are bent at a radius of no less than 6 times the outside diameter of the cable.*

COAXIAL CABLES and CONNECTORS

We then talked about typical coaxial cable and connectors for installation in our airplanes. We are operating at 108 to 136 MHz for VHF nav/comms, 121.5 and 406 MHz for ELTs and 978/1030/1090 for transponders, ADS-B and DME. We want the lowest loss cable with the least weight and size. Smaller cables have higher losses and lower power handling. Most applications require the use of RG400 (tan) double shielded cable to reduce interference and improve the ruggedness. RG58 (black) is not so rugged but could be used for short secured runs at low frequencies. Also, avoid cables that have solid center conductors and untinned shields due to breakage and Cu oxidization.

(A): ADS-B system allow no more than 1.5 dB in the coaxial feed.

What is a BNC Connector?

The Bayonet Neill Concelman (BNC) connector was named after both inventors and the innovative bayonet locking mechanism that the connector utilizes.

A TNC connector series is a miniature, threaded weatherproof similar to the BNC. The TNC series shares its contact design with the BNC series, utilizing a threaded coupling nut for secure mating and higher frequency performance than the BNC. It is often used on transponders.

The SMA connector is also used for a lot of new equipment. For example, my uAvionix EchoUAT has a small SMA connector to connect to the ADS-B antenna on the turtle deck. I didn't have the proper crimp tools so I got a local avionics shop to terminate the cable with a right angle SMA. These connectors are small and somewhat fragile and need special care and physical support.

[Coax Stripping Tool (youtube.com)]

[Fabricating Coax Cables for Experimental Aircraft (youtube.com)]

These cables can be stripped using basic razor blades or using a calibrated stripping tool. I had a 2-blade cutter which can be used to strip the jacket and shield. This is a cut and trial process. The process is described in the following video.

There are also some Steinair videos to help. The following describes putting on a BNC connector onto RG400 using basic tools.

[(943) 010: BNC COAX CONNECTOR CRIMPING (on RG-400) - YouTube]

I'm not sure that assembling RF cables could be described as being fun, as mentioned in the video. It requires precision work, planning, and the proper tools. I have a number of sets of tools which I purchased online but what is missing with most of these cheap kits are the instructions. Without the instructions you're going to trash some parts. If you really need a cable made properly, go to your avionics shop.

Below is a table of aircraft-typical coaxial lines, dimensions and losses. These are all 50-ohm cables.

Type	Dia "	100 MHz dB/m	400 MHz Loss dB/m	1000 MHz (A) (1.5 dB length)	Construction	ACS $/ft
RG178 M17/93 -	0.072	0.453	0.92	1.44 (1.0m)		
RG-58A	0.195	0.15	0.295	0.59 (2.5m)	Single shield Non-certified	Y $0.89
RG-58C M17/28	0.195	0.15	0.31	0.59 (2.5m)	Single shield Non-certified	Y $1.04
RG400 M17/128	0.195	0.15	0.295	0.46 (3.3m)	Double shield PTFE Dielectric	Y $7.99
RG-142 M17/60	0.195	0.125	0.256	0.426 (3.5m)	Solid conductor Certified	Y $11.65
RG304	0.280	0.082	0.174	0.39 (3.8 m)		
RG393 M17/127	0.390	0.066	0.141	0.29 (5.3 m)		
RG213 M17/75	0.405	0.66	0.157	0.272 (5.5m)		

Improved Electrical Connectors

At our January show-and-tell I displayed an electrical connector set which I was going to use to connect my new wingtip lights. I had looked through my Molex connector collection and couldn't find anything suitable. I never liked those unsealed nylon body connectors anyway. The knife edge disconnects were an option but they can be noisy. Luckily, I had acquired some sealed connectors with my landing gear actuators. These Deutsch DT type connectors are rugged, modular and it turns out there is a good supply of tools and parts to support them. These latching connectors are widely used in the automotive industry but are light and compact enough to fit in an airplane! They have contact ratings better than D-type connectors (5A), have an integral latch, as well as being sealed.

I selected a kit with machined contacts and 6 various contact arrangements. There are different contact sizes available but the most common available is #16, for wire sizes 14 to 20 AWG with a contact rating up to 13 amps. The crimp tool came with the kit and provides a quality 4 pin crimp similar to that for D connectors.

The pins can be inserted and extracted with simple tools. Sealing plugs were also supplied for unused pins.

There are stamped contacts also available at a lower cost, but I didn't like the design.

The following video describes the use of these Deutsch DT connectors.

[How to use Deutsch DT Connectors and Why I use them on everything!!! (youtube.com)]

These connectors appear to be well-built and hopefully, improve reliability in a seaplane application. I plan on using a lot of these connectors on my Searey as I conduct maintenance and install new systems in the plane.

- Lee Coulman

HELP WANTED

The Youth Aerospace Program is resuming April 11, and we are looking for instructors to assist with the program. Please consider joining me and Geoff Gartshore in teaching youngsters about aircraft and flight.

The lessons are already developed, so just follow along and have some fun instructing.

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 on Thursdays, between 10 am. and 1:30 pm.

For more information or to observe for a day, 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*

Apr 9-14	-	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 1	**-**	**KWRAA Fly-In at Mount Forest – Tom Shupe**
July 6	**-**	**KWRAA Fly-In at Largo Woods (CLW6) Cam and David Wood**
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 this 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.
