

- October 2017 -



By now most of you have likely heard that CPR3 has been sold and the new owners have zero interest in aviation or even keeping the strip open. Not only will Lee lose a great hangar and strip, KWRAA will lose a great fly-in venue.

## President's Message

Last issue, I mentioned that the cool summer we had was yielding way to a warm week or two as we headed into the autumn flying season. Well, it would seem we are getting a much warmer autumn than anyone even expected and this is creating some wonderful flying opportunities. Granted there have been some wet and windy times, but hey... this is Canada... not only do we get a mixed bag of weather, we get to complain about it too!

The warmer weather has delayed the fall colours by at least a couple of weeks, so if you haven't gotten out to enjoy the view from the air, your opportunity to do so has not vanished yet. Be sure to check out the fall colours report to find the best places to get some great views and photos of the leaves. The link is on our website. <http://www.ontarioparks.com/fallcolour> Most of the areas in Northern Ontario are now between 60 and 80%, so consider checking them out this week sometime!

In this issue of *The Leading Edge*, you will find a short article about a few more interesting

gadgets that I have added to my Highlander. I am writing up a longer and more detailed version for the *Recreational Flyer* magazine, but I thought our local members might enjoy a sneak peek at what's in the article. All of the parts are fairly reasonably priced and available either locally or on-line and would make easy (and I believe welcome) additions to any land-based or float-equipped aircraft.

I expect to be making a few more interesting changes to the plane this winter to improve STOL performance even more and also clean up the parasitic drag a bit with the hope of achieving a 4:1 flight speed envelope. I will be shooting for 25 mph stall speed while achieving over 100 mph cruise speed. I will share those changes with you at a later date, but for now I hope you enjoy reading about interesting safety features I have added to Aerial One.

There is certainly something to be said for owning an amateur-built aircraft!

- Dan

# The Leading Edge

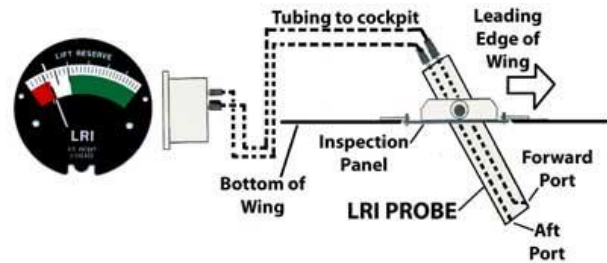
## Electronic Stall Warning Device

During the time I have owned the Highlander, there have been very few times that I have questioned the design of the aircraft. Based on the original Avid Flyer and of course very similar in construction to the Kitfox series of aircraft, the Highlander uses two aluminum spar tubes in each wing, with the leading edge of the wing actually being the front spar tube. This is a great design for a high lift wing and has been used in a number of great aircraft, but the one disadvantage I have found is the inability to mount a traditional stall warning reed-type device in the leading edge of the wing. What I needed was a way to get a stall warning without cutting into the spar or messing with the leading edge of the wing.

I decided to install an electronic stall warning device linked to my lift reserve indicator system. Since I already have a visual indication of "loss of lift", I needed a way to get an audible warning or some other means of grabbing my attention when the plane gets close to a stall. I had noticed a number of times that the bright red alarm LED's on my MGL instruments grabbed my attention quickly when any of the flight or engine parameters were out of the programmed ranges.

Maybe what I needed was a super-bright red LED to draw my attention to the reading showing on the lift reserve indicator? Given the information available on the usefulness of the lift reserve indicator and that it basically accounts for changes in angle of attack, aircraft speed, aircraft bank, and a number of other factors, this seemed like the logical approach to installing a stall warning device.

The lift reserve indicator or angle of attack indicator works on differential air pressure between two sources that are slightly offset to generate a different pressure with varying angles of attack of the wing. There is an LRI or AOA design shown on the RAA Canada website, which I had used to construct the one in my Highlander. It basically looks like this...



Since there is a pressure differential generated in the tubes to the gauge when the plane is moving through the air, I just needed a way to measure it electronically and turn on a switch when it dropped below a certain level. But of course nothing is ever that simple. Without a means of enabling the warning only when the aircraft is above a certain speed... maybe 30 mph or so, the stall warning would be going off the whole time the aircraft is on the ground.

Airspeed switches would work, but they are over \$60 each and only handle about 20 milliamps through the contacts. After researching options I determined the best solution used high efficiency furnace air pressure switches that were adjustable and handle in excess of 1 amp of current through the contacts leaving a huge margin of safety and increased long term reliability. To top it off they are light weight and have both a normally open and normally closed contact.



The unit pictured above is made by Cleveland Controls and is easily available on Ebay or other on-line retail sites; shipping can get a bit pricey from the USA so be careful ordering and remember that two are required for this circuit.

The first unit is connected into the pitot-static system with tees and adjusted to trigger the switch at about 25 knots... well above taxi speed. To test the proper level, hook up a small tube to the pitot tube and apply a very small amount of air pressure by using a small rubber bulb or blowing very gently into the tube after swallowing any saliva in your mouth first. Watch the airspeed indicator and adjust the set screw on the pressure switch to adjust the trigger point. You will hear a click when the switch operates.

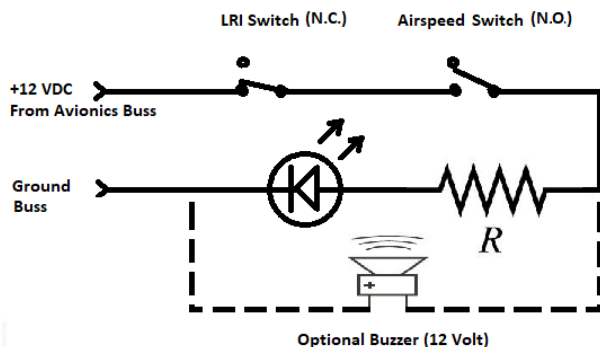
The second unit should be hooked into the lift reserve system with tees and tested in a similar manner by feeding a small tube into the upper tube of the probe and lightly pressurizing it in a similar manner. I used a length of small heat shrink to accomplish this. Adjust the set point of the switch to trigger as the LRI transitions midway through the yellow range.

To wire up the system, use the normally open contacts on the speed switch and the normally closed contacts on the LRI switch and wire them in series with the indicator LED and a resistor to limit the current through the LED. The LED that I used has a maximum current rating of 20 milliamps so I used a 680 ohm, ½ watt resistor to drive it near full brightness.

$$R = E/I \text{ or } (13.8V - 1.6V^*) / .02A = 610 \text{ ohms}$$

\* The red LED takes about 1.6 to 1.8 volts to operate

The next highest standard resistor value is 680 ohms, which yields 18 milliamps at 13.8 volts and drops to just over 15 ma. at 12 volts.



As you can see, the circuit is quite simple to connect, but use good quality connectors and Mil. Spec. wire to make reliable connections.

The fuzzy picture below shows the bright red warning light just below my lift reserve gauge. It just came on as I reached the mid-point of the yellow range on the gauge. You may find that you prefer it to come on just a bit sooner, maybe as it transitions into the yellow, but I like mine in the mid-yellow range.



Below it is shown in the full context of what it looks like in the cockpit and just how bright it appears as the plane gets closer to the stall speed... in this case due to landing.



I have shown this electronic stall warning device with an optional buzzer in the circuit diagram, but did not install the buzzer since I had other plans for the Highlander... more in the next article where you can see the stall warning system operating in conjunction with another little bit of modern technology!

- Dan

## Vertical Distance Warning Device

- Using a car backup alarm to assist with landings -

Glassy Water... every float plane pilot's least favourite landing scenario. How do you judge your vertical distance from a mirror-like lake? Sometimes you can use the shoreline... or objects floating in the water like buoys, but generally there are few indications of height over glassy water.

Float plane pilots are taught to set up a long approach into the wind with a 100 ft. per minute descent rate and just wait it out until the floats break the water's surface. When they do it will likely still be a surprise as the human brain has a difficult time judging distance without any definite clues. Sometimes it's hard enough when there are waves or ripples on the water to get an accurate picture of height off the water.

There are a number of electronic solutions available to measure distance, including radar lidar, and sonar. Given the complexity and relative expense of radio ranging technology and laser ranging technology, car back-up alarms use sonar systems, which incidentally have dropped tremendously in price as the technology becomes commonplace in most automobiles.

After a bit of research into the topic, I found a few people had already tried using automotive sonar systems in aircraft to determine vertical distance from the ground. Lee Coulman and I had several discussions about the feasibility and practicality of installing and using such systems and technology in amateur-built aircraft.

One of our main concerns was the range of these devices, which is typically less than 2 metres and the impact of noise generated in the slipstream around aircraft, whether from the propeller or just the natural flow of air over the fuselage at speed. We didn't know whether the "noise" generated by rushing air would produce a high enough frequency to interfere with or even mask the ultrasonic frequency pulses being sent and received by the sonar ranging system's transducers.

While Lee pursues a micro-processor based solution that integrates with gear position and

other functions in the aircraft, I decided to try an off-the-shelf solution designed for other purposes... a car back-up alarm. Below is a photo of the device I ordered and installed to test out our ideas on how, and even whether or not, it would work for aircraft use.



The system I ordered came with 4 sensors, a drill bit, a control box, and an LED display. Wiring is very easy since it is completely plug and play! When the unit arrived from overseas, I hooked it up to a 9 volt battery and plugged in a couple of the transducer/sensors to test the system. I was immediately impressed with how it functioned.

Knowing that I would be using this on my floats, I plunged one of the sensors into a glass of water and left it there for a half hour or so then tried it again... it continued to function correctly!

I fashioned a couple of small angle brackets and drilled them to fit the sensors into. I then mounted the brackets to the splash guards on my amphibious floats with the sensors facing downward. This positioned the transducers about 8 inches off the ground, which I figured was about the same distance a car equipped with one of these devices would park from a wall or other barrier the driver was backing up toward. I figured this should ensure similar results to what the device was designed to provide.

I then ran the wiring up into the cockpit and installed the junction box on the inside of the firewall and the display at the centre of the glare screen over the panel.

# The Leading Edge



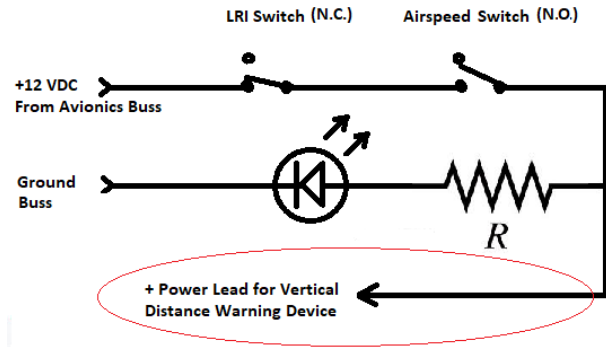
Photo of sensors on my floats courtesy of Lee Coulman

To conduct my initial tests, I connected the power lead to the avionics buss and the ground to the ground buss of course. When I turned on the master the unit came to life with a steady squeal and an indication of “0” metres distance and “full bars” on either side. As I taxied, the distance reading became a bit erratic, leading me to believe it would not function as hoped. On my take-off roll, the unit continued to squeal and the readings were not stable, but as I lifted off the ground, it beeped rapidly, slowing to the occasional beep and then became a steady squeal again with erratic readings and lights as I flew away.

Lee and I had agreed to go flying that day, so I met him in the air over CPR3 and we flew north to Glendale Aerodrome... also known as Williams Lake. Although the squeal persisted throughout the flight, landing was a different story with the sonar unit. As I approached on final the squeal disappeared and the unit functioned as expected. It began beeping at about 2 metres above the lake with the beeping speeding up as I got lower and turned to a steady squeal as I touched down on the water! Success!!!

Now I just had to work out the bugs and find a way to only turn the unit on when it is required. During the flight up to Williams Lake, I had been thinking about ways to power the unit only when required and realized that I already had the perfect power source in my stall warning system. The high power LED in my panel only comes on during takeoff and landing, so it only seemed logical to use that.

I rewired the positive 12 volt lead to the stall circuit and retested the system on numerous takeoffs and landings afterward.



I have to report that it seems to be working flawlessly! As I slow the plane to flare for landing the system beeps to indicate it is powered up and begins to show the appropriate bars and reading to indicate height from the ground. The beeping is slow to start and gains speed as the height decreases during the landing, eventually providing a steady squeal as the distance approaches zero, the same as it does when a vehicle equipped with a back-up alarm reverses toward a wall or other object.

To see the system in operation on a lake in Eastern Ontario check out this video...

<https://www.youtube.com/watch?v=Hi9zDGgQGOE>

The landing was a little bumpy, and you may have to turn up the sound to hear the beeping of the Vertical Distance Warning Device (Car Back-up Alarm) in my plane. Note how the system activates just before landing as the LRI drops into the middle of the yellow band on the gauge. Two seconds before the end of the video the plane slows enough for the system to deactivate, hence the light and beeping go off.

Given that the system came with 4 sensors, I expect that I will be installing the remaining two on my bush wheels when I make the change over from floats in the next week or so.

I don't expect this will change the way I perform my landings, but it's a great reassurance during landings to hear the beeping of the distance alarm going off as I transition towards the runway and especially as I get close to the water's surface during seaplane operations.

- Dan

# The Leading Edge

## Upcoming Events in 2017: (Highlighted lines are KWRAA Events\*)

October 16 - October Meeting at 7:30 in the Cadet building at CYKF  
November 13 - November Meeting at 7:30 in the Cadet building at CYKF  
November 24 (TBA) - KWRAA Christmas Party in lieu of a December meeting

\* KWRAA events are fly-in and/or drive-in (Please advise the host in advance if you plan to attend whenever possible.)

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### FOR SALE

**RV6 C-FTXF** - Standard build, slider with extension kit - SN 22483 - based at CYKF  
VFR, Lycoming O-360, first flight Sept 2014, painted 2017 by Purple Hill Aviation  
Sensenich fixed pitch cruise prop, Whelan strobes, Wig wag landing lights in wing tips  
new tires, no damage history, all service bulletins up to date  
Flew back from Oshkosh this year in just 2:25hrs - KOSH to CYKF direct  
**\$85,000** – Contact: Steve Gale at (519)496-5903 or [stevegale@rogers.com](mailto:stevegale@rogers.com)

**David Clarke Headset (H10-13.4)** – Over \$400 new!

Lightly used, works very well, looks brand new... **\$200**. Contact: Dan Oldridge at [oldridge@golden.net](mailto:oldridge@golden.net)

### **Fuel Tank Caps and Parts**

2 - RIEKE, 3" composite tank filler neck and cap (asking \$10.00 each)

2 - SHAW AERO, Aerobatic fuel stopper, non-vented adjustable type (asking \$25 each; current list price \$66.75 at ACS)

Contact: Clarence Martens at [cemartens@rogers.com](mailto:cemartens@rogers.com)

### **Rotax Heat Monitor Strips**

Mac has a number of Rotax Heat Monitor Strips that can be applied to sensitive areas to monitor for extreme heat readings. They are presently being recommended by Rotax to monitor the ignition modules. He is offering them individually for \$15 each incl. HST. or two for \$28 incl. HST.

Contact: Mac McCulloch at [macpat@live.ca](mailto:macpat@live.ca)

### WANTED

#### **Stringer Material**

5/16" x 1" rectangular tubing with 0.50 wall thickness in 12' lengths. Contact Ted Welfred if you have some for sale or know of any available.