EAA Chapter 675
MARSHALLTOWN, IOWA

THE SPIRIT OF AVIATION

April 2021

	WHEN:	WHERE:	PROGRAM:
APRIL MEETING	Saturday, APRIL 10TH, 1:00 pm	Ray Robinson's Shop Fernald, IA	WHAT'S HAPPENING!

WHAT'S FLYIN' THIS WAY !!!

We will be meeting once again at Ray Robinson's shop in Fernald, Iowa for another joint meeting with Chapter 135. Ray and his wife Sandy have been very generous to allow us a large place to meet in person and make everyone feel comfortable. So join us on Saturday the 10th at 1:00 pm for good hangar flying and we may even have a few new members attending as well! Make sure you introduce yourself and welcome them to our chapter. Bring a chair and a good story.

For those who are not sure where Ray's shop is, here are directions...

Take Hwy 30 west to Co. Rd. S27, also known as 650th. Go north about 5 miles to Richland St. There will be a sign on S27 pointing right to Fernald. Take Richland to Winchester Ave. Take a right on Winchester and Ray's shop is the second big building on the left. You can also put in R R Metalworks in your GPS and it will get you there too.

See you next Saturday!

WHAT FLEW BY !!!

Ray and Sandy Robinson, once again, hosted our chapter meeting in their shop in Fernald. Many members of Chapter 135 joined us and made it a great get-together of like minded aviating people. Ray showed us the progress he has made on the Wiley Post and there was more discussion and input on how to distribute the scholarship funds. Overall a great meeting.

Flying season is definitely here because Dave McCurry is back from his Arizona home and buzzing folks in his little yellow Taylor Monoplane! Now if the wind would just calm down a bit, more of us could get more air time!

Visit your NEW Chapter 675 website!
https://chapters.eaa.org/eaa675

•President

Paul Adams
2144L Marsh Ave.
Marshalltown, IA 50158
641-753-6222
dlpradams@gmail.com

•Vice President
Lorin Miller

309 West St.
Colo, IA 50056
515-231-2563
lorindmiller@hotmail.com

•Sec/Treas

Dave McCurry
5 Valley View Rd.
Marshalltown, IA 50158
641-752-4729
dmccurry@centurylink.net

•Newsletter Editor

Corey Butcher
2940 Arney Ave
State Center, IA 50247
641-351-5476
coreybutcher@voisin35.com

CALENDAR

There are a couple of fly-ins on the Iowa DOT aviation calendar. It's good to see the optimism coming back!

Saturday April 10
EAA 675 Meeting at Ray's Shop
Fernald, IA
1:00 pm

Saturday, May 8
Boone Municipal Airport (BNW)
Fly-in breakfast
7 a.m. – 11 a.m.
Pilots-in-command free
515-291-5094 (Dale Farnham)
Email: defarnham@msn.com
Website: www.farnhamaviation.com

Monday, July 26 – Sunday, August 1
EAA AirVenture
Oshkosh, WI

Saturday, August 7
Council Bluffs Municipal Airport (CBF)
Great Plains Wing CAF Flight Breakfast/open house
Military museum will be open
Breakfast: 8:00 a.m. -11:00 a.m.
Lunch: 11 a.m.
402-981-4633 (Jeff Hutcheson)
Email: jeffhutcheson3@gmail.com

Scholarship Update

Lorin Miller has made up an application form for the scholarship which he is tweaking a little bit from input that was received at our last meeting. As soon as he hears from Chapter 135 as to what they would like to contribute, he can finish up the application and present it at the next meeting for final approval.

Now on FACEBOOK
www.facebook.com/EaaChapter675

New Bally Bomber Video

In case you haven't seen it yet, here is a link to one of the best Bally B-17 videos out there.

https://www.youtube.com/embed/E-1_JwlHO-8

Here are some progress photos of Ray Robinson's Wiley Post biplane.

The Panel and fuel tank are in place.

The airplane is back on it's own legs now

The Franklin Engine has not run since 2006. It will be rebuilt.

Sailing is Really a Form of Low Level Flying

Believe It or Not

With the car being finished and up and running, I started the proverbial next project thought process. Some of you have already heard the result of my latest thoughts, a sailboat. I have had the desire to build a sailboat for many years and in fact set up a library to learn the art of boat building over twenty years ago. So it has been on the bucket list for a long time and finally made the let's-do-it stage.

But why a sailboat? There is a lot of similarity between sailboats and airplanes along with similarities in how they are sailed or flown. So the way I see it, a sailboat build project is just a natural extension of my love of building airplanes. But in saying there is a lot of similarity, it goes way beyond the fact that most sailboats and most airplanes have a rudder. For example they both have airfoils. So let's take a deeper look.

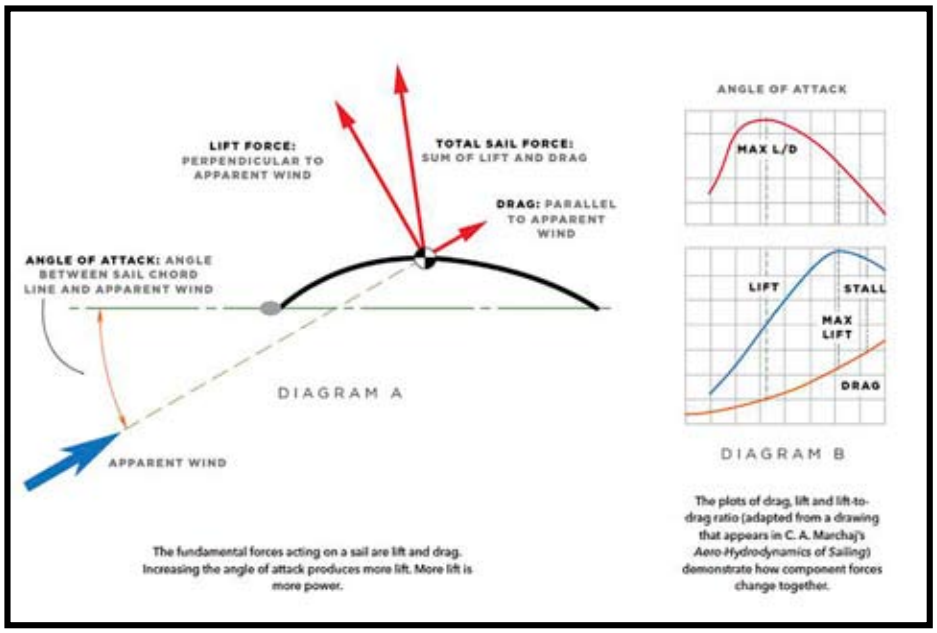
As we all know, a sailboat is powered by wind energy captured with a sail or sails. But how many of you realize that many sails, but not all, are airfoils very similar to an airplane wing? In my collection of books on sailboat construction I have one book that describes how to make various sails. The following picture is a copy of one of the illustrations the author used in describing the shape of a certain sail.

BIRDWING GUNTER

The sail type is a "Birdwing Gunter". Notice the upper reference to an "Elliptical Spitfire Wing". A reference to two lifting devices, one a bird the other one of man's flying machines. A Spitfire wing is a highly efficient low drag lifting device and the author explained that the "Birdwing Gunter" sail was designed using some of the Spitfires aerodynamic features.

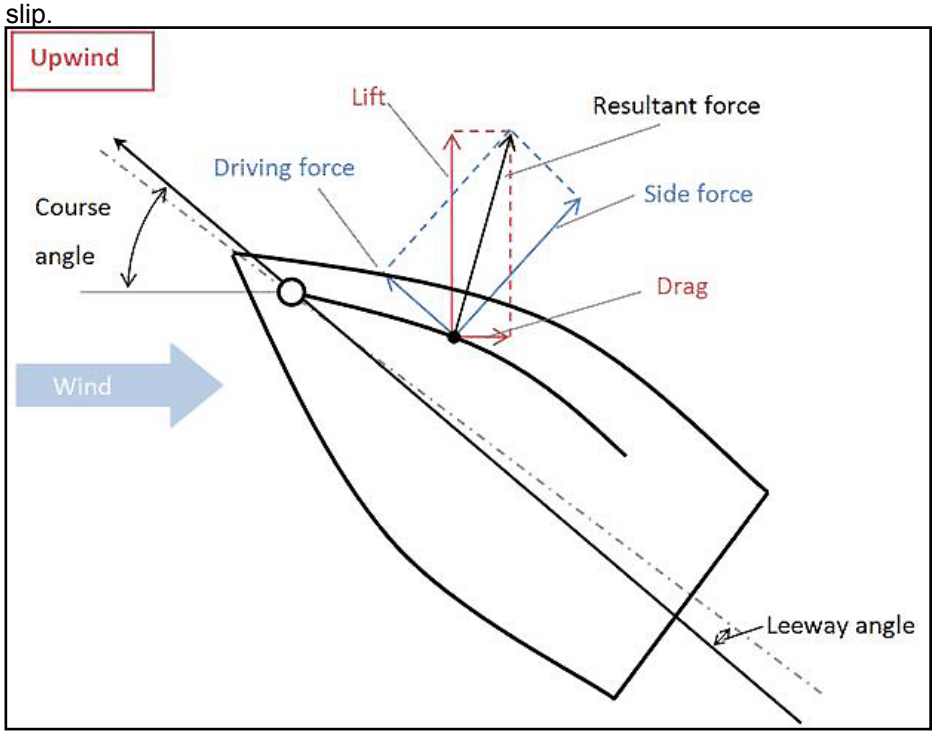
Have to have at least one airplane picture in this article, how about a beautiful Spitfire?!

Looking further into the similarities of the sail and an airplane wing, we can see even more common aspects if instead of looking at the shape as shown above we look at the airfoil. In fact, in the illustration below you will recognize some of the verbiage.

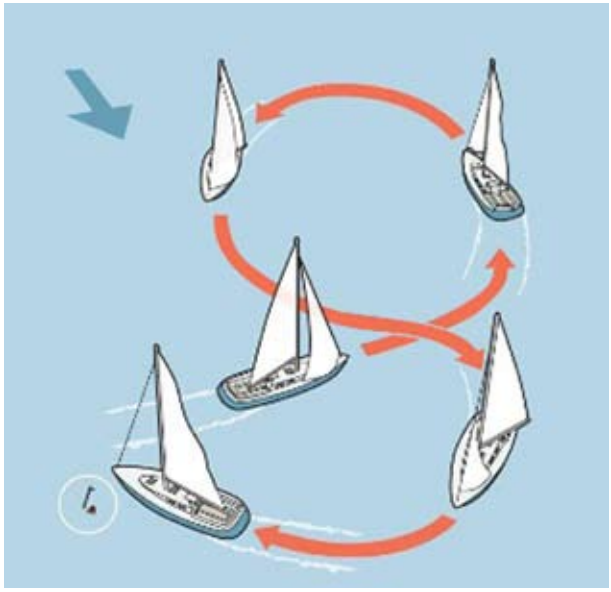


First notice that the shape of the sail appears to have the same upper contour as the camber of an airplane wing. As wind moves across the "airfoil" it generates "lift" the same way an airplane does by accelerating the flow on

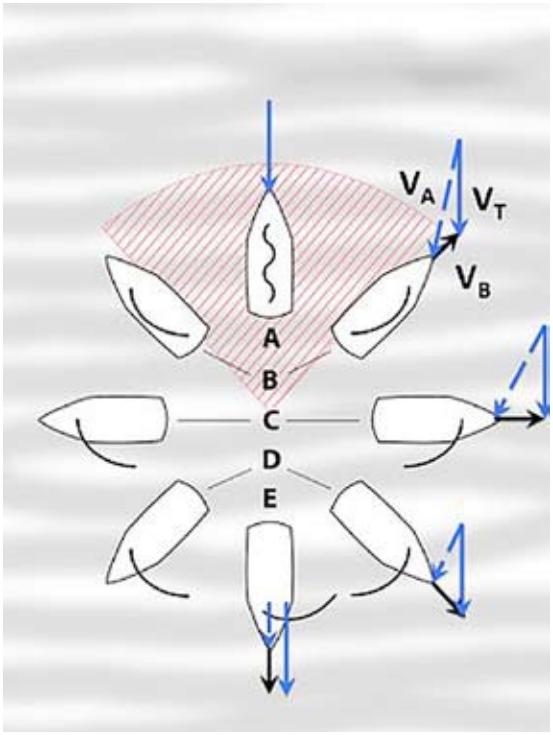
the contoured side, thus creating a lower pressure on the contour side, with the resulting differential pressure between the two sides being “lift”. However the sailboat “lift”, being horizontal, is used to propel the sailboat forward instead of lifting vertically against gravity as with an airplane wing. How this works may be easily seen in the following graphic. As with the airplane wing, the lift on a sail acts perpendicular to the sail surface with perpendicular resultants shown for the “driving force” and one for the “side Force”. The side force is opposed by the keel, center board, dagger board etc, but it is never completely canceled out, so sail boats always side slip a little when sailing by generating “lift”, Did you know that? When sailing with the wind directly behind the sailboat, known as a run, there is no “lift” generated and thus no side slip.



As with a pilot flying, the helmsman or sailor has a choice in direction, but not the vertical one of climb and descent. So how does a sailor keep “lift” or driving force working when doing what is pictured below, a figure eight. Do you remember the figure eight when training for your private?



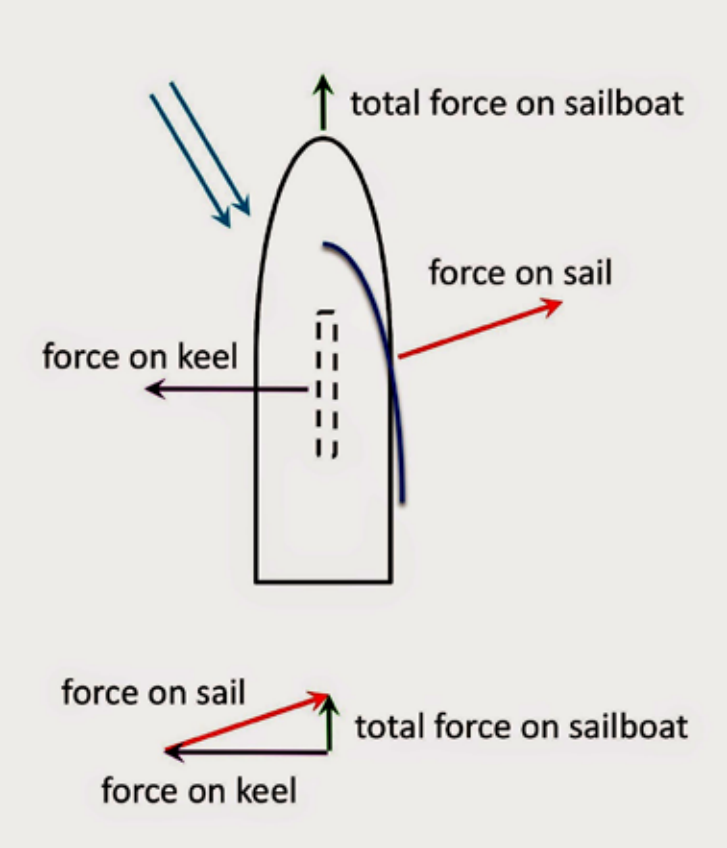
To start that discussion I would first say sailing is closer to glider flight then powered flight. Why? Because when “setting” the sails to make the figure eight above, the sailor is usually trying to “fly just above stall”. Similar to the glider pilot flying just above stall when thermaling in a rising current of air. Plus he needs to be very aware of the power and direction of the atmosphere, especially wind direction. In order to get the maximum lift or driving force from the sail, the sail is “set” at a point. If it was a airplane or glider wing, it would be at an incipient stall. Here is another look at this. Let’s pick a few points off of the figure eight.



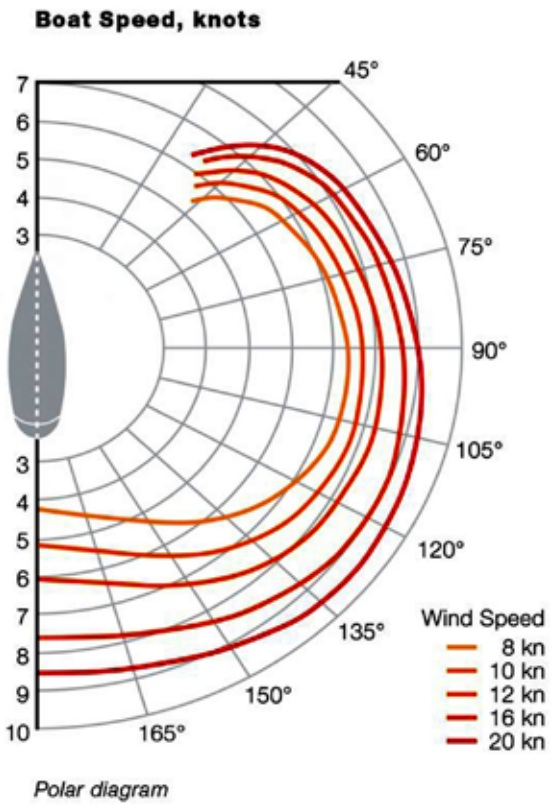
If you look closely at the above graphic you will notice that the sail is positioned different relative to the sailboats hull for each point of sail.

But relative to the wind the sail has not changed significantly. First a sailboat cannot sail directly into the wind. This is the red zone as seen above. The sail will not be filled by the wind and thus will not take the aerodynamic shape of an airfoil. At position “B” which is called a tack, port or starboard, the sail is filled and the position shown as to the setting of the sail is just above stall for maximum driving force. As the sailboat is turned away from the wind as in “C”, the sails are let out to maintain that angle of attack. At point “E” the sail is just catching the wind, what is called a run, and there is no aerodynamic or lift effect.

So to sum up the “sailing” of a sailboat, it is the matching of the sail position to the wind direction to maximize lift or in a sailboats case, driving force. The helmsman must match the position of the sail to the direction of the wind and if he or she desires the maximum driving force the sail is positioned just above stall. Here is a illustration showing the forces involved.



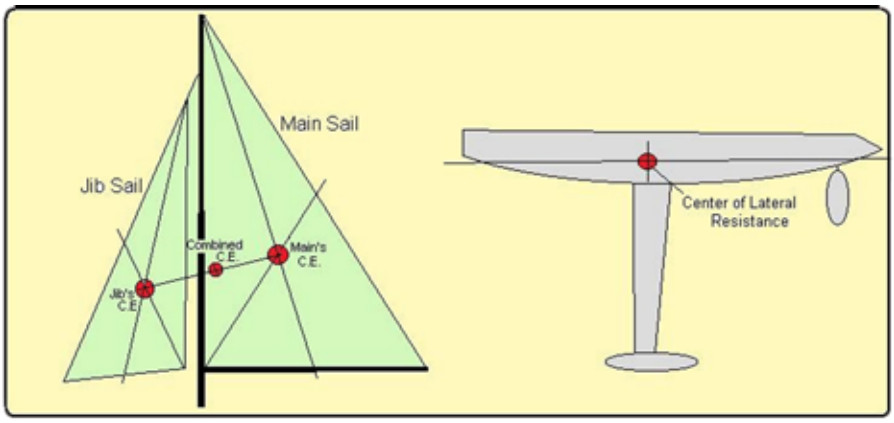
With flying of airplanes we often discuss speed. With sailing, especially when racing sailboats, speed is of course paramount. So lets next look at what points of sail, as we saw in the above figure eight, are the fastest. To study this the best way to look at it is to examine what is called a polar, as illustrated below.



Polar diagram

The sailboat polar shows five different wind speeds in various colors. The sailboat is shown positioned on a vertical line which displays various boat speeds and all speeds above and below the sailboat are in the forward direction. The wind direction, although not shown, is from the top to the bottom and the direction does not change. The radial lines emanating from the center of the sailboat are the different points of sail, or different directions the helmsman has decided to sail. So as we have already learned the areas with no colored lines from the 0 degree point to the 40 to 45 degree point are the no sail areas for each wind speed. The wind cannot fill the sail. But as the sailboat is turned by the helmsman through the remaining points of sail, 40 degrees to 180 degrees from the wind direction, the boat speeds changes with a maximum speed of about 9 knots at the 120 to 135 degrees, The reason for this higher speed is, with the sail appropriately set at the near stall position, the angle of the wind versus the angel of the sail provides the maximum driving force at the 120 to 135 sailing angle from the wind. Or the resulting forward component of the force provided by the sail is maximized and the side slipping force is reduced. All important factors when sailing. I might add each sailboat design and sail configuration will have it's own specific polar.

One of the main flying considerations for pilots is CG range. In sailboats it is also a consideration. To discuss this area I have decided to use a comparison of a two sail sailboat and a biplane. In the illustration below, as with a biplane the resultant of "lift" for each "flying" surface must be considered. In a biplane we call it the combined center of lift. In a sailboat it is called the combined center of effect, CE. For flying of course we use this to determine our acceptable CG envelope or range for safe flying. In sailboats the CE is positioned so that the portion of the sailboat that is used to



minimize side slipping, for example a keel or center board, is within an acceptable range. Since in a sailboat the forces on the sail are in line with the forces generated by the use of the rudder, it is desirable to have an approximately neutral rudder so the helmsman doesn't have unmanageable or tiring forces to deal with. Plus adding rudder if the CE and rudder forces are not aligned will increase drag and slow the sailboat. As a side note some small off set is usually left by the designer and it is called weather helm. In short it is a slight turning force in case the helmsman falls overboard the sailboat will turn away from the wind and will stay close instead of sailing away.

It makes for a shorter swim. If what is called lee helm, the opposite of a weather helm, is left in the design, the sailboat will sail away.

As with aviation there has been a lot of innovation in sailing. One of these is again associated with “lift”. But this time in the vertical direction not in the horizontal direction as with the sail. It is called “foiling”. As with aviation the quest for speed is a continuing motivation for some. Again as with aviation, in the sailing world some of the new materials, like carbon fiber, has opened avenues to pursue greater speeds. In sailing, one advancement is stronger and very clean aerodynamically efficient underwater airfoils. Here is a close up of an underwater airfoil used to lift the hull of the sailboat out of the water, thus dramatically reducing drag and dramatically increasing speed.

Sailboats of all sizes have utilized the foil to provide a whole new world of sailing. Small single handed craft as seen below use a foil on the center board and the rudder. Although I have not only not done this but actually never seen it done, I can imagine it might be close to flying.

Foils are used on larger sailing craft like the one below, and notice the sponsor of this racing sailboat, Airbus. The unusual item sticking out to the right of the hull is an unused foil.

I wonder if Shawn D Tucker of the airshow circuit knows he shares the same sponsor, Oracle, with the following racer that uses foils for greater speed. Speeds of over 50 mph can be achieved and in doing so the sailboat using two foils, the sail airfoil and the underwater foil lifting device, to sail faster than the wind speed by generating a large driving force with the sails and lowering drag with the water foil.

Well needless to say my entry into the sailing world with my next home built project will not be as dramatic as the 50 mph Oracle cruiser. But it will be challenging and I am sure fun. Here’s a couple of pictures of what I hope the results of my labor will look like.

But if someone is interested in a chapter project I might have found the one. Not in a kit but scratch built but I think we could hold meetings in it.

Just kidding!

“The Installation”

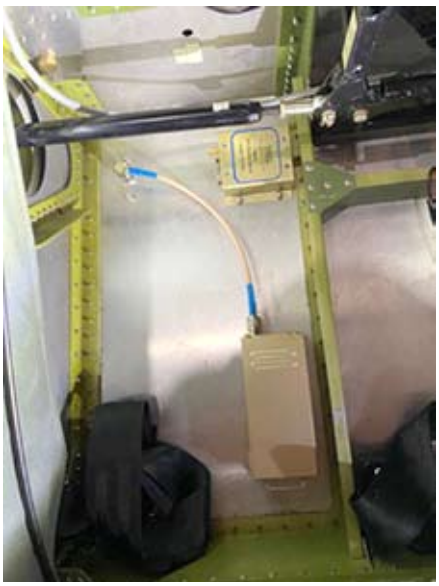
by Lorin Miller

It was a dark and stormy night; the rain fell in torrents—except at occasional intervals, when it was checked by a violent gust of wind which swept up the streets of the small village of Colo, rattling along the housetops, and fiercely agitating the scanty light of the house lamps that struggled against the darkness. There I sat, at my heavy desk, reviewing the literature provided by experts and pondering the wisdom of my upcoming venture - installing a new Trig transponder/ADSB compliant solution into my Sonex/Waiex aircraft - by myself.

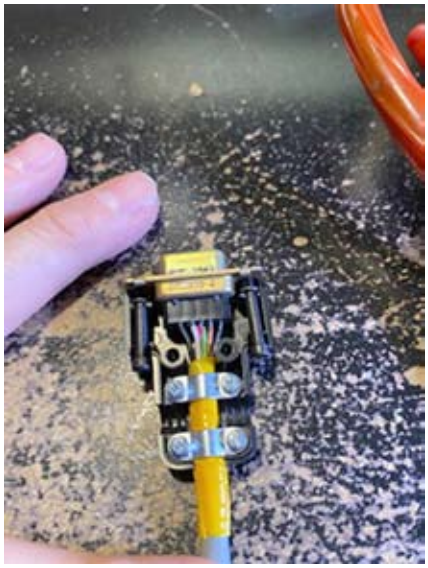
Similar to my adapted version above of the classic story “Paul Clifford” by Edward Bulwer-Lytton, I lead a dual life. By day, an upstanding citizen of the business and engineering world, but after hours - I tend to focus all of my energies on the world of aviation, enjoying the excitement, frustration, and thrills that it can lead to. This story unfortunately, contains all those elements. The excitement of new journey and knowing you will learn something from it, the frustration of not having it work correctly first time you turn it on (or the second, third, or even fourth time), and finally the thrill of successfully resolving the problem - without having to ask for help!!

After 300 hours on the hobbs of the Sonex/Waiex, my confidence levels in the plane have gotten to the point where I’m ready for some longer distance traveling. Some of it into the more rugged western lands, and some to the eastern, more densely populated states. I decided it was time to invest in a transponder/ADSB solution. Big swallow, cut the order on Aircraft Spruce, and thank God above that I have an understanding wife…

After a lot of research, I landed on the Trig ADSB solution. It not only fits the hole in my dash I originally put in place in preparation for a transponder, but it will integrate with a future EFIS upgrade I’m also planning. The Trig TT22 mode S transponder combined with the TN72 certified GPS receiver and the TA70 GPS certified antenna is a combination that meets the FAR 91.227 ADSB 2020 mandate. I also purchased a Red Tail blade type transponder antenna for mounting on the belly of the plane.



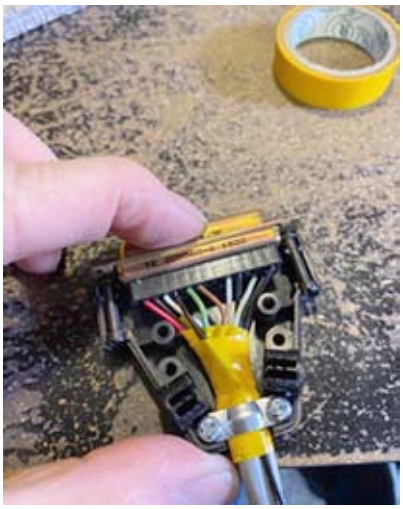
Installing this into your aircraft requires you to either fabricate the wiring harness and two antenna cables yourself - or take some solid measurements and pay somebody else to do it for you. I was very excited about this and used it as an excuse to buy more tools, I chose to manufacture it all myself and save several hundred dollars. The standard wiring used for the Trig wiring harness is 22 gauge and you have to crimp the individual wires into miniature pins that are used for d-sub connectors like are used with older type computer wiring (printer cables, VGA monitor connectors, RS232 cables, etc). These are super common with today’s electronic avionics and are very reliable. It takes a special crimper for these small pins, but it’s super easy. After you strip the wire ends and crimp the pin on, you just push the pins into the correct numbered hole in the connector. Removing pins is very easy, but it does take an extra $4 tool. On some of the wiring, it is suggested to twist it every inch or so if you don’t use shielded cable, to help mitigate any potential interference. Putting this harness together only took me about 2 hours total once I had the wire lengths needed.



Fabricating the antenna cables was a little more interesting. I used RG400 coaxial cable as it met Trig electrical resistance requirements, is readily available, and is double shielded. The transponder antenna cable needed a 90 degree BNC connection on one end, and a TNC connection on the other. The 90 degree BNC connector requires you to solder the center coaxial conductor wire to the pin. A TNC connector is just a threaded version of the BNC connector and both use the same dimensions for stripping the coax cable as well as the same crimper for the thimble and center conductor pin. The GPS RG400 coax cable uses a TNC connector for the antenna end, but a QMA connector for the receiver end. I’d never heard of a QMA connector. They are quite small, and you have to solder the conductor pin to the center wire because the pin is too small for a crimper. Outside of the small

solder exercise, it's pretty easy to make though, and the thimble crimper is the same size as the BNC/TNC thimbles.

It was actually more time consuming mounting the remote control head (TC20) of the Trig unit in my dash and running the static port tubing to it. It's cramped behind the dash of my Waiex, but I finally got it done. The Trig kit includes all the pneumatic adaptors, t-pieces and tubing clamps you need for this connection. I then mounted the Trig transponder unit on the floor under the pilot side in my plane, and put the GPS receiver just in front of it with the transponder antenna right beside it. A nice tight grouping minimizing length of wire and antenna cable runs.



So, after double checking all pins for continuity and that everything was powered and grounded correctly, I rolled the plane out and started up the electronics. The transponder immediately powered up correctly and led me through a "simple" configuration menu. I wasn't aware of all the information you have to enter into a mode S transponder like this - your tail number, the mode S number assigned to you, if there was an ADSB system hooked up to it as well as the type of system and the GPS receiver communication speed, how fast your plane is, how long your plane is, what is the wingspan, how far the GPS receiver is offset from the center of the plane, and some other stuff. It was a little more complex than I was expecting, but I finished it up.

Unfortunately, here's where the frustrating part comes in. The transponder flagged a warning to me that it wasn't receiving any GPS signal. Humm… lets start troubleshooting. Not receiving a GPS signal probably means a wiring or antenna cable issue I thought. Break out the multimeter again and start checking for wiring continuity, resistance, etc. I did find a potential intermittent ground connection for the receiver - but it didn't resolve the issue when fixed. Four hours of troubleshooting later - I decided to take a break, then do a formal engineering root cause analysis and troubleshoot in a more methodical manner, starting from easiest to most difficult. I documented absolutely every potential failure point in the installation that I could identify. Once I started this methodical process, it made me realize that potentially this may NOT be a wiring issue - but a transponder configuration issue. There was a communication speed setting in the configuration menu that I had selected called "Trig ADSB". When I went back to that setting, I found that one of the other options was "Trig TN72 SIL 3". One setting used a communication speed of 19.2kbps, the other 9600bps (or baud rate). The TN72 is a 9600 baud device. a Trig ADSB is a 19.2 k-baud device. That - of course - was the issue. The transponder was expecting to receive the communications at one speed, and the receiver was transmitting at a different speed. I changed the transponder setting and within 30 seconds everything was working just fine. What a thrill to have it completed and everything apparently working!!!

End result? I only have to take my plane to have the transponder checked and certified prior to use, then get a report on my ADSB performance and I'll be ready to take it into any airport from then on. Yes!!! I also now have a bunch of new useful tools - and a solid root cause analysis troubleshooting document for anybody else experiencing any Trig transponder/ADSB installation issues.