Shop Talk

The newsletter of the Sonex Builders & Pilots Foundation
sonexfoundation.com

November 2015

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President - Robbie Culver
Vice President - Mike Farley
Secretary - Dana Baker
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457 Members
40 Voting members

www.sonexfoundation.com

Submissions are always welcome at robbie@sonexfoundation.org

Club membership is free, and for those who wish to participate in elections and help direct this member-run organization, a voting membership is $25 annually. Your donations help us keep the websites running, and allow us to publish this newsletter. We sincerely hope you enjoy it.

Shop Talk

Robbie Culver, President - Sonex Builders and Pilots Foundation

As every person who has completed a project, is currently building, or wants to build an airplane knows, building an airplane is a journey with many challenges. It is an investment of time and money, an emotional and mental roller coaster of varying degrees, and a path one either chooses to see through to the end or suffer the consequences. I can't speak for others, but of all the challenges I have taken on in my life, this was by far one of the toughest. You have to want it to see it through to the end.

But if I can do it, so can you. For me, this journey began many years ago, when I first understood that people could actually build an airplane. It really took hold in May 2011, when we purchased plans SNX 1517 following the spring workshop at the factory in Oshkosh. Before that, I spent nearly 10 years overanalyzing what, if any, kit to invest in prior to going back to my original choice, a Sonex taildragger. I am so glad I did.

I am pleased and relieved to share that on October 8th, 2015, Sonex 1517 became N1517S following an uneventful FSDO inspection, and on October 10th I made the successful and uneventful first flight at the Aurora, IL airport (KARR). The last few weeks of the project were an amazing journey.

A successful first flight is no small thing, and for me it culminated nearly 40 years of dreaming and planning. I credit the success not to my skill or aerial prowess, but to the support of my family (especially my awesome wife Brenda), and the assistance of friends and fellow builders. I credit the ease I felt on my first flight to 4.5 hours of transition training, first with Michael Farley, and then with Joe Norris. I realize not everyone will, or can, go for transition training. But it sure worked for me.

I built from sub kits, and was an early AeroVee Turbo customer. When I started the tail, I honestly wasn't sure I would finish the airplane. Just bending the rudder horn made me wonder if I was cut out to build an airplane. Along the way, I learned a lot, and organized this foundation along with Michael Farley and Eric Seber. By the time we got to the engine build, not much could have stopped me from finishing the airplane. It is an incredible journey, and looking back I grew as much as the project did. (And my son, who was in 1st grade when we began, is now a 6th grader)

Our foundation members are builders and dreamers, scratch builders and kit builders, second owners and pilots of their own projects. Paraphrasing EAA Founder Paul Poberezny, each of us lends heart and mind to these projects. If you are thinking of building - go for it! If you are currently building - keep at it - you can do this. If you are the proud owner of a flying project - congratulations!! I look at my airplane now and am amazed at the fact that I built it. Wow...

This month we again feature aircraft and articles written by members. Featured is an interview with Jessica Bower of Sonex Aircraft, LLC. We have a report on ASA 2015 from John Davis and the GSSG from Mike Singleton. Also featured is builders updates from members. We have a great article on an ADS-B In solution by Detlev Ansinn, Sonex 422, that I can tell you first hand works great! Mike Smith, Sonex N439M, wrote a great and detailed article on Oil Analysis. Mike Turrell authored an article on differential toe brakes. I wrote up my transition training experience. And finally, Michael Farley wrote about modifications to his Waiex. I hope you enjoy the newsletter!

Pre Oshkosh event

Robbie Culver

If you are interested in a Sonex-friendly stop-over en route to Oshkosh on Saturday July 23rd or Sunday July 24th, 2016, we have just the place for you to stop. An existing fly-in in Rochelle, IL has graciously allowed us to invite Sonex pilots to stop and overnight on the way to Oshkosh. The event is supported by the community and the skydiving center based there, Chicagoland Skydiving. This is held the Saturday and Sunday prior to AirVenture and is a perfect stop for those headed to the show.

This will be a low key event. For those flying to Oshkosh, it can be an alternative overnight or fuel stop. It is well west of the Chicago Class Bravo, south of Rockford's TRSA, and not much more than an hour from Oshkosh. Plans are to meet there on Saturday and head up to Oshkosh early Sunday morning for the open house. If weather prevents a departure, we will be somewhere that we can camp, eat, and hang out together.

There is an existing event we can all join in on, at an airport with a hard surface runway, cheap fuel, places to eat and stay. The local hotels offer discounts.

There are no SBPF funds involved, and we are not involved in its organization. The event is called Wingfest and all things with wings are invited. For those driving up this is literally only several miles off of Interstate 39 in north central Illinois. You can read about the event in this months new Sport Aviation magazine, in the Experimenter section.

From the organizers: “The Comfort Inn and Suites are the closest and if you tell them you are doing business with Chicagoland Skydiving Center, they give a deep discount. Holiday Inn Express is nicer but a bit more expensive. Tell them you are in doing business with A&M Airsports for the discount.”

There is also a Super 8, a Red Roof and a couple other small ones in the area of Rochelle (no discounts).

The airport has a courtesy car. Event organizers have said they will try to help shuttle people, and there is a taxi service in town too. There are washrooms and showers on the field for people camping.

The Rochelle Comfort Inn can be reached at (815) 562-5551 and the Holiday Inn Express can be reached at (815) 562-9994. The website is http://www.airsportster.com/wingfest.html -- there is no specific information there right now. Look for more details in the spring.

An Interview with Jessica Bower

Robbie Culver

When I first met Jessica Bower, it was one of those events you don’t soon forget. I crashed her wedding reception.

I was in Oshkosh to attend a memorial service, and she and her husband Rusty held their wedding reception in the EAA Museum’s Eagle Hangar. A mutual friend and fellow Sonex builder managed to get me kind-of-sorta-invited, and I arrived tired and hungry right as the reception was getting rolling. I met her and Rusty at the reception for the first time. Now, some brides and grooms would not be happy with an extra guest. But the Bower’s took it all in stride.

For those that did not see the press release, Sonex Aircraft LLC recently hired Jessica. Her aviation experience reads like a pedigree, starting with her education and experience, and additionally enhanced by her hometown

*roots in the Oshkosh, WI area. She is also building a Sonex, as is her father, and the family also bought a flying Sonex. So they actually have two projects and a flying instance of the type. Before coming to Sonex Aircraft, Jessica most recently worked at....the Skunk Works. You know - **THAT** Skunk Works.*

Some of you may have met Jessica and her parents John and Carrie at the Sonex Builders and Pilots Foundation barbecue held at Wayne Daniels' home during AirVenture 2015. It was Wayne that managed to sneak me into their wedding reception, albeit with permission. I think.

Recently, I had lunch at the Rochelle, IL, airport's Flight Deck restaurant with a crowd of aviation enthusiasts and pilots, including Jim Cunningham, Wayne Daniels, Jessica and her husband Rusty, plus Jessica's parents John and Carrie.

I crashed your wedding reception at the behest of Wayne Daniels. You had no clue who I was. Yet when your husband and you greeted me, you did so with smiles -- what is it about aviation that you think makes this such a normal part of the intertwined family of friends we meet?

I think it is the type of person that is drawn to aviation – the people who love aviation tend to be driven, curious, and passionate. And who better to share those feelings than someone else who loves aviation!
I like to joke that aviation is an addiction, so it could also be addicts sticking together. But in all seriousness, airplane people are some of my favorite people. We all have stories to share and variations in how we indulge in our favorite pastime, but at the end of the day, it doesn't matter what you fly, where you fly to, or who you fly with or for – airplane people love and support all types of aviation.

What ratings do you have?

My only rating as of right now is private pilot. I plan to add to that in the future!

Did you grow up around EAA and an EAA chapter? If so how did that influence your career choice and the decision to come back to Oshkosh?

Yes, I grew up going to the museum and going to the convention. Living so close, I've been to AirVenture every year since I was 6 years old. EAA made me fall in love with aviation, so I can confidently say without it I don't think I'd be an aerospace engineer right now.

How did your parents involvement in aviation influence your decisions?

My dad got his license when I was 6 years old, and that was really the catalyst for everything. I was the second in my family to become a pilot, and my mom recently got her license as well. My dad is the one who first took me flying and brought me to AirVenture, so I tell him my addiction is all his fault all the time.

What advice would you give young people interested in a career in aviation?

Follow your passion! Also – if you love airplanes and aviation, there are many career paths other than professional pilot, so don't be afraid to explore a little and figure out what the best fit is for you!

Experimental aircraft are the key growth segment in General Aviation, and mark the largest number of new registrations annually. What do you think is a key factor in making this continue, and what do you think the kit industry needs to do or continue doing to make this happen?

I think it will continue to be important to give builders the best experience possible, and to try to reach new audiences. I think it is also important to try to share the joy that can be found in building as well as flying. As you well know, it's hard enough to stay motivated through a huge project like building an airplane, so it's essential to revel in the experience of building.

What is it about working at Sonex that got you back to your roots?

While it was Ben Rich's book The Skunk Works that made me want to be an aerospace engineer, it was EAA and AirVenture that got me really hooked on airplanes (along with my dad), which is what made me want to read the book in the first place. So in that respect, coming to work at Sonex and in the experimental aviation industry is going back to the very beginning for me.

If there were one thing you could tell builders/customers, what would it be?
Thank you for sharing our passion!

How is your project going? And what are you building?

My project is coming along, albeit slowly. This is now the 4th time I've moved my project, and that is getting old! I'm building a standard gear Sonex, and I'm done with all the tail surfaces, the tail cone, and have a partially built forward fuselage.

Will we see any new aircraft from Sonex in the next two years? (You knew I had to ask)

Well, I could tell you, but then… you know the rest!

Are you going to fly the SubSonex?

I'd love to fly the SubSonex! But right now I'm concentrating on building more familiarity with the slightly more conventional airplanes in the factory fleet.

What is your favorite airplane to fly?

The Sonex! I also had a blast getting 0.25 hours of T-6 Texan time in my logbook.

Experimental aviation has been marked by the NTSB and the FAA as having a less than stellar safety record compared to certified aircraft. What can we do as builders, pilots, and owners to reduce this, in your opinion? What kind of technology or enhancements do you see available or coming to change this?

I'm a big proponent of training. I completed transition training at Sonex a few years ago, and that program and others like it are a huge asset. I think we as builders/owners/pilots should also be students of other accidents and try to learn what we can from them. Safety features/new technologies are amazing, and we should take advantage of improvements as they become available, but they are not replacements for training, awareness, and being fully engaged throughout every part of every flight you take.

You worked at the Skunk Works, and I know better than to ask you about the things you worked on. But what can you bring to Sonex from that job that is unique?

I was privileged to work with some of the best engineers in big aerospace, all of whom taught me an incredible amount about how to approach problems and to work through things that seem insurmountable at first. Few companies tackle the breadth of design problems that the Skunk Works does, so I hope to bring some of that experience and training to supplement the many years of experimental aircraft building experience and expertise here at Sonex.

Is there anything you want to say to the Sonex community as way of introduction?

I am absolutely thrilled to be working to bring new products to life for our building community. The outstanding Sonex team and the quality of the Sonex airframe and plans are what made me choose to build a Sonex in the first place, and I am committed to bringing that high quality to future products.

American Sonex Association (ASA) 2015 Fly In Report

Regional events are the heart and soul of the Sonex community – please support your local Sonex event!

Well, the 2015 ASA event was about the same level of attendance as last year. We 94 registered and 72 in attendance and 5 aircraft arriving on Wednesday afternoon and Thursday morning. That was the last of the flying for the weekend. The weather was overcast and threatened rain most of Friday and Saturday, We did have a huge Sky Mart and lots of goodies for sale or trade.

Dynon sent David Weber from their West Coast home office to set up a display for the weekend and to deliver two very well attended discussions about his product as well as supplying a very nice door prize for the Saturday night door prize drawing.

We also had an outstanding demonstration by Dave Teter, who has built two glass aircraft, of the proper way to layup fiberglass and it was very well received and more is planned for next year. Bob Frost put on an excellent seminar about how to build up your VW engine and have a “no problem” startup. He also discussed the forces the turbo charging puts on the engine and let everyone draw their own conclusions.

Photo courtesy Wayne Daniels

Food was the usual great fare with Deluxe Dogs any way you want it for Friday lunch and Chicken for Supper. Saturday started off cloudy and glumly and there was a lot of hangar flying with interest in John Stophel's Onex that was on display.

Since the weather was rainy we got all the aircraft undercover both Friday and Saturday so we had some cowls off and that generated a lot of discussion and questions.

Saturday was pizza for lunch and the Big Boys BBQ for Saturday supper followed by a huge door prize drawing for all the gifts from our very supportive sponsors. Prince Prop once again supplied a prop for a raffle, with very nice prizes from Aircraft Spruce, B and C Products, Delta Pop Aviation, Grand Rapids Technology, Sonex Aircraft LLC, Shorty's Pilot Shop, Princeton Products, Ray Allen Company, Wicks Aircraft and Trade A Plane

Please note that next year's event will be the 2nd FULL weekend of October on the Friday the 14th and Saturday the 15th. See you next year with some good weather and lots of aircraft of more seminars on canopy and cowl work, a polishing demo, Lonnie Prince on Prop design, Swing back canopy discussion by Dave Augustine, and an Electrical Seminar if I can round one up. A full 2 day event.

John Davis

13th Annual Great Southern Sonex Gathering (GSSG)

The 13th Annual Great Southern Sonex Gathering was held on November 14th, 2015 (the rain date), at Coulter Airfield in Bryan, Texas. The event was sponsored by Mike Singleton, Robert Barber and EAA Chapter 1531.

In spite of the event being rescheduled from the previous week due to bad weather, eight Sonex aircraft, plus one Sonex project and approximately 50 participants were on hand.

As usual, everyone seemed to have a good time looking at the aircraft and visiting with other owners, builders and enthusiasts, and Sonex rides were given to several appreciative participants.

Thanks go to those who had their Sonex aircraft at the event, including: Phil Davis (Onex), Jim Brandvik, Bob Carson, Bruce Watkins & Tom Einhorn, David Lynch, Lou Rieckert, Margaret Hastedt (project), Robert Barber, and Mike Singleton..

Also, a special thanks to:

Nina Barber & Connie Singleton for all they do to make this such a special event.

Sonex LLC for support, door prizes and mostly for designing and offering such fantastic aircraft.

Sonex Builders and Pilots Foundation for support and providing door prizes.

EAA Chapter 1531 for co-hosting for the last two years and providing door prizes.

Nina Barber and Jane Haynes for cooking and serving delicious hamburgers.

Dick Gent for door prizes.

Phil Harper for venturing down from Missouri for the 13th year in a row.

Margaret Hastedt for providing her hangar as a base of operations.

Others who helped as needed.

And especially, all those who participated and make this such a rewarding annual get-together.

Each year this event gets more fun (though not bigger this year) and the Sonex people get ever more enthusiastic. It is a reunion of great people that keep us hosting this event year after year as we make more friends.

Mike Singleton

Builders Updates

Loren Sievila - Onex 0033

1. Serial #ONX0033

2. Standard Gear

3. Modifications: Mechanical heel brakes

4. Started building November of 2012-first flight May 21, 2014

5. AeroVee Engine with Rotec MKII Carb, Dynon Skyview with transponder, synthetic vision, and ADSB out EFIS, MGL V6 Radio and custom made leather seat

6. Based at KKLS(Kelso, WA) 35 miles north of Portland OR

7. Most challenging: First drawings had a lot of mistakes, sequence of build not clear. About 1100 hours to build but I could do one now in 500 or so.

8. Looking back I would have used a different power plant. I have purchased a Camit for the next project.

9. Advice: When it stops being fun and enjoyable, walk away for a while.

9. Mykitlog: Loren Sievila-click on the one with 955 entries

10. First flight was great-had to go around on first landing as the Onex is hard to slow down.

11. Didn't do much preparation except making sure the plane was ready to go. No chase plane or witnesses but a friend did get a video on his cell when he saw me landing. (Perfect 3 point)

12. Onex flies great-150 mph IAS at 6000 ft msl. Turns on a dime and I have pulled 3.1 g's. Very responsive on the controls. Still have to work on getting slowed down to land.

13. Maybe OSH next year and some fly bys at my 50th class reunion.

By the way we have 3 planes in one regular t-hangar. Two Onexs and an RV4

Tom Ryan - Onex 0074

Standard Gear Onex Aerovee 2180. Burp tube, remote oil filter, cabin heater. MGL extreme EFIS/EMS, MGL V6 radio, Trig TT22 Transponder, Garmin Aera 500 GPS, LED strobes, Advanced Flight Systems AOA Sport. Received kit Mar 2012 - First Flight Apr 2014

I installed all of Air Wards kits which makes the build easier and allows access to the space under and behind the fuel tank. I installed the wing tips with nut plates (Air Ward Kit) so they can be removed and shortened if one desires. Added hydraulic brake conversion. love it Most challenging was the wing-fold mechanism and the canopy/bow

First flight prep CURRENT tail-wheel watch “Onex pattern work” on you-tube for take-off and landing tips. P factor pulls nose right not the usual left. Engine ran hot….switched to 2.5 needle in aero-injector and flew it rich until temps normalized

Comments: Easy to taxi, steers very well, handles well on the runway, have to step climb on warm days, it is a rudder airplane, stalls straight ahead at 38 mph loads up quickly in a steep turn and stalls at 75 mph. Base to final 70 mph short final 60 mph touch-down 45 mph.

I find it fun to fly, somewhat pitch sensitive straight and level, but who stays straight and level very long in a Onex. I am based in Novato Gnoss field (DVO) Northern California. There are two Sonex’s flying and three Onex’s being built in the local area.

Mike Zurawski - Onex 0148

I am the builder/owner/pilot of trigear Onex #0148 with Aerovee #0777 based in Stevens Point WI. The airplane is stock with only minor modifications. Those include a fuel on/off knob; canopy venting latch; windshield, glareshield, and panel attached with screws; and a self rescue tool mounted in cockpit. I picked up the kit and began building in November 2013.

The first flight was September 30, 2015 and I now have 17 hours on the plane. The electronics include am MGL Xtreme EFIS and a Sporty's SP400 radio mounted on the panel which I now use with a Clarity Aloft headset. A 2 1/4 inch airspeed indicator is the only steam gauge. The only future thing I may do is paint. I chose the Onex for cost, ease of build and proximity to Sonex at Oshkosh (about 70 mi.) I made about 6 trips to Oshkosh during the build.

There were no major challenges with the build but many small ones. My problem solving skills were improved during the build. I would not make any big changes to the manner I built the plane. The best advice I have about building is to take advantage of all the internet has to offer to help you along, particularly the forums.

I prepared for the first flight by taking transition training at Sonex and because of that there were no big surprises on the first flight, that doesn't mean I wasn't nervous though. So far the Onex is definitely meeting my expectations and for now I am working on completing phase one testing.

ADS-B in Solution

Detlev Ansinn, Sonex 422

Editor's note - Detlev writes an excellent article - I set this up in my Sonex and can attest to the fact that t not only works, but is easy to configure. Even the "technically challenged" among us should be able to get this up and working. If you can't, ask your kids or grandkids to help. ;-)

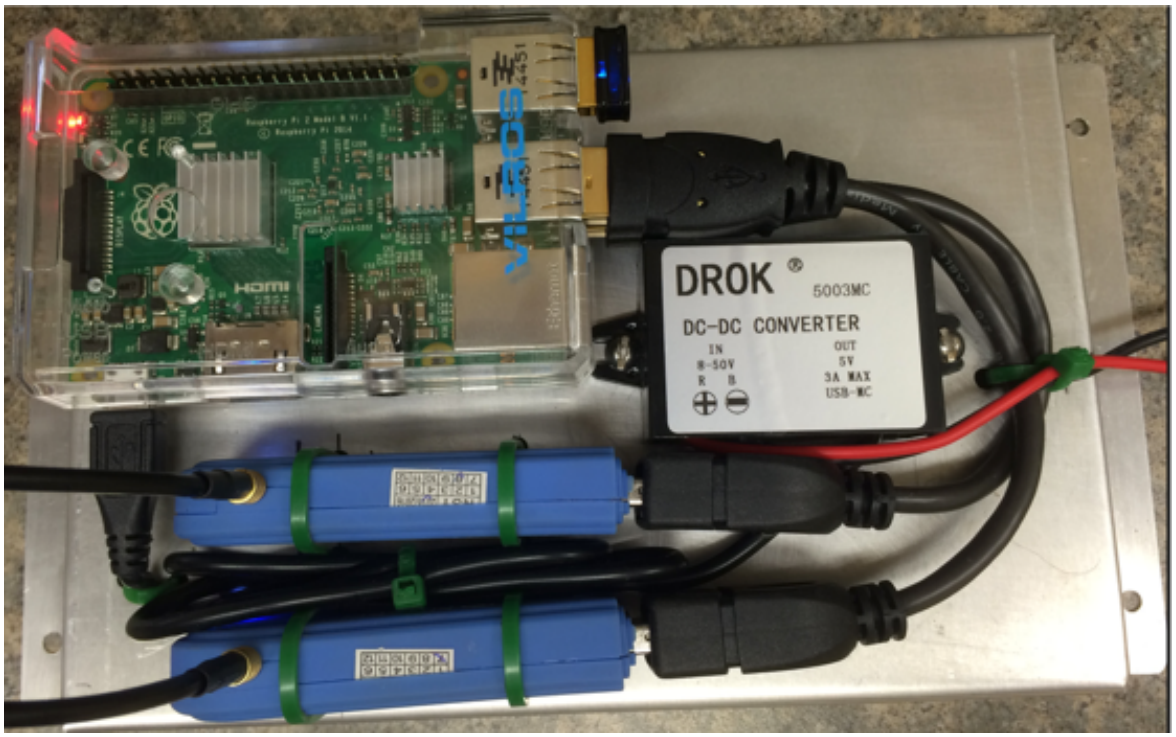
After reading the EAA article "Live Weather and Traffic for Less Than $120 By Tom Charpentier" and being a cost conscious (cheap) engineer type, I got pretty motivated to add this feature to my airplane. The intent was to be able to benefit from the ADS-B IN functionality and to explore the technology. The original article can be found on the EAA web site. It was the trigger for my endeavors. There also is another web site that features a lot of additional useful information and further links on the ADS-B IN

receiver subject matter of the EAA article. It is https://www.reddit.com/r/stratux.

My airplane, a Sonex (S/N 422), is a project that I started in 2003 and completed it in the fall of 2012. First flight was June 2013 after completing the T- Flight program at the Sonex factory. The airplane is configured as standard gear with a center stick and is equipped with an AeroVee engine. I am currently working on completing the airplane's flight test phase (weather and other obligations permitting).

My goal was different from the reference material in that I wanted to make a more permanent set-up. To this end, a mounting base was fabricated from 0.025 6061-t6 aluminum sheet stock. The required parts were mounted as shown below.

On the upper left is the Raspberry-PI computer in a see-through plastic case. Also visible is the USB Wi-Fi module (blue light). At the bottom left are the two USB software tuned radio modules. Since the "Stratux" software supports both 978 and 1090 mHz I opted for two receivers.

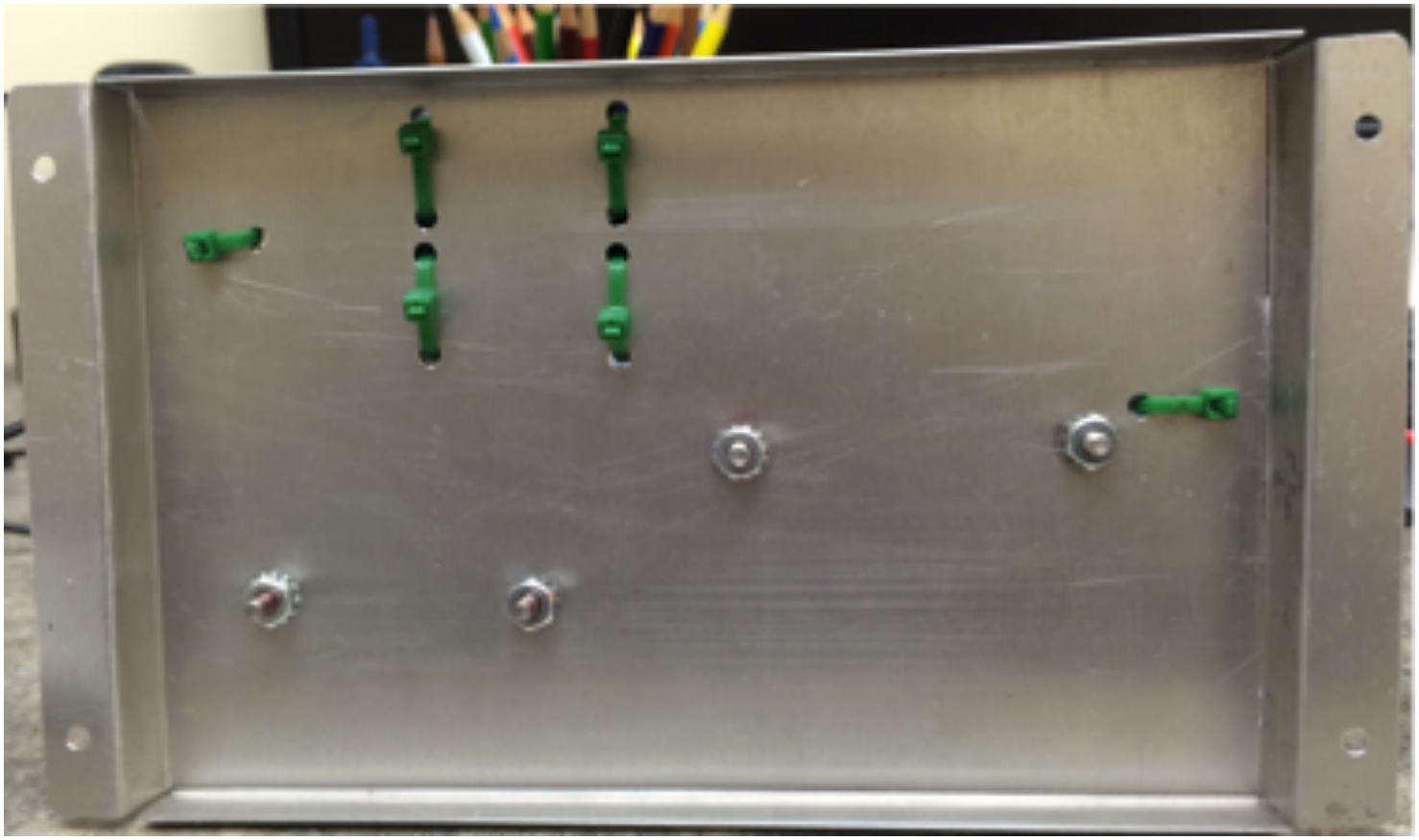


For the USB connections I used 6” male to female cables. While direct plug in into the Raspberry computer board would have been possible, I opted for this method so that I could properly secure the receivers. The direct plug-in method would have required removal of the plastic shells. In that condition there also was the risk of inadvertent contact between the circuit boards and their components.

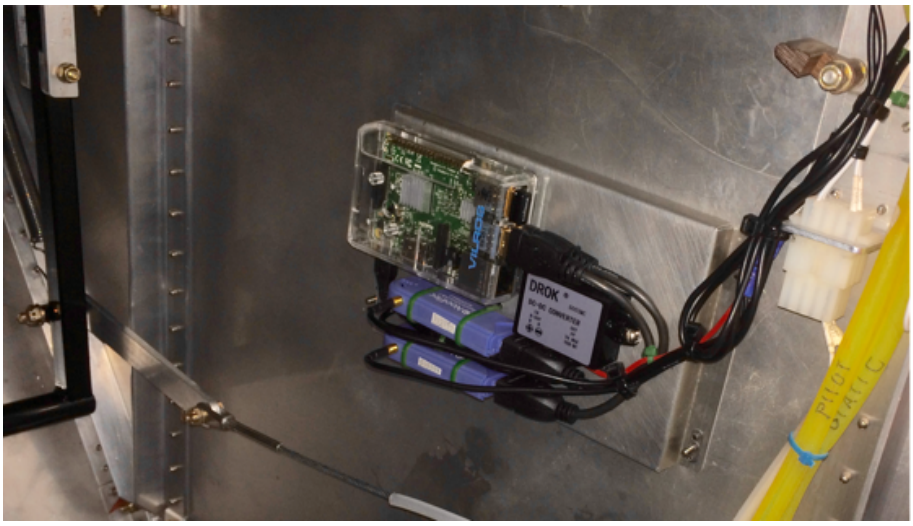
One of the advantages of the permanent installation is that the unit can be connected to the 12 Volt DC aircraft electrical system. Because of the added electrical load of the USB devices, I wanted to make sure that there was sufficient power supply to the Raspberry PITM board. The solution was in the form of a DC-DC convertor module with a current rating of 3 amps and a wide voltage input range (0-50 VDC). This module is now connected directly to a formerly spare circuit breaker that is part of the avionics bus.

There is and continues to be discussion on the reddit.com web site regarding supplying sufficient power to this ADS-B IN configuration. I was able to confirm that performance was indeed borderline while testing the system with my recently installed 2 amp regulated USB power jack in my airplane.

The adjacent picture illustrates the bottom of the assembly. The Raspberry PITM enclosure and the convertor module are attached with 6-32 screws and respective nuts. Thread locker was also applied. Cables and the receiver modules are secured with wire ties.



Flush riveted nut plates were added to the 4 mounting holes of the formed base to facilitate the final installation and easier removal.



Shown above is mounting of the ADS-B IN receiver assembly against the right side wall of the airplane. The goal was for it to be visible, and be accessible for trouble shooting and software updates.

I used the antennas that were supplied with the receiver modules. After removing the magnets from their respective bases I attached them to the glare shield with super glue jell as shown.

The whole system added 12-5/8 ounces to the weight of the airplane. The weight and balance data was updated accordingly.

I use the FlyQ EFB application from Seattle Avionics on an I-Pad Mini. Traffic was visible during the first test flight (both high and low altitude traffic) once above 1,000ft agl. My airplane is also equipped with a Levil AHRS with air data (pitot and static) and I use this in conjunction with a retired I-Phone. The picture below shows my current avionics layout. All data connects wirelessly.

Currently I am completing the design of an angle of attack sensor/display system using the Arduino Nano microcontroller at its core. Also I am in the process of integrating the RY835AI GPS, pressure altitude, and Attitude Heading Reference System (AHRS) with the Stratux system (approx. $40).

Disclaimer:

The foregoing illustrates an example of how the author solved a technical challenge. It is in no way intended as instruction on how to implement an ADS-B IN installation on any aircraft. This project, as described, is of purely experimental nature and serves strictly as personal education tool for the author of this document.

Any copying, duplication, implementation, in part or whole, is entirely at your own risk.

Oil Analysis - Cheap Insurance!

Michael Smith

Like most of you, I am not an A&P, and I don't have any more experience with engines than I have had with my AeroVee. So if I make a mistake I'm sure someone will be kind enough to correct me.

The AeroVee is only available from AeroConversions (a product line of Sonex Aircraft LLC) as a kit. Therefore I am the manufacturer and the maintainer. If I could have afforded it I would have gone for more horsepower in the form of a Jabiru 3300. But once I had decided on the AeroVee I felt that building an engine would be a great way to get to know it inside and out, literally. That turned out to be a good thing.

I decided from the beginning that I would get an oil analysis at every oil change. From reading for years about engine maintenance I gleaned that every engine is different, so absolute numbers don't necessarily mean that much. What oil analysis is very good at is indicating trends. But to see those trends you need to be diligent about taking samples at each oil change. As you'll read here I'm very glad I did!

There are many companies out there that do this service, with a very wide range of costs. I settled on the most inexpensive one, Lab One, Inc. (www.laboneinc.com). Their kits are available from Aircraft Spruce (http://www.aircraftspruce.com/catalog/eppages/labOneKit.php) and other sources, for about $13. That's the cost of the kit. The only other cost is $2.54 for outgoing postage.

Here are the very simple instructions for taking the sample. Note that samples are best taken after running the engine so that the oil is warm and the particulates are picked up and suspended equally throughout the oil.

"We recommend sampling within an hour of shutdown. Let about one quart flow out and place the bottle in the oil stream to obtain a clean sample. Fill bottle approximately to the shoulder. Make sure to tighten the lid and put each sample in the zip lock bag, and the ID tag in the mailer with the bottle. Used oil is not a hazardous or toxic material."

You drop the little package in the mail and usually within a week you get your results back via email.

This is an example of all my oil analysis. I'll explain the left two columns and the hand written notes later.

Control #	090820150902	090720150818	091420150409	092620141201	091220140912
Date Taken	08/30/2015	08/14/2015	04/03/2015	11/16/2014	09/06/2014
Service Meter Reading	125	119	79	62	45
Fluid Run Time	6	30	18	16	39
Fluid Added Gal / Qts	0 / 0	0 / 2	0 / 1	0 / 1	0 / 2
Fluid Status	Changed	Changed	Changed	Changed	Changed
Filter Changed	No	No	No	No	No
Iron (FE)	10. 60	3.74 113	75	53	80
Chromium (CR)	4	8	3	5	5
Copper (CU)	5	10	5	7	13
Tin (SN)	0	0	0	0	0
Aluminum (AL)	10.3 62	2.8 86	32	33	37
Nickel (NI)	27.5 165	8.3 251	72	67	80
Silver (AG)	0	0	0	0	0
Silicon (SI)	5.1 31	1.7 53	27	31	39
Phosphorus (P)	1534	1618	1735	1291	1270
Molybdenum (MO)	1	1	2	2	4
Titanium (TI)	0	0	0	0	0

The Numbers I have written in are the PPM per Hour. AS you can SEE There IS quite an increase on a per Hour BASIS. I would Recommend that you Boroscope the Cylinders as This is a dramatic increase in wear METAL. Something IS Comming Apart.

BILL G

Lab One Aviation

Aviation Oil Analysis since 1985

PO Box 20210 - Phoenix AZ 85036
101 West Mohave - Phoenix AZ 85003
480 839 5221 - 866 652 2663

Critical

1 of 1

09/03/2015

Make / Model

SONEX AEROVEE S.1

Unit/Serial

N439M/681

Compartment

Single

Fluid Type

VALVOLINE VR-1 20W50

WO / Reference

Current Interpretation

WEAR METALS HIGH BUT STABLE FOR OIL TIME. POSSIBLE RESIDUAL CARRYOVER FROM OIL CHANGE. POSSIBLE RESIDUAL BREAK-IN. CONTINUE TO CHECK FOR CHIPS. RESAMPLE 10 HOURS MAX.

If you're like most of us when you get the results back you are likely going to say something like, "Huh?! What do all these numbers mean?" Well, here is what Lab One Inc publishes as a guide. Since it is geared toward certificated engines it may not apply totally to our experimental engines, but it's still certainly a very good place to start.

This trouble shooting guide is designed to assist the user in not only interpreting oil analysis test reports, but implementing appropriate corrective actions as well. It is not intended to be a definitive reference, but an at a glance guide to be used with other reference materials.

SPECTROCHEMICAL ANALYSIS – WEAR METALS

IRON (Fe)
Origin: Gears, Rings, Roller Bearings, Cylinder Walls, Camshaft, Crankshafts, lifters, Rust

Purpose: Because of its strength, iron is the base metal of steel in many parts of the engine. Since iron

will rust, it is alloyed with other metals (i.e. Chromium, Aluminum, Nickel) making steel.

CHROMIUM (Cr)
Origin: Shafts, Piston Rings, Chrome Cylinders, Chrome plating on crankshafts

Purpose: Because of its strength and hardness, Chromium is used to plate rings and shafts that are usually mated with steel (softer). Chromium is also alloyed with iron (steel) for strength.

ALUMINUM (Al)
Origin: Bushings, Pistons, Turbo Charger, Compressor Wheels, Engine case

Purpose: Aluminum is a strong lightweight metal (smaller mass) which dissipates heat well and aids in thermal transfer.

COPPER (Cu)
Origin: Bearings, Bushings, Camshaft Thrust Washers, Connecting Rod Bushings, Oil Additive for Anti-wear/anti-oxidant. Valve guides.

Purpose: Copper is utilized to wear first in order to protect other components. Copper conforms well so it is used to seat bearings to the crankshaft.

LEAD (Pb)
Origin: Bearing Overlay, Low Lead Gasoline. Pb not done on recip engines because it is in the gas.

Purpose: Lead is a conforming material used to plate bearings. Lead is usually not reported as the lead from the fuel overshadows true lead from wear.

NICKEL (Ni)
Origin: Valve Stems, Valve Guides

Purpose: Nickel is alloyed with iron in high strength steel used to make valve stems and guides

SILVER (Ag)
Origin: Bearing Cages (low friction bearings), Silver Solder, Turbocharger bearings and wrist pin Bushings

Purpose: Silver is used to plate some components because it conforms well, dissipates heat and reduces coefficient of friction.

SILICON (Si)
Origin: External (dirt), Additive, Sealant's. Silicon can be an anti foam additive in the form of silicone.

FUEL DILUTION
Fuel dilution of crankcase oil by unburned fuel reduces lubricant effectiveness. The thinning of lubricant can lead to decreased lube film strength adding to the risk of abnormal wear. Fuel dilution is usually a product of poor leaning management although it can be caused by mechanical problems. Fuel dilution is not reported as it is an occurrence that happens during flight and can be burned off on the next

flight. The tendency for gasoline to evaporate before the lab received the sample will generally result in it not showing up in a test.

SOURCE RESULT

Incorrect air to fuel ratio	Metal to metal contact
Poor leaning technique	Poor lubrication
Incorrect timing	Cylinder ring wear
Defective injectors	Increased fuel burn
Leaking fuel pumps or lines	Decreased oil pressure
Incomplete combustion	Reduced engine performance
Incorrect timing	Shortened engine life

SOLUTION

Check fuel lines, worn rings, leaking injectors, seals, and pumps
Check timing
Avoid prolonged idling
Change oil and filters
Check quality of fuel
Repair or replace worn parts

INTERPRETING THE RESULTS TEST REPORTS AND TAKING CORRECTIVE ACTION

Once all of the tests are complete, a highly trained Data Evaluator evaluates the results. The evaluation will result in (1) a statement that the unit is normal, or (2) specific maintenance recommendations will be made. The report recommendations are only one tool that can assist you in making your maintenance decisions.

RECOMMENDATION CATEGORIES

Normal

No explanation is needed for this category. Keep in mind that it is important to know that a unit is normal. This can save you unnecessary tear-down.

Abnormal

This category is followed by specific maintenance recommendations, or a notation that component wear is abnormal: there might, for example, be a recommendation to change oil and filters, and a comment noting that abnormal bearing wear is present. We are not telling you that it is time to tear down the unit. We are suggesting that you perform the maintenance suggested, and advising you that bearing wear is present. A second sample in a shorter time span might be requested. We do not recommend that you go into a unit on an abnormal recommendation unless you have discussed the report with the appropriate Laboratory Data Evaluator, your mechanic, engine shop or you have indications that the unit has a more serious problem than is apparent in the report. Again, your judgement must be based on all of the tools at your disposal, including our report, your knowledge of the unit and your experience. Remember, oil analysis does not preclude other regular maintenance practices such as checking screens, cutting open the filter and checking for excess filter debris or compression checks.

Critical

This is the category we use to indicate potential failure and a serious condition exists. A telephone call

is made to the contact person and we will indicate the suspected nature of the problem and make a recommendation for maintenance action. Critical units require immediate attention.
Figures in grey are those that Need Close Attention: A serious problem could be developing and the unit should be closely monitored.

Re-samples: We will request a second sample to establish a trend whenever we have a potential "critical" unit with no previous history. If the wear increases, you will be advised of the suspected nature of the problem.

In some cases, the data will identify an obvious problem. For example, high levels of silicone usually indicate dirt or dust contamination, and the need to check air filters and the air induction system as well as alternate air doors if so equipped.

Sometimes however, the analytical data from an individual sample does not provide enough information to make more subtle judgments about oil or equipment condition. In these situations it is necessary to monitor the trends in analytical data over a series of samples to establish a wear trend pattern. By monitoring wear metals such as copper it is possible to detect the early stages of possible bearing failure. In most cases it can detect problem far enough in advance that it will allow for scheduling a bearing inspection at a convenient time, reducing or eliminating expensive equipment downtime and repairs.

The most common engine oil contaminant is silicon (dirt). Silicon (dirt) contamination is the most common form of contamination and causes serious engine wear due to its abrasive action against all moving parts within the engine. Silicon levels above 15ppm should be considered cause for inspection of the air intake system to locate the source of entry for the dirt and other airborne debris.

Wear metal analysis can indicate which engine components are wearing and if the wear is becoming significant. This information can make the difference between minor component inspections and repairs and major overhauls. Wear metal levels are provided by spectrographic analysis of the oil sample, indicate the element level in parts per million (ppm), of each of the common metals found in the engine: iron, aluminum, chromium, copper, nickel and silver, (and magnesium in turbine and jet applications).

Wear metal analysis requires more that simply plotting data on a graph. Wear metals can be generated from as many as a dozen different engine parts and locations making it difficult to identify the specific part that is wearing excessively. It is the knowledge acquired through years of experience and analytical training, that the analyst can draw upon, to provide the most accurate analysis possible for customers.

Oil analysis is best looked at on a trend basis. The first time that a laboratory looks at a sample, the analyst basis his judgement on experience and averages of other engines of the same make and model. The second sample can be compared with the first, but not until the third sample is a true trend formed. Very often people assume that the number we report in parts per million (ppm) are hard and fast numbers for each engine. There are so many variable factors to take into consideration such as; the time on the engine, the time on the oil, the flying conditions as in a acrobatic aircraft will show higher metals than another aircraft with the same engine flown normally. This would apply to crop dusting planes also. What oil analysis is telling us is when there is a deviation from what is normal for that engine, then there is a potential problem. This deviation has to be taken into account on a ppm per

hour scale. A deviation of 20 % or more on a per hour scale will indicate an existing problem. A gradual rise in any element is usually a warning of a problem that is oncoming. Oil analysis should be done at each oil change to develop a trend for the life of the engine. By doing oil analysis on a new or rebuilt engine you can monitor the break in which can occur up to 300 hours. Most engines break in fine but on a rare occasion you can catch an engine that is not breaking in properly. Oil analysis can help you decide when an engine need to be overhauled. When an engine reaches TBO and is not being flown commercially, doing regular oil analysis, compression tests and 100 hour inspections can help you determine when it is time for overhaul.

Does Adding Oil Between Oil Changes Affect the Analysis Results?

Here is an email Dudley Foster received from the Owner of Lab One Inc., in reference to some questions he had asked about how adding oil between oil changes might affect the results:

Wear metals are cumulative and therefore addition of relatively small amounts of oil over the oil change period should not have any grand effect on the results. Where we run into a problem is with radial engines that may put as much as 50 gallons of oil in between changes and the leakage factor along with the blow-by can make it hard to give a real good interpretation. I had a Bellanca Super Viking that burned a quart every 5 hours and it did not have much effect on the analysis as the oil burn was constant as well as the oil change period and therefore it all equaled out in the end.

The one thing that you have to get across is the fact that there are no hard and fast numbers, and that Oil analysis is best done on a trend basis, looking for a deviation from what is normal for your engine. No two engines will make the same amount of wear metals so you cannot make a comparison from one 0-360 to another 0-360. Rings seat differently, nuts are never torqued to the exact same pressure, the time on the oil sample, the time on the engine, what conditions the aircraft is flown in, what are the leaning procedures and I could just go on and on with other things that will affect the numbers.

Oil analysis does not preclude cutting the filter open and inspecting the filter for chips and that also applies to checking the screen. Oil analysis by us or any other company is done with a spectrometer. All spectrometers have a limitation in reading the ppm (parts per million) and will not recognize particles under about 10 microns. You could have an immediate parts failure and get chunks in the filter and the oil analysis would say it is fine and dandy. Oil analysis is a prediction of future wear, not immediate parts failure.

It is also important as to how a sample is taken. The quick drain should be wiped clean and the oil should be hot which gets all the particles in suspension in the oil. You should not sample the first quart or two nor the last dribble. A mid-stream sample will prove to be the most representative sample you can submit. Fill the sample bottle right from the stream and put the lid on before you wipe the bottle clean. Dividing the ppm by the number of hours on the sample gives you the ppm per hour. Although we do not report it that way, it is how we look at it in reference to weather the metals are up or down for time on the oil.

How Oil Analysis Proved its Usefulness

When I ordered my AeroVee 2.1 I opted for the Nickasil cylinders to save about 10 pounds over the standard cast iron cylinders. The Nickasil cylinders are aluminum, but are coated with a nickel-alloy (Nickasil) inside to provide the wearing surface for the pistons and rings.

They are used in Porsche and other engines with success, but when you do some searching on the Internet you'll also find they sometimes have their problems. Other AeroVee/Nickasil owners had reported problems, including the one I ended up having.

I found myself always adjusting my rocker arm valve gaps. More than most VW owners. I also found that whenever I retorqued my heads per the AeroVee instructions, some of the nuts moved pretty far to get the specified torque values (I adhered religiously to the torque values). But the engine was running fine, and all the temperatures were well in the green.

After returning from AirVenture 2015 I did an oil change at 119 hours on my engine, and sent in my sample. The results are in the column 2nd from the left, and showed very elevated levels of Iron, Nickel and Aluminum. That would make them all related to the cylinders and rings (aluminum cylinders, nickel coating, iron piston rings).

Lab One flagged the results in red and indicated I should take another sample soon. So I ran the engine for another 6 hours then retested. Those results are in the left most column (the original results I got back did not have the hand-written notes you see). Remember that the numbers are cumulative with time, so you have to divide the numbers by 6 (the number of hours I ran) to get the ppm/hour.

You can see the note under "Current Interpretation" said that wear metals were "stable for oil time," and "possible residual carry over…" That did not make sense to me so I questioned Lab One. The Owner wrote back to me with the hand-written notes on my analysis, and offered the following:

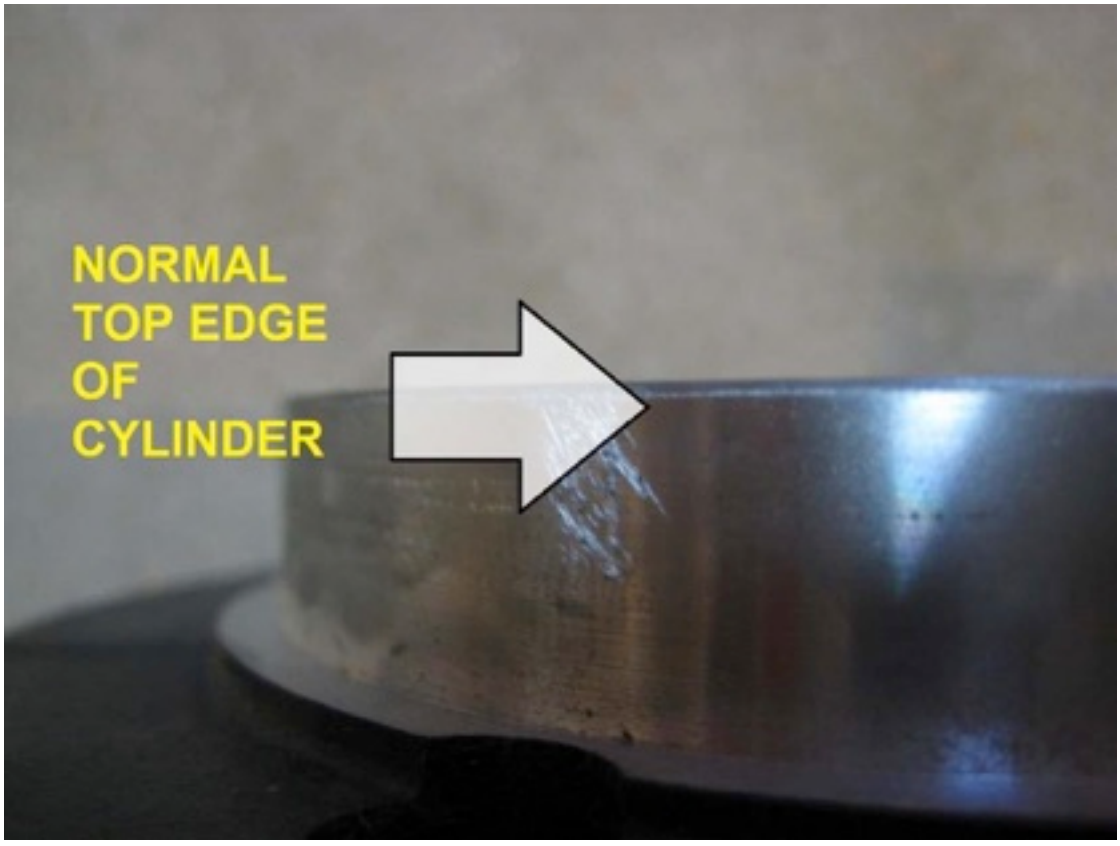
I have reviewed the sample in question and I feel that the engine is past break in and the values should be on the way down, not up. I went on line to review the specifications of the 2.1 engine and it looks like there is a problem, and in my opinion I think it is cylinder distress.

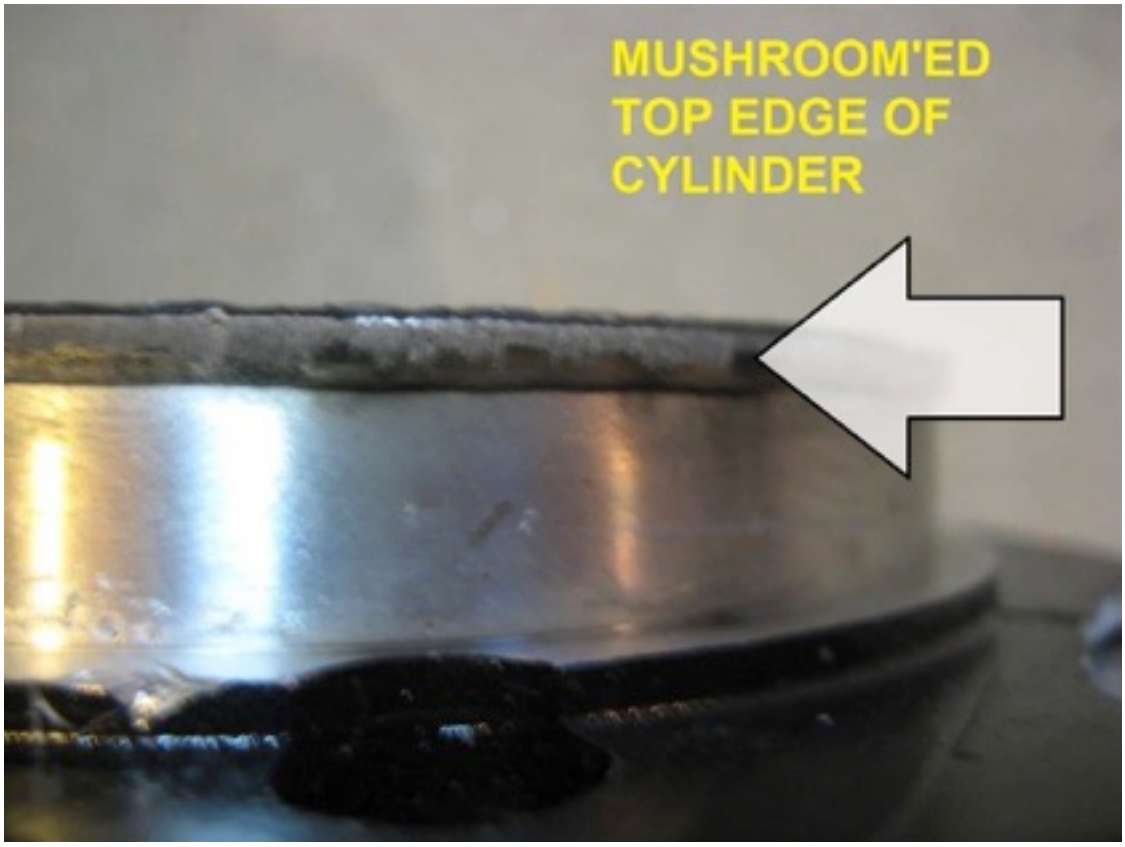
Therefore as my note says I would recommend borescoping the cylinders as a matter of caution. Although we have been analyzing aviation engines since 1985, we do not have a lot of experience with this particular engine.

I spoke to the tech that analyzed this sample and he was going on the basis of a Continental engine that can have a longer break in which in this case may still be possible. I let him know that when you see an engine that we do not have a lot of data on and it is in the critical mode, that it should be brought to my attention.

The lesson learned is to always ask questions if something doesn't make sense to you! Nobody is perfect.

So with all that I decided I had to pull the heads from my cylinders to have a look. A borescope was just not enough for me (and finding a good one is VERY expensive). It took a Herculean effort to get my heads off of some of the cylinders. When I did, here is what I found.


NORMAL
TOP EDGE
OF
CYLINDER


MUSHROOM'ED
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CYLINDER

The tops of the hard nickel cylinder walls remained mostly intact, but the softer aluminum cylinder walls were crushed by the copper head gaskets and the heads, and mushroomed out about half way around each cylinder.

This seems to have shifted the cylinders slightly and caused an asymmetric movement of the pistons in the cylinders. The rings began scraping away the Nikasil at the top of each stroke. So the aluminum cylinders, Nikasil coating, and iron rings were all wearing abnormally, hence the results of my oil analysis.

Had it not been for oil analysis I would have continued flying with this condition, which would have gotten worse and worse. Would the engine have failed before it gave me other signs? I don't know, but I'm glad I didn't have to find out.

I was able to save the heads, but if this condition had gone on just a few hours more, the mushrooming would have been so bad that there would have been no way to separate the cylinders from the heads, and I'd have had to buy new heads as well.

I was now afraid that all that metal might be affecting the bearings in the engine, so I decided not to chance it and to tear down the entire engine and rebuild it. I ordered new cylinder sets from Sonex (cylinders, pistons, wrist pins, rings), as well as all the internal bearings and rear oil seal.

I completely cleaned everything and checked the surfaces of the cam, crank and connecting rods. Everything looked good so I put it all back together and I'm flying again (and the engine is running stronger than the original build). It took me a total of 40 hours to remove the engine, rebuild it and rehang it. It's quite a bit simpler when you do it the second time. By then you really know the engine very intimately.

So my recommendation to anyone flying an internal combustion engine is: GET OIL ANALYSIS! It's cheap insurance, and you can't beat the extra peace of mind.

Michael Smith

Maynard, MA

Sonex N439M

Plans-built, Dual Stick, AeroVee 2.1

Differential Toe Brakes

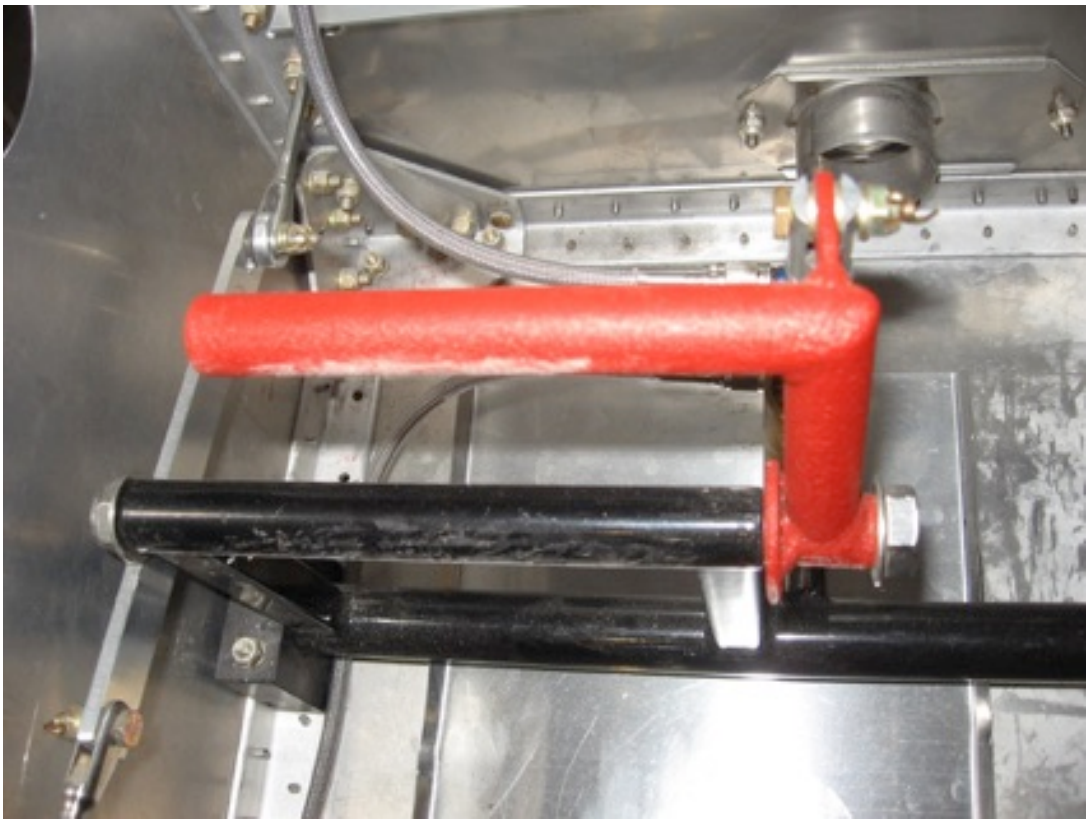
Mike Turrell

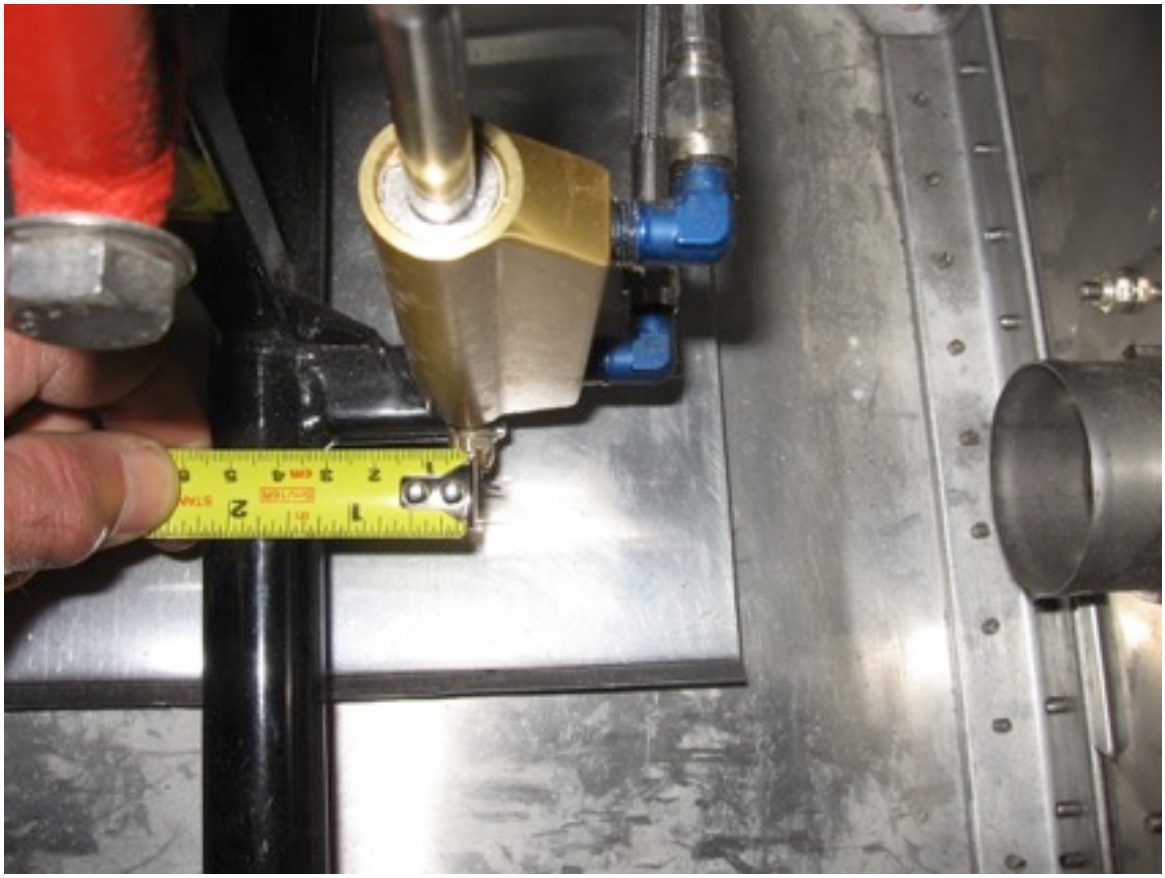
Mike submitted the following in response to a discussion on the SonexBuilders.net forum about differential toe brakes. The Sonex Builders and Pilots Foundation neither endorses such modifications nor encourages builders to make them. Any modifications to the design of the aircraft must be carefully considered.

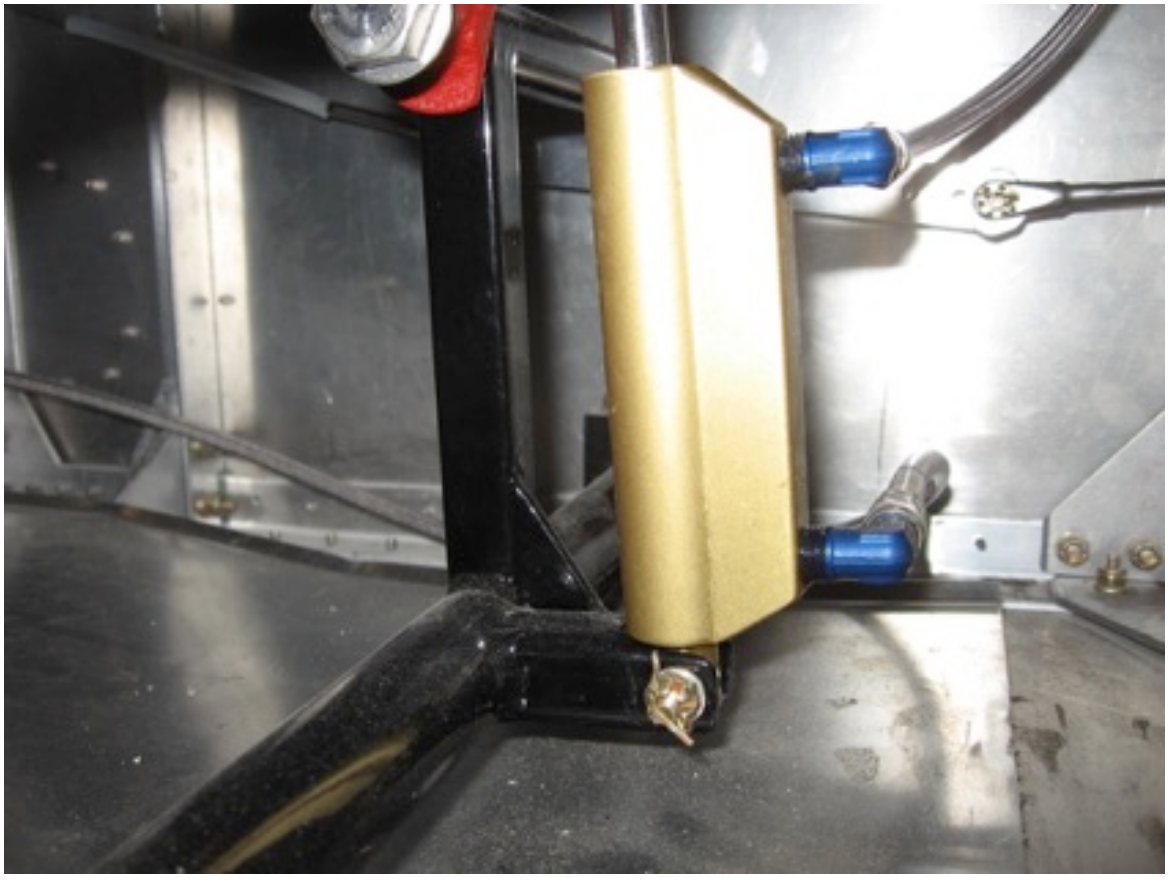
Brake cylinders are Matco MC-4's Matco will also supply brake lines and fittings or you can go the stainless route like I did from http://aircraftspecialty.com Steve will have the lengths he sold me on file.

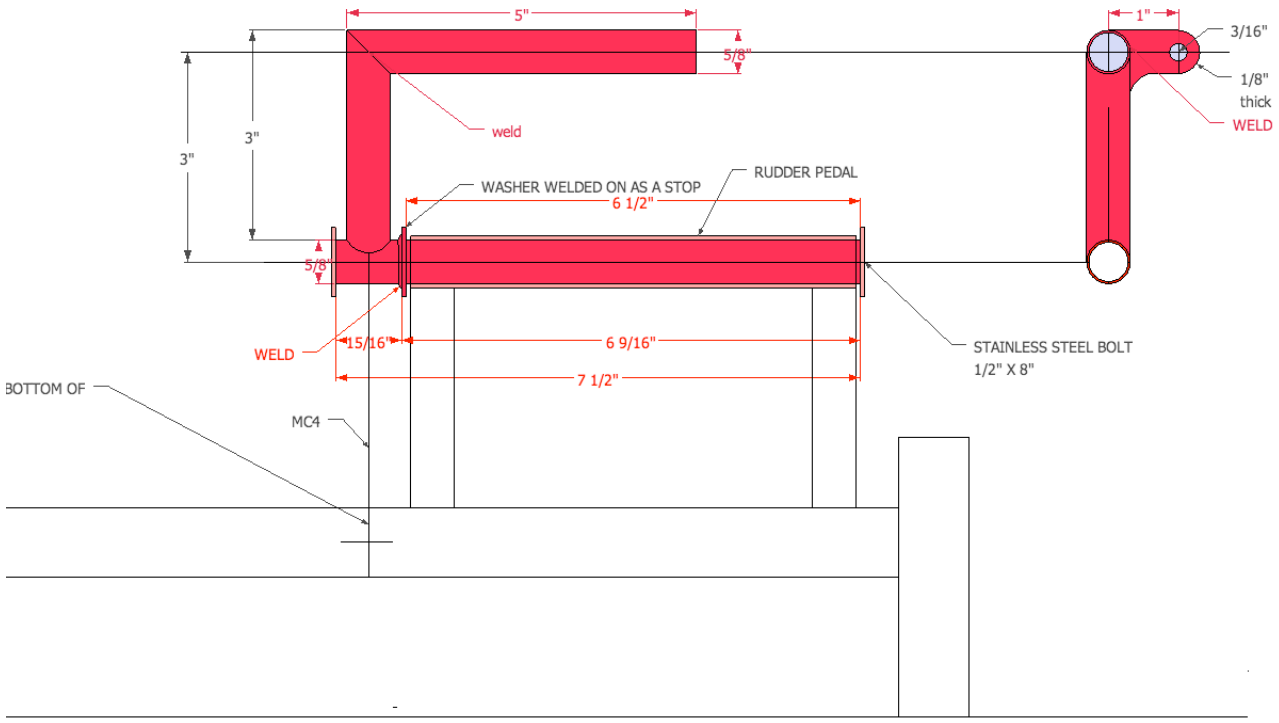
The Brake pedal should not be in line with the rudder pedal but rather angled back about 15 degrees or what seems comfortable. As can be seen in the last pic the bracket to capture the bottom of the cylinder is welded to the lower tube of the rudder pedals and is centered 1 1/4" from the edge.

If anyone has any questions I can be reached at mtyit@start.ca or through my web site onexmike.org





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5/8"
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WASHER WELDED ON AS A STOP
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6 1/2"
5/8"
WELD
15/16"
6 9/16"
7 1/2"
STAINLESS STEEL BOLT
1/2" X 8"
BOTTOM OF
MC4

Transition Training

Robbie Culver

In September 2015, as building my project began to wind down and the first flight was imminent, I knew I needed to get transition training. I was lucky enough to get to fly with both Michael Farley and Joe Norris. Both taught me valuable techniques that made my first flight a non event. You can see a video about my transition training at https://www.youtube.com/watch?v=txHCZyGnyao

The subject of transition training is always sure to spark a lively debate. There are those who insist that they have the experience to fly a Sonex, Waiex, Xenos, or Onex with no training required. And they may be right.

But there are ample statistics to show that for many pilots, receiving transition training prior to their first flight in a new experimental amateur built or as a second owner of a flying experimental is a wise investment of the time and money required. I know it was for me.

I spent 4 1/2 years building my conventional gear Sonex, but my last tailwheel time was 11 years ago. For my experience and situation, there was no way I was going to make my first flight in Sonex 1517 without formal training. As for many builders, the problem was how would I get that training?

As this foundation has often discussed, there is a process for approval to provide the training and to date, there are only two current authorized LODA (Letter of Deviation) holders for Sonex aircraft. One is Michael Farley in Columbus, Ohio, and the other is the Sonex factory in Oshkosh, WI.

I was lucky to be able to fly with both.

In late September, I drove 6 hours from the Chicago area to Columbus, Ohio on a Saturday afternoon - if you've never been to Columbus on a Saturday evening following an Ohio State home game, all I can say is you are missing out. I grew up in a Big Ten college town, and the rich traditions and intense rivalry is familiar to me. I was glad I wasn't wearing my Wisconsin Badgers sweatshirt!

On Sunday morning, Michael Farley and I met at his hangar at the Union County airport in Marysville at first light. Michael has a Waiex based there, and we had discussed the days plan before my trip. I had reviewed the syllabus Michael co-authored with Joe Norris at Sonex Aircraft, LLC. Michael and I had detailed discussions of what we would do and what I should expect. The syllabus for the transition training can be found here - http://sonexfoundation.com/uploads/Flight_Training_Syllabus_RevA_052113.pdf

We discussed the unique aspects of the aircraft and Michael's configuration and avionics. As I would hear again in Oshkosh, "sight picture" was the phrase of the day. After a thorough preflight and review of the aircraft systems in the cockpit, we started up and taxied out for departure on runway 9.

After a runup and control check, we pulled onto the runway. I gave the Waiex throttle and immediately overcorrected on takeoff. I could feel Michael guiding me and preventing me from getting out of control. The first thing Michael had told me was that the aircraft is sensitive in pitch. It is. Not over sensitive, nor twitchy, but the pitch control is definitely more sensitive than even the Cessna 150 I owned. I proved that on the first departure.

Michael had also reminded me to immediately get the left rudder in to center the ball after takeoff - another fact I had to have beaten into my head, but I finally got.

Soon enough we were climbing out over the Ohio countryside. Traffic was light and the early morning fog lay in the low areas adjacent to Marysville, with the sun illuminating the fields. I took a moment to soak in the moment. We let the Waiex settle in at fairly high power for a chance to see how it cruised, then slowed it down. A few turns left and right gave me a feel for how easy the airplane is to fly.

After flying around for a bit, Michael had me bring the Waiex back to Union County for some landing practice. First up, full stop taxi backs.

Slowing the Waiex for the pattern was, indeed, all about the sight picture. Judicious use of trim and the correct throttle settings produced a predictable sight picture in the pattern, and made for easy airspeed control. As flaps were added, a slight nose-down effect occurs, but nothing unexpected nor dramatic. The airplane is easy to fly in the pattern with, or without trim.

My first landing wasn't bad - it wasn't great, but it wasn't bad. I wish I could say that for the next few. We alternated between the grass and the hard surface, with various flap settings on each approach. I felt like I should apologize to Michael's Waiex for what I put it (and him) through in the next 40 minutes. Soon enough, it was time to taxi in for a break and fuel.

After our break, we climbed in again and headed back out - this time our pattern was easier for me to predict, and we stuck with the grass runway. The wind slowly increased and we switched directions to land on Runway 9. With each landing I felt more comfortable - some were better than others, but each was a confidence builder.

After 2.5 hours total time, I finally nailed one landing - rolling it onto the grass. Michael and I said in the same voice that was enough. We taxied back in and did a thorough debrief before I left for the long drive back to Chicagoland. I used the drive home to review what I learned and to really let it set in.

A little over a week later, I drove to Oshkosh, WI to fly with Joe Norris at the factory. Again football was a peripheral event, as I arrived the evening of a Monday Night Football game in Green Bay. Much like Columbus, football in Wisconsin has a rich tradition. Packers paraphernalia was everywhere in Oshkosh that night, nowhere more so than Friar Tucks where I ate dinner. The waitress was not amused at my quip asking if there was a football game or something....

The next morning I drove over to the factory, where Joe Norris, local builder and CFI Tom Helm, and Florida Waiex builder Craig Mock were waiting in the classroom. The factory has you attend about 2 hours of classroom instruction, also based on the transition training syllabus. My flights with Michael really helped me soak in Joe and Tom's advice - especially about sight picture.

One key piece of advice I used to my advantage both on the flight with Joe, as well as on my first flight in Sonex 1517, was to use the taxi time to establish the sight picture. My flights with Joe were also in a Waiex, and my sight picture differs significantly in my aircraft. The sight picture provides the view for what straight ahead looks like, where the center line is, and what the three point attitude in a tailwheel Waiex looks like.

Joe and Tom reminded us of common errors - flaring too high, landing off center, and crowding one side of the runway. I was guilty of all three during my flights, and also found a way to invent a new problem - flaring to aggressively and getting too nose high. We also discussed speed control - if you land too fast, it floats, and the airplane is very easy to get going too fast!

After a break from the classroom, our conversation continued with a discussion of in-flight sight picture, especially in left and right turns. Joe explained how each differed, and what to look for. Finally, we discussed the two hours of flight - the first hour would be airwork followed by a full stop landing and a break. This was to

get us used to the sight picture, and would include slow flight and stalls. The second hour would be pattern work, with touch and go landings.

Left to right, Robbie Culver, Craig Mock, Joe Norris, and Tom Helm

Joe pulled the Waiex out and we climbed in - the factory was kind enough to allow me to video the training so for the first flight I put my GoPro behind my head on a platform they had installed for video cameras. For the second half of the flights I clamped the Foundation's HD camcorder to the canopy bracing for a slightly different look.

We taxied out to Runway 9 at OSH, which I should point out is a long way from the factory on the east side of the airport. As Joe recommended, I used the time to memorize the sight picture. It was about the same as it was in Michael's Waiex.

Soon enough, off we went - and once again I had to be reminded to center the ball immediately after takeoff. The day I made my first flight I could hear both Michael and Joe in my ear telling me to center the ball. And I did.

We flew out to the southwest of the Oshkosh area and did 90 degree turns left and right, concentrating on the sight picture and keeping my altitude constant. As expected, at first I wandered all over the sky. But soon enough, I settled down and remembered to look out the window instead of at the gadgets in front of me. It became much easier then.

Next up was 180 degree turns, also intended to stay on altitude and end on an opposite heading. I did much better on those. Then we did 360 degree turns, then turns one way followed by turns the opposite way - that was both fun and challenging, but I did well.

Joe's advice on the sight picture in the turns was right on - and it helped me as I began my test flights in my Sonex.

We ended the airwork with slow flight and stalls - the Sonex simply does not want to stall, and warns you well in advance that it intends to stop flying. In fact, I had to work at it on our second stall to really get the aircraft to break. It did, but it was something I had to work at. Recovery was easy, and the airplane immediately began flying again.

We returned to the airport for a break, and my first landing didn't scare Joe to the point of grounding me, so I considered that a success. The wind was gusty and at about a 45 degree angle to runway 9 - but I never felt as if I ran out of rudder or was beyond my abilities. In fact, it was a huge confidence boost to fly in that gusty wind and successfully land. Now, I should point out that both of the transition training sessions I attended were in a Waiex, and only about a week apart. Flying with Michael, as the wind rose and began to become a strong crosswind, I soon ran out of rudder, which was minimized by the grass surface.

But at Oshkosh, the wind was much stronger and much more gusty - yet the rudder authority was much stronger. I am no expert, and have no answer as to why, but the factory Waiex was definitely better in a crosswind. In fact, it was easy. After lunch, we went back out to do pattern work. Only in Oshkosh can you be chased in the pattern by a DC-3. We used left traffic - again for runway 9 - and I soon settled into a rhythm. As I reviewed the video later, most of our turns to base were made at the same point on downwind, easily marked by the highway at the west end of the airport.

Repetition made the work easier and my landings showed the results. Even in a gusty crosswind, they got more consistent and - while I can't call them all smooth - I was definitely learning. Joe was great at letting me learn, never making me lose confidence. Again the sight picture was an important part of getting it right.

We used various amounts of flaps so I could get used to the differences, and I even managed a couple of slips, which I love to do. I found the Waiex was easy to keep high on final, then let it come down to the runway as it slowed up. Joe continued to coach me through each pattern and landing, and at last I was rewarded with one that made me ask Joe “Did I just do that?!”

After 2 hours total flying time with Joe, I was beat. One last landing - I wish I could say it was the best of the day, but it wasn’t - and then we taxied back to the factory.

Overall, I have to say that flying with Michael and Joe brought me two similar perspectives with the same messages - but each was in a different aircraft, at a different airport, in different conditions. It was very good preparation. Even if you can’t attend the transition training, at least read the syllabus, watch the videos, and see if you can at least get time with someone in their Sonex, Waiex, or Xenos.

On October 10th, when I taxied out to runway 27 at the Aurora, IL airport for the first flight in N1517S, I was ready mentally and physically. The flight was uneventful and I had a nice landing - credit to the training I received and the work I put in while receiving it.

As I have gotten farther into my flight testing, the lessons I took with me from both experiences have been beneficial in my flying. I no longer hesitate to get the rudder in right away after liftoff, I know what sight picture to expect in turns and on final approach, and I am able to approach each flight with confidence. And a recent flight in a gusty crosswind was a great learning experience.

My Version of KISS - Keep It Simple, (and Inexpensive, and Light) Stupid...

Michael Farley

Around the time you read this article, I will be flying my company's Hawker 800XP midsize business jet to a large midwest maintenance shop for its yearly inspections. Items on this year's checklist include a tear down and rebuild of the left engine (called a hot section), interior carpet replacement, and the installation of avionics to make the jet ADS-B compliant.

As most of you know, in preparation for the NEXGEN Air Traffic Control system, the FAA is requiring ADS-B (Out) compliance by January 1st, 2020 for operation in any airspace that currently requires a transponder with Mode C capability. While this may not affect many of us Sonex owners, failure to comply with this requirement would essentially render my company's Hawker useless, so that equipment is going to be added this year...for the tidy sum of approximately $120,000!

I don't know about you, but to me that's a staggering amount of money for one simple little upgrade, and while necessary, that price tag got me thinking about my Waiex and all of the upgrades I've already completed, as well as future upgrades I'd love to accomplish. I mean, what pilot doesn't want an airplane with all the bells and whistles, right? Yet at the same time, just because we want all of these fancy little goodies incorporated in our airplane, are they really necessary?

This is just my opinion, but when aircraft owners contemplate which upgrades to include into their build project or completed airplane, there are a lot of variables to consider. What's the benefit? How much weight does it weigh? How long will it take to install? How much does it cost?

It will ultimately be up to each aircraft owner to decide which upgrades are necessary, based on their own style of flying and intended mission. To share with you my own chapter of the story, the cost of completing a Sonex was a large deciding factor when I chose to build my Waiex.

Ultimately I was able to fly my AeroVee powered Waiex for right around $29,000 when it was completed in early 2012. At the same time, I was thinking I had perhaps one of the lightest Waiexes around when my initial empty weight came back at a light 644 lbs!

However, like most builders, I simply couldn't leave well enough alone and have performed several upgrades over the last few years which has added to the total project cost as well as the total weight. These upgrades include:

- AHRS Added to my MGL EFIS: While I have no intention of EVER flying my Waiex in an IFR environment, I did want the enhanced safety benefit of an artificial horizon just in case I ever got caught in a low visibility situation. Purchased through MGL for around $600.

- Interior Kit: Purchased online from another Sonex builder who wasn't going to use it, this added around 10 lbs and cost me $600. From a comfort standpoint, this was money well spent!

- Hydraulic Brake Upgrade: Purchased through Sonex, this upgrade hardly added any weight but did cost several hundred dollars.

- AeroVee Turbo Upgrade: Also purchased through Sonex, this has been the most significant upgrade in terms of work required to install (several weeks), weight (approximately 20 lbs), and cost (close to $4,000).

The result of these modifications has led to a predictable increase in both total project cost, which is now close to $35,000 as well as a new empty weight of around 675 lbs. Now, before I continue, please let me be clear: I've been very satisfied with all of these upgrades and whole-heartedly recommend them to all Sonex builders and owners who are interested in improving their airplane. In my opinion, I have yet to perform any modification to my Waiex that goes against Sonex Aircraft LLC's "Reality Check" principle of keeping the airplane light in weight, simple to build, and inexpensive to operate.

But are these upgrades really necessary?

For me, the answer is yes. For others, the answer may be different. Some of the items I have passed on, so far at least, include:

- A full paint job: Depending on who actually does the painting, this could range from $1,000 - $6,000+ and will normally add 20-35 lbs. And while polishing does take a lot of time, I do like the look of my airplane after a fresh polish job!

- Transponder/ADS-B Out Equipment: Mostly due to cost, this could run me $3,000-$5,000 plus necessary down time to install everything. Given the type of flying I do and where I'm based, this really isn't necessary.

- Autopilot: While not the most popular upgrade to a basic, fun to fly airplane like the Sonex, I do see more and more people consider this. In defense of an autopilot system I see A/P servos becoming very light and compact, but you still have to pay for them, not to mention an EFIS capable of driving an autopilot.

The purpose of this article isn't intended to tell others how to build their airplane; one of the luxuries of building an Experimental aircraft is that each builder can customize as much as they'd like. Rather, I hope this will lead to a future discussion either via newsletter article submissions or on the forums on what upgrades people have done, and if they would do the same again.