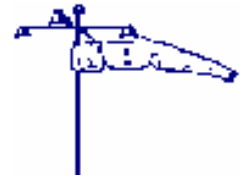


The Static Line

News and Views of EAA Chapter 538



Volume 32, Number 8

August 2007

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Chapter 538 Website www.eaa538.org

The Roy Castle Chapter (#538) of the Experimental Aircraft Association (EAA) publishes The Static Line monthly.

Unsolicited submissions are welcome and encouraged. Please send photos, art, articles, letters, calendar events or classified ads to the Editor. Submissions may be made via email (preferred) to the address listed above. CDs or paper can be submitted by USPS mail to the return address listed on the mailing label portion of this newsletter. All electronic submissions should be in standard MS Office (.doc, .xls, etc) or graphic (.jpg or .bmp) formats. Paper and CD submissions will be returned upon request.

Classified ads are free to all current members of EAA chapters and should be aviation-related.

Submission deadline is the last Tuesday of the month prior to the month of publication.

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TREASURER'S REPORT

submitted by Myra Ridder

07/18/07

Beginning Account Balance:	\$ 5,138.46
Income:	
Total Income:	\$ 0.00
Expenses:	
Total Expenses:	\$ 0.00
Ending Account Balance:	\$ 5,138.46

Membership: 49 Paid Members for 2007

Secretary's Report

July 10, 2007 meeting was called to order by Don Ridder at 7PM at Deer Valley airport Pan Am classroom A.

Current **Secretary Report** and **Treasurer Report** published in the newsletter and accepted as published.

Tech Counselor Report: none

Young Eagles Report: Letter from Air Academy attendee read. Next Young Eagles, Oct 20. Contact: Cheri McGunagle and Jim Moss.

Old Business: none

New Business: none

Announcements:

Be aware of parachute jumping 2 miles northeast of Casa Grande Airport. There is a notam published. Volunteers needed for project meetings.

Reminders: Don't forget to check the Chapter Website for newsletters and updates on meetings. See: www.eaa538.org. Yahoo group created for Chapter members to communicate with each other- groups.yahoo.com/group/ea538

A refreshment and socializing break preceded the program.

Program:

Issues using Ethanol in Aircraft by Bill Christie. See the following websites for information:

www.faa.gov/aircraft/safety/alerts (CE-07-06)

www.age85.org

www.aopa.org/whatsnew/newsitems/2007/070223fuel.html

Picture of Alan Stills' new glass cockpit panel (submitted by Tom Velvick).



Calendar of Events

Some events are tentative. **PLEASE CALL AHEAD TO ENSURE AN EVENT IS TAKING PLACE.** All chapter event information can be found on our chapter's website, www.eaa538.org.

Our **monthly chapter meetings** are held on the second Tuesday of each month. Project meetings and potlucks will be held, occasionally, in addition to the monthly meeting.

NOTE: The Static Line will be published on the first Tuesday of each month. Email reminders will be sent to all members. Those without email, and those who have requested, will be mailed a paper copy of the newsletter.

August 2007

14: Phoenix, AZ – **Chapter Meeting**, 7:00 pm, Deer Valley Airport (DVT), **Program Topic: Oshkosh Report/Discussion.**

17-19: Independence, OR – RV Fly In / Van's Aircraft Homecoming, Independence State Airport (7S5). Information: www.eaa292.org/RVflyin.

25: Big Bear City, CA – Wings over Big Bear Air Fair 2007, Big Bear Airport (L35). Information: www.bigbearcityairport.com

28: The Static Line submission **DEADLINE** for September issue.

September 2007

11: Phoenix, AZ – **Chapter Meeting**, 7:00 pm, Deer Valley Airport (DVT), **Program Topic: DVT Tower/Class B Airspace Status.**

28: The Static Line submission **DEADLINE** for October issue.

October 2007

9: Phoenix, AZ – **Chapter Meeting**, 7:00 pm, Deer Valley Airport (DVT), **Nominating Committee Report & FAA Medicals.**

20: Glendale, AZ – **Young Eagles**, Glendale Airport (GEU), 8:00 am.

25-28: Casa Grande, AZ – Copperstate Regional EAA Fly In, Casa Grande Airport (KCGZ), Thursday-Saturday, 8-5, Sunday 8-3. Information: www.copperstate.org

30: The Static Line submission **DEADLINE** for November issue.

Monthly Chapter Meeting Program Topics for the remainder of 2007:

September	DVT Tower/Class B Airspace Status
October	Nominating Committee Report & FAA Medicals
November	Election of 2008 Officers & Copperstate Report/Formation Flying
December	Members' Project Overviews

NOTE: There will also be a potluck on Saturday, December 8, 2007.

Volunteer Needed – Newsletter Editor

After serving as the editor for the chapter's newsletter for a bit more than seven (7) years, I will be stepping down at the end of this year. If you are able to use Microsoft Word (or any other Word processing or publishing software), please consider volunteering for this job. Please contact me or Don Ridder if you would be interested in or have questions about this position.

THANKS! Tina C.

About AHRS, gyros, strapdown systems, attitude and "how good?"

submitted by Tom Velvick, posted by: "rainier_lamers" rainier@MGLAvionics.co.za, Thu May 17, 2007

Having cut my teeth, pulled my hair and banged my head hard on what is now 6 generations of AHRS design, I think I am qualified to write a badly needed explanation as to exactly what you are buying.

Looking through other manufacturers manuals, this topic barely gets a mention. Perhaps for good reason. There is the perception that a certified AHRS is better than a non-certified unit. Let me set the record straight. Certifications means very little. It has nothing to do with reliability. Life is not that simple. TSO-C4c. That is the certification standard for a "bank and pitch" information system. Most of the requirements are surprisingly low (3 degrees error after a 180 degree rate one turn for example). Some are a bit more difficult (plugoid test). The SP-4 comfortably fulfills the requirements. Would you feel better if we submit the SP-4 for certification which means we have to freeze the design (the last thing we want to do), the cost to you would be around three times the current value (certification, being a largely bureaucratic procedure) is very expensive. Should we submit the software in the unit to DO-178 certification? It does not even properly cater for what we are doing...Yes; we will have to do all of that if we want to have these things installed as primary systems in certified aircraft. We don't have the money, manpower or patience to go this route.

Right, with this out the way, lets have a closer look as to how a modern "strapdown" AHRS works. You have three gyros. Each of these gyros can measure the rate of rotation around a single axis. The gyros are mounted perpendicular to each other so you can measure rotation rates around the three main axis. You add three accelerometers in similar fashion. These can measure the absolute rate of acceleration in each axis, including Earths gravity. Gyros and accelerometers come in various flavors. From expensive optical gyros (usually fiber-optic ring gyros) down to the outright nasty vibrating ceramic gyros used in remote controlled helicopters to stabilize yaw. The trouble with gyros and accelerometers is that they produce errors. Lots of errors. The more expensive the sensor, the lower the errors. The other trouble is the cheaper the aircraft, the worse a platform it gets for an AHRS as it likely has little mass and moves a lot as a result in directions other than its intended flight path (turbulence). So as we go for cheaper gyros, we get more measurement errors AND we get cheaper aircraft with much more critical movements to measure. Not a good combination at all.

It may surprise you, but taking an expensive AHRS out of a 747 and dumping it into your ultralight aircraft will give you a very badly performing system.

A 747 is an ideal platform. Nice, smooth movements. Money is no object so we use a \$100.000 AHRS. Works perfectly. On the little trike we use gyros in the \$30-\$40 range. Much worse performance and a lively little aircraft when flying through midday thermals. Can it get any worse? This is where the black art of AHRS comes in. At some point the text books help no more (they assume perfect gyros and stable platforms). Now it is down to plain magic, blood sweat and tears. Your software must become "intelligent". Errors must be carefully measured during manufacturing and compensated for. Filtering, signal interpretation and a whole lot of hardwired, yet flexible "judgment" needs to be incorporated, eventually resulting in a system that, despite being low cost can perform rather well. Remember, that little box of tricks needs to precisely measure every little movement of your aircraft, right down to vibration caused by the engine in order to calculate exactly how your attitude has changed relative to the last time it had a look.

This now brings us to the grand final question - how good? The disappointing answer is that all AHRS systems are flawed. Even the very expensive ones. A good AHRS will allow you to track the horizon to near perfection in a straight and level attitude while being subjected to moderate turbulence. Once you are in a continuous maneuver other than a stable one (i.e. you are throwing the aircraft around a bit), errors are bounded by time and dynamics (i.e. just what you are busy doing). Eventually, even the very best system will have to give up - just a matter of time. With the SP-4, I can fly a 360 rate one turn (two minutes) and when straightening out, the horizon will be perfect. I can throw the aircraft around the sky for a minute or so in extreme attitudes and when pulling straight the horizon will be perfect. That is how good it is. If I were to throw the aircraft around the sky in such a way that the SP-4 has no opportunity to correct for any errors and I give it as much rotation in any possible axis that I can throw at it, small errors will start showing after a minute or so, gradually getting bigger until you would have an incorrect horizon display that you can't live with. Once you give the SP-4 half a chance to re-acquire the general direction of the planet, the errors are quickly fixed (or simply press the "level" button on the instrument).

So, the SP-4 in its current form is rather good. It's perhaps as close to perfection as you can get considering the amount of your dollars that you have put into it.

Of course the SP-4 is not the absolute best system possible. That would require more of those little green pieces of paper humans are so fond of. This is why we have done the SP-5 which is now waiting in the wings for start of production. It's not a replacement for the SP-4, which would be silly - the SP-4 is just fine for most applications. The SP-5 is aimed at the more "up-market" installations that can afford the cost of MEMS ring gyros designed by BAe (former British Aerospace). These are very good gyros and the cost of the SP-5, as you would expect from us, will not be liked by our competition, but it is significantly more than you would pay for a SP-4, unfortunately. So, there you have it. I think a more open and honest generalized view on the current state-of-the-art AHRS you will not find anytime soon.

Rainier

Bits & Pieces

submitted by Tom Velvick

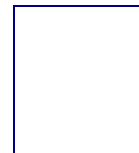


1/2 acre lots are for sale on new airpark on 21 mile long Lake Palestine near Tyler Texas <http://www.aeroestatesairpark.com> Check it out!

Here is a rainbow that happened last month at Deer Valley.

NTSB report on RV-6a flip-overs just released. http://www.nts.gov/publictn/2006/RV_Photos.pdf

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ADDRESS CORRECTION REQUESTED



Roy Castle EAA
Chapter 538

Next Chapter Meeting: The Usual Time & Place

Tuesday, August 14, 2007

Time: 7:00 pm

Program: Oshkosh Report/Discussion

Our chapter meetings are held Pan Am Classroom "A". Pan Am has 3 buildings; the classrooms are located in the one-story building East of their hanger building. From the parking lot go through the fence gate just north of the hanger building to the southeast building.

The airport is located at the intersection of Deer Valley Road and 7th Avenue in Phoenix, AZ.

REMINDER: No Summer Hiatus! We will have regular chapter meetings throughout the summer. See you on August 14th.

Mark Your Calendar: Next Young Eagles Event is October 20th