experimental aircraft association

THE LEADING EDGE

NEWSLETTER OF MUROC EAA CHAPTER 1000

Voted to Top Ten Newsletters, 1997, 1998 McKillop Award Competition

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http://www.eaa1000.av.org *September 2012*

Chapter 1000 meets monthly on the third Tuesday of the month in the USAF Test Pilot School Scobee Auditorium, Edwards AFB, CA at 1700 or 5:00 PM, whichever you prefer. Any changes of meeting venue will be announced in the newsletter. Offer void where prohibited. Your mileage may vary. Open to military and civilian alike.

This Month's Meeting:

The AirVenture Report

Tuesday, 18 September 2012
1700 hrs (5:00 PM Civilian Time)
USAF Test Pilot School Auditorium
Edwards AFB, CA

Just when you thought it was safe to go back to the auditorium...It's the annual postmortem technical report out brief of the Pilgrimage to Oshkosh. You'll laugh, you'll cry, you'll ask yourself, "How many more slides until we go to Burger King?" That's right, colleagues. It's **Death by PowerPoint**®. The good news for you is that only **Doug "Opie" Dodson** (and possibly **Gail**) will be speaking. You won't have to suffer through **Erbman's** never-ending Powerpoint gymnastics (that's next year). So, come join us. Listen with rapt attention as **Opie** mesmerizes you with tall tales of aviation exploits.

We'll do something it seems like we haven't done in the longest time—we'll meet at the Test Pilot School for soft drinks and C^3s. Then, we will proceed in an orderly fashion into the auditorium. Dinner at the **BK Dead Cow Emporium** to follow after the presentation. See you there.

- Erbman
For the non-existent **Vice Kommandant**

Last Month's Meeting

EAA Chapter 1000
City of Lancaster Skybox, Clearchannel Stadium
Lancaster, CA
21 August 2012
Gary Aldrich, Presiding

The August meeting was held at the City of Lancaster Skybox at JetHawk Stadium, courtesy of **Mrs. Kommandant** and her shady political connections. Sixteen members, spousal units and guests were in attendance, including one of our favorites, cool dude **Mike Machat**, to see our beloved **JetHawks** give a thorough drubbing to the visiting **Rancho Cucamonga Quakes** and their team of ruffians and assassins. We also welcomed new member **J. P. Kury** into the fold.

Situated high behind home plate in the air-conditioned VIP luxury suites, also known as "**Foul Ball Alley**", our suite certainly lived up to its name when in the bottom of the third, a Quake assassin fouled a power-ball our way, narrowly missing us and shattering the glass wall behind us. Those familiar with this column and our annual visits to the stadium will recall previous reports of jet-propelled fouls landing in our vicinity, but this is the first occasion of physical damage. Death was narrowly averted due to our high state of situation awareness, physical fitness and agility. We quickly pointed out to JP how astute he was in electing to join Chapter 1000 in that he would never get this kind of action with nearby Chapter 49.

Shortly after this near fiasco, another Quake assassin attempted to take out the JetHawk pitcher with a power line drive in his direction. He, too, narrowly escaped certain death from the Ninja/Quakes, only to exact a fearsome revenge with a 13-6 win.

The JetHawks are in the middle of an impressive run, winning the first two games (14-11 and 13-6) of a four-game series with the Quakes. The JetHawks won their third in a row to tie Lake Elsinore for second place in the South Division and move three games up in the battle for a playoff spot.

Kommandant and **Mrs. Kommandant, Erbman**, **Tuki**, **Opie**, and **Gail** stuck it out to the final inning, savoring the victory and cursing the name of those who left early.

Opie looks through the hole resulting from the Jet(Hawk)-propelled baseball. As expected, George "Ball Magnet" Gennuso was sitting in seat 1 and Nina "Red Shirt" Troxel was sitting in seat 2. "Cobra" Troxel knew enough to not sit next to "Ball Magnet". Fortunately, "Ball Magnet" and "Red Shirt" leaned away from the ball as it whizzed by. "Ball Magnet" claims he felt the wind of the ball going by.

Opie and Knife on the other side of the entrance wound. The geeks in the group calculated that the ball trajectory could never be repeated, as the probability of clearing the foul net by one to two inches AND clearing the seats by one to two inches was so small as to not be reasonable to repeat. Any higher and the ball would have hit the clear glass above which has been shown to be foul ball resistant. Therefore, the Skybox has been declared pre-disastered.

A small part of the glass shrapnel resulting from the hole. Apparently this has happened before, as the staff showed up with a pre-cut and painted board that perfectly covered the window.

Everybody needs a trade

KaBoom drops by to see what all of the hubbub is about

KaBoom checks in with the Kommandant. Note that Cobra has gallantly changed places with Nina, putting himself in the line of fire. That, or he believes that "Lightning never strikes twice" thing

Knife poses with the spoils of war

Most, if indeed not all of this is true.

- Kent "Cobra" Troxel
Minister of Propaganda

Kommandant's Korner

With the "unofficial" end of summer occurring last weekend it's time to start thinking about the fine flying weather we have to look forward to in the fall. There are always a few spectacular days in the spring and fall here in the Antelope Valley that make visitors wonder why everyone doesn't live here. Of course, long-time residents know better…that those days of mild temperatures and light winds give way to more extreme atmospherics around Thanksgiving time. But that doesn't stop us from exploiting the opportunity to exercise the ol' air machine when those in colder climes are putting theirs away for the "season".

Mrs. Kommandant and I…and, I think the **Troxels** and **Erbs** will be hoping for some of those beautiful days when we descend on the annual AOPA Aviation Summit. This year it is, again, on the "left" coast in the resort location of Palm Springs. **Anne** and I have attended this event a few times in Palm Springs and have always thoroughly enjoyed the adventure. The PSP venue affords the opportunity to witness a "Parade of Planes" down the city streets as the aircraft manufacturers move their newest and nicest products, under their own power, from the airport to the Palm Springs Convention Center. This usually happens pretty early in the morning, so if you want to see this event it calls for an early arrival at PSP. For those who may have missed AirVenture and are craving the latest and greatest aviation gadgetry, the Exhibit Hall will be the place to see. It has traditionally been crammed with all kinds of neat stuff to buy, try, or just look at. And, for the spouse or companion without terminal **gadgetosis**, there is always a smattering of exhibitors with jewelry, clothing, or other semi-aviation related wares.

Like many such gatherings, there is also a plethora of seminars and guest speakers on a myriad of topics from medical issues to aircraft ownership to "how to use your iPad in flight". Noted aviation humorist and high-time CFI, **Rod Machado** is always in attendance to give his slightly wacky talks on serious flying subjects. It's a great way to learn while being entertained…without the need for a cover charge or surly waitress to deal with. For "co-pilots" and significant others AOPA will present their award-winning seminar called the "Pinch-hitter" Course. This great talk, given several times throughout the 3 day event is aimed at making non-flying partners more comfortable and confident in the airborne environment. It comes highly recommended by **Mrs. Kommandant**, as well!

Don't forget, when you've had your fill of airplanes and wingnuts, you are still in a great resort city. On

Thursday night, Palm Springs runs a really neat street fair/farmers' market/nightlife-happnin'-place that's an easy walk in the balmy evening air from most all the hotels in town. Finally, the Summit is a great excuse to get a great "aviation fix" before the nastier winds and temps arrive in the winter. Oh, yeah, it's **October 11-13**. Check it out at: http://www.aopa.org/summit/. You don't need to be an AOPA member to attend (though you should be one already!)

After your great weekend adventure in Palm Springs, we will continue the aviation "high" with a special program for the October Chapter Gathering. I have arranged (with the help of ***PP*** **Trooper Hellmuth Steinlin**) for an entertaining presentation on the history of the **Laird Aircraft Company** by none other than the grandson of the founder "**Matty**" **Laird**. If you are unfamiliar with these early high performance aircraft, google-up "**Laird Super Solution**". We have one member of the chapter whose granddad thought very highly of that aircraft. Make sure you put a reminder in your smartphone not to miss this exciting meeting! I'll be plugging it again next month. Until then…

Fly Safe and Check 6!

- Gary Aldrich
Kommanding

Bearhawk Tail Wire Analysis

Have you ever met someone with "just enough knowledge to be dangerous"? They have just a little knowledge and use that knowledge to make decisions for reasons that may or may not be valid due to other factors not considered.

The case for discussion in this article concerns the wires connecting the Bearhawk horizontal tail to the vertical fin and fuselage. The horizontal tails are not cantilevered from the fuselage, but are held in position by bracing wires along with streamlined struts on the leading edge.

Recently someone distributed to the Bearhawk list a YouTube link (http://www.youtube.com/watch?v=ftq8jTQ8ANE) to a classic movie that you may have watched in science class. This movie "How To Reduce Drag" was produced by The Physical Science Study Committee and was presented by Ascher H. Shapiro, a very well-known Professor of Mechanical Engineering at Massachusetts Institute of Technology. In this movie Professor Shapiro demonstrates that a cylinder has 10 times the drag of an airfoil shape with a thickness equal to the diameter of the cylinder. This is certainly true…for a particular Reynolds Number range.

Based on this information, many builders would be led to believe that any round cross section exposed to the airflow is slowing their airplane down by at least 10 or 20 knots. This belief has led to a business manufacturing stainless steel streamlined flying wires. Not a huge business, as there were only two companies producing them, and only one of those companies is still in production. Recent information states that a company in New Zealand is starting to produce these wires. A lot of these wires were used for flying and landing wires on biplanes and some monoplanes such as the PT-22 and the Gee Bee racers. Of significance is that these airplanes had a large amount of these wires.

It has been a foregone conclusion for many Bearhawkers that using streamlined wires on the tail was necessary to get cruise speeds that wouldn't be too embarrassing when talking to the RV crowd. The fly in the ointment is that these streamline wires aren't cheap—a current quote is $812.08 for a complete set. Compare that to my wires which were made from 1/4 inch 4130 rod, currently selling for $15.47 total in the Aircraft Spruce catalog, or about 2 percent the cost.

About 10 years ago when I had to make a decision about tail wires, I decided to go with the 2% cost solution, figuring I could always change to streamline wires in the future. This also avoided the risk of ordering the expensive wires to the wrong length before I had built the tail.

Now that I've been building fairings for all of the other high drag areas on the airplane, I started to wonder if I should change to the streamline wires on the tail. After getting no noticeable speed increase from the wing strut

fairings and only about five knots from the wheel pants, I looked at the frontal area of the tail wires and started wondering how much change in cruise airspeed I could expect to get from changing to streamline wires.

Cruise Drag Estimation

While flying to and from Oshkosh in 2011 I recorded a bunch of cruise data. After all, what else is a career Flight Test Engineer going to do while sitting for several hours watching the autopilot fly? Here are the data from one cruise point:

Pressure Altitude (H_c)	6145 feet
Indicated Airspeed (V_i)	110 KIAS
Manifold Pressure	22.7 in Hg
RPM	2390
Outside Air Temperature (T_a)	64 F
Gross Weight (W)	2338 lbs

From the Bearhawk specification sheet

Wing Area (S)	180 sq ft

From the Lycoming engine chart and my propeller model

Brake Horsepower	176.3 BHP
Propeller Efficiency (η_p)	0.8221

From the definition of the Standard Atmosphere (you could use a standard atmosphere table too) we find the pressure ratio

$$\delta = \left(1 - 6.87559\,x10^{-6} H_c\right)^{5.2559}$$

$$\delta = 0.797007$$

The temperature ratio

$$\theta = \frac{T_a}{T_{sl}}$$

$$\theta = \frac{(64 + 460)R}{519R}$$

$$\theta = 1.009634$$

Now we can find the density ratio and density

$$\sigma = \frac{\delta}{\theta}$$

$$\sigma = 0.789402$$

$$\rho = \sigma\rho_{sl}$$

$$\rho = (0.789402)(0.0023769) = 0.001876 \text{ slug/ft}^3$$

Now we can calculate the true airspeed (assuming no position error and that equivalent airspeed equals calibrated airspeed)

$$V_t = \frac{V_e}{\sqrt{\sigma}}$$

$$V_t = 123.8 \text{ KTAS} = 209 \text{ ft/sec}$$

From the engine data we find thrust horsepower

$$THP = \eta_p BHP$$

$$THP = 144.94 \text{ HP}$$

from which we can find thrust and therefore drag

$$T = \frac{THP(550\,ft - lb/sec - HP)}{V_t}$$

$$D = T = 381.5 \text{ lbs}$$

Tail Wire Drag Estimation

Now that we know what the drag on the entire airframe is, we'll estimate the drag caused by the round tail wires themselves.

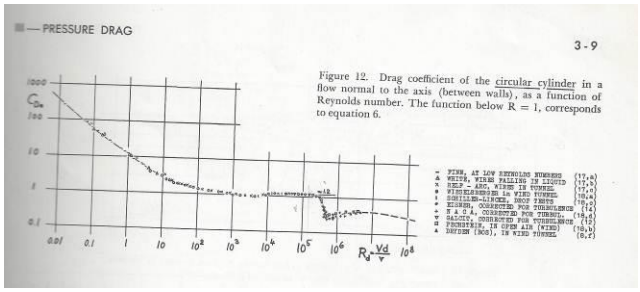
We need to be careful picking a drag coefficient for the tail wires because the characteristic length of the wires, in this case the diameter, is very different from the characteristic length of the airplane (the wing chord). Therefore, the wires are operating at a much lower Reynolds Number than the rest of the airplane. Since I have a value for viscosity at sea level, we'll calculate the Reynolds Number for the same true airspeed at sea level. It will be close enough. For 1/4 inch diameter tail wires

$$Re = \frac{\rho V_t x}{\mu}$$

$$Re = \frac{\left(0.0023769\,slug/ft^3\right)\left(209\,ft/sec\right)\left(\frac{1/4in}{12in/ft}\right)}{3.7373x10^{-7}\,slug/ft - sec}$$

$$Re = 27{,}693$$

According to the classic reference *Fluid Dynamic Drag* by Hoerner, page 3-9 figure 12 (shown below), the drag coefficient for a cylinder at this Reynolds Number is 1.0 based on the frontal area.



But is this the right drag coefficient to use? Notice on the Hoerner's curve in figure 12 that at a Reynolds number of about 30,000 (*actually it's 300,000—oops)*(remember it is a logarithmic scale) there is a drastic reduction in drag coefficient at what is called the Critical Reynolds number. After the Critical Reynolds number the drag coefficient has a value of 0.3. These are wind tunnel data and are in very low turbulence air flow.

On page 3-8, Hoerner states that the Critical Reynolds number will vary based on the level of turbulence in the air flow. The tail wires are in the propeller slipstream, and we can assume there is nothing "low-turbulence" about the slipstream. Therefore, the drag coefficient is probably closer to 0.3, but we'll investigate the results at both values.

For the tail wires

Width	1/4 inch
Total Length	151 inches
Tail Wire Frontal Area	37.75 sq in
	0.2621 sq ft

So the drag of the tail wires is estimated at

$$D = C_D \frac{\rho V_t^2}{2} S$$

$$D = (1)\frac{(0.001876)(209)^2}{2}(0.2621)$$

D = 10.74 lbs (laminar)

D = 3.22 lbs (turbulent)

Wow…that's not a whole lot…

Estimating Potential Speed Increase

To estimate the potential speed increase of going to streamline tail wires, we will simply assume that the streamline tail wires will have zero drag. This will give us an upper limit to the speed increase that we can expect.

For the laminar flow case, we subtract the drag of the tail wires from the overall drag of the airplane

D = 381.5 - 10.74 = 370.7 lbs (laminar)

At the original flight condition, the drag coefficient with no tail wires would be

$$C_D = \frac{2D}{\rho V_t^2 S}$$

$$C_D = \frac{2(370.7)}{(0.001876)(209)^2(180)}$$

$C_D = 0.0502$

With this new drag coefficient, we solve for the airspeed that the drag would equal the thrust of 381.5 pounds.

$$V_t = \sqrt{\frac{2T}{\rho C_D S}}$$

$$V_t = \sqrt{\frac{2(381.5)}{(0.001876)(0.0502)180}}$$

V_t = 212 ft/sec = 125.6 knots

Wow! So I could spend $812.08 on new fancy streamline tail wires and at most I would gain…a whole 1.8 knots. Hmmm, not so good. If we assume that the flow over the tail wires is turbulent (a reasonable assumption since it is in the propeller slipstream), the maximum expected gain goes down to 0.5 knots. That's the bad news. The worse news is that you will never be able to measure that much of a change.

Conclusion

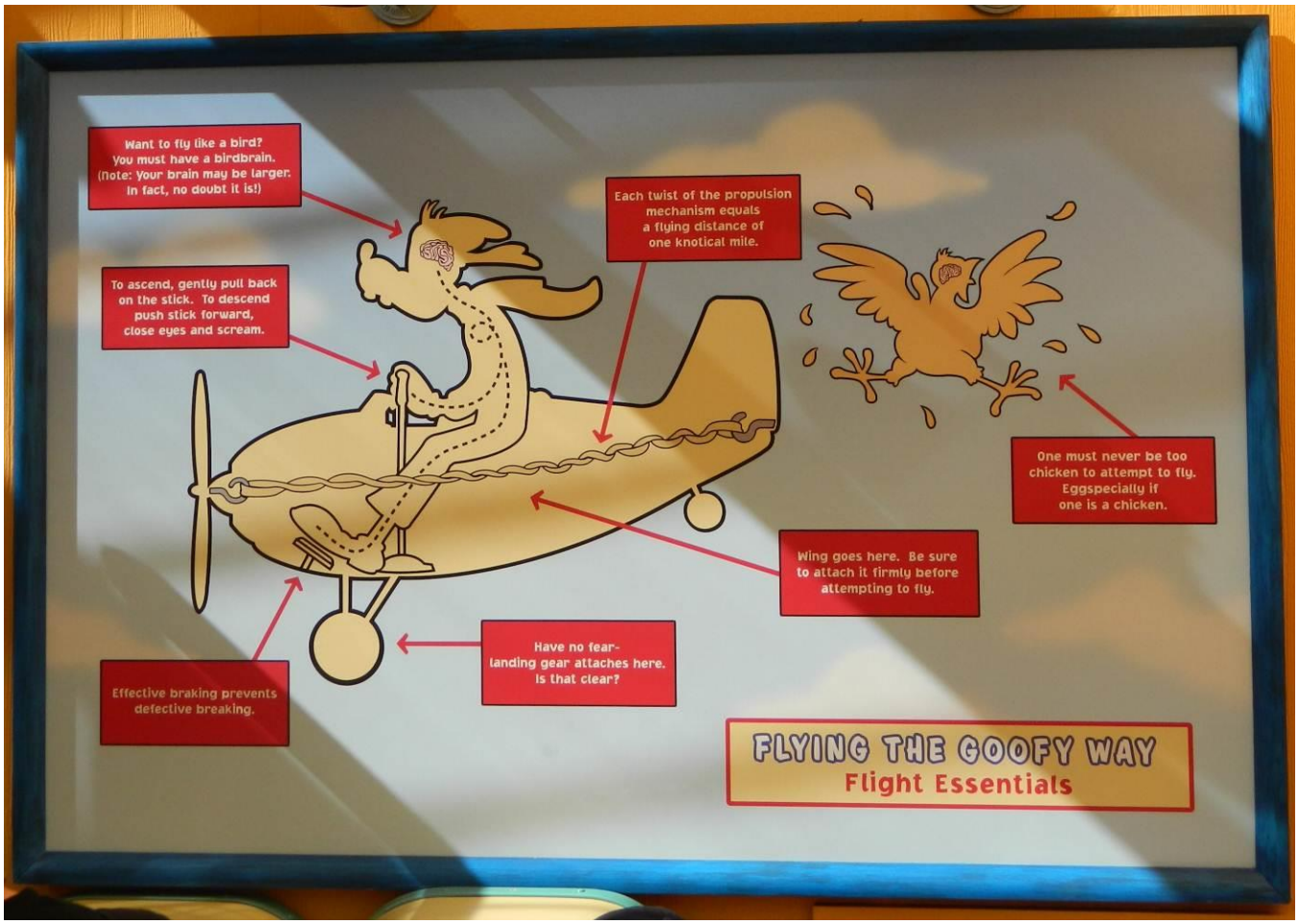
In my opinion, spending over $800 to net an immeasurable increase of airspeed does not make good economic sense. I won't be changing my round tail wires. The only possible reason I think I would accept for using streamline tail wires is because the builder likes the way they look and is willing to pay for that. After all, one of the joys of building your own aircraft is that you can make it look just like you want it to.

- Russ Erb

Goofy's Sky School

Learn To Fly The Goofy Way

One of the recurring themes in the magazines of all of the so-called aviation alphabet groups (including EAA and AOPA) has been the pilot shortage. Part of the problem with traditional flight school programs is the length of time required



to complete the training. In Anaheim CA, a flight instructor of dubious qualifications has opened a new flight school using a nontraditional training paradigm.

Goofy's Sky School has been opened on Paradise Pier in Disney's California Adventure. The new training regimen is based on the old "Mulholland Madness" roller coaster paradigm. The training consists initially of practice queuing up for up to two hours. During this time, students are invited to read various signs explaining the various fundamentals of flight. This is roughly equivalent to traditional ground school and just about as painful. This is then followed by a rapid fire "crash" course in flying utilizing "wild mouse" style maneuvering. Students graduate after logging about 1.5 minutes of flight time with 1 takeoff and 1 landing.

For further insights into the new training paradigm, search YouTube for "Goofy's Glider". The rumor that Goofy's glider instructor was **Gary Aldrich** cannot be proven.

Web Site Update

Just a reminder that the EAA Chapter 1000 Web Site is hosted courtesy of Quantum Networking Solutions, Inc. You can find out more about Qnet at http://www.qnet.com or at 661-538-2028.

Chapter 1000 Calendar

Sep 15: EAA Chapter One Open House. Flabob International Airport (KRIR). http://www.eaach1.org/

Sep 18: EAA Chapter 1000 Monthly Meeting, 5:00 p.m., Edwards AFB. USAF Test Pilot School, Scobee Auditorium. (661) 609-0942

Sep 27-30: Flabob Flying Circus, Antique Aircraft Fly-In. Flabob International Airport (KRIR). http://www.flabobflyingcircus.com/

Oct 9: EAA Chapter 1000 Board of Directors Meeting, 5:00 p.m., High Cay, 4431 Knox Ave, Rosamond CA. (661) 609-0942

Oct 16: EAA Chapter 1000 Monthly Meeting, 5:00 p.m., Edwards AFB. USAF Test Pilot School, Scobee Auditorium. (661) 609-0942

Nov 10: Veterans Day Celebration. Flabob International Airport (KRIR). http://www.flabob.org

Nov 13: EAA Chapter 1000 Board of Directors Meeting, 5:00 p.m., High Cay, 4431 Knox Ave, Rosamond CA. (661) 609-0942

Nov 27: EAA Chapter 1000 Monthly Meeting, 6:30 p.m., Edwards AFB. USAF Test Pilot School, Scobee Auditorium. (661) 609-0942

Dec 11: ~~EAA Chapter 1000 Board of Directors Meeting, 5:00 p.m., High Cay, 4431 Knox Ave, Rosamond CA. (661) 609-0942~~ Cancelled

Dec 11: EAA Chapter 1000 Festivus Etc Celebration, 6:00 p.m., Kommandant's Kwarters. Quartz Hill CA. (661) 609-0942

Jan 8: EAA Chapter 1000 Board of Directors Meeting, 5:00 p.m., High Cay, 4431 Knox Ave, Rosamond CA. (661) 609-0942

Jan 15: EAA Chapter 1000 Monthly Meeting, 5:00 p.m., Edwards AFB. USAF Test Pilot School, Scobee Auditorium. (661) 609-0942

Feb 12: EAA Chapter 1000 Board of Directors Meeting, 5:00 p.m., High Cay, 4431 Knox Ave, Rosamond CA. (661) 609-0942

Feb 19: EAA Chapter 1000 Monthly Meeting, 5:00 p.m., Edwards AFB. USAF Test Pilot School, Scobee Auditorium. (661) 609-0942

To join Chapter 1000, send your name, address, EAA number, and $20 dues to: EAA Chapter 1000, Doug Dodson, 4431 Knox Ave, Rosamond CA 93560-6428. Membership in National EAA ($40, 1-800-843-3612) is required.

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Inputs for the newsletter or any comments can be sent to Russ Erb, 661-256-3806, by e-mail to erbman@pobox.com

*From the **Project Police** legal section: As you probably suspected, contents of The Leading Edge are the viewpoints of the authors. No claim is made and no liability is assumed, expressed or implied as to the technical accuracy or safety of the material presented. The viewpoints expressed are not necessarily those of Chapter 1000 or the Experimental Aircraft Association. **Project Police** reports are printed as they are received, with no attempt made to determine if they contain the minimum daily allowance of truth. So there!*

THE LEADING EDGE
MUROC EAA CHAPTER 1000 NEWSLETTER
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Rosamond CA 93560-7692
http://www.eaa1000.av.org

ADDRESS SERVICE REQUESTED

THIS MONTH'S HIGHLIGHTS:
MONTHLY MEETING 18 SEP @ TPS
PPOs ATTACKED BY WAYWARD BASEBALL
AOPA SUMMIT SALES PITCH
TAIL WIRE DRAG ANALYSIS

EAA™
THE SPIRIT OF AVIATION