

# 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>

December 1998

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:



### Weather Safety Seminar AOPA "Seminar In A Box" Series Tuesday, 15 December 1998 1700 hrs (5:00 PM Civilian Time) USAF Test Pilot School Auditorium Edwards AFB, CA

Well, this month we have something way different in store for you. Ok, here it comes, a big curve ball, sports fans. This month we have "Seminar in a Box"! Yes, you heard me right, it's a seminar in a box.... Actually, it is a safety seminar from AOPA. I requested it, and they sent it. What I actually found in the box was pretty complete. There is a hand out on weather flying along with a videotape that provides the weather situation. We watch the tape, follow along, and see if we can spot the mistakes that the pilot in the video makes and offer suggestions for improving the procedures. The tape we have is from the *Never Again* series. It is taken from the *Never Again* column in AOPA magazine. The tape is stopped several times during the presentation for discussions on decisions made in the video and how they influenced the situation. They even include door prizes and some AOPA propaganda (flyers to join AOPA). So that's about it, everybody show up, this is going to be an interesting meeting (if we can pull off the technical stuff, you know, start the VCR, stop the VCR etc.). Lots of good food, friends and airplane talk.

- George Gennuso

### Chapter Leadership Workshop

Early in January, your National EAA Chapter Office is continuing its effort to get out and meet the members and pass along pointers on running a chapter. Our area has been chosen to have the first **Chapter Leadership Workshop** of the year, hosted by our friends in Chapter 14 in **San Diego**. It will be held on Gillespie Field (SEE) from 0930 to 1700. **Bob Mackey** and his minions will be springing for breakfast and lunch.

We'll be taking the *Project Police Paddywagon* down. Despite the name, this workshop is open to all EAA members, not just the elected officers. So if you'd like to go, you'll need to:

1. Let the Chapter office know that you're planning to attend and what chapter you are affiliated with. E-mail them at [chapters@eaa.org](mailto:chapters@eaa.org) or call them at 800-236-4800, ext. 4876.
2. If you desire to join us and the party in the Project Police Paddywagon, contact me at [erbman@compuserve.com](mailto:erbman@compuserve.com) or by phone at 805-258-6335. I'd like to know you are going even if you will get there by some other means. We'll work out the details of where to be when later.

### Last Month's Meeting

#### EAA Chapter 1000

BK Lounge, Edwards AFB  
Scobee Auditorium, Test Pilot School, Edwards AFB  
1200, 21 November, 1998  
Gary Aldrich, Presiding

This meeting was held at a non-standard time (on Saturday) in an effort to attract the attendance of members who could not normally attend the Tuesday afternoon meetings. Transportation was provided from Rosamond Skypark for those who flew in. Alas, other than our guest speakers, none did. If you'd like to attend the meetings but can't make it on Tuesdays, you're going to have to give your own suggestion to the board.

## Beforemath

As part of the experimental meeting rearrangement, the usual post-meeting imbibing at the *PPHFFRC* "BK Lounge" was held prior to the meeting at 1200. Good times and good food were had by all. Having had all of this fun that we could stand, we temporarily adjourned to reconvene at TPS.

## TPS Orientation

As Scobee Auditorium was being set up for the meeting, Prezident **Aldrich** took our guest speakers and other assembled members on a walking tour of TPS. Not only did they get to see really old pictures of current and retired astronauts and many chapter members, they also now know why the MOL room is called the MOL room. No, it's not because that's where we keep the students in the dark and feed them s...uh...well, that's just not why.

## Announcements

Ballots for chapter elections were passed out to and collected from the assembled masses. These were handled by the Prezident and Newsletter Editor and eventually passed to the Secretary, who was not present due to some weekend forced labor requirement impressed upon him by those who pay him a living wage. Other ballots were received by Secretary via the US Postal Service and their helpful forwarding service. Elections were closed out 1 December 1998. The results will be announced at the December meeting, although I seriously doubt there will be any big surprises.

Way cool EAA Chapter 1000 Patches (with the "steenk" removed) are once again available. **Gary Aldrich** will be happy to trade you one for a fiver.

**Bernie Bakken** displayed sample *Project Police* uniform shirts from a different supplier, including the proposed summer uniform, which is the negative of our current shirt (i.e. black letters on a yellow shirt).

In light of this, a call went out for a brief description of the *Project Police* for our new members and guests. **Russ Erb** rose to the task, and launched into a humorous, though not very brief, description of the history of the *Project Police*. If you still want to find out, read about it on the Chapter 1000 Web Site.

## Visitors

**Pete Freeland** came to join the chapter. Read more about him later in the New Members section.

## Minutes

Nobody mentioned the minutes of the last meeting, so unless somebody complains, according to Bob's Rules of Order, the minutes as published in the newsletter are approved as typed.

## Flight Advisor Report

Chapter Flight Advisor **Norm Howell** showed a pushrod pulled from the Flight Control System of a previously flying airplane. The holes for the bolts to hold the rod ends in had either been drilled very poorly or had worked in service to be much larger than the bolt. Everyone agreed that it was not airworthy. Norm also

showed the replacement that he had built which was very nicely done. Norm has threatened to put together a newsletter article describing the techniques for doing this sort of thing correctly. Remember, in Flight Control Systems, the goal is zero friction and zero slop.

## The Main Event

Our program was presented by **Cary Glieman** and **Rodger Larue**. Cary is the producer for the syndicated TV show *Air America* (KCAL on Sundays). Roger is his chief pilot and occasionally appears in the show.

The show is set in Costa Perdita, which looks a lot like Costa Rica. Lorenzo Lamas stars as a government agent working under cover (sort of a DEA thing). He and his sidekick spend their time that they're not fighting baddies running a little airline called "Air America." Their primary aircraft is an Aero Commander, similar to Bob Hoover's famous airshow mount. They are also seen to fly a Bell Jet Ranger occasionally. Most of the action takes place around a hotel that was built by some rich American who sent his daughter to run the place, mostly to get her out of his hair.

A small amount of filming was done in Costa Rica, but most of it is done around Camarillo and in the studio.

The show is built around two of Cary's favorite activities, karate and flying. Cary said that early on, the budget folks would come to meetings trying to reduce the cost of the show, and the first thing they would do was to throw out the flying scenes. Cary would then have to stick them back in. He said that early in the series, it got to where there was little flying at all (The one episode I've seen so far must have been early in the series...lots of fighting, not much flying...). Eventually the customers, especially the German market, started to complain, and later shows have much more aerial action.

Roger told us that he went to acting school thinking it would be a good way to meet girls. Much to his surprise, one day he found out that he had become an actor! Also an accomplished pilot, he serves multiple jobs on the crew. He flies at both ends of the camera, both in the on-camera aircraft and in the camera aircraft (though not at the same time usually...). He is also Cary's primary advisor on how to set up shots for the best effect, and, most importantly, how to do it safely. He spoke briefly about the famous gross buffoonery that led to the fatal crash while filming *The Twilight Zone*, what that crew did wrong, and how Cary's crew avoids those mistakes.

## Adjournment

The meeting was adjourned at sometime after it started. If you need more details, check the videotape out from the Chapter Library.

- **Erbman**, Pseudo-Second-String Secretary

## Program Rebuttal

(This e-mail received from our esteemed guest speakers...)

George, Gary and all at EAA CHAPTER 1000:

Rodger and I had a fantastic Saturday with the Chapter 1000. We're honored to be invited into the group. We invite you to plan a fly-in to Camarillo anytime it's convenient for y'all. With the Aero Commander, it took us about twenty minutes.

We'll clear the ramp around Rick Fleck's CAMARILLO AIRCRAFT. The hangar is right next to THE WAY POINT CAFE restaurant--great breakfasts and lunches--specializing in barbecue tri tip sandwiches and, of course, choc cubes.

We hope the meeting was fun and informative for everyone. It was for us. We sure would like a rain check to tour the flight line. The tour of the Test Pilot School was better than going to the academy awards. It was a tour down the hallowed halls of modern day aviation history. You accorded us a true privilege.

Calm winds and fair skies,  
Cary Glieberman  
Mowgliprod@aol.com

## The Prez Sez...

Russ asked me to give you an after-action report on **Operation PROVIDE SCHMOOZE**. If you don't have access to the Internet, or don't choose to surf the chapter site frequently you may have missed hearing of this exciting **Project Police** event.

Early last month (but too late for publication in the November "**Leading Edge**") the chapter **Signals Intelligence Officer** intercepted message traffic from EAA headquarters indicating that **Vice Grand Poobah for Chapter Stuff Bob Mackey** would be travelling out to sunny SOCAL the weekend of 6-8 November. A flurry of activity not seen since Admiral Yamamoto was gunned over the Solomons ensued and an emergency **Project Police** staff meeting was called to deal with this development. Dubbed "**Operation PROVIDE SCHMOOZE**", the objective was to give **PPO Mackey** a first hand look at **Project Police** operations as well as participation in his first raid since being inducted into the elite force at the last **Chapter Leadership Workshop**. The OPLAN was fleshed out to include multiple transportation modes, social and tactical events and general schmoozing.

Execution began with a late night VC-180 sortie crewed by myself and NLE **Erb** to pick up Bob at Hawthorne airport. We elected to avoid LAX since the landing fee would have wiped out the treasury...Anyway, we safely spirited the VIP back to WJF and provided billeting in the **Chief Oshkosh Suite** of the Aldrich VPPOQ.

On Saturday morning the raids began in earnest as **PPO Erb** arrived with the **Project Police Paddywagon**. Arrayed in our **PPTAF** uniforms and picking up **PPO**

**Gennuso** enroute, our first target was **Paul Rosales** and his "almost an airplane" looking RV-6A project. **Paul** and **Victoria** responded with the requisite **C<sup>3</sup>**, and after pronouncing the fitness of the project, the raiding party stole away to WJF again for an airborne assault on Tehachapi.



**Paul and Victoria Rosales' RV-6A**

Arriving at **L94** under threatening skies, we rendezvous'd with **PPO** and Rocket builder **Miles Bowen**.



**Lunching at the Project Police Top Rated HFS Procurement Station, the Raven's Nest at L94**

After a sumptuous lunch at the Raven's Nest (on the **PPO** top ten list of HFS procurement facilities), Bob was strapped into the front of an FFA (fiberglass flying apparatus), aka ASK-21 glider, for a short introduction to the world of silent flight. Despite his claim of inexperience with soaring flight, **PPO Mackey** proved an able glider guider. Proving once again that the OPLAN was simply a plan from which to deviate, we cancelled our intended inspection of Miles' Rocket due to worsening weather and escaped through a shrinking hole for our next destination: Edwards.





**Glider Guiding in the FFA**

Using the world famous Test Pilot School as a FOL, we treated Bob to a "windshield" tour of the Edwards flight line with a side stop to inspect **PPO** Erb's collection of neatly painted Bearhawk innards. Next stop was a short hop to L00 for a barbecue hosted by Flying Snake Ranch residents **Norm Howell, Gretchen Lund, and Bob "Waldo" Waldmiller**. There, after a crosswind landing that took at least a year off all our lives, we jammed the schmooze into high gear with a gaggle of 49/1000 members including **Jon and Tricia Sharp** and the Nemesis team. In short order we consumed, imbibed, schmoozed, and departed by land and air for the final raid target. Officers **Aldrich, Mackey, and Erb** secured the VC-180 at WJF and transferred to the **Paddywagon** for the assault on **PPO Gennuso's** freshly painted Pulsar, which was displayed like a fine jewel under bright lights in Paint Booth #4. Suitably impressed, and by this time pretty beat, we finally retired to our quarters to prepare for the following day's activities.



**Schmoozin' at the FSR**



**Critiquing the Pulsar Painting Progress**

Sunday dawned clear in the desert, but our target lay beneath a low overcast. Proving once again that it's better to be lucky than good, the VC-180 spiraled down through a sucker hole to land at Flabob International Airport. There, the crew (**Aldrich/Erb/Mackey**) was treated to the weird sight of garishly painted buildings with thatched roofs and foreign names. Quickly recognizing the work of a Hollywood film crew, we were relieved to discover the inside of the restaurant still contained the same good ol' grub despite the unusual outer wrapper. Bus drivers Erb and Aldrich performed a walking tour of the film preparations while **PPO** Mackey attended to his real (?) reason for coming to California (and I don't think it was the cheese...). After his business concluded we launched for another scud run...er...I mean...low level egress from the LA basin to recover once again at WJF.

After bedding down the VC-180, the crew moved to the "Way Out Inn" for a delicious dinner and continuing discussion and feedback session on most all of the current EAA topics.

**Operation PROVIDE SCHMOOZE** concluded with a pre-dawn Monday departure from WJF back into the bowels of the basin to drop off a tired, but thoroughly pleased High EAA Official with a new understanding of what it means to associate with the best chapter in the clan! You can see photographic evidence (to prove I didn't make all this stuff up) on the chapter web site. For those of you who helped make the Op such a success, thank you. For the rest, your turn will come. Given the favorable comments from our guest, I would not be surprised to see more visits from Oshkosh!

Have a great holiday season, fly safe and check six!

**- Gary Aldrich**





## Young Eagles Update

Still waiting for the reports of previous successes, but here is some critical information you might want to know: The **12 December 1998 Young Eagles Rally** will be held at **Rosamond Skypark (L00)** from 0900 to 1200. If you really want to go to Fox that day, you can, but you'll miss all of the fun. Your choice.

### Young Eagle Operations:

Dave Webber

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## Drilled Hole Tolerances

Normally we take a drill of the size hole we want, drill a hole, and forget about it; unless the bolt or rivet does not go through the mating part. Normally that is it, but, when is it not?

First let's quote Reference 1:

"Standard Drilled hole Tolerances"

"For holes drilled with a drilling machine using suitable jigs and fixtures, the hole tolerances depend upon the diameter of the hole and increase as the hole diameter increases. The following are standard for general machine work and apply in all cases except where greater or lesser accuracy is required by the design:"

Hole Diameter	Tolerances
.0135 Thru .125	+.004/-.001
.126 Thru .250	+.005/-.001
.251 Thru .500	+.006/-.001
.501 Thru .750	+.008/-.001
.751 Thru 1.000	+.010/-.001
1.001 Thru 2.000	+.012/-.001

These tolerances are generally accepted for rivet holes. That is why when using a hand drill it is good practice to first use small pilot drills for the larger rivets. Sloppy holes do not make for strong rivets.

There are a couple of interesting things in this table, 1) How do you drill a hole smaller than the drill size? and 2) A 2-inch diameter hole?

Remember, these are "twist drills" and not "auger drill bits." Also, these holes are in metal and not wood. To answer the questions:

1) A good twist drill actually has a taper to the shank to prevent galling on the side of the hole which would produce large amounts of heat. When a drill has been sharpened many times and it becomes shorter, it is a smaller diameter.

2) Yes, there are drills that are 2.000 inches in diameter. Not many. They are used in heavy machines and not a hand drill. It is definitely not the flat wood auger drill bits.

The table is pretty standard throughout the aircraft industry. Different manufacturers have a similar table in each of their design manuals. That is why I believe Reference 1 was originally cancelled in October 1973.

The table was originally published in July 1944. Before WWII there was very little consistency in anything between aircraft manufacturers. There were companies developed from Glen L. Martin on the East Coast and Douglas and Boeing on the West Coast. Then there were a lot of "Independents." (That is a story in genealogy and personal influences that should be told some day. Both Bell and McDonnell grew out of Glen L. Martin and had similar design manuals.)

You probably have noticed that Reference 1 is not AN but is AND series. AND is the acronym for Air Force - Navy Aeronautical Design Standard which was part of the Services drafting manual. (Before 1947 it was Army - Navy Design standard.)

### Reference:

1. "Drill Sizes and Drilled Hole Tolerances - Twist," AND 10387, July 1944. Cancelled October 1973

- Lee H. Erb

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## Project Police on the Road: Hanscom AFB Open House

While most of you had the opportunity to attend this year's Edwards AFB Open House, I was doing something similar in the Boston area. True, you may have experienced the world's windiest, dustiest, and rural of airshows, but I was at Hanscom AFB where the world's best flight demonstration team was featured.



The Blue Angels are simply the best. No flight demonstration team in the world flies as tight and low as these guys. Hand-shake distance wing overlaps in precision maneuvers at high speed are impressive. I had not seen the Blue Angels for years and this show brought back the memories of just how good this team is.



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Of course, this is a shameless plug for Naval aviation. It has to done for the sake of balance. Although balance gets scant attention in this mostly USAF TPS and happily associated EAA chapter newsletter, it must be stated clearly for the record. (*Balance? We don't need no STEENKIN' Balance! If the Project Police fought fair, it would take all of the fun out of it...besides, who stuck one in his craw?*)

Edwards does have a few advantages though. At least you've got more than one road in. The attendance this year at Hanscom was around 600,000, primarily because of the Blue Angels and a certain aircraft from Tucson. If you thought the drive in to main base was tough, this crowd arrived on a two lane road that was converted to exactly three lanes for the weekend. Most parking is off the base, so the walk in adds about two miles to the trip.

Hanscom is also an urban base. The field is about ten miles from downtown Boston, and that means everyone brave enough for the traffic shows up. Most Bostonians consider a two-hour wait at a dead stop on a major freeway a test of courage, so they all show up, of course. They're also the world's worst drivers and several miles of jinking to get a minor advantage (drive on the right, cut across the median, nose in with six inches to spare, etc.) is right in character.



Anyway, the show was great. I've included a few photos for the AADD bunch. (Explained in my last contribution. (See July 1998 *The Leading Edge*)) Hanscom is home base to a squadron of E-3 AWACS and also the E-8 Joint Stars aircraft, and they were displayed prominently. (No photos since you all know what they look like. Something a little more interesting perhaps.) The day was hot and the crowd was looking for shade. One of **Norm Howell's** C-17's was, by far, the most welcome wing span as you can see. I also was interested in the Grumman amphib (*it's an Albatross*) in USAF markings. Since when did the Air Force get web feet? (*Someone's got to cover for the NAVY while they're busy flying around at hand-shake distance wing overlaps instead of defending some patch of H<sub>2</sub>O...actually the Air Force used them for Search and Rescue*)



The Tucson contribution I mentioned earlier happened to come from **Mike Pelletier's** command. It really was a draw because of its unusual antenna arrays. Frankly, it looked like a big flying boom box. (For those of you with a compulsion for precision, it's an EC-130H Compass Call attached to the 41<sup>st</sup> Electronic Combat Squadron. KNX traffic reports from anywhere in the world I'm told.) The photo is of my daughters, a friend, and one of the crew. Major Ghyslaine was kind enough to pose with them, although I could tell from a brief conversation she had had just about as much of the public as she could tolerate in one weekend. Too many beer mugs near the SigInt gear for an anxious crew member who generally doesn't deal with civilians, let alone improper Bostonians.



The show was on par with Edwards in most other respects, but could use a display of experimental aircraft. They've got the hangar space for something like the set up in building 1600. Maybe it just takes an ex-patriot Chapter 1000 member to get it going. (*So hop to it!*)

- **Chuck Firth**  
EAA Chap 1000 Det 9, Auburn NH

**Dirt Cheap Ammeter Shunt**

Recently (*Okay, it's not exactly recently any more, but it was when I wrote this originally*) I had reason to suspect that something was wrong with the charging system in the *Project Police Paddywagon*. It was possible to turn on sufficient electrical loads (mainly two air conditioning fans) such that the alternator was not putting out sufficient current to keep up with the loads, and the battery was making up the difference, resulting eventually in the need to ask for a jump start. Running the shop manual troubleshooting tests cleared the voltage regulator and wires from fault, and pointed toward a bad alternator. However, before spending \$100 for a new alternator, I wanted to make sure that it really was the alternator and not just excessive load (all of the loads were original equipment). To do this, I needed to measure the current output of the alternator. If it was close to the rated current, the problem was excessive loads. If the current reading was significantly less than the rated current, the alternator needed replacing.

I relate this adventure to you since what I learned may be useful to you not only if you should need to check your car's alternator, but also for checking your aircraft's alternator or any other high current item, such as your landing lights.

**How Did I Know There Was A Problem?**

You mean other than needing a jump start frequently when everything appeared fine? Well, first of all, the installed ammeter was not sensitive enough or calibrated to show the slow drain on the battery. It took about an hour of running (less if you started the engine multiple times) before the engine wouldn't crank. You might say that it wasn't so much that the battery was being drained as much as it was it wasn't being recharged after each start.

As with most things electrical, let's first revisit Mr. Ohm's Law:

$$E = IR$$

where:

E = Electromotive Force (or Voltage)(Volts)

I = Current (Amperes or Amps)

R = Resistance (Ohms)

No, I can't tell you why Electrical Engineers (EEs) use "I" for current, they just do. "C" was already taken for Capacitance. "Ion Flow" maybe? Deal with it.

Anyway, remember that the job of the voltage regulator is to maintain "E" at a constant value, typically about 14.5 Volts in a "12 Volt" system. The battery, which sits at somewhere around 12.5 Volts, needs that additional 2 Volts to force electrons back through the battery against its own voltage, causing the chemical reactions that create current to undo themselves, thus recharging the battery.

What happens to this equation as we turn on more stuff? At the simplest level, we are adding extra resistors in parallel. Resistors in series merely add their resistance, but in parallel they add current. As a result, the resistance is given by the somewhat odd equation (Exercise: derive this yourself...):

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots + \frac{1}{R_n}$$

Stuff in some numbers for R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, etc and see that the more resistors you add, the lower the overall resistance (R) will be.

So what does that mean? For a constant voltage (E), as I turn on more stuff, the overall resistance (R) goes down, so the current (I) goes up! Well, duh! There's more stuff for the current to flow through, so you would expect the current to go up.

However, if your loads demand more current than the alternator can provide, the current maxes out, and the voltage goes down, even though your regulator is throwing full system voltage to the alternator's field. This is what I saw--if I turned on enough stuff, my system voltage dropped, eventually dropping below the battery resting voltage (BAD! BAD!).

**So Just Get Out Your Ammeter And Measure The Alternator Output, Right?**

Oh, if only it was that easy. The problem is that the multimeters available on the market (such as at your local Radio Shack) have a maximum current capability of 10 to 15 Amps. Not quite enough for a 100 Amp alternator. To measure current, you have to break the circuit and put the ammeter in series with it. 100 Amps would need some pretty big lead wires, not to mention what the meter movement would look like.

So what to do? Let's look at Ohm's Law again. As current passes through a resistance, the electromotive force gets "used up" such that the voltage decreases from where it started. Ohm's law tells us that if we can measure how much the voltage "drops" across a known resistance, we could calculate the current. This is known as measuring the "voltage drop."

Cool! So we pop down to Radio Shack, pick up a resistor, stick it in the circuit, measure its voltage drop, and we're golden! Right? Not so fast, Moosebreath! As Mr. Heisenberg told us (betcha never thought you'd see that name in an EAA newsletter!), any time we measure a system, we disturb (or change) the system. Putting that extra resistor in the line reduces the voltage available to the rest of the circuit by the amount of its voltage drop.

So the idea is to minimize the amount of disruption that we introduce into the circuit. An accepted value for the voltage drop across the resistor (now called a "shunt") is 50 milliVolts (0.05 Volts) at the expected current flow. Digital voltmeters are readily available that will read down to 0.1 milliVolts (0.0001 Volts), so we can easily measure this.

The other problem is with power dissipation. If you picked up a 1 Ohm resistor to use for your shunt, at 100 Amps it would consume a mere 10,000 Watts! Ouch! Radio Shack doesn't sell anything rated anywhere near that much! This is another reason why we look for such small voltage drops--it keeps the power consumption (and thus heating) down. Additionally, if you run those numbers back through Ohm's Law, you'll see that the voltage drop across this resistor would be 100 Volts! I haven't seen many 115 Volt alternators available for aircraft.

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### So How Do I Design My Shunt?

First of all, if you're looking for a permanent installation, buy one from the AeroElectric Connection or somewhere else. These shunts use special materials that keep a stable resistance over a reasonable range of temperatures. What I will be describing is a shunt for intermittent use, such as troubleshooting. The problem is that copper's resistance will change as its temperature changes. For intermittent use, this won't be a problem.

Use Ohm's law to determine the resistance required in the shunt. For my case, to get a 50 milliVolt drop at 100 Amps, I'll need a shunt with 0.5 milliOhms (0.0005 Ohms) resistance. Note that as the current you wish to measure goes up, the required resistance goes down to keep a constant voltage drop.

"Wait another minute, Moosebreath!" you say. "My whiz-bang multimeter only reads down to 0.1 Ohms. How do I measure 0.5 milliOhms of resistance?" Well, you could build a 4-wire micro-Ohmmeter as described in "The AeroElectric Connection," or you could just ask the physicists. The resistance of a wire depends on its length and its cross sectional area, given by the equation

$$R = \rho \frac{\ell}{A}$$

where:

R = Resistance

$\rho$  = Resistivity (Copper @ 25°C:  $0.67 \times 10^{-6}$  ohm-in)

$\ell$  = length

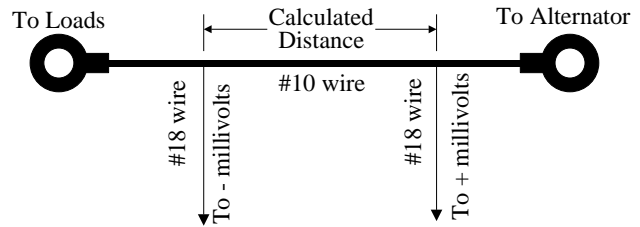
A = Cross Sectional Area

Decide how big of a wire you're going to use for your shunt. The bigger it is, the longer it will be. The smaller it is, the more it will heat up and mess up your readings (plus other undesirable things such as starting a fire). I chose about a #10 wire, since that's what the alternator wire was. Also, I had ring connectors that would fit #10 wire. Since I didn't have any #10 wire lying around, I used 8 strands from a #6 wire I did have, which came out to about the same size. I measured the strands to have a diameter of 0.036 inches, so one strand had a cross sectional area of 0.0010179 inches<sup>2</sup>, or all eight would be 0.008143 inches<sup>2</sup>. Using this area in the above equation, for a resistance of 0.5 milliOhms, I needed a length of 6.08 inches.

### Putting It Together

The hard part's over now. I cut a piece of my eight strand "#10" wire about 10 inches long, and soldered (or you could crimp) an appropriate terminal to each end. For my alternator, that was a ring terminal at each end. I then soldered two pickoff wires to the shunt wire a distance of 6.08 inches apart (yea, like I can measure that accurately...). I used #18 wires for this, simply because they were available. The size of the pickoff wires is not critical, since the current going through them to your several MegaOhm voltmeter is so small you'll never notice. Likewise, length isn't a problem, since the voltage drop in the pickoff wires will be undetectable (because of the low current). When you're done, wrap everything in electrical tape for insulation. My cost: \$0, (Can't beat that!) since I had everything on hand. If you had to buy

everything, you might spend a dollar or two. Still better than \$25!



### So How Do I Use It?

Remove the battery feed wire from the alternator B terminal, and connect the shunt between the alternator B terminal and the battery feed wire. (You might want to disconnect the battery while you're doing this. Don't forget to hook it back up again.) Hook the pickoff wires to your voltmeter and set it to read in the 50 milliVolt range. Start up your system and read the voltage drop. Shut it down, then divide the voltage drop by the resistance of your shunt. Behold! Amperage! (Current if you prefer)

On the *Project Police Paddywagon*, I measured about 30 to 35 milliVolts under load, which translated to 60 to 70 Amps. For a 100 Amp alternator, that's about 2/3, meaning that either one set of diodes was gone or one of the three field windings was gone. Anyway, my dirt-cheap ammeter shunt told me to go to Pep Boys and get a new alternator (which was not dirt-cheap).

Several months have since past, and even with using as much electrical load as I desired, I haven't needed any more jump starts!

### Thanx

To **Charlie Wagner, Chapter 1000 Guru of Things Electrical**, for clueing me in on how to calculate the resistance of a wire and describing how I could build my own shunt. Also to **Miles Bowen** for further pointing out why a 1 Ohm shunt was highly impractical.

- Russ Erb

### ATC Funnies

On our recent return flight from the Copperstate Fly-In, we were approaching restricted area R-2501 near Twentynine Palms. As I was fumbling with refolding the sectional to figure out where we were, our friendly flight-following ATC started to get a little nervous about our intentions. He called to us "Skywagon six one six niner one, do you having a **moving map** on board?" Without missing a beat, PIC **Gary Aldrich** replied:

*"Well, my copilot is moving the map around in his lap, but why do you ask?"*

- Erbman



**Boredom Fighter and Pulsar Update**

*(More e-mail traffic surreptitiously acquired by your Leading Edge staff...)*

Thought I'd check in and see how it's going. Any progress on the Pulsar? Have you done the painting yet? Any target on flying?

I've been working the cowl and the wooden I-struts before it gets too cold up here. Your method of using micro balloons/resin seems to be working pretty good. The sanding board with 36 grit works well and really creates the "snow". Looks like I have only one more application of the filler, then I need to make some cutouts and modifications. Then comes the Poly-Fiber water-based primer. I have a gallon of that stuff and can't wait to try it.

I did get to taxi the BF a couple of weeks ago and it handles like any taildragger. I'm glad that this has a tailwheel lock because without it engaged, I think it will go around in a circle very quickly.

Let me know how it's going.

- **Jim Piavis**

Hi Jim,

Thanks for the e-mail. Good to hear that you're making progress. I have had several false starts in trying to paint the Pulsar. Have had several people lined up and one thing or another happens and it doesn't work out. Right now I have Paul Rosales's (Chapter 49) brother who paints for McDonnell Douglas (Boeing) in Long Beach talked into helping me. We'll see if it comes off. Tonight I just finished the paint booth in my garage. It's big--20' long x 10' wide and 7'6" tall. I'm going to use PPG Deltron system 2000. A lot of guys on the Pulsar users group have used it and said it's the best, we'll see. It took 4 days to try to get rid of all the snow that's accumulated in the garage. That stuff gets everywhere. Between blowing it, vacuuming it, wiping it, mopping it and breathing it I think most of it is out. I am really glad that part's over with. I went over to Russ's house about three weeks ago and he showed me the finer art of Alodining. My ailerons and flaps are aluminum and thanks to Russ are beautifully alodined and ready for primer. Russ also took some nice shots of me and the Pulsar (thanks Russ). You can see them on our homepage under the *Project Police Picture Pages Phor Pilots*.

Glad to hear that the micro balloon frosting has worked out on your cowl and other parts--it worked great for me. You can become a sculptor with the 36 grit paper and then just refine it with the lesser grits. We should do an article for Chapter 1000 about it (we're thinking about ya, Russ) (*kew!*!).

You'll like using Smooth Prime, I did an article for the newsletter on putting it on, but basically just get those smooth foam rollers from Home Depot and roll on 3 coats, then use a palm sander with 180 grit to knock off the high points. Then palm or block sand with 320 grit and you're ready for paint. For the pinholes that Smooth Prime didn't get, I used glazing body putty put on with a plastic edge (make you own, any shape). It gives with the curves and

fills the pinholes nicely. Then hit it again with 320 and go paint it.

Take care

- **George Gennuso**

**Santa Maria Fly-out Report.**

*(EAA Chapter 49 planned a fly-out to Santa Maria. In an odd twist of events, the only people who showed up were Chapter 1000 members.)*

EAA Chapter 1000 members invaded SMX Saturday 7 November 1998. This flyout was planned by Sister Chapter 49. John Bush flew recon and arrived first. He had the entire airport secured when new member Gary A. Sobek arrived to reinforce. Due to strong head winds of 33 Kts, Gary's arrival was a little late. Apparently the other traffic in the area knew that Gary was arriving and departed as "My Sanity" taxied in.

John and Gary had a nice lunch and talk in the Hotel restaurant as we watched the rain come down. A United flight arrived and departed during lunch but no other reinforcements arrived. We had a great lunch; the no shows do not know what they missed.

After settling up the charges incurred for the grub, we departed at 1300. The flight Southeast-bound was at 1,500 so as to stay out of the clouds. It was necessary to fly at a reduced power setting (50%) to keep airspeed at 135 KIAS. We flew IFR (I FOLLOW ROADS) 101 toward Santa Barbara. Attempting to use the GPS to save time, I hopped over a hill to get a course a little more direct. This valley had rain in it. As I flew in the rain, visibility started to drop toward 1.5 miles. A one eighty was initiated and the IFR 101 route was again picked up toward the SW. Visibility was a good three miles in this valley. As some breaks in the low cloud cover started to occur, power was increased to maintain the 1,800-FPM climb. At 3,500 feet, it was VFR on top but there was white stuff in the distance. Since the only blue was straight up, I reduced power and 360'd back down to the IFR 101. As Santa Barbara neared, the ceiling started rising and so was the altitude and speed. Heading East from Santa Barbara, we climbed to 5,500 and established our economy cruise. Ground speed was now up to 172 Kts thanks to a 17-knot tailwind.

Approaching Van Nuys, the clouds were starting to lie directly ahead. Told SOCAL that we would need to climb or descend if we were to remain VFR. Cleared for the option, "My Sanity" increased power to maintain ground speed. Level at 7,500 and VFR on top was the scene the rest of the way home. 10 minutes out, SOCAL was informed that we were starting our descent. SOCAL asked a few questions as to what an RB-6 was. He now knows that it was a typo by ATC. He knows about Van's.

We leveled at 6,000 to stay out of the clouds. When a hole opened, SOCAL was advised that we would be maneuvering to maintain VFR. The 60-degree bank and 183 KIAS kept us VFR and clear of clouds. Back on course, SOCAL told us to Squawk VFR and change to CTAF. Slowed down to enter the pattern. Not slow enough as a Target Cessna was DEAD ahead. Too close

## THE LEADING EDGE

for missiles, switching to guns. Lucky he had the field made and did not burn on MY runway.

Over the fence at 60 and we are now on the ground and off the runway in front of the Cessna. Since it did not take full power to taxi, the gear must be down. I am thankful that my number of landings still equal takeoffs.

- Gary Sobek

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### Riveting Tips From The People Who Make 'em

*(I stole this from Chapter 49's newsletter)*

From RVator, third issue, 1998

Reprinted from "The Static Line" EAA Chapter 538

October Issue

Tom Green has a desk full of interesting tidbits...so I wasn't surprised when he dug up a publication called "Alcoa Aluminum Rivets". One paragraph caught my eye:

"The standards to which driven rivets should conform are frequently uncertain. In addition to dimensions and perfection of shape, inspection is concerned with whether the driven head is coaxial with the shank (not "clinched") and whether there is excessive cracking of the heads. It has been determined that even badly cracked heads are satisfactory from the standpoint of static strength, fatigue strength and resistance to corrosion. (Poorly set and cracked) rivets were tested in tension to determine how well formed a head has to be in order to develop full strength. The tensile strengths of all the rivets were within five per cent of the strongest. The test indicated that minor deviations from the theoretically desired shape of head are not cause for concern or replacement. **The second rivet that is driven in any one hole is likely to be more defective than the first, because the hole will be enlarged and the rivet will be more likely to buckle and form an imperfect head.**"

In another place, I found this: "Tests have shown that very small rivet heads are sufficient to develop the strength of the rivet shank, even when the rivets are subject to a straight tensile pull.... Where a large head is not needed for appearance... smaller sizes of driven heads should be used to decrease the required driving pressures."

In other words, rivets have a large margin of safety. Even under-set or cracked rivets provide sufficient strength. **You will probably reduce that strength by drilling out a "less-than-perfect rivet" and replacing it.**

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### Altimeter Settings and ATC

Ever wonder why when you're using ATC Flight Following, each time you get handed off to a new controller, the first thing he or she does is to tell you what the altimeter setting is at some nearby airport that you weren't planning to go to? Ever wonder why they think this is so important?

Well, the answer comes out in an answer that I got to a different question. While teaching Pitot-statics at the

USAF Test Pilot School, we were talking about altimeter settings and how they are only accurate (i.e. altimeter reading = actual altitude MSL) at one point, usually the elevation of the airport reporting the setting. Additionally, the Mode C encoded altitude is pressure altitude, or what you would see if you set 29.92 in your altimeter. One of the students asked me how ATC ensures ground clearance if all they are receiving is pressure altitude, yet you are looking at a compensated altitude.

Since I didn't know the answer to this question, I forwarded it to my fellow Bearhawk builder **Pat Fagan**, Chapter 49 member and air traffic controller at Los Angeles center (ZLA). His response:

"The radar screen that we look at is broken up by the computer into a grid, called sort boxes. The computer assigns data to a sort box, based on the computer program. One sort box may be assigned Boron as it's main source for radar data, while the one next to it may be assigned Paso Robles. It is my understanding that the altimeters work the same way. A sort box may be assigned the Bakersfield altimeter, and the computer knows what the altimeter setting is for Bakersfield and automatically compensates for pressure altitude for us so that we see the same thing as the pilot. Back when I was training, my instructor did an experiment, with the help of a pilot, to illustrate how this works, but I can't remember what the details of the test were. Hope that helps."

So what does that mean to you as a pilot? When the controller answers your call saying the Bakersfield altimeter is 30.02, you'd better set that in your altimeter. Not only is that probably more accurate than the Rosamond setting you took off with, but it gives you the best chance at seeing the same altimeter reading that your friendly controller is seeing. Not to mention the same altimeter setting that all of the other airplanes in your area are using and the controller is using to ensure vertical separation.

- Russ Erb

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### Obscure Airplane Revealed!



This month's bragging rights go to **PPO Jim Piavis!** Shortly after he received his newsletter, he was typing out the following e-mail to me:

"Pictured aircraft is an Aviation Traders Ltd. ATL-98 Carvair.

Here's some info gathered from several web sites:

Crew: 2-3, passengers: 85, engine: 4 x P+W "Twin Wasp", 1065kW, wingspan: 35.8m, length: 31.3m, height: 9.1m, wing area: 135.8m<sup>2</sup>, start mass: 33475kg, empty mass: 18762kg, cruise speed: 350kph, range w/max.fuel: 5560km, range w/max.payload: 3400km

**http://members.aol.com/TomGRR/dc4.htm:** Now for the Carvair. Freddie Laker (long before Laker Airways) was managing director of Aviation Traders and it's associated Channel Air Bridge, and he was searching for a replacement for its Bristol Superfreighter 32 car ferries, which transported cars across the English Channel. Since the market would be small, he proposed that a modification of an existing design would be logical. Thus, to a basic DC-4 fuselage, wings, and powerplant (P&W Twin Wasp R-2000), were mated a tail unit derived from the DC-7, and a new forward fuselage of gigantic proportions. This allowed a hydraulically operated nose door to be fitted for drive-on loading. The first flight was on June 21, 1961, and scheduled service began in 1962.

Total production was 21, and the usefulness of the design is such that several are still flying today around the world."

At this point, I was befuddled as to how Jim not only got the right answer, but how he got it so fast. He replied:

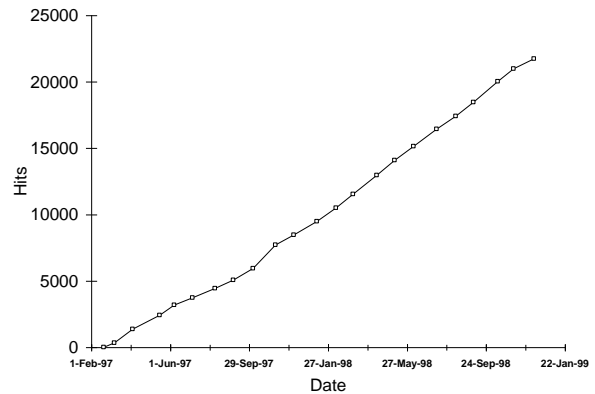
"Actually, Dad flew the Argosy, which has kind-of the same front end, but it's a high wing with twin tail booms. Therefore, I originally thought it may have been a close cousin so after a couple of searches, there it was. Not an Argosy, but equally obscure."

The following is the original caption from the *Star-Telegram* newspaper that I lifted the picture from:

"A 1944 DC-4 Carvair cargo plane taxis after landing at Arlington Municipal Airport yesterday carrying auto parts from Youngstown, Ohio, for delivery to the General Motors assembly plant. Several airport employees came out to view the vintage aircraft, which is said to be the largest to land at the Arlington airport. The Carvair, which was modified in 1962 to carry automobiles across the English Channel, is one of three remaining from 21 built."

**Web Site Update**

As of 6 December, 1998, we are showing **21725** hits. While this number shows a reduction of hit rate from about 39/day to about 24/day, I suspect this is not valid. This month, our host QNet moved a bunch of web sites, including ours, to a new server. In the transition, the counters were down for about a week, so any hits that week were not recorded. Anyway, see activity below:



**Usage History on <http://www.eaa1000.av.org>**

If you haven't visited the National EAA Web Site lately, you need to again. You'll find that the primary site (<http://www.eaa.org>) is heavily directed at convincing people to sign up with EAA. If you're looking for the member services stuff, look in the "Member's Hangar" section. Bring your EAA number with you--you'll need it to sign in.

National EAA is also catching up with the rest of us. You'll find a place at the top of the Member's Hangar where you can update your EAA records with your e-mail address. There's room for both a home e-mail address and a work e-mail address.

As for the Chapter Web Site updates, well, ask me how the Bearhawk is progressing...I can't do everything, you know.

**- Russ Erb, Webmeister**



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 805-538-2028.



**Dues Coming Due!**

By decree of the **Board of Directors**, your Chapter 1000 dues for 1999 will be increased to **\$20**, payable to **Gary Aldrich**, acting Treasurer. However, if you pay by 31 December 1998, you can get in at the current \$15 rate. Unless you've already paid ahead, **your dues are due in January 1999**. If you are not sure of your status, check with **Russ Erb**, keeper of the Chapter database.

**Chapter 1000 Calendar**

Dec 12: EAA Chapters 1000/49 Young Eagles Rally, 8:00 a.m., General William J. Fox Field, Lancaster CA. (805) 256-4829

**Dec 15: EAA Chapter 1000 Monthly Meeting, 5:00 p.m.**, Edwards AFB. USAF Test Pilot School, Scobee Auditorium. (805) 490-1476

Jan 6: EAA Chapter 49 Monthly Meeting, 7:30 p.m., Sunnysdale School. 1233 S. Ave. J-8, Lancaster, CA. (805) 948-0646

Jan 12: EAA Chapter 1000 Board of Directors Meeting, 5:00 p.m., Edwards AFB. Test Pilot School, MOL Room (805) 490-1476

**Jan 19: EAA Chapter 1000 Monthly Meeting, 5:00 p.m.**, Edwards AFB. USAF Test Pilot School, Scobee Auditorium. (805) 490-1476

Feb 3: EAA Chapter 49 Monthly Meeting, 7:30 p.m., Sunnysdale School. 1233 S. Ave. J-8, Lancaster, CA. (805) 948-0646

Feb 9: EAA Chapter 1000 Board of Directors Meeting, 5:00 p.m., Edwards AFB. Test Pilot School, MOL Room (805) 490-1476

**Feb 16: EAA Chapter 1000 Monthly Meeting, 5:00 p.m.**, Edwards AFB. USAF Test Pilot School, Scobee Auditorium. (805) 490-1476

**For Sale:**

Sonerai IIL project. Fuselage and wings 95% complete. Modified for A65 engine. Engine torn down for overhaul but complete with a great many spare engine parts. Includes instruments. Hydraulic brakes. All excellent work. Call Fletch Burns 760-373-3779

Sonerai IIL project for sale: Empennage 100%, Fuselage 99% complete, urethane primed. Ribs de-burred and straightened, otherwise untouched S-wing kit with formed spars and ailerons. Complete Monnet hardware kit. Gear, wheels, tires, brakes. Hapi 75 HP split head single electronic ignition (heads drilled for two plugs) engine with very little time, pickled. Spare un-used VW case. All engine and flight instruments, spinner, backing plate, safety harness, etc. \$6000 firm FOB Oakland, CA. A canopy, prop, and covering materials would complete this plane for well under \$10K. I'd gladly sell a half interest to a local builder. E-mail  
bredt19-2@idt.net or phone 510-530-8334. Or read about it at  
<http://shell.idt.net/~bredt19-2/Sonerai/MySonIIL.html>

*To join Chapter 1000, send your name, address, EAA number, and \$20 dues to: EAA Chapter 1000, Gary Aldrich, 42370 61<sup>st</sup> St. W, Quartz Hill CA 93536. Membership in National EAA (\$40, 1-800-843-3612) is required.*

*Contact our officers by e-mail:*

*Gary Aldrich: [gary\\_aldrich@pobox.com](mailto:gary_aldrich@pobox.com)*

*George Gennuso: [pulsar1@qnet.com](mailto:pulsar1@qnet.com)*

*Miles Bowen: [miles\\_bowen@ple.af.mil](mailto:miles_bowen@ple.af.mil)*

*Inputs for the newsletter or any comments can be sent to Russ Erb, 805-258-6335, by e-mail to [erbman@compuserve.com](mailto:erbman@compuserve.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**

**C/O Russ Erb**

**6708 Doolittle Dr**

**Edwards CA 93523-2106**

**<http://www.eaa1000.av.org>**

**ADDRESS CORRECTION REQUESTED**

**THIS MONTH'S HIGHLIGHTS:**

**REGULAR MEETING 15 DECEMBER AT TPS**

**MORE PROJECT POLICE REPORTS**

**DIRT-CHEAP AMMETER SHUNT**

**RIVETING--WHAT'S GOOD ENOUGH?**

