



THE LEADING EDGE

NEWSLETTER OF MUROC EAA CHAPTER 1000

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

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August 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:



**AirVenture Oshkosh
1998** (←Y2K Compliant) **Report**
Speaker: Charleen Beam
Tuesday, 18 August 1998
1700 hrs (5:00 PM Civilian Time)
USAF Test Pilot School Auditorium
Edwards AFB, CA

Well, sports fans, you're not going to believe who we have coming up this month--our very own Chapter 1000 **Project Policewoman** and all around good lady to know, **Charleen Beam**. Charleen will be presenting pictures from her recent trip to **EAA AirVenture** where she was the darling of the Aircraft Spruce display. She will also be making all of us jealous that we couldn't join her there. She also has some neat new stuff from *Aircraft Spruce* (copies of the new catalog, perhaps?) that she is going to bring with her and demo for us. No telling what that could be. According to our collective memory, this will be Charleen's first attendance at our regular monthly meeting. It promises to be a fun and informative evening, so don't miss this one and let's all turn out and give Charleen a big welcome to her first Chapter 1000 meeting!

- George Gennuso

Just An Old Fashioned Fly-In

On **12 September 1998**, Chapter 49 will be starting off this year's version of "Machtober" (*Machtember?*) with "**Just An Old Fashioned Fly-In**" at Fox Field. Events will include fattening up **Project Police** officers with a Pancake Breakfast and a Barbecue Lunch. They are also planning a Spot Landing Contest, Fly-Bys, a Weight &

Balance Clinic, Seminars, Young Eagles flights, and a Hot Rod Car Show.

All members of Chapter 1000 are encouraged to participate in this inaugural event and make it a success!

We Did It Again!

Approximately one week before the presentation at the Theater in the Woods, Bob Mackey called your Newsletter Editor (NLE) to say that **The Leading Edge** was once again chosen to receive the McKillop



Award, given to the top ten chapter newsletters in EAA. This sent us scrambling to figure out who was going to EAA AirVenture '98 (← Not Y2K Compliant) this year so that we could have a representative to pick up the award, since your NLE would be here teaching at TPS and building his airplane. This was a little more challenging this year, since our primary targets **Norm Howell** and **Gary Aldrich** were not going. Therefore, **Tricia Sharp** (the Sky Queen Neme-Babe (her own words)) was deputized and pressed into service as our official NLE rep. Post operation reconnaissance (**Herb Carlson** at the Young Eagles Rally) revealed that **Tony Ginn** actually accepted the award. I'm still waiting to find out how that change of command came about. For that matter, I'm still waiting for Tony to contact us to tell us how we placed! Herb says he thinks we were 10th place again. No worse than last year, and still something to be proud of! (A lot better than 11th place!)

My thanx goes out again to all of our faithful contributors to this newsletter! This award is yours too! Keep those articles and **Project Police** reports coming in!

- Russ Erb
Newsletter Editing Dude

Message to EAA HQ Chapter Executive Director, Bob Mackey, from Subliminal Man: EAA Chapter 1000 is the chapter for me!

Last Month's Meeting

EAA Chapter 1000

Scobee Auditorium, Test Pilot School, Edwards AFB
1700, July 21, 1998

Gary Aldrich, Presiding

The meeting was called to order at 5:33 following a record low-fat (*no-fat, no-nothin'*) schmooze time, our illustrious **Schmoozemeister** being on vacation.

Announcements

We are gearing up for *Operation Desert Valet*, aka the General Aviation portion of the **Edwards Open House**, October 3, 1998. Chapter 1000 is putting on *The Big Schmooze* on arrival evening, Oct. 2.

The *D.V.* organizers are working on getting Chapter 1000 member **Norm DeWitt** and his **Edge 540** for the airshow.

EAA Calendars are available; contact Prez. **Gary Aldrich**.

The *Chapter 1000 Alodining Facility* is now open for business. Contact **Russ Erb**.

Visitors

Bert Fredrick, a fabricator at Scaled Composites, is about to start a new Long-Eze.

Bernie Bakken, a new member, a construction manager with the Jet Propulsion Laboratory. Welcome, Bernie.

Andy Gerner was in town to teach the Introduction To Aeronautics course at TPS. In his normal duties, he is an Assistant Professor in the Department of Aeronautics at the USAF Academy. As a 91A Test Pilot graduate of USAF TPS, he teaches the Flight Test Techniques course (Aero Engr 456) that our own **Russ Erb** taught before him. He has about decided to arrange for the students in this course to receive a subscription to *Sport Aviation*, both as a source of info on current aircraft and to leverage those flight test articles by folks such as the CAFE Foundation, Ed Kolano, and Budd Davisson. We've almost got him convinced to become a Chapter 1000 member and re-open the Det at the USAF Academy. After his week here, he was taking the family to *EAA AirVenture*. What a way to start off...

Minutes

Accepted as published. Whoopee!

New Business

None.

Old Business

None.

Program

This month's program was a presentation on "What's Happening At Scaled Composites" given by our very own *Project Police Officer* and first ever *Project Police Kommandant* **Bob Waldmiller**.

The first project Bob discussed was the Advanced Technology Tactical Transport (ATTT), a 63% proof-of-concept provided on schedule and within budget to DARPA. Known as the Grizzly, it was powered by two Pratt and Whitney of Canada PT6A-135A turboprop engines, and equipped with eight 43% chord Fowler flaps. It had excellent STOL capabilities. The ATTT project was the first to demonstrate Scaled's ability to perform aerodynamic and structural design, and to build, test, and deliver manned research aircraft on schedule and within budget.

The next project Bob discussed was the single-stage-to-orbit rocket-powered vertical takeoff and landing concept DC-X developed in conjunction with McDonnell Douglas Aerospace. Scaled's responsibility was to build the structural aeroshell and aerodynamic control surfaces. The DC-X aeroshell has a height of 62 feet and a maximum width of 15 feet at the base. Scaled completed the structure, coming in 300 lbs. under the goal of 3,000 lbs.

The Agile Responsive Effective Support (ARES) aircraft was developed in-house as a follow-up to an earlier Rutan Aircraft Factory project designed initially in response to a U.S. Army request for a Low Cost Battlefield Attack Aircraft. Still in flyable storage, the ARES is powered by a JT15D-5 turbofan engine. During November of 1991, under a contract from the U.S. Air Force, initial ground and flight (air-to-air and air-to-ground) tests of the GAU-12/U 25mm Gatling gun system installed in ARES were performed. The ARES also starred as the ME-263 jet in the movie *Iron Eagle III*.

An interesting project that Scaled Composites developed for Lawrence Livermore Labs was the Raptor, an unmanned aerial vehicle capable of loitering at 65,000 ft for 48 hours. To meet the light structural weight required, the Raptor uses the same structure (single ply carbon fiber over Nomex honeycomb core) as was used on the Voyager. The Rotax 912 is turbo-normalized and develops 100 hp up to 50,000 feet.

In 1993, Scaled built a proof-of-concept prototype of a single engine business jet for the VisionAire corporation called the Vantage. From go-ahead to first flight, Scaled required only 8 months to construct the Vantage. Scaled is now responsible for certifying and manufacturing all of the structural composite components for a certified production version of the Vantage to be built at Scaled Technology Works in Montrose, CO, a sister company to Scaled Composites.

Another exciting project at Scaled is the Williams V-Jet. Scaled started with a Williams preliminary design, conducted detailed design and analysis, then manufactured and flight-tested the prototype "V-JET II" that flew in to Oshkosh '97. Initially flown with two existing low bypass ratio, 550 lb thrust, FJX-1 turbofan engines developed previously by Williams, the aircraft will be used primarily to demonstrate new high bypass ratio, FJX-2 engines being developed cooperation with NASA as part of the AGATE program.

Bob's pride and joy at Scaled Composites is the Proteus, currently being developed for Angel Technology as an airborne relay link for cell phone service for third world countries or disaster-stricken areas. Proteus was the

Greek god who could change his physical form at will, referring to the reconfigurability being designed into the aircraft by Scaled. To oversimplify, various airframe components can be mixed and matched depending on specific mission requirements. The aircraft can be configured for such varying roles as high-altitude atmospheric research, reconnaissance/surveillance, and even airborne space launch operations. Engine runs and low speed taxi tests have been conducted, and by the time you read this, initial test flights should have been conducted.

In response to the question "What's it like to work for **Burt Rutan**?", Bob responded that Burt recognizes that everyone has their niche, and that it is exciting to watch Burt combine the special talents of his people to take a project from concept to flight, many times in less than a year. Bob also mentioned that Burt gives his people the freedom to innovate. He encourages them to try new concepts and to not be afraid to fail.

Bob also commented on the fact that Burt is a UFOlogist. Burt claims to have seen a UFO and says that we need to figure out how to build one without fasteners.

Bob mentioned that small groups (less than 3 or 4) may request tours of the Scaled Composites Facility. Scaled is located at 1624 Flight Line, Mojave, CA 93501-1663. You may reach them by phone at (805) 824-4541, by fax at (805) 824-4174, or by email to info@scaled.com. Their normal business hours are 7 am to 4 pm, Pacific time. Details on projects mentioned here, and other goings-on at Scaled Composites, can be found on their Web site: <http://www.scaled.com/>. Thanks, Bob for a very interesting and informative program.

Adjournment

The meeting was adjourned at 6:28, at which time many attendees decided to gather at the **PPHFFRC (Project Police High Fat Food Replenishment Complex)**, aka Burger King, where good times were had by all.

- Miles Bowen, Secretary

The Prez Sez...

Wow! The summer's almost over. Hope you all have realized your goals for this fun time of year, whether they included flying more Young Eagles, finishing up a major section of the airplane, or just spending more time with the family. Personally, this has been a good summer for your "first family". While I've been able to spend more time flying the Skywagon, I didn't fulfill my goal of a repeat adventure to OSH (all bow down and face northeast). Between my new job at TPS and a flying compadre who wimped on me (a certain member whose name will go unmentioned-but not his initials--**JDIII!**) the Fighting Skywagon only patrolled the local area during **AirVenture Oshkosh 98**. Never fear, though! I have resolved to start planning now for an assault on the last great airshow of the millenium. I hope others in the chapter will be able to join the adventure--maybe our NLE will even consider picking up his next award in person! (*is that an offer for a seat in the Fighting Skywagon?*) (For those who haven't heard,

please check to masthead to confirm that Chapter 1000 was again in the top ten newsletters!)

Speaking of airshows, the EAFB Open House is shaping up nicely with a greater emphasis on flying entertainment this year. I've seen the lineup and it's truly impressive, with more civilian acts (including our own **Norm DeWitt** and his spectacular **Edge 540**) and a pace designed to keep you looking skyward nearly every minute of the day. Of course, everyone is planning to attend, right? (Answer correctly--the **Project Police** are listening!)

Another aviation event for your calendar's is the "**Old Fashioned Fly-In**" sponsored by our Chapter 49 brethren. Be sure and check the upcoming events list and come out to support what could well become a standard September event.

Well, I hope I've rambled on long enough to satisfy our award-winning NLE. With every trophy he gets more demanding! Next month he may even expect my column to arrive in his computer before the deadline!?! Seriously though folks...when you see Russ, be sure and congratulate him on his **McKillop** award. We are truly fortunate as a chapter to have such a talented and tireless volunteer in our midst!

Fly safe and check six!

- Gary Aldrich

More Air Racing With Chapter 1000

It's a good thing the McKillop award judges don't know the things we screw up....

Last month in this space we lauded the high placed accomplishments of the Test West RACE crew at the Jackpot NV races. While the information provided to **The Leading Edge** editorial staff was complete and presumed accurate, our attention was not drawn to (*yea, that's the ticket...*) the mention of another fine Chapter 1000 member. While no affrontery was intended by our gross buffoonery, amends must needs be made.

Our own soon to be USAF pilot **Bryan Duke** silently appeared at the recent Jackpot RACE in his Vari-Stealth-Eze. It seems that the last year's worth of aero mods Bryan has done have paid off. He turned a race average of 179.49 mph besting his last year's speed by over 23mph! **Project Police** operatives have learned that major engine work is underway at Fox's hanger 509 and Bryan has promised another 23mph for next year.

Congratulations, Bryan!

susceptible as other alloys. The reason is that other alloys are usually used at higher strength levels. 4130 is generally used at annealed values for its toughness and ductility (energy absorption).

Cad has no effect on fatigue except through hydrogen embrittlement.

Toxicity and Search for Substitute

Above 450° F Cad sublimates and is toxic. That is why no Cad plated bolts or hardware should be used in the firewall or forward. Use Stainless Steel (Cres) instead.

The EPA and Industry are trying to get rid of Cad. One of the major problems is in overhaul, such as at Hill AFB. To overhaul a part usually means cleaning the paint and Cad off first. Special precautions are taken so that workmen don't breathe the dust. (It is worse than lead or asbestos.) Then they have to get the Cad contaminated sandblast sand to a toxic dump site.

There have been many research programs to find a substitute. Whoever patents a full substitute will become a multi-billionaire.

Corrosion Control Characteristics

Cad has many good corrosion control characteristics. The corrosion protection is by the Cad providing sacrificial corrosion. That is it will corrode before the mating materials will. It is higher on the Dissimilar Metals Galvanic Chart than either aluminum or steel.

Cad plating is usually only .0002 to .0005 inch thick. The thinner plating appears to be specified for the higher strength steels (above 220,000 psi tensile).

Cad is soft and easily scratched, however, it has the unique characteristic that if it is scratched, it will flow and cover the scratch (how about them apples!).

Bolts

Standard steel alloy AN and MS bolts are cad plated for corrosion protection and can be inserted into either aluminum or other steel. Since the corrosion protection of the cad is by sacrificial means, I will never permit a rusty standard steel bolt to be inserted in an airplane. If the bolt is rusty it means all the Cad is gone and there is no corrosion protection between the bolt and the mating surface.

Because Cad is sacrificial it disappears over time. That is why aircraft owners should inspect all bolts periodically. Replacing bolts may not be for fatigue life requirements, but it may be just because the Cad has disappeared.

Stainless steel bolts generally do not have cad because they are used in high temperature locations. They sometimes have "dry lube" or molybdenum disulfide coating for the higher temperatures.

When Titanium fasteners first came out in the late 50's there was an option for cad plating. In the 60's it was determined (after many fastener failures, that cad and Titanium in contact with each other cause hydrogen embrittlement in the Titanium.

Miscellaneous

Cad is used a lot on bushings. (Bushings are another subject all together.) Bushings are a different material than

the housings they are pressed into. A thin coating on the outside acts as a lubricant when the bushings are installed with a press fit. Some Cad is scraped off but there is some remaining between the bushing and the housing for corrosion control.

Corrosion Control Without Cad

A homebuilt aircraft is going to have reasonable care against corrosion. I like a couple of coats of prime on steel before paint. All your non-stainless steel parts should be painted including forward of the firewall. 4130 is susceptible to rust both inside and out. Sometimes I specify paint on Stainless Steel.

Please Note: Homebuilt aircraft are not built the same as Industry built. In many ways homebuilts are built better.

Thanx

Thanks to Stan Klein, Bob Urban, and Ron Yarbrough who over time have kept repeating the explanations until the knowledge sank in.

References

1. "Plating, Cadmium (Electrodeposited)," QQ-P-416.
2. "Cadmium Plating, Low Embrittlement, Electrodeposition," MIL-STD-870(USAF), Inactive December 1996.
3. "Cadmium -Titanium Plating, Low Embrittlement Electrodeposition," MIL-STD-1500, Inactive December 1996.

- **Lee H. Erb**

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ZEN AND THE LOST BLACK ART OF ANTENNAe (Part 2)

(A series of explanations/procedures for the COMPLEAT IDIOT)

Antennas work both ways

If the VSWR is low, the antenna receives better. If an antenna receives well it probably transmits real good too. This factor is called reciprocity, which is a somewhat meaningless bit of trivia.

There are two kinds of antennas: balanced and unbalanced. This is only related to the CO-AX feed method rather than the antenna.

>>>> **NOTE: REAL IMPORTANT >>>>** ALL antennas **MUST** have two conductor/radiators, it is just that in some antennas one radiator is camouflaged to look like airplane, or car, or dirt. Sort of like the oriental Ying/Yang theory. Fiberglass and that ilk are not conductors to direct current energy; another reason they don't work as a ground plane.

A Monopole or MARCONI antenna (typically used on metal skinned aircraft) has only one apparent radiating element more than 1/4 wavelength long and a characteristic impedance of 50 ohms. Hmmm. This is an unbalanced antenna. You connect the shielded portion of

the cable to the antenna mount or ground. My CO-AX radio antenna lead in has an impedance of 50 OHMS per length...Lesson here: Why do you think most metal aircraft have monopole antennas? (hint: 50 OHMS impedance, ease of manufacture...) However, you do get weird impedances and lengths longer than 1/4 wave until you get to 1/2 wave. They can increase or decrease as the electrons see fit. There is actually a mathematical series of equations concerning skin current flows and related yucch, but that stuff makes my head hurt.

New Lesson: Why don't glass aircraft have monopoles? Because there is no provision for the ground portion of the antenna. You do HAVE to provide some sort of a ground plane of reference or the antenna impedance can end up being anything it wants to be. The ground plane can be 1/4, 1/2, 5/8, or 1, 2, 4, 6 multiples of wavelength. This radiator HAS TO BE one of the above even portions of wavelength or it does not work. 5/8 is an exception, but don't worry about it. By the way, each antenna needs its OWN GROUND PLANE REFERENCE.

Monopoles work best when the ground reference is at least 6 wavelength in diameter. Why 6? Those that have done STANDARD DEVIATION/STATISTICS know that when the std deviation gets beyond $6\sigma_{n-1}$ the population becomes so small as to be inconsequential. Funny, the same effect in Electronics. Those like me that flunked math and need Idiot English: 6 wavelengths are so far away that the electrons get too tired by the time they get to the end to cause trouble.

Monopoles can and will work with teensy ground references, or monstrous ground references, or, anything in between, but you get weird radiation patterns and angles which could render the antenna useless. You sometimes get weird impedances, too. Monopoles can be bent into all sorts of weird shapes, but once again you are modifying the radiation pattern which may or may not be a problem. People that say their antenna does not require a ground actually use the coax outside shield as a ground radiator; some times the aluminum radio case too.

Dipoles have TWO active radiating elements (DI: a word from some ancient dead foreign language meaning two, not a dead foreign princess). Dipoles are usually 1/2 wavelength long. It is a BALANCED antenna, which means you should not connect your CO-AX directly to it without some sort of adapter called a BALUN. They have a CHARACTERISTIC IMPEDANCE of 72 to 75 OHMS which is why they are usually not efficient antennas for aircraft. 50 OHMS of your radio does not balance 75 OHMS of the antenna so you lose some efficiency. You need to BALUN your radio because you could be flying over; SAY, all TEN MILLION WATTS of KNX TALK RADIO on your way to Torrance ZAMPERINI Airport. The shield of your COAX becomes an antenna of sufficient length to receive KNX RADIO, and feeds talk radio energy into your radio. Best case is no effect to you. Middle case is that you listen to Talk Radio instead of the pearls of wisdom that Torrance Tower has regarding your landing clearance. Worst case is you are out the huge sum of money to replace the 1ST transistor receive amplifier (which now-a-days is on a chip and costs more). Fortunately you can still transmit in the blind because that portion was not hooked up to the antenna at the time. A

BALUN (acronym for BALANCED to UNbalanced) takes the antenna and converts either end to what the other end needs to see. Since one half of the dipole antenna is positive and the other half is negative, KNX RADIO is balanced at neutral. It also provides some increase of efficiency because your antenna is now twice as long as it was previously. Baluns do not solve the 75 OHM IMPEDANCE problem, however. Most people take the increased efficiency (200%) and average it out against the impedance loss (25%), and so are happy with what they get. I use one for my nav portion, but it only works better when flying FROM an OMNI. I also use a 75 to 50 ham impedance/adaptor BALUN called a "BAZOOKA" because I like the conceptual thought of "BAZOOKAing" my transmissions.

These guys with their fancy circuit board dipole antennas are just scamming the public on how good they actually are. You don't see me using one do you?

Radiation Patterns: How do you find out where your antenna radiates the best?

Traditionally, for monopoles, you visualize the ground plane as the direction of most efficient radiation, that is, where you get the best patterns. In Idiot terms, where the biggest piece of airplane points is where you talk the best. I can show you reams of data, but trust me. Therefore, for monopoles, if you want to talk up to the SPACE SHUTTLE in orbit, you put the antenna on the bottom. If you want to talk to towers the antenna should be on the top. My technique is to use a dark area like a hangar with the doors closed and lights off, and a flashlight since light and radio waves behave real similar. Take the flashlight and place on the pointy end of the antenna with the light beam facing the aircraft and running down the antenna length. The shadow approximates which direction will work the best. Did you get a surprise?

Dipoles are different. Since you have both elements radiating, Dipoles work like so: Take a doughnut, place over the antenna so that the hole slides through the center of antenna, and the doughnut is perpendicular to the antenna. Where the doughnut is biggest is the direction you talk best. Notice that if the dipole is in the wing, you talk forward real well (handy for talking to the tower from 20 out) but do not talk well out the sides in the pattern. It is even possible to even not hear the tower in the pattern. Dipoles should be located in things that are vertical, rudders, speed tips, fuselage, etc, but there is another problem which is that dastardly fiend, capacitance. If you mount antennas inside of things; because everything is a conductor to RF energy, you add capacitance. The VSWR goes way up, the antenna length requirements go way down, it is an terrible, terrible, ugly thing to behold. Can you calculate the effects? NOPE, you can only measure the effect after you install. You could encapsulate a thing that fits where you plan to put the antenna and simulates the installation then test the results, trim to resonance, retest, but that is time consuming and I don't know anyone that has a bridge that works on transponder frequencies. Best remedy is to take antennas and hang them outside in the breeze; take the 1/2 knot speed penalty [DON'T GET ME STARTED ON SPEED MODS (LIKE YOU CAN

REALLY MEASURE 1/2 KNOT above 100 knots CAS)].
(*Can I eat the doughnut now?*)

Ask anybody interested in appearance (yuppie scum, dinks, and 2nd Lts): Looking cool, good, and, stylish is not conducive to comfort and ease.

A cool thing about dipoles and monopoles is that you can streamline them in a 45 degree manner and gain electrical performance while lowering drag. You actually end up fooling the electrons into believing that the antenna is shorter, so it works on higher frequencies (this is called bandwidth). However since TANSTAAFL¹, you become directional where the open end is, or opposite to the streamlining, which is O.K. for Variezes 'cuz they fly backwards anyways.

By the way, things like gear legs, flying wires, metal spars, strobe leads, fuel lines, all being a mass, alter the pattern you are radiating. If you put any antenna between the spring gear, you could effectively block all the energy and absorb it into the gear. Remember the thing about inductors and wire?

The doughnut TRICK works on monopoles, but gets real bizarre when there are bends.

Polarization

If the antenna you are talking to has his antenna horizontal, your best efficiency is to have a horizontal antenna because the waves of radio energy match up. MOST FAA/FCC people hang their antennas on long poles in a vertical manner because it gets the antenna higher into the air (works better, but not an issue at 10,000 ft MSL). Guess what? The wing mounted horizontal dipole loses maybe 50 to 75% efficiency talking to towers. Government people get around this problem by throwing around huge amounts of power, say a thousand watts (1,000 X 1% efficiency = 10 watts at 100% efficiency). They can yell at you from very far away, but they cannot hear you yell back. 75 miles is generally their limit. In order to yell back, you will have to consume prodigious amounts of alternator power (about 25 amps, which can be bad Karma), so that when your radio wave arrives at their antenna, it really excites them electrons in the gov't antennae. Gets 'em right agitated y'hear?

The hot new thing in antennas for GPS is CIRCULAR polarization which is a real pain to do. How it works is so: the antenna is many, many, many wavelengths long and is wound in a helix pattern like a spring. Why do the GPS guys do this? 'Cuz their signal is so teensy that they can't afford to waste any signal in polarity losses. A spring will accept polarity in any direction because there is a full wave antenna in a 360 degree pattern. There is a matter of left hand and right hand polarization, but now we are getting really obscure, and since GPS is such a hardship to deal with frequency wise, just let the PROS do all the headache stuff.

Resonance

Think of antenna resonant length like a tuning fork. The tuning fork only vibrates at one frequency when you excite it. You can excite it with other frequencies, but they have to be some sort of a multiple of the tuning fork

frequency, unless you pump massive amounts of energy into the fork, such as a sharp and sudden whack. Same thing with antennas, only they also have a sloppy area of excitement (wide bandwidth). If you are not resonant, it ain't gonna "HUM" properly. Remember that the physical shape of the tuning fork affects the operating frequency just like on an antenna, i.e. Fat forks, like fat antennas have to be shorter for the same frequency as a skinny antenna.

Gain

This is a mythical performance factor that uses a dipole as a comparison factor. Gain works funny (logarithmic) so that it takes 6 gains to make one twice as strong power, or twice as good. PLAIN old vanilla straight Dipoles are considered to have a gain of "UNITY" (1). So if someone claims to have a GAIN of 3, his antenna only works 1/2 times better which is not considered to be a big deal. Usually gain gets bigger at the expense of directivity. Omnidirectional antennas have lousy gain. Satellite dishes have humongous gain (like 40 to 75) but teensy little itty-bitty aiming points. Sometimes the antenna guys try to fool you and say their antenna has a gain of 30 dB. dB is just another way of saying "gain". If the antenna guys say their antenna has a 3dBa gain, they are shucking you because the dB(A) scale is modified for only what human beings hear and has no bearing on radio frequencies.

Decibels (dB):

These are little weird things that some math magician invented so he could appear to be smarter than me. In RF, everything works in a logarithmic way. When you stack losses together, you add them, but they are equal to 1/3. 6 in a stack makes either 1/2 of something or two of something. In RF you can't subtract anything, so everything you do adds to signal loss. A connector is usually a 1 dB loss. Most radio systems have 2 connectors, so you have already lost 2/3 of incoming signal strength (why you need 3dB gain to start with). You need to look up how many dB you lose per foot of cheap co-ax wire. That can be scary. Cool thing about dB is that you never really get to zero, but get so tiny that zero and your result are real close together shaking hands.

Cable

Rule number 1: keep your cable as short as possible. Not using any cable works the best.

Rule number 2: Do not buy Radio Shack RG58-U plain wire. It has a single wire center conductor which will break, usually just as you are about to enter Burbank ARSA. [What do you mean you do not fly into the Burbank ARSA so this warning won't apply to you??? AAAARRRGH!]

Radio Shack pre-made cable assemblies with male BNC connectors in 6 or 12 ft lengths are made from the "GOOD STUFF" cable which is RG58-AU or RG58-CU. They call the stuff test equipment hook-ups, it has BNC connectors of the right shape, and it's real cheap. RG-8 is real good stuff, but fat. There are more specific types of cable; thinner, thicker, in day-glo colors that have higher "RG" numbers, but mostly the higher the "RG" number, the higher the cable costs, like double, triple, like how

¹ There Ain't No Such Thing As A Free Lunch

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much do you have to spend? You need to be a government to afford.... Cable manufacturers are always proud of their product and stamp their name and cable type all over the covering. If someone gives you 300 ft of unmarked RG-178, be suspicious of people in dark suits and sun glasses.

Do not use TV cable, it is the wrong impedance (75 or 300 ohms) and does not balance your radio. Do as I say, not as I do.

Mil spec requirements state that you need to secure the wire every 3" minimum, unless it is in a conduit. I recommend that you procure some real thin wall metal pipe to run your wires through; for: sensors, strobes, tip lights, whatever. Aluminum foil glued on the outside of a tube will also work. You will thank me later when a wire fails inside your wing. You tie any fuselage ends to the negative lead of the battery and WOW all your radio noise will disappear like magic! (do not connect the outside ends to ground) You can also use this conduit as the ground plane for all your antennas, even in 'glass ships. Buy the cheap stuff and get it big enough for more wires later.

Do not bend your CO-AX tighter than a 3" radius for small cable, or 6" radius for large stuff. You say that Radio Shack stuffs their cable into real small packages? Yeah, but they guarantee their stuff to work, and you can take it back if it don't. It is difficult to fix antenna leads when flying along at 10,000 ft. unless you are in the YB-49 flying wing, or HK-1 Hercules.

How to fix BAD VSWR

Note:>>>> do not EVER touch antennas with ANYTHING when transmitting!

I guess by now you have some way of telling your VSWR is worse than 2:1. Most people use a SWR BRIDGE. Don't use the cheapies unless you know that they actually cover the aircraft bands. Most bridges are for lower bands, and since they have capacitors (UGH), are not reliable above 50 MHz. If you know some amateur radio person (HAM), borrow some of their 2 meter stuff. You will have to go to Radio Shack to get the adapter ends, because Ham's use a different connector for their equipment. By the way, VSWR gets better when the meter needle moves less. You want it so the meter does not move at all, but make sure the meter works, first.

Tune your radio to 123.000. If the VSWR is bad (the needle moves a lot), try 119.000. If the VSWR got lots better, you have: 1.)an antenna tuned for 119.000, 2.) a too much length problem on the radiators, 3.)kinked CO-AX, 4.) a 'GLASS airplane. Tune to 133.000. if the VSWR got lots better, your antenna was too short, or is in a 'GLASS plane. If it did not get lots better high or low, you have kinks, or a crummy installation, OR a scum radio. I can't help you with the glass airplane problem, just throw those nasty fiberglass things away.

If you have too much length, try bending the antenna until ultimately you have a 45 degree gentle bend. If that works, smile and be on your way, ignoring the ugly kink. You can always cut off the extra length, 1/16" at a time, but try bending first. If your antenna has a little ball on the end, DO NOT cut that end off. That little ball is real

important electrically, not just to keep from poking your eye out.

If your antenna is too short, well; OH, well. You can make it longer, but it will always be ugly with bumps and gobs. Use house style solid copper wire, about # 12 or #10 gauge, AFTER taking off the insulation. Figure out the length you need (remember formulae pg. 2) and make the length that long over all. If that fixes your problem, smile, if not, sell that stupid VariEze.

For cable kinks, use a new piece of cable or other antenna. If the problem goes away, well, shoot howdy, fix the cable or use the other antenna. This is why conduit in the wings is soooo nice. If the problem stays, you are going to have to spend some real money getting your radio fixed. Try someone else's Handheld on the problem antenna. If the VSWR fixes, get your VISA card out and remember to smile friendly at the radio technician, because they can sense fear or ignorance and it effects your bill.

Another important VSWR problem comes from having your antennas too close together. Anything less than 1/2 wavelength (4 ft) apart, and the antennas will inter-react with unpredictable results. By the way, if you are going to have bunches of antennas all over the ship, do not shorten the leads, just let them dangle in a tidy sort of way. I personally think that more antennas than installed radios is just asking for communications problems. More radios than the one you need is just asking for money problems.

You 'Glass guys can have your internal antennas if you have a standard fuselage. Just imbed some copper or aluminum window screen somewhere, about 4 square feet. Tie this to the ground system or negative battery cable. Go buy a 1/4 wave monopole kit from anywhere, and mount the antenna inside the fuselage, not touching anything. I am working on a solution for backwards flying fiberglass log grazing aircraft that involves Radio Shack Burglar alarm foil and magic.

Finally: Multiple Antennas

There is an on-going theoretical war concerning the gain advantages of "stacked" antennas. The gist of the arguments is that when you have bunches of antennas, they all receive, effectively, the same amount of radio energy. Stacking them together is like stacking flashlight batteries to get more voltage. The BIG SKY SETI listening program uses this concept in the Owens Valley. The down side is that impedances in parallel become less so power matching becomes difficult. A folded dipole (300 ohms Z) done 6 ways = 50 ohms, more or less. Insuring that all the antennas are fed the same energy at the same time (co-phasing) is the problem.

Happy talking!

- Pete "Paddles" Moore

Why Do We Have N-Numbers?

(That's it...I'm going to have to start checking this stuff out before I publish it...Gary Aldrich, who is also a licensed amateur radio operator, weighs in with his own rumor on

why U.S. aircraft registration numbers begin with "N." I think this one sounds more believable...)

Couldn't help but notice the little trivia byte at the end of the newsletter concerning the origin of the "N" numbers on our civil aircraft. While I greatly admire Mr Schiff, and his knowledge of aeronautical minutia, I have heard of a slightly different slant on the story....

Around the same time as Barry's story of the NC-4, a world congress was held (in The Hague, I think) to discuss the division of the radio frequency spectrum due to the burgeoning "wireless" communication industry (led, by the way, by American amateur radio operators). During this conference the topic of call signs for radio stations was first discussed. The conferees divided up the alphabet among the represented nations based on the number of radio stations then in existence. Since we had the majority, the US was assigned W, K, A, and N.

Back at home, the FCC further divided up our letters, assigning the letters W and K to commercial broadcast stations in the east and west halves of the nation, respectively. The "K"s start around Kansas City and go west with the exception being KDKA--the first commercial station in Philadelphia. Amateur radio stations were assigned all the letters for use; and, because the Navy was in the lead in equipping their aircraft with radios, aeronautical stations were assigned the letter N.

As further support for my story I'd point out that the second letter, "C" was actually used to denote "civil" aircraft with standard airworthiness certificates and standard registration. The letter "X" was used for experimental aircraft (e.g. Spirit of St Louis - NX211). "R" was used briefly for race aircraft (e.g. Hughes Racer - NR1). Of course, it didn't take too long before the military aircraft ceased using "civil" call signs. When they did, the second letter became unnecessary and was dropped.

On a side note, if you look on the FAI-sanctioned soaring badges issued by the SSA, you'll find an N, denoting the USA. The same badges in Germany have a D.

- Gary Aldrich
Director of Useless Information

Thinking of Installing Those Tokyo Tanks?

(This was posted on the Bearhawk e-mail list, though it was said to have originated on the RV e-mail list. It makes some good points about additional fuel tanks in a humorous fashion)

1. What kind of range will your ordinary main tanks give you? _____
2. How many hours is this in the air? _____
3. How long can you fly without needing to stop and pee? _____
4. If the answer to 3 is less than the answer to 2, check this box []; and if you will be the only pilot of this aircraft, **Stop Here.** You don't need aux tanks.
5. How much will the aux tank system weigh when empty? _____
6. How much does one pound of weight reduce your range? _____

7. Multiply line 5 by line 6. _____
8. Subtract line 7 from line 1. This answer is **the amount your normal range will be after installing the aux system.** _____
9. If line 8 is shorter than your common destinations, and line 1 is not shorter than your common destinations, check both of these boxes [] [] If you continue to fill out this form, you will be audited.
10. How much fuel will the aux tanks hold? _____
11. How far can you fly on one gallon of fuel? _____
12. Multiply line 10 by line 11. This answer is **the amount your range will be extended if you add aux tanks.** _____
13. If line 12 doesn't get you any place line 1 already reaches, check this box []
14. Will you be flying over mountainous terrain? If NOT, check this box []
15. Will you be flying over vast stretches of uninhabited country? If NOT, check this box []
16. Will you be flying over large bodies of water? If NOT, check this box []
17. How much time will it take you to design and install an aux fuel system? _____
18. Multiply line 17 by \$20. _____
19. How much will you spend on parts for the aux fuel system? _____
20. Add lines 18 and 19. This is the cost of the aux system. _____
21. If line 20 is greater than \$800, check this box []
22. How many hours per week have you spent on construction? _____
23. No, honestly, how many hours per week, really? _____
24. Divide line 17 by line 23, and multiply the result by 1.3, because you're still lying. This is **the number of weeks adding an aux fuel system will add to your construction.** _____
25. Count the number of boxes you have checked in lines 4, 9, 13, 14, 15, 16 and 21. _____
26. Subtract line 25 from the number "8" (8 - line 25) _____
27. Multiply line 26 by 3: _____
If this is greater than the number in line 24, check this box []
28. If line 27 is checked, add one to line 25 and write the result here, otherwise just write line 25's value here. _____
29. Each box checked represents a strike against installing aux tanks. If line 28 is 3 or less, you have a strong case for installing aux tanks. If line 28 is 6 or more, you'd be installing aux tanks for very little gain. If the answer is somewhere in between, flip a coin.

Capacitance Fuel Sending Unit

(Reprinted with permission from The Canard Aviators' Mailing list, <http://www.canard.com>)

<<The Long EZ system on the other hand, is not as good for estimating exactly how much fuel remains when it's low. The fuel quantity indicators on both planes are too hard to see during flight and easily mis-read. >>

THE LEADING EDGE

I would strongly encourage all owners of existing EZ and VE to place a capacitance type sending unit in your tank. The ones I have came out of a Subaru. Get a used one at wrecking yard for \$5. They are smaller than 1/2" diameter x 1" cylinders. Drop it into your tank and feed the two thin wires into your vent tube. You can have wires exit at any point near end of vent line. Just drill vent line and seal after feeding wires.

Sorry I don't know the details of wiring this to your dash light. But with a zillion auto's having that light that slowly gets brighter and says "fuel low", shouldn't be too hard to figure out.

I haven't closed my fuel tanks yet, but have both the capacitance indicator and normal fuel sending unit. I'll be sending 1VDC through fuel sending unit.

If you look at the causes for crashes, fuel related is #1.

FWIW

- Al Wick

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Icing and Ellison Throttle Body Injectors

(Brian's response to a question about if Ellison Throttle Body Injectors are subject to icing)

Though you are dealing with an EZ, you may find my experience of interest.

I have an Ellison EFS-3 on my O-200 powered Q-200 and it is working just fine. It is a very high quality system at a very reasonable price. It is not, however, immune from Carburetor ice. Carburetor heat is recommended by Ellison and based upon the physics of the configuration. As air passes through the venturi and fuel is injected, the air does loose heat and ice can form, especially on intake arrangements with a cold manifold such as Continentals. Gene Sheehan has been running an Ellison for many years on his Q-200 and he claims that he has never had carb ice even when flying through rain and snow falls. Mr. Sheehan's arrangement pulls air from a long NACA duct on the face of the lower cowl to the lip of the TBI at a right angle to the bell mouth (i.e., without any airbox arrangement at all!)

Ellison recommends an air box to feed the TBI with an airflow based upon sporadic experience with inlet flow turbulence (which can cause fuel droplet pooling inside the injector and resultant poor atomization and distribution). I will not kid you, the TBI is different in operation and there are a few things you will need to know to make it work right.

I went through all kinds of changes trying to make my engine work and thinking that I had a problem with the Ellison, mostly because no one in my local area had any experience with the TBI and didn't trust it. In the end, my problems turned out to be due to fuel tank venting, but I went through a dozen different airbox configurations and a change back to the M-S Carburetor before I sorted things

out. The lesson here is that you should insure that your fuel system is good before you jam an Ellison TBI on your plane and expect the world to get rosy. I like my Ellison and I wouldn't trade it for another Carburetor...real fuel injection or an Airflow performance system would be great, yes, but a lot more expensive. I like my Ellison...it works good and lasts a long time. A good hint would be to talk to one of the Ellisons before you buy...let them tell you precisely how to configure it on an EZ.

- Brian Martinez

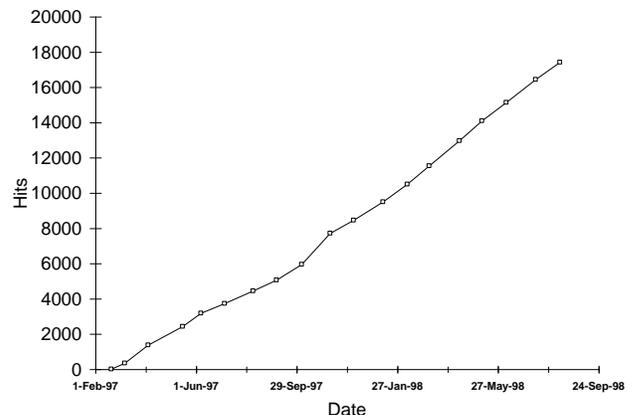
More On Pattern Use

I read your article at EAA Chapter 1000's web site (<http://www.eaa1000.av.org/technicl/patterns/patterns.htm>). For several years, I have been using CAD to create patterns for a variety of hobbies (applied to both wood and aluminum). You might want to try the low-tack aerosol adhesives available at artist supply houses. They do a wonderful job! Just lightly spray the back of your pattern (it doesn't soak the pattern) and apply to the material. Seems to have just the right amount of adhesion and the pattern can be peeled off easily after you've cut, drilled, etc.

- Frank Pruitt

Web Site Update

As of 9 August 1998, the old hit count tote board is up to **17406**. The hit rate is down slightly to 34 hits/day. Probably everybody either at EAA AirVenture or following it on AV Web. See the graph of the activity below.



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

Update activity was again slow, as your Webmeister has been spending most of his time corrosion treating zillions of airplane parts. Now that I'm finally making progress again, I'm trying to catch up from the last several months.

One new addition was the page for *Operation Desert Valet*, our invitational fly-in for GA aircraft as a part of the Edwards Open House. As specified on this page, we're looking for aircraft fitting these criteria:

1. Award winner at a major EAA Fly-In (i.e. Oshkosh AirVenture, Sun-N-Fun, Copperstate, etc)

OR

Is unique enough that you think that we don't have one already

2. Fits into one of the EAA Showplane Categories (Experimental Amateur Built, Experimental Research and Development, Antique (built in the years 1903 through 1939), Classic (built in the years 1940 through 1959), or Contemporary (built in the years 1960 through 1964))

Warbirds are handled separately.

Got this e-mail in: "Just took my first look at the Home page for EAA Chapter 1000. Pretty nice except the little animated Earth globe (with the airplane going around it) is rotating in the wrong direction. The way you have it, the sun would come up in the West and set in the East. Could screw up some almanacs. Cheers, Dan Schaefer, Also an EAA type." Of course, he is referring to our quest to discern our more intelligent readers. With this e-mail, that quest has finally ended. I got tired of explaining why. Hit the site to see what has replaced it.

We can also thank **Jim Piavis** for exposing the name of our expert on *Project Police* Operations. You'll find this expert near the bottom of the home page.

We also received these e-mails: "Jeff Grant here, President of Chapter 103, Nampa, ID. (*Kitfox/Pulsar territory*) We are blessed to have a lot of aviation activity here in Idaho along with great weather. I am also the newsletter editor for the chapter and really find your web page helpful. We hope to have a chapter page in the near future when I can find a host on which to put it."

"My name is Dave Nuss, and I am the newsletter editor for EAA Chapter 117 and also for the Cleveland Soaring Society. I live in a small town in North-east Ohio called Cortland. I've just started to explore your website and so far it looks great! I'll continue to browse, and thanks for the offer to use your material in our newsletter (with proper credit, of course!)."

- 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.

and you will realize that a mere \$238 million has been well spent!

A	Affirmative	N	New
B	Bearing	O	One
C	Czar	P	Ptomaine
D	Disregard	Q	Question
E	Emergency	R	Repeat
F	Fire	S	Say-again
G	Gnu	T	Tsunami
H	Hold	U	Unsafe
I	Iago	V	Violation
J	Jalepeno	W	Weather
K	Knew	X	Xerox
L	Llanelli	Y	Ypres
M	Mnemonic	Z	Zero

New Phonetic Alphabet

(From Bill Sweetman, by way of Brian Martinez)

You may not be aware that a team of international academic authorities has been commissioned by the European Community to create a new phonetic alphabet free of patriarchal references (such as Papa) or words that might otherwise be offensive to minorities (e.g., Zulu) or those of differing gender. (Romeo, for instance, connotes a sexually obsessed individual, possibly a harasser.)

Fortunately, we have been able to obtain an early sample of their work. Try any common communication,

Chapter 1000 Calendar

Aug 18: EAA Chapter 1000 Monthly Meeting, 5:00 p.m., Edwards AFB. USAF Test Pilot School, Scobee Auditorium. (805) 490-1476

Sep 2: EAA Chapter 49 Monthly Meeting, 7:30 p.m., Sunnydale School. 1233 S. Ave. J-8, Lancaster, CA (805) 948-0646

Sep 5: Flyout to Chino (805) 943-9343

Sep 8: EAA Chapter 1000 Board of Directors Meeting, 5:00 p.m., Edwards AFB. Test Pilot School, MOL Room (805) 490-1476

Sep 11-13: EAA Chapter 1073 Wings On Air Fly-In. Truckee Tahoe Airport (TRK), Truckee CA. (530) 562-0617

Sep 12: EAA Chapter 49 "Just An Old Fashioned Fly-In," General William J. Fox Field, Lancaster CA. (805) 948-0646

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

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

Sep 25-27: Golden West EAA Regional Fly-In, Castle Airport, Atwater, CA

Sep 27: Bohunk Fly-In, Bohunk Airpark (805) 942-7080

Oct 3: Edwards AFB Open House and Airshow

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

Oct 8-11: Copperstate EAA Regional Fly-In, Mesa AZ

Oct 10: Flyout to Death Valley-Furnace Creek (805) 943-9343

Oct 13: EAA Chapter 1000 Board of Directors Meeting, 5:00 p.m., Edwards AFB. Test Pilot School, MOL Room (805) 490-1476

Oct 17: EAA Chapters 1000/49 Young Eagles Rally, 8:00 a.m., General William J. Fox Field, Lancaster CA. (805) 256-4829

Oct 20: EAA Chapter 1000 Monthly Meeting, 5:00 p.m., Edwards AFB. USAF Test Pilot School, Scobee Auditorium. (805) 490-1476

Nov 4: EAA Chapter 49 Monthly Meeting, 7:30 p.m., Sunnydale School. 1233 S. Ave. J-8, Lancaster, CA. (805) 948-0646

Nov 7: Flyout to Santa Maria (805) 943-9343

Nov 14: EAA Chapters 1000/49 Young Eagles Rally, 8:00 a.m., General William J. Fox Field, Lancaster CA. (805) 256-4829

Nov 17: EAA Chapter 1000 Monthly Meeting, 5:00 p.m., Edwards AFB. USAF Test Pilot School, Scobee Auditorium. (805) 490-1476

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

For Sale:

Sonerai III 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

To join Chapter 1000, send your name, address, EAA number, and \$15 dues to: EAA Chapter 1000, Gary Aldrich, 42370 61st 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

George Gennuso: pulsar1@qnet.com

Miles Bowen: 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

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