experimental aircraft association

THE LEADING EDGE

NEWSLETTER OF MUROC EAA CHAPTER 1000

Voted to Top Ten Newsletters, 1997 McKillop Award Competition

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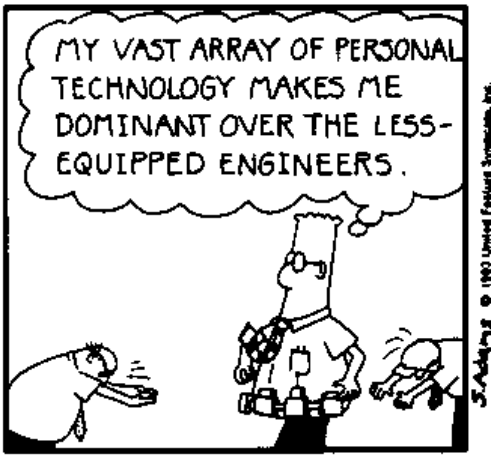
Chapter 1000 meets monthly on the third Tuesday of the month in the USAF Test Pilot School Scobee Auditorium, Edwards AFB, CA at 1700 or 5:00 PM, whichever you prefer. Any changes of meeting venue will be announced in the newsletter. Offer void where prohibited. Your mileage may vary. Open to military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

This Month's Meeting:



What's Up At "Scaled"

Speaker: Bob "Waldo" Waldmiller
Tuesday, 21 July 1998
1700 hrs (5:00 PM Civilian Time)
USAF Test Pilot School Auditorium
Edwards AFB, CA

O.K., this time we have someone special…Do you all remember **Bob Waldmiller**? One of the founding members of EAA Chapter 1000, past President, Vice President, ranking (his excellency) ***Project Policeman***, inventor of the ***Project Police Dust Depth Detection Indicator*** (***P²3DI***), ***Excalibur*** builder, and so many other accomplishments that **Russ** won't let me list them cause we don't have enough budget to pay for the extra stampage…Well, I remember Bob. The last time I saw Bob…He was…It was kind of…I thought that Bob had…Oh %#!!@**, I'll just tell you about the last time I saw Bob Waldmiller. It was at the 1997 Fox Field Air Races. I was there to help park arriving aircraft and Bob was in charge.

It was early in the morning when I arrived and as I was walking into the pit area I ran into **Russ Erb**. Russ, I'm here to help Bob Waldmiller, have you seen him? A strange look came over Russ's face as he said, "Bob?" Then pointing to the east taxiway, he said, "Bob, if you can call him that, is out there, just this side of the runway. "Thanks," I said and started walking, thinking to myself, what the heck was that supposed to mean…So, I'm walking out there and as I approach Bob something just didn't look right. His back was to me during the long trek, but as I got within 30 feet he seemed to know I was there. He slowly turned to face me…GGEEeezzzeeee, WHAT HAPPENED TO YOU, BOB?

He looked half human and half machine, more machine if you ask me. Let me tell you what I saw. He had all this equipment attached to his body. I couldn't tell if it was grafted onto his head or attached mechanically, but I personally counted 17 wing nuts and at least 2 rolls of electrical tape. There were antennas sticking up out of his head, wires and tubes coming out here and going back in there. His eyes were covered with shiny metal shielding devices. There were several layers of listening devices over his ears and some kind of radiation shield covering his head. He had several electronic devices attached to his waist, hip, shoulders and arms, and a big tank on his back. The tank must have been some kind of feeding device because he kept sucking on a tube that ran directly to it. When he walked he made these menacing flatulent sounds causing people to keep their distance. Bob? Bob, is that you?

His reply startled me. "Bob is gone, I am of the collective. I am 7 of 11, Haaa, Cha, cha, chaaa…You are here to assist the BORG, You will…," then he abruptly stopped talking, his eyes were fixed, the collective was communicating with him. Then his arm shot up and he began speaking into a small rectangular device on his wrist…"Experimental niner seven seven whisky tango, turn right off the taxiway, proceed straight ahead follow the Cessna…." Then he continued with my orders, "...direct the arriving air vehicles per my instructions relayed from the collective." Then he continued communicating with the BORG collective as if I weren't even there, issuing orders, moving flawlessly about the arriving aircraft. I was just starting to get used to the new Bob when he turned, pointed his finger at me, paused as he listened and then said, "George, go directly to the registration booth, do not pass GO...." Who was I to argue, although I could have use the extra $200 dollars. On my way I ran into **Gretchen**, and couldn't believe my eyes. She too was festooned with wires, tubes, devices of every description, antenna, reflectors and so on.

"Gretchen, what's going on?" She replied that Gretchen was gone, she was 2 of 11..." and so on. You get the picture. I asked where **Norm** was and she pointed at the tower and said, "Norm is the collective, he is 1 of 11 and we all follow his instructions..."

The Air Races went off flawlessly, and everyone was impressed with the smooth transitions from event to event. Aircraft were landed, taxied and parked in record time, and the same was true of the departures. I guess the BORG really know how to organize an event. I never saw 1, 2 or 7 of 11 the rest of that day, but I've been wondering since that time if they were ever freed from the collective. But here is the best part of the deal, as President Gary and I sat under the wing of his 180 watching the sun set he turned to me and said...Wait, that's another story and I've gone on way too long as it is. Russ is going to kill me….

These past events happened many months ago and I haven't seen Bob in all that time. Recently I did reach him by phone and asked him to speak at our next meeting. He is working for **Burt Rutan** at **Scaled Composites** now and has agreed to share some of what he is working on with us. So, be prepared for an entertaining and information filled presentation from Past President, **Bob Waldmiller**.

I wonder if he is still communicating with the collective....

- George Gennuso

Last Month's Meeting

EAA Chapter 1000
Scobee Auditorium, Test Pilot's School, Edwards AFB
1700, June 16, 1998
Gary Aldrich, Presiding

The meeting was called to order at 5:40 following the **schmoozemeister's** (et al) fare of high fructose snacks.

Visitors

Mark Mitchell, a returning former member.

Phil (didn't catch last name), retired after 27 years in the aircraft industry.

Mike (didn't catch last name), an active member of the C-17 program.

Ed Fuller, a second time visitor from the Air Force Research Laboratory.

Minutes

Accepted as published.

Announcements

The 1998 Edwards Open House will be held Saturday, October 3. Civilian airshow acts are being solicited.

Gary Aldrich will make his copy of *The Experimenter* available for perusal at Chapter meetings.

1999 EAA Calendars are available at the list price of $10.99. Quantity discounts are available.

Within the last month, both the PAPA-51 Thunder Mustang and the second prototype of the RV-8, and their crews, were lost to accidents. Current information on the RV-8 investigation can be found on Van's web site, **http://www.vansaircraft.com**.

New Business

In appreciation to **Olaf Lansgaard** for the use of the FBO facilities at Rosamond for Chapter 1000 activities, the chapter voted to provide him with a $50 gift certificate.

Jack Roth was voted by acclamation to be the official Chapter 1000 ***Boothmeister***.

Old Business

None.

Program

This month's program was a presentation on the Advanced Range Instrumentation Aircraft (ARIA) program given by our very own ***Project Police*** **Officer Bill Grahn**.

The ARIA fulfills three roles: Orbital Support, Air Vehicle Support, and Optics Support. In Orbital Support the ARIA provides data telemetry, data processing, and real-time data relay for orbital vehicles in areas where ground tracking stations are not available. Much of this role has been taken over by satellite-based systems. In Air Vehicle Support, ARIA is used to observe (and sometimes provide range safety for) cruise missiles. In Optics Support, ARIA is used to observe and photograph ballistic missile reentry vehicles.

The ARIA aircraft are the responsibility of the 452nd Flight Test Squadron, which has the distinction of being the only squadron in the Air Force assigned a balloon. The two aircraft types used for the ARIA missions are the EC-135 and the EC-18. The EC-135 is a modified tanker, while the EC-18 is a modified American Airlines 707-320C. The two types are very similar other than some minor dimensional and flying quality differences. The most obvious feature of both aircraft is the bulbous nose housing a 7-foot S-Band telemetry antenna, which is the worlds largest steerable airborne antenna. Other features common to both aircraft are HF antennas for radio communication, and a small radome on top of the fuselage for data transmission via satellite.

The presentation was topped off with a tour of one of the ARIA aircraft which had been parked on the flight line behind the Test Pilot School. This airplane was an EC-18, one of the converted airline 707s. Besides all of the oohing and aahing over the neat equipment, there was an extensive discussion of the "Military Airplane Smell" that had permeated the airplane. We suspect that this is a Mil Spec odor that is required to be installed in all military aircraft by regulation. Probably comes in little cans at high prices.

Thank you **Bill Grahn** for a very interesting and informative program.

Adjournment

The meeting was adjourned at approximately 7:30, at which time many attendees decided to gather at the **Burger King** where ***Project Police*** approved high fat food and good times were had by all.

- Miles Bowen, Secretary

The Prez Sez…

"Summertime...and the flyin' is easy..." Yep, looks like summer has finally arrived in the High Desert. The landscape is taking on that familiar old brown cast as the mercury hovers near triple digits and the afternoon winds top 20 knots. The other day I re-learned the sometimes painful (and expensive) density altitude lesson as I tried to coax a gross'd-out Socata TB-10 off the sun-baked runway at Fox Field. This time it was merely "challenging", but the experience drove home the importance of careful planning and the dangers of complacency. It's amazing how heavy stuff gets this time of year (*especially if you're at Big Bear*)....

Well, enough of the instructor-talk...Summer is also a time when vacations, yard work, soccer practice, and Little League compete for the available daylight with our main passion. Your Board has begun preparing for our "other chapter fly-in". I've been attending committee meetings for the '98 Edwards Open House and Airshow and I can tell you that it will be a memorable event. This year's theme is "Air Supremacy Through the Jet Age". Naturally, we can't expect the same sensory overload of last year's two-day show, but the Airshow committee is working extra hard to ensure a good show. We will be tasked, once again, to arrange a fitting welcome dinner for our fly-in guests on Friday before the show. This is a return to the norm after last year's no-host cocktail party sponsored by the Air Force. In order to allow more members to share in the fun I will be forming committees to honcho this event as well as the annual invasion of genav aircraft. If anyone has a preference, or would like to chair a committee, you know how to contact me. You wall-flowers can just wait until I or your committee chair contacts you. In the meantime, enjoy the great flying/building weather and try and save some time to come out to the monthly meeting, fly a Young Eagle or two, or just hang out at the airport.

Check "6" and fly safe!

- Gary Aldrich

Air Racing With Chapter 1000

The RACE group (Rutan And Composite Enthusiasts) held their Jackpot '98 event at Jackpot NV on 4 July 1998. The ***Project Police*** were well represented with their best showing to date. In the Super Stock, O-320 Long EZ event, **Bob Waldmiller** placed 3rd in a field of 15 at 217.27 mph, presumably in Long EZ N271J. **Norm Howell** was 2nd in a field of 5 at 232.41 mph. We suspect he was flying an O-360 Berkut.

Congratulations to the Test West Crew!

Young Eagles Update

Another rally was held on 11 July 1998 at Fox Field. We introduced 35 new Young Eagles to the wonders of flight. We're still waiting for **Dave** and **Dave** (**McAllister** and **Weber**) to submit the report. Maybe next month…

Flight Report - Grumman HU-16A Albatross

"Albatross! Albatross!" It was with these immortal words of John Cleese[1] running through my head that I walked out of the TPS door for my qualitative evaluation (qual eval) ride of the Grumman HU-16A. With me were my intrepid test pilot **Jackie Van Ovost**, pilot/owner **Rich Sugden**, M.D., and pilot/crew chief/generally in charge of a lot of things **George Northup**. Rich Sugden is a Family Practice doctor, which he is quick to point out does not bring in enough money to support an aircraft the size of an Albatross. It seems he also got into some business with computers some years ago. More significant is that he is a Director of EAA Warbirds Of America.

Size

The Grumman HU-16A Albatross is a high-wing flying boat amphibian. It has a wingspan of 85 feet, a length of 62 feet, and a 22,000 pound empty weight. This ain't your neighbor's Piper Cub!

Propulsion

Power is two nine cylinder two-speed supercharged Wright R-1820-76 radial engines of 1450 horsepower each. Versions of the same engine are used on the T-28 and the B-17. Each engine drives a three-bladed constant speed propeller. Unlike most constant speed propellers, these propellers are electrically controlled and hydraulically actuated independent of engine oil. The governor RPM is set by toggle switches, and the governor

[1] *Monty Python's Flying Circus*, Show 13

and prop hydraulic pump are driven by the engine. A prop oil cooler is integrated into the hub dome. The propeller uses a lighter weight oil than the engine. This system allows immediate control of the propellers on engine start without waiting for the engine oil to warm up. On the water at low speeds, the air rudder is not effective, and no water rudder is installed. The primary means of directional control is differential power. At idle power settings, control is best accomplished by moving one prop in and out of reverse. No beta range was available on these propellers. When the engine is running, the propeller is thrusting one way or the other, so immediate control is necessary.

Primary fuel is carried in main wing tanks. Additional fuel can be carried in the tip floats. However, water operations are prohibited with more than 100 gallons of fuel in each tip float. Otherwise, the tip floats wouldn't. Runway landings are also prohibited with more than a 100 gallon difference in fuel load between the tip floats. This aircraft is equipped with wing racks capable of carrying bombs or drop tanks. With main, tip, and drop tanks, this aircraft can carry a total of 10,200 pounds (1700 gallons) of fuel, for a reported range of 3000 miles. This aircraft has flown non-stop from Nome AK to Japan in 16.5 hours.

Landing Gear/Hull

Landing gear was installed for land operations. The main gear retracted into the side of the fuselage, and the main gear strut folded into the side of the fuselage and underside of the wing. During water operations, the main gear well is flooded with approximately 1000 pounds of water. During the takeoff run, the acceleration forces this water through a hole in the rear bulkhead, through a tube which exits near the center of the hull in the low pressure area immediately behind the step. A smaller hole near the bottom of the bulkhead lets out the remaining water.

The nose gear lowers through doors in the center of the forward part of the hull. Damage to these doors can occur if the aircraft if landed on the water in a too nose-low attitude. True to Navy tradition, the nose gear has two wheels. I suspect this was more to save space in the lower fuselage by using smaller wheels than for straddling a catapult track. The nose gear is free castering with no nose wheel steering provided. Directional control during land taxi is provided by differential thrust, augmented by differential brakes (which are generally ineffective for water operations). A less than desirable note about the brake system was that every application of the brakes required pumping the pedals several times. This increased the difficulty of taxiing. The requirement to pump the brakes was verified by the owner as "normal" for this aircraft.

The nose gear compartment is sealed from the hull, and is partially flooded during water operations. A small window in the top of the compartment is visible from the flight deck, giving a quick check if the nose gear is up or down (doors open or closed), at least for daytime operations.

Tip floats are provided for lateral stability in water operations. The underside of the fuselage is assembled with round head rivets, while the remainder of the aircraft is flush riveted. As told to us by the owner, the Albatross was originally designed and built with flush rivets on the underside. After an operational accident, a large hole in the underside of an Albatross was repaired in the field, but the mechanic only had round headed rivets available. Much to their surprise, the water takeoff performance improved, getting off the water 5 to 10 knots sooner. Word was sent back to Grumman, who verified this with testing. Therefore, all subsequent Albatrosses were completed with round headed rivets on the hull bottoms. In an odd twist to the story, because the sheets were already dimpled/countersunk, they used a special rivet which was essentially a flat head rivet, but with a round head added on top of it. Countersunk round head rivets-only on the Grumman flying boats...

Flight Control System

The flight control system is fully reversible (cables, pulleys, pushrods), with hydraulic boost available for the rudder. Hydraulic rudder boost is normally only used during takeoff and landing, and is mostly intended to relieve pedal forces during single engine flight. Rudder boost is not required for normal flight.

Electric trim is provided for all axes, driving trim tabs on the elevators, rudder, and left aileron. A fixed tab is provided on the right aileron. Each elevator has a trim tab, and each elevator trim tab is controlled and driven independently, providing redundancy. Trim is controlled by toggle switches on the panel between the pilots. A coolie hat switch was added to the yoke. Fore and aft movement controls the left elevator tab. Side to side movement controls the rudder trim, not aileron trim. This was judged by the owner as more useful during normal ops, allowing easy trimming for p-factor, torque, and single engine flight.

The flaps are electrically controlled and hydraulically operated. The flaps are also hydraulically balanced, a feature unique to Grumman aircraft. In the absence of air loads, lowering the flap lever lowers the flaps, which may come down asymmetrically. However, as soon as air loads are applied, a cross-feed between the actuators will allow the flaps to re-adjust until the loads, and thus position, are symmetric. I saw this happen during a land takeoff. When the flap lever was set to 15 degrees, the flap appeared to move down about 5 degrees. Shortly after we started moving, the flap moved to the 15 degree position.

Getting In

The aircraft is entered through a hatch (no doors-this is a Navy bird) on the left side of the fuselage. Since the hatch has to be above the water line, it requires climbing a six step ladder to get in.

Stepping inside, the first word to come to mind is "cavernous." We're talking really big! I was reminded of Dean Wilson's Explorer, only with a more substantial looking frame. Immediately behind me at this point was another hatch leading to the lavatory and "head," which can be very important when flying 16.5 hour sorties. This aircraft was equipped with 4 medical stretchers (used as bunks), 4 passenger seats, and enough room left over to set up a nice home office.

Immediately behind the wing is a large hatch in the roof of the fuselage, with a sextant port in the middle of it.

I am told that this hatch was big enough to load an entire R-1820-76 engine quick change kit (engine, mount, and accessories) into the aircraft. We never did figure out how you would get the engine out in the middle of the ocean to fix a crippled aircraft without some sort of crane. On the back of the sizeable wing spar carry-through structure (guaranteed to instill confidence in passengers) is a handle which, if pulled, starts inflating a life raft on top of the wing. The life raft would push open a hatch as it inflated, then slide down the top of the aircraft to the left side, coming to rest right in front of the exit hatch. During restoration, this handle was accidentally pulled, and the life raft, which had been stored for 20 years, inflated and slid down the left side, just as designed. Since an inflatable boat is carried in the fuselage of this aircraft, this compartment is used to hold engine oil, a line (Navy for rope) to lift the gas hose up to the top of the wing, and other items.

The top of the aircraft can be reached from the entry hatch using a folding step and two hand holds above the hatch. Alternatively, hatches are located above the pilot and copilot seats. These techniques all work on land or water.

Walking forward through the aircraft (boat? ship?), you step through another Navy style hatch into the flight deck. The walkway is a the same level as the deck (Navy for floor) in the cargo/passenger compartment, but the flight deck on either side is about kneecap height. Pilot and copilot seats are where you'd expect them, with an additional seat behind the pilot and another behind the copilot. A complete set of flight instruments are installed on each side (a good thing considering how far apart they are), with engine instruments in the center. Engine controls (including throttles and mixture levers), propeller RPM switches, flap controls, fuel selectors, radios, and rudder boost control are all located on the overhead center console. A large red lever on the left side of the overhead console controls throttle friction.

A very nice flight director system was installed. A major improvement to the instrument panel was to take all of the warning, caution, and advisory lights from all over the cockpit and consolidate them into one logically grouped panel near the center of the instrument panel.

Enough of that, let's go flying...

Takeoff and Climbout

Our adventure started with a land takeoff from Edwards AFB. Our startup gross weight was about 29,000 pounds, with about 3000 pounds of fuel on board, and a mid-range cg.

Lineup was made with the nose about 10 degrees right of centerline, knowing that torque and p-factor would bring it back around. Flaps were set to 15 degrees down. The propellers were set to full increase, governing at 2700 RPM. The throttles were advanced to maximum power, giving 49" Hg manifold pressure on this day. The limiting manifold pressure was 51" Hg. The left throttle was advanced slightly ahead of the right throttle, again to compensate for torque and p-factor. The rudder was used for fine directional control once it became effective. Rotate speed was 80 KIAS, which was also used as V_{mca}.

Boy, talk about LOUD! I didn't have a sound pressure level meter with me, but even wearing a noise-canceling headset, it was still louder than I would want to put up with for much longer than a minute or two. I'd hate to think what the boys flying these operationally in the '50s went through. (What?...I can't hear you...) It was so bad during takeoff and climbout that the voice activated feature of the intercom had to be turned off and push-to-talk used.

The landing gear was retracted and the flaps were raised at 100 knots. Due to the immense volume of the hydraulic rams on the landing gear and the limited volumetric capacity of the hydraulic pump, the landing gear do not retract simultaneously. The nose gear (with the smallest volume requirement) comes up first, then one of the main gear, then the other. The yaw due to the unsymmetrical gear retraction can be felt in the cockpit, but can be easily compensated. On one takeoff and landing I had the opportunity to watch the main gear retraction and extension from a bubble window just behind the main gear. (It's an interesting experience to stick your head "through the side" of the fuselage and not feel any wind blast--great view too!) If you enjoy mechanisms and seeing how things work, this one is a real treat! It's amazing how such a complex folding can be done with just two actuators. Even after fully retracting, the main gear wheels continue to rotate for about a minute.

The limit speed on the landing gear was 140 KIAS, which was well above any speeds needed for normal extension and retraction.

The climbout was flown at 120 KIAS, which yielded about 800 to 1000 fpm rate of climb.

So What's It Fly Like?

On our way to and from Lake Isabella, we checked out the flying characteristics. Cruising at 6750 feet, we were making 150 KIAS at 28" Hg manifold pressure and 2000 RPM. That's 165 KTAS to you and me (190 mph if you insist on using those archaic units). At a fuel weight of 2600 pounds, we were burning 97.7 gallons per hour. By rough calculations, for a full load of 1700 gallons of fuel, that would be 17.4 hours of endurance, with a range of 2871 nautical miles, or 3306 statute miles (no reserves). These results match reasonably with the claimed performance.

Power settings were easy to set, assuming you remembered to loosen up the throttle friction.

The L/D_{max} airspeed (minimum drag airspeed) for this aircraft was around 135 KIAS as tested, with a very flat thrust required curve. This leads to an interesting technique being used to reach cruise speed. For most aircraft that fly well above the minimum drag speed, the technique is to climb to cruise altitude, push over, accelerate, and then set cruise power. With the Albatross climbing at 120 KIAS, pushing over at cruise altitude and setting cruise power, the aircraft will seem to stabilize at about 120 KIAS. While it may be accelerating very slowly, any pitch bobble up would quickly stop that. However, without moving the throttles and diving to reach 145 KIAS, then leveling off, the aircraft magically stabilizes at 145 KIAS! Almost seems like 25 KIAS for free!

The electric trim was thought to be overly sensitive in pitch and yaw. We were told that no changes had been made to the trim system, other than to remote two switches to the coolie hat switch. Thus, this was the original trimming speed. Roll trim was not tested.

Freeplay in the wheel (yoke) controller was "not too bad," with about 5 to 8 degrees of freeplay in roll. Control forces were qualitatively high, as would be expected in a reversible control system for an aircraft of this size, and appropriate to an aircraft that spends most of its time cruising.

The short period response (pitch damping) was deadbeat (no overshoots). The dutch roll was snakey (more yaw than roll) and damped out after one overshoot.

Stalls were accomplished at 6500 feet, cruise power, clean and with 15 and 30 degrees of flaps. In each case, natural airframe buffet and control yoke shaking were felt 5 to 10 KIAS above the stall. The stall warning was obvious and unmistakable. The stall airspeeds were about 80 KIAS with 15 degrees of flaps, and 70 KIAS with 30 degrees of flaps. In each case, the left wing slowly dropped about 20 degrees and the nose fell through the horizon. Recovery was by letting the nose drop, raising the wing with a bootfull of rudder (boost off), and leveling off. Power was not changed during the maneuver. Recovery took 8 to 10 seconds, even with full rudder, and lost about 500 feet of altitude.

No significant pitch changes were noted when changing power settings. I suspect this is because the c.g. of the aircraft is fairly high. All of the heavy parts of the aircraft (wing structure, fuel, engines, tail) are more or less lined up with the thrust line. Though the fuselage is large below the thrust line, it is mostly a large shell around air space. Pitch change with power might change if the aircraft was heavily loaded.

Now the part you've been waiting for...

Water Landings, Taxi, and Takeoffs

Water operations were conducted on Lake Isabella. Coming in for a water landing is similar to an off-airport landing, with some modifications. Flying a box pattern over the proposed landing area, we looked for any obstructions, such as stumps, floating debris, boats, people, etc. (That's the first time I've ever called boat traffic in an airplane!) To determine the wind direction, you can look at which way the waves are moving. You can also look around peninsulas for "slack water," which is the smoother water on the leeward (Navy for "downwind") side. Even running the checklist is different. The IP was very specific about stating that this would be a **WATER** landing and that the landing gear was **UP**. Landing in the water with the gear down is just as bad as landing on land with the gear up. Knowing the wind direction and having cleared the landing area, fly a normal downwind, base, and final. On final, stabilize on the desired airspeed and power setting. If the water is not glassy (tough to judge altitude), then flare as normal.

When you first touch the water is when all similarity to land landings ends. Land landings may start with a bounce but then rapidly smooth out. In water landings, you start out as a high-speed boat, planing and bouncing across the waves just like you were in a fast ski boat. The waves were running about 18" crest to trough when we landed, so the bouncing was definitely noticeable. As the aircraft/ship/boat continued to slow, it would eventually come off the step and dig in, accompanied by a big splash. Now you were floating by displacement instead of planing. About the best simulation I can think of would be riding Splash Mountain at Disneyland or the Log Flume at Six Flags. At the end of the big drop at the end of the ride, your "craft" is set skimming (planing) across the waters surface. After a few bounces, it digs in and gives a big splash. The pilot's biggest job in this maneuver is to maintain the proper pitch attitude, which mostly consisted of pulling back to keep the nose up. We tried one max effort landing, approaching with full flaps and reverse thrust after touchdown. Our estimated water run was about 200 to 300 feet, with water going everywhere! This just goes to show that you can put this airplane down in a much smaller area than you can get it back out of!

Low speed taxiing (ploughing, or plowing if you prefer) is accomplished with the engines near idle thrust. This still gives a good 5 to 10 knots, much like bringing a motorboat into a dock. Speed and directional control is by the engines. A very effective way to control direction at low speeds is simply to put the prop on the side you wish to turn toward into reverse. Pull the throttle to idle, then push up. It takes some practice to smoothly get in and out of reverse, and getting out is harder than getting in. For pilots new to the airplane it is hard to determine if the throttle is in reverse without looking.

Unless you happened to be going directly upwind, steering is a constant effort to maintain direction. That big vertical fin is still out there and is still trying to turn you into the wind.

This is a good time (assuming you're not the one driving) to go forward to the bow. Back down onto that walkway between the pilot and copilot, duck under the instrument panel, turn on the light, and open the bulkhead hatch. This hatch leads to the nose compartment, where you open the overhead hatch, then stand up in front of the cockpit. Turn around and wave at your pilot. Then plug your headset back in so she can hear you. The primary purpose of this hatch is so you can use a boat hook (long pole with a hook) to grab the mooring buoy, which, of course, is out of the view of the pilot. If you look forward, the nose disappears from your field of view. As such, you can spread your arms, tilt your head back, and do your best Kate Winslet impression. Of course, you'll be a lot closer to the water than she was on the Titanic, but hey, think of it as flying low level.

Step taxiing is preferred if you have a long way to go, such as getting back to the takeoff point. This maneuver consists of getting up enough speed to plane across the water ("on the step"), but not enough to take off. Flaps are left in the **UP** position, which for some reason allows the aircraft to get up on the step easier. Again, the primary job of the pilot is attitude control. Ailerons are used to get the tip floats out of the water (harder than it sounds), and it takes a LOT of aileron! Full aileron takes over 180 degrees of control wheel rotation, with a sizeable force. Add to that pulling all the way back on the yoke to keep the nose up while applying power. Lead with the left throttle to counter p-factor until the rudder becomes

effective. As the aircraft comes up on the step, it will probably start to porpoise (oscillate in pitch), which is not a good thing because this is an Albatross, not Flipper! Stop the porpoising by smartly pulling back on the yoke as the nose is going down. Once the porpoising stops and you are on the step, the pitch attitude becomes more stable. Now you've got a big, high-speed motor boat. Directional control is by rudder at this point. Doing this maneuver for the first time will probably leave you feeling short about two arms, between the pitch attitude, keeping the tip floats up, adjusting the throttle, maintaining directional control, and the myriad of other things you have to do. That's when it's nice to have a copilot to run the throttles or something. Step taxiing downwind is even more challenging because with less airspeed, the ailerons are less effective and you may not even be able to get the tip float out of the water. Directional control is also less effective.

Water takeoffs start off just like step taxiing, with a few changes. This time the throttles are advanced to full power, and the aircraft transitions from low speed taxi to step taxi. Once on the step, the flaps are dropped to 15 degrees, and at 80 KIAS, pull back and lift off. Once off the water, its just back to being an airplane.

The takeoff can be rather spectacular to watch from the bubble side window. Applying takeoff power sets up an incredible rooster tail, with water going through the lower part of the prop, up the side of the fuselage, and across the horizontal tail, which doesn't do wonderful things for the fabric covered elevators and rudder. Initially, this water plume fully engulfs the bubble window, but eventually the window clears and gives a spectacular view to the rear.

Albatross Buffoonery

This is an incredibly fun aircraft to fly if you ever get a chance. In warm weather, you can set down on a lake, set the barbecue on a shelf outside one of the side hatches (on the downwind side), crawl up on top of the wing and have quite a picnic. The wing also makes a great diving platform. If you really want to confuse your friends, lower the landing gear in the water (it's okay to do after you've stopped, but pull them up before any more taxiing). Then tell your friends that you're going to swim under the fuselage and see them on the other side. Then swim under, but come up in the nose gear well. There's plenty of trapped air in there. This will leave the rest of the folks wondering where you've gone. You'll have to decide how long to carry on this charade.

I Want To See More!

See a whole mess of pictures on the *Albatross Pictorial Tour*, courtesy of USAF TPS, accessible from the ***Project Police Picture Pages Phor Pilots*** on the Chapter 1000 web site.

- Russ Erb

ZEN AND THE LOST BLACK ART OF ANTENNAe (Part 1)

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

Since Big Brother Government is constantly "improving" ATC and is always trying to save us from ourselves, whether or not we wish to be saved; it behooves the average airplane driver to be able to talk to these people as they deem necessary (pay attention here, **Waldo**). Being homebuilders, we should be able to design and install superior devices for enhancing the prospects of clear communications. Historically we don't. Airplane people generally go down to the nearest airplane parts place and fling enormous sums of hard-earned cash for stuff that has the magic incantations "FAA-PMA approved." I wonder what authority the FAA has with FCC radio related things? I guess government is government, like parts is parts.

I find that there is a certain satisfaction of being able to say to ATC that they need to repair their equipment when they cannot talk to me. Of course, being GOVERNMENT employees, they don't listen, but.... I also constantly talk to other aircraft, Approach, Departure, towers from 80 - 150 miles distant. I listen to BFL or WJF towers from 50+ miles and through mountains on a hand held radio. I do it, why not you?

Anyhow, I will attempt to provide an understanding of what some consider a black art WITHOUT using math (not much anyway, mostly because I am required by law and accountants to totally abstain from doing anything remotely resembling math). I will keep this to a level that anyone can understand. If I can understand it, you ought to be able too. The lone exception will be Rocket Scientists because they are so fixated on whatever project they work for that gaining entry to their conscious is difficult. You, the reader, are therefore obligated to not snicker loudly when I give over-simplified explanations. Besides, you are reading this because you think I know something you don't. Maybe you just need Prozac.

I started my informal education of design and installation during the real early days of the CB radio goofiness, prior to, say, 1972. Guess what? Antenna design for those days translates into proper antenna design for aircraft. Who'd a thunk...This early experimentation with handheld 500 milliwatt children's walkie-talkies led to a personal favoritism concerning very long length wire designs, some times many wavelengths long. CB (29 MHz /10 meters) frequency makes for a very long antenna (see following formula) which is impractical for aircraft use. Fortunately, aircraft bands require only about 8 ft (less than 3 meters) for full wave radiators with other designs being significantly shorter.

We do have a serious problem in the Aviation Bands because they occupy the spectrum of 108 to 135 MHz which is a spread of 27 MHz. This spread is equal to several entire amateur radio bands, and those guys use as many as 5 DIFFERENT antennas per band. Obviously, a single purpose antenna is not going to be efficient due to extraneous stray capacitances and inductances affecting

antenna lengths. In Idiot: too big or too short to hum along with the song.

Another problem we face is the current annoyance that Government requires ATC to use the higher portions of the Band for ENROUTE COMMUNICATIONS because they were stupid and filled up the lower areas with mandated ground and tower talking. Voltage to Standing Wave Ratio (VSWR) rises sharply with antennas being off-resonance, and efficiency suffers greatly. One solution is to have two dedicated COMM radios and antennas, each tuned to a portion of the band: One that centers on 123.000 MHz and the other centered on 128.000 MHz. Each will function somewhat on the other's assignment, but will be the most efficient where they are tuned. Obviously, you do not want to purchase a radio that has both NAV and COMM functions derived from the same antenna.

STUFF to know because it is useful and really impresses chicks at the bar

One half wavelength (inches) = [495 / (frequency in MHz)] X 12 for free air dielectrics in ether.

Notice the formula is for FREE AIR and bare wire or not covered with insulation? By the way, I wonder how they get free air out there in the ether?

This formula is based on the theoretical distance required to form a sinusoidal wavelength in space (The final frontier. These are the voyages of the Starship Enterskies.).

Everything in antennas is conveniently based on either 1/4 or 1/2 wavelength for spacing, lengths, distances from other antennas. Figure out how long a 1/2 wavelength is for your interested frequency and you have most of your problems solved. By the way, 1/4 wavelength for midpoint of most tower frequencies (123.000 MHz) is 24" more or less [way cool nerd thing to know]. You engineer types just figured out that it is actually 24.146341 inches, but IS IT REALLY? More later.

VSWR (voltage to standing wave ratio): What you get when the antenna does not radiate all the energy you throw at it. Effectively, you get relatively high voltage returning back down the antenna and back into your radio. The lower the VSWR number the more power you are radiating, the better you communicate because the radio is not wasting power. It is possible to have a VSWR ratio of 1:1 using idiot-proof techniques. If you have a real high VSWR, say over 3:1, you can and probably will overheat or destroy the final amplifier stage leaving you without a transmitter. VSWR will increase for frequencies high or low that are not matched to your antenna length. Responsible radio manufacturers usually have a circuit that automatically limits power to the final amplifier if VSWR gets too high (above 2:1).

Responsible antenna manufacturers should make antenna VSWR ratios below 2:1 but THEY USUALLY DON'T !!!

A 2:1 VSWR means you are bouncing at least 3/4 transmitter power you just threw at the antenna right back into the transmitter like a ping pong ball. What does the transmitter do with reflected power? Make heat. Ever notice that the belt clip of your ICOM hand held gets hot when you use the rubber antenna a lot? Do you know how ICOM heat sinks the power amp? That's right, kiddies, it is the metal belt clip. ICOM considers the rubber antenna an emergency antenna only.

Impedance is a restricting force against the free movement of electrons. FREE RANGE ELECTRONS? You betcha, Pilgrim. In techno-babble, impedance attenuates electron flow. In Idiot English, impedance is a drag. Impedance always makes heat, which is considered bad Karma, DUUDE. Big impedance, big heat. Little impedance, much more heat, and, you let the smoke out of your components which is difficult and expensive to put back in.

Impedance can be Inductive (+), Capacitive (-), or resistive (0). Carbon fiber or fiberglass is a combination of all these. Capacitive and Inductive Impedance tend to cancel each other out and make zero for one set of circumstances (usually frequency). Everything has impedance of some sort which is measured in OHMS but you cannot measure these ohms directly (you guess or pay large sums of money to consult a Electrical Engineer). Impedances add together and do weird things in parallel. Impedance is also the thing that makes antennas not have a free lunch because you can't change one thing without affecting overall impedance (always higher).

What makes impedance?

Capacitance shortens antenna lengths because it makes electrons apparently move slower. WHATT??? HUNH!!? Does Einstein know about this? WHY? Well, without math it is impossible to explain, so just trust me. Everything that is not a perfect insulator to RF energy (nothing known except possibly mega-magnetic fields in magnetic linear particle accelerators or black holes) has capacitance, which is one reason why 'glass planes usually have so many antenna problems. Capacitance is also a dastardly thing that has an annoying tendency of decreasing impedance as frequency goes up.

Inductance is like magnetism or a big fishing net, at least as far as electrons and radio waves are concerned. The more inductance you have the more electrons you capture. The longer the wire you have the more inductance you have (somewhat how coils work). However, the more inductance you have at high frequencies, the more impedance you get.

Velocity Factor

Velocity Factor is a weird effect caused by capacitance, that makes the required wire actually shorter than the theoretical length at the speed of light. Wire manufacturers publish charts with this data. You just multiply the resonant formula length by the velocity factor to get actual length. Note that this only counts when your wire has a insulating covering which YOU won't use, right?

Note: If you want to get really efficiency nuts, you have your co-ax antenna wire in exact multiples of 1/4 wave, so this is where velocity factor is important because the length will be shorter than theoretical.

Radio frequency (RF) energy has abnormal properties

IMPORTANT>>>>> There are no known insulators to RF energy. It will penetrate rock, metal, PLASTIC, FIBERGLASS, skin, yada, yada, yada (particularly

penetrating to that last yada). You can only "channel" RF energy along conductors (how shielding and wave guides work, but not 1-900-PSYCHICS) The "HAM" guys actually use electrical components like resistors in real high frequency stuff for structural materials.

Things that are at least 1/4 wavelength are always a radiator of energy. This is how things that look like a short aren't a short. A 1/4 wave delta match antenna at 1296 MHz is a dead short less than 2 inches long. I still have my own problems with that concept but use blind faith because I tried it and it works. If I remember correctly, your CUTE LITTLE TEENSIE wire transponder antenna is actually a full wavelength long.

RF energy will collect and flow down metal surfaces (like wires) because most metals have inductance. If the metal is not an even part of a wavelength long, RF will re-radiate itself when it gets to an end of the piece of metal (sometimes useful to know, mostly a problem because it can cause signal cancellation, echoes, loss of signal etc., but it IS how your TV antenna works). If the metal is an even part of a wavelength long, the energy hangs around looking to do something useful before it gets wanderlust.

(*We'll continue this fascinating and useful discussion next month*)

- Pete "Paddles" Moore

Project Police Long Range Patrol

Raid Site: Wolfeboro, New Hampshire

The old cliché that the world is getting smaller was never more apt than the day I got a call from **Bill Grahn** about an upcoming fly-in. "Not unusual," you say. "We see Bill all the time and he's often in the thick of things when it comes to chapter events" might have been a typical response. Well, this is the other **Bill Grahn**, and he's in New Hampshire. He also happens to put **Sr.** behind the name to distinguish himself from the younger Bill of California fame.

Bill Grahn, Sr., is president of EAA Chapter 917. Bill the Younger had read my last contribution to the newsletter about the winter fly-in at Alton Bay, New Hampshire, and mentioned in conversation I was living just south of dad's home in New Durham. (No, I don't know why everything is New in New England.) Bill the Wiser wasn't about to let a possible recruit from the Greatest Chapter in the Known Universe get through the summer without a little local hospitality, so without hesitation, my call from Bill Grahn.

Chapter 917 sponsors a fly-in and barbecue/potluck each year at Wolfeboro. Wolfeboro is a small community on the eastern shore of Lake Winnepesaukee in central New Hampshire. Around this part of the world, the area is known as the Lakes Region and a fair amount of big-city money is invested in lake-front cottages of anywhere from 500 square feet to about 10,000 plus. The bunch that uses a phrase like "We're summering at the lakes..." have the big ones. Wolfeboro is not unlike La Jolla or Sedona when it comes to ambiance and the number of establishments that price well in excess of rational just to give you the flavor.

But you're not interested in money, or ostentatious behavior, or tanned hard-body babe/hunk sight seeing, so on to airplanes. (Photos by Pacific Flyer; hunks included for equal opportunity political incorrectness.)

The airport at Wolfeboro is not quite what you would expect. On the sectional it's listed as Lakes Region--probably for those who have a hard time with proper geographical names on sectionals that don't jive with their familial land holdings in these parts--in other words, the one's who were born with too much money. The elevation is listed at 580 feet. There's a decided slope to the runway so I figure it starts 2000 feet back at about 400 feet. Maybe I'm exaggerating, but it seems pretty steep for a runway. Landings are upslope and a proper flare is a little unsettling given the fact you lose the horizon as the airport property pitches down at the top of the runway. (Better than Catalina where you lose it mid-runway.) Pranging the nose is probably a fine art here for conventionally geared planes.

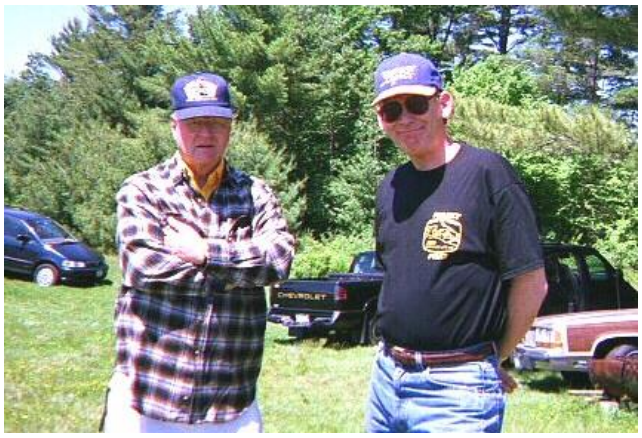
The fly-in was small, but the hospitality was big. Lots of tail draggers and a nice weather day were the draw. I had the family in tow for the event and despite the lack of younger males, my two daughters found enough interesting airplanes to keep them busy looking and wandering for several hours.

Moms, Kids, Cub

Wing Walker in Training

I must say I liked Bill Grahn Jr.'s parents a lot. Very nice people who only grudgingly accept that California and Edwards AFB are a good place for their son to live and work. While mingling with the folks I heard lots of Bill Jr. stories including some about unplanned landings in places not too far from the airport. Bill Jr. is kind of famous in these parts for his off-field landing skills. Bill's mom seemed to like us so much (my daughters can be charming and my wife makes up for my irascible nature) that I could swear an adoption was about to be proffered. I just might accept since Bill's Dad has a very nice J-3 project going and Mom (it just comes naturally Bill) was ever so gracious.

The airplanes were more like I would expect at a fly-in than I found when I was up this way in February for the ice event. Nothing big or terribly expensive, with the exception of rather beefy Yak. (Bad pun not intended.) Of course there were a few planes down on their tires and looking a little sad, but that's not unusual at small airports. There's also a nice small-facility FBO on the field and lots of tie down space. It's just the sort of place you could fly to on a sunny afternoon for a picnic and some tall tales with friends. Sort of reminded me of Rosamond, except for the lack of houses, wind, desert, restaurant, proximity to a major military facility, etc.



Bill Jr. Flying Skills Review In Progress by Bill Sr.

Since I've become the chapter's unofficial ***On The Road Detachment*** (*we could make it official!*), I've included some photos. That's mostly for those of you who suffer AADD, Airplane Attention Deficit Disorder, when an airplane photo isn't included. I also wanted to show I was properly uniformed for the event. The snow plow and blower just behind the red/white *(he thinks we can do color!)* pole in the photo below is a little local service to assure you the guys who run this place are ready for winter. The pole is how they measure snow depth in the winter time.

Old Planes, Old Plows

So now that I've embarrassed **Bill Grahn Jr.** sufficiently, more of you can send me the home address of your family and I'll go get a bag full of stories about you to tell in the newsletter. I'll just write up the one's fit to print in the newsletter and offer everything else for sale. I will accept blackmail payments in the form of parts, labor, and abundant praise. And Bill, I think you're family life in New Hampshire is safe, at least until Christmas or the first flight of the J-3.

- Chuck Firth
EAA Chapter 1000 Det 9, Auburn, NH

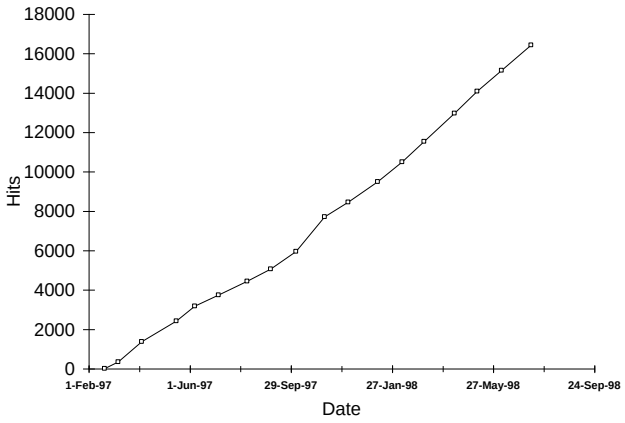
Just An Old Fashioned Fly-In

On 12 September 1998, Chapter 49 will be starting off this year's version of "Machtober" (we need a new name since it's not all in October this year) 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.
The other events of this month are the **Golden West EAA Regional Fly-In** at Castle Airport (Sep 25-27), the Bohunk Fly-In (near Fox) (Sep 27), the Chapter 1000 Fly-In and Military Air Show, more commonly known as the **Edwards AFB Open House** (Oct 3), and the **Copperstate EAA Regional Fly-In** in Mesa AZ (Oct 8-11). Start scheduling those kitchen passes now!

Web Site Update

As of 11 July 1998, the old hit count tote board stood at **16424**. That matches last month's hit rate of 36 hits/day. See the graph of the activity below.



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

Update activity on your favorite chapter web site has essentially been non-existent this month. This is due to the weak excuse that your Webmeister was on leave for three weeks and gone to Texas for most of that time. You know how Grandparents insist on seeing their grandkids. I did manage to get an initial qualification on Lee Erb's project doing some terrain following testing while surveying the future site of the Texas Buckeye Ranch Airfield (STOL operations ONLY).

- Russ Erb, Webmeister

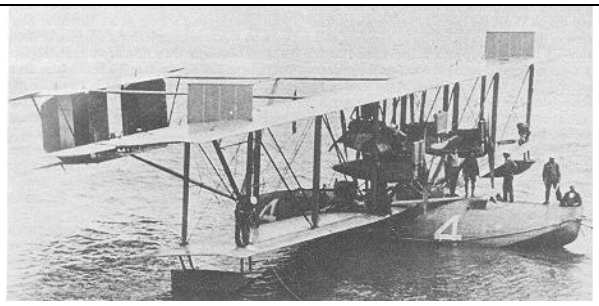
Just a reminder that the EAA Chapter 1000 Web Site is hosted courtesy of Quantum Networking Solutions, Inc. You can find out more about Qnet at http://www.qnet.com or at 805-538-2028.

Why Do We Have N-Numbers?

(*From the EAA Chapter 96 Newsletter, Torrance CA*:)

Hal responded to Barry Schiff's AOPA quiz question "Why do our registration numbers begin with N?"

In 1919 an international convention was held in Paris to decide the matters of national aircraft registration. The Navy NC-4 (Navy Curtis) had just completed the historic first trans-Atlantic crossing. In honor of that event, the letters "NC" were awarded to the United States. The "NC" was later shortened to the single "N" and today the registration of every US civilian aircraft starts with that letter.



Chapter 1000 Calendar

Jul 21: EAA Chapter 1000 Monthly Meeting, 5:00 p.m., Edwards AFB. USAF Test Pilot School, Scobee Auditorium. (805) 490-1476

Jul 29-Aug 4: 46th Annual EAA AirVenture Oshkosh, Oshkosh WI

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

Aug 8: Flyout to Fresno Sky Park (O6O) (805) 943-9343

Aug 11: EAA Chapter 1000 Board of Directors Meeting, 5:00 p.m., Edwards AFB. Test Pilot School, MOL Room (805) 490-1476

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

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

Looking for a Taylor Monoplane flying or project or Bowers FlyBaby. $100 to the person or club that leads to the purchase. Dave at (toll free) 1-888-754-3980 or aainds@yahoo.com.

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

*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 21 JULY AT TPS
HU-16A ALBATROSS FLIGHT REPORT
THE BLACK ART OF ANTENNAS
CHUCK FIRTH'S UP NORTH FLY-IN REPORT