experimental aircraft association

THE LEADING EDGE

NEWSLETTER OF MUROC EAA CHAPTER 1000

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

President	*Gary Aldrich*	*661-609-0942*
Vice-President	*Scott Weathers*	*661-317-9453*
Secretary	*Kent Troxel*	*661-947-2647*
Treasurer	*Doug Dodson*	*661-256-7276*
Newsletter Editor	*Russ Erb*	*661-256-3806*

http://www.eaa1000.av.org *August 2011*

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 Hotwash

Tuesday, 16 August 2011
1700 hrs (5:00 PM Civilian Time)
USAF Test Pilot School Auditorium
Edwards AFB, CA

Colleagues, we have returned victoriously. Those of us who ventured to, well, AirVenture have returned. At our next meeting on 16 Aug 11, we will regale you with tall stories of feats of heroic proportion. You may find our hair a little whiter, our beards a little longer after our pilgrimage to Mecca. We will meet in the auditorium at the Test Pilot School with the usual fare of soft drinks and C Cubed Cookies. There will be photographs, PowerPoint slides, and oral dissertations. Please note the departure from our normal annual agenda. The **AirVenture Hotwash** meeting has typically taken place in September. So, this year, we are reducing the amount of time the pilgrims have to prepare. What does that mean to you? Perhaps it means there will not be the usual level of embellishments and exaggerations. Nah, we pretty much make those up on the spot. How about Death by PowerPoint? Well, there are lots of photographs, even more this year since our Australian friend, **Greg Jones**, was involved. I heard Greg claim that his digital camera could hold 32,000 happy snaps without refilling, and I think he pushed that limit. Many of those photos were of the same dirty smudge on the windscreen of the Big White Ford. But still, (no pun intended) there will be some items of interest. The real challenge will be to see how much PowerPoint animation our own **Zurg** minion **Russ Erb** will be able to build into his slides in such a short time. (*probably none*) But, join us. Come heckle the presenters and eat the cookies. If we haven't killed your appetite with the presentations, you can join us at the **Bravo Kilo Dead Cow Emporium** after the meeting.

- Brother Stormy of the Trek
Vice Kommandant

Last Month's Meeting

EAA Chapter 1000
Los Angeles ARTCC
Palmdale, CA
19 July 2011
Gary Aldrich, Presiding

The July meeting was held at the **Los Angeles ARTCC** at Palmdale (kind of like the Los Angeles Angels of Anaheim).

Fifteen members and guests gathered at the visitor's entrance to the FAA Los Angeles Air Route Traffic Control Center (ZLA) on Avenue P at 20th Street East, just across from the Blackbird Airpark, shrine to all black things Lockheed (A-12, SR-71, U-2, F-117 and D-21).

Unfortunately, no cameras were allowed on this visit.

Our host **Rick Fodor**, 15K hour pilot and former controller ushered us into a classroom where we were subjected to a 96 chart Powerpoint® brief on **Operation Raincheck**.

ZLA is one of 22 ARTCC's and is classified as level 12 (the busiest), controlling 177,000 square miles of airspace in parts of California, Arizona, Nevada and Utah, and includes 70,800 square miles of Special Use Airspace (SUA), with about 5 to 6 thousand operations daily.

The presentation covered a brief history of air traffic control. The first "center" was established in Newark in 1935 by the airlines. The government took control in 1936. The Los Angeles Center was opened in Burbank in 1937, moved around a bit, eventually relocating to Palmdale in 1963. It currently employs around 500 people including 270 controllers. It has the distinction of being

the location where the "ATC scenes" for "**Close Encounters of the Third Kind**" was filmed.

Other subjects discussed included Thunderstorms, PIC Authority, Deviations, Flight Service Stations, Pireps, Airmets, Sigmets and the New York Metz.

After the Powerpoint® brief, we were broken into groups of two (no doubt intended to separate and keep us off-balance, a frequently used government ploy in handling detainees) and given a short tour of "the floor" where "the action happens".

Let me see if I can describe this: like entering a semi-dark cave, illuminated only by the literally hundreds of large and small flat screen monitors everywhere (no overhead lighting). Gone are the rows of the old round PPI screens which lent the moniker of "scope dopes" to the operators. The area was broken up into "cubicles" housing 4 to 8 controllers, depending on the volume of the sector being controlled. Occupants had a distinctively casual manner of dress (very casual), with slacks, dress shirts and ties going the way of the scopes. **Knife** and I were paired up with "**Wes**", a senior controller and a really cool guy who mentioned he was two months away from retirement. **Rick** later informed us that controllers face mandatory retirement at age 56, although Wes looked well short of that. However, it was dark in there.

Everyone we met and talked to were friendly and courteous, just like the controllers on the radio.

There was still talk (albeit in hushed tones) about "the strike" and the defunct PATCO.

Concluding the tour, **Rick** escorted us back to the gate, making sure we had not picked up any loose office supplies. Most of proceeded to BJ's for dinner and discussion.

Most, if not all of this is true.

- Kent "Cobra" Troxel
Minister of Propaganda

Kommandant's Korner

Way back in the last century, when Chapter 1000 was ruled by the likes of **Norm Howell** and **Bob Waldmiller**, the thought of launching a ***Project Police Tactical Assault Force*** of any significant size against a target the likes of Oshkosh was the stuff of dreams. There were few ***Aerial Assault Vehicles*** (***AAV***) under OPCON at that time and raids were limited to small, surgical strikes by single troopers or small teams. As a result, these early Chapter 1000 **AirVenture** visitors were overwhelmed by the event (or at least whelmed).

That situation changed in 2009 when the first formation of ***PPTAF AAVs*** struck out across the northern plains. That assault, like any first effort, was not without drama as has been documented in these pages. This year, the bar was "upped" once more, when a phalanx of five vehicles and nine personnel performed a (somewhat) coordinated multi-axis attack on **AirVenture 2011**. Using the power of the **ATT SMS** for tactical command and control, six seasoned Troopers (**Aldrich, Erb, Weathers, Doolittle, Dodson Jr, Marten**) augmented by three conscripts (**Jones, Hanaoka, Dodson Sr**) descended on EAA headquarters by various modes of travel and vectors of attack. ***AAVs*** included the **Fightin' Skywagon**, the **Combat Bearhawk**, **Strike Mooney II**, and…new this year, the **Glamorous Glasair**. Providing heavy-lift transport support was the **Big White Ford**, under command of **Vice-Kommandant Stormy Weathers**.

Fortunately, for all concerned, the weather in the target area had returned to more "normal" Wisconsin summer-time fare. Unlike last year's soggy mess, the grounds were firm enough to taxi on and the skies only burst open once or twice to dump prodigious amounts of water on the huge crowd of aircraft. With the possible exception of a "**post-hole**" maneuver over Ripon executed by the **VC-180** crew to negotiate a stubborn broken ceiling (the more exciting Split-S was deemed inappropriate due to the traffic density), arrival of the force went without incident.

What ensued was a week of combat shopping, airshow gawking, and generously lubricated camaraderie. Specific details and other useless information are to be provided on the raid during a mass briefing at a time and place to be announced…so watch these pages. What can be said is that the ***PPTAF*** had nothing to do with the Alabama Guard F-16 who demonstrated a max-effort stop and slide maneuver off the end of Rwy 36L….we weren't there, you can't prove it. (Though the **Bearhawk** can be seen in the Youtube video.)

Completion of the **AirVenture** attack capped a very busy summer flying season for **N2705K**. Accumulating approximately 6500 nm and 50+ hours since June, she has earned a respite while **Mrs. Kommandant** and I go overseas for the next couple of weeks in search of whisky and castles (and the answer to that age-old mystery about Scotsmen and their kilts). Upon return, short forays are planned in the **Skywagon** to keep the controls limber and the oil circulating. I hope your summer is at least as exciting!

Fly Safe and Check 6!

- Gary Aldrich
Kommanding

Chasing Queertrons: Troubleshooting Tales of the Unqualified

(*When we last left our unqualified RF Engineer, he had just installed a fancy new expensive antenna on COM1, only to find out that it didn't fix the problem.*)

Time to work on another theory. Was the RF entering the control head directly through the case? Tests using a handheld radio showed a pitchup when the radio was keyed with the antenna next to the control head. Repeating the same test with the handheld antenna next to the wires leading to the control head did not cause a response. Therefore, I concluded the EMI must be going straight into the control head and not entering through the wires

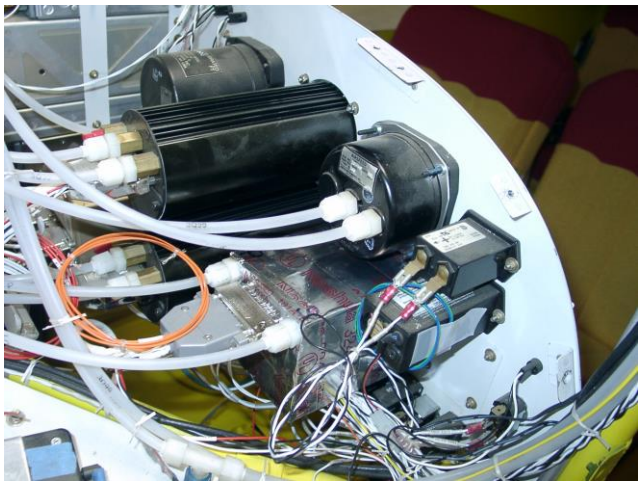
New COMANT antenna installed

(Theory #4). The forward antenna must be too close to the control head, being only about three feet away in a straight line. This is presumably closer than antennas mounted on RVs because the canopy of the RVs forces placement of the antenna farther away or underneath the fuselage on the other side of an aluminum sheet. The aft antenna on the Bearhawk was about 10 feet away from the control head, and according to the one-way R^2 rule the radiated power reaching the control head would be only about 10 percent of that from the forward antenna. That could explain why the aft antenna didn't cause a problem.

Based on Theory #4, the solution would seem to involve shielding the control head. Doing some more research on the Interwebs, I found that the theory of shielding was dependent on wrapping a conductor completely around the item to be shielded. If the shield is conductive in a closed loop around the item, the item is shielded. However, if the shield has a break in it, it ceases to be an effective shield. I think of it as the edges act as antennas, re-radiating the RF that the shield is trying to block. That may not be the best explanation, and I invite anyone else to submit a better explanation to this newsletter. To test the shielding idea, I wrapped some aluminum foil around the control head. While not pretty, the ground test indicated that there was a good possibility of this solution actually working.

But what material to use for the shielding? One suggestion was to use mu-Metal, but someone more knowledgeable than me said that mu-Metal was best for shielding magnetic fields, but at radio frequencies was not significantly better than other metals, certainly not enough to justify its noticeably higher expense. I also entertained several ideas for building sheet metal boxes in aluminum, copper, or brass around the control head with varying levels of complexity. Complicating the issue was the small amount of clearance around the control head as installed. At this point **Stormy Weathers** said something to me that I considered so wise that I have continued to remember it. He said something to the effect of "When faced with multiple possible solutions to a problem, start with the easiest, cheapest solution first." The easiest, cheapest solution was a roll of aluminum tape supplied by **Stormy** for the purpose. This tape is sold in the aviation supply section at Home Depot for the stated purpose of sealing sheet metal ductwork. That is, it is tape for ducting, but not duct tape.

Complicating the use of this aluminum tape was that the adhesive on it was non-conductive. Thus, to keep the shield conductive without any breaks, the control head would have to be completely wrapped using one continuous strip of tape. In the end, this wasn't that difficult to do. Five sides of the box were covered with the aluminum tape, and the tape was trimmed flush with front of the box where it contacted the instrument panel. (Foreshadowing: The last half of that sentence would prevent this from being a complete solution.) The stickers on the box, such as the serial number and the warranty seal, were covered in plastic to prevent the tape from sticking to the stickers, just in case the tape would have to be removed. Prior to taping, photos were taken of the stickers to retain the information.



Autopilot control box wrapped in aluminum tape

The box was reinstalled and the ground test repeated. The response of the autopilot to the radio transmission was significantly reduced, enough to be considered effectively zero. Thus, the interference problem was fixed. Yay! There was much rejoicing all around. Flight tests in November 2009 showed that the pitchup with radio transmission was gone.

That is, until…

In early April 2010, while on the return trip from San Diego, I noticed a small pitchup while on autopilot and transmitting on the COM1 radio. Not as big of a pitchup, but a pitchup nonetheless. Later that month, on a flight to Davis the autopilot worked normally with no pitchup. The very next day, on the return trip, transmitting on the COM1 radio while on autopilot resulted in a very large pitchup, similar to the original problem over Apple Valley. However, about 90 minutes later on the same flight (thus no changes made behind the panel), the pitchup was gone. It was as though the problem had fixed itself. The problem would continue to be intermittent for the next several months.

In October 2010, while cruising the exhibitors at Copperstate 2010, I chanced upon the TruTrak booth. Talking with the General Manager, I started to describe the problem when he asked if I was having pitchups when I keyed the radio. Since he stated the problem before I did, I realized that this problem must not be unique to me. This gave me hope that maybe they had found a solution. He did say that they found that their pressure transducer made

a wonderful RF inductor. He asked what type of case was on my control head. I told him it was plastic. He suggested that I contact TruTrak technical support and arrange to have my control head returned and fitted with a metal case. I hoped that the metal case would form a better shield than the tape I had used before.

Soon thereafter I removed the control head, removed the aluminum tape, and shipped it back to TruTrak. They made some modifications to one of the circuit boards and completely replaced another circuit board to bring my unit up to the current design. Finally they installed a metal case. They told me that normally they charge $400 for the service done, but since this was to address a problem that had existed for a long time, they cut me a deal for only $250. The control head was soon returned and reinstalled. Again, with great hope, I ran the ground test, and…the pitchup remained. Krap! Now what?

I called TruTrak technical support with the report of non-success. Somewhat befuddled, he asked me to try replacing the antenna lead, since that seemed to be the only part that hadn't been removed from suspicion. Theory #5. Because installing a new antenna lead would require cutting some of the fabric covering in the interior, I wanted to just make a test lead to run straight from the radio to the antenna. However, because of the modifications required to mount the new antenna, the BNC connector at the antenna was inaccessible, and the only way to remove it was to remove the antenna from the airplane and then disconnect the antenna lead outside of the fuselage. Remembering how it took **Stormy** and me close to an hour to get the washers and nuts on the mounting screws when we installed the antenna, I wasn't in a hurry to remove it. I got the idea to use another VHF antenna with a ground plane to try to determine if this fix would work before removing the antenna.

A poll of local EAAers uncovered that **Bill Irvine** had a VHF antenna available in storage. I mounted an aluminum sheet ground plane to it and connected it with the new antenna lead. I repeated the ground test with the antenna in many different locations. Some locations resulted in no response from the autopilot, while other locations resulted in a significant response. Oddly enough, the greatest response from the autopilot came with the surrogate antenna in the installed antenna location. It would seem that I just happened to mount the antenna in the perfect location to cause the most interference with the autopilot. Strangely there was no response if the tip of the antenna was on the autopilot control head as there was for the handheld radio, but there was a response if the bottom of the antenna was pointed at the control head.

While moving the antenna around and trying to make sense of the test results, I started to wonder if the aluminum instrument panel could be responding to the RF energy. The metal box around the autopilot did not extend all of the way to the instrument panel, but stopped about 3/4 inch short of the instrument panel because of the plastic face plate. I wondered if this gap in the shielding could somehow be funneling the RF energy into the control head. I disconnected the control head from the instrument panel and tried the ground test with the control head at different distances from the instrument panel. Changing the distance from the instrument panel changed the response of the autopilot to transmissions. This made me think I was on to something. Perhaps the problem was that the metal shield box wasn't grounded (or electrically bonded) to the instrument panel (Theory #6).

New metal case with RF filter connector mounted to DB25 connector

Plastic faceplate which gave an entry path for RF interference

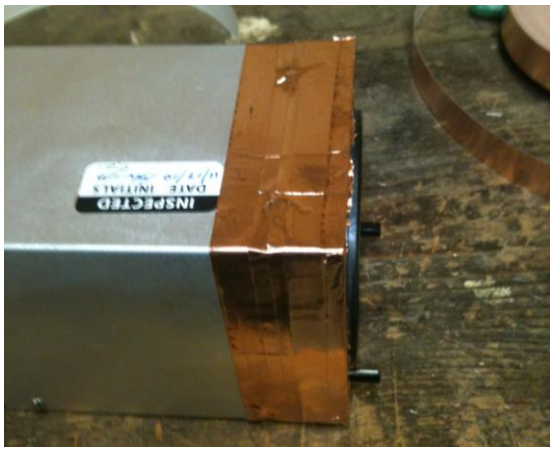
The first piece of wire I could find was a piece of house wire that I borrowed from **Stormy**. Making a short jumper from the metal box to a nearby screw in the instrument panel virtually eliminated the autopilot response to radio transmissions. Taking advantage of the fact that **Randy Kelly** had recently started working just down the hall from me at TPS, I told him about what I had found. He agreed that the gap between the metal box and the instrument panel could certainly compromise the shielding effect of the box.

Unfortunately, there were no convenient connectors on the metal box to attach a wire to. The only place I could find to attach a wire was at the DSub connector on the back of the box. I fashioned a ground wire from the DSub connector to a screw on the instrument panel. Running the ground test again showed the same pitchup response as seen without the grounding wire. I described the results to **Randy Kelly** and he said that while the box may be grounded in DC, depending on the length of the wire it may not be grounded in the RF world. I reconfirmed that the short wire I tested before did show a major improvement. I decided I needed to connect as short of a conductor as possible between the metal box and the instrument panel.

While researching solutions, I came across a roll of copper tape with electrically conductive adhesive (www.amazon.com, part number CFL-5CA/COP07536). I purchased one and used it to wrap the plastic faceplate of the control head. I wrapped from the metal box across the plastic faceplate and around onto the front of the faceplate so that it would contact the instrument panel. The paint was removed from the contact area on the back of the instrument panel. Thus the copper tape with the conductive adhesive formed an electrical connection between the instrument panel and the metal box on the control head, making a complete shield. The control head was reinstalled and the ground test repeated. This time…absolutely no response from the autopilot while transmitting on the radio. Success at last! Subsequent flight testing confirmed that the EMI Dragon had finally been slain!

Autopilot mounting hole with non-conductive paint removed

So what happened with the aluminum tape? Why did it work sometimes and not other times? The final answer was a combination of Theories #4 and #6. The control head needed to be shielded, and that shield needed to be electrically connected to the instrument panel. The aluminum tape was trimmed off right at the edge where it would contact the instrument panel. If the aluminum tape happened to be in electrical contact with the instrument panel, the shield worked. However, if vibration or other causes broke that electrical connection, the shield stopped working and the interference problem returned. This would explain how the problem seemed to fix itself in flight--the aluminum tape came back into contact with the instrument panel. Had I thought to wrap the aluminum tape around the front of the control head so that it would contact the panel, the aluminum tape would have been the final answer. As it was, the copper tape with the conductive adhesive was a better solution because it was easier to get the required electrical contact.



Copper tape bridging the gap between the metal case and instrument panel

Copper tape wrapped onto front of case to connect with instrument panel

Just in case someone else should ever have this problem, I posted my solution on the TruTrak customer forum so that it would not be forgotten.

- Russ Erb
Not an RF Engineer

Web Site Update

As of 7 August 2011, the hit counter showed **139081**, for a hit rate of 11 hits/day for the last month.

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

Chapter 1000 Calendar

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

Sep 6: EAA Chapter 49 Monthly Meeting, 7:00 p.m., General William J. Fox Field, Lancaster, CA. (661) 948-0646

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

Sep 20: EAA Chapter 1000 Monthly Meeting, 5:00 p.m., Edwards AFB. The Airventure Death by Powerpoint Presentation. USAF Test Pilot School, Scobee Auditorium. (661) 609-0942

Oct 4: EAA Chapter 49 Monthly Meeting, 7:00 p.m., General William J. Fox Field, Lancaster, CA. (661) 948-0646

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

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

Nov 1: EAA Chapter 49 Monthly Meeting, 7:00 p.m., General William J. Fox Field, Lancaster, CA. (661) 948-0646

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

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

Dec 6: EAA Chapter 49 Monthly Meeting, 7:00 p.m., General William J. Fox Field, Lancaster, CA. (661) 948-0646

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

Dec 20: EAA Chapter 1000 Festivus Etc Celebration, 6:00 p.m., Kommandant's Kwarters. Quartz Hill CA. (661) 609-0942

Jan 10: EAA Chapter 1000 Board of Directors Meeting, 5:00 p.m., High Cay, 4431 Knox Ave, Rosamond CA. (661) 609-0942

Jan 17: EAA Chapter 1000 Monthly Meeting, 5:00 p.m., Edwards AFB. USAF Test Pilot School, Scobee Auditorium. (661) 609-0942

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

Contact our officers by e-mail:
President/Flight Advisor Gary Aldrich: gary.aldrich@pobox.com
Vice President Scott Weathers: flynwx@pobox.com
Secretary Kent Troxel: kenttroxel@sbcglobal.net
Treasurer Doug Dodson: houdu@pobox.com
Technical Counselors: Gary Sobek: Gary@rvdar.com
Bill Irvine: wgirvine@yahoo.com

EAA Chapter 1000 Technical Assistants

Composite Construction		
Doug Dodson	douglas.dodson@pobox.com	661-256-7276
George Gennuso	pulsar1@sbcglobal.net	661-265-0333
Brian Martinez	brianmmartinez@aol.com	661-943-5379
Bob Waldmiller	waldmilr@qnet.com	661-256-0932
Wood Construction		
Bob Waldmiller	waldmilr@qnet.com	661-256-0932
Aluminum Sheet Metal Construction		
Bill Irvine	wgirvine@yahoo.com	661-948-9310
Miles Bowen	cessna170bdriver@yahoo.com	661-822-0806
Russ Erb	erbman@pobox.com	661-256-3806
Welding/Welded Steel Tube Construction		
Russ Erb	erbman@pobox.com	661-256-3806
Engine Installation		
Bob Waldmiller	waldmilr@qnet.com	661-256-0932
Doug Dodson	douglas.dodson@pobox.com	661-256-7276
Electrical Systems		
Miles Bowen	cessna170bdriver@yahoo.com	661-822-0806
Instrumentation and avionics requirements for VFR/IFR		
Gary Aldrich	gary.aldrich@pobox.com	661-609-0942

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

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

THE LEADING EDGE
MUROC EAA CHAPTER 1000 NEWSLETTER
C/O Russ Erb
3435 Desert Cloud Ave
Rosamond CA 93560-7692
http://www.eaa1000.av.org

ADDRESS SERVICE REQUESTED

THIS MONTH'S HIGHLIGHTS:
MONTHLY MEETING 16 AUG @ TPS
ZLA ARTCC VISIT REPORT
MASSIVE OSH ASSAULT SUCCESFUL
THE UNQUALIFIED TROUBLESHOOTER

EAA™
THE SPIRIT OF AVIATION