experimental aircraft association

THE LEADING EDGE

NEWSLETTER OF MUROC EAA CHAPTER 1000

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

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http://www.eaa1000.av.org *February 2014*

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:

North American XB-70 Valkyrie

Richard W. Fraser

Tuesday, 18 February 2014
1700 hrs (5:00 PM Civilian Time)
USAF Test Pilot School Auditorium
Edwards AFB, CA

Back in the late 1950s, the U.S. Air Force was looking for a replacement for its "aging" B-52 bombers. After all, the B-52 was approaching 10 years old, and to even think that such an airplane could last in operational service for more than 20 years was just crazy talk.

At the time, the expected tactics were to fly at very high altitude and fly very fast. This would keep the bomber above the reach of interceptors. In this case, that was an altitude of 70,000 feet and a speed of Mach 3. Thus, the XB-70 was conceived.

The common legend is that the MiG-25 Foxbat was designed in response to the XB-70. In addition to this, in 1960 a surface-to-air missile shot down a U-2 over Russia at high altitude. Sensing that the high altitude/high Mach regime was no longer invulnerable, the preferred tactics shifted to low-level ingress. The XB-70 was not suitable for this type of flying. The Air Force cancelled the production, but ordered two prototypes for research flight testing on high altitude, high supersonic flight.

Pay Your Dues! Now! This Means You!

(If you have already paid your dues, please disregard this notice)

Send your cash, check, money order, or other legally negotiable instrument to any chapter officer, or pay online by PayPal through the EAA Chapter 1000 web site.

Do it now and avoid the embarrassment of appearing on the Dues Delinquent list next month!

You may also qualify for the government sponsored EAA Chapter 1000 "Free Dues" program.[1]

This month, we are honored to host as our speaker **Richard W Fraser**, Engineer, Designer, and Consultant from Orange CA. Mr. Fraser was part of the XB-70 project back in the day, and will be telling us all about it. I would give you more details about his involvement, but I forgot what they were. Come and find out for yourself.

If that name sounds familiar, it would be because he was our speaker last February, when he told us all about the Pou du Ciel (Flying Flea), a slightly smaller aircraft. Apparently Richard really enjoyed being treated to dinner at the **BK Dead Cow Emporium** last time, and has been spending months putting together slides in anticipation.

Be sure to ask him about what else he has done, so we'll know what to ask him to speak about in February 2015!

[1] Simply write you name on a government printed "Free Dues" coupon and hand it to any chapter officer. "Free Dues" coupons are available at any bank, ATM, and many businesses. Ask for it by the secret code name "Twenty Dollar Bill."

Last Month's Meeting

EAA Chapter 1000
USAF Test Pilot School
Scobee Auditorium
Edwards AFB, CA
21 January 2014
Gary Aldrich, Presiding

About 15 ***Project Police*** **Officers** and guests assembled in the Rick Husband lounge for schmoozing and a hearty helping of **Tuki Kukis** and **Buffalo Chicken Dip**, as well as both kinds of soft drinks (Coke and Diet Coke). Even TPS Commandant (with a "C") **Lars Hoffman** was caught up in the excitement of members throwing "Free Dues Coupons[1]" at **Erbman** (representing **Opie**) and threw in one of his own. It only took a year and a half of prodding to get him to sign up.

Having survived that excitement, we sallied forth to the auditorium for a much anticipated presentation by **Mark Skoog** from NASA's **Armstrong Flight Research Center (AFRC)**, which was still known as the **Dryden Flight Research Center (DFRC)** when the last newsletter went to "print". As billed, his presentation was about the Automatic Ground Collision Avoidance System (A-GCAS), a system designed to prevent pilots from flying perfectly good airplanes into perfectly hard terrain. The original system was developed for the F-16, and is now being put into operational service. The system works by comparing the aircraft's navigation position to a stored terrain database. If the system predicts you are about to hit said terrain, it takes command of the airplane and pulls up to avoid the collision.

The major objectives in the development program (besides making it work) were to minimize "false alarms" and to not be a nuisance to the pilot. Apparently these goals were achieved so well that during some of the testing the test pilot reported that the system failed to work, but analysis of the data showed that it did take command of the airplane, but did it so seamlessly that the pilot didn't even notice.

Buoyed by this success, Mark talked to the F-22 SPO about installing the system in the F-22. Their response was that there was no more memory in the flight control computer. When Mark pressed them, they admitted that they had maybe a megabyte of memory left (*maybe it was a gigabyte, but in any case, it wasn't much*). In a move they didn't anticipate, Mark asked would they be interested in incorporating A-GCAS if he could get it to fit into that small space. They said yes, but it sounded to them like a case of stuffing 100 pounds of krap into a 1 pound bag. Mark did it, much like we do it in the TPS curriculum, but that's another subject.

To do it, Mark set about doing some incredible and very clever compression on the terrain database. This led to another challenge: Could he host the entire A-GCAS on an Android cell phone? He figured if he could do that, no one could say that their aircraft didn't have enough computorial power to incorporate A-GCAS. And yes, he did that too. This was demonstrated by incorporating it into a Dryden Remotely Operated Integrated Drone (DROID) UAV. (*Would that now be an AROID?*) The DROID was basically a large radio controlled model airplane with a Piccolo autopilot.

In the F-16, the terrain avoidance maneuver was simply to roll wings level and pull up. Since the DROID didn't have the climb capability of the F-16, two other avoidance maneuvers had to be considered—turning left or turning right. This change was the key to opening the capabilities of A-GCAS to all forms of airplanes, not just fighter jets.

Mark continues his quest to get this technology into as many aircraft as he can, but has run into an odd dilemma. Through exceptional cleverness, the hardware and software is not very expensive to integrate into an aircraft. However, that means the requested budget for any program is small compared to most NASA programs. You would think this would be a good thing, but apparently many NASA managers think that if your program doesn't have a large budget then it can't be very important. Thus, the task of educating those who control the money continues on.

The ensuing discussion was very lively, to the point that **Kommandant Aldrich** had to interrupt and declare **Victory!** He stated that further discussions could continue at the **BK Dead Cow Emporium**. I challenged the ***PPO*****s** to pepper Mark with so many questions that he wouldn't be able to eat his burger. We were so successful in exploiting his zeal to talk about his project that I watched him hold up a 1/3 eaten burger for about 20 minutes without taking a bite. Noticing that we were all finished eating and our guest speaker had barely started, I was forced to drive a change to the subject so that he could finish eating. Of course, we declared another **Victory!** for that not so intentional trick.

By the way, we tried to volunteer the ***Fightin' Skywagon*** as the next testbed for A-GCAS, but the **Kommandant** didn't seem too excited about that.

- Russ "Erbman" Erb
Emergency Backup Deputy Minister of Propaganda

Kommandant's Korner

Excitement is building as we begin our slide down the "backside" of winter. We've been incredibly blessed with excellent flying weather thus far. This, of course, is a byproduct of the extreme drought conditions which grip the Southwest. It's truly unfortunate that our pilot's blessing is a curse to the farmers, skiers, and others who need moisture to fall from the sky. The local news is touting a rainy weekend as I type this…hoping for more than the 0.04 inches of water that "deluged" the Antelope Valley yesterday afternoon. I am

content to leave the **Fightin' Skywagon** parked for a time so that Mother Nature can restore the natural balance of things.

I'll be using alternate means of transportation for the rest of February, starting with this weekend when I embark on a Carnival Cruise Line ship in Long Beach Harbor. This weekend "party" excursion is in support of **Mrs. Kommandant's** Rotary Club and my tasking is limited to being the "charming arm-candy". The quick "out-and-back" will visit the exotic port of Ensenada before wandering around Santa Catalina Island for a while.

A short time after returning from tropical Mexico we will be off to Kaua'i, the "garden isle" of the Hawaiian chain. This trip, with daughters and husbands was originally scheduled for the Christmas season, but illness and high ticket prices intervened. I ran the numbers on the Garmin Pilot™ flight planning app and I've decided to allow United Airlines to fly us there in lieu of the VC-180. Seems I would have to leave my flowered shirts and sandals home in favor of carrying more fuel and that just won't work for a Hawaiian trip. Oh, if I just had as much range as the "**Glamorous Glasair**"…

N2705K did get a little exercise this last weekend when **Anne** and I participated in the "**99's Furnace Creek Fly-out – Part Deux**". Organized by the multi-organizational **Leigh Kelly**, a squadron of aircraft dominated by Chapter 1000 members descended well below sea level to land at the **Furnace Creek Airport** (**L06**). I filled the available Skywagon seats with Anne and a couple of good friends for the pleasant hour-long flight. Since it was Saturday the eatery of choice became the **Forty-Niner's Café** at the "ranch" rather than the Sunday Brunch at the Furnace Creek Inn. This casual diner serves excellent fare, though a bit more pricey than usual. Apparently the cost of moving groceries into Death Valley via 20-Mule Team jacks the cost up a bit. Performance from the mighty Continental was awesome on departure despite the increased gross weight from lunch. The thick air below the level of the oceans provided increased bite for the prop and we fairly rocketed back to our 8500 ft MSL cruising altitude for the RTB. Hopefully you will read other versions of this adventure in this or future 'Edge editions.

VK Steinlin has, once again, arranged a fabulous program for us this month. I only wish I was able to attend, but I will be with the membership in spirit as I sip my Mai Tai on the lanai of my condo in Princeville. Please try and make it out to **Scobee Auditorium** (TPS) for the meeting so that we may recognize the hard work that **Hellmuth** puts into arranging guest speakers. Bring a friend! These meetings are not "members only". I will guarantee you that you know someone who would be interested in hearing about the incredible XB-70. I'm looking forward to a report on the program.

Until then…Fly Safe and Check 6.

- Gary Aldrich
Kommanding

Wind Turbines

I was asked "Why do Wind Turbines generating electricity turn so slow in comparison to helicopter rotors and airplane propellers?" The quick answer is: "Blade Tip Speed and blade airfoil Critical Mach number."

Wind turbines generating electricity are huge compared to helicopter rotors because of the low energy of the wind. One criterion for design has been that generation should start at 9 miles/hour wind speed. The dynamic pressure at sea level standard day at 9 miles/hour is about 0.2 pounds / sq ft. Helicopter rotors create "wind" at about 3 to 5+ pounds /sq ft dynamic pressure. Thus, wind turbine rotors must have large diameters to capture sufficient energy from the wind. This results in longer blades.

In helicopter aerodynamics the symbol of rotational speed in radians/second is the Greek letter **Ω** (omega). The length of the blade is defined in feet as R. Therefore, the speed at the tip of a rotating blade is calculated as **Ω**R in feet/sec so it can be compared to the speed of sound for calculation of Mach number. If the tip speed exceeds the speed of sound (Mach > 1), then shock waves will form. The shock waves will cause flow separation and the drag of the airfoil will become horrendous .

The critical Mach number for an NACA 0012 airfoil (representative of the wind turbine blade airfoil) is about 0.72 Mach or about 700 ft/sec. A helicopter rotor with a radius of 22 feet will reach a tip speed of 700 ft/sec at 31.8 radians/second or 304 rpm. A 70 foot long wind turbine blade will reach a tip speed of 700 ft/sec at only 10 radians/sec or 96 rpm. Actual observed wind turbines maintain high efficiencies by remaining well below this rotational speed at about 12 rpm.

This table shows dimensions of Wind Turbines through the years from "Average Rotor Diameter and Hub Height Installed in the USA" (Lawrence Berkley National Laboratory, *2011 Wind Technologies Market Report*)

RPM values assume a rotor tip speed of 700 ft/sec.

Years	Hub Height feet	Rotor Diam feet	RPM
1988-99	183	157	85
2000-01	191	174	76
2002-03	217	209	64
2004-05	241	239	56
2006	252	257	52
2007	257	259	52
2008	258	260	51
2009	259	268	50

Personal foggy memories -

About 1965(?) the Defense Advanced Research Projects Agency (DARPA) requested proposals for what became wind turbines. All propeller and helicopter rotor blade manufacturers were prohibited from submitting proposals.

Years later I went to a wind turbine conference and heard the papers about the problems the companies had.

The three main problems were (1) vibration due to the turbulence from the tower ahead of the rotor; (2) natural frequencies of the blades causing structural failure; (3) two-bladed rotor instability (That is why all turbines are three-bladed for symmetry.) Oddly enough, this meant that the companies had re-discovered the same issues that the manufacturers prohibited from participating already knew about.

Side note: Art Young, with a helper Bart Kelley, stabilized two-bladed rotors with a stabilizer bar. Years later Ken Wernicke designed the Under-slung Feathering Axis (UFA) hub and Wes Cresap designed the "Door Hinge" and multi-bladed "Flex Beam" rotor systems. Mike Folse laid out the concept of the HueyCobra. (All good guys)

- **Lee H. Erb**, Aka Erb the Elder
EAA Chapter 1000 Det 5, Arlington, TX

Secret Mission: Don't Tell Hellmuth!

Project Police **Intelligence** has determined the date for the annual pilgrimage to Adelanto: 26 April 2014. This is the date of the Open House for 52CL. No other details have been released yet, but all of the Lairds will be waiting to greet us. Imagine **Hellmuth's** surprise when we all show up on his door step unexpected! If you have access to an airplane, plan to fly there. If you don't have access to an airplane, ask someone who does if they have an empty seat!

Contribute Painlessly to the Preservation of Flight Test History

Next time you are ready to make an online purchase, take an alternate route to Amazon. Go instead to http://smile.amazon.com . It's the same Amazon web site that you are used to, with one minor twist. When you first go to the web site, you will be asked to name a charity that you would like to support. Of course, you may choose any charity you would like, but the **Kommandant** recommends that you type "Flight Test Historical Foundation" into the search box. A fraction of a percent of everything you spend will be donated to your charity at no additional cost to you. You were going to spend the money anyway, so why not send some of it to your favorite charity?

BTW, you cannot designate EAA Chapter 1000 because we are not a 501c3 organization.

Flying The B-29

In the February 2014 *Sport Aviation*, **Jeff Skiles** writes about what it was like to fly the biggest bomber of World War II. Back in November 2010, B-29 *FIFI* visited Long Beach Airport as part of the AOPA Summit. We never ran any pictures from this event in these pages, so we run them now to augment Jeff Skiles article.

Pilot's station

Copilot's station

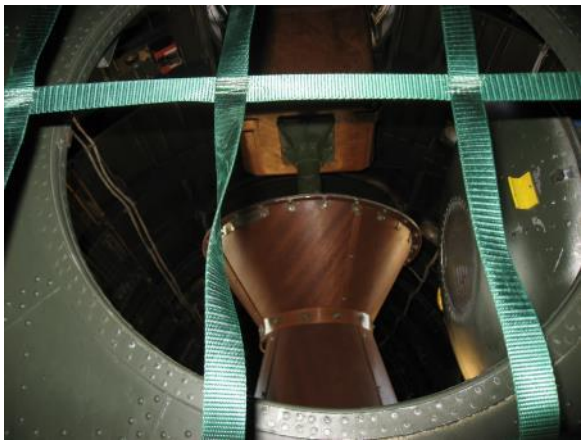
Flare pistol port

Flight Engineer's station, flying backwards behind the copilot

Flight Engineer's panel

Navigator station behind pilot

Radio Operator's station. Where is the flip-flop button?



The "Barber Chair" for the lead gunner in the rear pressurized compartment

Inside the tunnel for travelling through the bomb bay between pressurized compartments

Web Site Update

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

Chapter 1000 Calendar

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

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

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

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

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

Apr 22: EAA Chapter 1000 Monthly Meeting, 6:30 p.m., Flying Dog Ranch, 4400 Knox Ave, Rosamond CA. (661) 609-0942

Apr 26: Annual Adelanto (52CL) Fly-In

May 10: Twenty Third Annual *Project Police* Airport Barbecue, Rosamond Skypark (L00), Rosamond CA. (661) 609-0942

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

May 20: No EAA Chapter 1000 Monthly Meeting. You should have gone to the fly-in 10 days ago

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

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

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

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

Jul 28 – Aug 3: EAA AirVenture. Oshkosh WI.

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

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

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

THE LEADING EDGE
MUROC EAA CHAPTER 1000 NEWSLETTER
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ADDRESS SERVICE REQUESTED

THIS MONTH'S HIGHLIGHTS:
MEETING 18 FEB @ TPS
WHY WIND TURBINES TURN SLOW
SUPPORT THE FTHF
SUPPLEMENTAL B-29 PIX

EAA™
THE SPIRIT OF AVIATION