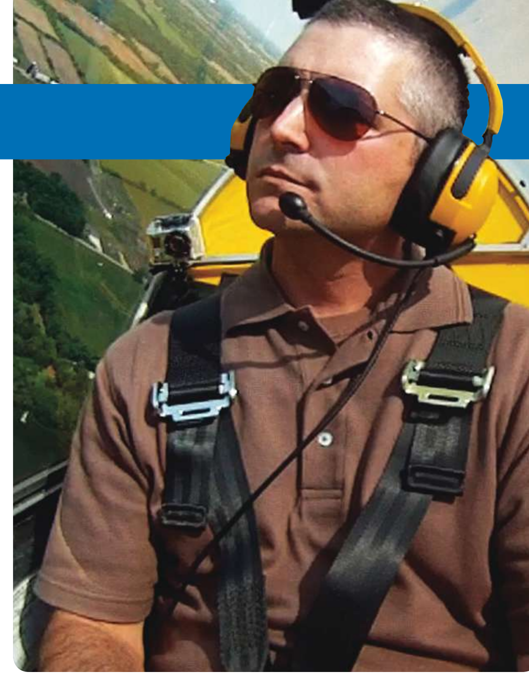
EAA
EXPERIMENTER
The Spirit of Homebuilt Aviation | www.eaa.org
DECEMBER 2012

Revisiting Don Stewart's Headwind

An LSA for the ages?

» **Introducing ULPower's Engines**
Four and six-cylinder options

» **14 or 28 Volts**
Which system is best for you?



Renaissance Plan

Is there a plans-built resurgence?

By Chad Jensen

From the day I finished my RV-7 in 2010 I knew that I would be aching to have another project. Over the past two years, I've started numerous projects but haven't found the end of those projects. My observation of those of us who have built and finished kit airplanes is that many of us just need a project, and there's a common thing I'm seeing: plans-built airplanes seem to be on a bit of a resurgence among successful kit builders: A flying kit plane and plans in the shop.

I'm not the best example because I've had trouble finding the "correct" airplane to build next, but many successful kit builders are finding solace in plans-built airplanes after finishing their speedsters by building an opposite mission airplane, and vice versa. For example, RV and Glasair builders working on Cubs and Legal Eagles, and RANS and Kitfox builders working on GP4s and Cozys. Those are just examples, but I get the feeling that the highly successful (with no end in sight) kit industry may be spawning a new generation of plans builders…which is an all-around good thing! Some of the kit manufacturers offer plans-built versions of their airplanes, so there is certainly value in what they are doing and their thinking.

There are plenty of repeat offenders in the kit world, so what I'm saying in this column isn't that all kit builders are turning to plans- or scratch-built aircraft. But it is an easy and economical way to keep your mind engaged in airplane building on the not-so-nice days, and you have the ability to go fly that Velocity, Titan, or Zenith on nice days.

As I said, I'm not the best example of my thinking here, but I did do exactly as I'm describing when the RV was finished. I almost immediately bought Hummel Bird plans. I've since added Tailwind, Zipster, Cougar, EAA Biplane, Legal Eagle, and Sport Trainer plans to my shop library. Projects have included a Thatcher CX-4, Tailwind, and Cougar. Those projects are all with new owners, but a Sport Trainer (Wag-Aero CUBy) is currently being built in my shop. That project is a split plans/kit project because I am building wood wings from plans, but I may end up buying kit components for the fuselage…a very nice option.

So I'm curious; I'd like to hear from you to see if my thinking is valid. Are you a successful kit builder who can't put the tools down? In doing so, have you opened your mind to a new challenge in plans-built airplanes? Send me an e-mail at cjensen@eaa.org to let me know. EAA

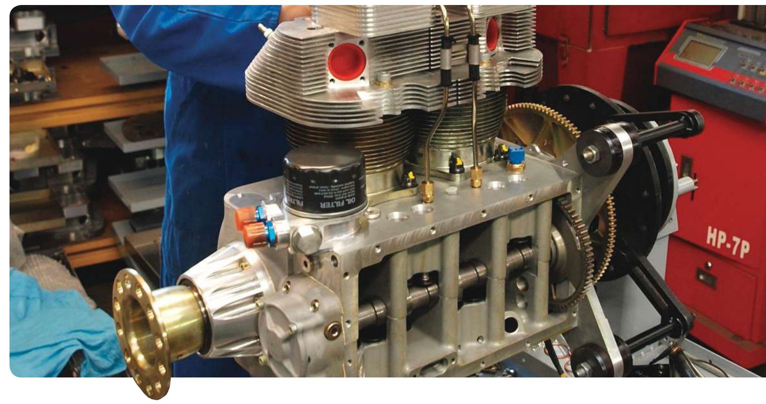
On the cover: Don Stewart designed the Stewart Headwind in the early 1960s, but the design lives on; Bill Budgell completed this Headwind in 2011. (Photo courtesy Bill Budgell.)

EAA EXPERIMENTER

NO. 4/DECEMBER 2012 | A publication of the Experimental Aircraft Association

Contents

Features



Departments

Columns

LSA Certification Change Does Not Affect Homebuilders

I have received several questions about the FAA cracking down on LSA certification. The issue only revolves around *factory-built* special light-sport aircraft (S-LSA) being certificated for the first time. This crackdown does not affect aircraft being certificated as experimental amateur-built (E-AB).

Even though you may be building a plane that qualifies under the FAR Part 1 definition as an LSA (RV-12, Zenith 750, Kitfox, etc.), it is not certificated as an LSA. It will receive the standard experimental amateur-built certification, and there are no restrictions on an appropriately rated FAA designated airworthiness representative for issuing the airworthiness certificate.

Keep building and be happy!

Earl Downs
Cushing, Oklahoma

(Earl recently received a Letter of Deviation Authorization (LODA) to give transition training in his Zenith 601 XLB. He can be reached at oklahomaaviatorw@earthlink.net.)

Looking for Early Sonerai Newsletters

I've undertaken the task of collecting all of the newsletters that were published by John and Betty Monnett from 1972 through 1986 when they owned Monnett Experimental Aircraft Inc. My goal is to have a complete set of newsletters, both in hard copy and electronic format, which will eventually be donated to the EAA Museum. Where I need help from our readership is obtaining copies of the newsletters written in 1972 and the first issue of 1973. I would like original copies, good-quality photocopies, or good-quality scanned copies. If there are any builders of the Sonerai I or the early Sonerai II who have copies of these newsletters, please call me at 262-835-7714 (leave a message and I'll return your call), or e-mail me at fredkeip@aol.com.

Fred Keip
Franksville, Wisconsin
Owner/Builder/Pilot of Sonerai IIL, N99FK

Send Us Your Hints, Aircraft Photos, and More

Homebuilding Community Manager Chad Jensen and I invite you to share hints you've discovered for the *Experimenter* Hints for Homebuilders column. Cy Galley has graciously been assisting us in gathering hints, but we don't want to burn him out completely. So we would welcome your hints as well.

We'd also love to have you share photos of projects you've finished or are currently working on. Snap some photos with your camera or phone and send them to Experimenter@eaa.org along with a few words describing your aircraft. We'd love to share them with other *Experimenter* readers.

And we're also interested in any ideas you have for improving the content of *Experimenter*, again, drop us a note at Experimenter@eaa.org.

Mary Jones
Experimenter Editor

PUBLICATIONS STAFF

Founder: Paul H. Poberezny
Publisher: Jack J. Pelton, EAA Chairman of the Board
Vice President of Publications: J. Mac McClellan
Homebuilding Community Manager: Chad Jensen
Editor: Mary Jones/EditEtc. LLC
Graphic Designer: Chris Livieri
News Editor: Ric Reynolds
Copy Editor: Colleen Walsh
Multimedia Journalist: Brady Lane
Visual Properties Administrator: Jason Toney
Contributing Writers: Marino Boric, Budd Davisson, Cy Galley, Dan Grunloh, Dick Koehler, Ed Kolano, Stephen L. Richey, Lynne Wainfan, Rick Weiss
European Correspondent: Marino Boric

ADVERTISING

Display
Sue Anderson
Jonathan Berger
Jeff Kaufman

Mailing Address:
P.O. Box 3086, Oshkosh, WI 54903-3086
Phone: 920-426-4800
Fax: 920-426-4828
E-mail: experimenter@eaa.org
Website: www.EAA.org

Need to change your address or have other membership questions, call 800-564-6322 (800-JOIN EAA).

You are automatically entered* if you are a:
New Member, Renewing Member, Rejoining Member, Automatic Renewal Member, or a Lifetime Member

2013 EAA Sweepstakes

Join EAA & enter to win a Stearman.

When you join EAA, you are automatically entered* in the 2013 EAA Sweepstakes for a chance to win a Stearman, fully-restored by Air Repair, Inc. Built in 1943, this living time machine transcends age by continuing to challenge and excite the modern pilot.

Plus, when you choose to donate with your sweepstakes entry, you are helping EAA create the next generation of aviators.**

Second Prize: 2012 Can-Am Spyder and Trailer
Hit the road in style on the Can-Am Spyder RT-S. This sleek roadster offers the excitement and fun of a motorcycle along with greater safety and stability.

For complete Official Rules, prize descriptions, or to enter the 2013 EAA Sweepstakes, visit **EAA.org/sweepstakes**

EAA® THE SPIRIT OF AVIATION

AIR REPAIR, INC.

A special thank you to **Air Repair, Inc.**

*EAA Members (determined as of September 20, 2013) will be entered automatically as follows: New Members – 50 entries; Renewing Members – 50 entries; Rejoining Members – 50 entries; Automatic Renewal ("AutoPilot") Members – 100 entries; Lifetime Members – 250 entries. Trial Members do not receive automatic entries. ****A purchase or contribution will not improve your chances of winning.** EAA encourages you to make a donation with your entry. All donations support EAA's mission to grow the next generation of aviators. For complete Official Rules by which all entrants are bound see http://www.eaa.org/sweepstakes/official_rules.asp.

Defending the Future of Homebuilts
More regulation does not mean more safety

There's one goal everyone agrees on: Continuing to improve and enhance safety in all of aviation, including amateur-built aircraft, is a top priority. Without improving safety, all the rest of our flying rights and privileges in homebuilts and other aircraft are open to further scrutiny and regulation.

Since the National Transportation Safety Board released its study and 16 recommendations for improving amateur-built safety on May 22, EAA has been reviewing and analyzing those recommendations and what they could mean to individuals who want to build and fly aircraft. EAA officials have talked with the volunteer members of our Homebuilt Aircraft Council as well as to those in the industry, the flying community, and government about the possible ramifications of those NTSB recommendations.

If we do not improve ground and flight safety or create cultural, technical, and educational opportunities to do so, it could bring more regulation. That would hamper those who want to become part of the homebuilt community and hurt all of us in the long run.

EAA has always maintained education is more effective than regulation to raise the safety bar. That's why we're working with the FAA General Aviation Joint Steering Committee, type clubs, kit manufacturers, and others to improve safety programs. EAA also formally commented to the FAA in October on where we agree and disagree with the NTSB.

EAA agrees with some of the 16 NTSB recommendations, including:

- encouraging additional flight training prior to conducting flight tests or transitioning into a new amateur-built aircraft
- partnering with the FAA to create a current listing of amateur-built aircraft approved for flight training
- identifying when a second pilot may be allowed on a test flight as a safety observer
- building a coalition of kit manufacturers, type clubs, and others to build "best practices" guidance for those who fly homebuilt aircraft.

There are other recommendations where EAA disagrees, mostly because it would create cost, paperwork, and/or technical requirements that would keep people away from building and flying aircraft. Those where we disagree include:

- mandated functional test of aircraft fuel systems
- required FAA approval of initial and completed flight-test programs
- compulsory use of electronic data recording during test flights
- the requirement that an aircraft owner must create an aircraft flight manual before moving into Phase 2 operations.

EAA's Technical Counselor and Flight Advisor programs are essential building blocks to improve safety. We'll be refining and improving those programs so they are even more effective for those who use them.

What can you do? Think safety and act safely at all times by doing such things as:

- Always seek transition training before test flying or flying any unfamiliar aircraft.
- Stay proficient as a pilot while building an aircraft.
- Don't be a test pilot unless you're qualified and current in that make and model of aircraft.

Finally, be a high safety standard for others at your airport. EAA will do its part to protect the future of amateur-built aircraft, but all involved must also play a role in continually improving safety. Our actions now will determine our freedoms in the future.

EAA Safety Efforts Aim to Lower GA Accident Rate

EAA is continuing to lead and collaborate on a variety of programs that are focused on lowering the general aviation accident rate, with efforts that range from aircraft construction to pilot decision making.

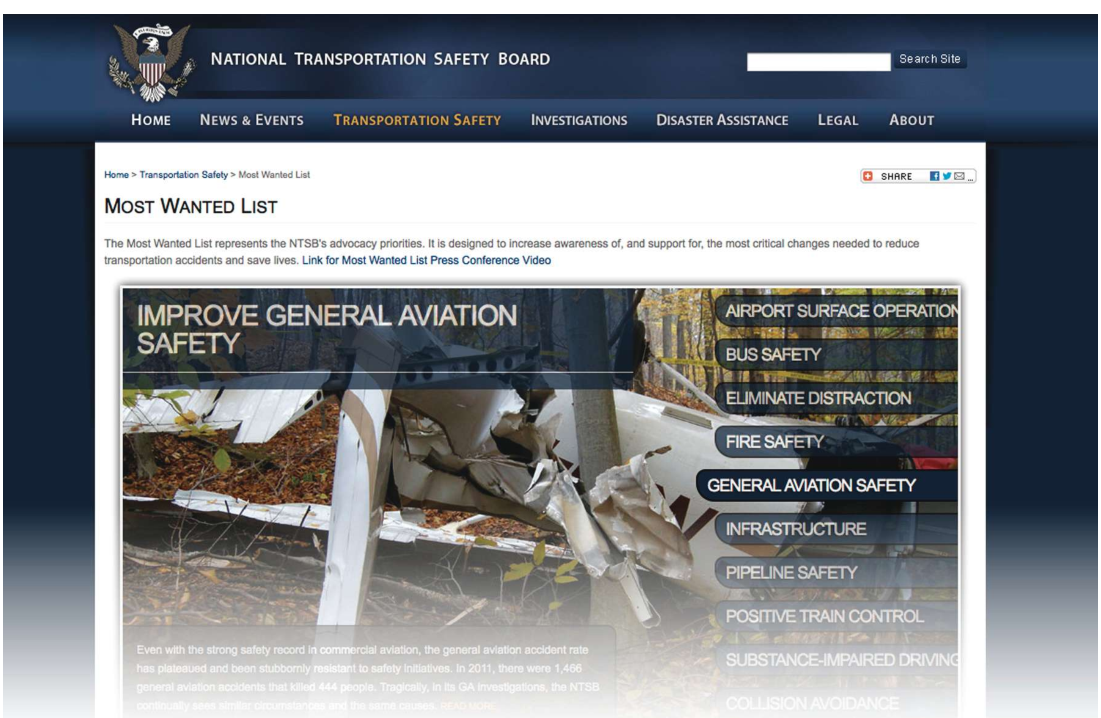
These EAA initiatives, both long-standing programs and new partnerships with other aviation organizations and industry members, are aimed at a single goal: enhancing GA safety. They also show the continuing work of the GA community to raise safety awareness as the National Transportation Safety Board (NTSB) studies ways to improve aviation safety. In mid-November, the NTSB released its annual "Most Wanted List" that included GA safety on a list that also included safety issues in automobiles, buses, trains, and pipelines.

"Everyone agrees that safety is a never-ending priority, and that's why EAA has been so active in working with other organizations such as AOPA, as well as type clubs, pilot groups, manufacturers, and government agencies," said Sean Elliott, EAA vice president of advocacy and safety. "We maintain that education is a far better way to improve safety than regulation. That includes education from our organization and the safety mindset that every aviator must have. Many of the accidents we see are from common avoidable factors. We can never stop learning from each other."

Among EAA's recent participation in safety initiatives include:

- co-founding the Type Club Coalition, which represents aviators in a variety of aircraft types who are seeking best practices in flight operations
- leadership within the FAA's Loss of Control Working Group, part of the General Aviation Joint Steering Committee, which is studying accident factors and possible ways to minimize those risk areas
- participation in the FAA's Part 23 committee that is studying aircraft certification.

These efforts reinforce some of EAA's long-standing programs that have proven to enhance safety for EAA member builders and pilots to participate in them. Those include the Technical Counselor program that offers guidance for aircraft builders and the Flight Advisor program, which allows pilots who are transitioning to new or unfamiliar aircraft to evaluate their piloting skills and seek additional training so they are fully prepared when initially flying that aircraft.



"We have worked with the NTSB, FAA, and other agencies to find the ways that are the most effective for pilots to be aware of safety and make that a part of every flight," Elliott said. "The GA accident rate has dropped drastically over the past quarter century, but there's more that can be done. The flying community uniting in these efforts will help enhance safety and preserve the freedoms to fly that we enjoy."

EAA Participates in Part 23 Reform

EAA participated in the first meeting of the ASTM International F44 Technical Committee in Atlanta in mid-November—a group charged with providing industry consensus standards for the certification of standard-category general aviation aircraft as an alternative to the current FAA-prescribed certification process. This effort takes the lessons learned from the successful use of consensus standards for light-sport aircraft (LSA) and applies them to the rest of the GA fleet.

The creation of the F44 committee was prompted by the continuing work of the Part 23 Aviation Rulemaking Committee (ARC), which is a partnership between the FAA and industry groups to reform the certification rules for standard-category aircraft. The group's ambitious goal is to halve the cost of aircraft certification while doubling the level of safety by making new technologies more accessible. EAA is an active participant on the Part 23 ARC and is a strong proponent of the use of industry consensus standards as an alternate and more economical means of aircraft certification.

The light-sport rule pioneered this concept a decade ago with the creation of the ASTM F37 Committee, which governs the consensus standards for LSA. EAA was instrumental in creating and leading that committee through the critical early phases of its development, and continues to be involved today as it evolves and matures.

"The creation of F44 is an exciting step in the process we have been working on through the Part 23 ARC," said Sean Elliott, EAA vice president of advocacy and safety. "The use of industry consensus standards as a method of certification for standard-category aircraft has the potential to not only lower the cost of new aircraft, but also to dramatically simplify the retrofit process. This will benefit all of our members who fly type-certificated aircraft, both the existing fleet as well as new manufactured airplanes."

Photography courtesy Andy and Mike Porter

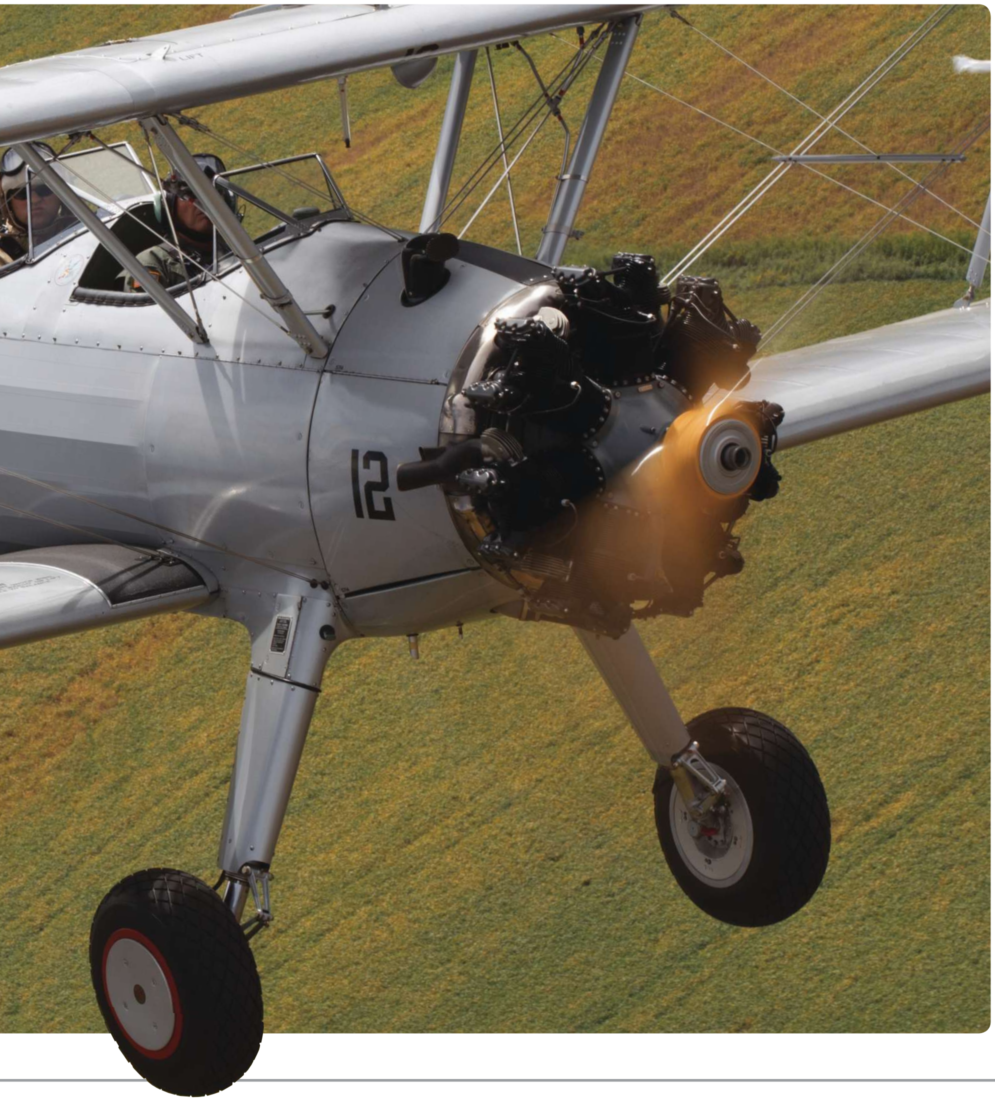
Win a Stearman!
Iconic biplane is 2013 EAA sweepstakes grand prize

Next year marks the 50th anniversary of the annual EAA Aircraft Sweepstakes, and the grand prize certainly rises to the occasion: a completely restored 1943 Boeing Stearman Model 75 biplane!

The airplane, undergoing restoration at Air Repair Inc. of Cleveland, Mississippi, was once owned by Curtis Pitts. Its long list of features includes a 300-hp Jacobs R-755-A2M engine, 24-volt electric system, dual basic instrumentation, and others you can see at www.EAA.org/sweepstakes.

Designed by Lloyd Stearman in 1934, the Model 75 was the training platform for a whole generation of pilots who served in the U.S. Navy and Army Air Forces, the Royal Canadian Air Force, and other nations. Fighter and bomber pilots earned their wings flying the thousands of Stearman trainers produced for World War II. Imagine winning the EAA grand prize and soaring through the sky like those who flew to preserve freedom!

This year will feature a new format for entering in addition to previous contests. All new members, renewing members, and rejoining members will receive 50 entries. Automatic renewal members (AutoPilot) will receive 100 entries, while lifetime members will receive 250 automatic entries. (Trial members do not receive automatic entries.)



There will be a limit of 500 total entries in the sweepstakes by each eligible entrant, regardless of means of entry. Entry coupons will be included in select issues of *EAA Sport Aviation* (starting this month), plus they can be downloaded from the sweepstakes website. Complete sweepstakes rules are also available online at www.EAA.org/sweepstakes.

Sweepstakes entries will again be available during EAA AirVenture Oshkosh 2013, July 29 to August 4. EAA Chapter 22 of Rockford, Illinois, which began the sweepstakes 50 years ago to benefit EAA programs, will again coordinate the sweepstakes efforts at Oshkosh.

In addition to the Stearman grand prize, the sweepstakes second prize is a 2012 Can-Am Spyder RT-S with a Can-Am Trailer. Proceeds from the EAA sweepstakes support the organization's programs that educate, engage, and empower people of all ages to take the next step in pursuing their dreams of flight. EAA would like to thank Oregon Aero for its generous donations of seats and PS Engineering for the intercom to enhance the Stearman. EAA

Extreme Efficiency
Ebneter's E-1 sets another record

Arnold Ebneter's E-1 airplane, which he flew to an unofficial world record for airplane efficiency on October 5.

Arnold Ebneter, 84, of Woodinville, Washington, appears to have set another world aviation record for airplane fuel efficiency in his incredible E-1 airplane.

Ebneter, EAA 450548, unofficially set the record on October 5 during a nonstop flight from Harvey Field in Snohomish to Spokane; Pendleton, Oregon; and back to Snohomish, using 62 pounds of fuel and achieving 55 mpg. That shattered the old mark of 67 pounds in the less than 1,100 pounds aircraft category.

The record will require verification by the Fédération Aéronautique Internationale (FAI) before becoming official. In July 2010 he flew his E-1 nonstop from Paine Field, Everett, Washington, to Fredericksburg, Virginia—an 18-hour, 27-minute flight covering 2,327 miles—to set a new world mark for the longest nonstop flight in an experimental aircraft weighing less than 1,100 pounds. He shattered that by 8 percent, far more than the 1 percent required by FAI rules.

FAA Approves Five Quicksilver Kits for 51-Percent Compliance

Quicksilver Aeronautics announced in early November that it has received FAA letters of authorization for five of its kits—the MX Sport, MX II Sport, MX Sprint, MX II Sprint, and the Sport 2S.

The FAA's National Kit Evaluation Team performed evaluations on September 11 and 12, resulting in the addition of the models to its Revised Listing of Amateur-Built Aircraft Kits. These five, plus Quicksilver's GT 400 single-place and GT 500 tandem, give the company a total of seven kits on the listing.

"The team has determined that all five kits may allow an amateur builder to meet the major portion requirement," read an FAA statement regarding the evaluations.

Will Escutia, president of Quicksilver Aeronautics, remarked, "FAA's visit proved the company under new leadership is maintaining the high standards for which Quicksilver has been known since the early 1970s."

Escutia and Daniel Perez purchased Quicksilver Manufacturing earlier this year and continue to operate Quicksilver Aeronautics LLC in Temecula, California.

Rotax Revises Four-Stroke Engine Manuals

Rotax-Owners.com has announced that the following manuals for Rotax's four-stroke engines have been revised:

- Operators Manual (OM) 912 Series, Edition 3
- Line Maintenance Manual (LMM) 912 Series, Edition 3
- Installation Manual (IM) 912 Series, Edition 2

These manuals may also be downloaded for free from the Manuals section of the Rotax-Owner.com website.

Photography by Jay Tolbert and James Lawrence

SeaReys Earn LSA Compliance

Progressive AeroDyne to begin immediate production of ready-to-fly version

The SeaRey LSA amphibian recently passed its FAA Light-Sport Aircraft Prototype Audit, and a ready-to-fly version will begin production immediately, according to manufacturer Progressive Aerodyne Inc. (PA).

After receiving approval from the D.C.-based FAA AIR-200 audit team, PA obtained an airworthiness certification from the Orlando MIDO (manufacturing inspection district office) on November 8.

Working with Silver Light Aviation of Wesley Chapel, Florida, PA worked for several years to meet relevant ASTM standards and FAA regulations. It was the first of seven LSA manufacturers in the past two years to pass the FAA audit without any major findings, the company reported. One FAA auditor termed the result "Very commendable."

The SeaRey first flew in 1992 and has been available in kit form the past 20 years. PA will start production of the compliant airplane immediately, and deliveries to customers of new factory-built airplanes will begin in a couple of months, according to the company.

"We will carry on the legacy of the beloved SeaRey in the production airplane," said Kerry Richter, PA president. Adam Yang, CEO and chairman, added, "This is a milestone for PA to get to the next level of company growth and treat it as a new start of world-class manufacturing and service."

www.searey.com

Team RV Now Team AeroDynamix

Team RV is now Team AeroDynamix, beginning with the upcoming 2013 air show season.

Mike Stewart, Team RV founder and flight lead, said the new name better communicates the high-entertainment nature of the team's precision formation aerobatic performance. The group flies 12 Van's RV aircraft and is billed as the world's largest air show team.

"As Team AeroDynamix, we are the same pilots under the same leadership, flying the same dynamic air show expected of us," Stewart said. He notes that despite increased popularity and name recognition as Team RV, that name creates a brand conflict for the general public, which often equates the term "RV" with "recreational vehicle."

The decision to change the name was made months ago, but the team completed the 2012 season as Team RV and followed the air show business cycle to the end of the year. The team will be at the 2012 International Council of Air Shows (ICAS) Convention, December 10 to 13, as Team AeroDynamix, then prepare for its first performance at the U.S. Sport Aviation Expo in Sebring, Florida, performing January 18 and 19.

AeroLEDs Announces New Sunbeam Landing/Taxi/Recognition Light

AeroLEDs has completed testing on its new Sunbeam landing/taxi/recognition light that features two intense light-emitting diodes (LEDs). Featuring a 50,000-hour life, the Sunbeams are produced in a rectangular format to fit the Cirrus SR-22, a variety of light-sport and experimental aircraft.

AeroLEDs has created a reliable light source that requires only 25 watts of power to produce more than 100 watts or 60,000 candela, which amounts to 1600-plus lumens. Featuring wig-wag capability, the AeroLEDs on any aircraft can be seen in hazy daylight long before people can make out the airframe; because of their long life they can be active at all times. Individual lights have a built-in pulsing capability that is nearly as effective as the wig-wagging.

Sunbeams can be installed by an IA, using a 337 form for certificated aircraft. The IA will file the paperwork. In most circumstances the light will outlast the life of the aircraft.

Like all AeroLEDs products, the Sunbeam is completely sealed and is rugged. It is protected against overheating with a built-in protection circuit and is also secured against lightning, voltage spikes, reverse voltage, and under voltage conditions. The Sunbeam is 2.8-inch high, 4.03-inch wide, and 1.36-inch deep. It sells for $499. For further information, visit www.AeroLEDs.com or call 208-850-3294.

Wicks Aircraft Offers Aircraft Hardware Kit

In light of recent high-profile disasters related to faulty or worn-out hardware, Wicks Aircraft has assembled the most popular hardware components into a handy kit (p/n Hardware Package). It contains hundreds of AN bolts, nuts, and washers, and is organized into a sturdy rack with four slide-out segmented boxes.

A new addition to the Wicks online catalog, the rack (p/n RACK-L, list price $62.99) keeps all four "hardware kits" neatly and securely stacked for transport and to take up minimal benchtop space. The "Large Hardware Kit" also includes four classic Wicks "packs" (NP100, BP100, WP100, and CP100—individually available, with their contents all listed on the Wicks website) and carries a special discounted pricing of $299.

"That's like getting a discount on the four hardware packs, plus getting the $60 rack free," said Scott Wick, president of Wicks Aircraft. "Reliable aircraft hardware, in good condition, easily accessible: That's one of the most effective and least expensive safety items on an aircraft."

Visit www.WicksAircraft.com to learn more. EAA


Fill in the Gap!
EAA's NEW Accidental Death and Dismemberment Insurance Plan offers members the opportunity to fill in gaps traditional life insurance may leave.
> Guaranteed coverage for members under age 70
> Coverage available up to $250,000
> Optional Family Plan
> FAST and EASY online quote and buy
Visit EAAinsurance.org to get an instant quote and purchase insurance today.
EAA Aircraft Insurance
Administered by Falcon Insurance, Inc.
Coverage is underwritten by Starr Indemnity & Liability Company, a Texas insurance company, has its principal place of business in New York, NY and is an admitted insurer rated "A" (Excellent) by A.M. Best Company.
© 2012 Experimental Aircraft Assoc., Inc.
Standard Category | Vintage | Aerobatics | LSA | Homebuilts | Warbirds | Sea Planes | Powered Parachutes | Trikes | Gliders | Helicopters | AD&D

Stewart Headwind

An LSA for the ages

By Budd Davisson

Builder Jack Roberson flew his VW/Maximizer powered "A" model Headwind to Oshkosh from Phoenix, Arizona in the '80s. Note his self-designed spring gear. The aircraft is currently owned by Timothy Stover of Apple Valley, California

Everyone has a list of favorite airplanes. Sometimes it's loaded with high-performance barn burners (Mustangs, Pitts Specials, Harmon Rockets, etc.). Other times the list is dominated by summer-afternoon-sunset flyers (Cubs, Pietenpols, Fly Babys). As a general rule, the lists are fairly parochial, with no crossover. However, one little homebuilt flying flivver, the Stewart Headwind, sometimes shows up where it doesn't belong: on a high-speed list. It makes that list because it is the quintessential summer-afternoon cruiser with very cute retro looks (like a 1930s free-flight model). It's also one of aviation's best-kept secrets—something we'd like to rectify with this article because the Headwind is the absolutely perfect, low-dollar, low-tech, light-sport aircraft (LSA) compliant, good-flying airplane anyone can build. And we mean anyone. And it will cruise at 90 mph!

Photography courtesy EAA Archives

Don Stewart, who designed the Headwind in 1961 and flew the prototype in 1962, said, "At the time, everyone else was trying to go fast, but I was trying to go slow and spend as little as possible to do it. That's why I named it the Headwind, in counterpoint to the Wittman Tailwind. I saw the Headwind then, and I see it now, as an 'everyman's airplane,' an airplane that can be built by anyone who knows which end of a screwdriver to hang on to. Plus, I wanted it to be super easy to fly while at the same time having plenty of performance."

Don has been a serious free-flight modeler his entire life and a longtime, hardcore student of aircraft design and engineering. (He has designed and built a number of aircraft after the Headwind and does engineering consulting.) So, when he laid a clean sheet of paper on his drafting table (that was the early '60s—he uses CAD now), all of his background and tastes helped shape what eventually took place in the drawings. He knew from his free-flight experience that low wing loadings and low span loadings gave the most performance for the least amount of power. That meant light structure and long wings. He also liked a specific look that was often embodied in many traditional free-flight model designs: high wing: low-slung, minimal fuselage; and a high thrust line as epitomized in Alberto Santos-Dumont's Demoiselle of 1908, one of Stewart's favorite airplanes. So, there's little surprise that Don mixed all of those ideas together and came up with what is one of the most practical homebuilt, light airframes sport aviation has seen. The primary reason the Headwind is not better known is because it's not the kind of airplane someone builds to go to fly-ins. They build it to have a good time in their local area, so even after half a century, the Headwind hasn't developed a profile on a national level.

"I used the triangular fuselage cross section, as used on the Demoiselle, Champ, Aeronca C-2 for the same reason those designers did," said Don. "It's quite strong and light. Better yet, it has far fewer pieces of tubing in it than a rectangular layout would have. I designed it specifically for the amateur, so it is much simpler and easier to build. This goes for every aspect of the airframe. I wanted a guy who is building his first airplane to have no doubts that he can do it."

Bill Budgell of Wasaga Beach, Ontario, Canada, one of the latest Headwind builders, addressed the construction difficulty of the airframe by saying, "I tell everyone that there is nothing hard about building this aircraft. If I were to rate the difficulty of building on a scale of 1 to 10, with 10 being the hardest, the average

Bill Budgell of Wasaga Beach, Ontario, Canada, flies behind a Continental A-75 engine, which is heavier than a VW, but it gives phenomenal performance to his Headwind, which he completed in 2011.

builder should see this as a 3 to 4.5 scale of difficulty. I can't think of an easier first-airplane project. Or a less expensive one."

A casual perusal of the plans shows that Don also drew up the plans with the first-timer in mind because no interpretation is needed to figure out how everything goes together. Plus, an outstanding cutaway is available that shows the relationship of all the parts to one another.

"The plans are well drawn and very self-explanatory," Bill said. "A little studying and there would be no reason to contact the designer. They are that understandable. This really is an airplane anyone at any skill level can build. Same thing with flying it: It's very docile and Champ-like, so piloting skill required is also minimal."

Bill thinks so much of the airplane that he makes himself available to answer building questions and will custom-build components, if needed (capaviation1@rogers.com).

A note should be made here concerning the use of the term "simple." There is a definite difference between "simple" and "crude." Simple means a lack of complexity. It means designing and engineering something so the job gets done with the smallest number of parts possible and making certain that each of those parts is, itself, easy to make. And that is the design philosophy behind the Headwind: Every single part of the airplane could be made with a hacksaw and files, if need be (except the axles). In theory, the entire airplane could be made with hand tools. In fact, it could be done without power tools, if you don't mind drilling a few holes in metal by hand. Now there is a worthwhile challenge: Prove that you can build an airplane without power tools! Of course, there's no reason to.

Don said he built the prototype in five months using nothing but a hacksaw and a powered hand drill. He continued, "You start the fuselage by laying out the bottom truss, which forms the bottom of the triangle. You bolt that to a firm table and lift the tail end of it up to the right height, as indicated on the plans, bending the longerons in the process. Then you build some simple wooden jigging that locates the tail post and top longeron. Everything sort of 'hangs' from that.

"One approach is to make three plywood patterns and stand them up on the worktable. The first establishes the firewall station, and you build the forward fuselage station and motor mount, which is part of the fuselage, to that. The second locates the front end of the top longeron and the main wing and landing gear fittings, and the third plywood station establishes the back of the

Landing shocks are absorbed by stacks of rubber wafers or Chevy motor mounts.

The cockpit can be built to fit almost any size pilot. The door can be eliminated.

Headwind builders consider simplicity to be more important than streamlining.

cockpit including the rear wing fittings and seat position. Spend a little time studying the drawings, and most people can build the jig and start cutting tubing the first weekend. Progress is very quick. If someone is afraid of welding, they can always have Bill weld up a fuselage for them, which I think they can do and still stay within the 51-percent requirement. However, the nature of the structure is such that only a few welds are critical, and those have enough weld length involved that they have a large safety margin included."

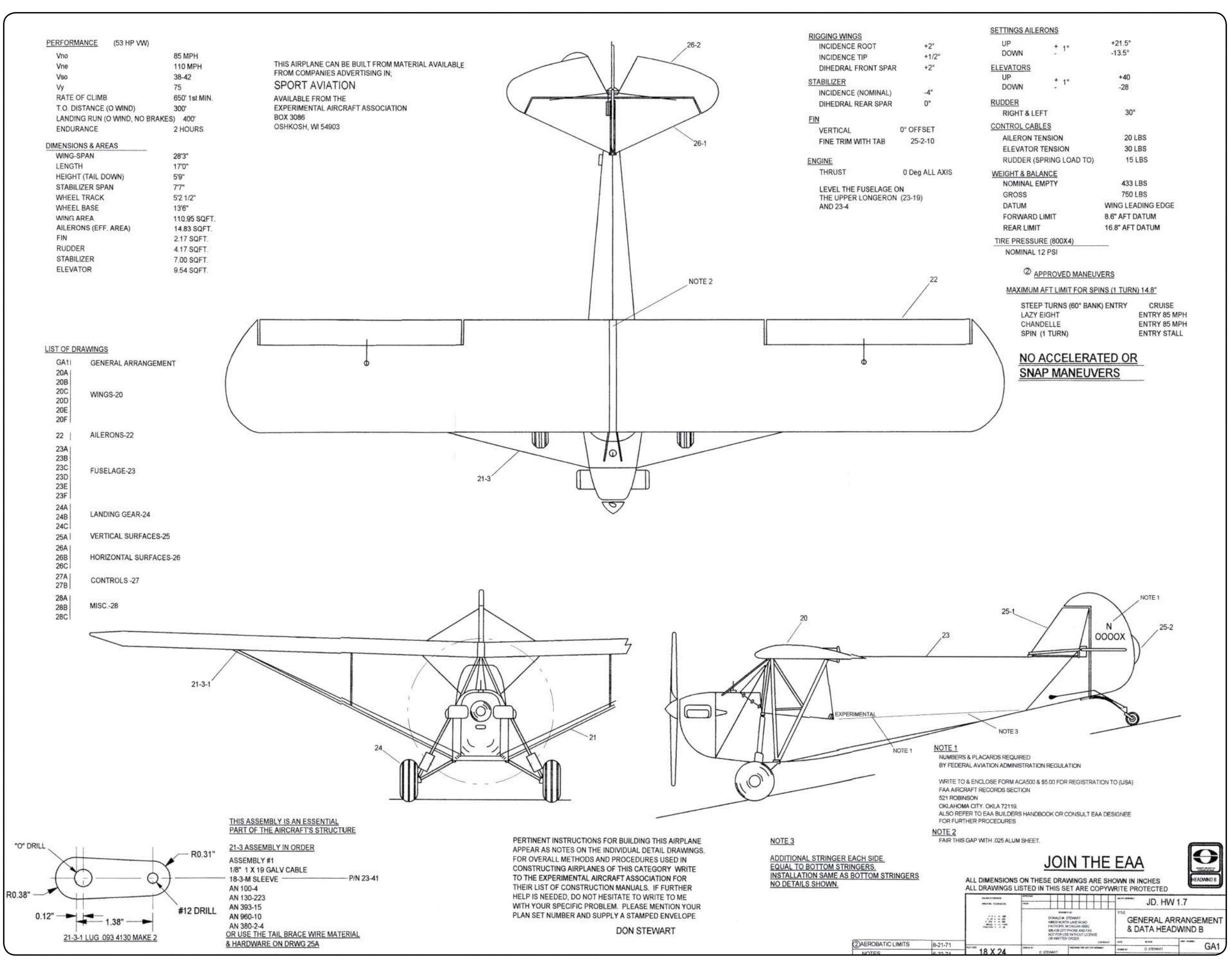
The fuselage structure features a triangular cross section with the top longeron running from the main wing fittings to the rudder post. The motor mount is integral to the fuselage.

The landing gear is another area where low cost and simplicity is involved.

"I made the gear sort of an outrigger arrangement so the shock struts would be super simple to build and gear alignment would be easy," he said. "The shock absorption system is a stack of wafers that are cut from a sheet of one-inch, 50 durometer rubber sheet with a hole saw—it cuts easier and cleaner if you freeze it first—or a stack of Chevy motor mounts. The part number is in the plans."

Don built the prototype to be light and simple, which included no brakes on the former 800 x 4 Cub wheels, but few builders have gone that route.

"Builders have used every size of wheel and brake available with 600 x 6 being the most popular," he said.



The Headwind in the photo above uses a spring gear and direct drive VW, while the Headwind below uses the rubber wafer damped gear. Its Maximizer-reduced VW has a higher thrust line, which produces the different nose profile.

"Some have even gone down to 500 x 5, but I think the airplane retains more of its retro look with bigger tires. Sort of like an old 1930s free-flight model. Because it's so light, it doesn't need very much in the way of tires or brakes, so lots of used ones could be sourced cheaply."

The plans clearly show a door on the right side, which Don said is just there as an option and not really needed. "The door can be on either side of the cockpit or it can be eliminated completely. Crawling in the window is no problem. But the door makes it much easier, and it can be flown with the door left off and the side open, like a Cub."

The wings are classic fabric wing construction identical to any number of wings, except the ribs are made from ¼-inch Marine plywood. They can easily be band sawed and sanded in stacks and the internal cuts made with a jigsaw. However, they absolutely scream to be made on a homemade router table after making up a master pattern out of hardwood or ¼-inch Masonite. (Birch or oak from Home Depot would work, too).

Bill said, "You can jigsaw them out and do them all in a long weekend. However, Don's son, Bill, and a friend have set up a CNC router to make them for a good price. Their e-mail is pwr985@hotmail.com."

In keeping with the search for economy in construction, Don said, "Although spruce is best for the spars in terms of weight, you can also use Douglas fir, and in the drawings I clearly say what to look for in terms of grain lines per inch, run-out, etc. A really good source for spar material is 'porch stepping,' the straight grain fir they specify as being good enough to make stair steps out of."

One of Don's professed frustrations is that more people haven't used VW engines using his Maximizer belt-driven reduction system.

Don said, "A lot of Headwinds are flying with stock, or nearly stock, VWs, and they fly really well. However, I originally designed the airplane around a VW with my Maximizer belt reduction system on it. VWs are tiny engines and get their power with rpm, not displacement, so they need to turn up fairly high. They can't do that, of course, with a long propeller, which is much more efficient, so I designed the Maximizer system to let them turn up but swing a bigger prop at a slower rpm. I was really happy with the way it worked, and the airplanes performed great. But I was never able to get the units produced in quantity. Today, someone could take my drawings to one of those online CNC operations and get the drive pulleys turned out relatively inexpensively."

As it happens, the majority of the Headwinds built use either a direct-drive VW or the old, reliable, and readily available Continental A-65. They are heavier, and a little bit of beefing up is required of the forward fuselage bay; but apparently they really do the job, and midtime engines are generally available for $5,000, give or take.

Bill Budgell has an A-75 (an A-65 turning up another couple hundred rpm) in his airplane, and he said, "I routinely get a solid 900 to 1,000 fpm climb, and the takeoff happens before you're ready for it. Maybe a 200-foot run. I'm cruising at 92 mph at 4 gallons per hour, and the airplane is surprisingly solid in flight. In a lot of ways, it's a Champ. Very easy to fly."

The cost of covering and painting an aircraft has risen to ridiculous levels, but Don has something to say about that. "I like to stay with known fabric, like Poly-Fiber," he said, "but, and I know this sounds crazy because it is so nontraditional, some Headwind builders have been experimenting with household exterior latex paint over normal aircraft Dacron. We have latex-Dacron test panels out in the sun that are more than seven years old, and we see no deterioration at all. To spray it requires thinning it out more than you'd really want; but I just looked at an airplane that the builder painted with a fine-nap roller, and it was amazingly smooth. I asked the manufacturer's rep about it cracking from flexing, and he reminded me, '…It's mostly rubber, remember?' I'd forgotten that."

The Headwind is an airplane that's absolutely made for scroungers and do-it-yourselfers. There are an amazingly small number of parts, and there are alternates for some of them. The lift struts, for instance, don't have to be streamlined tubing. If you want, you can use round tubing (all that will happen is you'll go a little slower) or streamline the tubing using wood, thin aluminum, or available plastic fairing strips. The price of round tubing is less than half that of streamlined.

You can keep your eyes open for someone upgrading a J-3 to a C-85 and pick up an A-65 for a good price. Wheels and brakes, tail wheel, instruments, etc. all could be sourced. This is an airplane that would benefit from you spending a few hours on eBay or cruising swap marts looking for highly airworthy items.

We're not proposing using substandard parts, but we are saying that for a 90-mph airplane, not every part needs to be new. Every part does, however, have to be rebuilt or judged to be airworthy by someone who knows (such as your local A&P).

Bill estimates that with a little creative scrounging and luck, the Headwind can be built for $12,000 to $15,000. With a good find on an engine it could be under $10,000.

The Headwind was born during a period of EAA's growth, when getting into the air as safely and as inexpensively as possible was the standard goal. The concept of $50,000 to $100,000 homebuilts couldn't even be imagined. The Headwind harkens back to the "good old days" and can once again make flying highly affordable. Better yet, you don't need a medical to fly it. So, what's not to like? EAA

Budd Davisson is an aeronautical engineer, has flown more than 300 different types, and has published four books and more than 4,000 articles. He is editor-in-chief of Flight Journal magazine and a flight instructor primarily in Pitts/tailwheel aircraft. Visit him on www.AirBum.com.

Dick Giede, a retired Cessna engineer from Wichita, built this to-the-plans Headwind in the early 1960s. Equipped with a direct-drive VW, at last report he had logged more than 1,000 hours on the airplane.

Photography courtesy EAA Archives

EAA Employee Brian Tesch #849155 wearing Camp Shirt
Plane provided by Curt Drumm, Lakeshore Aviation member #374143
EAA AirVenture Oshkosh Sea Plane Base 2012
It's never too early...
...to start planning what
you want for the holidays.
EAA
THE SPIRIT OF AVIATION
Shop online today.
ShopEAA.com
Photo by Ken Cravillion
© 2012 Experimental Aircraft Assoc., Inc.

ULPower Airplane Engines

Born in a helicopter with racing genes

By Marino Boric

Left—This is the final layout of the newest ULPower engine. The six-cylinder engine is actually the well-known ULPower four-cylinder powerplant that was stretched in the middle by the addition of the all-new cylinder. The forward and rear cylinders/pistons/piston rods are taken from the current production. Of course, the crankshaft and the intake manifold plus wiring wee adapted to the longer engine.

Photography by Marino Boric

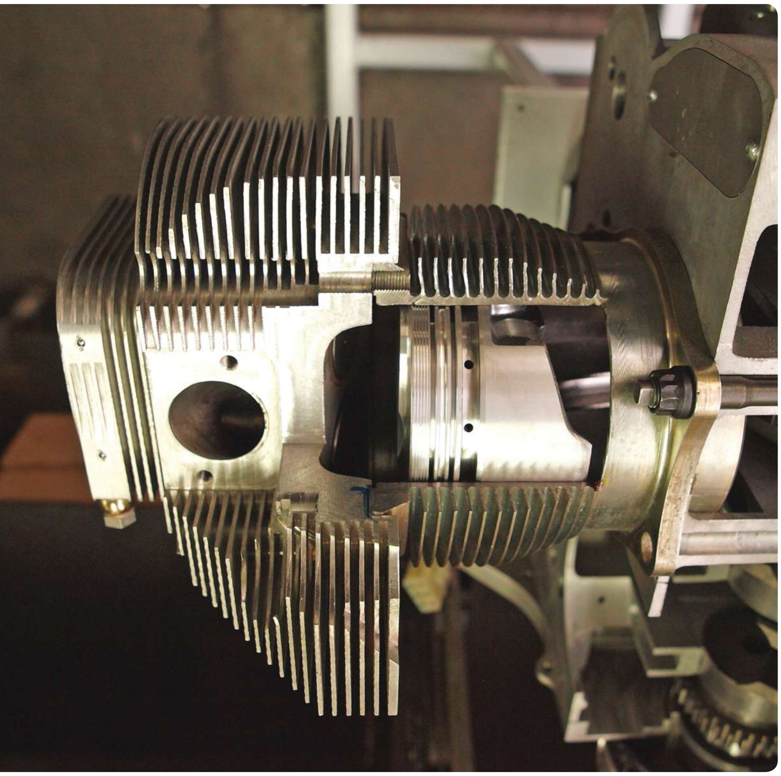
The American experimental and European ultralight (UL) markets have been waiting a long time for a new aircraft engine rated above 120 hp. ULPower, a small aircraft engine manufacturer from Belgium, has now started selling a new six-cylinder engine. The new engine is actually available in two models—UL390 and UL520—and develop from 140/160 hp to 180/200 hp. Uncommonly, ULPower folks first took on production of the bigger and stronger six-cylinder UL520i/iS engine. The smaller six-cylinder UL390 i/iS (140/160 hp) is still undergoing ground and dyno testing and will be soon available.

The new six-cylinder engine was first shown two years ago during AERO Friedrichshafen 2010. At the time, it was just a test balloon to determine acceptance in the marketplace. The public reaction was so good the ULPower team decided to proceed with the engine development. The first six-cylinder engine was running on the factory dyno in fall 2011.

Because the thrust-to-weight ratio is pretty appealing to designers, we will likely see these engines on several "power-hungry" aircraft; during AERO 2011's opening day, ULPower sold five engines.

To better understand ULPower's engine family, we have to step back into the past and describe the uncommon story of ULPower. As I started collecting information about the company, I was quickly confused. First, I was not able to understand how this small company was able to bring to the market an entirely new engine family, which now counts 10 different powerplants, so fast. Secondly, I was not able to understand why there were two different locations in Belgium that are involved in the engine manufacturing.

So let's start from the beginning. Some of you might remember the Belgian light helicopter project called the M-80 Mosquito that was developed in 1996. That helicopter was first powered with the two-stroke Rotax 582 engine and with the Jabiru 2200. The Mosquito designer dropped the Rotax engine because of warranty issues associated with a vertical engine installation and focused on the only other promising engine on the market at that time—we're talking about the year 2000—the Jabiru. That four-stroke engine seemed suitable for the



A cut-through of a ULPower cylinder. This image clearly shows how the cylinder foot is screwed to the opposite half of the engine block through the half on which it is sitting. The cylinder head is fastened to the cylinder top.

All ULPower engines exist in two different displacements and compression versions. The higher displacement versions use the taller cylinder (at left) while the lower displacement versions use the cylinder shown at right. All ULPower cylinders have a 105.6 mm cylinder bore; with two different crankshafts and shorter and longer cylinders, the stroke is 74 mm or 100 mm respectively, resulting in two different displacements. That is the difference between the ULPower 260 and 350 engines with 2.6 and 3.5 liter of volumetric displacement. But additionally on each engine with the same displacement, with two different cylinder heads and two different compression ratios you get two different power outputs. That's the ULPower equation for a wide power output choice.

vertical installation. The Mosquito Aircraft factory searched for a person able to transform the Jabiru for helicopter use and turned to the well-known race engine tuner DR Tuning in Oostende, Belgium. This was the start of ULPower. Lionel D' Hondt, owner of DR Tuning, was (and still is) successful in tuning all kinds of race car engines for street use. For him it was not a problem to adapt the Jabiru engine for helicopter use. DR Tuning was able to rebuild the Jabiru engine and equip it with the fuel injection for helicopter use. But the delivered power of the tuned engine was not sufficient, so DR Tuning was asked again if it could build something more suitable.

Beside the fact that it was illogical to buy the engine in Australia, disassemble, tune it, and reassemble it in Belgium, the Jabiru factory also denied support for the heavily modified helicopter installation. Lionel decided to build his own 2.6-liter boxer engine developing 120 hp. While that engine was running on the dyno, Mosquito Aircraft's business failed, so there was a valid engine but no longer a helicopter for it to power.

Lionel reflected briefly and then asked his partners and suppliers if they would manufacture the parts for the engine so he can start his own production. When he got the answer "If you want to start production, we will go with you," ULPower Aero Engines was formed. After additional development in the years 2004 through 2006, the UL 260i engine with 2.6 liters was born. First flight was in an aircraft called Mission in 2006. The first flight of the 3.5-liter engine was in 2008. Development of the engines was not a problem because DR Tuning was always earning money with car tuning activities. So the aviation engine development was fun and not a big additional investment; the machinery was already there, and no major new investment was needed. Besides that, ULPower is owned by four stockholders, each with 25 percent of the assets. Several ULPower shareholders own another Belgian metal manufacturing company called ROPA that manufactures all ULPower's hardware. ULPower production represents only 5 to 10 percent of ROPA's business. These facts together are a reason for the easy and glitchless production start and steady development of ULPower.

Currently, ULPower offers eight engines: six four-cylinder engines and two six-cylinder engines.
The four-cylinder engines are:

1. UL260i, 97 hp
2. UL260iS, 107 hp
3. UL260iF, 100 hp
4. UL260iSA, 107 hp
5. UL350i, 118 hp
6. UL350iS, 130 hp.

The two six-cylinder engines are:

1. UL390i/iS, 140/160 hp
2. UL520i/iS, 180/200 hp

This metal throttle position sensor (TPS) was the most secret part of the new six-cylinder engine and was specially developed for the new engine. It is much shorter than the older sensor, has double exits, and no moving parts that are in direct contact inside. The new TPS (shown on the left here) is already mounted on the throttle body. On the right in this photo is the older sensor used on four-cylinder engines. The position of the butterfly valve is no longer determined by the position of the rotating finger on a sliding arch; instead it is now contact-less.

This is the piston and piston-rod of the entire ULPower family of engines.

All ULPower four- and six-cylinder engines are nearly identical and are modularly built. Their cylinders have the same bore of 105.6 millimeters, and only the stroke is different—74 millimeters for the 260 while the 350 models are 100 millimeters, with 2.6 and 3.5 liters respectively. The multiplication of models is obtained with two different compression ratios of 8.16-to-1 and 9.10-to-1, which result in approximately a 10-hp difference from the low to high compression models. The same process will be done with the six-cylinder engines that all use the same components as the four-cylinder models but have two more cylinders. That means that the now-in-production UL520i/iS engine that derives from the UL350 has either 180 hp (low compression) or 200 hp (high compression). The six-cylinder version of the four-cylinder UL260 engine is called the 390 (i/iS) and will develop 140/160 hp (high/low compression game, again) once in production. This engine is not yet fully tested and will probably be on sale soon.

Installed weight of the UL520i/iS is 242 pounds, and like the popular UL260/UL350 line (weighing 159/225 pounds), the new engines are direct drive, horizontally opposed, and air-cooled with electronic ignition, and multiport fuel injected FADEC (full authority digital engine control). Weight difference between the four- and six-cylinder engines with the same fractional (single cylinder) volume is from 8 to 10 kilograms.

ULPower Engines

	UL260i	UL260iS	UL350i	UL350iS	UL390i	UL390iS	UL520i	UL520iS
Displacement	2,592 cc	2,592 cc	3,505 cc	3,505 cc	3,900 cc	3,900 cc	5,200 cc	5200 cc
Compression	8.16:1	9.1:1	8.0:1	8.7:1	8.16:1	9.1:1	8.0:1	8.7:1
Max Torque	207 Nm	240 Nm	305 Nm	320 Nm	320 Nm	370 Nm	425 Nm	465 Nm
Max Power	97 hp	107 hp	118 hp	130 hp	140 hp	160 hp	180 hp	200 hp
Alternator Output	30A	30A	30A	30A	50A	50A	50A	50A
Fuel Types	95ron/98ron/100LL	98ron/100LL	95ron/98ron/100LL	98ron/100LL	95ron/98ron/100LL	98ron/100LL	95ron/98ron/100LL	98ron/100LL
Installed Weight	72 kg	72 kg	78 kg	78 kg	100 kg	100 kg	108 kg	108 kg
Price	13,100.00	14,100.00	16,800.00	17,500.00	21,250.00	22,250.00	26,250.00	27,250.00

Photography by Marino Boric

An aerobatic version of the UL260 engine is called the UL260iSA (A for Aerobatic). The difference is the modified stock engine block with holes for better internal oil transport to the oil pan, the "smart" oil pickup tube that is not fixed but can swivel for 90 degrees total, and an oil breather "bottle." Fuel systems are the same as on all ULPower engines: fully electronic ignition and multipoint fuel injection (FADEC) system. All engines come standard with one generator (20/30A for four- and six-cylinder engines), single engine control unit (ECU), one set of ignition coils, and battery. The mixture ignition is via two spark plugs per cylinder. It is possible to get a second ECU (for 2000 Euro) and even a second generator (price on request).

The double generator was first shown in 2010 on the six-cylinder engine where it was mounted directly behind the first unit. According to ULPower, the double ignition system option (two ECUs) existed from production start, but demand is not very strong. The whole electric system is so made that the engine connectors/wiring doesn't have to be modified for the double system. Since the introduction of the six-cylinder engines, ULPower is using a smaller throttle position system (TPS) indicator with a Hall sensor without sliding parts in contact.

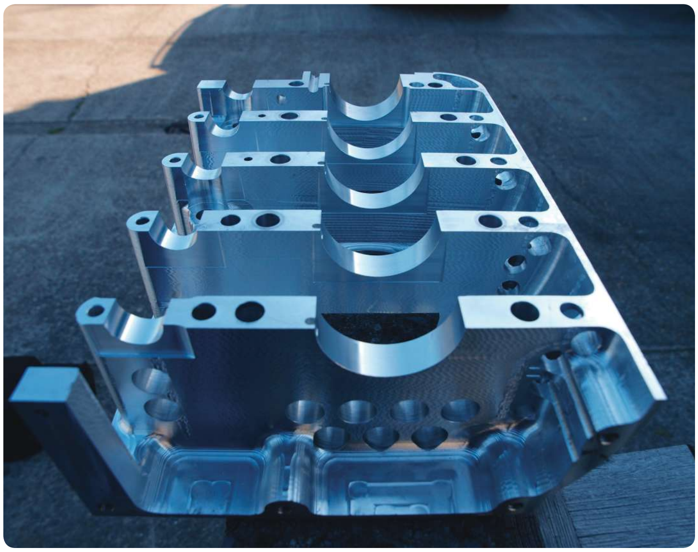
Marketing, distribution, and hardware production is done by ROPA in Geluveld, Belgium. DR Tuning is contributing electronic/electric components, assembly, and engine testing.

Since 2006, ULPower has sold more than 250 engines. In the past year they delivered more than 75 engines. Their numbers are growing steadily.

In Europe, ULPower is selling its engines from Belgium; ULPower of North America LLC is the exclusive distributor of the ULPower Aero Engines products in the United States and Canada. The new company is working with several American manufacturers to develop firewall-forward packages and installation support for its engine line in popular light aircraft, including the Zenith CH 650 and STOL CH 750, RV-12, RANS S-19, and the Just Aircraft Highlander. The first new engine has already been sold in the United States to Renegade Light Sport Aircraft, which will offer them as options for the Comet biplane. EAA

» For more information about ULPower engines, visit www.ULPower.com and www.ULPower.net.

Marino Boric, EAA 1069644, is an aeronautical engineer and holds a private pilot license in Germany with commercial and instrument ratings (CPL/IFR). He also flew as a military pilot.



This is one of two main differences between the normal UL260iS and the UL260iSA where "A" stands for acrobatic. On the aerobatics version the engine block has drilled holes inside the crankcase casing for better oil transport during aerobatic maneuvers and has a 45-degree swiveling oil-pump pick-up tube with a hinge joint that is capable of picking up oil from the oil sump while the airplane is climbing or diving.

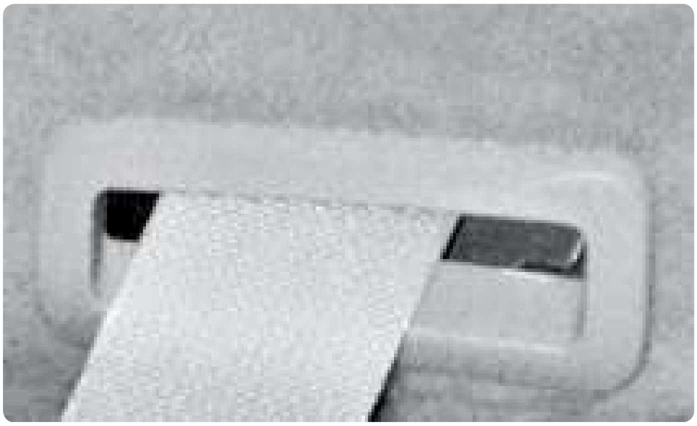
Photography by Marino Boric

Shoulder Harness Installation Tip

By Cy Galley

After several decades of the FAA permitting the use of non-approved harnesses in Alaska, it has now approved the installation of non-STC'd or -PMA'd shoulder harnesses through Policy Statement Number ACE-00-23.561-01 and Advisory Circular (AC) 21-34 in certificated aircraft. The FAA's philosophy was any harness is safer than no shoulder harness. Click on the links for all the pertinent details. One can also use this information to install a shoulder harness in your homebuilt as the installation geometry and parts are the same.

One of the most important criteria for any shoulder harness installation is to have the top anchor point located almost even with the shoulder to about 30 degrees above. This minimizes compressive spine injuries. This criterion automatically means that on a high-wing plane the shoulder harness will need its attachment point to come through the headliner.



Installed headliners are not normally designed for a slot that will contain an active strap. Cutting the slot is easy, but keeping it neat and non-frayed is the problem.

If it is new headliner installation, one can serge the edges similar to around a buttonhole on a suit coat, but what can one do on a retrofit?

Your local car dealer or salvage yard has a great solution. The attached photo shows how the auto industry does it. Look at cars in a car dealer's showroom to see the small plastic slot they use. You will find them on the hat shelf behind the rear seat where the shoulder belt exits. The parts department of your local auto dealer should be able to sell you a couple. A salvage yard might be cheaper, but the plastic might be weakened from the sun's rays. These slots come in a variety of color matched to the interior of the car, so you should have a wide range of colors from which to select one. Also note that the slot is wider than the strap so as not to pull or damage the headliner when you lean to one side or another.

So what are you waiting for? There's no better safety item than a shoulder harness for you and your passengers. EAA

Hints for Homebuilders Videos

Making a Set of Fluting Pliers

Homebuilders love to make tools. Brady Lane from the EAA staff shows how he made an inexpensive set of fluting pliers. Watch the video.

Cutting Aircraft Plywood

Timm Bogenhagen of the EAA staff shares a few ways to cut aircraft plywood. Timm is a technical counselor and builder of an Oshkosh award-winning TEAM MiniMax. Watch the video.

You can access the hundreds of other Hints for Homebuilders here.

David Wright and Chuck Schroll's homebuilt clipped-wing Maule.

A Homebuilt Maule
Clipped-wing style

By Lynne Wainfan

David Wright and Chuck Schroll were on their way home from the Sun 'n Fun Fly-In in Lakeland, Florida, in 2004 when they hatched an idea: Build a clipped-wing Maule. Not familiar with Maule aircraft? You should be. The Maule factory has produced more than 1,800 airplanes in its 50-year existence. Maule aircraft have earned a reputation for being reliable, rugged, and capable of going anywhere—on wheels, skis, or floats.

David loves the Maule design—a high-wing, STOL taildragger with a chromoly steel truss fuselage, and metal spars. He had worked in the company's engineering department for eight years, helping to develop the 260-hp and diesel engine Maules. A few years ago he left Maule Air Inc. "I had to catch up at home," he said, "so I took a leave from Maule. But I still haven't caught up at home." Now David owns Wright Aircraft Technology LLC down the street from Maule Air Inc. in Moultrie, Georgia. "I work on Maule aircraft and anything related to them," he said. David starts with older models, tears them down to bare metal, and rebuilds them to look like new. "Better than new, actually," he said. "We add any modern upgrades that the company has come up with—metal stringers, for instance."

After talking with Chuck, David liked the idea of building a clipped-wing Maule. "I learned to fly in a Maule. But the newer models have longer and longer wings." In addition to his sentimental attachment to shorter-winged Maules, David had another motivation: He wanted to go fast.

As you probably know, one way to increase a vehicle's speed is to reduce its drag. Drag is proportional to a

Photography by Jim Raeder

term called Cd or drag coefficient. Drag coefficient itself is a sum of two factors:

- induced drag, and
- the sum of (factor drag + skin friction drag).

Induced drag is a function of the lift of the aircraft; factor drag is related to the size and shape of the body; and skin friction drag is a function of how much of the aircraft is in contact with the air. For a more technical description, see these short NASA descriptions: a drag overview and an explanation of induced drag.

So will a clipped-wing Maule go faster than a longer-winged version? On the surface (no pun intended) it would seem so; reducing the wing's surface area reduces the skin friction drag. Unfortunately, it's not that simple. Drag is a function of other factors, which may actually get greater as the wing is shortened. For instance, the induced drag coefficient increases when aspect ratio (the span squared over the wing area) goes down. Since the clipped-wing Maule's aspect ratio is lower than the longer-winged version, the induced drag coefficient is higher. The increase in induced drag will work against the decrease in skin friction drag. Depending on whether the aircraft is climbing or cruising, along with other factors that would require equations and calculations, the shorter-winged airplane may or may not go faster in all flight conditions.

We now return you to nonengineering speak.

Chuck's reasons for wanting a clipped-wing Maule were different from David's. Originally Chuck thought of building a clipped-wing Monocoupe because the plane would be easier to build, would respond better in turbulence, land better in crosswinds, be easier to hangar, and therefore, would have less hangar rash. But he wasn't fixated on a Monocoupe; he'd owned three Maules and liked them. David, a former high school science and math teacher, flies his factory-built Maule as a volunteer for LightHawk. His work flying and photographing ecology earned him a national award for volunteering. After Chuck learned of David's background and interest in designing a clipped-winged Maule, Chuck was impressed. He said, "David is where engineering meets art. He can close his eyes and picture the parts of the airplane." Chuck was easily convinced to build a Maule instead of a Monocoupe.

Because Maules are factory-built, Chuck and David knew the FAA would have to be convinced that their airplane would be amateur-built. As most EAAers know, for a person to obtain an amateur-build certificate, the builder must show that at least 51 percent of the fabrication and assembly tasks were performed by the amateur(s). The so-called 51-percent rule usually comes into play for designers and builders of kit aircraft since the kit can't be "too complete" for homebuilders. (The EAA has a FAQ about the 51-percent rule.) This project would be a little different—the team would have to show that Chuck had built at least 51 percent of something very close to a production aircraft.

Fortunately, the FAA has a 51-percent checklist for just such an occasion. The checklist is helpful for a number of people: kit designers; people who want to build a factory plane; those who wish to use commercial

Lots of windows offer great visibility.

assistance; and builders who want to modify their kit's fabrication and assembly process.

David planned out the work using the 51-percent checklist, deciding what Chuck would build and what factory-made components they could use. "Fortunately," Chuck said, "David had a hangar full of old parts." They also reviewed the FAA's list of components that are excluded from the 51-percent rule:

"Items such as engines, engine accessories, propellers, rotor blades, rotor hubs, tires, wheel and brake assemblies, instruments, and standard aircraft hardware, including pulleys, bell cranks, rod ends, bearings, bolts, rivets, hot air balloon burners, and fuel tanks, are acceptable and may be procured on the open market. The use of these items is not counted against the amateur builder or kit manufacturer when the FAA determines whether the amateur-built aircraft has met the major portion requirement."

If designing and building a clipped-wing factory aircraft wasn't amazing enough, here's where the story gets fantastic: Maule Air Inc., rather than seeing David and Chuck's *Wright Rocket* as competition, was actually supportive of the project. Extremely supportive of the project. David Maule, son of company founder D.B. Maule, let the team use the factory jigs after hours. Since the jigs were available, David and Chuck simply laid out the wings, skipping a 36-inch section outboard of the struts. The wing root and tip are identical to those of a Maule factory airplane. David Maule wanted to help more, so he even built some parts himself. David Wright spoke with admiration of David Maule: "When you go to the factory, he (David) looks like one of the employees. One time a man asked David, 'What do you do?' and David, who was in the factory working, said, 'President.'"

Wright said that David Maule is following the example of his father. D.B. completed the first Maule aircraft in 1957, winning an EAA award. D.B. wanted a plane that could go anywhere and be used in rugged and unimproved environments. Father and son were known to work tirelessly on product improvements—people passing the factory late at night would see the lights on and the two of them still working. As a result of this work ethic and openness to trying new ideas, Maule Air's engines, avionics, and other features have been upgraded over the years. Fortunately, the Maule's basic mission—to be rugged, simple, and reliable in unimproved environments—remains the same. Maules retain what D.B. valued in his slogan: "It's performance that counts."

Photography by Jim Raeder

In addition to David's help, other Maule Air employees helped with the project as well. Quality inspector Wayne Frasier took a special interest in the clipped-wing project. He shared Maule's wing manufacturing process with David and Chuck and discussed ideas about skin thickness. Wayne was open to the design changes David Wright had come up with. "That's what experimenting is all about," he told them. Not only did Wayne openly share processes, concepts, and jigs, he was intrigued with the clipped-wing concept as a future product offering. "This might be something we'd like to do," he said.

When the application for airworthiness certificate had to be notarized, another member of the Maule Air family helped out. June Maule, D.B.'s wife for 51 years, had run the procurement department and then owned the company after D.B. died. She notarized the application shortly before she passed away in 2009.

David and Chuck did some experimenting with other aircraft components along the way. They had planned on using an Innodyn engine, a turboprop that has an innovative, one-basic-moving-part design. The engine had been tested on a Van's RV-4 and PV-6AT, along with a P-18 Super Cub. Chuck built a mock-up engine and mounts before realizing that the engine was not going to be available anytime soon. As David reports, "We took our losses—mostly Chuck's loss—but it was a big letdown." They ended up using a 300-hp Lycoming O-540, David said, "because it would do what a standard 235 or 265 Maule would do, and the extra horsepower would compensate for the clipped wings."

They chose a beta MT three-blade prop that has reverse-pitch capability. "The MT would be great for floatplanes," David said. "The plane wouldn't drift after landing or on start-up."

Finally, in 2010 the plane was completed and ready for inspection. David had lots of evidence that they had built the airplane: 570 pictures and the 51-percent checklist. When the builders totaled up their work, Chuck had built 54 percent of the airplane.

Power for this homebuilt Maule is a 300 hp Lycoming O-540, with an MT Propellers three-bladed prop.

The Wright Rocket's modern instrument panel. To learn more about Maule Aircraft's certificated aircraft, visit www.MauleAirInc.com.

David and Chuck flipped a coin to see who would fly the plane first—Chuck didn't say who won, but he hopped in. He spoke in his matter-of-fact way about that first flight. "It was a 3,000-foot grass strip. There were tall pines all around. There was no time to play, so we just went for it." He reports that the plane flies great and that its performance is about what he expected.

Does the clipped-wing version go faster than the factory airplanes? David and Chuck haven't quite come to agreement on that. As David points out, the airplane's performance has not been independently tested. Chuck reports that they haven't methodically assessed the plane's performance over the entire flight envelope. He said, "David likes to fly wide-open throttle." They both agree on a rule of thumb for the aircraft's basic speeds: where the factory Maule would climb, cruise, etc. in miles per hour, their clipped-wing version flies in knots. The two are happy with their 15-percent improvement in basic speeds, pleased with the award they won for outstanding workmanship, and especially touched by the support they've gotten from Maule Air Inc.

As David said, "This airplane is a tribute to the Maule family." EAA

Lynne Wainfan, Lifetime EAA member 504081, is an aerospace engineer who was part of a three-person team to build an angular lifting body, the Facetmobile, which was designed by her husband Barnaby. Lynne is a private pilot and former national champion model airplane enthusiast.

Video of the Month

Douglas Dodson and his dad came to EAA Oshkosh for the first time in 1987. They liked the looks of several of the then-new fiberglass aircraft. Three years later, they purchased a Glasair II kit…and Douglas finished it in 2011. "You don't build an airplane," Douglas said. "You build a bunch of airplane parts until there are no more parts to build."

Photography courtesy David Wright

Selecting Your Aircraft Voltage

14 or 28?

By Dick Koehler

Recently I received an e-mail with the following question, "Looking at avionics components and wondering why components that are 14 volt are more expensive, two times the price of ones that are 28 volt. Why? Are most systems 14 volt as opposed to 28 volt?"

I thought my answer might be helpful to many readers. The basic voltage of your system defines all the electrical equipment you will use, and it is not a trivial decision. Let's look at some of the considerations so you can apply a bit of logic to making the decision.

Most small planes are 14-volt systems, but there is a definite weight saving associated with a 28-volt system, and the savings get significant as the size of the plane increases. That's why most larger planes are 28-volt systems. There are exceptions, of course. The weight advantage on small planes from lighter wire is usually trivial, compared to the convenience of being

able to use automotive equipment, which was commonly done in years past. However, if you buy a new Cessna today, it will be a 28-volt system. Anyway, the result is that almost all small planes (approximately 350,000 airplanes) are 14-volt systems, while commuter and airliner types are almost all 28-volt systems (approximately 40,000 airplanes). That means there is a much greater demand for 14-volt accessories, so they command a higher price when sold used. Usually the premium is on the order of 15 to 20 percent higher, not double, but it depends on the item and its desirability. (Capitalism at its best.)

Another consideration is the voltage required for the avionics you will want. Some of the newer equipment will operate on either 14 *or* 28 volts, but most of the older generation radios require either 14 or 28 volts. For instance, the popular King KX-155 Nav Comm comes either in 14 or 28 volts, but not both. Interestingly, a used 28-volt version is usually cheaper because most people do not use it.

Another popular unit is the Garmin GNS-430/530. Early versions required 28 volts for the radio portion but would operate the GPS portion on 14 or 28 volts. I had to buy a 14 to 28 up-converter for about $350 to make my used GNS-430 work. The newer Garmin units do not have this restriction.

There are power converters you can buy if you have a 28-volt component that you want to install in a 14-volt aircraft and vice versa. For instance, the Ameri-King AK-550-6C costs $328 from Aircraft Spruce and will boost 14 volts to 28 for 6 amps. Higher-amp converters cost more, obviously. Down converters, 28 to 14, are cheaper, such as the 9-amp AK-551-9 for $189 from Aircraft Spruce. Also driving the market is the fact that it is less costly to install 14-volt accessories in a 28-volt plane than vice versa.

Another consideration is the voltage required for the avionics you will want. Some of the newer equipment will operate on either 14 or 28 volts, but most of the older generation radios require either 14 or 28 volts.

These factors are the prime reasons why used 14-volt gear is more expensive than used 28-volt avionics gear.

So, how do you decide whether to go with a 14- or 28-volt system? Let's kick that around a bit. The advantage of using a 14-volt system is that it is common with most automobiles, so you can use many of the less expensive electrical components available for cars, such as lights, switches, etc. Also, 14-volt systems are the most common in homebuilts and smaller GA aircraft.

The great advantage of the 28-volt system is that it uses wire that is significantly smaller (approximately 70 percent less weight) than in a 14-volt system, which is why the higher-voltage system is used on larger aircraft. With all of the new avionics aircraft are acquiring these days, even smaller, single-engine aircraft from Cessna, Mooney, and Beech are coming with 28-volt systems, probably for the weight savings. Consider this: If your plane had 1,000 feet of wire in it and you were able to use a 28-volt system, you could reduce the wire size from 12 gauge to 20 gauge, and the weight savings would be about 16 pounds! Our average homebuilt uses much less than 1,000 feet of wire, and much of this wire is "signal" wire (like encoder to transponder) and the same size irrespective of the system voltage.

On the other hand, the alternator would be lighter for the same power in a 28-volt system, but manufacturers seem to make the 28-volt alternators on the same frame as those for 14 volts, and with the same amperage, which means that you get twice the power (whether you need it or not) for about the same weight.

One other consideration for our 14 versus 28 discussion that favors 28 volts is that some newer avionics are designed to run on anything from 10 to 30 volts. If you have a 28-volt system and have an alternator failure, it will take longer to drain the battery down to 10 volts than if you started at 14, so the 28-volt system should give you a larger margin of safety in case of an electrical power generation emergency.

Let's also consider battery costs before we leave this discussion. For a 14-volt system battery on a smaller-engine aircraft, say below 150 hp, the Gill G-25 or its equivalent from Concorde, the CB-25, can be purchased for about $150 to $200. For larger engines, the G-35 or CB-35 is standard for an additional $40 to $50. On the other hand, for a 28-volt system you will either have to use two of these batteries in series (twice the weight and twice the cost) or buy a battery made for a 28-volt system. The cheapest one listed in Aircraft Spruce costs more than $430 and is roughly equivalent to the G/CB-25. So, you can plan to spend up to twice as much for a 28-volt system battery, and it may weigh the same or twice as much as your 14-volt system battery.

One other consideration for our 14 versus 28 discussion that favors 28 volts is that some newer avionics are designed to run on anything from 10 to 30 volts.

Let's pause here and look at system voltages. A 14-volt system actually is nominally designed to operate at 13.75 volts of direct current. This should be the output of the alternator when the engine is operating at a high enough rpm for the alternator to carry the full electrical load. The battery for this system is nominally rated at 12 volts. The higher voltage of the alternator allows it to recharge the battery. So, if you look at the buss voltage in your plane and it reads 12, the battery is carrying the load. And if it reads higher than that, the alternator is online and carrying the load. For a 28-volt system, the same idea applies, but the fully charged battery puts out 24 volts, and the alternator produces 27.5 volts to recharge it.

Another thought is jump-starting and troubleshooting. I know you are not supposed to jump-start an airplane, but if you ever had to, it would be easier with a 14-volt battery system and your car than if you have a 28-volt aircraft system.

Which voltage system should you use? You have to decide. But that decision drives everything else in the electrical system. Only you can provide the answer, but remember, most homebuilts have 12- or 14-volt systems.

Hope all this discussion on voltage helps you with your project. EAA

Battery	Alternator	Called
12 volts	13.75 volts	14 volts
24 volts	27.5 volts	28 volts

Dick Koehler, EAA 161427, is a retired Navy carrier pilot, A&P/IA, Technical Counselor and Flight Advisor. He teaches the electricity course at SportAir Workshops and can be seen in many Hints for Homebuilders.

Kitfox Series 7

Experimental Aviation

Part 1: At the forefront of aviation safety

By Stephen L. Richey

A Call to Arms

Homebuilt aircraft, by virtue of their standing in the eyes of the FAA, are not constrained by many of the same requirements that commercially designed and constructed aircraft are required to abide by. Some in our homebuilt community see this as a blessing (from the government) to build without excessive interference from an onerous and restrictive agency. Others see it as freedom to go above the regulatory safety minimums that are often based off of outdated research and to truly live up to our moniker—experimental aviation—and make the entire realm of flight even safer for everyone involved.

There is often much debate over which is safer—a commercially built aircraft or a homebuilt aircraft? The problem with answering this question, which is one I get asked frequently as a safety researcher, is that it is

Photography by Bonnie Bartel

a lot like asking which team at the Super Bowl is more talented. In the case of an aircraft, it really depends on how you define safety and how the aircraft is designed, built, maintained, and operated. The safest aircraft is the hangar queen or museum showpiece that never leaves the ground.

However, we must not concern ourselves so much with safety that we become fearful of leaving the ground and thereby deprive ourselves of the beauty and wonder of flight. Agricultural aircraft spend much of their time low to the ground, often closer to obstructions such as trees, power lines, and antennae than many non-ag pilots would be comfortable with, but in terms of crash survivability they are at the forefront. The mentality that the agricultural aviation community embraced long ago is one of, "If you are going to expose yourself to the risk of a crash, why not give yourself the best possible chance of being able to walk away from it?" This is an approach that homebuilders can easily and should readily embrace. We are one of the only groups in aviation given the needed leeway to do so by the FAA.

The idea of openly and frankly discussing crash survivability among pilots is a somewhat controversial one. This is due in part to the desire not to worry our families and friends, and discourage public support for our chosen hobby and general aviation as a whole. My response to this is that the best way to counter the concern about the safety of flying is not to sweep any mention of it under the rug but to drag the specter of crashes out into the harsh light of inspection and crush it under our collective heels.

Other resistance to the idea of using our collective creative, engineering, and construction talents to make experimental aviation the safest form of aviation comes from within. Pilots as a group tend to self-select for people who are confident in themselves and their abilities. Homebuilders are probably even more apt to have these sorts of traits because it takes a fair amount of ego to build and then fly an aircraft. The same traits that lead one to want the freedom to build and fly can prove to be a double-edged sword. No one likes to admit his own fallibility, and when you bring up the subject of crashes, you often encounter the attitude—either directly stated or subtly implied—that "it won't happen to me." Graveyards are filled with aviators who thought that same thing. Human beings—no matter how well educated, or experienced—are fallible.

The best argument against the myth that most people involved in crashes die is to get more people involved in aviation and at the same time reduce the number of persons killed annually. These are not contrary motives but rather the only way we can remove the albatross that hangs around our necks with regard to the mistaken beliefs about aviation safety.

The first step to this is to banish the word "accident" from our lexicon. The loss of an aircraft or those persons on board it is not an "accident"; it's a crash. Accident implies that it is unavoidable or simply the bad luck of our number coming up. Crashes are avoidable; they are never the luck of the draw, and we must stop allowing ourselves to slide into thinking otherwise for it undermines the necessary collective will and drive to improve these statistics.

Second, let us get into the details of how people are hurt and killed in aircraft crashes. We must understand not only ourselves but also our enemy in order to have reasonable assuredness of success in battle. The biggest problems in aircraft crashes are head injuries, chest injuries, and the factors in the post-crash environment that kill those who would have otherwise survived. This latter group includes an aircraft that is on fire or sinking in water. We will get into this in greater detail in the second part of this series.

Many of those whom I talk with who think of safety as a secondary consideration or an afterthought also tend to be the most vocal opponents of greater federal regulatory oversight of general aviation and especially experimental aviation. They fear having their ability to build and fly taken away. When this comes up, I ask them what they are doing to help keep the FAA and National Transportation Safety Board (NTSB) off our backs. Support of advocacy groups such as the EAA and AOPA are great starts, but there is something more that every homebuilder and pilot can do.

If we make ourselves as safe as possible, then we have the best argument against further restrictions and can help to erode the misconceptions of general aviation as unsafe. Improving crash survivability through improved design is one step toward this goal. We are the only GA community able to effect this change and prove that this can work. The FAA has given us some rope to work within the current regulations. The choice of whether we use it to bind ourselves together as we climb higher on the mountain of aviation achievement or fashion it into a noose around the neck of our hobby is our own. EAA

Stephen Richey is an aviation safety researcher who has been involved with flying starting with his time as a "junior hangar bum" with a local EAA chapter as a child in Indiana in 1988. He has logged about 700 hours thus far including times in ultralights and as a student pilot in light singles. His current project is the design of a new composite homebuilt known as the Praetorian.

Richard DeHaven making videos from the cockpit of his Sting Sport LSA.

Light-Sport Aircraft Videos
FanWing

By Dan Grunloh

Icarus Envy – The Lure of Light Sport Flying is an excellent one-hour DVD by filmmaker Bob Leff that provides a tour of all the different kinds of flying on the light side of aviation. The film includes everything from foot-launched powered paragliders to the latest state-of-the-art, 120-mph light-sport aircraft (LSA). The video is fast-paced and fun, and includes plenty of in-the-air footage to give viewers a good feel for what it's like to fly in this category of aircraft.

The film begins with a history of ultralights, including footage of some of the earliest ultralights. Bob obtained old movie clips of ultralight flying from some of the 17 pilots he interviewed, which enabled him to mix those scenes into the story being told by the pilots. The film transitions smoothly from pilot interview to takeoff and landing shots to cockpit views in the air while flying. As one of the pilots says, "Once you leave the ground, it's like a different world."

The film moves from ultralights to light-sport flying with emphasis on experimental amateur-built aircraft including Challengers, an Avid Flyer, a Pietenpol and a Titan Tornado. We see aircraft flying on skis in winter and some captivating float flying sequences. The ending of the film is a montage of flying sequences set to the music of the "Hallelujah Chorus" that highlights the pure joy of light-sport flying. If you don't want to fly after viewing this, there is no hope for you.

Icarus Envy would be excellent for viewing by youth clubs or other organizations as part of a meeting program. The flying action is nearly nonstop, making it suitable for continuous viewing as part of a chapter display at local fly-ins. The cost of the DVD is $24 from www.VAPfilms.com. This is Bob's 11th film since he started in the business in 1996. He grew up on Long Island, New York, three miles off the end of Runway 31R at JFK Airport, infatuated with aviation and spending a lot of time listening on a makeshift aircraft radio to traffic control and watching the giant transports roar overhead.

There isn't much to find fault with in the choice of material, the video editing, and the use of sound and music. There is a six-minute supplemental feature that explains the different kinds of LSA, but no actual footage in the film is of the latest factory-built special light-sport aircraft (S-LSA). There are no sources or references for additional information, nor any mention of EAA and AirVenture, but it's still an excellent film.

Making and Editing Light-Sport Videos

Richard DeHaven, pilot of a Sting Sport LSA in Davis, California, has posted a series of videos on cameras, mounting methods, and editing tools for making your own videos while flying light-sport aircraft. All together, the three videos provide a concentrated cram course on how to make better flying videos. His first video on small video cameras provides a quick, fun tour of the available equipment and introduces solutions for the common problem of "Jell-O effects," also known as CMOS (complementary metal–oxide–semiconductor) rolling shutter effects. If you have watched many online flying videos, you have seen the all-too-common unpleasant wave effect caused largely by the design of the cameras. Richard reports it can be controlled through choice of camera, eliminating vibration, avoiding certain type of shots, and through postproduction software. He has tested five different cameras and has had that many mounted on his Sting Sport on a single flight. His favorite camera is the GoPro Hero 2.

In his second video on camera mounting methods, Richard advises discarding the original mounts that come with the cameras as most are not rigid enough for use in light aircraft. He shows how to fabricate your own better mounts using the RAM mount products. The final video covers editing and publishing your video, including choice of software, obtaining music, and the use of sound. See his YouTube channel for these videos and other examples of his work. GoPro has recently introduced a new revised model; the GoPro Hero 3 is said to be lighter,

The electric-powered Peebles FanWing UAV flying since 2008.

An artist's depiction of a proposed full-sized FanWing.

faster, and higher resolution, and it comes with a Wi-Fi remote control.

FanWing Coming to EAA AirVenture Oshkosh 2013

Pat Peebles is out to prove that everything in aviation hasn't been invented yet with his continuing 14-year development of the FanWing principle he invented. A series of models have been built and flown leading up to the announcement, reported in EAA's weekly *e-Hotline* newsletter, that he hopes to build a full-sized, man-carrying version to be displayed at EAA AirVenture Oshkosh 2013. A spinning, cylindrical turbine is embedded into the wing. It moves air along the top of the wing and directs it back and downward, creating both lift and forward thrust. Although it looks bizarre and has been called a flying lawn mower, it really does fly, at least in model form. The first public flight of the FanWing was in 2008 in the United Kingdom, where it demonstrated its potential as a UAV (unmanned air vehicle) to be used for surveillance. (Watch the video.) The FanWing UAV model flew again in 2010 at the Farnborough air show.

White index marks on radio controls let me confirm at a glance that my radio volume and squelch are set properly so I won't miss any radio calls.

The increased airflow over the top of the wing gives the FanWing a shorter takeoff and will give better lifting capability and longer endurance, according to the inventor. The craft can autorotate like a helicopter if there is an engine failure, and would have a 1-to-3 glide ratio. FanWing models have been tested in wind tunnels, and Peebles received United Kingdom government financial support for scale-model flight tests. The project team received a boost with the addition of former United Kingdom BAE Systems engineer George Seyfang whose analysis confirmed some of the potential of this unusual form of propulsion.

Early FanWings had a conventional tail mounted high to avoid the powerful downwash behind the wing. A new model with twin booms and twin tails (or outboard horizontal stabilizers) was first flown in 2010. Wind tunnel tests have convinced Peebles the performance advantages of his concept will increase as the aircraft is scaled up. The proposed full-sized design shown in the drawing would have a 32-foot rotor span but retain the outboard horizontal stabilizers, giving it a total width of 46 feet. His initial proposal had a Rotax 503 mounted on each wingtip (hence the wingtip bubble in the drawings), but his latest specifications indicate a center-mounted Rotax 912 engine and a 60-knot cruise.

The FanWing can be viewed as a kind of hybrid between fixed-wing and vertical-lift aircraft but with very simple controls. Because engine power provides both thrust and lift, reducing power suddenly will cause a rapid descent. Clearly the turbine blades are vulnerable to foreign objects (including birds) as are the blades of helicopters, jets, and even the blades of our airplane propellers. If a FanWing turbine stops or cannot autorotate, it may descend in a manner that would require an emergency parachute. Read more about the unlikely looking aircraft at www.FanWing.com and check the simulation tab for information about how to download and run an X-Plane flight simulator version of the design.

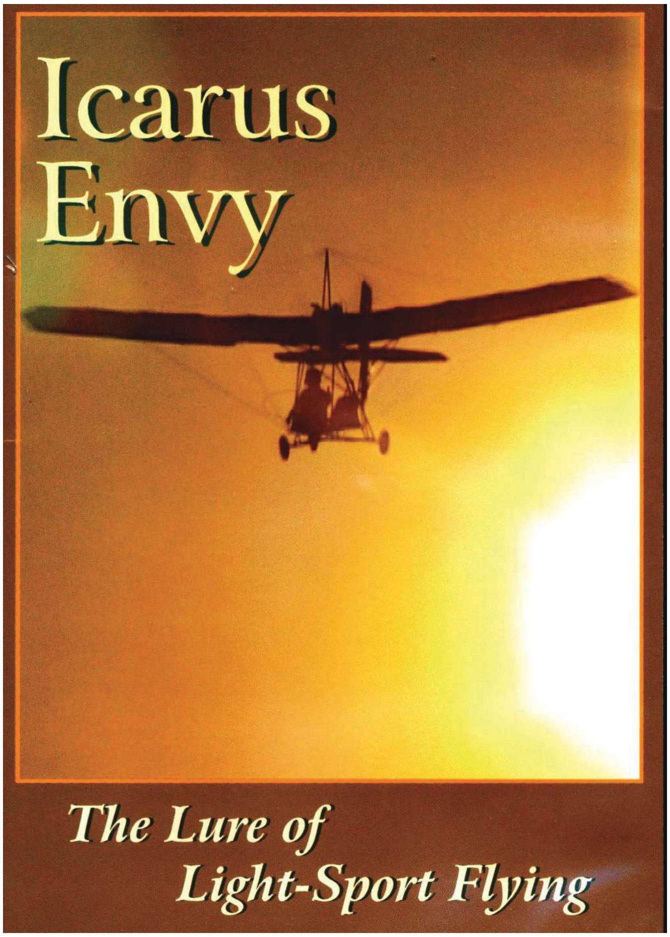
Pilot Tip – Failsafe Radio Controls

Here is a quick and easy aviation radio tip. I marked the volume and squelch control knobs of my cockpit-mounted handheld radio to indicate the perfect settings for normal cruise flight. A dab of white office correction fluid worked great for me. Now I can confirm with a quick glance that they are set properly and have not been bumped out of position. It may be less of a problem with a panel-mounted radio, but in an open cockpit like mine, the controls can be bumped while moving around or taking pictures. It could lead to missing important radio transmissions. The marks also help confirm I have turned the radio off at the end of the flight. I've been flying for several years with this setup and I love it.

This idea came to me during the practical exam for my sport pilot certificate. There I was in the front seat of a trike I had never flown before, shooting approaches and landings at a busy uncontrolled airport. The passenger and owner of the LSA trike, a designated pilot examiner, had set the radio and intercom controls before takeoff, and everything worked fine. I was doing a great job in the flight and was calling out traffic to the examiner as we went around the pattern for yet another landing. I wondered who taught these other pilots to fly, as most were not self-announcing in the pattern. When asked, the examiner advised that the squelch control on his radio was overly sensitive. He touched it lightly, and the world of aviation came back to my ears. EAA

» Please send your comments and suggestions for this column to dgrunloh@illicom.net.

Dan Grunloh, EAA 173888, is a retired scientist who began flying ultralights and light planes in 1982. He won the 2002 and 2004 U.S. National Microlight Championships in a trike and flew with the U.S. World Team in two FAI World Microlight Championships.



Box cover of new DVD features an ultralight, but the film covers much more.

Airspeed Calibration

Flying the ground course

By Ed Kolano

Last month we talked about selecting your ground course for your airspeed calibration test flying. The ideal location is flat, clear of obstacles, and has consistent topography with options for landing off airport if something should go wrong with your airplane during a run. Now it's time to describe the test methodology. If it starts to sound too complicated or challenging, just remember, all you're really doing is flying straight and level.

Do not make your first pass over the ground course during your airplane's first test flight. Preview the course the day before to become familiar with it. Survey the course from a safe altitude, say 1,500 feet AGL, making sure that you have plenty of turnaround room at both ends.

Look for your checkpoints, obstacles, and other disqualifying features like wires, farm animals, etc. Then make a run in both directions at a comfortable cruise airspeed at a lower altitude. Make a few more passes at progressively lower altitudes until you are satisfied the course is suitable and you are comfortable flying it at the low test altitude. You're not recording data here. The purpose of these runs is to become familiar with the course and comfortable flying it at low altitude.

Test Day

As part of your test planning, determine the correct MSL altitude that will put your plane at the desired safe AGL altitude, based on the course's known elevation and local altimeter setting. After you've established the desired test altitude, set your altimeter to 29.92 to read the pressure altitude you'll need to calculate density altitude after your test flight.

Photography by Jim Koepnick

The barometric pressure can change between your weather brief and arrival at the course, so keep your eyes on the terrain as you approach your test altitude. If it looks like you're too low, raise your test altitude to a more comfortable height.

Maintain your altitude throughout the test run. Because you were already established "on condition" before the run began, there should be no need to make power or trim adjustments.

Steady is essential. Have the airplane stabilized in the test configuration at the test airspeed in level flight at the test altitude on the correct heading with the power set before passing the start checkpoint.

Record your configuration, pressure altitude, observed airspeed, outside air temperature (OAT), and run direction before you pass the start checkpoint. Include altitude, airspeed, and OAT in your scan during the run, and update your recorded data if necessary after the test run. (Figure 1 shows a sample data card.) These parameters should not change, and recording them when established for the test run but before the start checkpoint frees you to concentrate on steady flying with a diligent outside scan.

This is a risky flight environment, so stack the safety deck in your favor. Rather than writing your data on a kneeboard, consider using a portable voice recorder (properly secured with wires safely routed) or transmitting your data to someone on the ground to record. If you've accomplished your FAA-required fly-off, a copilot can record the data you call out over the intercom. A second crewmember can provide another set of eyes for monitoring altitude, keeping an eye on the engine instruments, and watching for birds. Now that I've suggested an onboard human data recorder, let me discourage this idea. Test flights can be risky, and the minimum flight crew essential to the flight test or safety is prudent. Both of you must decide whether the benefits outweigh the risks.

Begin your timing as you pass the start checkpoint. Call "hack" into your recorder or transmitter or say it over the intercom for your copilot to operate the stopwatch. Your hands should remain on the stick and throttle.

Maintain your altitude throughout the test run. Because you were already established "on condition" before the run began, there should be no need to make power or trim adjustments. If the airspeed changes during the run, scratch that run and try it again. Use the horizon as a pitch attitude indicator to avoid chasing an artificial horizon, vertical speed indicator, or any other flight instrument. Keep your eyes outside the cockpit as much as possible.

Upon passing your end checkpoint, stop your timing. Make a qualitative assessment of the run you just performed. If the airspeed varied or you made aggressive control inputs or the heading wandered, consider not counting that run, and start again with the reciprocal heading.

Give yourself plenty of room to turn around for the reciprocal heading run. There's no need to remain at the low test altitude during this repositioning. Leave yourself enough room to get established on condition before beginning the second run. With enough turn-

Gear Position	Flap Position	Run Direction	OAT (°C)	Pressure Altitude (feet)	Planned Airspeed (knots)	Observed Airspeed (knots)	Elapsed Time (seconds)

Figure 1: Sample data test card.

around room, you should be able to accomplish the turn and setup without changing power or trim if you fly smoothly.

Repeat the process on the reciprocal heading. When you are satisfied with the quality of two reciprocal runs, set up for the next test airspeed and repeat the test run pairs until you've mapped the airspeed range.

By the Numbers

1. Stabilize the airplane in level flight at the test airspeed in the test configuration in level flight at the test altitude on the correct heading with the power set.
2. Set your altimeter to 29.92.
3. Record your configuration, pressure altitude, observed airspeed, and OAT. Note your power setting to help you quickly re-establish your airspeed for the reciprocal heading run in case you have to make a power adjustment during the turnaround.
4. Begin timing as you pass the start checkpoint.
5. Fly a constant heading, constant airspeed, and constant altitude test run. Note any non-steady parameters, including OAT and engine power settings.
6. Stop timing as you pass the end checkpoint.
7. Decide whether the quality of your run is satisfactory. If not, repeat the run. If it is satisfactory, turn around and perform Steps 1 (Step 2 is already done) through 6 flying the reciprocal heading.
8. Repeat Steps 1 through 7 for every test airspeed.
9. Reset your altimeter to the local setting before returning for landing.
10. Repeat the entire process for every configuration of interest.
11. Repeat the process at a different weight, spot-checking a few airspeeds for post-flight comparison.

Low, but Not Low Risk

Yes, I've harped on the risky nature of this test, and here's more. The airplane is perfectly capable of flying these test profiles. It doesn't care whether it's two wingspans above the ground or a few thousand feet. The risk is situational. Even a slight distraction can

Photography by Jim Koepnick

result in ground contact at these test altitudes. For example, an airplane flying 50 feet AGL at 150 knots will hit the ground in less than 6 seconds if the flight path is just 2 degrees below horizontal. Stay heads-up out there, and maintain a good external scan.

Some of your runs will be low, slow, and dirty. Should it lose power, your airplane won't have a lot of excess energy (speed) you can convert into altitude (and time aloft). Consider this when selecting your ground course.

Perfectly flat and clear is ideal, and you can't do any better than a long, off-duty runway. (Make sure you have the airport/control tower's permission and cooperation.) You should have plenty of clear surface both paved and unpaved. An additional advantage of an airport test site is that the airport survey map tells you exactly how long your run is. For a non-airport test site, check local government records to determine your exact test course length.

Regardless of your test site, you should have a plan if things go wrong. If the engine stops, you won't have time to contemplate your actions. Base your plan on the topography, your airplane's capabilities, and the nature of the emergency. For example, you'd probably handle an engine stoppage different from a bird strike to the wing. Mentally rehearse your actions for every conceivable emergency.

Low and slow is not the only flight configuration for concern. Low and fast means bad things happen faster. If your electric trim suddenly decides to run away nose-down, faster airspeed means less time for you to react. Start with a mid-envelope airspeed like your plane's typical cruise speed. Then fly progressively faster runs. Follow that with progressively slower runs starting from your first mid-envelope speed.

Finally, fly legally. FAR 91.119 gives the minimum safe altitudes above people and buildings (but you should not be testing above them, anyway). When flying over sparsely populated terrain, you must remain at least 500 feet from any person, vessel, vehicle, or structure. No matter where you fly, even over barren terrain, FAR 91.119 says that if the engine quits, the minimum safe altitude is one that allows an emergency landing without undue hazard to persons or property on the surface.

Give yourself plenty of room to turn around for the reciprocal heading run. There's no need to remain at the low test altitude during this repositioning.

Next month we'll cover the data reduction and convert all those test run timings into true airspeed and calibrated airspeed, and then we'll correlate them to the observed airspeed readings. EAA

» Questions about flight testing for Ed? Send an e-mail to *Experimenter@eaa.org* with the words Flight Testing in the subject line, and we'll forward your questions to him.

Ed Kolano, EAA 336809, is a former Marine who's been flying since 1975 and testing airplanes since 1985. He considers himself extremely fortunate to have performed flight tests in a variety of airplanes ranging from ultralights to 787s.

Flight Testing webinars

In September, Chad Jensen, EAA Homebuilders Community Manager, conducted the first of a series of webinars discussing flight testing of homebuilts. The first webinar focused on preparations for flight testing your homebuilt airplane and what to expect when planning your flights and flying your plan. You can view that webinar here.

On Thursday, December 13, at 7 p.m. (CST), Chad will present the second installment in the series and will explore best practices and decision making while flight testing homebuilt aircraft. Space is limited and registration is required; sign up now to participate at www.eaa.org/webinars.

About Your Homebuilt Aircraft Council

What we do

By Rick Weiss

Dateline Oshkosh, Wisconsin: It's Saturday, November 17; a brisk 32 degrees at 4:30 a.m.; foggy (RVR-500), there's ice on the car and I'm whining, as only a freezing guy from Florida can do. I think back to the old days when our fight attendants used to ask, "What's the difference between the jet engines and the pilot? Answer: When you park at the gate and the engines are shut down, they stop whining."

Okay, I get it, but darn it's cold. In my Kitfox, I can whine all day with no grief from anyone, and I don't need to get up at 4 a.m. to catch a flight home. I mention all of this only to let you know why EAA AirVenture Oshkosh is held in July.

Yes, another AirVenture is well behind us, but the work of your Homebuilt Aircraft Council (HAC) continues throughout the year, and this past week we were in Oshkosh. I'd like to talk about what the HAC does, but before I do that, it may be best to explain what the HAC is, as I'm guessing many of you probably have never heard of us.

Here's some background. In 1999, EAA President Tom Poberezny and Executive Vice President Bob Warner thought it would be a good idea if the aircraft builders in EAA could help the staff better understand the issues and priorities they face as they build and fly their aircraft, as well as letting the staff explain what they were doing to preserve and protect our freedoms to build and fly. A few EAA members were selected and they formed the first council. The group evolved over the years, and the chairman of the HAC was invited to serve on the EAA Board of Directors to represent the members at the highest level of the organization.

Fast-forward to 2009. The HAC placed a notice in *Sport Aviation* asking for members who were interested in volunteering to be on the council to self-nominate themselves.

Photography by Brady Lane

Having retired a couple of times from different aviation and space careers (and as a builder), I felt it was time for me to pay back to the aviation community for all the great fun I've had along the way. The interview process was quite interesting and comprehensive. Pretty much what you would expect if you were applying for a high-level position in a company. The requirements, among many other issues, were to be a builder and a pilot and to have knowledge of the FAA and its rulemaking process. Fred Keip and I were selected to the council after AirVenture 2009.

Shortly thereafter, I was selected to be the chairman after the outgoing chairman, my good friend Doug Kelly. In the fall of 2009 I became a member of the EAA Board of Directors. The only reason for telling you this is so you know that those of us on the HAC are builders, members like yourselves, and volunteers. We come directly from the EAA membership. The HAC provides advice and counsel to the staff on all subjects related to the activities of the homebuilt aircraft community.

In 2011 history repeated, and the HAC again placed a call in the pages of *Sport Aviation* for members to self-nominate for four open positions, and 78 members answered that call. The then-current HAC members—Joe Gauthier from Connecticut, an experienced builder and pilot of many experimental aircraft and an outstanding designated airworthiness representative (DAR), along with Fred Keip of Wisconsin, an experienced chapter leader, plans builder, and the HAC-designated "voice" of the Homebuilts in Review program—and I caucused for quite a few months until we narrowed the field to the six best candidates from the 78 excellent resumes we reviewed. We all agreed the talent pool within EAA is incredibly outstanding, and that made every decision much more difficult. We invited the "final six" to join us the Sunday before AirVenture 2012 for personal interviews. Everyone was exceptional. Joe, Fred, and I then selected the final four to form our chartered seven members of the HAC. In no particular order, they are: Dave Prizio from southern California; Keith Phillips from Port Orange, Florida; Gary Baker from Cleveland, Ohio; and Randy Hooper from Nashville, Tennessee. All of them are experienced builders with outstanding resumes and a passion to make EAA the best organization possible to serve and represent the members. To be clear, despite what you may have read on any forum discussions, EAA staff and management left the process and selection to the three of us on the HAC. EAA had no input into the selection procedures, thus making this process a truly member-centric function. Every one of us on the HAC is a volunteer and not beholden to anyone except you, the members. If you sat in on our meetings you would know this to be true.

This past AirVenture was one of the most "interesting" events ever. All of us on the HAC talked to hundreds of members, volunteers, and visitors to get their opinions about different things. We learned what was liked or disliked. If have read the threads on the Internet or heard

from others you know of the many issues that rose to the top this year. The annual membership meeting on AirVenture Saturday was the culminating highlight for many of us that week. It was there that volunteer after volunteer told us what they thought. At this point, we on the HAC (and the Board of Directors) can honestly say we listened to you, we heard you, and we have acted to correct many of the deficiencies that were discussed that morning. Clearly, there will be no chalets on the flightline at AirVenture 2013, but more importantly, we all need to reflect on what our founder, Paul Poberezny, has said over and over again. EAA and AirVenture are not about the airplanes; it's about the people. I believe that the HAC believes that and your Board of Directors believes that. I'm certain you will notice (or have noticed) a midcourse correction of the organization.

While I'm on the subject of AirVenture, let me address one or two other issues that were discussed on the Internet forums. Even with a staff of about 130 of the most dedicated and hardworking individuals ever assembled, AirVenture could not happen without the additional support and dedication of the nearly 5,000 volunteers who turn out every year to make it successful. The HAC, the board, and the staff all recognize and believe this. Thank you, volunteers!

There was a lot of discussion on those forums about how the board has no representation from the homebuilt community. In my honest opinion, this is an incorrect perception. Half of the people on the board are homebuilders, a few also own businesses that are directly related to supporting our passion, and all are aviators who have a passion for all facets of aviation. They care and it shows in their deliberations and discussions. Ours is an inclusive organization. All people, from every walk of life, every country in the world, are welcome to be members of EAA. Builders, restorers, aviators, interested hobbyists, government folks, and private sector people are all at AirVenture because they love aviation and everything about it. Folks can be hanging out at Aces Café or the Theater in the Woods, have a great conversation about aviation, and not know that one owns a G-V and the other a Baby Ace until hours have passed. What a great social equalizer!

Well, off the soapbox and onto some insight into what the HAC does. The week of November 12, we met for two full days to discuss many issues related to flying or building aircraft. The HAC believes our freedom to fly is always under the microscope, not because some think the FAA wants to regulate us out of existence, but it does have to meet its obligation to protect and serve the public. It's our job to educate and help the FAA as it strives to find that delicate balance that meets everyone's needs. Not by confrontation, but by being proactive and working with the FAA to improve our safety. To the FAA, it may seem like a numbers game—reduce accidents by 10 percent, do this or write that—but to the HAC, it's personal. Not a one of us wants to see our friends die in an airplane accident for

Photography by Michael S. Kelly

any reason. These are our friends flying in airplanes they built, and we want them to be safe. This year our number one priority is to address the recent NTSB E-AB Safety Study. We have done this by addressing the NTSB's recommendations to the EAA and FAA. I'll provide detailed information about this in future articles, but suffice to say we are working on improving the Flight Advisor and Technical Counselor programs as well as addressing and developing specific safety education programs. We don't believe any new rules or requirements will be as effective as creating better builder and pilot educational initiatives.

Certification issues always arise as FAA policy and individual FAA inspectors, DARs, and we aircraft builders interpret rules. Obviously, the FAA can't address every possible question in advance. Thus, we attempt to help the agency by continuing to work with them as partners; in attempting to clarify the right way to go about solving the problems. The HAC is constantly working to stay on top of this incredibly dynamic area.

Delta Dyke designer John Dyke describes his airplane during one of the Homebuilts in Review program during AirVenture.

Another of the HAC's more visible programs is AirVenture. The homebuilt aircraft area is just one of many thematic areas that requires constant attention and resources to improve the member experience. We work this through a process fondly referred to as the Planning and Zoning Committee. This is where the HAC must become more corporate in coming to solutions. I think most of us will agree that the new air-conditioned, clean, and modern restrooms have added much to enhance AirVenture. The food and beverage concessions are always being addressed to reflect what the visitors tell us they like to have. This is an ongoing challenge. More AirVenture changes unique to the homebuilt aircraft community are coming, and they will do much to enhance the experience of your visit to AirVenture, whether for a day or the entire week, and whether you camp under your wing or at Camp Scholler, or even stay off-site. We will address these changes in future articles. Change is in the air; and it's good!

We are working on new and exciting opportunities for members by enhancing our educational programs to address the first flight in your new aircraft, or if you are buying a pre-owned experimental aircraft, as a subsequent owner. We are working with Charlie Precourt, a former astronaut, homebuilder, test pilot, and EAA Board member, to help us develop the tools and resources needed to bring this opportunity to every builder. We intend to export this knowledge using every means possible and especially by using our chapter network led by EAA Vice President Jeff Skiles. We are hopeful we can reach everyone who intends to make that first flight or a pilot transitioning into an unfamiliar pre-owned aircraft. Our goal is to provide you with increased resources and the opportunity to acquire more knowledge so that your first and subsequent flights are a safe and enjoyable experience.

There are many more projects on the drawing board, and we will describe them to you throughout the coming year. I hope this brief overview has provided some insight into who and what the HAC is. In closing, we would also like to thank the EAA staff, particularly our Homebuilt Community Manager Chad Jensen, for all the hard work and time they put into supporting all of us.

Fly safely! EAA

Rick Weiss, EAA Lifetime 214428, is the chairman of the Homebuilt Aircraft Council and a member of the EAA Board of Directors. He built a Kitfox Model V and now is working on an RV-7A.

Photography by Mike Steineke


Electrical Wiring
Fabric Covering
Composite Construction
Fundamentals of Aircraft Construction
Gas Welding
Repairman (LSA) Inspection-Airplane
RV Assembly
Sheet Metal Basics
TIG Welding
What's Involved in Kit Building
Get hands-on.
EAA SportAir Workshops get you the skills you need from the experts you trust. For workshop dates, locations and costs, visit SportAir.org or call 1-800-967-5746.
Sign up now for the January 26-27, 2013 workshop in Oshkosh, WI and participate in a lunch conversation with EAA Chairman of the Board, Jack Pelton.
EAA SportAir Workshops
Copyright © 2012 EAA
EAA SportAir Workshops are supported by Aircraft Spruce & Specialty Company and Poly-Fiber Aircraft Coatings