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

Mike Finney's Cub
A Plans-Built Champion

» **Reno's Racers**
How do they go so fast?

» **Serial Homebuilder**
Keith Kreth's Three Rvs

How Many Staffers Does It Take?

Building EAA's CH 750

By Chad Jensen

In an effort to answer that question as it relates to building an airplane, I decided many months ago the EAA staff needed to build another airplane. Actually, that question never really came up, but I did wonder how many staffers I could get interested in building, especially those who have never done something like this before. Building an airplane at EAA by staff is not a new idea. It has been done in the past successfully, most recently two years ago with the completion of a Sonex, but that was a private staff endeavor with private owners at the end. This time around, we are building a Zenith CH 750 STOL airplane under experimental light-sport aircraft rules that will belong to EAA in the end.

So how many people signed up? Almost 40 EAA staffers have signed up to help; as of this writing, we are only a few weeks into the build, and more than half of them have already come by to cleco, drill, deburr, and rivet parts together. The kit industry is prospering, and the prepunched, match-drilled hole kits are on top of the heap. The Zenith 750 kit is touted as having a 400-hour build time. I know we won't get close to that number, but it is still going to be a very fast build compared to many others available today.

So when will it be done? That's the age-old question that everyone is asked when a project is getting started. On my own projects, I don't set hard goals. But because this is a group project, and with a strong effort to keep our staff interested, the goal is Memorial Day weekend 2013. That's ambitious for sure, but with the talent being developed early in the build, I am confident we'll succeed.

When the airplane is done, it will be added the EAA Employee Flying Club as a light-sport qualified trainer and all-around fun flying airplane for us all to enjoy. Check out www.Zenith750Project.com for all the details as they develop. I will be "blogging the build" using that website. See you there!

On the cover: Mike Finney peeks out from underneath the wing of his award-winning Clipped Wing Wag-Aero Cub. Photo by Russ Munson.

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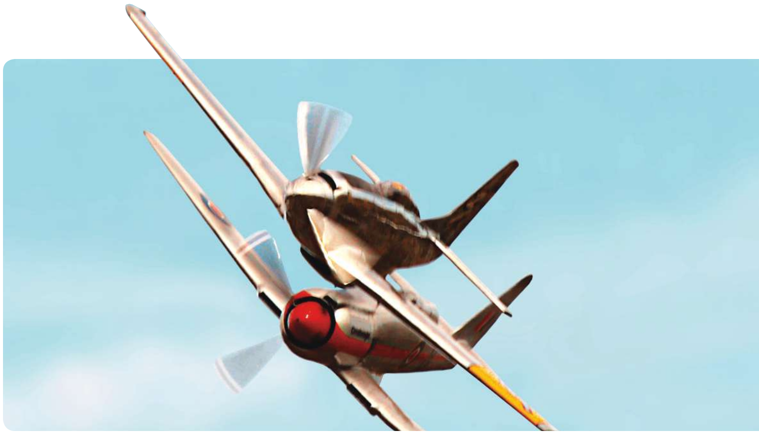

Departments

Columns

More Reader Reactions to the Digital *Experimenter*

I am not a technological kind of guy and refuse to have e-books of any kind. But I find this e-magazine is actually great. Easy to use.

William Jesse
EAA 363185

Now here is a magazine that I intend to go back and read most of every article. Even some that are not in my primary area of interest look interesting. Nice range of topics, good balance between just fun reads, and good-to-know homebuilding information.

Bob Marshall
Santa Maria, California

Just finished the "new" *Experimenter* and must congratulate all associated with this enterprise. It is GGGRRREEEAAATTT!!!!!!

Will be looking forward to subsequent editions/volumes.

Doug Brownlee
EAA 28103

Nice to have another magazine without the paper trail. I loved learning about the 1/3-scale B-17. Can't wait (but will wait) to see and hear it fly. Great on transition training. It's hard to come by for some aircraft, but [this article] represents a pressing need to improve our safety stats.

Joe Truncale
EAA 572767

I had to write to express my delight with the latest issue of *Experimenter*. I read the entire issue cover to cover, and you knocked it out of the park. I had suggestions to make for further issues, but on reflection the best suggestion I can make is to review some of the printed *Experimenter* issues up to the time of the name change to *Sport Pilot (& Light-Sport Aircraft)*, which I still covet. I would really like to read about the Bodacious ultralight. I saw a YouTube video about it which was interesting.
Thanks again for publishing a great issue!

John Jennings
Brookfield, Illinois

The latest issue of *Experimenter* is awesome! I take back my previous critique that it looked like *Kitplanes*. This issue looked unique and has its own flavor.

I love the fact that EAA has an online magazine dedicated to its core effort—custom-built aircraft.

Thanks for all the hard work you folks put into it. Fantastic!

Robbie Culver
EAA 539433

The new *Experimenter* magazine is the best thing EAA has done in a long time for the homebuilding community.

James List
EAA 16091

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Photo by Jeff Miller/EAA
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EAA
THE SPIRIT OF AVIATION

Don't Forget Your Transponder's ICAO Address

The FAA reports that a number of homebuilders are not correctly setting up their Mode S transponders during installation. If a transponder is not configured correctly during installation, it can cause confusion in the air traffic control system and may also confuse airborne traffic warning systems, with which all larger airplanes are equipped.

Mode S transponders—the S stands for "selectable"—broadcast two different identification codes. One code is the familiar four digits we set as assigned by controllers. But there is another permanent Mode S address that is assigned to your aircraft at registration. This is the 24-bit ICAO address that is an international identification for your specific airplane.

When an N-number is assigned, an algorithm generates an eight-digit (24-bit in computer speak) code that is part of your registration. You can find that code by looking at your N-number registration data. When a Mode S transponder is installed, specific programming steps must be followed to enter the ICAO code during setup. Not all builders are following the correct steps to enter the ICAO code when they install a transponder. The result is airplanes flying around and broadcasting incorrect addresses.

The ICAO address must also be programmed into any universal access transceiver (UAT) when that system is installed to participate in automatic dependent surveillance-broadcast (ADS-B).

The immediate problem for wrong ICAO addresses mostly involves airborne collision avoidance systems in larger airplanes. Traffic collision avoidance systems (TCAS) required in all larger airplanes use the ICAO address to keep track of nearby Mode S transponder-equipped airplanes. A wrong ICAO address could possibly threaten the proper functioning of the traffic warning system.

A more widespread problem with wrong addresses will develop as the FAA moves to its NextGen (next generation) air traffic control system that relies on ADS-B signals to locate and track aircraft. Mode S signals are a fundamental component of ADS-B, so the proper address is essential.

The solution is for builders to carefully read all setup instructions and follow them closely when they install a Mode S transponder or UAT system in their aircraft. Avionics shop technicians are well trained on this step, so the problem of incorrect ICAO addresses is almost entirely with homebuilts. It's also vital that an airplane owner or second owner change the Mode S ICAO address in his Mode S transponder if the aircraft N-number changes.

Photography courtesy Garmin

EAA Employee CH 750 Project Takes Off

On Saturday, September 29, EAA's employee CH 750 project got under way with the first building session at the Kermit Weeks Hangar in Oshkosh. Zenith's Sebastien Heintz and Roger Dubbert personally delivered the kit from company headquarters in Mexico, Missouri, and greeted more than a dozen EAA employees for a daylong builders' workshop.

Chad Jensen, EAA special interest community manager, reports that 36 employees are signed up to participate in the project. "Sebastien and Roger were absolutely thrilled with the progress we made on Saturday. We had three teams working on three rudder projects, and all three teams succeeded with a finished rudder!"

"This is a fantastic opportunity for EAA to show our love and appreciation for homebuilt airplanes." Jensen added.

The goal is to have a finished airplane by Memorial Day 2013. Progress will be reported through EAA.org, EAA's Facebook page (EAA – The Spirit of Aviation), and other communication channels.

Some of the 36 employees who've signed up to help build the CH 750.

Photography by Jason Toney

EAA Safety Efforts Noted in GAO's GA Report

The General Accounting Office (GAO) recognized EAA's safety programs as key contributors in improving GA safety, particularly for experimental amateur-built aircraft.

The GAO released its report "General Aviation Safety: Additional FAA Efforts Could Help Identify and Mitigate Safety Risks," which the agency compiled at the request of members of Congress. The study looked at all segments of the GA community and interviewed those in both government agencies and organizations within the GA community. The GAO interviewed EAA representatives twice during the study period.

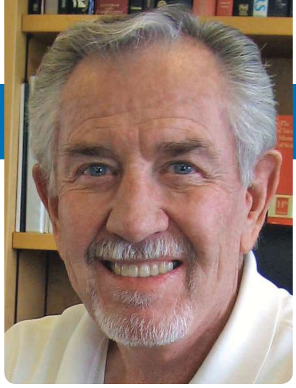
The report found that GA accidents have decreased over the past 20 years, but it also found major differences between the types of aircraft that make up the GA community. As EAA has maintained, the current method of accounting for safety based on flight hours skews the data in favor of those operations that fly straight and level for hours at a time with only one takeoff and landing. For example, corporate operations differ greatly from the multiple takeoffs and landings that may take place during an hour of recreational flying, therefore creating very different operational profiles and safety scenarios for the measurement of accidents when solely accounting for flight hours.

EAA was recognized by the GAO as one of the organizations that "actively promote the importance of safety and, in many cases, offer educational opportunities to pilots." The report also noted that "EAA offers advisory programs for experimental aircraft builders and pilots" as a way of promoting a safety culture and continuous education among its members.

"The GAO report states a number of areas that parallel EAA's recommendations for additional safety education, including improvement of GA flight-hour statistics gathering and use of the General Aviation Joint Steering Committee," said Sean Elliott, EAA's vice president of advocacy and safety. "The GAO recommendations regarding amateur-built aircraft mirror the recent NTSB report for that same category, which gives the community a real opportunity to emphasize that additional education, not regulations, will make the real difference in improving GA safety."

The report noted that the FAA has undertaken a five-year GA safety strategy, but developed that strategy without major input from GA stakeholders, such as those on the GA Joint Steering Committee (GA-JSC). The GA-JSC was re-formed in 2011 and has been studying accident factors with a view toward addressing some of those risks through additional safety education. EAA is an active member of that committee and its working group studying fatal accidents caused by loss of control.

The GAO also recommended several other actions to the FAA, including expanding data available on root causes of accidents, setting specific GA safety improvement goals through a data-driven risk management approach, and developing performance measures for the agency's safety programs and activities.



Frank Christensen to Speak at EAA Wright Brothers Memorial Banquet

EAA cordially invites aviators to Oshkosh on December 14 to welcome Frank Christensen, innovative pioneer in the homebuilt kit movement, as keynote speaker at the annual Wright Brothers Memorial Banquet.

In 1978, Christensen, EAA Lifetime 36663/IAC 90, unveiled his Christen Eagle II, the first complete kit aircraft that revolutionized the homebuilt movement. His approach made the hands-on challenge of building an airplane an easier, logical, and achievable project for the nonskilled builder. Regardless of experience or skill level, one could take on a Christen Eagle build project and be successful.

Christensen's prototype Christen Eagle II, which he donated to the EAA AirVenture Museum in 2011, is the centerpiece of a new exhibit under construction that will be dedicated during the reception at the banquet. Funded by EAA Lifetime members Lewis Shaw and John Dunham (who himself built a Christen Eagle), the new exhibit will allow museum visitors to understand, appreciate, and be inspired by the kit approach to building an aircraft.

Seating is limited, so reserve your spot by calling 800-236-1025, or via the link at www.SportAviation.com. Tickets are $55 each for EAA members or $65 for nonmembers and include the reception and exhibit dedication, full-service dinner, and evening program. We look forward to seeing you in Oshkosh!

New Data Credits EAA With Helping Increase E-AB Safety

AOPA's annual Nall Report on GA safety, released in early October, had encouraging news for the homebuilt community. The 52-page report contains comprehensive statistics on accidents in all facets of GA during calendar year 2010, the most recent year for which there is sufficient data.

EAA was credited for its role in increasing amateur-built aircraft safety with its many educational initiatives in recent years. The report found a 28-percent reduction in the experimental amateur-built (E-AB) fatal accident rate over 2009, and a 9-percent drop in the overall E-AB accident rate over that period. The raw number of E-AB and experimental light-sport aircraft (E-LSA) fatal accidents was down by one-third, making 2010 the safest year for the two categories since 2004 (also the year that the light-sport rule was introduced).

E-ABs and E-LSA continue to account for a disproportionate percentage of the noncommercial accidents versus the amount of hours flown by the segment, although this is in part due to the uneven distribution of aircraft uses across the GA fleet. For example, the vast majority of flight training—statistically among the safest of GA activities—occurs in type-certificated aircraft.

The per-hour accident rate is also a difficult statistic to compare across the GA spectrum. For example, an E-AB or E-LSA pilot flying for recreation might be expected to make more "short hops" than a pilot flying a type-certificated aircraft for personal transportation. An hour of "short hops" contains more time in higher-risk phases of flight such as takeoff, approach, and landing than an hour of cross-country flying.

According to the data, a higher proportion of accidents is caused by mechanical failure in the E-AB and E-LSA segments as compared to the overall GA fleet. As EAA has previously stated, a significant percentage of these E-AB accidents occur in the first several hours of flight testing.

"EAA continues to develop new and innovative safety programs to help amateur-built aircraft builders and aviators," said Tom Charpentier, EAA government advocacy specialist. "Aided by the expert guidance of the EAA Homebuilders Advisory Council, we have been continuously adding to and improving our existing safety curriculum including the Technical Counselor and Flight Advisor programs, webinars, SportAir Workshops, and AirVenture forums. Safety education is a key component of EAA, and we strive to improve both ground and flight safety of the experimental community." EAA

Van's Aircraft to Offer Factory-Built RV-12

Van's Aircraft Inc. announced at AOPA Aviation Summit 2012 that it will offer a ready-to-fly RV-12 light-sport aircraft, factory-built by Synergy Air, an RV builder training facility in Eugene, Oregon. Target introductory price for a standard-equipped airplane is $105,000, with an all-options-equipped Signature Edition at an introductory price of $115,000. Van's will begin taking orders at the end of November, with first deliveries expected in early 2013.

Standard versions will include a Rotax 912ULS engine, Dynon Skyview EFIS including Mode S transponder and GPS, Garmin SL-40 comm, Flightcom stereo intercom, 406-Mhz ELT, Flightline interior, and LED lighting for night flight. Optional equipment includes wheelpants, automatic dependent surveillance-broadcast, a two-axis autopilot, premium paint finishes, and Oregon Aero seats and interior.

The first planes produced by Synergy Air will be 12 Signature Editions, which Van's states will "define and codify the production process." The company is also establishing a network of maintenance and repair service centers.

» To learn more about the RV-12 or to place an order, visit www.VansAircraft.com.

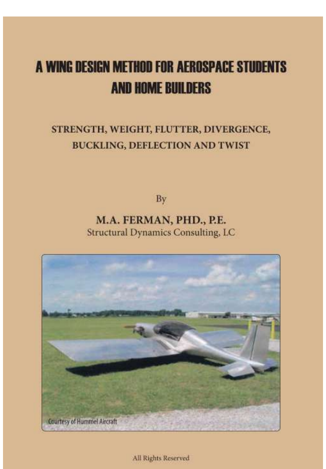
Photography courtesy Van's Aircraft

Zenith Available for Transition Training

EAA member Earl Downs of Cushing, Oklahoma, has obtained a Letter of Deviation Authority to provide transition training in his Zodiac 601 XLB. His approved courses cover transition training, first-flight preparation, and training for the Jabiru/GRT engine display system. "All you have to do is read accident reports to see that transition and first-flight preparation training is needed to improve the safety record of E-AB flying," Downs said. "I find it rewarding to promote safety in my own homebuilt airplane."

For more information, contact Downs at oklahomaaviator@earthlink.net.

Help for Homebuilders



Professional engineer Marty Ferman has developed a method for simplifying wing structural design and has chronicled the method in a book titled *A Wing Design Method for Aerospace Students and Home Builders*. Ferman came up with the method after working for 56 years in industry and academia.

The method employs a simple shell-like structure to allow calculation of the required skin thickness for strength. The weight is then calculated, as is deflection and twist under maximum maneuver loads. Then the flutter and divergence speeds can be calculated by simple formulas to ensure safe flight conditions. (Most preliminary design books do not offer this feature.) Design changes to add or reduce skin as necessary are next. The user can then go forward to more refined design stages sequentially, again calculating stiffness and weight and flutter for each. In the end, the builder will have a design to fabricate.

The book can be purchased on Amazon.com or from the publisher, Trafford Books, Bookstore.Trafford.com.

Improved Safety First Goal of Aircraft Kit Industry Association

By J. Mac McClellan

When airplane kit makers and the businesses that support kit building got together to form the Aircraft Kit Industry Association (AKIA) earlier this year, the objectives were, naturally enough, to promote the success of the kit industry. But from the beginning it was obvious that for kit building to prosper and grow, the safety record of experimental amateur-built (E-AB) aircraft flying has to improve.

"Safer products simply are more attractive and more popular," said Dick VanGrunsven, head of Van's Aircraft and the first president of AKIA. "For us to promote growth in our industry, safety quickly became the foremost issue. We must improve safety while preserving the freedom to experiment and innovate."

The member companies of AKIA—now 17 and growing in number—realized that E-AB aircraft were coming under increased scrutiny by regulators and NTSB safety investigators. Among the E-AB safety improvement recommendations made by the NTSB in a recent report was creation of an organization to help educate E-AB pilots and owners on safety issues and operational risks. AKIA was formed and is doing what the NTSB recommends.

Among the member companies of AKIA are the major kit makers and also companies that supply components such as materials and tools, and engines and avionics. Van—as he is known to many—said even one insurance underwriter that covers a number of E-AB aircraft has joined the group.

The first AKIA target for safety improvement is pilot training. AKIA recognizes that most kit airplanes have significant differences in flying qualities and performance from standard category airplanes, and specific flight training is needed for pilots to safely operate an E-AB airplane.

The accident record shows that pilots transitioning into an E-AB, or those moving into a different type of E-AB they are unfamiliar with, are at higher risk, and AKIA plans to emphasize the need for specialized training. An early goal is to work with the FAA to ease restrictions that have been imposed on flight training for hire in E-AB aircraft. Another goal is to work to change regulations so that instructors can fly with builders during the early Phase 1 flight testing of an E-AB aircraft.

"We need to grow the size of the group of CFIs who are qualified to train people in E-AB airplanes," Van said. "The rules allow any CFI with any level of experience to instruct in a kit airplane, but we know that type-specific experience is crucial." What incentives and programs AKIA can offer to help create a larger pool of experienced E-AB instructors is still a work in progress.

AKIA also plans to take a hard look at a typical kit airplane in search for ways to enhance safety. "For example, very few kit airplanes have stall warning systems," Van said. "There have been developments in stall warning technology and angle of attack sensing that make sense for kit airplanes, and we need to have those systems installed. Stall-spin accidents are a major cause of kit airplane crashes, and stall warning systems can help."

AKIA has also begun to look closely at engine and fuel system installation procedures because it acknowledges that kit airplanes suffer power loss at a greater rate than standard production airplanes. The difference in power loss rates doesn't appear to be caused by the engines because many are standard production engines. So AKIA is beginning the search for an explanation and resolution for the problem.

Van said AKIA is also working with EAA and others to promote the establishment and growth of aircraft type clubs. A type club can provide very specific information about how to safely fly an airplane and how to maintain and improve it. Promotion of type clubs is another one of the NTSB's safety recommendations.

The bottom line for Van is that AKIA and everyone involved in E-AB need to educate builders and pilots about the risks involved—and provide solutions. "An important issue is what I call peer influence instead of peer pressure," Van said. "Many kit airplanes are sporty and have good performance and maneuverability, and they can tempt pilots to take unreasonable chances. I think peer influence can go a long way toward helping pilots understand that it's not okay or admirable to take risks. If we don't improve our safety record, the FAA knows how to improve it with regulations that none of us want." EAA

Mike Finney's **Clipped Wing Cub**

Building a Cub to your style

By Budd Davisson

Piper Cub. For generations those two words have conjured up visions of warm summer sunsets, magic vistas seen through an open door, and a yellow, fabric-covered flying machine begrudgingly giving up flight as it whispered through tall grass or skimmed across a calm lake.

Those same two words issue a challenge to anyone who is contemplating building a Cub of any kind: "What can you possibly do to a J-3 Cub that hasn't been done before that won't ruin the spirit of the airplane?" Putting a turbine in it is passé, has been done, and takes away the essence that is "Cub." Going to symmetrical wings and a fire-breathing big engine gives performance, but again, the "Cub" is gone. How about a terrazzo and linoleum interior? Nope, goes against the simplicity upon which the Cub is based. So, what can you do to a Cub that will make it "yours" but still have it be very much a Cub? A parallel question is, "How can you take what is almost sacred in its perfection and make it even more perfect?"

Photography by Russ Munson

The answer to those questions is easy: Talk to Mike Finney (EAA 132617) of Albany, Indiana, and do what he has done to produce a J-3 that won Reserve Grand Champion Plans Built at EAA AirVenture Oshkosh 2012.

Mike is not a newcomer to either sport aviation or building/rebuilding airplanes. The fact that he and his wife, Sherry, were married in a Baron in solid IFR conditions while it was being flown by his father shows how deep his aviation roots run. And his Cub roots run at least that deep: He was barely out of high school when he bought his first airplane—a 1939 J-3 Cub.

"I flew that old airplane a lot," Mike said. "It was a good airplane, but it was a typical Cub for the time. A little ratty around the edges but pure J-3, and I loved it. However, even at that age, I kept thinking how cool it would be to have a Cub that was perfect in every way. At the time, I thought 'perfect' meant smooth and shiny. Now, however, having built an airplane or two and having flown many kinds of airplanes, my definition of 'perfect' has changed a little."

Mike's life experiences have given him a better appreciation of what makes one airplane better than the next and have given him the realization—and this is dangerous to say out loud—that a J-3 Cub is not absolutely perfect. Shocking, isn't it? But you only have to look at some of the details Mike worked into his scratchbuilt (yes, scratchbuilt) J-3 Cub to know that even the "Lock Haven Legend" has room for improvement.

Mike and Sherry Finney enjoy their Reserve Grand Champion Plans Built award at AirVenture 2012.

"I'm not sure exactly when I decided to build my own Cub," Mike said. "However, since I bought a set of Wag-Aero plans in 1975, I've obviously been thinking about it a long time but didn't actually start until 2000.

The modification involves removing 40-½ inches from the inboard end of each wing, two rib bays each side.

"Before that, I had scratchbuilt an Acro Sport II, which taught me a lot of stuff having to do with building rag and tube airplanes. I got really good at making jigs and welding. And being a biplane, an Acro Sport has a lot of ribs, so I got good at building those, too. [What Mike doesn't often mention is that Acro Sport took home the Plans Built Champion Bronze at AirVenture '94.]

"Another thing the Acro Sport taught me was that I really liked being able to do light aerobatics. So, long before I started cutting metal for the Cub, I had already decided it was going to be a clipped-wing Cub, which I like better anyway regardless of the aerobatics, because they're a little faster and their higher wing loading makes them less like a whiffle ball on final."

We don't know when the Reed Clipped Wing Cub STC was developed, but clipped Cubs have been on the air show circuit since the 1950s, and Cub pilots have been enjoying the added utility it gives them ever since. The modification involves removing 40-½ inches from the inboard end of each wing, two rib bays each side. This moves the ailerons to within one rib bay of the fuselage, which is the easiest way to identify whether a Cub has been clipped or not: The proportions appear so perfect that sometimes it's hard to tell.

Making Improvements

Since Mike was scratchbuilding the airplane, he could change anything he wanted without worrying about the 337/STC hassle of changing something on a certificated J-3. And although the airplane was going to be a J-3 in fact and spirit, it would include a lot of improvements that, in Mike's mind, improve on its utility by improving those items that have irritated generations of Cub pilots.

“Building the fuselage was fairly straightforward,” he said, “although in some areas you have to build a three-dimensional jig and suspend things like the main spar attach points in space. I used a lot of plywood building jigs, and when finished, bolted an 8-foot piece of 2-inch angle iron to the firewall station running spanwise. Measurements from the end of the angle iron to the tail post became my guides. I checked those dimensions every time. I did my best to keep the tail post perfectly centered.”

As Mike proceeded with the fuselage and started fitting the myriads of tabs, bushings, and fittings, he began making his personal mark on the airplane, working from the front to the back.

He said, “You really can’t change much on the front of a J-3 without screwing up those classic looks, so I changed almost nothing about the design of the cowl and used Univair Cub nose bowl pieces. I also used their boot cowl, although I did some whittling on it to make it fit a little tighter and flow better into the cowling sheet metal.

“When I got into the cockpit, I really started changing stuff. But you’d have to know Cubs to know what I changed because some of the changes are fairly subtle. They all, however, address some of the minor things about Cubs that are universally disliked, the brakes being the first thing.”

For those who have never suffered them, the brake pedals on a Cub are difficult-to-use heel brakes with the rear pedals sticking horizontally out from under the front seat and integral to big metal master cylinders. Although you need brakes very seldom on a Cub, it would be nice if they were more accessible, less expensive to maintain, and more effective without being too effective. It’s easy to put too much brake on a Cub, which leads to Cubs on their backs on the runway. Mike solved all of those problems.

“I designed and built a brake system that is as much Acro Sport/Pitts as anything else. The pedals are tubing structures with toe brakes that activate Grove cylinders that pivot with the pedals. It’s a very common and user-friendly way of doing things. Easier to maintain than the originals too.

“I was determined to hang on to as much of the Cub look as possible, so I used the fat, old 8.00-by-4 tires and wheels but stayed away from Cleveland disc brakes. Those stick out like a sore thumb. Instead, I replaced the old expander tube brakes with the Grove conversion

Nothing fancy here, but practical and neat.

Simple, neat, clean ... the qualities that AirVenture judges appreciated.

that looks so close to original that you really have to look to know the change was made.

“Then, when I was building the window frames, I got rid of the sliding left window entirely and replaced it with a swing-up version that’s almost identical to the top half of the door on the other side. The sliding windows are next-to-impossible to keep from rubbing against the framing, so they always have scrub marks in the Plexiglas. And they’re hard to operate. The swing-out arrangement is cleaner all the way around, and it clips open to the bottom of the wing using a really nice latch I found at a camper store. When you have both the window and the door opened, it’s like flying an open-cockpit airplane!

“I built a new front seat that’s square, sort of like a Super Cub, so it’s a lot more comfortable. However, getting in the front seat of a Cub requires a peculiar little

Photography by Jim Raeder

dance, and the square seat, although being easier to build, makes that dance just a bit more difficult."

The Cub has always been about simplicity and utility, but a few of its features, like the baggage area behind the rear seat, for instance, border on being downright crude. The baggage bin in Mike's airplane, however, is anything but crude. The old lawnmower bag has been replaced with a nicely done aluminum box structure that maximizes the room but protects the fuselage side fabric at the same time.

If you decide to try Mike's Cub on for size and climb on board, as you're settling into the European leather back seat, you'll have to move the control stick to get clearance for your leg. That's part of the getting-in dance. And the second you touch the stick, you realize that Mike made another major change: He removed about 90 percent of the friction in the control system, and the control stick moves as if it's stuck in butter. Or in a Pitts. It's amazing! The old sawing-wood feel of a Cub is completely gone!

"That was easier to do than it sounds," he said. "I just lined all the fair leads up as perfectly as possible and replaced all the pulleys in the control system with ball bearing units normally found in Luscombes. I knew that would clean up the system, but I was really pleased when I felt the final result. It makes for a nice-feeling airplane."

One of Mike's cleverest mods, and one seldom, if ever, seen is also the most subtle and difficult to spot. Stock-clipped Cubs must suffer the indignity of having a notch cut in the top of their bottom door about 3 inches wide and an inch or so deep. This in turn requires a matching cover plate be attached to the top half of the door to cover the hole when closed. The notch is necessary for the bottom door to clear the struts that are at a steeper angle when the wings are clipped. Mike's airplane doesn't have that notch, but almost no one is going to notice it's missing. However, Mike will.

Next to naming babies and picking spouses, deciding on a paint scheme can be the most difficult decision in most homebuilders' lives. Not so Mike and his Cub.

"That's another beautiful thing about building your own fuselage," he said. "I just raised the lower doorsill a little, which allows the door to go all the way down and clear the struts without the notch. Again, a simple thing that can only be done to an experimental airplane."

The Wag-Aero wing plans are very Cub-like but depart in the construction of the ribs: Rather than being truss ribs made out of a funky aluminum T-shaped

The seats in Mike's Cub are more square, like a Super Cub, than a typical Cub. That doesn't make it any easier to get in and out of, but they are comfortable.

material, they are traditional spruce trusses.

"I'd had a lot of practice building those kinds of ribs for the Acro Sport, so they went pretty fast," said Mike. "However, I basically doubled up on the ribs the way a lot of aerobatic guys do in their clipped Cubs. Everywhere there was a nose rib, I gave that station a full-length rib. It strengthens the fabric during aerobatics and lessens the possibility of broken ribs. At the same time, I went to a heavier leading edge that won't dent as easy as Cubs usually do. It was a bear to bend, but well worth the effort."


That's a Cub nose.

Adding the Wings

As accurately as Mike built his fuselage, when hanging wings, there's always an opportunity to introduce mistakes or corrections, but Mike has a method that produces precision wing alignment every time.

"I drill and mount the front fitting," he explained, "then I move the wingtips and get the tip-to-tail measurement as close as possible, then drill the rear fitting. I got this one within 1/32 of an inch total. It always lets me match the angle of incidence left-to-right exactly so the airplane is really square and you can really tell it, when flying it."

Next to naming babies and picking spouses, deciding on a paint scheme can be the most difficult decision in most homebuilders' lives. Not so Mike and his Cub. "This airplane has been rattling around my brain for most of my life," he said, "and not for a second was the image of it anything but yellow. How could it be anything else? I used AirTech Coatings throughout over Ceconite, which meant it had to go on slick because I couldn't sand and buff it. At first I had problems with orange peel, but I figured it out in the end."

The pointy end of the airplane no longer has A-65 cylinders peeking out. As befitting its aerobatic status, Mike's Cub is powered by a C-90-8F, which is the lightest engine in its class. And since Mike built it himself, it's also one of the least expensive. "I put a 72-by-46 wooden Sensenich on it because it's so pretty," said Mike. "But after this trip to Oshkosh, I won't go on long trips with the airplane. A metal prop is measurably faster."

How Much?

It's common to ask how much a builder has invested in his airplane, but it's seldom we get an answer like Mike's. "From beginning to end, which was 10 years of off/on building, it cost just a hair over $19,000," he said. "We don't think that's bad at all."

Neither do we!

It's also common to ask a builder what his plans are for his airplane, and Mike's answer is classic. He said, "My plans are to fly the wings off this airplane and grow old with it. This is a keeper, and I expect the next two or three generations of Finneys will enjoy it as much as Sherry and I do."

What a grand thing to leave as a legacy.

Here's a video of Mike Finney discussing his award-winning Cub, and a photo gallery showing construction details. EAA

Budd Davisson is an aeronautical engineer, has flown more than 300 different aircraft types, and 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 at *www.Airbum.com*.

Reno’s **Racers**

Like the rest of us, only faster

By Tim Kern

Speed is really a matter of degree. Several degrees.

Every year, normal-looking pilots get into generally normal-looking airplanes and go abnormally fast. It’s not that the pilots are just so good or that the airplanes are just so good; it’s both.

Pilots at the Reno National Championship Air Races come from the ranks of the military, the airlines, the air show circuit, ag flying, corporate flying…and neurosurgery, general practice, and veterinary medicine; law and law enforcement, oil fields, engineering, car dealerships, and banking and financial institutions. What makes them so good is their dedication and focus, on top of their talent. Can anybody fly at Reno? Well, to the extent that anybody can drive in the Indianapolis 500, yes; all it takes is talent, dedication, practice, knowledge…plus money and maybe a little luck. The knowledge and money can come from other people; the rest is the result of talent and dedication.

Ultimately, it's about the racing! *Here, Unlimiteds* Precious Metal *(Mustang) and* Dreadnought *(Sea Fury) show why formation experience counts—60 feet off the ground, at 450 mph!*

Photography by Tim Kern

The airplanes, however, are a different story. Ranging in speeds from under 200 mph to more than 500 mph, from dead-stock Pitts biplanes to purpose-built, one-off racers, from RVs to P-51s, each airplane flying in the races is as fast as it can be. What adjustments are made to some of these airplanes for that week is the subject of this feature.

Even the "stock" T-6 Class, which includes the Harvard, SN-J, and AT-6 variants, has entrants that are running at 240 mph-plus. In 2012, Nick Macy in *Six-Cat* flew at more than 246 mph, beating the old record by a mile and a half and posting his sixth T-6 Class win. As further evidence of progress, the slowest T-6 this year was faster than the first Gold Race winner in 1968!

Race airplanes get faster as time goes on; that's a given. Still, these are "stock" Texans; and your typical T-6 cruises about 140 knots. How are these racers so much faster, even around a pretty tight course?

If a T-6 Race Plane Is "Stock," How Does It Go So Fast?

Although many of the nonstock modifications are pretty obvious and allowed (no T-6 ever left the North American factory with a wraparound windscreen, I'm pretty sure), other items are not so obvious: The tightness of seams, the smoothness of fillets, and the tightness of control-surface gaps all bring possibilities for speed to the venerable machines.

Technical inspections are tight—incidence of the wings and horizontal stabilizer, wing sweep, dihedral, and washout are all checked.

And there's always power to consider. The "stock" Pratt & Whitney 1,340-inch radials can be assumed to be in top shape, maintaining as much compression as they can, using their stock-ratio superchargers. Power-robbing accessories are turned off or removed.

John Lohmar, who finished third in the Gold Race in 2010 and again in 2012, noted that the biggest single performance improvement modification is the use of a "race" prop. Ordinarily, a longer prop (within the rules) is the knee-jerk choice of nonracers, but as Lohmar noted, "We use the smaller props because the limiting factor is the speed of the prop tips. We can turn a smaller prop faster, using more horsepower, which we'll have because we're turning the supercharger [and engine] faster." Larger props that would absorb all the power *available* at lower rpm would not be using all the *possible* horsepower; in this case, that would be a bad tradeoff.

Lohmar noted, "We're allowed to remove all instrumentation 'not required for flight.' Some of these airplanes were used as instrument trainers and had full IFR panels; you can imagine how much all those old instruments and gyros and wires and stuff must have weighed! You can pull all that out. I have a 10-inch Dynon panel that weighs about 4 pounds that tells me everything I need for my primary

Walt Orth's modernized but authentic LTA at Wings Over Miami Museum has a lot of original and heavy instruments…that's the stuff racers get rid of.

Lohmar's canopy is more than it seems. It's been optimized to be as light and aerodynamically clean as possible.

flying. You need five instruments in the rear cockpit—*any five*—and they have to work. We've moved the battery (and thus CG) aft. We also add lead to the rear to bring the center of gravity all the way to the legal limit. The rear seat and stick come out and stay on the ground for the race."

The original T-6 empty weight of about 4,200 pounds is reduced as much as practical, through removing (or sometimes substituting or downsizing) components. Removal of power-sapping accoutrements (such as venturis, antennae, and even wind-powered generators) helps weight reduction, too (although some of the race modifications, such as fire-suppression systems, the pilots' parachutes, and ballast, for example, add weight). 1997 and 2005 champion Mary Dilda, a very slim blonde, said that her crew wanted *her* to lose a hundred pounds.

Lohmar said, "In the Unlimiteds, they have two main rules: a piston engine and a minimum weight of 4,500 pounds. In our class, we have to stay true to the original certificate's specs and use the R-1340 with a 10-to-1 blower (the 12-to-1 'helicopter' blower is now illegal). During tech inspection, all the front spark plugs come out to be sure nobody's running domed pistons; the flat-tops pistons are assured. No nitrous, no enhancers [no oxygenates]. We all use 100LL, and the tech inspectors check fuel randomly, right before the race.

"In the Gold [Race], the big advances come from aerodynamic cleanup. Make all the seams fit; make all the panels lay real nice and flat. This plane's 1,000 little panels, so we use flush rivets where they're allowed (and we'll even put a coat of Bondo on to make them nice and slick). Make it cleaner, with straighter rigging, better sealing. We use a polymer outer coat to reduce drag, and then we go over the whole plane just before the race with a 'California duster' and get the last bit of dust off."
The canopy looks primitive; that's just how it *looks*. The original was made of metal framework and a number of mostly flat glass panels. Now, "We routed the edges of the Plexiglas panels on the canopy to be flush; on ours, as on most of the racers, the main canopy is actually all one piece." The metal "cage" fits into grooves in the one-piece clear plastic, presenting a flush outer surface to the wind.

"We make sure the gear doors are tight and flush, and we'll reroute the fuel tank vents and change the drains," which hang down when they're stock.

In sum, Lohmar said, "It's commonly thought that somehow we've made huge modifications, but the rules say they need to conform to the original certificates; and they check. Long ago, there were a lot more modifications allowed—*Miss TNT* was a great example."

Miss TNT was fast (a seven-time Gold champion), but its extensive modifications would not be allowed today, and those mods likely figured into its retirement.

Photography by Tim Kern

Tom Aberle's Phantom *is not your father's Pitts. It goes 260 mph-plus. It was featured in* Experimenter *in 2009.*

When it's time to go to work, Lohmar is like the rest of us: "I get a lot of my stuff from Wicks—hardware and tools, especially. T-6 parts come from specialty houses, of course."

When the Rules Don't Dictate 'Stock'

Nearly all the aircraft in the Biplane Class claim their lineage from Curtiss Pitts; the notable exception is *Phantom*, a product of Tom Aberle's mind and airplane shop. *Phantom*, a rules-optimizing and meticulously prepared racer, is roughly 50 mph faster than the rest of the field; Aberle regularly laps everybody! In 2012, when a heat race snafu forced Aberle to start from the back of the pack in the standing start, he was in third place by the time the field was halfway through the first lap; he was leading by the end of Lap 2, and he fell short of lapping second place by only about 200 yards

Casey Erickson's Pitts is typical of the Biplane Class entries.

Endeavor has been winning Formula One lately.

at the finish, in his (and *Phantom*'s) eighth Gold Biplane win.

What do the other guys (and ladies) do? "We clean up the airframe as much as possible," said Casey Erickson, who won her first Silver Heat Race and eventually placed second in Silver. "We make everything as smooth as possible. We cover the gaps; we make everything fit as tight as we can."

Horsepower in the Biplane Class is largely limited by the class's engine rules and fixed-pitch props, and the Pitts airframe isn't designed for slickness; greater gains are realized through aero sanitizing than from modifications made firewall-forward.

In the International Formula One Class, though, where the old-design O-200 (no hollow cranks allowed!) is the powerplant, the airframe isn't limited to any one design. The minimum wing area of 66 square feet is not limited to any particular design; we've seen long wings, the Cassutt slab wings, and this year a new gull-wing design. Pushers dominated the class in the 1990s; two airplanes, one a traditional design, the other a slick composite bird, have dominated in this century. In this class, with fixed gear and props, slickness and flying style mean everything. Plus a few tricks.

When You Just *Need* to Have a New Airplane

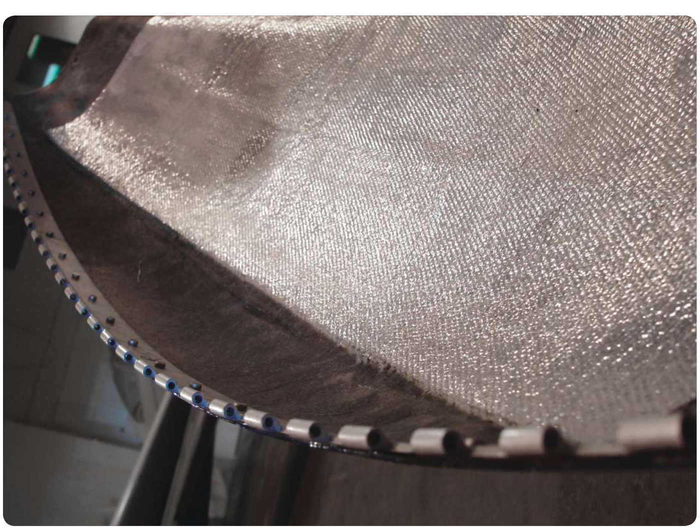
September Fate, a gorgeous gull-wing, one-off Formula One, made its appearance at Reno 2012, with veteran Brian Reberry inside. Built to Reberry's own dimensions (and he lost 30 pounds to make those dimensions as small as possible), it would be hard to fit someone much taller than 5 feet 8 inches into the cockpit. The diminutive fuselage cross section takes advantage of a small frontal area (pretty much defined by the O-200 engine) and modern aerodynamics, in turn possible because of modern composite engineering.

Built in Mark and Frank Miller's shop at Warped Designs, and with the help of the late Gary Hubler's family and crewman John Chambers, *September Fate* has a long, tapered wing.

"There's a lot of glider in there," said Reberry. "It doesn't have the roll rate of a slab-wing Cassutt. But it's

Mariah *and pilot Gary Hubler (shown in 2005). Hubler and* Mariah *recently dominated Formula One, winning consecutive races, 2002 to 2006, before Hubler was killed in a heat race midair collision in 2007 that also destroyed* Mariah.

September Fate*'s low gull wing drew crowds all week.*



Although September Fate*'s cowl joint looks like a smooth sweep, inserting the pins is a practiced art.*

plenty responsive for pylon racing, and it doesn't wear you out like a twitchier airplane. And it doesn't bleed speed in turns." With two wing tanks plus a header tank, *September Fate* could be used for longer runs than Reno's spring practice races, "but we haven't done any flying that wasn't testing and preparation for Reno yet," said the pilot.

The spar is made of some 60 layers of carbon cloth, and the wing has composite ribs; it's not a foam-core construction, despite its smooth surface. "It's the modern way to build a classic airplane," Reberry said. "It's not terribly difficult to fly, but it's different. With a deck angle of just 8 degrees, it lands two-point only, and with the low wing, there's a lot of ground effect."

Slippery is as slippery does. Even with a sexy shape, details matter. One example is the cowl attachment; using long, compound-curve, internal piano hinges that are inserted and removed through the cockpit.

The engine was down on power this year. Although Reberry objected to my characterization of the mill as a "sweepings" engine, he did admit that the engine wasn't the prime concern this year and that all he wanted was reliability; horsepower will come later.

Reberry qualified at 231 mph and finished fourth in the Gold in *September Fate*'s first time out.

Development Matters

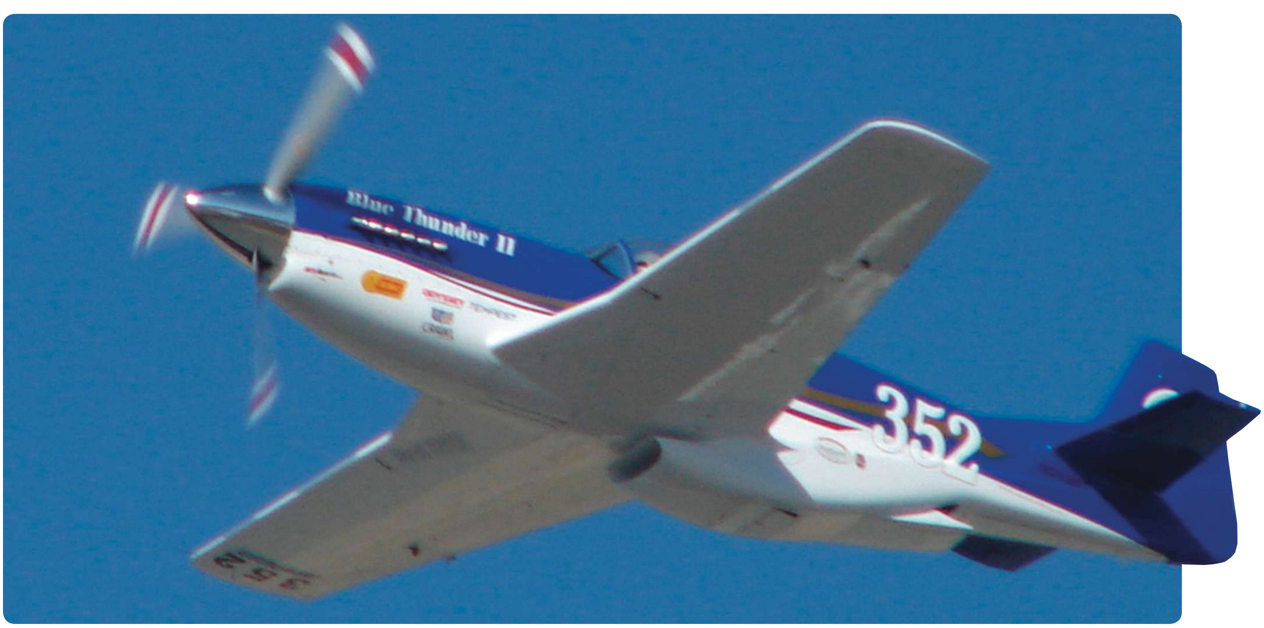
In the Sport Class, as much as anywhere, the development of a fast design matters. While 308 mph was good enough to win when the first Gold Race was held in 1998, qualifying speeds have increased nearly 100 mph since, with purpose-built racers and optimized kit designs upping the ante. Although Lee Behel's wood, single-seat, Chevy V-8–powered, George Periera-designed GP-5, *Sweet Dreams*, made everyone's mouth water and captured fourth in Gold in its first year of racing, veteran racers Jeff Lavelle and his Glasair III have set the pace for two years, at more than 400 mph. Jeff says it's just constant refinement and smoothing of the airframe, plus reliable twin-turbo horsepower, that makes the airplane fast; he's too modest to mention that he knows how to fly a race plane!

Second fastest was John Parker's *Blue Thunder II*, another plane capable of 400 mph but unable to reach that mark this year because of Parker's strategy of holding back on his use of nitrous oxide during qualifying and heat races. His plan of

surprising everyone in Sunday's trophy race was nixed when the nitrous didn't come on! Still, after a furious battle with Lancair pilot Lynn Farnsworth, Parker pulled out a convincing second, behind Lavelle.

Farnsworth, running perhaps the cleanest turbocharged Lancair Legacy in the world, insists that it's attention to details that adds speed. Gap tape, "pinking tape" at critical points in the airstream, and many Aerochia aerodynamic mods (from internal cowling and exhaust to wing-root fillets) mean that Farnsworth's considerable horsepower has less drag to fight.

Lee Behel's Sweet Dreams*: V-8, wood, fast, and gorgeous.*



John Parker's Blue Thunder II*: almost…*

Photography by Tim Kern

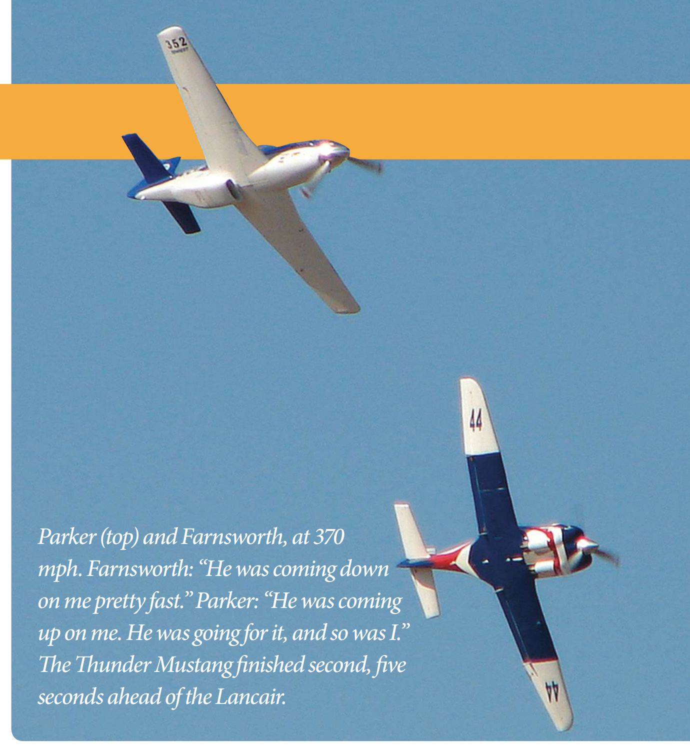
Kevin Eldridge, who has gone more than 400 mph in his NXT, *Relentless*, noted how detail work can win the day, as exemplified by Lavelle's Glasair. "It's hard to believe there's all this specialized [race] equipment [pointing to his NXT and Lee Behel's *Sweet Dreams*, nodding toward John Parker's Thunder Mustang], and he goes so fast in a [exasperated pause] *Glasair*!"

Ease Your Mind and Go Faster

Veteran racer and former Formula One champion Thom Richard was flying the super-polished, contra-rotating prop, Griffon-powered P-51 known as *Precious Metal*. "This is the fastest this plane has ever gone," he said. "We're faster than ever. Of course, so are *Strega* and *Rare Bear*." The big changes this year were a better propeller on the airplane and a full-time safety chief on the team. "He oversees everything. He's accountability." Richard explained that, as owner and pilot, "I'm going in so many directions, it's just too much. This is the first year I've managed to delegate everything. Without this team, it wouldn't be possible."

Success, Head First

Swiss flyer Vito Wyprächtiger has been campaigning *Scarlet Screamer* for three years, the fastest near-Cassutt in the field. Part of his success is in his precise flying, part is in his trick wing surfaces (a patented surface that emulates sharkskin), and part is just that he's smart and mature. On Wednesday, he noticed a vibration that the crew traced to a loose nose bearing on his crankshaft. Since these machines run long prop extensions (up to a foot long), anything wrong up front gets



Parker (top) and Farnsworth, at 370 mph. Farnsworth: "He was coming down on me pretty fast." Parker: "He was coming up on me. He was going for it, and so was I." The Thunder Mustang finished second, five seconds ahead of the Lancair.

David Casey also raced his RV-3.

Jeff Lavelle's Glasair is the world's fastest Glasair—and fastest Sport racer at Reno the past two years.

magnified. Vito elected to change the engine, which if done overnight would allow him to compete in Thursday's heat race, keeping his hopes for a good starting position in Gold alive. (Missing the heat race would put him at the back of the pack, a significant handicap in a standing-start race.)

"I think we should change this engine tomorrow [Thursday]," he said. "Even if we could do it tonight, we would be tired, maybe make a mistake; and I would be tired in the race on Thursday. We are for sure in the Gold, even without Thursday's heat race." So *Scarlet Screamer* would start from the back with an unhurried engine change and fresh pilot. Vito took second place in Gold, passing everyone but the uncatchable Steve Senegal in the purpose-built *Endeavor.*

Reno teaches that improvement comes a little at a time. The Reno experience provides the raw material for all of us. What we can improve on our homebuilts will come from our own curiosity, experience, and dedication… and some hints from these Reno racers. EAA

» For more information about the Reno National Championship Air Races, visit www.AirRace.org. The official dates for Reno 2013 are September 11 to 15. Show up on the 8th and get in on the early action!

Tim Kern has attended every Reno race week since 2002. His accounts of Reno events, personalities, and technology have been published in various EAA publications, as well as other publications in the United States, Africa, and Europe.

Race an RV? Sure—Bob Mills ran his RV-6, one of four RVs entered in 2012.

Former Formula One champ and jet racer Thom Richard added a safety officer to his team and ran Precious Metal *faster than ever; still, he lost a gear door and did not finish in the Gold.*

Vito Wyprächtiger (yellow shirt) used his head and grabbed second place in Gold.

What's All This "Gold," "Silver," and "Bronze" Racing About?

In each class at Reno (T-6, Formula One, Biplane, Sport, Jet, and Unlimited), racers are grouped by qualifying times and heat race finishes, so that by the weekend, when prizes are awarded, the fastest racers in any class all race against each other in the Gold Race. Bronze Races are run first; if the winner of the Bronze elects to forfeit his place and prize, he may move up to the Silver Race, if there is room in the field. Likewise, the Silver winner may elect to take all his chances in Gold—again, space permitting. How lucky do you feel?

Evelyn and Keith Kreth, with their dogs Hannah and Ginger.

Keith Kreth Builds a Flight of RVs

Builder first, flier second

By Larry Martin

Keith Kreth (EAA 214482), a retired periodontist, has completed two and most of a third aircraft in the last 14 years, all while flying more than 1,400 hours. On the recent occasion of his 80th birthday, when asked, "What's the secret of your success?" he said, "I'm committed to a regular schedule, and I never miss a day. I do nothing 24 hours a day, but never before 11 in the morning and never after 3 p.m. I'm not perfect, though. Sometimes I stay overtime, and when that happens I come in early the next day to make up."

All joking aside, such perseverance pays. Since retirement, by adhering faithfully to this schedule, Keith has completed an RV-4 and an RV-8 and is putting the final touches on an RV-7A for Evelyn, his wife.

Beginnings

Young people who came of age during World War II were aware of the dire possibility of an aerial attack on the mainland, similar to Pearl Harbor. The U.S. government encouraged men and women to learn to identify the silhouettes of U.S. and enemy aircraft, to watch the sky, and to report suspicious activity. Keith built solid wood identification models during those years, painted them black, and hung them from the ceiling to memorize their silhouettes from many different angles.

From solid wood he graduated to rubber-band-powered stick and tissue models. The models were held together with glue and dope.

Photography by Desha McCluskey

Then life intervened—marriage, dental school, family, and building a successful practice. It was not until the 1970s when life turned predictable again that Evelyn suggested he needed a hobby, and he returned to model building, first with U-controlled and then radio-controlled (RC) models. A collection of these scale aircraft adorns his hangar today, along with some interesting early glow-plug engines.

At the peak of his model-building days, Keith invited Evelyn to fly them with him. She gave it a try but commented that she would rather fly a real airplane, and she proceeded to do just that. Soon she was a private pilot, while he continued to perfect the art of landing RC aircraft right at his feet so he would not have to chase after them.

Evelyn is not just a partner and supporter in Keith's building ventures; she is an entrepreneur and an accomplished pilot. In 1979 she purchased a Cessna 172, then stepped up to a Cardinal. The Cardinal was regularly campaigned in proficiency events organized by the National Race Pilots of America, and she was named Pilot of the Year in 1986.

The Cardinal may have been too easy to fly, because she traded it for a vintage Taylorcraft L-2 and went taildragger for several years. In the L-2, Evelyn said she learned how to "turn right while flying left" and vice versa. Those old-school airplanes taught serious rudder skills.

Keith avoided becoming a pilot until a friend took him up in a C-150 Aerobat. That sealed the deal, and in 1980 he earned his private ticket. By the time he started his first homebuilt, he had already owned a hangar in Arkansas at the North Little Rock Municipal Airport (KORK), had five airplanes, and was a fixture around the local FBO, assisting with the annual inspections of his own aircraft.

The RV-4

The RV-4 was certificated just 24 months after the kit arrived from Van's Aircraft. Keith flies daily and has put more than 1,200 hours on the airplane since it was completed, all while buying, flying, and selling several other aircraft and starting the RV-8 and the RV-7A projects.

After the RV-4 canopy departed the aircraft, Keith re-engineered the fastenings. Shown here is a twist knob he installed to operate the port-side latch.

This RV-4 was Keith's first build project and it's still flying, with more than 12,00 hours logged. Keith paints his aircraft himself, outdoors, with very good results, though he says that it takes a year or more for the "orange peel" to lay down.

Keith's newly completed RV-8 with USAF markings here on the port side and U.S. Navy markings on the starboard side.

The RV-4 kit was purchased before the widespread use of CNC routers and predrilled holes. Like every builder, Keith spent many hours measuring, marking, drilling, clecoing, and riveting, with Evelyn at his side, bucking rivets.

The RV-4 is powered by a 150-hp Lycoming O-320. The engine was "fresh" when he bought it, showing only 40 hours on the meter. He brought it to the hangar, performed a top overhaul, pronounced it good, and has flown behind it ever since. It swings a fixed-pitch Sensenich metal prop.

Keith with a true RV grin!

With perhaps one exception, Keith's assessment is that the RV-4 has been a joy to own and fly. That exception, an incident that occurred after only 70 hours of flying time, was an attention-getter.

The flight had been uneventful, with Keith up front maintaining a 185-mph cruise and Evelyn handling navigation from the back, when there was a loud pop, a horrific rush of air, a solid blow to the right side of Keith's head, and some difficulty controlling the aircraft. From the pictures taken of his face at the time, it is a wonder there was anything left up there to actually be in control.

The canopy had departed the aircraft, attempted to remove his head, danced across the portside horizontal stabilizer, and then disappeared, thankfully leaving the stabilizer intact, along with a dazed and confused crew that managed to keep the airplane in the air for quite a while before a safe landing was possible.

Keith made changes to the canopy mount when he repaired the RV-4. It was originally attached using a piano hinge to starboard and a push/pull latch to port. The piano hinge had literally unzipped, leading to the incident. He moved the push/pull latch to starboard and installed a rotating latch to port. These mechanisms are unlikely to fail, but the canopy still can be quickly detached if necessary.

How hard was it to build that first airplane?

"It wasn't difficult," Keith said, "if you've spent as much time as I have building model aircraft. But you have to work at it like a job you love." That's where his everyday schedule commitment comes in.

The RV-8

The RV-8 was a 12-year project completed in August, 2012, barely in time for Keith's 80th birthday celebration. It is roomier, heavier, and more powerful than the RV-4, and a capable aerobat at 1,600 pounds gross.

Keith spreads the credit around for the completion of this airplane. It is clear from the stories he tells, the photos on his wall, and the friends who drop by his hangar every day that the community of amateur builders and GA pilots surrounding him is an important component of his homebuilding success.

EAA Chapter 365 is located at KORK, and Keith and Evelyn have been members, supporters, volunteers, and contributors to the chapter and its activities since the early 1980s. Chapter 365 is a focal point for flying enthusiasts in central Arkansas and a rich resource of information, advice, and willing helpers when the occasion arises.

Being part of a flying community is important, Keith said. Local airports have been able to preserve small-town American culture in ways that are rapidly disappearing elsewhere. "There's trust, shared interests, remarkable expertise, and a willingness to pitch in and help where you find local communities of pilots and homebuilders," he noted. But he is concerned that culture might be squeezed out as small airports set their sights on corporate jets and high-end real estate development.

Keith enjoys putting the new RV-8 through its paces, which include finding the straight and level top end at 210 mph, climbing 2,000 fpm at 120 mph, and trying out a series of loops, rolls, wingovers, lazy eights, and spins. He always taxis back to the hangar with an RV grin on his face.

The RV-8 is powered by a converted helicopter engine, a 180-hp Lycoming HIO-360, with a 2850 rpm redline—100 more than the nonhelicopter version. It is fitted with a fixed-pitch Sensenich propeller because the helicopter engine has a solid crankshaft, lacking the oil channels required to operate a constant-speed propeller.

The engine had logged 12 hours when Keith purchased it. It was a great find, but it had a quirk he would learn about later. The HIO-360's fuel injection system is specific to helicopters. Such systems are different in one important way: They are designed to run at max continuous power and no other speed.

The RV-8 panel. No fancy avionics here; just analog instruments and a portable GPS unit.

Photography by Larry Martin

The difference was discovered the first time he cranked the engine, which led to a bit of excitement and a flurry of activity. While this was not the optimum way to learn about the quirks of helicopter engines, the fix was straightforward; just order the right fuel injector servo, install it, and crank the engine again.

The RV-7A

The RV-7A is a work in progress, but the end is in sight, with support from Evelyn and the local flying community. This airplane is powered by a classic 180-hp Lycoming O-360 A1A, swinging a Hartzell constant-speed propeller.

"I've had fun in the fighter-style airplanes and will fly them as long as I can, but it's time for side-by-side seating," Keith said. "This will be Evelyn's airplane. I'm hoping she'll let me retain flying privileges with her in command if the time comes that I decide to let go of my medical certificate."

Given their history of partnering, riveting, flying, competing, and volunteering together, it is likely that Evelyn will agree to his request. If he remains committed to his unforgiving schedule, the RV-7A may roll out of the hangar for taxi testing by spring. But Keith's been building now for quite some time, and he's way too wily to forecast an end date for the project.

Here's a gallery of more images of Keith's aircraft, including some of the dental tools he uses while building. *EAA*

The RV-7A in progress. Since this photo was taken, the engine and instruments have been installed, leaving painting and wiring yet to go.

Video of the Month

Paul Sedlacek and his partners were looking for a low-and-slow airplane to fly for fun and relaxation. A Kitfox III fit the bill, even though it took them some time to complete. Hear their story.

Photography by Larry Martin


EAA Employee Brian Tesch #849155 wearing Camp Shirt
Plane provided by Curt Drumm, Lakeshore Aviation member #374143
EAA AirVenture Oshkosh Sea Plane Base 2012
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Nicropress Tools

Tips for easier splicing

By Cy Galley

If you have ever made a cable using a Nicopress tool, you know how unwieldy and cumbersome this large tool can be. It takes two hands and something or another person to hold the cable and sleeve. One way to get a free hand is to clamp one handle of the tool in a vise, but that's not very handy when making a cable in an airplane or in its original use, making a wire splice on a telephone pole. Yes, on a telephone pole.

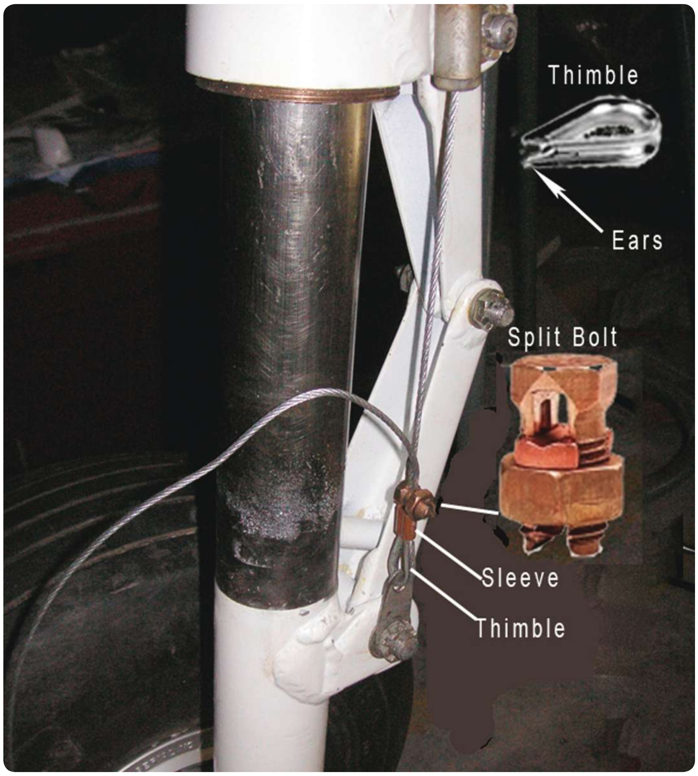
The Nicopress system was originally invented for the electrical trade for splicing wires. Those crimped sleeves worked so well that their use spilled over into the aircraft industry and even to garage door cables. Nicopress sleeves are quick, strong, and reliable.

Because one needs both hands on the tool to compress the sleeves, the electrical industry came up with "split bolts" for use where the Nicopress tool is impractical, such as on a power pole. Even though split bolts work very well, the FAA has not approved their permanent use on aircraft cables. However, split bolts work very well as a temporary clamp in getting a cable the right length, with the thimble slid tight against the cutoff ears.

Yes, cutoff ears. An old-timer showed me that trick many years ago. Clip off the ears of the thimble with your dikes so you can get the sleeve and cable tight against the thimble. The thimble then is less likely to slip out or become distorted.

It's very easy to use the split bolt, as you can slide the sleeve up against the thimble, adjust the cable length, then hold it there with the split bolt as you tighten it with a small wrench or ratchet. After everything is in the proper place, when you have the desired cable length, the split bolt acts as a third hand to hold everything in place while you use two hands to swage the sleeve with the cumbersome Nicopress tool. You can even swing the end out to obtain room for the tool with the length maintained. When you are finished swaging the sleeve, remove the split bolt and return it to your toolbox for when you need help on the next cable.

So where can one obtain one of these wonderful devices? They can be purchased at almost any place that sells electrical supplies such as a "big box store" or your local hardware store. You need to get one that has the slot just big enough for your cable, as they come in sizes for even heavy network supply wire. EAA



Sleeve being held against the thimble by the split bolt before crimping. Difficult to see but the ears have been cut off.

Hints for Homebuilders Videos

EAA has produced hundreds of hints for homebuilders videos. You can view them all here, www.eaavideo.org/channel.aspx?ch=ch_hints.

Burt Rutan's Boomerang (top) and Catbird.

Transitioning to Experimental or Unfamiliar Airplanes

Part 3 – Conclusion

By Hobie Tomlinson

As we have said for the last two months, with the FAA and NTSB stressing the importance of transition training in reducing the amateur-built accident rate, we're concentrating our first Safety Wire columns in *Experimenter* on Advisory Circular (AC) Number 90-109, "Airman Transition to Experimental or Unfamiliar Airplanes," which was published by the FAA's Flight Standards Division (AFS-800) on March 30, 2011. (To read the entire AC, click here.)

This month we'll conclude our discussion by reviewing Transition Training for Family V, VI, and VII airplanes.

Photography by Jim Koepnick

Family V airplanes have nontraditional or unfamiliar airplane systems operations. A light-sport aircraft example is the Flight Design CTSW.

1. Family V aircraft are defined as aircraft with engine, avionics, fuel systems, etc. that require operational practices that are outside the normal procedures used in standard category airplanes, e.g., Rotax engines.

Although an experienced pilot, he had only flown the aircraft for a 30-minute orientation flight previous to the day of the accident.

2. A typical accident would be similar to the iconic accident of John Denver. Wikipedia states the following information on the John Denver accident: "The singer-songwriter John Denver died while flying a Long-EZ on October 12, 1997. The NTSB believes that he inadvertently pushed on his right rudder pedal while twisting to the left in his seat as he struggled to operate the fuel selector valve. Contributing factors in the crash were other pilot errors, a design that led to an overly optimistic preflight fuel-check estimate, a known defective (very hard to turn) fuel valve, and nonstandard placement of the fuel selector valve by the kit plane's builder, at variance with Burt Rutan's specs."

Even though Denver was aware of the faulty valve prior to takeoff, he had not refueled the aircraft. Although an experienced pilot, he had only flown the aircraft for a 30-minute orientation flight previous to the day of the accident.

The NTSB cited the original builder's decision to locate the unmarked fuel selector handle in a hard-to-access position and the use of unmarked, nonlinear, fuel quantity sight gauges. The NTSB also cited Denver's inadequate transition training and his total lack of experience in this type airplane.

3. Transition hazards:

a. Type-certificated (TC'd) airplanes have standardized instrument panel layouts and system control locations that are very similar between airplanes. Pilots who are accustomed to operating flaps, fuel systems, retractable landing gear, and engine controls in TC'd airplanes usually can transition between models without the need for extensive training.

b. Experimental airplanes may have every aspect customized to the individual builder's preference, which includes installing systems not found in TC'd airplanes. Also, even familiar instruments and controls may be placed in unfamiliar locations on the panel or in the cockpit area. Because these airplanes are custom built, there are likely to be significant differences even between identical models of a particular design. *One large hazard in operating such airplanes is the potential for system misuse or mismanagement, which can result in an inadvertently induced abnormal or emergency situation.*

c. Unlike TC'd airplanes, experimental airplanes do not usually have extensive pilot's operating handbooks (POHs) or other documentation outlining the unique nature of the airplanes' installed systems or controls. This places the entire burden of becoming familiar with the airplane's specific systems and controls upon the pilot. *Ensure that you can identify every system and control location and function on the airplane before flying it.*

Flight Design CTLS

4. Recommended training is as follows:

a. Ground training must provide sufficient time sitting in the cockpit (while on the ground) to learn the location and correct function of all controls and switches. This recommendation even extends to the point when the pilot is capable of per-

Photography by Jim Koepnick

forming a military-style "blind cockpit test" that requires controls and switches to be located from memory. *It is important for the pilot not to fly the airplane until gaining a thorough familiarity with the cockpit layout, including seeking any available advice from previous airplane operators and the kit vendor*.

b. Flight training recommendations are as follows:
   i. Best training is accomplished in your specific airplane with a well-qualified instructor who is experienced in the specific make and model.

   ii. Second-best training source is information from, and from flying with the previous owner, if you purchased your aircraft already built.

   iii. All training should emphasize the reasons why the installed controls are the way they are and what operational characteristics they have. This should include covering any unusual handling characteristics that may arise from application of a control or system that may catch the pilot off guard. Again, be sure that you explore your plane's handling qualities under safe, supervised conditions.

Transition Training for Family VI Airplanes

Family VI airplanes have nontraditional or unfamiliar airplane system or component maintenance requirements. A light-sport airplane example in development is the Terrafugia Transition roadable airplane.

1. Family VI aircraft are defined as aircraft that have engine, propellers, fuel systems, avionics, etc. that require practices outside of the normal procedures used in standard category airplanes.

2. A typical accident involves an aircraft component failure caused by improper assembly or maintenance. The example provided is of a stainless-steel horizontal stabilizer "L" attachment bracket that failed in flight, causing the right horizontal stabilizer to separate from the fuselage. Fortunately, the onboard flight instructor was able to land the airplane after some abrupt pitch excursions. The accident was determined to be caused by a fatigue failure of the attachment bracket. In turn, this was the result of a loose bolt in the fitting caused by improper maintenance procedures.

3. Transition hazards:
   a. Manufacturers of TC'd airplanes, as well as their systems and components, provide supporting maintenance and repair documentation that shows owners and maintenance personnel how to properly maintain and repair their airplane. These documents are readily available from several sources and easily accessed by anyone maintaining or repairing the airplane.

   b. Experimental airplanes typically do not have extensive maintenance and repair documentation available. In addition, they may incorporate components and systems not found on TC'd airplanes. Maintenance and repair information on these components and systems may be difficult to find or even unavailable.

4. Recommended training is as follows:
   a. Ground training on the specific maintenance procedure is the main requirement for this group, as it is defined by unique maintenance requirements that lead to issues of improper maintenance. Owners and operators should seek all possible information sources and develop maintenance procedures that will ensure early detection of potential maintenance problems or continued airworthiness issues. Regular attendance at aviation events will also expose the owners/operators to others who operate similar airplanes, thus providing a venue for information sharing.

Owners and operators should seek all possible information sources and develop maintenance procedures that will ensure early detection of potential maintenance problems or continued airworthiness issues.

   b. EAA offers both print and electronic publications that will support the maintenance and operation of experimental airplanes. Type clubs and their related websites provide a good source of information on the operation and maintenance of these airplanes, as well as a method of contacting other operators.

   c. The current edition of AC 43.13-1, Acceptable Methods, Techniques, and Practices – Aircraft

Inspection and Repair, contains methods, techniques, and practices acceptable to the FAA administrator for the inspection and repair of nonpressurized areas of civil aircraft only when there are no overriding manufacturer maintenance or repair instructions.


Terrafugia

d. Flight training recommendations are as follows:
i. Best training is accomplished in your specific airplane with a well-qualified instructor who is experienced in the specific make and model.

ii. Second-best training source is information from, and from flying with the previous owner, if you purchased your aircraft already built.

iii. All training should emphasize the reasons why the installed controls and systems are the way they are and what special operational characteristics they have. This should include covering any unusual handling characteristics that may arise from application of a control or system that may catch the pilot off guard. Again, be sure that you explore your plane's handling qualities under safe, supervised conditions.

Transition Training for Family VII Airplanes (Specialty Airplane Family)

1. Family VII aircraft are defined as aircraft that fall into one of the following categories:
a. One-of-a-kind or highly modified
b. Limited kit production
c. Unique
d. Unstable
e. Extremely high power-to-weight ratio
f. Jet powered
g. Turboprop powered
h. Rocket powered
i. Other unconventional powerplant

2. A typical accident involves loss of aircraft control and/or structural failure during initial flight testing, as typified by the Hughes H-1 Replica aircraft accident.

Wikipedia states the following information on the Hughes H-1 Replica aircraft accident: "Jim Wright of Cottage Grove, Oregon, built a full-scale replica of the H-1 that first flew in 2002. So exact was the replica to the original that the FAA granted it Serial Number 2 of the model. The achievement in re-creating the aircraft was heralded in virtually every well-known aviation magazine of the time. On August 4, 2003, after a successful unveiling of the replica at the 2003 AirVenture at Oshkosh, Wisconsin, Wright fatally crashed. On his way home to Oregon, he had landed briefly in Gillette, Wyoming, to refuel. While on the ground, Wright met briefly with local reporters and indicated that the aircraft had been having propeller "gear problems." He then departed, crashing just north of the Old Faithful Geyser in Yellowstone National Park about an hour later. The replica, originally slated for use in the film *The Aviator*, was completely destroyed, and Wright was killed. The official accident report points to a failure of a counterweight on the constant-speed propeller."

The achievement in re-creating the aircraft was heralded in virtually every well-known aviation magazine of the time.

Interestingly, the replicated aircraft was so true to the original that its subsequent crash and destruction were due to the very design weakness the original aircraft suffered from—a harmonics problem created by that particular engine-propeller combination!

3. Transition hazards:
a. One of the core principles of the experimental

aircraft movement is the freedom to design, create, or modify aircraft to produce a unique machine. Nowhere is this as evident as in this family of airplanes with its very special one-of-a-kind designs and/or highly modified existing designs.

b. While the creation of leading-edge products is probably the most exciting form of homebuilding, *it is also the highest risk category because of the very high degree of undetected hazards and flaws!* (To quote Donald Rumsfeld, a previous secretary of defense, "There are things we don't know we don't know." Those are the things that can get you into a lot of trouble with this family of airplanes.)

c. Becoming highly familiar with every aspect of your airplane, prior to its first flight, is very critical for pilots who are interested in pursuing an airplane model from this category. Because these airplanes are, by their very nature, unique, there is no "beaten path" to follow and you are assuming all risks, both the known and the unknown!

i. It is highly recommended that an analysis of likely performance and handling characteristics be obtained from the aviation department of a university or college using aircraft design software or from another experienced source of aeronautical design analysis.

ii. This category is not for the weak of heart or financially challenged individuals. It is a high-end, high-risk endeavor and requires the ability and resources to obtain the services of organizations and/or personnel who possess the required expertise in the fields of aircraft design and structures, fabrication and construction processes, and initial flight test procedures.

iii. Not taking advantage of every opportunity to understand your unique aircraft prior to attempting a first flight can result in a catastrophic outcome!

4. Recommended ground and flight training for this family of airplanes requires the development of a specific, customized training plan for your specific airplane. This plan must encompass all the specific parameters that make your specialty airplane unlike most other airplanes.

a. Seek specialty training from an instructor who has experience in your type airplane or an airplane type that is very similar to your airplane.

b. Do not think that you can just "feel" your way through an initial flight test program in this family of airplanes. Their special characteristics require dedicated training to master! c. When using turbine, turboprop, or other specialty engines, use the training resources of companies which have established training courses for that specific engine.

Transition Training Guidance

Transition training guidance can also be found in the following publications:

- AC 61-107, Operations of Aircraft at Altitudes Above 25,000 Feet MSL and/or Mach Numbers (Mmo) Greater Than .75
- AC 6-67, Stall and Spin Awareness Training
- FAA-H-8083-3, Airplane Flying Handbook
- FAA-H-8083-25, Pilot's Handbook of Aeronautical Knowledge
- Turbine Pilot's Flight Manual by Gregory N. Brown and published by ASA
- The Advanced Pilot's Flight Manual by William K. Kershner and published by Blackwell Publishing

Additional Information can be found at the following sources:

- EAA, www.EAA.org
- AOPA, www.AOPA.org
- GAMA, www.GAMA.aero
- FAA Safety Team, www.FAAsafety.gov

That wraps up our series on transitioning to experimental or unfamiliar aircraft. Every time we fly we all influence the safety record of the experimental amateur-built movement. Fly safely and enjoy every opportunity to fly. EAA

Hobart C. "Hobie" Tomlinson is the Director of Safety for Heritage Aviation, Inc., in South Burlington, Vermont. He is also a Flight Advisor for EAA Chapter 613. He received the 2012 Spirit of Flight award from the Society of Experimental Test Pilots.. He was also named the 2012 National CFI of the year by FAA.

Baffling, Part 2
Solving hardcore challenges

By Tim Kern

In last month's column, we covered the basics of baffling, and I promised to give "a few special-case solutions (e.g., pusher/seaplanes) and some traditional and not-so-traditional expedient measures (e.g., cowl flaps, spray bars, and electric fans)."

In response to feedback, though, I'm taking this column in a different direction: toward optimizing the more typical tractor systems that don't use complicated additional systems (e.g., spray bars and cowl flaps). Electric fans are becoming more prevalent in pusher configurations, particularly seaplanes; their employment is fairly self-explanatory, with common sense and experimentation dominating the small and enthusiastic population of builders.

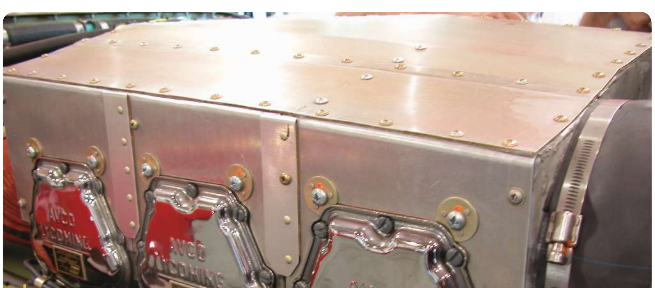
So we're presenting some (mostly) good examples of good examples.

To see what can be done in cooling maximum horsepower with minimum drag, there's nothing like a world-class competition such as the Reno National Championship Air Races to bring out the best ideas. And a lot of that technology is directly transferable to our "civilian" airplanes.

Because more complicated installations are harder to describe, I've included photos and their explanations rather than trying to use mere words.

Get the Air in Gracefully and Use It

Kevin Eldridge had the only 720-inch flat-8 engine at Reno, and the cooling requirements were met adequately by this baffle system that sits independent of the outer cowl. Notice the large volume and the fact that both inlets feed into the plenum; no matter whether the inlet is on the up or down side of the prop's travel, all cylinders will get equal cooling. Notice also the clean, close-fitting exhausts.



At Reno in 2005, Will Mathews campaigned his Silver-winning "twin-engine" O-300-powered *White Lightning*. Notice that metal makes a great plenum, too: There is no air wasted in this superbly fitted air box.

The dominant Formula One racer over the past few years has been *Endeavor*, piloted first by David Hoover and now by Steve Senegal, both of whom have won multiple Gold championships in it. Notice the clean box design and also the long prop extension. Such a long nose not only aids overall streamlining but also allows the smallish air inlets to expand at the optimal angle as they approach the plenum, leading to the greatest pressure buildup atop the cylinders.

Slower airplanes? Perhaps their designers know they already have so much drag that they don't feel it's necessary to do any fancy ductwork and plenum-building. This example, photographed in Alaska in 2004, shows a "suboptimal" solution that apparently works just fine, in its application.

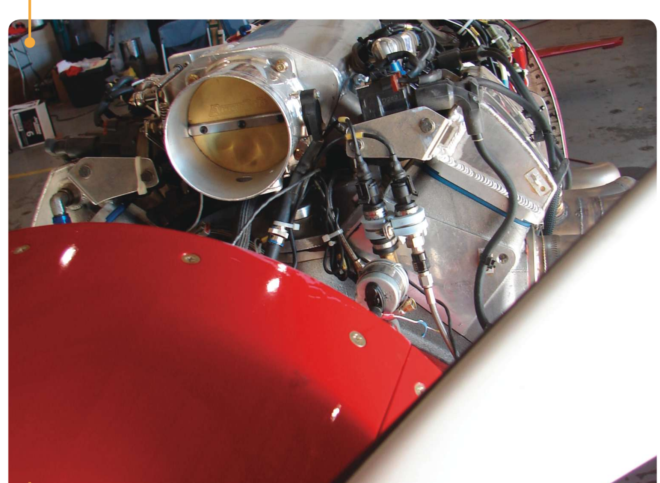
This unusual upward-exiting baffling works. It's on the fastest biplane in the world—Tom Aberle's *Phantom*. Aberle goes more than 260 mph around a tight course, with an O-360 and fixed gear and prop; cooling drag figures greatly in such an equation. He's so fast that he regularly laps the field, in the *Gold* Race!

Bruce Bohannon's *Flyin' Tiger* holds every time-to-climb record but one for piston aircraft, and Bohannon has also flown it to more than 49,000 feet, setting altitude records. Here he taxies out for another record attempt in 2004; master fabricator Gary Hunter's huge hood scoop was doing its job.

It Has to Go Somewhere

Of course, getting the air in is only half the battle. Getting it back out after it's done its job is the other half! Ideally, the exit should be in a low-pressure area of the airplane.

All the air needed to cool Bohannon's horsepower has to come out somewhere. What better place than routing it out alongside the ginormous turbo's exhaust?



The Sport Class sensation at Reno 2012 was *Sweet Dreams*, owned and flown by Lee Behel, and designed by George Periera. Its Chevy V-8 engine needed intake air up top and received it through an Andy Chiavetta Aerochia–designed and fabricated two-piece scoop that led to a plenum before heading into the intake. While this is not a "cooling" design, some of the details of the inner and outer scoop construction are noteworthy: Both pieces are required to get maximum airflow with minimum drag.

There are lots of places to have the air exit. This new Lancair, the creation of Cascade Aircraft Management, was to have raced at Reno in 2012, but they ran out of time to get the airplane completed. Still, the novel exits for the intercoolers, placed as "portholes" under the canopy's edge, have a certain charm. Do they work? We'll have to find out next year.

Even little airplanes benefit from attention to detail. The LT-1 seen at EAA AirVenture Oshkosh 2012 is designed to go 150 mph on 60 hp. The only way to do that is to be efficient. Designer/developer Andy Chiavetta has removable exhaust shrouds on the prototype to allow fine-tuning the overall design. Once the ultimate shape has been settled on, the cowl molds will incorporate it.

A superb example of using all available energy in whatever way possible is demonstrated under Lee Behel's Sport Class racer Lancair. *Breathless* uses its exhaust blast to help evacuate the cowl.

Takeaway

It is a given that flying is a game of optimizing compromises. For every design plus, there is a trade-off. Efficient cooling's tradeoff comes in the required time, craftsmanship, and design skill necessary to achieve it. There isn't a cooling system anywhere that couldn't be made at least a little better; where one stops experimenting is determined by one's knowledge, skill, pocketbook…and the desire to stop working on it—and *go fly the airplane*! EAA

Tim Kern is a private pilot who lives near Indianapolis, Indiana. He has written for more than 40 different aviation magazines and also provides writing and marketing services to the aviation industry. He was key builder on two aircraft and has earned the certification of Certified Aviation Manager from the NBAA.

This M-16 Magni gyroplane at the Mt. Vernon expo was manufactured in Italy and has flown from Tennessee to California.

Midwest LSA Expo
and Epic Flights

By Dan Grunloh

Anyone interested in buying a new light-sport aircraft (LSA), or wanting to learn more about them, would have felt like a kid in a candy store at the Midwest LSA Expo held in Mt. Vernon, Illinois, September 6 to 8. The most eye-catching of the approximately 40 aircraft on display was Greg Gremminger's M-16 Magni gyroplane with the *Angry Birds* paint scheme. Greg said kids come straight to his aircraft when they see it displayed at air shows and fly-ins. Adults over a certain age fail to recognize the popular video game characters and are puzzled by the graphics. Greg isn't angry, but he is impatient over the continued failure of the FAA to allow for the manufacture and sale of special light-sport aircraft (S-LSA), ready-to-fly gyroplanes. Sport pilots can fly gyros, but currently gyroplanes like the Magni trainer must be registered as amateur-built experimental aircraft.

The newest LSA at Mt. Vernon was the Vulcan C-100 by SAB Aviation of Italy. SAB Aviation has expanded into the U.S. market by introducing an LSA derivative of the Falco kit plane. The Vulcan C-100 on display is the only example in North America, and it has become the 127th design to be approved in the United States under the S-LSA rules. The all-metal low wing started out as the Pegaso project by Corivi Aviation until it was bought by SAB. The Rotax 912–powered aircraft was originally available with fixed or retractable gear. Learn more in this Vulcan C-100 video. Look for future announcements about the Vulcan at www.BoomerangLSA.com or contact SAB of the Americas at 940-781-5186.

It was my first time at the Midwest LSA Expo, and I was surprised to see displays by Quicksilver, Quad City Challenger, and Kolb Aircraft. They do not produce S-LSA but are perfectly positioned to attract the attention of buyers suffering from sticker shock. Jim Robinson from Erie Airpark was there for the Challenger line, and he presented a forum on the construction of the Challenger kit. He said you can build a two-place Challenger for a fraction of the price of the top S-LSA and still have a lot of flying fun. Dan Johnson and Dave Loveman teamed up to document all the aircraft displayed at the Mt. Vernon show in a complete set of short YouTube videos. They also released a fabulous 90-minute video compilation of the entire show. Watch the Midwest LSA Expo compilation video and go to www.ByDanJohnson.com for the latest LSA industry news.

Craig Valentine Lands in 48 States in 36 Days

On July 11, 2012, Craig Valentine of Lodi, California, landed at Grove Airport in the state of Washington, completing his quest to be the first trike pilot to land in each of the 48 contiguous states on a single journey. He accomplished it in 36 days, despite challenging weather that grounded him some of those days. Craig departed from Lodi on June 6, heading east across the southern tier of states. Flying in the Colorado River Valley near Needles, California, he found his ground speed was down to 38 mph while the airspeed indicator was reading 91 mph. The headwind was 53 mph! Two days later in Tucumcari, New Mexico, a similar tailwind found him cruising at 140 mph. At one point in the flight he noted a personal best of 164 mph ground speed in a trike!

Craig did not have a preplanned course; instead he picked his next destination based on the forecasted weather and winds. He did not stop to give talks, visit local sights, or raise money for a charity. He simply flew. Craig is flying with a full flat panel "glass cockpit" in his trike. An Enigma EFIS on the instrument panel is complemented by an iPad running WingX Pro and Flight Guide. An iFly 720 GPS with moving map is in his lap, mounted off the trike keel.

After battling winds and following lines of thunderstorms across the United States, he ended up in Kitty Hawk, North Carolina, flying over the birthplace of aviation. Then it was up the East Coast to rendezvous with John Williams in Virginia. John is a trike pilot and fan of

Regis Silva with the SAB Vulcan C-100.

long cross-country flights. They continued up the coast and met with Barry Maggio, who attracted attention when he first flew a trike in the Hudson River Special VFR corridor to see the Statue of Liberty. Read the story "Barry Maggio's Rendezvous with Lady Liberty." Craig and Barry repeated the feat again as shown in this video. Craig's odyssey continued up to Maine and back westward across the United States, including a flyover above Mt. Rushmore and Crazy Horse.

Craig has a background in mountaineering and bicycling in many continents. His first feat after getting into trike flying was to land in all 246 airports in California. The trike used in this trip was a 100-hp Rotax 912–powered P&M Aviation Quik, which is capable of a 90- to 100-mph cruise speed. He bought the trike in Georgia and flew it to California, a 2,000-mile trip that helped spur the idea of flying in all 48 states. While many of us are content to fly for an hour or less, Craig likes to fly for hours on end, and with his cruising speed, he can cover a lot of ground.

Couple Embarks on 100,000-Mile World Flight Adventure

In a time when around-the-world flights are becoming more commonplace, Andreas Zmuda and Doreen Kroeber have embarked on an incredible and ambitious journey. On July 21, 2012, they departed from Zephyrhills, Florida, with plans to fly 100,000 miles over a 32-month period, crossing 74 countries and five continents and ending in Sydney, Australia, in April 2015. A native of Germany, Andreas has worked as a tour guide for adventure trips in South and Central America for the last 20 years. The couple met during a tour of the Amazon when he was a guide. His first trike was a flying inflatable boat that he used to fly tourists around the Mayan ruins of Belize. For the around-the-world flight, their light-sport aircraft is a DTA Voyager weight-shift control trike built in France and known for its ruggedness.

Unfortunately a hard landing in very rough conditions at the Kentland Airport in Indiana grounded them for six weeks. At first he thought there was no damage, but it didn't seem to handle right. A close inspection by an experienced trike mechanic at Cushing Field in Newark, Illinois, revealed the frame of the DTA trike was slightly twisted. The DTA Voyager is an S-LSA trike built in France, and only the factory can determine how the problem should be fixed. A new frame would have to be shipped from France, and the factory was temporarily out of stock. It would take three weeks to manufacture plus the shipping time from France to Chicago. The six-week delay required a new plan and allowed time for some sightseeing. See their

Craig Valentine's 100-hp P&M Quik trike is built in the United Kingdom, carries 17.2 gallons of fuel, and is capable of 100-mph cruise.

new planned route and schedule on the logbook tab of the website Trike-Globetrotter.com. Also find the link to their SPOT tracker to learn their current location, and visit the links for their Facebook page and blog.

Ultralight Anniversary Celebration and AirVenture Statistics

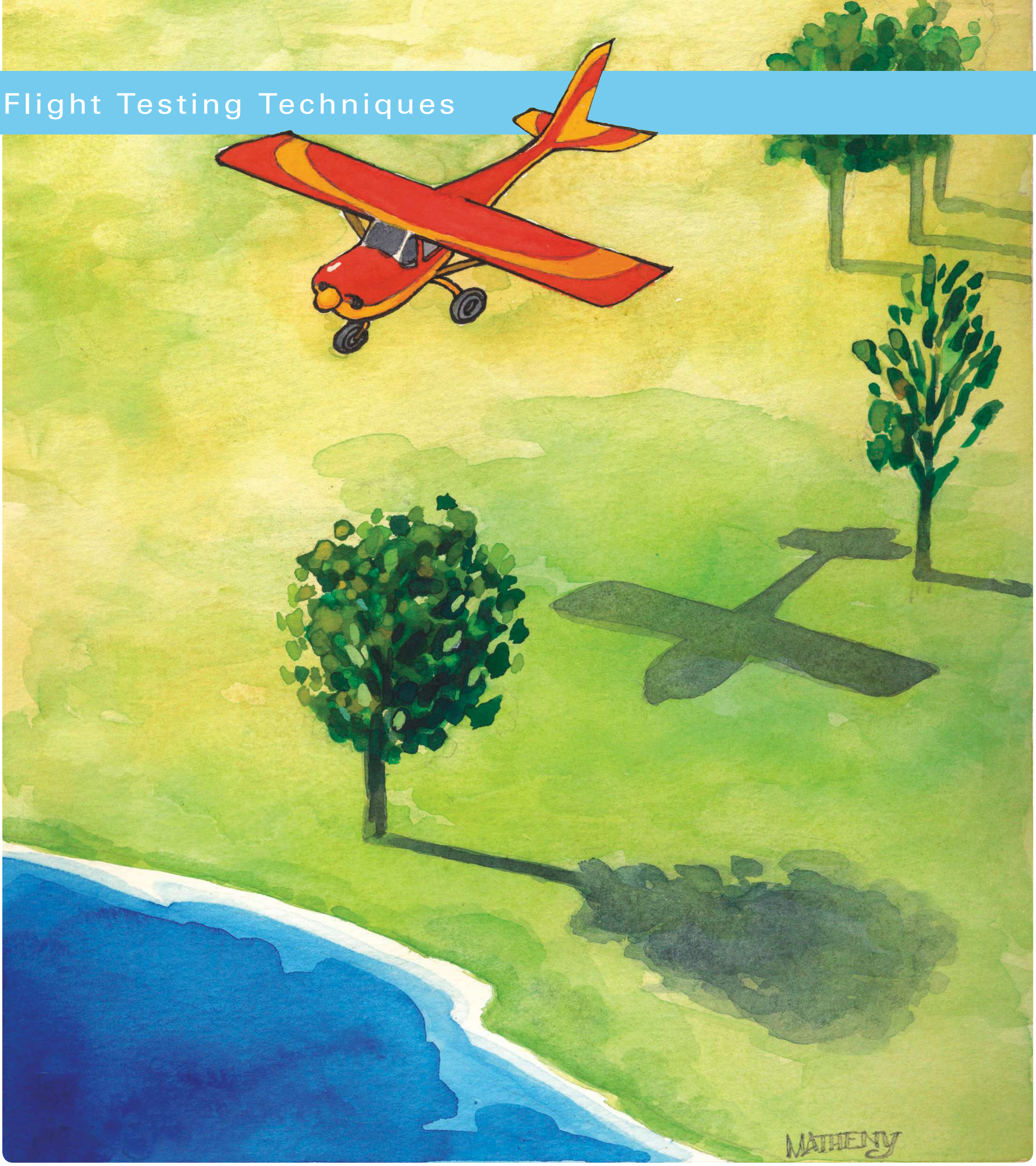
About 75 devotees of ultralight aviation gathered down on “the Farm” in the ultralight area at EAA AirVenture Oshkosh 2012 to celebrate the 30th anniversary of FAR 103, the federal regulation that makes flying ultralights permissible in the United States. It was a little sad that there weren’t 500 or 5,000 joining in the hoopla, but a look around the group seated for punch, cake, and speeches revealed many pioneers of the sport. The two most recognizable figures from the “dawn of ultralights” were Ed Sweeney, who displayed two Hummingbird ultralights, and Dale Kramer, creator of the Lazair and the eLazair. The master of ceremonies was the ultralight area chairman, Lee Crevier, who presented special certificates of appreciation to those who exhibited FAR 103 ultralights. Retired ultralight/light plane announcer Frank Beagle gave an address to the group about the history of FAR 103, and he included a moment of silence for all the pioneers and fellow pilots who have departed.

Timm Bogenhagen, EAA staff liaison for ultralights and light planes, has released a postconvention compilation of statistics from the ultralight/light plane area at AirVenture 2012. There were 106 ultralights and light planes registered, with a total of 1,629 takeoffs and landings during the seven-day period. (A volunteer counts them.) A total of 104 volunteers served 5,080 man-hours in the area at the convention. Our fuel building pumped 407 gallons of auto fuel, and there were 23 forums in our seminar tent with 802 attendees total. Please send your comments and suggestions about ultralight/light plane seminars to dgrunloh@illicom.net. EAA

Doreen Kroeder and Andreas Zmuda plan to spend the next three years flying all over the world in this DTA Voyager trike.

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.

Lee Crevier opens the ceremony celebrating the 30th birthday of the ultralight rules and stands bravely between the assembled attendees and the free punch and cakes.



Airspeed Calibration: Ground course preparation

By Ed Kolano

The airplane we were flying had a fly-by-wire flight control system. It automatically trimmed itself for 1*g* flight. No doubt the designers figured that would be a good starting point for every flight, and it was. You could trim if you wanted to with the hat switch atop the stick grip, but the gouge (slang for good unofficial information) was never to touch the trim. The reason was that the computer was thinking digital out to who knows how many decimal places, so there's no way to blip yourself back *exactly* to that initial 1*g* trim number. You could find that number buried in some maintenance page on one of the displays, but thumb-flicks were much too coarse even while watching the digits.

Illustration by Dave Matheny

So it is with airspeed. If you don't start from a known place, everything else based on that place is suspect. Now it's time to take your airplane flying to determine whether its airspeed indicator is telling the truth or whether it's lying.

Last month we described the various airspeeds pilots deal with:

- Observed corrected for instrument error yields indicated.
- Indicated corrected for installation error yields calibrated.
- Calibrated corrected for compressibility yields equivalent.
- Equivalent corrected for density altitude yields true.
- True corrected for wind yields ground speed.

Okay, let's get practical. Your airspeed indicator is already installed and plumbed, so you don't need to worry about the instrument error. Most homebuilt airplanes don't fly fast enough or high enough to worry about the compressibility effects. This makes your airspeed calibration easier because you can assume your calibrated and equivalent airspeeds are the same. The practical information you want to know is the calibrated airspeed that corresponds to the observed airspeed you read on your airspeed indicator, and that's what this test will tell you.

There are a couple of reasons you'll want to know the relationship between calibrated airspeed and what you read on your airspeed indicator. One is so you can calculate true airspeed for cross-country planning and know what you should read on your airspeed indicator to achieve that true airspeed. Another is that most airspeed limits, like maximum flap extension speed, are usually stated in calibrated airspeed.

There are several acceptable methods for airspeed calibration: They range from exotic laser tracking to trailing bomb usage to pacer airplane formation flying to the fairly math-intensive tower flyby to the simple ground course. And then there are several methods that use GPS, and we'll address those in future *Experimenter* issues.

Ground Course

The ground course method, sometimes called speed course, is straightforward. You simply time how long it takes to fly a known distance. You determine your ground speed by dividing the distance flown by the time it took to fly it. Then you apply a correction for air density because you probably won't fly your test at sea level on a standard day, and you get your calibrated airspeed. Now compare this airspeed with what you saw on your airspeed indicator during your test run, and you'll know what your airplane's calibrated airspeed is when your airspeed indicator reads the value it did during the test. By flying reciprocal headings (not tracks) for each test and averaging the ground speeds, you eliminate the wind effects. Repeat the process for the range of airspeeds your plane is capable of flying, and you can create a table or plot of calibrated versus observed airspeed. Repeat the entire process for each different landing gear and flap configuration to get additional applicable plots or tables.

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There are a few practical rules for the ground course method. First, you'll need a ground course with some special features. It should be essentially flat, because you may be flying very low. The lower you fly, the easier it will be to accurately time your start and end points passage. Do not fly lower than about two wingspans to ensure you'll remain out of ground effect. Flatness is also warranted because each run must be flown at a constant airspeed, and you'll want to avoid climbing or descending.

Terrain features should be consistent to avoid anything that could cause a variation in airspeed or altitude like land/water shorelines that can generate thermal activity or abrupt drop-offs with associated up/down drafts. Clearly identifiable start and end points will be necessary. You don't want to be searching for that special tree among many when flying in this risky environment. Plan your course so your checkpoints are to the side of your track. This will make it easier to "hack" your time as the leading edge of your wingtip passes the checkpoint.

Consider selecting your course so that you can easily see your airplane's shadow on the ground. You can get a much more accurate time hack by noting when your shadow passes the checkpoints, or better yet, a straight-line ground feature perpendicular to your course that passes through your checkpoints. Another advantage to using your shadow is you can fly much higher—a couple of hundred feet—and still get an accurate time hack at the checkpoints.

Smooth air is essential for obtaining good data. Early morning is usually the best time for calm conditions, and the sun's low position also ensures your shadow won't be under you. The FAA recommends less than 10 knots of wind for this test, but I'd stick with less than 5 knots with no gusts. Calm is best.

The effects of your airplane's center of gravity should not affect your data. Weight, however, can affect data. The heavier your airplane, the higher its angle of attack must be to produce lift equal to its weight for a given airspeed. Because higher angles of attack create stronger upwash and downwash around the wing, which can affect the pressure sensed at the static port, weight can have an influence in your calibration. To check this, perform the entire test profile at a heavy weight, then spot-check several airspeeds at a near-minimum weight for comparison. If there is a significant difference, you may want to perform the entire test profile at maximum and minimum weights. The FAA recommends testing several speeds between $1.3V_{S1}$ and maximum level flight speed. V_{S1} is your airplane's stall speed in the tested configuration. The 1.3 factor is there for safety. Remember, you'll be low and slow, and that means you won't have a lot of options should something go wrong.

Select a ground course whose length is compatible with your airplane's speed range. FAA Advisory Circular 23-8C recommends a 5-mile course for airspeeds faster than 250 knots and a one-mile course for airspeeds less than 100 knots. For an airplane with a test speed range of 65 to 150 knots, a 1-½-mile course is probably a good choice. Course length is up to you, but longer courses require very demanding flying for longer periods, and shorter courses can mean larger airspeed errors if your timing is off. For example, a 1-second timing error on a 1-mile course flown at 150 knots produces a 6-knot airspeed error. That same 1-second timing error on a 5-mile course causes an airspeed error of less than 2 knots.

That should about do it for the flight-test procedural considerations. Next month we'll get into how to fly the ground course, the data you'll need to record, and setting the stage for crunching that raw data into useful charts for your operator's handbook. EAA

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Glasair II