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Vol.65 No.10 | October 2016

Radical Radial
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+

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Homecoming
Homebuilts at Oshkosh

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Saving Personal Aviation

Without E-AB and LSA there would be almost no new single-engine airplane production

BY JACK J. PELTON

THE NEW AIRPLANE DELIVERY report from the General Aviation Manufacturers Association (GAMA) for the first half of 2016 was discouraging. Only 377 new standard piston-powered single-engine airplanes were delivered worldwide, and the total includes manufacturers both here in the United States and other nations.

The delivery count is down more than 4 percent from last year, but it's still not as low as it was several years ago. The bright side is there have been more than 800 experimental amateur-built (E-AB) planes registered annually in recent years. This category of aircraft is truly propping up all of GA.

There are many reasons so few piston singles are being produced. The price of a new airplane is near the top of the list, but the situation is more complex than simply cost.

Only a handful of the new piston singles built were two-seat airplanes. Even basic four-seat singles like the Skyhawk and Warrior were a small minority. High-performance and higher priced airplanes like the Cirrus were the best sellers. Blaming slow sales on the price of new piston singles isn't a complete and useful answer.

Instead, I believe, the issue is the difficulty — or maybe impossibility — of successfully manufacturing airplanes that many pilots desire, and doing so at a profit. And that's where E-AB aircraft and the movement EAA Founder Paul Poberezny started more than 60 years ago save the day. They've made the truly personal airplane possible when conventional manufacturing cannot.

History shows that many pilots are looking for single- or two-seat aircraft with good performance for the power, low fuel burn, rugged field operation, and at least mild aerobatic capability. That's the definition of a successful homebuilt design, and the description of an airplane that is nearly impossible to manufacture at a profit. Big airframe manufacturers were mostly founded on basic two-seat designs like the Cub or Cessna 140, but that's ancient history. They had to give up building basic two-seat airplanes decades ago.

In the homebuilt world you can pick and choose from an unimaginably long list of designs to stoke any pilot's passion. For example, the Van's Aircraft line of RVs are quick, are a delight to fly, offer good cruise speed, and can satisfy most pilot's aerobatic whims. If your tastes are for classic looks and performance, there are designs like the Acro Sport that would have looked right at home in the 1930s. There are futuristic-looking canard designs to choose from, or you can opt for compact speedy airplanes that are faster than anything from a factory.

Pilots are a diverse group with a huge variety of likes and priorities. This is what Paul and other early EAAers understood from the beginning, and their tireless efforts helped give us all the freedom to satisfy our own flying passion. EAA worked hard with the FAA to create regulations that make the complete airplane kit possible. Using a modern kit, almost anybody with modest mechanical skills and limited amounts of time, space, and tools can build an airplane of excellent design integrity and known flying qualities.

The FAA's re-registration program has made a hash of the number of registered airplanes, so it's hard to know exactly how many exist. But in the most recent FAA activity survey they found nearly 20,000 homebuilts actively flying, not merely registered. The survey also identified nearly 6,000 more active airplanes in the light-sport and other experimental categories.

There were more than 120,000 active manufactured piston singles in the survey, so homebuilts and LSA are not nearly a majority. But we are growing in numbers while manufactured singles are not. That should be no surprise. When energetic, passionate, and dedicated people are given the freedom to pursue their interests good things happen. That is the founding mission of EAA, and one we pursue every day.

Freedom, especially in this contested election season, is an overused word. But at EAA we prove every day that giving people the freedom to fly what they want works. EAA

PHOTOGRAPHY BY ERIN BRUEGGEN

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E-mail: *editorial@eaa.org* • **Website:** *www.EAA.org*

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ON THE COVER Head on with Brian Kelly's Radial RV-8R.
Photo by Jim Busha

ON THIS PAGE Brian Kelly and his RV-8 *Kentucky Lass*.
Photo by Bob Terry

For more on many of the topics in this issue, visit *www.EAA.org/sportaviation*.
To view and submit aviation events, visit *www.EAA.org/calendar*.

DEPARTMENTS

COMMENTARY

NEWS & INFO

MEMBER CENTRAL

BEHIND THE SCENES

JUST WANTED TO PASS on my thanks for a great write-up, "Backstage with the Snowbirds" [August 2016]. Hal Bryan put a lot of detail in a few pages to capture the professionalism and discipline of these fine-skilled aviators to our north.

That picture on pages 54 and 55 captured a look as if to say "When you sit down here you better be prepared." The Canadair CT-114, a senior jet aircraft, must be a worthy challenge to keep in peak condition, but I think Hal's comments were spot on. I am sure a little more power would be appreciated, but then again, the fine finesse of energy management versus brute force brings out the skill of these aviators. Like a fine wine, you appreciate it.

I spent a bit of time in Canada prior to my retirement from American Airlines. I always respected the dedication and astuteness of the aviation family in Canada. From Transport Canada, pilots, ground engineers, support staff, and, naturally, military aviation.

Thank you again for a great depiction of the Snowbirds.

–
Ed Hasch, EAA 237979
Franklin, Tennessee

Another Option

STEVE ELLS' ARTICLE [The Workbench, "Unscrew It"] in the August issue on convincing uncooperative screws was a great read, and very helpful. But, here's still one more plan B method. Go hit the flea markets and get an old-fashioned carpenter's brace and bit. Insert a removable bit and add a skosh of grinding compound. You get great leverage, and the palm thingy on the end (that's a technical term) lets you put some weight behind the tool. Cries of "Invictus!" are optional.

–
Paul Rodriguez, EAA 705661
Kansas City, Missouri

Awkward Placement

THIS FANTABULOUS ARTICLE [Robert N. Rossier's "Maneuvered Into an Ugly Corner," August 2016] suffers from a cruel coincidence. Part of the sentence that bridges from page 45 onto 46 says, "Some would argue that flight at less than 2,000 feet AGL adds unnecessary risk ...."

But page 47 is a full-page advertisement depicting flight well below 2,000 feet. It seems like we are not all on the same page about reducing our accidents!

–
David Maultsby, EAA 130422
Crestwood, Kentucky

Memories

I ALWAYS ENJOY LAURAN Paine Jr's articles. They ignite memories. I flew the Republic F-84F for about five years ["Aviation Life Lessons," August 2016], and I wanted to add something: We called it the "Super Hog." The F-84 was the "Hog." When the Republic F-105 came out, a letter came down from TAC (U.S. Air Force Tactical Air Command) headquarters that the F-105 would not be called the "Ultra Hog." Of course that was what we called it until the "Thud" took its place.

The F-84F used a lot of runway, especially in a high density altitude condition. The one nice thing I remember is that it was an easy transition from the F-84F into the F-100. It was almost like just adding an afterburner to the F-84F. The feel was similar, and the weapon delivery techniques almost identical. Of course the "Hun" got airborne a lot quicker and carried enough fuel and ordnance to be much more effective in combat. (I'm glad I had a Hun in Vietnam.)

Thanks again for your articles.

–
Bob Beabout, EAA 640262
Aurora, Colorado

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THE NATIONAL BIPLANE FLY-IN

MR. RIFFEL'S SHORT ARTICLE [August 2016, Page 13] contains a major factual error.

The National Biplane Association of Tulsa, Oklahoma, created and conducted the Biplane Expo (on occasion colloquially called the National Biplane Fly-In by some) at the Bartlesville Municipal Airport, Frank Phillips Airfield, from June 1987 through its grand finale in June of 2009. Over the 24-year span, the Biplane Expo attracted 2,700 biplanes, over 6,000 non-biplanes, and approximately 75,000 aviation fans. Our patrons were from all parts of the United States, Canada, and Mexico. We remain a legal corporate being although we conducted our last fly-in event in June of 2009.

The National Biplane Association and Biplane Expo of Tulsa and formerly Bartlesville have no connection or relationship of any nature with the event in Junction City, Kansas, which calls itself The National Biplane Fly-In. The National Biplane Fly-In has been in existence since 2010, a period of six years and seven events, not 30 years.

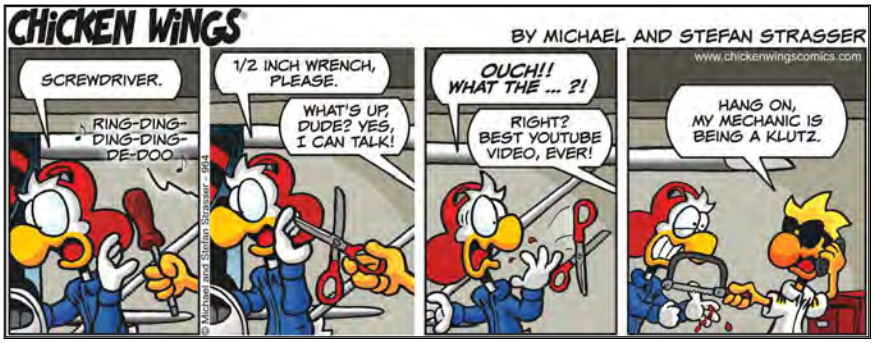
The article's phrase "This fly-in has been around for 30 years" is factually in error and should be corrected. The two events are in no way related; they are two completely separate events in different places, at different times with completely different principals, leadership, and general constituency.

Thank you in advance for the courtesy of a correction.

–

Charles W. Harris, Co-Founder, Chairman, and President,
National Biplane Association
Tulsa, Oklahoma

Thank you for the clarification. We regret the error. — Editor



SUBMISSIONS

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Right On

I THOUGHT [Innovation, "The Prandtl-D Wing," July 2016] was extremely well-written, very interesting, and exciting.


INNOVATION
The Prandtl-D Wing

I've read and re-read the article, gone to the NASA link, and saved their report plus Al Bowers' technical paper. I've been talking to others about this, but it's mainly beyond the interest of my family and close friends so I have to limit how much I say and my enthusiasm a bit.

I (finally) learned to fly in 1968 at 30, with my wife's encouragement. Got private in about two months, then continued to commercial rating just over a year later, then instrument rating in 1975. At that point I planned to take some aerobatic training in the 1970 Great Lakes biplane my FBO (Ottumwa, Iowa) had bought newly built to 1940s plans (I see they're being built again now, but in upgraded form). I knew this would make me a better and safer pilot. However, I never got to it.

We took a number of nice trips as a family, I used flying for some business trips at company expense, and I kept practicing so that my instructors envied my 'painted on' landings. My favorite flying of all was sailplanes from a field near Lake Elsinore in California (I think it's long closed now). I soloed there and went one day for myself every time we visited California.

All my life, it was understood by everyone, including me, that I'd go to college and become an aeronautical engineer, then design aircraft or spacecraft. However, I never made it there. You see, this beautiful young girl of 16 came along, and we were so amazingly well-matched and fell so deeply in love that I asked her to marry me my graduation week of high school. We married three months later. We had three children together, now all deep in their 50s and doing well. This was the best decision I ever made in my entire life. I went to work in a metallurgy lab, took college classes nights, and eventually became a metallurgical engineer instead. My interest in flying, aircraft, and cars never diminished, though, and is still alive today. I did build and successfully fly rockets à la Homer Hickam of *October Sky*, and did design and build some model airplanes that flew exactly as I intended. EAA

–

Gene Smithson, EAA 1188211
San Marcos, Texas

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BOEING

New Commercial Drone Rules Create Greater Responsibility

ON AUGUST 29, the FAA's new rules governing the commercial use of small unmanned aircraft systems (sUAS), or drones, went into effect. This was the culmination of a more than 18-month process to bring the increasingly popular segment of aviation under FAA authority. The rules exist in Part 107 of the Federal Aviation Regulations and address the operating limitations, as well as airman certification and aircraft requirements, related to commercial drone use.

This brings commercial drone operations at least partially into the same aeronautical knowledge process as certificated pilots of manned aircraft. That's an important element in the effort to establish safety minimums and even levels of responsibility for everyone who uses the national airspace system (NAS).

Under the new rules, a person who wishes to operate a drone weighing less than 55 pounds for commercial purposes must obtain a remote pilot airman certificate with an sUAS rating, or be directly supervised by a person who holds the certificate. To obtain the remote pilot certificate, one must be at least 16 years of age and pass an aeronautical knowledge test at an FAA-approved testing center. Pilots with a current airman certificate (other than student pilot), must take an FAA-provided UAS training course. The rules also require visual line of sight with the drone as well as ATC notification for operations in class B, C, D, and E airspace, and prohibit operation at night. Operators must keep sUAS below 400 feet AGL and yield the right-of-way to manned aircraft, among other requirements.

PHOTOGRAPHY BY **ERIN BRUEGGEN**

Though Part 107 does not create additional requirements for recreational use of drones or model aircraft, it does give the FAA enforcement authority over recreational users who endanger airspace safety.

After the commercial drone notice of proposed rulemaking (NPRM) was released in February 2015 EAA commented on the proposed rules, stressing that manned aircraft should always have priority over drones within the NAS and that no new equipment mandates should be required of manned aircraft as a result of drone integration. EAA has also taken the position that airspace access for manned aircraft should not change as a result of the increase in commercial drone operations. That includes actively opposing measures such as air traffic control privatization, which could limit the general aviation community's voice over what entities control access to the NAS.

Part 107 represents a significant step in bringing commercial drone operations under FAA oversight. While we recognize the popularity and potential of drones, EAA will continue to work with the FAA and industry to ensure manned aircraft are not adversely impacted by their integration into the NAS.

Through work on government and industry committees as well as support for drone safety initiatives such as Know Before You Fly, EAA seeks to ensure that the proliferation of drones, both commercial and recreational, does not affect manned aircraft safety. Education is paramount in ensuring drone operators develop the same respect for airspace safety that manned aircraft pilots maintain.

Learn more about the new rules under This Month's Extras at *www.EAA.org/sportaviation.*

EAA STC GOES LIVE

THE ACCESSIBLE SAFETY STC allowing the installation of the Dynon EFIS-D10A and EFIS-D100 systems in standard-category aircraft has officially entered the general aviation fleet. After generating excitement and interest at EAA AirVenture Oshkosh 2016, EAA STC LLC — EAA's subsidiary for STC projects — has begun shipping STC packets to customers and published the Instructions for Continued Airworthiness (ICA) and installation instructions to guide installers and operators. The order form and pertinent documents are available at *www.EAA.org/sportaviation* under This Month's Extras.

Both EAA and Dynon have installed the EFIS-D10A in example aircraft. The EAA Employee Flying Club's 1976 Cessna 172M recently resumed flight-training operations with both instructors and students making an easy transition to using the device. The optional angle of attack function installed on the aircraft adds safety to critical phases of flight.

EAA continues to refine and expand the STC based on member feedback. The next expansion of the approved model list is underway, and work has started on creating new STCs for additional safety-enhancing equipment. Meanwhile, other companies are joining the affordable avionics market, including Garmin, which announced a similar STC for its G5 EFIS at AirVenture 2016.

Updates will be forthcoming as EAA and others in the industry continue to expand the envelope for safety and affordability in type-certificated aircraft. Check EAA's website and *e-Hotline* newsletter for more information as it becomes available.

SPORT PILOT FLIGHT INSTRUCTION SHOULD COUNT

EAA RECENTLY SUBMITTED COMMENTS on an FAA notice of proposed rulemaking (NPRM) that, among other provisions, responds to a longstanding EAA request to allow time logged with a flight instructor with a sport pilot rating (sport CFI) to count toward higher ratings. Current FAA policy only allows time logged with a sport CFI to count toward the sport pilot certificate, whereas time logged with a traditional CFI toward a sport pilot certificate can also be applied toward the dual training requirements of higher ratings such as the private pilot certificate.

The FAA's NPRM allows time with a sport CFI to count toward up to half of the dual requirement for higher ratings, although the agency also noted it was willing to consider allowing unrestricted credit for such time. EAA urged the FAA to implement the latter option.

In our comments we wrote, "There is no safety benefit to the limit [on credit for hours proposed in the NPRM]. The light sport certificate provides the pilot with the same fundamental knowledge that any other certificate is built upon, and a [sport CFI] is equally capable of delivering instruction on any of these points as any other CFI."

EAA also noted that requiring students and designated pilot examiners to sort out which instructors have particular ratings is a record keeping and administrative burden, particularly if a student resumes training at a later point and is unable to verify if a former instructor is a sport CFI or otherwise.

We are very happy that the FAA took action to fix this shortcoming in the sport pilot rule. We hope that the agency will adopt a straightforward and common-sense approach to crediting hours toward higher ratings, and not needlessly overcomplicate the process.

EAA GETS IT DONE

BY SEAN ELLIOTT, EAA VICE PRESIDENT OF ADVOCACY AND SAFETY

EAA'S ADVOCACY WORK CONTINUES to be one of the top reasons members belong to EAA. The organization has maintained a solid reputation of accomplishing good things for general aviation and grassroots flying. 2016 has proven to be a terrific year for EAA with several major wins for the good of GA and the EAA membership.

First on the list has to be our success in medical reform. This monumental accomplishment took both EAA and AOPA years of hard work to finally provide relief to recreational pilots who currently are burdened with an onerous medical process. This came at the same time we successfully pushed back against ATC privatization that some in Congress wanted to tie to medical reform. Some GA pilots had already given up but now have a way to re-engage in flying. Other aviators want even more, such as a pure "driver's license medical." EAA will continue to pursue solutions along those lines as well.

The EAA Accessible Safety STC has provided a landmark change in access to affordable avionics and safety equipment for standard category aircraft. Announced at the Sun 'n Fun International Fly-In Expo in April, this new EAA STC has changed the landscape to bring lower cost equipment to the typical GA aircraft owner. Our first partner, Dynon, has the D10A, which is a terrific EFIS display that brings a whole new level of situational awareness to the cockpit. Replacing the old vacuum-driven gyro, this technology brings a fantastic upgrade in capability with a price tag the average owner can easily reach.

Our members' ability to construct homebuilt aircraft, restore type-certified aircraft, and make a friendlier social setting has been a challenge within FAA airport hangar use policy over the past decade. In June, we finally saw the release of a new hangar use policy that incorporated much of EAA's feedback on what is truly important in defining an "aeronautical activity" for airport management. Airport managers across the country now have much better guidance with which to evaluate tenant activities and if they meet the intent of FAA airport grant funding.

There are many other smaller wins such as stadium overflights for experimental aircraft, FAA Order 8130 updates, and numerous other policy or individual accomplishments. The bottom line is that EAA is your organization that does indeed Get It Done! EAA

EAA Chapter Building Airplane for Pilots with Disabilities

EAA CHAPTER 1083 AND John Robinson, the founder of AV84all.org, have banded together to build a Zenith CH 750 Cruzer in Salisbury, North Carolina. At press time, the EAA chapter members planned to launch the Zenith build on September 10, 2016, at Rowan County Airport (KRUQ).

Chapter 1083 was formed in 1993 and serves to encourage participation in aviation-related programs and to help others experience the thrill of flight. The chapter is committed to assisting AV84all.org with this build, and is looking forward to creating a new flying club full of fellow builders, pilots, and enthusiasts in the area. EAA Chapter 1083 President Jack Neubacher, EAA 307007, said, "When I was first contacted by Zenith about helping John with this special project, I felt it was a great chance to help with one of the most important missions of our chapter — to encourage, educate, and promote aviation for all."

Robinson is excited about what the group build project will do for his organization. "EAA Chapter 1083 is literally making a dream come true for AV84all.org," he said. "Without their help it would take a lot longer to get this project off of the ground, and they are making flying for the disabled a reality." Robinson earned his pilot certificate through the Able Flight organization in 2015. After obtaining his certificate, he wanted to continue on the journey of making general aviation accessible for all people with disabilities.

He formed AV84all.org as a nonprofit organization, and this group-build project is the first step in allowing pilots with disabilities to form a flying club. Other future goals for AV84all.org include a ground school, trial flights, flight training, simulator sessions, and more.

Executive Director of Able Flight Charles Stites, EAA 340352, is optimistic about the opportunities this project will establish for people with disabilities in many different areas. "It's wonderful to see this project come together, not as an Able Flight project, but as an initiative of someone who has been through our program," Stites said. "And it's especially gratifying that Zenith Aircraft, a company that also supports Able Flight, has generously chosen to work with EAA Chapter 1083 to help make this possible. I am hopeful that the success of this project will inspire similar efforts throughout the country."

Zenith Aircraft will provide an engineering review to help customize this Zenith CH 750 Cruzer to better fit the needs of the pilots with disabilities involved in this project. "One of the wonderful things about experimental amateur-built airplanes is they can be fully customized by the builder to make it one of a kind," Sebastien Heintz, owner of Zenith Aircraft, said. "The new EAA Maker Edition of SolidWorks is a tool that will be used for the customization of the needed hand controls for this group build project. This computer-aided design software offers a huge advantage to the owner/builder/pilot when building their own aircraft, and especially for those who have a specific purpose in mind."

For more information about this project, see This Month's Extras at *www.EAA.org/sportaviation* or call John Robinson at 704-302-3276.

HYBRID AIRSHIP FLIES IN U.K.

FOLLOWING THE COMPLETION OF indoor testing, the gigantic Hybrid Air Vehicles Airlander 10 airship successfully completed its first flight at Cardington Airfield in Bedfordshire, United Kingdom, on August 17. Chief test pilot Dave Burns said, "It was a privilege to fly the Airlander for the first time, and it flew wonderfully. I'm really excited about getting it airborne. It flew like a dream."

In addition to helium for buoyancy, the Airlander 10 uses a combination of vectored thrust from four 325-hp diesel engines and aerodynamic lift to carry payloads exceeding 20,000 pounds for days or even weeks at a time. At 302 feet, the Airlander 10 will be the longest aircraft currently flying, besting the Antonov An-225 by nearly 30 feet, and will be used for a wide range of communication, cargo carrying, and survey roles in both the military and commercial sectors. While the aircraft was damaged after what was described as a "heavy landing" on its second flight, testing is expected to resume shortly.

GONE WEST: SCOTTY WILSON

EAA WAS DEVASTATED TO learn that Scotty Wilson, EAA 572551, lost his life in the crash of the remarkable Bugatti 100P replica. Scotty, 66, of Broken Arrow, Oklahoma, was a fighter pilot in the U.S. Air Force for 25 years before taking on the herculean task of re-creating the unusual late-1930s airplane, starting several years ago.

Scotty was a regular visitor to EAA, spending several days here in the fall of 2009 studying and taking precise measurements of the original Bugatti 100P, which is on permanent display in the EAA AirVenture Museum. He returned several times, proudly displaying the then-unfinished replica during AirVenture, and educating and inspiring a packed house when he told the airplane's story during EAA's annual Wright Brothers Memorial Banquet in 2013.

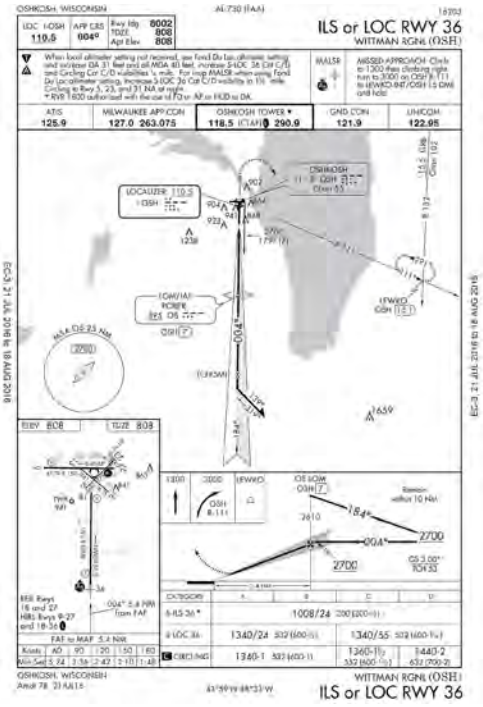
As those familiar with the story know, the original airplane was never flown; Bugatti's plans for its use to set speed records were derailed by the onset of World War II, and the airplane was set aside and largely forgotten. Scotty first learned of the airplane while training in the F-100 Super Sabre, when he came across a story in a 1973 issue of *Air Progress*. The sleek and mysterious 100P struck a chord, and 35 years later when he saw it in the museum, he knew he needed to re-create it. Scotty later said that he took on the project because he was "retired and looking for something to do rather than get old and fat and lose my mind."

Seven years — and more than 10,000 man-hours after his first glimpse of the original, his team watched as Scotty made the triumphant first flight of the replica on August 19, 2015. Ever the engineer, Scotty downplayed the flight as "anticlimactic." The second flight came in October of 2015, after which he and his colleagues were focused on preparing the airplane for display in a museum in Great Britain. The accident, which is currently under investigation, occurred on August 6, 2016, on what was reportedly intended to be the aircraft's final flight.

IFR PAPER CHART PRICE INCREASES COMING

THOSE OF YOU WHO fly IFR and use printed charts, take note: Costs are expected to rise significantly in the next few months. This change applies specifically to terminal procedures publications (TPP), which include instrument approach procedure (IAP) charts, departure procedure (DP) charts, standard terminal arrival route (STAR) charts, airport diagrams, as well as takeoff, radar, and alternate minima textual procedures.

Word of the projected increase comes from Michael Wolf, president and CEO of Sporty's, who said not only is wholesale pricing increasing dramatically, but that resellers will be required to pay shipping as well. "The FAA has been subsidizing the TPP to keep the price reasonable for safety, but now, going private, the price is going up," Wolf said. While details aren't final, Wolf expects retail prices for printed TPP from any vendor to nearly double, beginning with the November cycle. *EAA*



For more information and direct links to Flightline stories, visit *www.EAA.org/sportaviation*.

Homebuilt Innovation on Display

The Mojave Experimental Fly-In

BY BETH E. STANTON

The whole fly-in is based around the concept of experimentation: design, build, and test. —Justin Gillen

LOCATED IN THE REMOTE southern California desert, 15 miles northwest of Edwards Air Force Base, is the Mojave Air and Space Port. In 80-plus years, it has evolved from a rural airfield into a world-renowned flight research center, with a rich history as a homebuilder hotbed. It was here in the 1960s that Burt Rutan, EAA Lifetime 26033, founded the Rutan Aircraft Factory. Mojave is now home to dozens of companies specializing in research, aerospace design, and flight testing such as Scaled Composites, XCOR Aerospace, and Virgin Galactic.

In 2012, Scaled Composites was ramping up for its Stratolaunch program and needed more engineers. It tasked design engineer, test pilot, and "hard-core homebuilder" Elliot Seguin, EAA 841245, to bring in new talent. Instead of going to career fairs, Elliott decided to bring the career fair to Mojave. "The concept was Willy Wonka opening the gates to the chocolate factory," he said. College students came from around the country to attend. They hired 80 new engineers. The following year, Elliot had an inspired idea. "This airport, by its mission, needs to be closed. To do research like this, you need to have a little bit of privacy. But what if the whole airport gathered together on this one day when we can show off Mojave to the community?" he asked. The Mojave Experimental Fly-In was born. "It was an excuse for me to call the coolest guys I could think of, my heroes — Gary Hertzler, Robbie Grove, Lee Behel, John Parker, Jim Rust — guys I just wanted to be around," Elliot said. "I called them and said, 'We're having this event; you've got to come. Can you bring an airplane?' You'd be able to stand next to them and listen to them talk. *That* would make an event worth my time."

Kevin Eldridge, Best Design, FADEC iE2 Lycoming IO-540 engine on Lancair Evolution demonstrator.

PHOTOGRAPHY BY **EVAN PEERS**

"Mojave is like EAA for the little guy. Compared to Oshkosh, it's much smaller. You can check out the projects in more detail. The people that come here get more of a spotlight on projects that are cool for experimental reasons." – Justin Gillen

DESIGN, BUILD, TEST

Elliot's original vision when he conceived of the fly-in was to draw from the global homebuilding community and to bring the coolest, best experiments to Mojave since Mojave is the homebuilder's mecca. *– Justin Gillen*

Now in its fifth year, pilots and enthusiasts flock to the Mojave Experimental Fly-In to display their airplanes, set records, and swap ideas. Justin Gillen, EAA Lifetime 1017487, test pilot and engineer in charge of developing the fuselage segment of the Stratolaunch carrier aircraft at Scaled Composites, coordinated the fly-in this year. "Mojave is like EAA for the little guy," Justin said. "Compared to Oshkosh, it's much smaller. You can check out the projects in more detail. The people that come here get more of a spotlight on projects that are cool for experimental reasons." A highlight of the weekend-long event is the Experimenter Awards. Categories of Best Design, Best Build, Best Test, Best Effort, and Experimenter of the Year represent the phases of experimentation. A panel of judges interviews the experimenters and inspects their projects. Elliot believes that certain personality traits determine an engineer, designer, builder, or test pilot, but that by working together, each group can improve. "You say, I'm naturally an engineer, but I'll be a better engineer if I can build. ... That's the concept that gets me fired up in experimental aviation." Since these guys mostly work on their projects alone after work in their spare time, the cross-pollination of ideas is galvanizing.

Joe Coraggio, EAA Lifetime 563242, built a highly modified Long-EZ that he calls the *Garaggio-EZ* (a play on words between the garage where he built it and his last name). He described what makes this event unique. "One of the coolest things about Mojave is the high caliber of people who are out there and what they care about," he said. "It's not the expensive paint job or interior, but the innovative nature of people willing to break the mold, and not just doing it haphazardly, but with engineering and science behind the whole design, build, test concept. That really opens up the door to a group of people who I don't think are recognized."

2016 MEFI EXPERIMENTER AWARD WINNERS

The Experimenter Awards are about celebrating the great work that everybody does and making sure that the teams behind the scenes get recognized for the awesome work that they do. *– Andrew Findlay*

BEST DESIGN

Kevin Eldridge of Lancair with the first full authority digital engine control (FADEC) on a piston-driven iE2 Lycoming IO-540 engine on the Lancair Evolution demonstrator.

Craig Henry and Joe Coraggio, Best Build, modified Long-EZ, aka Garaggio-EZ.

BEST BUILD

Joe Coraggio modified a stock Long-EZ with the goal of racing in the 2016 AirVenture Cup. He made about 30 modifications to the plane to make it as fast as possible, the most noticeable being the blended winglet. He created a radius between the horizontal and vertical sections in an effort to reduce intersection drag.

Justin described the results as "freaking beautiful."

Adam Burch and Rian Johnson, Best Test, Van's Aircraft RV-14.

BEST TEST

Rian Johnson, EAA 600116, of Van's Aircraft. The new RV-14 had some issues after initial flight testing. In true homebuilder fashion, a solution was found using balsa wood from a hobby store. A reverse trailing wedge modification to the elevator fixed the problems. Rian explained, "Control surface design is somewhat like black magic. It's all about the little tweaks and knowing how to tailor things."

BEST EFFORT

Tom Siegler , EAA 435722, is restoring a Cosmic Wind and brought his project to Mojave in a U-Haul trailer. The Best Effort award goes to the person who traveled the farthest, pushed the hardest to get something done in time and didn't quite make it, or put in the most effort to be there.

Andrew Findlay of One Moment Air Racing Team, Experimenter of the Year, describing mods to his Lancair Super Legacy, Race 30.

EXPERIMENTER OF THE YEAR:

Andrew Findlay, EAA 1034372, of One Moment Air Racing Team, Lancair Super Legacy Race 30, for three project modifications. The Blackworks group at McCauley designed a new propeller specifically for Reno air racing. Other mods were a new air intake design made in part with 3-D printed parts wrapped in carbon fiber, and a fuel system modification allowing large fuel flows at reasonable fuel pressure.

"Control surface design is somewhat like black magic. It's all about the little tweaks and knowing how to tailor things." – Rian Johnson

MAKING AVIATION COOL AGAIN

Andrew described Mojave as, "A cool way to celebrate and share all the awesome stuff that is going on in aviation. Some racers are secretive and don't share anything. The way I see it, the faster I go and the faster *everybody* goes, it's good for the sport. At the end of the day, nobody is making money racing airplanes; we're just out there having a good time. If we can push each other to do better, that's what it's all about." The energy at the Mojave Experimental Fly-In is electric. Words like "cool" and "awesome" are used repeatedly with hand-waving excitement. Andrew pointed out, "In general aviation, we always ask how do we get more people involved, how do we get young people excited, how do we share aviation with more people? We do it at EAA, Reno, and Mojave. There is still a lot of really cool stuff going on. Any way we can share that is good." Elliot's incandescent energy and enthusiasm is contagious. He proclaimed, "I didn't start this event because I wanted to be an event planner, but because I wanted to make it easier to be a homebuilder. I wanted to give you a reason to come here and meet these guys. How could you not get excited about this?"

The next Mojave Experimental Fly-In will be held April 14-16, 2017. EAA

Beth E. Stanton is a competition aerobatic pilot and president of Northern California Chapter 38 of the International Aerobatic Club. She can be reached at *bethestanton@gmail.com*.

PHOTOGRAPHY BY **EVAN PEERS**

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STEVE KROG
COMMENTARY / THE CLASSIC INSTRUCTOR

So You Want to Fly a Taildragger

Part three: Wheel landings

BY STEVE KROG

WHY WHEN MENTIONING WHEEL landings to a tailwheel pilot do they get glassy-eyed and question my sanity? The wheel landing should be nothing to fear, but more often than not it does cause a serious case of sweaty palms. Why? In most instances it's because the tailwheel pilot seldom practices this type of landing.

The wheel landing has its place depending upon the landing conditions, wind direction, and make and model of the aircraft being flown. To earn a tailwheel endorsement, a pilot must be able to satisfactorily demonstrate both the three-point/full-stall landing as well as the wheel landing in both normal and crosswind conditions.

Recently I had the opportunity to teach wheel landings to a student in his Taylorcraft. He had mastered the three-point landing and was ready for the challenge. Wind conditions were 220 degrees at 9 knots with gusts to 15 knots. Turf Runway 18 was selected.

SETUP AND APPROACH

The setup for a good wheel landing begins at midpoint of the downwind leg of the traffic

PHOTOGRAPHY BY JIM KOEPNICK

pattern, as described previously for the three-point landing. Altitude is stabilized, the radio call is made stating our position and intention, then carb heat is applied, and as we reach a point abeam the runway end markers (or numbers) power is reduced to approximately 1700 rpm. Pitch or nose attitude is positioned for 60-65 mph. Don't make the mistake of chasing the airspeed indicator as it lags behind the airplane by two to four seconds. Position the nose and let the airspeed adjust to you. At about a 45-degree angle from the runway end centerline, initiate a coordinated descending left turn to the base leg, re-evaluate altitude (does it feel like we are high, low, or about on the desired glide path?), check traffic to the right (for the unannounced straight-in pilot), then plan and make the descending turn to final.

The approach to a wheel landing is near identical to a three-point landing. Where it begins to differ is on short final — at about the same time back pressure is applied to level off, arresting the rate of descent, and power is generally reduced to idle.

While on approach, adjust power as needed to maintain the glide path in a 60-65 mph attitude. If the wind is gusting or the velocity is stronger than anticipated, slight power application may be needed to remain on path. If the winds are light, or even calm, power may need to be reduced to idle.

If a bit of power was added on short final, leave it alone until after leveling off and breaking the rate of descent. Maintain slight back pressure and gradually reduce the power. Do not let the airplane drop to the runway but rather try holding it inches off the runway. As it slows, lift is reduced and the airplane will gently settle onto the runway. As the wheels skim the runway surface, relax the back pressure you are holding, then apply just enough slight forward pressure, creating a slight but positive downward load on the main gear.

A good measure to determine how much forward pressure to use is being able to see over the nose of the aircraft. This does two things. First, it keeps the main gear in contact with the runway preventing the airplane from bouncing or "skipping" down the runway. And second, forward control stick pressure keeps the tail in the air. Directional control is maintained by the flying tail and rudder. Tap the rudder pedals as needed to keep the aircraft tracking a straight line on the runway.

With the tail in the air, the wings are in a neutral or near negative angle of attack. In this attitude they will not generate lift if encountering wind gusts, making for a safe rollout. As the aircraft slows, the tail will begin to settle. As it touches down, apply full back pressure on the stick or yoke, causing the

elevator to provide downward pressure, keeping the tail wheel firmly on the ground for good and safe directional control. Continue flying the airplane until coming to a stop. A majority of tailwheel landing accidents occur after the aircraft has assumed the three-point attitude on the rollout.

If while on final approach you reduced power to idle while maintaining 60-65 mph, you may find it necessary to add 50-100 rpm as you level the airplane. This action helps break the rate of descent while also providing a bit of forward thrust, giving you more time to relax and set up for the desired smooth touchdown. Should you add a bit too much power, keep the airplane stable but inches off the runway. Slowly reduce power until the main gear makes contact. Forward stick or yoke pressure is then applied while reducing any remaining power to idle.

For a heavier tailwheel airplane I recommend modifying the landing slightly. Recently, I had the opportunity to check out the new owner of a Stinson L-5. It is a great airplane but considerably heavier than a Cub or Taylorcraft. The procedure I prefer to use for a wheel landing in the L-5 is to make the approach as described above, but upon touching the main gear on the runway, reduce any power being carried and don't try to keep the tail in the air. Rather, let it settle and come down. By doing so two things are accomplished: first, the aircraft, being much heavier, is not going to generate enough lift to come back off the runway once in the tail-low attitude. Secondly, the wings will act as speed brakes helping to slow the aircraft more quickly.

If you apply a lot of forward pressure, keeping the wings level and the tail well off the ground, the L-5, or most any heavier tailwheel airplane, will roll for several thousand more feet.

Many airplanes have their own unique handling characteristics. I highly recommend talking to a person with experience in the type and model aircraft in which you are about to attempt wheel landings, as the aircraft may have some peculiarities you'll want to be aware of. Knowledge followed by experience leads to a safe, fun, and challenging flight.

If you own a light single-engine tailwheel aircraft but are leery of wheel landings, I'll offer up these suggestions:

- Try to practice the first few attempts on a turf runway if possible. The turf is a much more forgiving surface on which to practice while perfecting your wheel landings.

- Fly the approach, level off over the runway as you would for a three-point landing, but rather than touching down, add power and keep the airplane a foot or two above the runway. Fly the length of the runway, then go around. This will help develop a good sight picture as well as help to relax your calf muscles.

- Fly a few approaches holding the airplane inches off the runway and don't allow yourself to push the stick or yoke forward and force the airplane onto the runway. This will induce some spectacular bounces that usually require making a go-around.

- When you plan to touch down the first time, think ahead, knowing it will only be for a second or two followed by a go-around. Try this two or three times. Be prepared to apply right rudder offsetting torque and P-factor when full power is applied.

- As you get more comfortable with the approach and smooth touchdown, roll along on the runway for a thousand feet or so, then go around. You may need to add a little power to keep the tail up allowing you to see over the nose.

- Finally, do a wheel landing to a full stop after practicing the touchdown and go-around method mentioned above. You'll find that with a bit of practice, wheel landings are a lot of fun and slightly challenging but very safe to perform.

CAUTION

Never take your eyes off the runway edge as you roll out. I taught myself a very good lesson decades ago when after making a near perfect wheel landing, I looked at my pilot friend, Stephen DeLay, who was riding with me. The Super Cub I was flying decided it had a mind of its own at that instant and proceeded to demonstrate its S-turn abilities until finally coming to rest on its nose in a snowbank. The end result was a slightly bent prop, a very badly bruised ego, and a loss of confidence that took hours of flight to regain. Now, more than four decades later, it has never again happened.

Flying a tailwheel airplane is not only fun but also offers a bit more of a challenge than flying a tricycle-gear aircraft. I'm firmly convinced, based on my experience with students, that mastering a tailwheel aircraft will make a better, smoother, and more coordinated pilot. EAA

Maintaining light back pressure, the main gear gently touches down. Note the position of the elevator. Slight forward control pressure is applied neutralizing lift.

PHOTOGRAPHY COURTESY OF STEVE KROG

Steve Krog, EAA 173799, has been flying for more than four decades and giving tailwheel instruction for nearly as long. In 2006 he launched Cub Air Flight, a flight-training school using tailwheel aircraft for all primary training.

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J. MAC MCCLELLAN
COMMENTARY / LEFT SEAT

Flying for the Cycle

Airplanes made the difference in my life

BY J. MAC MCCLELLAN

ONE OF THE MOST uncommon feats in baseball is hitting for the cycle. To hit for the cycle a batter must hit a single, double, triple, and home run during one game. The "natural cycle" when the batter gets the hits in order of single through home run is extremely rare.

I was a mediocre baseball player in school, at best, but as I look back I see that I have been able to fly through the big cycles in life. It's hard to say exactly when I flew for the single or triple, but I know airplanes played a key role every time.

The first hit — and maybe the home run because all others followed — involved a Beech Baron, a winter flight in 1979 from Florida back to New York, and this time as a passenger. It was my seatmate that mattered, and it was the Baron that made the difference.

A group of us from what was then the Ziff Davis Publishing aviation division, which included *Flying* magazine and *Business & Commercial Aviation*, had flown to Vero Beach where Piper was announcing several new models. One of the people on the trip was Stancie Lane.

Stancie and I had both come to work for Ziff and the aviation magazines in 1976. She was in sales, and I was a lowly editor. In fact, she was the first publisher of a daily newspaper at Oshkosh starting in 1977. But I thought she was pushy and loud and a little flamboyant. In other words, from sales. She thought I was a dweeb — this was before nerds — who spent all of his time thinking about and flying airplanes. Many of you can remember the old saying that when we pilots were around other pilots we only talk about girls. When we were around girls, we only talk about airplanes.

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DAHER

Other than the natural antipathy between sales and creative types, we didn't actively dislike each other. But Stancie and I certainly didn't find the other to be interesting.

The Baron trip changed all of that. A Baron is very comfortable as GA airplanes go, but you're still close together, and the only person in this pre-intercom era you could talk to was sitting next to you. So we talked. The heater quit halfway to New York, and we shivered and talked. By the time Jack Olcott, who was then editor of *B&CA*, landed at LaGuardia and dropped us off we had each decided the other one wasn't so bad after all.

Among the early flights together one I remember most was a trip out to Kansas City where we planned to relocate. There were, as usual, a bunch of thunderstorms over West Virginia, and I flew through what the controller saw as a "soft spot" on his radar. The wings on the A36 Bonanza we were flying stayed on, though there was a moment of doubt, but the real annoyance was the stall warning started to blow and wouldn't stop. The airplane had those flush circuit breakers you couldn't pull so we listened to that darn horn for the next two hours. The heavy rain had shorted the stall vane on the wing.

Our most important early flight together was on the way from Los Angeles back to Kansas City in a Mooney 231. We landed at McCarran in Las Vegas and told the cab driver who picked us up at the FBO that we wanted to get married and not waste any time. The cabbie took us to the license place, to the world famous Chapel of the Bells, and back to the FBO. It all took about an hour and 45 minutes.

We had long intended to get married in Vegas because we admired the way they cut through the clutter of the whole event. Plus we were pretty much leftover hippies who didn't then admire the pomp and circumstance of previous generations. And we were able to combine a wedding and a fuel stop. That's flying efficiency any pilot can admire.

You can imagine the next hit in the cycle, a baby. By then we had bought an Easter egg blue Mooney 201. Neither of us really liked the color, but we couldn't agree on the other hues Mooney offered in 1981 so we compromised on the light blue.

With baby Karen less than 3 weeks old the mission was to show her to grandparents, first in Austin, and then in Freeport, Illinois. I don't remember much about what the grannies thought of the new baby, but I do remember the mountain of stuff required to fly an infant.

Our Triumph Spitfire and Ford Mustang had surrendered to a Chevy Malibu station wagon for baby transport. By the time Stancie gathered everything she wanted to travel with the infant the station wagon was full. I carped and moaned all the way to the airport that it was too much, it wouldn't fit.

But that little Mooney swallowed the entire load. I think it was because Mooney baggage doors hinge at the top of the fuselage and you drop stuff in instead of pushing it in sideways. I still can't believe it all fit.

The other flying with baby trip that stands out in my memory was from Austin to Tucson. I was in initial Learjet pilot training at Tucson, which at the time took three weeks. For the third week I flew over to Austin to pick up Stancie and the baby at granny's and fly them back to Tucson to spend the week lounging around the hotel pool. It was August.

We've been fortunate in many ways, for sure, and being able to fly ourselves for life's big cycle events is right at the top of the list.

If you have flown over the southern deserts below FL 390 on a summer afternoon, you know the drill. It is the most miserable, awful flying imaginable. The turbulence is mostly moderate, and worse, it's constant. I looked over to see Stancie, now pregnant with Martha, and baby Karen both barfing into the same bag. I offered to land, but she pointed out that wouldn't get us to Tucson. Oh the glamorous life of a general aviation family.

The next big hit in flying for the cycle came about 17 years later when it was time for Karen to pick a college. I said all schools within unrefueled range of our Baron 58 could be considered. That was a pretty big circle from our New York base. The final choice came down to the University of Michigan and North Carolina at Chapel Hill. A visit to the mud and snow of March in Ann Arbor followed by a flight to the sun and flowers and kids in T-shirts and shorts in Chapel Hill settled that.

Two flying memories of the many trips to Chapel Hill loom large. First was move-in day for freshman on a boiling August afternoon. Karen drew the ninth floor of a dorm with only two elevators. That I didn't keel over from a heart attack on those stairs in that heat was a miracle. But so was the flight back to New York.

It was before Garmin and then others brought us satellite weather radar in the cockpit, and there were thunderstorms everywhere. I had a radar in the nose of the Baron that could see thunderstorms at maybe 30 miles, so I kept turning to avoid the cells on the radar while trying to work our way to the north and east. We had the airspace to ourselves because the storms were so widespread the airlines and high-altitude traffic were on the ground because the major terminals were all affected.

It was before 9/11 and the controllers were able to authorize deviations in any direction, even when we flew into Washington approach control airspace. There was no GPS or moving maps yet, so I couldn't be sure of my exact position. As I turned further right to avoid a big red target on the radar, the Washington controller became ever more concerned. When could we turn back left? He kept asking. Finally, it was "you have to turn left now."

As luck would have it we just missed the cell and flew into a clear spot looking directly down at the Pentagon. Our deviation had aimed us right at prohibited area P-56 that covers the White House and Capitol building. If that had happened today, missiles may have been on the way to meet us.

There were many flights to Chapel Hill for games and Delta Delta Delta sorority parent events, but after four years the one I remember most was for graduation. An unusual-for-late-spring weather pattern brought days of low ceilings and drizzle. It was a happy event,

for sure, but still gloomy for such a beautiful part of the country. But when it was over and we climbed through a few thousand feet of murk, we broke out into clear sky that Tar Heel supporters have claimed as "Carolina Blue." That blue has looked so great on Michael Jordan and a host of other Heels stars, but never looked better than that day to me.

The fourth hit in the cycle happened this summer. Overlapping Oshkosh, in fact. And that was Karen's wedding on a beautiful golf course in Woodstock, Vermont. Karen and Dan's friends and assorted relatives were using all sorts of complicated and inconvenient transportation methods to get to Woodstock, but for Stancie and me it was a dirt simple three-hour flight in our Baron across southern Canada from Grand Haven, Michigan, where we live to Rutland airport in Vermont. It took less time than for the kids to drive up from their home in Connecticut. Needless to say, it was a topic of conversation among wedding guests and an eye-opener for most who didn't understand the utility and convenience of personal aviation.

The wedding went great, everyone was happy, and my new son-in-law demonstrated to me how much my golf game has degraded and how hopeless future improvement will be. And the flight home didn't disappoint in delivering yet another interesting trip.

There was an east-west cold front across New York state and the Great Lakes were generating a solid line of storms directly over the route we had flown a few days earlier. This time I had satellite weather in the cockpit. The storms were moving east-southeast so a deviation north into Canada looked shortest. But for a variety of reasons the satellite radar mosaic covers only the southern area of Canada near the U.S. border. I couldn't be sure that there was a lack of thunderstorms to the north, only that there was a lack of radar coverage.

So we turned south, almost to the southern Pennsylvania border, before being able to head back north well west of Cleveland to head home to Michigan. We didn't hit a big bump, barely flew in the clouds, and other than adding about 150 miles to the trip, everything went perfectly. What a difference from flying through that "soft spot" in the storms over West Virginia 36 years earlier.

We've been fortunate in many ways, for sure, and being able to fly ourselves for life's big cycle events is right at the top of the list. Maybe there are a few singles left to hit before I lock the hangar door for good, but flying for the cycle is enough for one lifetime no matter what comes next. EAA

J. Mac McClellan, EAA 747337, has been a pilot for more than 40 years, holds an ATP certificate, and owns a Beechcraft Baron.

PHOTOGRAPHY BY **GARREN POIRIER,** GARRENTEE PHOTOGRAPHY

Valve Care

Good habits keep oil flowing smoothly

BY STEVE ELLS

THE HUMAN HEART IS similar to a reciprocating airplane engine in one way; both use valves to control vital fluid pressures. Both Lycoming and Continental Motors engines use simple spring-loaded ball-and-seat type valves to control the engine oil pressure. In addition to the simple oil pressure relief valve there's at least one more oil system valve in every oil system designed to protect components and prevent oil cooler damage.

All oil pumps consist of two meshed gears that revolve inside the pump housing — one gear is driven, and it in turn drives the second gear. As the gears rotate, oil drawn from the sump is forced around the outside of the gears. Before it's circulated to the engine one of these valves comes into play.

High-pressure oil from the pressure side of the pump flows through either the oil screen or through the engine oil filter before the oil goes on to the engine.

Lycoming oil pump

Both oil screen assemblies and oil filters have filter bypass valves. What does a filter bypass valve do? It keeps oil flowing to the engine should the filter or screen become clogged by oil-borne contaminants. The oil-borne contaminants that clog engine filters and screens are almost always caused by the failure of internal engine parts such as the aluminum wrist pin plugs or main or connecting rod bearings.

When the filter or screen becomes clogged it's a sure thing that the engine will fail within a very short time due to the loss of oil cooling and lubricity at critical points in the engine.

A few minutes of operation may still be possible after the bypass valve opens and unfiltered (and contaminated) oil continues to circulate until engine failure.

The get-on-the-ground-now sign of impending engine failure is a dropping oil pressure and a rapidly rising oil temperature.

Hopefully none of us will ever experience an engine failure, but it's almost a sure bet that a number of pilots have unknowingly caused a filter (or screen) bypass valve to open because of a full-throttle-type engine start or the lack of engine preheating.

Continental says to preheat when ambient air temperatures drop below 20 degrees Fahrenheit. Lycoming says to preheat anytime the temperatures drop below 10 degrees F except for the O-320-H series and the O/LO-360-E series engines; the preheat trigger is 20 degrees F for these engines.

Many experienced pilots believe these limits are too low and start preheating whenever outside air temperatures are at 30 or 40 degrees F.

PHOTOGRAPHY COURTESY OF **STEVE ELLS**

Hopefully none of us will ever experience an engine failure, but it's almost a sure bet that a number of pilots have unknowingly caused a filter (or screen) bypass valve to open because of a full-throttle-type engine start or the lack of engine preheating.

OIL-PRESSURE RELIEF VALVES

The variation in the rotational speed of the oil pump from idling to full throttle and the fluctuation of viscosity of the oil because of temperature changes are compensated for by the tension on the pressure relief valve spring.

After the oil passes through the filter or screen the oil pressure relief valve controls the maximum oil pressure. Oil pumps are always oversized — this ensures that there will always be a more-than adequate supply of oil pressure and volume in all conditions. The spring-loaded relief valve can be likened to a hole in the main oil galley (tube) that is automatically opened to vent off too-high pressures. The "hole" opens when the oil pressure pushing against the "oil" side of a round steel ball exceeds the pressure applied to the other side of the ball by a spring. Engine oil pressure is adjusted by changing the spring pressure.

Lycoming wants an oil pressure of 25 psi at idle; Continental wants 10 psi. Low oil pressures may be caused by internal engine wear or by channeling off the oil-relief valve seat. These seats can be refaced in the engine without too much trouble.

Oil-pressure relief valves rarely cause any trouble. Occasionally a piece of debris gets caught between the ball and the seat; the symptom for this malady is lower-than-normal oil pressure. But unlike a major engine or oil system failure, the oil temperature will stay steady instead of rising. If this should happen, reduce power and land as soon as possible and get the relief valve cleaned.

Lycoming oil pressure relief valve

PHOTOGRAPHY COURTESY OF **STEVE ELLS**

Vernatherm

PREHEATING AND OIL COOLERS

The oil cooler used on the 150-hp Lycoming O-320 series engine must be capable of withstanding continuous pressures of 150 pounds per square inch and a proof pressure of a minimum of 400 psi. These numbers are far above anything pilots will ever see on an instrument panel gauge.

Yet oil coolers still burst — and this is almost always caused by extreme high-pressure spikes caused by failure to preheat the engine and oil cooler during cold weather.

Oil coolers are also equipped with valves; these valves, which operate much like the thermostat that controls coolant flow through an automobile radiator, automatically control oil flow through the cooler. At lower temperatures this temperature-controlled valve is retracted and cold oil bypasses the cooler. When the oil temperature increases to approximately 150 degrees F, the valve assembly — often called a Vernatherm after the manufacturer's name — will lengthen toward a tapered seat. At 180 to 185 degrees F the valve will be fully seated — sealing the bypass route and routing all the oil through the cooler.

Another feature of the Vernatherm valve is a spring that assists the bulb in seating the valve end. This spring has one other important job. In the event of an oil-pressure spike — a high-pressure surge — this spring will be compressed to open the bypass route to protect the cooler. It's critical to always preheat the oil cooler. This is a bigger problem on Lycoming engines where the coolers are most often remotely mounted.

If the cooler hasn't been preheated, the Vernatherm valve and seat may be damaged. As the engine warms up, the Vernatherm valve senses warm oil temperatures and will lengthen to seal against the bypass seat. This routes the warm engine oil to the cooler. If the cooler hasn't been preheated, this warm oil will bump up against exceedingly viscous cold oil in the cooler. At very low temperatures, the oil in the cooler will be extremely thick. This causes a pressure spike that exceeds the spring pressure against the valve of the Vernatherm, and the bypass path will open. This immediately drops the oil pressure and the valve then slams shut against the seat. This jack-hammering of the oil pressure at the cooler will cause the valve to hammer against the seat, and can also cause damage to the oil cooler. In extreme cases the cooler will burst.

What's the takeaway from all of this? Learn how to start your aero engine gradually; high rpm starts are one of the most destructive things you can do to an engine. Preheat the engine and the oil cooler when it gets cold. Consider using multi-viscosity oils during winter months; they aren't anywhere near as viscous as straight-weight oils. EAA

Steven Ells, EAA 883967, is an A&P mechanic, commercial pilot, and freelance writer. He flies a Piper Comanche and lives in Paso Robles, California.

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DAVE MATHENY

Tintinnabulation

Loud but not clear

BY DAVE MATHENY

"CESSNA EIGHT SIX THREE, stand down," said Crystal tower. I was on a right downwind for Runway 14 Right at Crystal Airport (MIC) in Minneapolis.

Uh, wait. Stand down? I keyed the mic: "Crystal tower, Cessna eight six three, say again?" I asked, trying not to sound like the kind of ignoramus pilot who doesn't know what "stand down" means. But I didn't know what it meant.

"Eight six three, Crystal, extend downwind." Oh! Well, that made sense. He had other aircraft on final for both left and right runways, and he was trying to keep us all well-separated. By extending my downwind leg, he would have me turning to base about the time the guy ahead of me landed. A big

ILLUSTRATION BY **DAVE MATHENY**

part of the problem was that 863, a rental Cessna 152, didn't have headsets with microphones. It just had a speaker in the cockpit and a mike you left in your lap, picking it up and shouting into it as needed. The speaker was cranked up to max so you could sort of make out what was being said despite all the ambient mishmash of noise, and you just had to live with the garbling. My brain had converted the phrase "extend downwind" into the even more familiar words "stand down."

Not long after that, I bought a pair of headsets with boom microphones and an intercom to plug them into, and sailed away into a bright flying future.

Our grandparents pretty much just lived with extremely loud, ear-damaging noises. I say that with some hesitation because in general I dislike the attitude that we know so much more today than previous generations. But in this one arena we have — I'm going to say it — wised up.

WE MODERNS ARE SO COOL

Our grandparents pretty much just lived with extremely loud, ear-damaging noises. I say that with some hesitation because in general I dislike the attitude that we know so much more today than previous generations. But in this one arena we have — I'm going to say it — wised up. Up until recent times, the loudest noises around would have been firearms, thunder, church bells, and that sort of thing. The culture has adopted hearing protection, but slowly.

Some years back, I was preparing to shoot a heavy revolver with an older in-law of mine and offered him a pair of cylindrically shaped foam earplugs, showing him how you roll one end between your fingers to compress it into a point, then insert it into an ear as far as you can, holding it there with a fingertip until it expands to fill the whole canal. He took one, stuck it in an ear, and gave me an expectant look. I could see it hanging half out of his ear, the inner end of the little cylinder still visible, obviously accomplishing nothing. He was just humoring me and didn't really care. "Good enough!" I said, realizing we were at a dead end. These days he wears hearing aids — although nature alone can cause hearing loss over the years.

The noise inside the cockpit of a single-engine airplane is in the 70 to 90 decibel range, according to an FAA brochure. The same source gives the sound of a power lawnmower or chain saw at 80 to 110 decibels.

If you can't make out what the controller just told you, you can't just nod and smile and walk on, as if he were some raggedy guy on the street ranting about the end of the world.

Exposure to loud, steady noise over 90 decibels for a short time, even several hours, may cause temporary hearing loss. Prolonged exposure to higher levels can cause permanent damage, and may go unnoticed for some time.

I wonder if Edgar Allan Poe ever experienced that kind of noise. When he wrote "The Bells," in the late 1840s, he made up the word tintinnabulation for use in the lines: *In a sort of runic rhyme, to the tintinnabulation that so musically wells, from the bells, bells, bells, bells ... from the jingling and the tinkling of the bells*. Maybe Poe overdid it when he researched his subject, spending too much time in a belfry and developing tinnitus — a faint ringing or hissing in the ears that can be caused by overexposure to noise. Which would account for the *jingling and the tinkling*. I've been fanatical down the years about noise avoidance, and maybe because of that I don't need hearing aids.

A TWOFER

A great thing about noise suppression is that it can come in the same package as clear communication. That is, if you have almost any kind of aviation headset, loud and extraneous noises will be suppressed so you can hear communications clearly. No doubt there's a scientific study out there somewhere, conducted at great expense, that says that it's better to understand what you are being told at the time you hear it than to have to figure it out, running various words and phrases through your brain until something makes sense. But we could have figured that one out for ourselves. Trying to sort through all the possibilities — "Sam dow," "Sen dow," "Sin dough" — while attending to the other actions necessary in landing an airplane is a bother. If you can't make out what the controller just told you, you can't just nod and smile and walk on, as if he were some raggedy guy on the street ranting about the end of the world.

But it's beyond bother, it's dangerous. Not understanding what the tower was telling me, I might have concluded that it was some garbled form of the call I was expecting, "Turn to right base for one four right," and wound up trading paint with the guy already on final for that runway.

SAY AGAIN?

The single-cylinder, 20-hp Zenoah mounted on my first aircraft, an American Aerolights Eagle, produced an absolutely hair-raising shriek at full throttle. Engine, exhaust, and prop combined into a banshee scream. Nature often gives us a clear alert when danger is near, and everybody within 30 feet instinctively ducked and backed quickly away when I went to full throttle. I used foam earplugs and a helmet to keep the sound manageable — not pleasantly hushed, just suppressed to less than hearing-damage levels. Given that I was the only one in the single-seat ultralight at the grass strip I used most of the time, there was never any question of needing air-to-air or air-to-ground communication. It was all see-and-be-seen, with a heavy emphasis on the first part, *see*, because you can never count on being seen. In my present Quicksilver GT400, I still use plain old earmuffs, not a headset, that have no electronic wizardry.

When I bought my Ercoupe, I dug up my old headsets, which still work beautifully — after much adapting and updating of connections — but they don't interface with my handheld radio well. So we can't yet enter towered airspace.

You can buy an excellent set of electronic noise-protection earmuffs for shooters for under $100. They are so effective that you can conduct a conversation with somebody standing a few feet away, while the muffs use some sort of electronic magic to reduce the sound of high-powered rounds to no more than that of snapping fingers. In fact, the wizardry somehow actually intensifies small sounds, so you can hear leaves rustling 15 yards away. But here's a strange thing: When it comes to aviation, most headsets cost anywhere from $800 to well over $1,000, even though the only apparent additions are a boom mike and a cord to plug into the radio or intercom. Even so, some headsets can be found for under $200. Whatever the price, having clear communication and not having your head stuck in a belfry are worth it. EAA

Dave Matheny, EAA 184186, is a private pilot and an FAA ground instructor. He has been flying light aircraft, including ultralights, for 34 years. He can be reached at *DaveMatheny3000@yahoo.com*.

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CHARLIE PRECOURT
COMMENTARY / FLIGHT TEST

Flight Test Safety on the Upswing?

Two years with no Phase 1 accidents since Additional Pilot Program

BY CHARLIE PRECOURT

I LEARNED A COUPLE of very good philosophies early in my flight-test career that made a big difference in safely getting through some hazardous aircraft tests. The first was "don't test something in the air that you can first test on the ground." Sounds simple enough, but you'd be surprised how many test plans get put together with test points in flight that aren't necessary because the data can be collected just as thoroughly on the ground.

I learned this lesson the hard way, directly from the commanding general of the Air Force Flight Test Center, when I was presenting a structural loads test plan for the F-15E. We needed to take the structure to 9*g* under a number of flight conditions to clear the new flight envelope. Our plan had made it through all kinds of pre-approvals, and yet he caught a very big miss with a simple question, "Can't you guys get that load margin data [on one of our subsystems] on a ground-test vibration bench?" He was referring to one of dozens of high-risk test points in a multi-flight program, but he was right, and my engineers and I were pretty embarrassed for missing it. In fact, gathering that data on a test bench would have given us information that decreased the risk of flying the other test points that could only be done in the air. I obviously packed that one away for repeated reference later in my career.

The second philosophy seems pretty intuitive and goes back to the earliest days of flight testing: "Do all test flying with only one pilot on board, or for a crewed aircraft, with the minimum crew necessary to fly the test." This seems intuitive, based on the idea that you don't want to expose any more than the absolute minimum of personnel to the risk of a flight test.

At EAA, when we began examining the idea of the Additional Pilot Program, this philosophy was the first dilemma we all had to address. We got there by opening up the assumptions that go into the philosophy in the first place. One is the assumption that typically you're testing an aircraft or a modification that hasn't flown or been cleared through its flight envelope, and there is uncertainty in how it will handle in flight. A second assumption is that the pilot flying will be someone professionally trained for test flying, and who has spent weeks and months alongside the engineering team developing the aircraft or modification and its required test plan, making that pilot more likely to safely handle any surprises.

It turns out in our amateur-built community those two assumptions don't really track. With regard to the aircraft, the vast majority of our experimental designs are no longer a brand new design, but rather a copy of an existing kit- or plansbuilt model that can reference the flight experience of many that precede it. What remains is the uncertainty of builder variations in their airframes. As for the pilot-builders, most would not have had an opportunity for professional test-flight training, and perhaps no experience in the type of aircraft in question.

So the philosophy can be challenged, which is what we chose to do, in working with the FAA to create the Additional Pilot Program. The program is now in its second year of operation under AC 90-116. The APP enables a builder to fly with an additional pilot who meets certain criteria relative to experience in flight testing and/or in flying the model in question. The additional pilot's experience combines with the builder's intimate familiarity with his or her airframe to form a team that creates a better Phase 1 test result. It also enhances the builder's own skills in flying the new machine under the guidance of a more experienced pilot, while ensuring the builder can also enjoy the thrill of the first flight and opening the envelope.

The result in our first two years has been superb — no accidents in Phase 1 flight testing for those using the program. A darned good result — so far. We still need more data and feedback from users of the APP to know where it may have problems and need further changes. In the Lancair community we are getting a lot of good feedback. The Lancair family of aircraft is among the most challenged with its safety record, and we know of eight pilots who have used the APP program with no accidents or incidents.

But one area we know will need to be addressed is the 40-hour (or 25-hour with certified engine installations) Phase 1 flight-time requirement. And that issue comes back to the first philosophy I mentioned. Establishing the correct flight-test plan and actually flying the required flight-test maneuvers to clear the aircraft through its flight envelope is far more important than logging 40 hours before taking passengers — whether clearing the envelope takes 15 hours or 60 hours to get the test plan done. Knowing what to test, in what order, and what should be done on the ground first were the questions we had to answer. So for the past couple of years we have been wrestling with a way to introduce a task-based approach to Phase 1 flight testing as a follow-on to the APP that will replace the 40-hour requirement.

We have created a handbook that provides a template for a generic experimental amateur-built aircraft with a sequence of flight tests that use a buildup approach to open the envelope and collect the performance and handling data necessary to build a full pilot's operating handbook. We call the approach "XP^3" for Experimental Plane and Pilot Performance. The XP^3 contains a series of 18 flight tests that flow from ground tests and initial engine runs through first flight, envelope expansion, stalls, climb, cruise, and descent data collection, and stability and handling characteristic determination. The user only needs to tailor it to his or her particular type, and the document provides guidance for doing that.

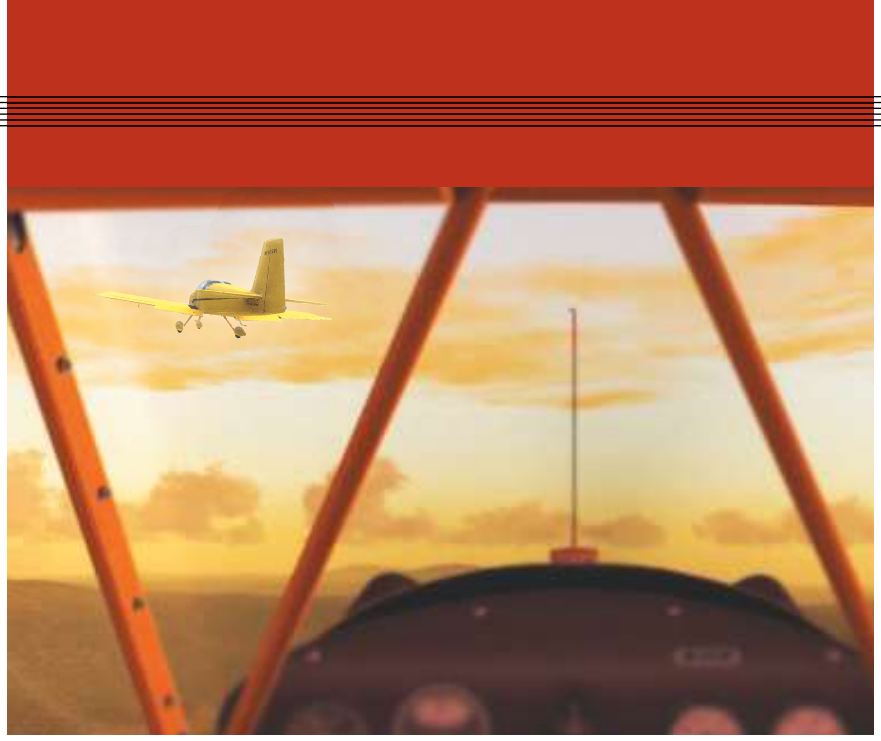
We have beta tested it with a few folks in the community and received great reviews. Paul Dye, editor of *Kitplanes*, wrote about his assessment of XP^3 recently, and he tells me his phone is ringing off the hook from folks wanting to get their hands on it. You can see his assessment of this topic at *www.EAA.org/sportaviation* under This Month's Extras.

Given that feedback and the logic of filling Phase 1 with value-added content (and eliminating droning in the sky to fill the 40-hour square), we met with the FAA at AirVenture this year to open up a process to move to the next step after APP: getting to a task-based Phase 1 program that we will base on the experience we've had creating XP^3. We have asked the FAA to work with us to issue an advisory circular based on the XP^3 content. Then completion of Phase 1 would be based on a logbook signoff that the test cards are completed; a more robust result than the current 40-hour rule. Along the way we still need your continued feedback on the new Phase 1 under the APP — if you've used it, please let us hear from you. Send your critique and thoughts about what we can do differently to our staff here at EAA.

Fly safe! EAA

Charlie Precourt, EAA 150237, is a former NASA chief astronaut, space shuttle commander, and Air Force test pilot. He built a VariEze, owns a Piper JetPROP, and is a member of the EAA board of directors.

LAURAN PAINE JR.
COMMENTARY / PLANE TALK



Aviation Courtesy

A safety technique in any airplane

BY LAURAN PAINE JR.

FAIR WARNING, THIS ISN'T going to be a warm and fuzzy column. Instead, it's a column about some things that need to be said. We're all in this aviation thing together so sometimes we need to address that which needs to be addressed.

It all started innocently enough when I attended an aviation safety seminar this spring. It was hosted by Willamette Aviation in Aurora, Oregon (UAO). Willamette Aviation is very proactive in sponsoring seminars, ground schools, learning sessions, all that good stuff. This particular seminar was geared toward aircraft home-builder safety.

I love the interaction with the other attendees. A topic comes up and all kick it around offering advice, experiences, and solutions. Good stuff! Scott McDaniels, who works in engineering for Van's Aircraft, talked about aircraft inspections. Many accidents are the result of inspectable items so, of course, those are important to discuss. Scott had photos of cracks and flaws and such found during inspections, many of which I wondered if I would have picked up on if it were my airplane. They were photos to make you think. And he also talked about something as simple as the inspection light you use: Use a good one! With all the nifty LED lights out there, there's no reason not to have one.

Then Dick "Van" VanGrunsven spoke. When he speaks, I listen. And so does everybody else. He has not only so much knowledge about experimental aviation, but also sincerity, humility, and passion. He talked about pilot loss of control, the cause of a lot of accidents. He believes in the new stall warning systems for experimentals and that they can help save lives. And he spoke of "stunt flying." You know the kind: low-level passes over the local runway and steep pullups, that sort of nonsense. That pilot may impress the uninitiated but seldom impresses his peers. It's just hogwash (my words, not Van's). One attendee suggested having a place online where pilots could report egregious flying. The peer pressure concept.

There's a quote in my book of quotations, *If Airplanes Could Talk*, that says, "Impromptu air shows for friends or relatives often result in death." I still stand by that quote. I'm reminded of the time when I was in U.S. Air Force pilot training that a T-37 instructor pilot was doing cloverleafs, unauthorized, over his grandparents' family farm and ended up crashing, 90 degrees vertical to the ground, in front of them.

Have you ever met a pilot who says he's dangerous? Probably not. It's like you've experienced a lot of bad drivers in your time, but you've never had one of those drivers tell you that *they* were a bad driver. It's *always* the other guy. Well, I'm going to tell you about a dangerous pilot. This came to me in a letter from a reader who is retired military and has a J-3 Cub that he absolutely loves to fly. He wrote:

ILLUSTRATION BY **BRANDON JACOBS**

I would like to tell you about a Super Cub fly-in I flew to this last weekend in northeast Oklahoma. Shortly after arriving I invited another pilot to fly to a different airport for fuel.

We took off and were flying over the river at about 500 feet when, from below and to our right, an RV streaked perpendicular across our path not 30 yards in front. Wham-bam! We immediately hit his wake as he flew up and to our left, where he turned and flew down to a few yards above our left wing. I'm sure he thought he was hidden by the wing, but my copilot in the front seat could see him in the skylight.

My copilot friend was visibly shaken. (He is a high-time commercial, multiengine, instrument CFI.) All the way back he kept saying, 'Damn RV drivers, I hate them! They're all like that!'

When we returned to the fly-in, after fueling, I had made up my mind that if the yellow RV was still there, I was leaving. I was honestly afraid of what I intended to do to the pilot if he was still there. He was there, and I packed up immediately and flew out.

Twenty years ago my copilot lost a good friend and mentor and his wife when an RV pilot making a similar strafing run plowed right through the middle of their airplane. Four killed. The day before, that same RV pilot strafed my friend when he was on final for another airport. Instead of making an issue out of it, my friend decided to shrug it off and say nothing. Twenty years he has been blaming himself for what happened that next day.

This time my friend found and confronted the Oklahoma RV pilot. The guy was unapologetic and laughed it off, acting a total jerk. After the confrontation, my friend and his wife packed up their airplane and left the fly-in as well.

I know from your column that you fly an RV. I wanted to ask, do you fly strafing runs like this guy? Reading your columns, I can't believe you do. But it's obvious that RV drivers have questionable reputations.

I fully intended to make some stops and fly to Oshkosh in July for the first time. But if this is the type of crowd a Super Cub/EAA fly-in gathers, I want nothing to do with it.

I don't know about you, but reading about the errant RV pilot got my dander up. (And my answer to the reader's question is, *No, I don't strafe unsuspecting pilots. Never would I do that!*) There is absolutely no place for crud like that! It's bad for you, it's bad for me, it's bad for everybody. And the reader is not a guy who scares easily: He served in the Army's infantry in the rice paddies and jungles of Vietnam — you don't do that unless you have character and courage. And the fact that the RV guy just blew it off makes him a dangerous pilot. Presumably, he's still out there — and unsafe.

Want to dogfight? Attend an air combat course, where they fly similar airplanes. Fancy yourself a low-level aerobatic pilot? Earn your low-level aerobatic waiver. Want to fly formation? Attend a formation clinic. Do not — *do not* — bounce a fellow pilot in a slower airplane who's out enjoying the scenery. That's bush league.

To the jerk RV pilot: There are a lot of warbird pilots who could do the same to you. But they don't because they act like professionals.

Aviation courtesy *is* a safety technique. Bottom line: We can't be our own worst enemy and survive.

Every airplane has its rights. Back in my airline days I used to chafe when we'd be at some big airport and a Cessna 172 would taxi by and a youngish first officer would derisively say, "What's he doing here?" (Never mind that the first officer was flying the same type airplane a year and a half ago before he got his airline job.) Airline cockpits are no place to start a fight so I'd usually just say, "He has every right to be here."

Aviation courtesy *is* a safety technique. Bottom line: We can't be our own worst enemy and survive. EAA

Lauran Paine Jr., EAA 582274, is a retired military pilot and retired airline pilot. He built and flies an RV-8 and has owned a Stearman and a Champ. Learn more about Lauran at his website, *www.ThunderBumper.com*.

ROBERT N. ROSSIER
COMMENTARY / STICK AND RUDDER

Training Day

Preparing for the real test

BY ROBERT N. ROSSIER

THE OTHER DAY A friend of mine called to let me know some exciting news. He had just passed the checkride for his instrument rating. I was impressed. After all, the instrument rating is not easy to earn. It takes a lot of time, study, training, and dedication. Some would say it's the hardest pilot rating to earn. So I was all on board to celebrate his achievement. But as he told me about his experience, his preparation, and how he handled the flight test, I reflected on the way we approach training and checkrides.

Earning certificates and ratings certainly ranks high in the milestones of a pilot's career, but passing a test — whether it be a checkride for a new certificate, or a regular flight review — is not the real measure of our piloting achievement. The real test comes the day that something goes wrong, and we're called upon to use the hard-won skills and knowledge to bring the flight to a safe conclusion.

On a cold day in January 2009 when Capt. Chesley "Sully" Sullenberger set an Airbus A320 down on the Hudson River with 155 passengers and crew, he passed the real test. Something went wrong — geese flying through the engines of the Airbus instantly converted it into a glider. He reverted to his glider flying skills combined with his

The real test comes the day that something goes wrong, and we're called upon to use the hard-won skills and knowledge to bring the flight to a safe conclusion

ILLUSTRATION BY **GARY COX**

experience and training in the Airbus. With the help of a well-trained first officer and crew, he executed a picture perfect ditching on the Hudson River. It was a scenario fitting of a checkride, only it was real.

Our approach to and attitude regarding training should reflect not just the immediate milestone we hope to achieve, but the real test — the one that comes upon us in a split second without warning.

REINFORCING PROCEDURES

When it comes to training and checkrides, the axiom is to train the way we fly and fly the way we train. The idea is to reinforce the procedures that we use in the type of flying we regularly do. It doesn't matter if our typical flying involves buzzing around the pea patch in a Champ on sunny Sundays or flying a pressurized Bonanza IFR in and out of high traffic density airports. Either way, we need some challenges to test and hone our skills. We need to review the details of how we fly and make decisions both on the ground and in the air. And we also need to review the abnormal procedures and emergencies that can arise while engaged in whatever type of flying we typically do.

Even the most experienced and best intentioned pilots aren't perfect, and so a review of standard procedures is important to finely hone any dull edges of skills and procedures. This includes use of checklists, scanning and collision avoidance, and radio calls. But it should also include decision-making and thought processes during takeoff, such as when do we retract the flaps and gear? When do we start our turn after departure? Do we maintain a sterile cockpit during taxi, takeoff, and climb? After all, it's inattention to these details that could precipitate bad outcomes when surprises come out of the blue.

Another aspect of our training should be to focus on the areas of operation that historically offer the greatest challenges. This might include crosswind landings, wind shear, or go-arounds, since these are situations and conditions that often result in bent metal and broken pilots.

ROBERT N. ROSSIER

Just as important as the skills themselves are the decisions we make that determine whether or not we need those skills. Do we wait and fly another time? Do we choose a different runway, or different airport? Do we continue to descend on final, or do we see the conflict developing and continue around the pattern again to avoid a possible go-around in the landing flare?

Our training also needs to reinforce emergency procedures. This includes the "big ticket" split-second emergencies such as loss of power on takeoff or an engine fire in flight. But even the "easier" problems require practice and training. In retractable-gear aircraft that includes all types of scenarios including gear that won't extend and gear that won't retract. We need to know the procedures for emergency gear extension, and be able to accomplish the task as per the checklist. But we also need to engage in the decision-making that goes along with real-life scenarios. Do I land at this airport or divert somewhere that has better facilities and resources? Do I land on the pavement or on the grass? Do I risk shutting down the engine(s) on short final to prevent damaging them during landing? Who can I call to get help sorting out the problem and maybe finding a better solution in the air?

We need to review the details of how we fly and make decisions both on the ground and in the air. And we also need to review the abnormal procedures and emergencies that can arise while engaged in whatever type of flying we typically do.

Another problem that might not seem as urgent at the outset is a loss of electrical power. Maybe we shed the load, conserve electrical power for the landing, and land at the nearest airport — simple. But loss of electrical power could precipitate more challenges. For example, we might not be able to extend the flaps, and so we have to make a no-flap landing. Or maybe we're flying at night under IFR, and we end up without lights, navigation, or communication. In this case, our hands are more than full.

THE DAY OF THE CHECKRIDE

We all know how to prepare for the checkride, and so we work hard to make certain everything is in our favor. We prepare mentally and physically. We study, review, and get a good night's rest. We get a thorough weather briefing, do the weight and balance, and check the aircraft weight and balance and performance. We do a careful and thorough preflight, taking our time and using the checklist. After start-up, we taxi slowly, check for traffic, get the proper clearances, and perform a thorough run-up.

On checkride day, we don't take shortcuts. We use the checklists, and every action is slow and deliberate. We're highly focused on safety, paying that extra bit of attention to the details, and pausing when we suspect a hidden trap. We're mentally prepared and ready for anything that comes our way. We're the best we can be. We've got a good attitude — an attitude we should take with us on every flight.

FINAL THOUGHTS

With that thought in mind, perhaps we should train more frequently. We can regularly practice the skills we need to meet the unexpected challenges, and we can exercise the thought patterns and decision-making we reserve for checkrides on each and every flight. In short, we treat every flight as if it were a checkride. If we find ourselves doing things on the day of the flight check that we don't do on a typical flight, then maybe we should ask ourselves why we don't fly the way we train, and readjust our attitude accordingly.

I'm all for celebrating milestones of achievement such as earning a new certificate or rating. The day we avoid disaster by doing things right when a situation goes wrong? That's the day to really celebrate. EAA

Robert N. Rossier, EAA 472091, has been flying for more than 30 years and has worked as a flight instructor, commercial pilot, chief pilot, and FAA flight check airman.

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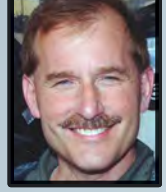


JEFF SKILES
COMMENTARY / CONTRAILS

The Tri-Motors

An era that will never be seen again

BY JEFF SKILES

IN THE DECADES SINCE the Wright brothers first flew there have been airplanes built with anywhere from no engine (gliders) to 12 engines (Dornier Do X). While the Dornier was certainly an aberration, there have been many airplanes designed and built with one, two, and even four engines. What hasn't been quite as popular, however, are airplanes built with three.

The term tri-motor will be forever associated with the venerable Ford Tri-Motor airliners, but other three-engined contemporaries of the Ford were built by Stinson, Boeing, Fokker, and Junkers. The early 1930s was the era of tri-motors. After 1935, however, three-engined airliners entered a period of dormancy lasting for 30 years until, in perhaps a last hurrah, jet-powered tri-engined airliners emanated from all three domestic manufacturers: Boeing, Douglas, and Lockheed. Today, however, tri-motors are relatively rare in the skies over the United States.

Single-engine biplanes first inaugurated what passed for passenger service in the early days of aviation, but the need for more payload and performance demanded an increase in the number of propellers spinning on the airframe. There were at least five different tri-motor airliners that were produced in number, and they formed the backbone of airline fleets in the 1920s and early 1930s.

PHOTOGRAPHY BY **TYSON RININGER**

FOKKER TRI-MOTOR

The Fokker F.10 was produced by the Fokker Aircraft Corporation of America. Powered by three Pratt & Whitney Wasp engines, it carried 12 passengers; the improved F.10A carried 14. As many as 65 were ultimately manufactured and flew for a number of airlines of the day. In appearance the F.10 was a high-wing aircraft much in the mold of the Ford Tri-Motor, but its construction was quite different. Anthony Fokker followed a design philosophy very similar to early homebuilt aircraft leading to a fabric-covered, steel tube fuselage married to a wing of wood construction. The Achilles' heel of his methods, however, was the plywood covering of the wing.

Knute Rockne will forever be paired with the Fokker tri-motor in historical record. He was traveling over Kansas when the wooden wing failed on the Transcontinental and Western Airlines Fokker he was flying in. The ensuing crash took the life of the gridiron coach. The investigation found evidence that water had gotten into the wing causing its glue bonds to separate leading ultimately to the catastrophic in-flight failure of the wing. After the accident the resultant rigorous inspection schedule required by government regulators, and the negative public perception of wood airplanes in general, doomed the design and led to the adoption of all-metal airliner construction extending to the present day.

BOEING TRI-MOTOR

In the late 1920s Boeing Airplane Company had a sister company named Boeing Air Transport that carried freight, mail, and passengers on scheduled routes. For this service Boeing manufactured the most luxurious of the tri-motors, offering three-across seating with two passengers on one side of the central aisle and one on the other. The first four Boeing Model 80s carried 12 passengers. The subsequent Model 80A, with larger engines and an extended fuselage, carried 18 passengers in as opulent surroundings as the aeronautical world had to offer. The Boeing 80's passengers enjoyed leather seating, reading lamps, cabin heat, forced air ventilation, and a lavatory boasting hot and cold running water. Boeing Air Transport even inaugurated a new class of employment as unmarried registered nurses formed the first cadre of stewardesses serving the needs of the traveling passengers.

The Boeing 80 was unique among the airline tri-motors in being a biplane, the extra wing surface was felt necessary to land at the challenging, high-altitude airstrips of the western mountain states. One variant was initially built with an open cockpit, although it was later modified to the standard closed-cockpit construction. Only 16 of the Model 80s were produced, and they worked exclusively for William Boeing's passenger and freight airline. The aircraft soldiered on in the service of Boeing Air Transport, later United Airlines, until 1934 when they were replaced by the all-metal, low-wing Boeing Model 247.

JEFF SKILES

STINSON TRI-MOTORS

Stinson actually built three tri-motors that were flown by a number of airlines. The Stinson airliners were smaller than their contemporaries and were designed for feeder rather than mainline routes.

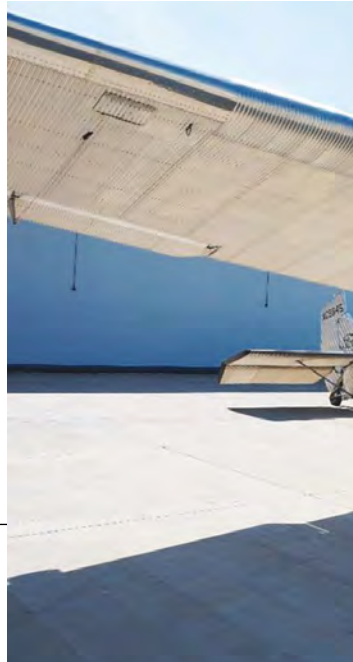
The Stinson SM-6000-B, also known as the Model T, was a 10-passenger, high-wing design looking very much like the Ford Tri-Motor but with more traditional construction. The aircraft had an enclosed cockpit, and the outboard engines were mounted on the main landing gear consistent with the design of the Ford. It was far lighter, however, with a gross weight of only 8,600 pounds allowing it to be powered by the relatively small Lycoming R-680, 215-hp engines. Ultimately, more than 50 airframes were produced before it was upgraded to the Model U.

The Model U Stinson was similar in appearance to the B but had the engines mounted on stub wings, called sesquiwings. The engines on the Model U were an upgraded version of the Lycoming R-680 producing 240 hp. The aircraft was a bit larger in all dimensions and a had gross weight of 9,300 to 9,400 pounds. More than 20 were produced before the design was eclipsed by faster all-metal airliners.

The Stinson Model A was an entirely different aircraft and was built to meet a request by American Airlines for a low-cost, short-field-capable, feeder airplane. It was designed a few years after the other Stinson tri-motors and made its first flight in 1934. With a low wing, retractable gear, and an enclosed cockpit sitting high above the passengers it had a unique look. The A carried eight passengers as fast as 163 mph and was said to be able to take off in 800 feet and land in as little as 400. More than 30 were produced and flew in this country and also, notably, in Australia.

FORD TRI-MOTOR

The Ford Tri-Motor was an outgrowth of Edsel Ford's interest in aviation and his father Henry Ford's desire to show the viability of airline transport. In a similar fashion the Ford Tri-Motor itself was an outgrowth of the earlier single-engine Stout 2-AT Pullman. The Ford Tri-Motor, along with its European counterpart the Junkers 52, was a metal airplane covered with a stressed corrugated aluminum alloy skin. In appearance it was very close to the design of the Fokker tri-motor — perhaps too close. Ford lost two patent infringement cases in Europe brought by Fokker as a result of its production of the Ford Tri-Motor. One only has to see a photo of the Stout 2-AT however to see that it, and not the Fokker, was the obvious ancestor of the Ford.



Two models were produced side by side on the assembly line to customer specifications, the 4-AT and the slightly larger 5-AT. EAA is proud to

operate one of each model. The Ford was produced in many variants sporting different engine combinations. There were both civil and military versions, and some models even had skis and floats. Eventually 199 aircraft rolled off the assembly lines and served airlines around the world.

The Ford Tri-Motor was in a perfect position to capitalize on the aftermath of the Knute Rockne Fokker crash and the traveling public's perception that metal airplanes were more safe than those of wood and fabric. It couldn't, however, compete with the new low-wing, fast, retractable-gear airliners coming on the market in the mid-1930s. Henry Ford had proven his point, however, and having shown that air transportation was viable and potentially profitable, he returned to building cars and never produced another Ford-designed aircraft.

THE END OF AN ERA

Aviation was moving at an exceedingly fast pace in the mid-1930s. With the introduction of the Boeing Model 247, Douglas DC-2, and later the DC-3, the older tri-motor airliners were almost instantly obsolete and rapidly faded from mainline service. Many continued on in foreign countries carrying passengers to remote locations or were converted for other purposes such as freight hauling, fire jumping, or crop dusting. In America, however, the tri-motor era had come to a close, and the airliners that built a nationwide transportation system would scarcely be seen again. EAA

Jeff Skiles, EAA Lifetime 336120, has been a pilot for 40 years. He currently flies a Cessna 185. Jeff can be reached at *JeffreyBSkiles@gmail.com*.

modern vintage

BRIAN KELLY'S RADIAL RV-8R

BY JIM BUSHA

BRIAN KELLY, EAA 578554, of Spruce Creek Airpark, Florida (7FL6), admits his aviation path was forged long before he could even utter the word airplane.

"As a kid growing up near Chicago, my father, Michael, [EAA 86483] was an airline pilot by trade, but his passion was with EAA and the general aviation side of flying," Brian said. "My dad volunteered for many years at the EAA conventions, and I grew up with them every summer as I went with him to Oshkosh." Michael had always wanted to build an airplane and looked at many different models: Kitfox, biplanes, canards, and so on. He eventually bought the plans from Rutan's RAF for a Long-EZ, but, Brian said, "All they did was collect dust on a shelf, never moving, as life seemed to get in the way."

Brian, on the other hand, while taking excursions around the EAA grounds with his father, would take mental notes on all that experimental homebuilding had to offer. He confesses it was the Van's Aircraft product line that really caught his attention.

PHOTOGRAPHY BY **BOB TERRY**


CLICK THIS VIDEO
TO SEE MORE ABOUT THE RADIAL RV-8R

"I had really grown fond of the Van's RV airplanes," Brian said. "Their sleek lines really caught my eye and I liked the fact it was powered by a certified engine, used mainly sheet metal construction, and it appeared to me that Van's really did a tremendous job getting it as close to Part 23 standards as possible." In 1997, while still in high school, Brian sent for the preview plans of the RV-8. "When they arrived, my dad agreed and we both decided right then and there, this was going to be a father-son project and we set our sights on flying our own Van's RV," Brian said.

Up until that time, Brian's aviation experience had been limited to flying right seat with his father in the family Cessna 180 and later Beech Baron. As a teenager, he hadn't been exposed to the building side of aviation, but that was about to change when the RV parts arrived.

"I guess it was like lighting a fuse on a stick of dynamite," Brian said. "My aviation world exploded into new horizons. Working on that RV taught me a whole new skill set. Growing up, I had been taught how to fly airplanes, but never knew how to work on them until the RV came along. Sheet metal really called to me and I found I had a knack for it, especially shaping metal into special shapes, some of them pretty intricate."

What began as a hobby for Brian actually ended up becoming a second career path. It was the deciding factor and the main reason Brian pursued a dual career, as both an airline pilot and an A&P/IA.

"I always knew I wanted to earn a living flying," Brian said. "But because of the time spent with my father on the RV project, and the new skill set I obtained, I also focused on A&P school because I really enjoyed the mechanical side of aviation. Having that maintenance degree in my back pocket actually paid off several times in my career, because when I would get furloughed from the flying side, I went right to the maintenance shop and began turning wrenches."

As Brian cracked the books and turned wrenches, he kept in constant touch with his father, who pushed ahead on the RV and finished it in 2002, trimmed out in an Air Force paint scheme.

"Right when his airplane was finished, I came down to Florida to visit him with my wife, Jill," Brian said. "I sat in his house, looking outside, and framed in his picture window was his airplane, basking in the sun. I knew I wanted — no, needed — to have my own RV to fly. The building bug had bit me hard!"

IT'S JUNIOR'S TURN

Brian stayed with what worked and what he knew well, and decided on the Van's RV-8. But his vision firewall forward took another bearing.

"My plan was to go with the stock RV look, maybe one with a pseudo military paint scheme," Brian said. "But as I looked around — especially at Spruce Creek — there are over 60 Van's RVs on the field, and to me they all look pretty much the same beneath the paint."

Brian said he had never really been one for run-of-the-mill looks or staying within the lines of normalcy. He also knew he wanted to learn some new things on this project.

"If you build the same model 20 times, you really aren't going to learn new tricks or skills," he said. "I wanted to expand my horizons, if you will, and try my hand at fiberglass, and reach beyond my comfort level in metal shaping and push myself to make more unique shapes."

Brian looked at installing a liquid-cooled engine at first, but the manufacturer he was following went out of business. He also had an eye on the Rotec Radial engines from Australia and thought it would be cool and retro-looking to have a radial engine up front.

"I found that the diameter of the Rotec R3600 radial engine was pretty close to that of the width of a Lycoming engine," Brian said. "It's a 150-hp, 220-cubic-inch, 275-pound engine, which is the same weight of a Lycoming O-320, and the fuel burn is the same at 7.5 gallons per hour. The main reason I chose this particular engine was the fact that it fit the engineered parameters that Van's put forth on the airplane — it didn't exceed the recommended horsepower or weight."

All of the hard points that Van's designed for the engine mounts have remained unchanged. The radial engine mount is from Rotec and it's a swing mount that, according to Brian, is a nice feature. "It's very similar to a Cessna 195 type mount — you pull two bolts and the whole engine swings out, which really gives great access to all the components on the back of the engine," he said.

The final decision came when Brian pulled up a picture of an RV-8 on his computer and modeled a radial engine on the nose using an archaic computer program. He was amazed at how it looked.

"From that point forward, it became a quest to put a radial engine on my RV," Brian said.

In 2009, Brian spoke with the Rotec folks at EAA AirVenture Oshkosh and they were all smiles, especially when he told them of his plans and put a deposit down on an R3600. By then the tail feathers and wings were mostly complete and he was ready to start building the fuselage.

PHOTOGRAPHY BY **JIM BUSHA**

"I knew that's where all the major changes were going to take place, so I started what some call the 'mad scientist look' and began figuring out how I was going to make this all work both correctly and safely," Brian said.

The first thing he did was change the shape of the firewall and the top skin. Brian crafted a wooden circle mockup of the engine and placed it out forward where the real radial would be housed. He began lofting the shape using a piece of metal, which he relates as a pretty simple process. Once the shape of both the top and bottom of the firewall were nailed down and correct, Brian made wooden bucks and cut the stainless steel for the firewall pieces. When that was completed, he could go backward to the fuselage and complete the rest of the modifications.

"As I was building the fuselage, I ended up lofting a new intermediate bulkhead, found behind the instrument panel and in front of the firewall, and manufactured a new top skin and baggage door," Brian said. "Also, to prevent the Yak look, I installed a raised turtle deck from Show Planes. I also modified that kit to make it a sliding canopy instead of the tip-over that typically comes from them. Once that was complete, I went to town on the cowling; actually that was a slow ride to RV town, as it took me two years to finish that."

ROUND AND ROUND YOU GO

According to Brian, the cowling was by far the biggest struggle in the whole building process. When designing it, he went with a well-known commodity and found all the NACA reports from the 1930s to assist him with the design. He didn't need to reinvent the wheel, because the same issues of cowling a radial engine were addressed and figured out long ago. The data he found from years of research were still applicable today.

"The lip diameter and the lip shape were the foundation for my cowl's performance," Brian said. "My cowling shape is similar to an F8F Bearcat cowling — top cheek exits and a larger exit on the bottom. The only thing I don't have is cowl flaps — yet. I have a set made up but am waiting to install until I determine it's absolutely necessary." It was interesting to note, he said, that the research found the size of the intake didn't matter as much as the shape, along with how important the baffling and exit were, for example, throttling the exit.

"The point of all of this research and fabrication was to create a cowling that mitigated the drag of the engine as much as possible," Brian said. "This would help preserve as much performance as possible in the installation. My pride and joy is what I call the elephant trunk — a bifurcated duct work that takes in the air from the front snout and splits it. The top part goes to the oil cooler and the bottom part goes to the engine."

PHOTOGRAPHY BY JIM BUSHA

The metalwork was easy because he knew how to do it. Fiberglass was a whole new animal, and that's where the learning process of trial and "a lot of errors" took its toll on time. The only fiberglass pieces from Van's are the wingtips and the tail tips — everything else Brian made from scratch. That includes the dorsal fin, canopy skirt, cowling, gear leg fairings, and wheelpants.

"I decided I was going to learn new skills with this project, and boy, oh boy, did I! The cowling is all fiberglass, and all new to me," Brian said. "For me it's just a prototype — it's been cut up and re-glued at least five times. Every time I get a new idea, it gets cut. I changed the front snout from a smaller one to a bigger one, and various other changes along the way to make it what I wanted. I learned how to make molds, get the molds to release, how to make patterns off of molds, but the biggest thing I learned was finishing. Finishing is what everyone sees, so it has to be spot on or everyone gets to see your flaws."

With the radial engine hung on the airplane and the cowl fitting complete, Brian began to measure for the maximum diameter prop he could carry, taking into account the RV's short gear legs. What was first thought to be a simple decision between manufacturers soon turned into a new set of problems.

DIAMETER DILEMMA

The Rotec R3600 could swing an 80-inch diameter prop if you had long enough legs, which of course the RV-8 didn't.

"I started looking for a prop, sent messages out to the various manufacturers, and thought I would be flooded with solicitations," Brian said. "Unfortunately, that wasn't the case when I received word back from Craig Catto of Catto Propellers, stating that a fixed-pitch prop will not work on my airplane with that engine configuration." Craig recommended a constant-speed prop to address the wide speed range and a smaller diameter due to the short gear. Unfortunately, Catto did not have a model that would work. "I sent messages out to the other manufacturers and received similar responses," Brian said. "Until GT Propellers out of Italy came back and said, 'Sure we can do it, but we are going to design it specific for your airplane.'"

GT variable-pitch propeller blades are manufactured from a mixture of woods. The blade roots are made of highly compressed beech wood, which is specially produced for aviation applications and has a tensile strength similar to metal. It is tapered, mated through special joints, and bonded to the outer blade, which is made of lightwood (spruce/cedar). The entire blade surface is then laminated with two or more layers of glass, carbon, or Kevlar and epoxy resin. Leading-edge protection is applied by injecting a special two-component resin. The blades are finished with several coats of two-component acrylic and polyurethane paint.

PHOTOGRAPHY BY **JIM BUSHA**

PHOTOGRAPHY BY BOB TERRY

"For the next year and a half, I was in constant contact with GT as we went back and forth with never-ending engineering data — engine diameter, estimated speeds, airframe data, and so on," Brian said. "To design a prop, you need desired rpm, cruise speed, and the maximum diameter allowed. As far as I am concerned, GT hit the nail on the head. I am 20 mph faster than my design goal, which was 140 mph. And I haven't even begun to fine-tune it yet, so there are no complaints from me."

In the spirit of a true homebuilder, Brian is generating the data himself, taking many unknowns on this project, and seeing if they work. But when you tackle a project like this, you need to have an open mind and a greasy thumb. "You can't come in and expect perfection — especially if something is a one-off, or never used before," Brian said. "You have to deal with the issues that come along and face facts. You are a test/engineer pilot, so you need to deal with it — period."

THE FINISH LINE

Because Brian has a passion for history as well, he always knew he wanted a World War II-era scheme. He looked at all the services and decided on a Navy scheme after seeing a picture of an F6F Hellcat on the deck of the USS Lexington.

"For me this airplane looks like a F6F Hellcat and I already had the nose art — *Kentucky Lass* — named after my wife, Kimberly 'Jill' Kelly, who hails from Kentucky," Brian said. "My dad and I did the painting ourselves, using PPG Concepts. To get the color period-correct, I was given a piece of fabric from a mechanic who worked at American Aero in New Smyrna Beach, specializing in warbird restorations. It was from a real F4U Corsair that they had been restoring, and he saved the original fabric with period-correct paint on it. It was fun making it as close to a baby Hellcat as I could, with interior colors and military-style placards."

But make no mistake — there is plenty of modern instrumentation inside.

"I installed a dual-screen Dynon SkyView and an XCOM 760 radio. What I like to tell admirers is, this is a 'modern vintage' airplane — by that I mean it has a vintage feel," Brian said. "When you start it up, you get clouds of pearl-white smoke flowing back from the radial engine and that distinct rumble sound that only comes from a round engine. But inside you have those modern conveniences that make it so much fun to fly."

Brian and his wife Jill, the plane's namesake.

Michael made the first flight in early 2016 as the RV-8R (radial) took to the skies over Spruce Creek. And as Brian predicted from the start, there have been squawks to deal with.

"Those were expected, but they have been minor and dealt with as they sprang up," Brian said. "This project will never be finished to my standards; there is always something fun to tinker with and I just can't stop tinkering."

When he set out to build the plane, Brian just wanted something to fiddle with and turn wrenches on, but that all changed when he moved to Spruce Creek. "This project took on a life of its own and quickly became a community project, with so many fellow aviation enthusiasts getting involved," Brian said. "I can't say enough about all the mentors I had assisting me with this project, from experts in fiberglass, to guys who were jacks-of-all-trades who would come by and point out what was right and what was wrong. In my mind, you can never have enough different sets of eyes on a project like this. Each and every one of them wanted to see things done right, as no one here wants to see anyone get hurt or be unsafe. As a builder, it's comforting to know I can trust each of them to tell me if something's wrong and needs to be changed. For me, it's what EAA's foundations were built upon and I am proud to be carrying that torch forward." EAA

Jim Busha, EAA 119684, is an avid pilot and longtime contributor to EAA publications. He is EAA director of publications and editor of Warbirds and Vintage Airplane magazines, and the owner of a 1943 Aeronca L-3 and 1943 Stinson L-5.

OIL TANK TROUBLE

BY BRIAN KELLY

Since the writing of this article, the Radial RV completed its Phase 1 flight testing. While most of the problems were minor, one problem turned into a major headache. The oil tank would aerate the oil, and it would come out of the breather and cover the belly in a short amount of flight time.

I tried all sorts of techniques to help alleviate the problem, but alas, Band-Aids were just not going to cut it. So I designed a purpose-built tank and had it built to my specifications. It's designed specifically to deal with aerated oil.

The problem lay with the new tank's installation. I had to move basically everything firewall forward to accommodate it. So the oil cooler was moved and the induction trunk modified again.

Also, I used the opportunity to warm up the engine, as I was overcooling quite a bit. I installed the cowl flaps and am in the process of designing and building a larger spinner and aft spinner fairing.

Hours in project: 5,000-plus over 10 years, in between two jobs, two moves, and two kids. I never had a stopwatch out and never kept an end date. The plane would fly when it was ready to. You never want to rush a project or be rushed — that's where mistakes will creep in and bite you.

PHOTOGRAPHY BY **JIM BUSHA**

PHOTOGRAPHY BY **JANE JARVIS**

BUILDING ON A SHOESTRING

THE PHILLIPSON BROTHERS' RACE TO RENO 2015

BY BETH E. STANTON

California native Justin Phillipson is a San Francisco Bay Area flight instructor and A&P mechanic with glider, seaplane, rotorcraft, and ATP ratings. He likes a challenge, continually seeking what he can do next. After attending the Reno National Championship Air Races in Reno, Nevada, for years, he decided to see what it was like on the other side of the fence. In 2012, he found a Formula One (F1) Class plane to borrow and some friends to serve as crew, with veteran Reno crew member Bryant Steele as chief. Josh, Justin's brother, who broke his back rolling his truck in 2011, hung out with the crew in his wheelchair. In Justin's first year flying Race 12, *Outrageous*, he won second place and rookie of the year. Justin thought that racing at Reno was just going to be just a "one year thing." However, the following year, the plane was still available, so he raced *Outrageous* again, this time to a third place overall win. In 2014, he flew Race 31, *Fraed Naught*, winning third place overall again. All week, jokes bantered in the pits. Justin wisecracked, "You really think I like coming in third? Fraed Naught!"

WE'LL JUST BUILD ONE

He sends me two pictures, and I think, that's not bad; that will be pretty easy. There are only a few big parts. Put an engine on, a prop, and wheels and we'll be good. *– Justin Phillipson*

Justin and Josh were stoked to continue racing F1 at Reno, but Justin couldn't rationalize buying a raceplane on his flight instructor earnings. He decided to build one instead. "It'll be cheaper, and we can put it together however we want it. As you know, that's the wrong way to look at it," he said, laughing ruefully.

Miraculously, Josh was gradually recovering from his paraplegic paralysis injury. He was able to move his feet and walk with leg braces and was eager to take this project on with his brother. Hep Porter, a longtime racing industry friend, tipped them off to an F1 Shoestring project for sale, an airplane Justin had never seen before. Lockheed engineers designed the Shoestring in 1948. There was money up for grabs, Justin explained. "The guys from Lockheed figured they'd go home after work and tinker in the garage and build a big model for fun and find someone to fly it," he said. The successful design won many races over the years. Justin said, "I had the plans for the Shoestring, and every time I looked at it I saw something else and thought, man, these guys really knew what they were doing."

They brought the Shoestring project to Josh's shop in Chico, California, in November 2013. Their goal was to keep the plane light, clean, simple, and user-friendly. F1 planes are trailered to the races. "The less stuff I have to take apart, the less stuff I'm going to forget to put back together," Justin said.

As he looked closer at the plane, he began to wonder what he had gotten them into. "The more I messed with it, the further we took it apart." One major issue was integrating the fabric and fiberglass so the plane would not look cobbled together. Josh, a fabrication whiz, said, "Let's do it with composite. It would look better and probably be lighter." Josh had worked in the collision repair industry for more than a decade. Years ago, he fashioned a homemade CNC router "as a toy." This router proved to be an invaluable part of the project. "Basically, I learned everything as far as the CAD software and CAM software and the router by building the airplane," Josh said. The brothers collaborated on the design, then divided tasks according to talents; Josh worked on fabrication from firewall back, while Justin worked firewall forward on the engine and mechanics.

SKIN DEEP

You know how you get into the cockpit and make airplane sounds? It helps keep you motivated while you're seeing the progress. *– Justin Phillipson*

They stripped the plane down to the frame, and Josh put it into SolidWorks on his computer. The plan was to shape foam, put wood formers in, sand it down, lay a carbon fiber/composite skin over it, cut the skin off, pull the foam off, put the skin back on, and they'd have a perfect, lightweight skin. This plan failed gloriously.

Undeterred, Josh next made big jigsaw pieces with his CNC router, pieced them together, filled them with foam, and sanded them to make a male mold. From this, he made a female mold. The skin was composed of one layer each of fiberglass, structural foam, and carbon fiber.

The learning curve on the first skin attempt was steep. It came out damaged, and the fix would cost additional weight. Josh told Justin that they could use the skin, but it wasn't going to be right. They swallowed $1,000 to make another one. "It was a heck of a lot of work and cost a lot of money, but it was worth it," Justin said. The lower skin weighed in at just 12.5 pounds from firewall to tail. The upper and lower cowling and 13-inch spinner came in under 7.5 pounds.

Justin planned on using a spray primer on the frame to save weight. Josh overruled him and had it powder coated. Sponsor HotCoats Powder Coating Specialists changed the name of its red to "Race Plane Red" afterward. The frame went from 39 to 37 pounds after stripping off the old paint. Justin ordered all new hardware. "It's so much easier to build a project when you have the right stuff. Building all the parts with brand new hardware and the red color makes it look really sharp and professional," he said. The skin went back into the mold to hold its shape and was bolted to the frame.

The Shoestring was starting to shape up.

BIRTH OF F1 AIRPLANE RACING

In January 1947, the Goodyear Aircraft Corporation offered a $25,000 prize purse (worth more than $270,000 today) for a new class of racers at the Cleveland Air Races. The primary rule for this 190-cubic-inch class was the use of a Continental C-85 powerplant. Twelve of the 21 airplanes entered in the new class flew at the September races that year. The class officially became known as Formula One. The Continental O-200 engine was permitted as a replacement when C-85 engines became scarce after going out of production in the 1960s. This has been the only significant change to the class in almost 70 years. There are just five rules for F1 racers: a Continental O-200 engine, minimum empty weight of 500 pounds, 66-square-foot wing area, fixed-pitch propeller, and fixed landing gear. F1 racers must use stock compression, cam profile, and carburetor. Builders get creative squeezing out every drop of speed within the set parameters. F1 aircraft are designed specifically for racing and the only class to go more than 1 mph per cubic inch. Their 200 cubic inches can produce speeds that top 250 mph.

BUILDING A LEGENDARY RACER

The only thing we used from the original project was the frame, wing, vertical, and canopy glass. We hardly had any components. Everything else we didn't like and had to build our own. *– Justin Phillipson*

The wooden wing is at least 40 years old. The spruce spar is structurally sound and the thin plywood wing absolutely straight when the tip of one aileron is lined up with the other. They sanded, filled, primed, and painted the wing to a glass-smooth finish. It attaches to the frame with only four 1/4-inch bolts. Even with a double safety factor of 9*g*'s, the bolts hold 40 pounds more force than a pilot could ever put on it. "Remember, Lockheed engineers designed this," Justin said with a smile.

The metal tail was functional, but Justin wanted a classic rounded Shoestring shape. "Call me weird, but I didn't want a square tail with a round wing," he said. A wooden vertical stabilizer came with the project, and Josh built a horizontal stabilizer, elevator, and rudder with his router per the plans. "My brother and I are pretty smart, but we're not engineers," Justin said. "We didn't want to go tempting fate by thinking something might work. It came out great. It's 7 feet wide and weighs a lot, but it sure has a good shape to it."

Some F1 canopies hinge on the side. Others come completely off and sit on the ground. An expensive plexiglass bubble left loose to blow over in the wind was not an option, so Josh designed a hinge on the back reminiscent of an F-16. The aluminum frame he originally made was too flexible, so he made another more rigid frame out of carbon fiber and foam.

Taking off with 3.5 gallons, Justin uses 1.8 gallons for a seven-minute race, using only about 8 gallons the entire week. "Gas is my cheapest expense at Reno," Justin said. He designed a shape for the racer's 5-gallon tank that would use the least amount of material.

Instruments add up in weight, and there wasn't much room to work with in the cockpit. Justin is pleased with their MGL XTreme EFIS. "It's small, light, has everything we need to know, and looks professional," he said. The instrument panel bolts directly to the gas tank.

The primary way to get 150-165 hp out of a stock O-200 engine is to ramp up the rpm. Redline is 2700-2800, and F1 racers ratchet it up to about 4200 rpm with speeds up to 250-plus mph. Even with precision balancing, engine life maxes out at a couple of hundred hours. Justin bought two engines, one for cruising and one for racing, and took them entirely apart, then rebuilt them for maximum performance from stock configuration following F1 minimum weight rules.

Multiple components were custom fabricated to minimize weight: rudder pedals, carbon fiber backing plate, sprung aluminum landing gear, and lightweight magnesium wheels. Baffling, cowling air, and exhaust exits were designed for the most efficient airflow and cooling.

The plane took about a year and a half to build. Between July 5 and September 9, 2015, Josh worked on the plane seven days a week for eight to 10 hours a day. Justin instructed students a few days a week to fund the project, then flew back to Chico in his Cessna 120. "I'd be there three or four days and never leave the shop. We'd get there first thing in the morning and work all day," he said.

DAYS CLICKING AWAY

The airworthiness certificate was issued the first week of August, just four weeks before Reno. During the test flight, Justin was less concerned about the plane flying and more concerned it would catch on fire. “Things started to heat up and smell hot, but not in a bad way. I didn’t want to tempt fate,” he said. The first flight lasted 10 minutes, but when he started to fly off the 40 required hours he noticed a vibration. The more he flew, the worse it got. He had the 3100 rpm cruise prop balanced, but the problem remained. He pulled off the engine and discovered a bent crankshaft and destroyed bearings. The same occurred when he tried the second engine. The only thing left to check was the extension shaft and structure of the prop itself. A digital micrometer determined the extension shaft was within 1/1,000 inch of spec. It was three weeks before Reno, and Justin had two engines in pieces with hours still to fly. In a last-ditch effort to track down the cause, he replaced yet another set of bearings on the engine and put on his 4200 rpm carbon fiber race prop. The vibration disappeared. The culprit had been a delamination problem with the cruise prop.

WING AND A PRAYER

It’s a raceplane, not a showplane, and I have to remember to treat it like that. It’s used for one thing, racing, not to sit in a corner and look like a showpiece. *– Josh Phillipson*

With a 36-hour countdown to Reno, a crew assembled for a marathon session to paint the plane. The plan was to prep Thursday, drive to Lake Tahoe, California, to have it painted Friday, and then drive to Reno on Saturday. With the clock ticking midnight on Thursday, Josh vetoed this plan. They had run out of time to properly prep for a good paint job. Dave Triano had planned a snazzy paint scheme, and Josh didn’t want to disappoint him with the results due to a rushed prep. Longtime sponsor Jerry Robinson glanced at a military surplus parachute he had displayed in the hangar and declared, “Let’s paint it olive drab green and call it a day.” Josh picked up the phone and placed an order for OD green epoxy primer. Millers Graffix had made stickers to match the stripes in the original red paint scheme so they scrambled to make all new ones, including the checkered tail Justin really wanted. As they loaded the plane at 5:30 a.m. Saturday to leave for Reno, the paint was still drying. They assembled the airplane Saturday at Reno-Stead Airport and started the race engine for the first time on Sunday. They put the wheelpants on Monday (the plane had yet to be flown with them) and affixed the rest of the sponsor decals. Race 79, *No Strings Attached*, qualified on Wednesday with a speed of 235 mph, ranking fifth out of 16.

PHOTOGRAPHY BY **DARCY HARRIS**

PHOTOGRAPHY BY **ROB MILLER**

PHOTOGRAPHY BY **ANTHONY TAYLOR**

PHOTOGRAPHY BY **TIM ADAMS**

PHOTOGRAPHY BY **JANE JARVIS**

RACE ON

It was all worth it when the flag dropped on Sunday morning. *– Justin Phillipson*

F1 pilots fly eight laps less than 50 feet off the deck around a 3.1875-mile racecourse marked by pylons in the desert. They start on the runway in a racehorse assembly, accelerating from zero. Race 79 weighed in at 564 pounds, and Justin knew he would accelerate fast.

For the Sunday F1 Gold Race, Justin was positioned in the second row. After takeoff, he passed the front row pilots, started the clock, and led the pack for two and a half laps. For Justin, this was the best part. "Here we have a 70-year-old design airplane with the paint barely dry, and we were in the lead," he said. The faster planes eventually passed, and Justin finished in fifth place with an average speed of 229 mph. Josh was pleased. "The plane performed well and looked good. For what we brought to Reno, it exceeded all my expectations."

By unanimous decision, the Formula One board voted Josh Phillipson 2015 Formula One crew chief of the year. Justin acknowledged that the main reason the airplane got to Reno was Josh's creativity, determination, and relentless effort. He also noted they never could have succeeded without the support of their sponsors, crew, family, and friends.

RACE 79 IN 2016

We're going up there to win, not to just have a good time. If that were never the goal, why would you go racing? *– Josh Phillipson*

At time of writing, modifications were in the works to make *No Strings Attached* fly even faster at Reno 2016. The engine has been torn down, inspected, and flown to break in the cylinders. A new carbon fiber fuel tank, wheelpants, and tail have netted substantial weight savings and more efficient aerodynamics. The removal of the paint beneath the sticker on the wing saved even more weight. "We're a little bit lighter, the CG is in a better spot, the engine has been broken in and has a little more 'go' to it from last year," Justin said. "We're not going to be the fastest airplane out there, but at the same time, we're going to put up a heck of a fight."

The original intent behind the creation of the F1 Class was to enable pilots to design, build, and race their own planes for an affordable price. F1 Gold division airplanes are priced from the mid to high $30,000 range. Justin estimates they have already spent well in excess of that, not including labor. "We can't compromise because it's not going to get us anywhere," Justin said. "You can have fast, reliable, or cheap. Pick two, because you can't have all three. F1 racers are extremely purpose-built airplanes. They are designed to go as fast as they can for eight minutes at a time, one week out of the year. It's a little ridiculous, but it's a passion. How fast can we make this thing go? How efficient can we be for what we have to work with for an engine? It's the ultimate challenge."

Follow Race 79, *No Strings Attached*, on Facebook and find out more at *www.EAA.org/sportaviation* under This Month's Extras. EAA

Beth E. Stanton, EAA 1076326, is a competition aerobatic pilot and president of Northern California Chapter 38 of the International Aerobatic Club. She can be reached at *bethestanton@gmail.com*.

HIGH HONORS

THE LINDY GRAND CHAMPIONS OF 2016

Pictured:
Post World War II Grand Champion
Temco TF-51D Mustang, N551CF
The Collings Foundation; Stow, Massachusetts

PHOTOGRAPHY BY **SCOTT SLOCUM**

BY MEGAN ESAU

SHOWPLANE ATTENDANCE BROKE RECORDS yet again at EAA AirVenture Oshkosh 2016 with 2,855 aircraft entered for judging — an increase of 7 percent from 2015. This was just a fraction of the more than 10,000 aircraft admired by aviation enthusiasts during this year's weeklong aviation celebration.

While AirVenture attendees were able to witness the graceful dance of the Snowbirds for the first time in more than 30 years, feel mist cool their faces from the mighty Martin Mars water drops, and stand in the shadows of such massive airplanes as the C-5 and Cathay Pacific's Boeing 747, Oshkosh is about more than air shows and big planes.

Many EAA members put passion, hard work, and countless hours into building, restoring, and maintaining aircraft, and Oshkosh is that time of year when we can share a collective sense of pride and goodwill in our accomplishments. This dedication deserves to be rewarded, and each year a lucky few receive honors for their work.

The Lindy Awards, named after aviation icon Charles Lindbergh, are presented to the best of the best aircraft each year at AirVenture. Aircraft must excel in a set list of criteria to be honored, and if the judges do not feel any aircraft in a given category are worthy of the Lindy distinction, they may choose not to hand out an award.

Categories for the Lindy awards include vintage, homebuilt, warbirds, seaplane, rotorcraft, and ultralight/light-sport aircraft. A Gold Lindy receives the title of Grand Champion, while runners-up are awarded with a Reserve Grand Champion Silver Lindy or a Bronze Lindy.

The following owners have been presented with EAA AirVenture's highest honor for lending their time and talents to the impeccable craftsmanship and maintenance seen on their aircraft. A congratulations and thank-you to the winners for sharing their pride and joy with us at EAA AirVenture Oshkosh 2016.

Vintage Antique Grand Champion

1936 Ryan ST, N14985
Ted Teach, EAA 36640; Dayton, Ohio

Ted Teach's goal of restoring his ST as near to original as possible was no small task, considering it is the only one flying out of the five built by Ryan in the 1930s. Many parts had to be custom-made or adapted. Rings for the piston on his Menasco engine were no longer available, nor were the inner tubes for the tires on the Goodyear brake and wheel assembly. "Every time we turned around we were having those kinds of issues because the airplane is 80 years old," Ted said. The restoration process was helped along by hand-drawn copies of Ryan's original plans for the ST, which were made by former ST owner and professional draftsman Ev Cassagneres. Ev visited several times during the restoration before his death prior to the project's completion. Ted said Ev was always pleased to watch the restoration's progression. In all, Ted said hard work paid off in winning a Grand Champion Lindy. "I don't know how I could feel any better," he said.

Vintage Antique Reserve Grand Champion

1938 Beech E17B, N233EB
David Smith, EAA 477684; Milaca, Minnesota

PHOTOGRAPHY BY **JIM KOEPNICK**

PHOTOGRAPHY BY **ERIN BRUEGGEN**

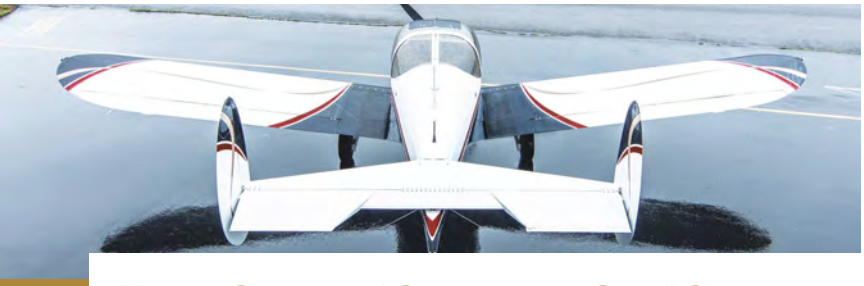
Vintage Classic Grand Champion

1948 Stinson 108, NC6365M
Richard Preiser, EAA 857263; Delray Beach, Florida

The story behind how Richard Preiser came to own NC6365M is unique. After purchasing a Stinson 108, serial number 4364, curiosity led him to another Stinson 108 — one with the next consecutive serial number, 4365. Despite the fact that 4365 was little more than a frame with battered wings and missing parts, Richard recognized this special opportunity, purchased the airplane in August 2007, and spent eight years restoring it, with guidance from friend and A&P/IA Kevin Proodian. "I promised my wife ... that I wouldn't start on it until '08," Richard said. "I had to finish some house chores before I could jump into a project like that." His work paid off. "I can't find words to describe how it feels to walk out into my hangar and say I won the gold."

Vintage Classic Reserve Grand Champion

1947 Cessna 140, N2350N
Richard and Elaine Harris, EAA 115323; West Nyack, New York



Vintage Customized Contemporary Grand Champion

1965 Alon A2 Aircoupe, N6557Q
Jan Lee, EAA 291432; Sandpoint, Idaho

After purchasing N6557Q in 2006 and being told by their mechanic that the airplane's firewall needed to be cleaned up, Jan and Paula Lee decided to go all in and remanufacture their Aircoupe. The airplane was stripped down to a bare fuselage and rebuilt to more modern standards. Jan opted to convert to an electronic autopilot, lay out a newer instrument panel, and insert an AirGizmo docking station for his iFly 740 GPS. During the Aircoupe's first flight one day prior to AirVenture 2015, Jan discovered fuel leaking out of the right tank vent. Although disappointed that he couldn't bring the airplane for judging last year, this fluke allowed for another full year of flight testing before bringing the Aircoupe to Oshkosh 2016. He said winning the Grand Champion Lindy came as a total shock. "When you look at the quality of aircraft and the workmanship in many of the airplanes [at AirVenture], it's really humbling to actually be considered among those peers."

Vintage Customized Contemporary Reserve Grand Champion

1959 Meyers 200A, N492C
David Smith, EAA 477684; Milaca, Minnesota


PHOTOGRAPHY BY **MARY JONES**

Homebuilt Kit-Built Grand Champion

Lancair Legacy RG, N321TF
Valin and Allyson Thorn, EAA 399291; Broomfield, Colorado

The 15-year-long build of Valin and Allyson Thorn's Lancair Legacy, nicknamed *StarHawk*, culminated on July 20, 2016, just in time for AirVenture 2016. The airplane's space theme is a tribute to the couple's careers in human spaceflight at NASA; both husband and wife retired last year. Allyson said she felt "a combination of disbelief, exhilaration, and appreciation" upon receiving the award. Half of the 15 years it took to build the *StarHawk*, which included 10 hours of work per week, were spent on creating new and modified elements. "With so many outstanding airplanes at Oshkosh this year, we did not think these EAA honors for our airplane were possible," Valin said. "We still can't believe it!"

Homebuilt Kit-Built Reserve Grand Champion

2015 Van's RV-8, N747BM
Bob Markert, EAA 482609; Littleton, Colorado


PHOTOGRAPHY BY **JASON TONEY**

Homebuilt Plans-Built Grand Champion

F.8L Falco, N453YR
Bill Roerig, EAA 144292; Kaukauna, Wisconsin

This Lindy Award was very special to Mike and Al Roerig, as they accepted it on behalf of their late father, Bill Roerig. Bill spent 32 years building his Falco from a set of plans he purchased after falling in love with the work of Italian airplane designer Stelio Frati. "What motivated him to take on this project was the challenge of the project itself," Mike said. "It was the challenge of building, and it was a huge undertaking, but that's what motivated him." Although Bill died in March 2015 without getting the chance to fly his Falco, he was able to witness the airplane pass its airworthiness inspection that February. Bill's peers called out the rigorous attention to detail he paid when building; his friend Brian Lee noted how Bill even carved the Falco logo into the airplane's brake pedals. Mike said the Falco winning a Grand Champion Lindy really touched off his father's accomplishments. "It was an awesome end to the legacy that he's left."

Homebuilt Plans-Built Reserve Grand Champion

2014 Starduster, N410SL
Robert Engkvist, EAA 495668; Esmond, North Dakota

Warbirds World War II Grand Champion

Curtiss-Wright P-40M Kittyhawk III, N5813
Tri-State Warbird Museum; Batavia, Ohio

After serving as a trainer and being flown by Royal New Zealand Air Force pilots returning home after World War II, this Kittyhawk III, designated NZ3119 by the New Zealand military, was sold for scrap in 1948. Although rescued from being melted down in 1969, the aircraft's outer wing panels had been cut off with a torch, and it sat in storage until the Tri-State Warbird Museum purchased its remains in 2006. Despite the previous damage, Tri-State Warbird Museum President Paul Redlich said his team preserved as much of the original airframe as possible, including the fuselage, tail feathers, paneling, and landing gear. While the restoration was first completed in 2011, the airplane experienced an engine failure on takeoff and ran into a fence at the end of the runway. "The airplane was totaled, and we had to start again," Paul said. "Five more years after that we finished the second time, so it was a 10-year process, and we were very happy to win at Oshkosh."

Warbirds World War II Reserve Grand Champion

Stinson L-1, N1377B
James P. Harker, EAA 340949; Blaine, Minnesota

PHOTOGRAPHY BY **JAY BECKMAN**

Seaplane Grand Champion

1953 de Havilland Beaver, N450DM
David Marco, EAA 267503; Atlantic Beach, Florida

David Marco purchased his de Havilland Beaver 17 years ago newly restored after it had been damaged in a crash in Canada, and then spent his time flying the plane until its engine ran out. "It was time for an engine overhaul so I said what a great time to restore it again." David said one of the most important things he did in preparation for judging was keeping a detailed book documenting the parts of the restoration judges can't see from the exterior of the plane. Besides that, he said he felt it essential to keep true to the airplane's character. "It's a Beaver, and a Beaver should not have a leather interior and a fancy corporate paint job," David said. "It needs to be a clean, good, utilitarian restoration, and that's what the judges realized and I think they liked." This is the third Grand Champion Lindy David has won; the first two were awarded to a Mustang and a Lockheed 12.

Seaplane Reserve Grand Champion

1976 Piper PA-18, C-FIXA
Paul Wild; Sault Ste. Marie, Ontario, Canada

Post World War II Grand Champion

Temco TF-51D Mustang, N551CF
The Collings Foundation; Stow, Massachusetts

The Temco TF-51D Mustang is the Collings Foundation's latest addition to its Wings of Freedom flight experiences tour. The Mustang, nicknamed *Toulouse Nuts*, was purchased in 2012 as nothing more than a fuselage and a set of wings. As the only surviving Temco-built Mustang, which was contracted as a two-seat version of its North American P-51 predecessor, the Collings Foundation took great care to make its restoration as authentic as possible, even finding enough original AN fittings to fully outfit the airplane's wings. It is not the first time the Collings Foundation has won a Lindy Award; some of its previous award-winners include an F4U Corsair, an A-36, and a B-24 Liberator. "It's something that we strive for in coming to AirVenture," said Ken Miles, director of operations at the Collings Foundation. "To be judged is the bar that we have set for ourselves for all of our restorations. It's an honor to receive that again for the TF-51."

Helicopter Grand Champion

Safari 400, N567TK
Thomas Kurtz, EAA 1163872; McVeytown, Pennsylvania

Thomas Kurtz purchased his Safari kit in 2014. One and a half years and 925 hours, and 399 cap nuts later, he had a completed helicopter. Thomas said the build went relatively smooth, although he did need a friend to help with the wiring. Keeping his family in mind during the build, he also made a slight modification to the aircraft: making the passenger cyclic easily removable so both his father and grandchildren have an easier time getting in and out of the helicopter. Although the helicopter is finished, Thomas can't fly it on his own just yet. "I do not have my pilot's license," he said. "I'm getting my license now and using my aircraft to get it!" Thomas said it was an honor to receive a Grand Champion Lindy, and that his only wish was that he could enter N567TK again next year.

Helicopter Reserve Grand Champion

Safari 400, N615RK
Russ Kunz, EAA 354107; Neosho, Wisconsin

Gyroplane Grand Champion

Magni M-16, N15069
John Craparo, EAA 752480; Georgetown, Texas

Winning a Gold Lindy was the icing on top of a great year for Magni M-16 owner John Craparo. A cross-country trip in his gyroplane last October connecting Dallas, Santa Monica, and New York City's LaGuardia broke four National Aeronautic Association and three Fédération Aéronautique Internationale records for speed over a recognized course. Although John owns two other restored aircraft, the M-16 gyroplane, which he built in two weeks in November 2014, was the first aircraft he brought to Oshkosh. He said winning a Grand Champion Lindy was a great way to culminate the past 10 years of attending. "I'm very proud of it and proud of the fact that I did it in an aircraft that I really enjoy flying and do a lot of flying in."

Gyroplane Reserve Grand Champion

Magni M-16, N317KD
Dayton Dabbs, EAA 1179353; Taylor, Texas

Light Plane Grand Champion

Zenith CH 750, C-GMMC
Joe Harrington, EAA 486103; Lethbridge, Alberta, Canada

A little more than seven years ago, Joe Harrington and a group of five friends decided they wanted to build an airplane, but they knew trying to divvy up flying time could be a challenge in the future. Their solution was to build six Zenith CH 750s, each one a group effort. "We each had our roles, and it was a cooperative project," Joe said. When each airplane reached a certain level of completion, its respective owner would then customize the CH 750 to their own liking. "If you take a look at my airplane, it's all my personality showing through," Joe said. His Zenith had its first flight on June 26, just one month before the start of AirVenture. Although excited to bring his airplane to Oshkosh to show off his work, Joe had no intention of entering it for judging until being encouraged to do so by a few of the judges. "To this day I can't believe it," he said. "I just did the best job that I could." EAA

Light Plane Reserve Grand Champion

Van's RV-12, N913BC
Brent Connelly, EAA 874578; Hackettstown, New Jersey

Megan Esau, EAA 1171719, is EAA's staff writer, regularly contributing to both print and digital publications. She's an aspiring pilot, a passionate aviation enthusiast, and an avid learner of just about everything. E-mail Megan at *mesau@eaa.org*.


N122PT
FRANCAIR


EXPERIMENTAL


PA14EXP
N18P6

BUILT IT

HOMEBUILTS AT EAA AIRVENTURE OSHKOSH 2016

PHOTOGRAPHY BY **MARY JONES AND DON JEFFRIES**

The Homebuilts area is the place to go for the makers and doers at EAA AirVenture Oshkosh. With daily workshops and forums, it is also the perfect place for current and aspiring builders to gather and share information and inspiration. Homebuilders from all over bring their aircraft to share the results of their hard work and dedication.

Clockwise from top left: *Robert Engkvist's red, white, and blue Starduster Too sits amid a sea of homebuilt showplanes. The bright biplane was named Plans-Built Reserve Grand Champion. Volunteers are the lifeblood of AirVenture, and the Homebuilts area is no exception. Each year, pilots who fly their homebuilt aircraft to AirVenture receive a special patch featuring a homebuilt design; this year's patch honored the Van's RV-6 to help celebrate the design's 30th anniversary. Matt Tisdale brought his AirCam to AirVenture 2016 from Triple Tree Aerodrome after finishing it in February, and won a Kit Champion award.*

CLICK THIS VIDEO

TO SEE MORE ABOUT HOMEBUILTS AT AIRVENTURE OSHKOSH 2016

PHOTOGRAPHY BY **DON JEFFRIES**

PHOTOGRAPHY BY **DENNIS BIELA**

PHOTOGRAPHY BY **TYSON RININGER**

PHOTOGRAPHY BY **DON JEFFRIES**

PHOTOGRAPHY BY **ANDREW ZABACK**

PHOTOGRAPHY BY **PHIL HIGH**

PHOTOGRAPHY BY **DAVID K. WITTY**

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PHOTOGRAPHY BY **DAVID K. WITTY**

PHOTOGRAPHY BY **JAY BECKMAN**

PHOTOGRAPHY BY **DON JEFFRIES**

Clockwise from top left: *John Tumilowicz's rare MJ-5 Sirocco came cross-country from Tehachapi, California. Visitors in the Homebuilts area have a unique opportunity to get up close to the completed projects of passionate builders. Kurt Gubert of Ashley, Michigan, takes a break from the fast-paced atmosphere of the convention grounds in his Sopwith Pup-inspired Fly Baby biplane. Watch for feature stories on this airplane and the Sirocco in upcoming issues of* Sport Aviation *and* Experimenter. Skye Racer, *a Sonerai I owned by Jeffrey Lange, took first place in the Sportsman T category during the 2016 AirVenture Cup Race. Sunlight glints off the open canopy of William Clapp's Saberwing. The homebuilders workshops are where people of all ages gather to learn and share their knowledge with others.*

PHOTOGRAPHY BY **PHIL HIGH**

PHOTOGRAPHY BY **DON JEFFRIES**

Mustang II owners gathered at AirVenture 2016 to celebrate the 50th anniversary of the first flight of the type. Jeffrey Plantz's custom homebuilt JP-1 seaplane makes a landing on Lake Winnebago. We celebrated a lot of anniversaries in 2016, including the 30th of the RV-6, which brought in record numbers of Van's designs.

PHOTOGRAPHY BY **JIM KOEPNICK**

PHOTOGRAPHY BY **DON JEFFRIES**

Check out the digital edition of *EAA Sport Aviation* for a video about homebuilts at AirVenture Oshkosh 2016.

Stop Dreaming. **Start Building.**

"EAA SportAir Workshops were critical and priceless steps in building my RV-7 and One Design aircraft. The courses took each overwhelming stage of the build and broke it down into manageable, capable steps. I would say that these workshops are the best investment one can make in their aircraft build."

Jeff Seaborn
EAA 793688
Calgary, Alberta, Canada

Workshops Attended:

- ☑ Sheet Metal Basics
- ☑ Fabric Covering
- ☑ Electric Wiring & Avionics
- ☐ What's Involved in Kit Building
- ☐ Composite Construction
- ☐ RV Assembly
- ☐ Gas Welding
- ☐ TIG Welding

Take the first step toward fulfilling your dream of homebuilt flight with EAA SportAir Workshops. Visit **EAA.org/SportAir** to learn more about the various courses available and to register for an upcoming workshop near you.

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LIVE THE OSHKOSH SPIRIT YEAR-ROUND

JOIN A CHAPTER

EAA is unique among member-based aviation organizations due to the vision and effort of Ray Stits and Paul Poberezny back in 1953. Together, they worked to create a chapter network, now almost 900 strong, for aviators worldwide. Today, chapters carry on Ray and Paul's vision of affordable aviation for individuals at the community level.

Chapters are where aviation enthusiasts gather to share stories, tools, and expertise. They teach, mentor, socialize, and build goodwill for recreational aviation in their communities. Members can learn about the roots of aviation, about flying, restoring, and building – and do it together.

In 2015, EAA created a five-year plan to help strengthen your chapter network. We've increased the number of chapter leadership academies, developed a new chapter operating handbook, and produced five on-the-road training seminars. Chapters also can now order promotional banners and brochures, business cards, and customized chapter apparel. We even started a chapter camping program for AirVenture so chapter members can attend and camp together.

Chapters are a great place to start or continue your aviation adventure. To find an EAA chapter near you, or to start your own, visit *www.EAA.org/sportaviation* and look under This Month's Extras.

QUESTIONS ABOUT YOUR MEMBERSHIP?

Want to change your address or need other assistance? EAA's Membership Services staff is available to assist you Monday through Friday from 8 a.m. to 6 p.m. and on Saturdays from 8 a.m. to 4 p.m. (Central time). Call 800-564-6322 (800-JOIN-EAA), e-mail *membership@eaa.org*, or visit *www.EAA.org/membership*. To see the benefits EAA members enjoy, visit *www.EAA.org/memberbenefits*.

PHOTOGRAPHY BY **BRADY LANE**

The Passing of Buck Hilbert

Aviation, EAA, and Vintage Aircraft lose an icon

BY CHARLES W. HARRIS, DIRECTOR EMERITUS, VINTAGE AIRCRAFT ASSOCIATION

EAA WAS SADDENED TO hear of the death of Elroy "Buck" Hilbert of Union, Illinois, on Wednesday, August 3. He was 91 years of age.

Buck has gone west after a lifetime of being deeply immersed in aviation from his earliest days as a lineboy at the old Chicago Elmhurst Airport where he soloed an Aeronca LA Chief at 16, which was quickly followed by a thrilling solo in Jack Rose's tiny 40-hp open-cockpit Parrakeet biplane. Following his military aviation career during World War II and Korea, Buck joined United Airlines in 1952 and flew a full airline career in DC-3s, Convairs, Viscounts, DC-6s, DC-7s, 707s, 727s, and concluded his United cockpit career in DC-8s; he retired from United in 1989.

When EAA Founder Paul Poberezny began to form the EAA Antique/Classic Division, now the Vintage Aircraft Association, in 1971, he invited Buck, EAA Lifetime 21, Vintage Lifetime 5, Warbirds 2928, and IAC 8262, to be the president. Buck accepted, and the rest is history. Buck was exactly the right man, at exactly the right place, at exactly the right time. Today the Vintage Aircraft Association is the finest, largest, and most successful vintage airplane association in the world.

EAA and the Vintage Aircraft Association extend heartfelt condolences to the Hilbert family and to Buck's countless aviation friends and associates.

Name: Olivia Trabbold, EAA 419065
Position: Art Director

WHO'S WHO AT HQ

Describe what you do:
I'm the graphic design layout artist for *Vintage Airplane*, *Warbirds*, and *Sport Aerobatics*.

What do you enjoy most about your job?
Creating magazines that will excite the members about aviation and their individual flying passion.

How many years have you worked at EAA?
Twenty-five.

If you could fly/own any airplane, what would it be? Why?
I love the Gee Bee. This racer has so much history and has an incredible story. Its shape drew me to it, wondering how it could possibly fly. When the replica came to AirVenture it was always a must see.

Most memorable EAA experience?
Since I love being creative and working with my hands, I was able to help build a Sonex with a group of EAA members. I feel that it is quite an accomplishment that I am proud of.

Most memorable person you met through EAA?
The most memorable would be Paul Poberezny, for the obvious reason of being the founder of EAA and quite an interesting person. But I was also fortunate to meet Dick and Burt Rutan, who are not only inspirations, but also fascinating people with their accomplishments.

Who introduced you to aviation/flying?
Jack Cox. He was a person with a deep passion for aviation and the people who built and flew airplanes. He would always tell me fascinating stories relating to the behind the scenes of his articles. His interest in an aircraft's history and how it wrapped around a person's life was awesome.

Who is an inspiration to you in aviation? Why?
Anne Morrow Lindbergh. She was a multifaceted woman who pioneered a life of many accomplishments. Being an author, aviator, and the wife of a famous aviator, she lived her life with a passion for who she was.

EAA PRESENTS MARV HOPPENWORTH WITH LIFETIME ACHIEVEMENT AWARD

MARV HOPPENWORTH, EAA LIFETIME 2519, was presented with EAA's Lifetime Achievement Award at EAA Chapter 33's August meeting. Because Marv was unable to attend the Chapter Leadership Breakfast during AirVenture this year, Charlie Becker, EAA director of chapters and communities and homebuilt community manager, surprised Marv by visiting Cedar Rapids, Iowa, to present the award.

Although best known to the EAA membership as the designer of the pedal planes sold at Oshkosh, Marv has made a number of other incredible contributions to the organization over the years, including being a founding member of Chapter 33; serving as an EAA regional representative for a five state area from 1962 to 1965; forming the first emergency repair tent for convention in the early 1960s with Marshal Turner; participating in the first group of EAA technical counselors; serving as a classic airplane judge at Oshkosh from 1980 to 1990; teaching welding at Oshkosh workshops; and designing and building six Wright Flyer pedal planes for EAA to commemorate the 100th anniversary of flight.

This year marked Marv's 60th consecutive year of attending convention. "Marv Hoppenworth is someone who I wish could be in every EAA chapter," Charlie said. "His enthusiasm and willingness to share his knowledge and skills is just as strong today as it was when he joined EAA back in 1956."

EAA SPORT AVIATION APP NOW AVAILABLE FOR DOWNLOAD

***SPORT AVIATION* MAGAZINE NOW** has a mobile app to make it easy for EAA members to access the magazine from a mobile device or tablet with or without a network connection. Take the digital edition of the magazine on the go, no matter where you go (or fly). Readers will find eye-catching photo galleries, videos, interactive graphics, and links to other resources online. To download the app, you can search for it in the iTunes, Google Play, or Amazon app stores, or just go to *www.EAA.org/sportapp.*

YOUNG EAGLES RAFFLE WINNER ANNOUNCED

JOAQUIM LAMBIZA, EAA 862298, of Portugal has been announced as the winner of the 2016 Young Eagles Raffle grand prize, a 2016 Ford Mustang GT Premium Convertible provided by Ford Motor Company and Kocourek Ford of Wausau, Wisconsin.

"I have bought [tickets] every time I was at AirVenture, but although I kept secretly dreaming with the Mustang, I rationally never expected to win," Joaquim said, adding that he plans to take his new V-8 engine Mustang roaring on a coast-to-coast road trip.

The annual raffle raises money for EAA's Young Eagles program, which provides youth ages 8-17 with free first flights in general aviation aircraft to support EAA's mission of growing participation in aviation.

"I have an immense respect for the Young Eagles program and to everyone involved either in the background, in donating, or doing the actual flying," Joaquim said. "I personally consider it a critical do-or-die mission for aviation as a whole. We all have to keep the next generation highly involved, and especially us pilots should all share that mission and keep introducing aviation to the young ones."

This year during EAA AirVenture Oshkosh, the Young Eagles program hit a milestone by providing its 2 millionth flight since the program was founded in 1992.

Scott Ross of Whippany, New Jersey, took home the second place $5,000 prize, and David Besterfeldt of Crystal Lake, Illinois, received $2,500.

345TH BOMB GROUP VETERANS VISIT EAA

FOUR VETERANS OF THE 345th Bomb Group Air Apaches visited the EAA AirVenture Museum for their annual reunion in August along with many family members of others who have passed on. The museum recently installed an exhibit on the 345th Bomb Group with a number of artifacts and photos. The unit was famous for its low-level attacks on the enemy in the Pacific theater using the North American B-25 Mitchell. The group received a special dedication ceremony and autograph session followed by a tour of the museum. To top off the day they were given private access to the museum's B-25, where they were able to sit in their old seats and allow family members to sit where their loved ones served. Many laughs and tears were had. The EAA AirVenture Museum is honored to be the caretaker of the legacy of the Air Apaches. EAA

Treasured Tri-Pacer

Texas PA-22

I GREW UP IN an aviation family. My father flew a P-51 in World War II and later turbine and piston type rotorcraft, light military jets, and ag aircraft. My brother was a warrant officer 3, and my sister had a long career in the Air Force.

In 1974 my father soloed me in a PA-18 Super Cub, and later I obtained my certificate. Not soon after having my certificate I had to quit flying, due to family and finances, until 1997. I rented various aircraft until I came across the older rag-and-tube Pipers and purchased a very long-in-the-tooth Piper Colt. That gave way to another Colt, and then to this Tri-Pacer.

Most people would not take on a project that required fabric cover, steel tubing repair, electrical rewiring, engine overhaul, painting, plumbing, avionics, sheet metal fabrication, upholstery, and tons of paperwork. I spent my youth in technical schools learning about electrical systems and welding. I later spent years working in the automotive world. Many of the other skills required in this and other rebuild projects I learned as I went along. Often I opened a book and tried what I had just read on a test basis, often with poor results on the first try, but I just kept trying. But this was not the only way I acquired the needed skills. I've always felt that if you stop learning, you die intellectually, so I spent many years in night school — night automotive schools and college.

I found this project in a lean-to in Fitzgerald, Georgia, and dragged it home. It wasn't until I got it home and apart that I found out how poor its condition was. Because it had spent too many years outside there was major airframe damage. It required 14 tubing repairs, including 7 feet of the lower left longeron and all the spider metal that holds the sheet metal on the bottom of the airframe.

I'm one of those who scrounge for everything; I have become a master of finding bargains. Scrounged items were all the fabric, covering materials, chromoly tubing for airframe, all the wiring, the cable for the controls, the sheet metal used, all of the interior covering materials, the headliner, the insulation, all the rebuild parts for the engine, vacuum pump system, oil filter housing, carb air filter housing, and much more. Most of these items were new/unused and perfectly legal and airworthy (complete with certification paperwork).

AIRCRAFT SUBMISSIONS

Share your craftsmanship with *EAA Sport Aviation* readers worldwide! Send us a photo and description of your project and we'll consider using it in "What Our Members Are Building/Restoring." Please include your name, address, and EAA number. We reserve the right to edit descriptions. For guidelines on how to get the best photo of aircraft, visit *www.EAA.org/sportaviation*.

Mail: EAA Publications, Aircraft Projects, P.O. Box 3086, Oshkosh, WI 54903-3086

E-mail: *editorial@eaa.org*

Major changes included a different starter, charging system, relocation of the oil cooler on the left rear baffle, modification of the battery box, brake booster, instrument panel replacement, seat belt installation, airframe repair, and the installation of a strobe system. The instrument panel change took the most work and effort in design. Tri-Pacers have small instrument panels and very little room for avionics. I doubled the space, which required bumping up the panel cover. This required several parts and extensive use of a slip roll to curve the parts to fit (hours of bent metal, mostly in the wrong direction).

Avionics included UMA oil pressure, oil temperature, cylinder head temperature and exhaust temperature, Electronics International tachometer, volt/amp meter, fuel gauge, and a Shadin Miniflo linked to the GPS. I used Cessna-style rocker switches for most electrical circuits and toggle switch/circuit breakers for landing lamps. The communication radio is an Icom IC-A210. I found a used King KT-76C that did not work because of a bad cavity tube. That is the death wish on a transponder, but I had scrounged some good used tubes from other transponders that had other major problems, and it works like new. I wanted a big screen GPS but didn't have the bucks, so I purchased a King KLN-90B used ($250) and a King KMD-540 ($650), and I have a great system that also drives my autopilot. This dinosaur of the air also has a Brittain autopilot, installed under an STC in the early '90s.

I can't say how much time I have invested — my wife would say too much — but it did take three years of work to make it fly again. These are easy to fly airplanes that are easy to maintain and priced on the low end of the market for what you get. The biggest problem is finding an A&P/IA who has experience with one of these. There is great support through the Short Wing Piper Club. I would also like to give thanks to Art Baker, my A&P/IA, for all of his assistance over the past 15 years.

If you have trouble changing a tire, don't start a project like this, but if you have some mechanical skills, these are easy to work on and most parts are still to be had, or you can make them for yourself if needed.

James R. Calamon, EAA 179193; Luling, Texas
E-mail: *n1703p@gmail.com*

CALIFORNIA *FUNK*

IN 2009, I FOUND a Funk in the Port Townsend Aero Museum in Washington for sale. In 1940, the Funk Model B was powered by a Ford Model B water-cooled four-cylinder engine producing a whopping 62 hp. Currently it is powered by a Continental 85-hp air-cooled four-cylinder engine. All engine baffles and cowling needed to be made new from original Funk drawings.

New wing ribs, leading and trailing edge metal, new nuts and bolts, and fabric covering was needed, and took more than one year to finish. I bent thin aluminum over wooden ribs and nailed it to the solid spruce wood spars with brass tacks to form the wing leading edge, just as wings were built in the Funk factory in Coffeyville, Kansas, more than 75 years ago.

Trim springs attached to upper and lower elevator horns relieve control forces in flight, and trim springs are adjustable in nose-up or nose-down directions. I took care not to shrink the fabric covering too much, as that would warp the wooden stringers and compromise the beautiful curves that characterized the Funk.

The Sensenich propeller is brand new and equipped with brass leading edges and lead rivets, which is how wood propellers have been manufactured for more than 80 years. Twin tail brace wires for structural redundancy set the Funk apart from its competitor, the Piper Cub, which featured single tail brace wires. The wisdom of the Funk design is that failure of a single tail brace wire does not lead to catastrophic results. The Funk featured parallel lift struts that made entry/exit easier than its high-wing competitors of the 1940s.

I overhauled all the gauges on the original instrument panel, painted a circa 1940 sunrise graphic on the inner door panels, and added shoulder harnesses for safety, a feature not originally installed in the Funk.

Joel Marketello, EAA 1025643; San Luis Obispo, California
E-mail: *jamo552@msn.com*

CONNECTICUT *FLYING FLEA*

IN LESS THAN TWO years, I completed one of my childhood favorites, a reproduction 1933 Flying Flea. I incorporated some updates and modifications that make it a safer plane to fly than the original, including an updated airfoil and strict adherence to the Mignet formula defining the relationship of the wings to each other. As do many modern day pilots with an enthusiasm for antique aviation, I had to consider my size and weight in the construction of the fuselage. I relaxed the curve slightly in the front to give me more legroom and added a few additional ribs to the wings for a lighter wing loading. Finally, I installed a powerful 65-hp BMW R100 engine with a Rotax C gear-reduction drive. Add a 72-inch prop from Culver Props and you have the aircraft in the photo. I also incorporated a variation on the landing gear that I prefer, and use a tailskid with a keel.

Jim Bruton, EAA 749427; Middlebury, Connecticut
E-mail: *geonav1@yahoo.com*

WASHINGTON *RV-12*

OUR FIRST EXPOSURE TO an RV was in 2000 when Trent assisted Bob Hicks in completing his RV-6 and flew the first flight. We later enjoyed cross-country flights to Wisconsin and Iowa in that plane.

We purchased a kit in 2013 and spent the next three years building together, and were fortunate to have an RV-12 mentor. What does it take to build a plane? More than man-hours and tools, experience is the best teacher. We went the extra mile in preparation for all facets and equipment for this aircraft. We recommend inventory control, categories of all airplane parts, and pieces. Before removal of stickers, replace numbers with the aid of felt-tip pens, then Scotch-Brite every piece for noncorrosive spray paint before even starting. We never had an argument working together.

Little by little you see your work transform into what looks like a plane. What a thrill when the tail fits onto the fuselage. It has legs, wheels, engine is hung with care, and the last of the boxes disappear. This was the greatest adventure of our lives, the creation of something so magnificent.

Our knowledge to fly yesterday's models is still there, but the challenge of a new style of electronic equipment encouraged us to find a test pilot to fly this machine through the testing course.

We both built it, we both flew it, and we both wear RV grins! Oh what a feeling.

Donna and Trent Sommer, EAA 938; Sequim, Washington
E-mail: *planepix@olypen.com*

TENNESSEE *KITFOX*

THIS IS THE THIRD Kitfox I have built in less than five years. Inspired by how well my Kitfox 2 performed, and by Frank Knapp's Lil' Cub, I went looking. I found this Kitfox 3 kit with the same high-lift airfoil as my 2, then threw away the builder's manual and went a little crazy. My goal was to end up with something different, while retaining the same incredible STOL performance and gross weight as my 2, and replace the Rotax 582 with a 100-hp 912 ULS. In the interest of saving weight, I used a 10-gallon aluminum fuel tank instead of wing tanks, replaced drooped wingtips with carbon fiber wingtip fences, eliminated the cowling and the upper portion of the firewall above the engine mount attach points, and was very sparing with paint.

I also built extended gear so I could swing an 82-inch Catto STOL prop. It came in at 533 pounds. Two other modifications worth mentioning: I added about 4 inches to the chord of the elevator and the rudder, and dual puck Matco brakes. Ground handling and visibility are fantastic. It leaves the ground before I can get the throttle to full open and climbs out at 1,700 fpm in 90 degree temperatures. I spent about eight enjoyable months building and got the inspection in April 2016.

Thanks to John and Debra McBean at Kitfox for all their help. EAA

Tom Tschantz, EAA 388597; Chuckey, Tennessee
E-mail: *kitfox3@hotmail.com*

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Gone West

Not alone into the sunset but into the company of friends who have gone before them.

ARIZONA
John Camp (EAA 9305), Lake Havasu City
Bill Moeny (EAA 678853), Cottonwood

CALIFORNIA
Larry Beidleman (EAA 170857), Granada Hills
Robert Beveridge (EAA 167222), Newport Beach
Doug Cooke (EAA 175692), Yorba Linda
Walden Cooper (EAA 41060), Lompoc
David DePaolo (EAA 819290), Port Hueneme
Robert Furney (EAA 628351), Pacific Grove
Thomas Moore (EAA 639104), Norco
Leigh Robinson (EAA 191407), El Cerrito

FLORIDA
Carl "Norris" Bryan (EAA 205937), Webster
Mort Dubinsky (EAA 327159), Fort Lauderdale
Mike Farrell (EAA 1096194), Port St. Lucie
Gregory Koenig (EAA 523919), Lutz
James Logan (EAA 83873), Jacksonville
Ellis O'Neal (EAA 1161850), Gainesville
Judith Wells (EAA 857460), Lake City

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David Nell (EAA 783557), Wheeling

INDIANA
Charles Magrady (EAA 214039), Crown Point

IOWA
Jack Lund (EAA 63843), Bettendorf

KANSAS
Lee Crites (EAA 70842), Lenexa

MICHIGAN
James Riverside (EAA 79540), Iron Mountain
Al Todd (EAA 208792), Stevensville
Chester "Chet" Uncapher (EAA 427299), Zeeland
Richard Von Berg (EAA 69232), Saginaw

MINNESOTA
Clair Dahl (EAA 540519), Ellendale
Harlan Ernst (EAA 216599), Fergus Falls
Gerald Rinehart (EAA 457174), Elk River
Glenn Young (EAA 24761), Litchfield

MISSOURI
Larry Lyman (EAA 36787), Chillicothe
Jim McKown (EAA 219883), Easton

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Anthony Dolphay (EAA 1054048), Havre

NEBRASKA
Michael Salisbury (EAA 870332), Omaha

NEVADA
Joseph Loewenhardt (EAA 579129), Minden

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Charles Doucette (EAA 55787), Danville
David Ingalls (EAA 475334), Kingston

NEW JERSEY
Richard Nierenberg (EAA 547948), Somerset

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Bernard Orzel (EAA 182738), Clarence Center

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Rube Jones (EAA 11670), Dyersburg

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Bill Crist (EAA 281518), Houston
Donald Hollister (EAA 201724), Midland
Mike Mitchell (EAA 563893), Rhome
William White (EAA 7426), Cedar Hill

VERMONT
Marion Fitz Gerald (EAA 1031584), Essex Junction

VIRGINIA
Richard Anderson (EAA 135076), Roanoke
Ryland "Stanley" Felts Jr. (EAA 724097), Highland Springs
Peter Schmeelk (EAA 398844), Arlington
Tom Yates (EAA 525243), Lawrenceville

WASHINGTON
Bert Klempel (EAA 1156767), Everett
Johnnie Swecker (EAA 35143), Des Moines

WISCONSIN
George Bush (EAA 105152), Sister Bay
Robert Marks (EAA 318953), Neshkoro
Jack Wojahn (EAA 55500), Oshkosh

AUSTRALIA
Hew Dreyer (EAA 1030780), South Guildford, Western Australia

CANADA
William Gibson (EAA 685645), Winnipeg, Manitoba
Howard Lester (EAA 463753), Sarnia, Ontario
William Muirhead (EAA 1187782), Kamloops, British Columbia
Howard Parr (EAA 27387), Regina, Saskatchewan
Houman Yahyaei (EAA 1169756), Laval, Quebec

NEW ZEALAND
Lars Fellman (EAA 220049), Auckland

2016 Halls of Fame Inductees

EAA IS PROUD TO honor five new inductees into our Sport Aviation Halls of Fame at a dinner ceremony on November 10, 2016, in the Founders' Wing of the EAA AirVenture Museum. The five inductees, representing ultralights, the International Aerobatic Club, Vintage Aircraft Association, Warbirds of America, and homebuilding, have dedicated their lives to their respective areas of aviation and join an esteemed group of individuals who represent the spirit of EAA in the highest form.

ULTRALIGHTS: TRACY KNAUSS

Tracy Knauss, longtime publisher of *Glider Rider*, which became *Light Sport and Ultralight Flying* magazine, helped knit together the small community of hang glider and ultralight pilots with the publication he started in 1976. Photographer, artist, space buff, photo restorer, genealogist, magician, husband, and father — the list of Tracy's roles is long and varied, but the one that started him down the path to international recognition was magazine publisher.

When Tracy discovered hang gliding in 1976, he saw the need for a publication that informed pilots about news, warnings, new products, flying tips, and, yes, even gossip. He formed a company called Glider Rider and started a magazine by the same name. It was immediately successful and quickly became the go-to publication for hang glider pilots in the United States as well as in more than 60 other countries. "There is a commonality in flying that transcends language differences," Tracy observed.

As the sport evolved and pilots started putting engines on their hang gliders, Tracy followed the trend, changing the magazine's title to *Ultralight Flying*, and began including coverage of motorized ultralights. In its 40th year of publication, and now titled *Light Sport and Ultralight Flying*, the magazine continues to cover hang gliders and ultralights of all kinds, both powered and unpowered. "We've been covering the lightest end of aviation since 1976, and hope that the best years are still ahead of us," said Tracy.

INTERNATIONAL AEROBATIC CLUB:

ROBERT ARMSTRONG, EAA 113152

Robert "blames" his aviation career on his junior high school, which was located right next to an airport, providing ample opportunity to gaze longingly at airplanes through the window. He soon began swapping manual labor and airplane washings for flying time. Robert obtained his private pilot certificate before his senior year and received his A&P certificate the summer after graduation.

Robert built an S-1C Pitts Special and flew it first to Oshkosh, then down to Fond du Lac, Wisconsin, for his first aerobatic contest. He was the highest-scoring first-time competitor in Sportsman, and he counts that trophy as one of his most cherished. From that first contest at Fond du Lac, Robert met many fellow aerobatic enthusiasts involved in the IAC, finding them to be a helpful and friendly group of people. From then he was hooked and never wanted to leave. In 1988 Robert competed in the U.S. Nationals for the first time, winning second overall. He later began flying the CAP 231 and in his aerobatic career has flown in a total of 10 World Aerobatic Championships.

Robert has logged more than 17,000 hours of flight time, more than 5,000 of those in general aviation. This includes 1,600 hours of aerobatic time. The list of aircraft types he has flown exceeds 80. Robert is a retired airline pilot, having flown the 717 for 12 years at AirTran, and today flies a Citation XLS for a local company, allowing him the benefit of flying out of the same airport for both work and play.

VINTAGE:

PHIL COULSON, EAA LIFETIME 71350

Phil Coulson of Lawton, Michigan, has been immersed in aviation for all of his adult life. Phil enlisted in the U.S. Air Force during the Korean War and, on his return to Michigan, learned to fly in a prewar Piper J-5 Cruiser. Phil discovered a passion for sport aviation, and began attending the early EAA conventions at Rockford starting in 1962.

Phil began volunteering with EAA at Rockford, and then at Oshkosh, where he became an advisor in the Antique/Classic Division in 1985, followed by election to its board in 1987. During this period, Phil acquired a Waco UPF-7 open-cockpit biplane. The experience of owning the Waco, and the camaraderie with other owners that followed, led Phil and his friends to organize the American Waco Club (AWC) in 1993. Phil was named the founding president, a leadership position he continued until his retirement in 2013.

Phil also edited and published the *Waco World News*, the publication of the

AWC. In addition to the UPF-7, Phil and his wife, Ruthie, have owned a G35 Bonanza, a Cessna 195, a Waco RNF, a Waco 10, and a rare Waco UBA.

As a director of the Vintage Aircraft Association, Phil has chaired the annual Vintage Parade of Flight during EAA AirVenture Oshkosh and served as a long-term senior judge in the Antique category. Phil chose to take emeritus status with the VAA board in the fall of 2015 after nearly 30 years of active, involved, and dedicated service to both EAA and the VAA.

WARBIRDS: DOUG CHAMPLIN, EAA 62048

Doug Champlin dedicated his life to the historic preservation of military fighter aircraft, including 27 examples from World War I, World War II, Korea, and Vietnam. All of these aircraft were maintained in flyable condition and represented combat pilots from the United States, the United Kingdom, Russia, France, Japan, and Germany. The aircraft were based at the Champlin Fighter Museum in Mesa, Arizona, from 1980 through 2002. His museum didn't just house aircraft, but also featured a staggering collection of other artifacts, including an armored car, a Soviet T-34 tank, and a large number of other weapons, including a Gatling gun. In addition, Doug maintained what was considered to be one of the world's largest collections of autographs from famous fighter aces throughout history. The museum was also home to two notable veterans' groups: the American Fighter Aces Association and the Flying Tiger Association.

The Museum of Flight in Seattle, Washington, is now honored to be the permanent home of the Champlin Collection, proudly displaying Doug's treasured airplanes throughout their Personal Courage Wing gallery. Doug was a member of the Museum of Flight's board of trustees, and was gratified to see his collection remain intact when it was acquired by the museum and put on display in 2004.

Over the years, as he devoted his life to the acquisition, restoration, and display of so many rare and historic aircraft, for Doug, the most rewarding thing was the opportunity to meet fighter pilots from around the world and hear their stories firsthand. Those meetings led to many long-term friendships that he cherished until he passed away in May of 2013.

HOMEBUILDING:

JIM BEDE, EAA LIFETIME 3758

Jim Bede, an Ohio native, made his first foray into the experimental aviation world with his original BD-1. The airplane had a number of innovative features including the use of bonding the aluminum structure instead of riveting. The rights to that airplane were eventually bought by the Grumman Aircraft Company and became the Grumman Yankee. Jim followed that design with the record-breaking BD-2, and then the iconic BD-4. The simple and innovative design features of the BD-4 set the standard for simplicity and excellent performance. It was the first homebuilt aircraft to be offered in kit form, requiring no welding by the builder.

In 1971 Jim started the aviation world buzzing with the introduction of the BD-5 Micro. After the first flight, stability issues required a redesign, and Jim hired Burt Rutan to head the flight test department. One of the challenges faced by the BD-5 was the choice of engine. While searching for a reliable piston powerplant for the BD-5, Jim decided to create a jet-powered version. The BD-5J, best known for its role in the opening scenes of the James Bond film *Octopussy*, was a 300 mph manned bullet powered by a Sermel TRS-18-046 turbojet.

Jim was an active member of Chapter 1252, and there was no doubt about his passion for aircraft design. He devoted his life to helping people who had the dream of building and flying their own airplane. To those members in Chapter 1252, he was a mentor, a friend, a father figure, and a crazy old guy who loved to tell jokes. Jim passed away on July 9, 2015. EAA

WELCOME, NEW LIFETIME MEMBERS

ALABAMA
Paul Click (EAA 534218), Vernon

CALIFORNIA
Sanjeev Batra (EAA 1200696), Roseville
Alan Jones (EAA 1216310), Gridley

COLORADO
Jack Wallace (EAA 1215415), Englewood

GEORGIA
J. Alex Bell (EAA 1188888), Warner Robins
John Conway (EAA 678545), Cumming

ILLINOIS
Ronald McLawhon (EAA 611337), Orland Park
Karla Temple (EAA 1217401), Orland Park

INDIANA
Robert Catania (EAA 9012957), Mooresville

KENTUCKY
Cathy Davis (EAA 438758), Lexington
Jonathan Hill (EAA 473153), Taylorsville
Natalie Hill (EAA 1007929), Taylorsville
Robert Semones (EAA 485420), Louisville
Charles Tari-Head (EAA 1163908), Lexington

LOUISIANA
Shannon Elliott (EAA 602074), Sunset

MARYLAND
Lloyd Clark (EAA 1218281), Hanover
Lynda Thilly (EAA 879679), Towson
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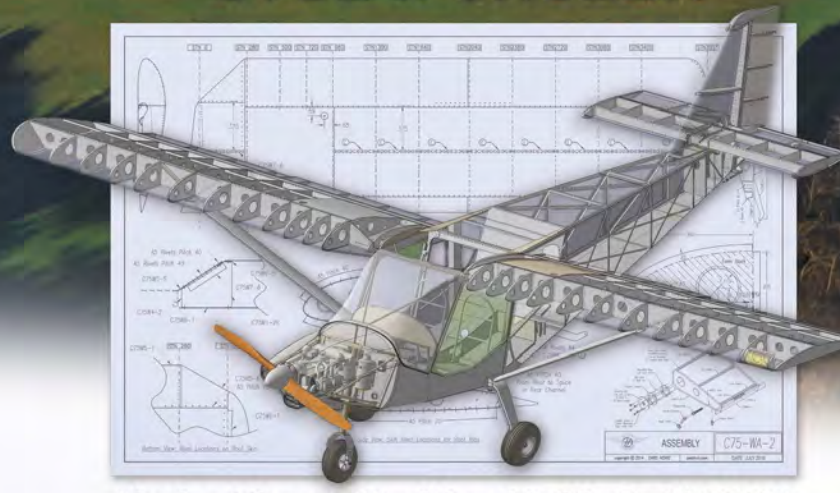

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VINYL VELOCITY
COVERING A CANARD

GOING GYRO
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FEATURES

DEPARTMENTS

ON THE COVER: John Craparo's Gold Lindy-winning Magni M-16. Photo by Jack Fleetwood

Figure 1

OLEO STRUT BASICS

Maintenance and service is key

BY CAROL AND BRIAN CARPENTER

AN OLEO STRUT IS a pneumatic air/oil hydraulic shock absorber. The primary purpose of the oleo strut is to absorb the landing loads on an aircraft. The force, which the aircraft structure is subject to, can be expressed in Newton's second law of physics F=MA, or force equals mass times acceleration. Acceleration is simply the change in velocity over time.

If we can double the time interval for deceleration of the aircraft through the landing gear by lengthening the shock strut, we can reduce the total force exerted on the structure by half. This is the basis for incorporating the long struts on short takeoff and landing (STOL) aircraft like the Just Aircraft SuperSTOL and the Fieseler Storch. Watching these aircraft perform short-field operations, you can see what appears to be near vertical approaches, culminating in a very impressive squat of the aircraft as the long stroke landing gear struts absorb the landing loads.

Although there have been many variations upon the oleo strut, there is some particular genius in its design. The basic physics incorporated in the operation of the oleo strut are what has made it so popular in so many different designs from the smallest aircraft to the largest. This basic design concept (Figure 1) is so efficient that even the most modern aircraft use the same basic principles that adorned aircraft landing gear designed and built as far back as the 1930s.

ILLUSTRATION BY CAROL AND BRIAN CARPENTER

Let's look at the basic operation of the oleo strut. (Figure 2) Inside the strut we likely have a combination of Mil-H-5606 hydraulic fluid and dry air or nitrogen. The primary job of the air located in the upper chamber of the strut is to act as a spring. And the primary job of the hydraulic fluid, which is located in the lower chamber of the strut, is to regulate and transfer the loads from the lower half to the upper half of the strut and subsequently into the airframe. Located in between the upper and lower sections, but attached to the upper portion of the strut, is an orifice (shown in green). This orifice restricts the flow of hydraulic fluid from the lower half to the upper half of the strut. This basically lengthens the time interval during the compression stroke created by the landing gear's impact with the ground.

Many early strut designs simply stopped at this point, using a fixed orifice to control the fluid transfer from the lower to the upper half of the strut. Later designs improved upon this concept by incorporating one more component called the metering pin (shown in pink), which takes the design to an entirely new level. This metering pin is attached to the lower portion of the strut and is tapered starting at the top getting wider as it approaches the bottom section of the strut. This metering pin is co-located within the center of the orifice essentially creating a variable-sized orifice. When the strut is fully extended, the gap between the orifice and the metering pin is relatively large, allowing fluid to flow rapidly. According to Newton's second law, the greatest amount of force imposed onto the landing gear structure will be at the point where we have the highest amount of deceleration (initial impact). As the rate of strut compression decreases, so does the force. This design allows the restriction between the orifice and metering pin to progressively get smaller and smaller, essentially maintaining a constant force onto the structure while exponentially decreasing the rate of strut collapse. (Figure 3) This allows the entire length of the lower section of strut to progressively collapse, absorbing the landing loads over the longest time interval possible. It's really quite a brilliant concept.

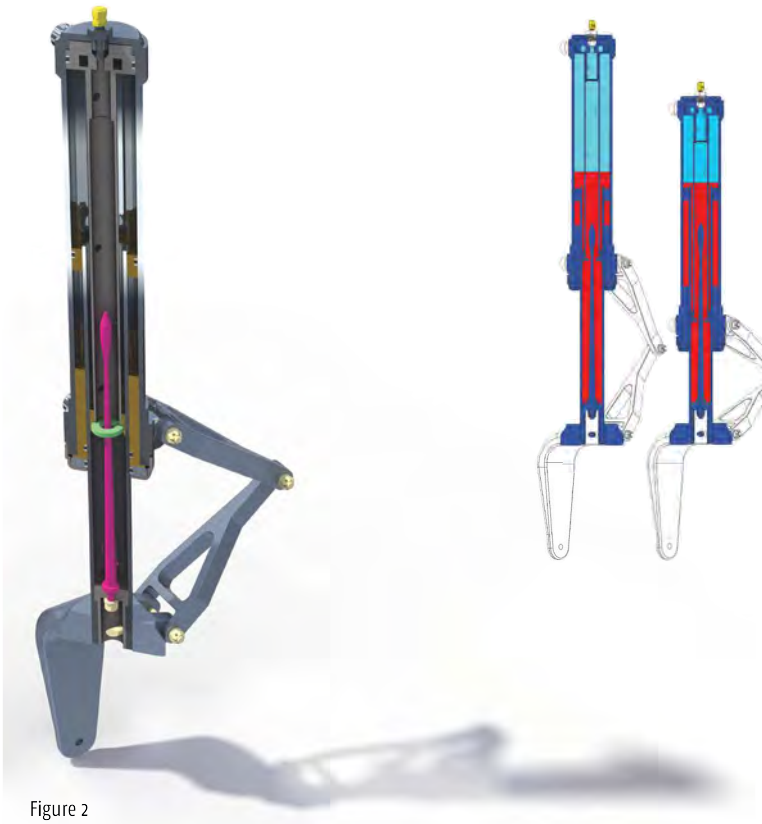


Figure 2

Figure 3

ILLUSTRATIONS BY **CAROL AND BRIAN CARPENTER**

A properly serviced strut is virtually impossible to bottom out because of this increasing restriction. Landing forces that could cause the strut to bottom out would likely result in ripping the strut from the aircraft structure. Recognize that it is the fluid and only the fluid that is responsible for the strut's amazing ability to absorb these landing loads. A strut that has lost its fluid is virtually useless. A strut without fluid is the equivalent of welding the bottom half of the strut to the upper portion strut in the collapsed position. The time interval for deceleration in this case drops off dramatically. This in turn causes the loads imposed into the structure to also increase proportionally. We often wonder how many of the accidents where we see a collapsed nose strut are a direct result of improper servicing or simply loss of fluid.

This brings us to the topic of proper servicing of the strut. The standard caveat certainly applies here: You should always use the proper and current service manuals for your particular aircraft when servicing the struts. With this being said, let's consider some basic principles associated with servicing a strut. Keep in mind that during the compression stroke of the landing gear the hydraulic fluid is non-compressible. This essentially means that over-servicing the strut with hydraulic fluid could lead to a liquid lock, thus reducing the overall length of compression, compromising the strut's ability to absorb the landing loads. Normal servicing of the strut might require that after adding fluid we completely collapse the strut ensuring that any excess fluid is squeezed out before we add air or nitrogen. (Use of dry air or nitrogen is to reduce the potential for moisture getting into the internal structure of the strut and causing corrosion.)

With the strut in the collapsed configuration and filled with fluid, the total volume available for air is really quite small. Once you have applied enough pressure to bring the strut up to the proper servicing height (approximately 25 percent of total stroke), the air simply acts as a spring to return the strut to a height that will allow the fluid transitioning through the orifice and metering pin to dampen shock loads associated with taxiing. Because of the small volume of air in the normally serviced position, as the strut begins to extend, the pressure drops off dramatically. If you've ever seen the nose of a Cessna sitting higher than normal, you would probably be able to grab the prop and move the nose up and down fairly easily. This simply means that there is a larger volume of air in the nose strut reducing the amount of pressure change as the strut moves up and down. By default, the only way to get a larger volume of air within the strut is to reduce the volume of fluid, meaning the strut is low on fluid.

If you come out to the ramp and find your strut has collapsed, you have a problem not associated with the amount of air in the strut. The initial urge is simply to service the strut with more air. However, you probably still have the proper amount of air inside the strut. What has happened is that the strut has lost a small volume of fluid, increasing the total volume available for the air. Generally speaking, the most probable source of leaking are the O-rings where the lower strut goes

into the upper strut housing. All of the other seals within the strut are static with a very low likelihood of failure. Because the air is on top of the fluid, the first thing to go is always going to be the hydraulic fluid.

Although it's purely anecdotal, we see a direct correlation between aircraft owners who wash their aircraft on a regular basis and those who have a higher number of strut seal failures. We hypothesize that the cause of the strut seal failure is due directly to the owner of an aircraft cleaning and washing not only the aircraft, but the landing gear struts as well. If you were to completely clean the chromed portion of the oleo strut, you will be left with a very dry surface. As you confidently fly off for your hundred dollar hamburger and to show off your nice clean airplane to all of your buddies, you probably don't even realize that you have just set yourself up for a potential strut seal failure. If you inadvertently make a harder than normal landing, you may exercise the landing gear into the portion of the strut that has just been spotlessly cleaned. It is a common occurrence on dry struts, where the landing gear is exercised aggressively, that the internal O-rings will grab onto the nice clean chromed surface causing them to stick and roll. When the O-ring rolls, it normally does so in just one section ... causing the round O-ring to twist. This twist now becomes a pathway for the hydraulic fluid and air to escape. The result, of course, is a collapsed landing gear strut. Once the O-ring has become rolled or twisted, the only fix, typically, is to disassemble the strut and install new O-rings. Ironically, the aircraft owner who never does any maintenance on his aircraft, and has oil puking out of the engine down onto the struts, never ends up having to replace nose strut seals because of his leaking engine, otherwise known as an automatic strut lubricating system. Of course, we jest, and do not recommend this as your primary solution to preventing strut seal failures.

Most aircraft maintenance manuals, and even flight manuals, recommend after washing the aircraft struts to relubricate the chrome portion with a clean rag soaked sparingly in Mil-H-5606 hydraulic fluid. By maintaining a well-lubricated strut, the O-rings will slide effortlessly along the chromed surface. It then becomes virtually impossible to roll an O-ring. Many aircraft checklists even incorporate this procedure as a preflight item. This procedure not only relubricates the strut and protects it from corrosion, but gives us an opportunity to remove any bugs, dirt, and old dried-out hydraulic fluid that may have accumulated. Although not as dramatic a failure as rolling an O-ring, dirt and debris that continuously get into the seals of the strut can cause the strut seals to become worn out and eventually leak.

The landing gear struts in our aircraft are such an amazing piece of engineering, but all of that engineering won't do you a lick of good unless you keep them properly maintained and serviced. EAA

Carol and Brian Carpenter, EAA 678959 and 299858, owners of Rainbow Aviation Services, have co-authored two aviation books and team teach the Light Sport Repairman Workshops. Brian is a CFII, DAR, A&P/IA, and the designer of the EMG-6 (an electric motor-glider). Carol is an SPI, PP, LSRM, and FAAST representative.

Dan Grunloh and his Air Creation Racer trike.

HAVING FUN FLYING

Fun Fly Zone 2016

BY DAN GRUNLOH

WE HAD A GREAT week in the Ultralights area, now known as the Fun Fly Zone, during EAA AirVenture Oshkosh 2016. The area got its new name because we have fun there, and because it now encompasses much more than just ultralights. By every measure and count — the number of people, airplanes, special activities, forums, workshops, even donuts sold — there was a significant increase in activity from last year. Interest in sport aviation tends to run in cycles, and there is little doubt we have been seeing a steady increase for several years now.

There were 135 pilots registered to fly on the ultralight runway, plus 31 more pilots registered to fly helicopters. The aircraft aren't physically counted. There were at least 20 to 25 powered paragliders and powered parachutes. I counted 14 in the air at one time and was informed several more were out of sight. About a dozen brand new FAR 103 fixed-wing and trike ultralights were parked in the vendor area, and more than that were in the general exhibitor area. If we had around 135 aircraft, I'm estimating one-third of them were ultralights. AirVenture in the Fun Fly Zone is the largest gathering of powered ultralights in the country. About 130 volunteers are needed all week to make the whole place run smoothly. Members of the Civil Air Patrol provided runway security, bringing the total to around 300 people working the area.

The area got its new name because we have fun there, and because it now encompasses much more than just ultralights.

LET'S GO FLYING

I've been flying in the Ultralights area at AirVenture for almost 30 years but had not brought an airplane since 2013. I have flown the 300-mile trip from Illinois in my trike several times, but it's hard to bring enough camping gear on a single-seat trike. I could stay away no longer, so I rebuilt an old flatbed trailer especially chosen for a very low deck height. A shallow ramp makes for easy loading of the trike and of the wing itself,

PHOTOGRAPHY COURTESY OF DAN GRUNLOH

which weighs about 100 pounds when packed up. It worked great for my trip to Oshkosh, and my plan is to use it to travel to distant venues like the Sun 'n Fun International Fly-In and Expo at Lakeland, Florida, next spring.

Flying from the ultralight runway can be serene and beautiful in early morning or late evening, and it can be pleasantly exciting when it is busy. The runway is short, it has a significant slope, and the approach requires a turn just before landing. The first thing you see when climbing above the trees is Lake Winnebago. It soaks up almost the entire eastern horizon and has a beautiful blue color in the morning sun. You can forget it's there if you spend your time at AirVenture on the ground.

A friend who came to watch for the first time expressed surprise that we took off and immediately came back to land. The truth is that spectators come to see the landings and takeoffs. They are the most fun part of flying once you figure out the conditions and the techniques needed. Trees near our runway cause rotors in westerly winds, and crosswinds can be interesting at times. A good technique is to always land long regardless of wind direction or traffic direction.

Camp Scholler with safety lane for ultralights visible ahead.

Typical view of the EAA AirVenture Oshkosh grounds from the ultralight pattern.

Flying from the ultralight runway can be serene and beautiful in early morning or late evening, and it can be pleasantly exciting when it is busy.

PHOTOGRAPHY COURTESY OF **DAN GRUNLOH**

Saturday morning's successful balloon launch from the ultralight runway.

This scratchbuilt Hummel UltraCruiser by John Ventrice from Oak Forest, Illinois, won an honorable mention from ultralight judging.

Pattern altitude is 300 feet because heavier aircraft are flying nearby at 500 feet. Sometimes pilots and altimeters wander a bit. You can be certain your altitude is correct if all the other planes in your pattern are on your horizon, which brings up a problem.

The visual ground clutter around the biggest fly-in in the world is immense. It is airplanes, buildings, people, cars, and campers as far as you can see. Anyone who descends below 300 feet instantly becomes harder to see.

Powered parachutes and powered paragliders have their own dedicated time slot, but all fixed-wing ultralights, trikes, and light-sport aircraft fly together, at the same time, without radio control, and with wide-ranging cruising speeds. There isn't enough daylight to offer a flying period for every type, so over a period of time, and with good protocols, we successfully mix aircraft that cruise at 35 mph with others flying more than twice that speed. The slowest planes stay to the outside line, while all passing is to the inside.

Ultralights are also now getting more exposure on the main AirVenture runway show line. Last year John Moody flew his Easy Riser down the main runway before the start of the evening air show. This year the Paradigm Aerobatic Team opened the Wednesday and Saturday night air shows with a team of six powered paraglider pilots who demonstrated precision group formation flying and performed aerobatic maneuvers including full vertical inside loops. It was a stunning, jaw-dropping performance.

NEW PRODUCTS

Team Mini-Max displayed a complete but uncovered all wood two-seater called the Epic Sport. The Epic Sport has laser-cut plywood wing components and a stock wood-construction fuselage. The engine is a four-cylinder 85-hp Volkswagen of 2400 cc built by Scott Casler of Hummel Engines.

Belite Aircraft flew its UltraCub ultralight (now available as a quick-build kit) and displayed a new version of the low-wing SkyDock. The new SkyDock has a sophisticated carbon fiber fuselage and wings with carbon fiber D-cells. It can be built as an ultralight, but projections indicate the airframe is capable of more than 95 mph and is expected to be offered as an amateur-built kit.

PHOTOGRAPHY COURTESY OF **DAN GRUNLOH**

Team Mini-Max Epic Sport two-seater.

The Kolb TriFly ultralight was flying with a 50-hp Hirth F-23 twin opposed free-air cooled engine. The engine has recently been flown on a number of ultralights including Quicksilver, Belite, Fisher 202, and the Aerolite 103. Bryan Melborn of Kolb Aircraft said the engine is smooth, and it gets very good fuel economy. The F-23 weighs 78 pounds complete with electric start, exhaust, and belt reduction drive. Andy Humphrey of Heavenbound Aviation said the engine installation is a little more complicated because it uses a dual exhaust system.

Also on display was Brian Carpenter's EMG-6 electric motor-glider which will also be available as a gasoline-powered version. The EMG is a very clever concept aircraft that incorporates 3-D printing of plastic parts on the aircraft. Brian's forum in the Fun Fly Zone seminar tent was packed with attendees interested in the project.

Verner Motor of the Czech Republic has introduced a line of four-cycle radial engines including the Scarlett 3VW, a three-cylinder engine producing a maximum of 42 hp at 2500 rpm and 34 hp maximum continuous at 2200 rpm. The 74-pound engine is expected to be flying soon on a Milholland Legal Eagle. It has an electric starter, a 12-volt electrical system, and runs a single Walbro carburetor.

All the way from Ukraine, Alexander Voronin, director of Aeros Ltd., displayed and flew two examples of the Aeros Nanolight Trike. The lightweight trike intended for soaring easily qualifies as a FAR 103 ultralight and can be fitted with five different wings depending on pilot experience. The trike disassembles easily and can be transported in a small car (with the wing on the roof). The trike features retractable main gear for optimum soaring potential.

Also on hand was the unique REV single-seat trike by Evolution Trikes that has no front strut to obstruct the view. Evolution also flew a pair of its deluxe REVO two-seaters, giving rides all week.

AirVenture 2016 was a week of very full days for me, typically beginning with the pilot briefing at 6:30 a.m. and going all the way to the end of the night air show or other evening entertainment. I want to thank everyone — strangers and friends — who spoke to me, and all the volunteers who helped make the week in the Fun Fly Zone so enjoyable. EAA

Dan Grunloh has been an EAA member and volunteer since 1981, and he has logged 1,500 hours in ultralights and light-sport aircraft. He can be reached at *dangrunloh2@gmail.com*.

PHOTOGRAPHY COURTESY OF **DAN GRUNLOH**

Wrapped Up

APPLYING VINYL AS AN ALTERNATIVE TO PAINT

BY RANDY OTT

PHOTOGRAPHY COURTESY OF **RANDY OTT**

MY MOTIVATION FOR VINYL-WRAPPING my Velocity stems from a combination of simple economic efficiency and my desire to learn how to do new things that create extraordinary results. It all started when I purchased N333RR at the Velocity factory in Sebastian, Florida. N333RR is a standard RG and had spent most of its 20-year life as a hangar queen.

In 2012, when 3RR emerged from hibernation, it received a fresh coat of paint. I don't know what kind of paint was applied, but by the time I purchased the aircraft its finish was seriously deteriorating. Scott Swing and the folks at the Velocity factory were gracious enough to sand down the worst of the worst and give me a nice coat of epoxy primer, and I flew my Velocity cross-country to its new home in Stockton, California, with epoxy primer on the top of the fuselage and the strakes. The wings were in slightly better shape, although they were still dull and deteriorating.

The seat upholstery is one of the few design elements I hired someone else to do. The burl wood window trim was created using vinyl wrap.

RENOVATIONS BY RANDY

I focused on upgrading the interior first. I had used a local gentleman for the interior of my previous plane, and I was very pleased with the quality of his work. However, his quote for the Velocity came in at $7,500.

I had watched his crew work during that prior installation, and the process looked very straightforward. I know, those are a novice's famous last words right before he jumps in over his head. Fortunately, we live in the era of YouTube. I spent a few days reviewing instructional videos and gained enough confidence to tackle the project on my own. I bought identical materials to those quoted at $120 per yard for just $30 per yard online. I farmed out the actual seat upholstery to a local guy for $1,000 and did the rest myself. The total project cost me $1,700.

As part of the interior redesign, I used vinyl wrap to create a burl wood window trim effect around the cockpit's interior. This was another learning experience in which YouTube was my mentor and the school of hard knocks my playground. The finished project turned out about 1,000 times better than it had previously looked. It wasn't perfect, I made some mistakes along the way, but the results were still extraordinary!

With the interior (vinyl) wrapped up, my attention then turned to the exterior. I called a well-known paint shop in Salinas, California, for a quote. It said a basic Velocity paint job usually runs about $12,000 — perhaps a bit more — depending on how much prep work is necessary. If I wanted a lot of fancy stuff, the price would, naturally, go up from there.

This was simply not in my budget, so I started searching for lower-cost alternatives. My first thought was to paint it myself. I found a place online that caters to people who want to paint their own aircraft. Their pictures all looked great, but the further I got into it, the more barriers popped up. I have a hangar partner. How would I protect his plane during this process? I would also need to build a ventilated paint booth — and the Velocity is a *big* airplane — so that wasn't the most viable alternative. Furthermore, I would need to obtain all the required spray equipment — *and* learn how to use it. On top of all that, the airport did *not* want me painting an aircraft in my hangar.

PHOTOGRAPHY COURTESY OF **RANDY OTT**

VINYL VIABILITY

I knew that vinyl had been successfully applied to other aircraft exteriors, so I began investigating that alternative. I found some beautiful examples of vinyl-wrapped birds: everything from light airplanes to B-737s. My initial concern was, "Is that stuff really going to stay on?" I called some of the vinyl application places, all of which said that is the first question on everyone's mind. They have been applying vinyl to race cars for years — and now to large aircraft — and it's still not coming off.

The general consensus was that a vinyl application costs about 90 percent of what a standard paint job would run. This *can* be true — *if* you desire several intricate graphics on your plane. I did much, much better.

Unlike paint, vinyl graphics are printed on the material *before* it is applied to the aircraft's exterior. Once the images are printed, there is a lamination process that puts a clear layer of vinyl over the top to lock in the ink. Another positive is that, unlike paint, the cost of elaborate vinyl imagery is basically the same as simple graphics. You are limited only by your design capability. Application companies typically charge $450-$800 to come up with a design for your aircraft. With airplane graphics, everything has to be precisely aligned, and all curvatures need to be taken into account for the final application. It's a detailed installation process to say the least.

That got me to thinking: What if I don't want any sophisticated graphics? What if I treat it like a basic paint job, with a white base layer and then just apply whatever imagery on top, just as I would with any other installation? The cost savings of that approach was significant. Also, since most of the price of a vinyl wrap is the labor of installation, the savings would be even greater if I did it myself.

I watched hours of vinyl wrap installation videos on YouTube, and it looked like something I could do with a little practice. Next, I needed to decide which manufacturer's product to use.

I talked with Metro Restyling, a vinyl company based in Detroit. It recommended an Avery product because it is a bit more conformable than the 3M product similar to what I used on the interior, and would be easier to use with the Velocity's numerous complex curves.

PROTECTING YOUR INVESTMENT

To a great extent, the life span of a vinyl exterior is determined by the quality of the ink and its exposure to the sun. This is especially noteworthy for those who want to use intricate imagery. These days, most installations come with a five-year life span (based on full daylight sun exposure), after which your exterior will begin to fade and removal of the product will become more difficult. The gentleman I spoke with said they have 12-year-old installations (on hangared aircraft) that still look brand new.

I just wanted a bright shiny Velocity with a few accents that my wife would be proud to fly in, so I purchased a 60-inch by 65-foot roll of Avery SW900 Supreme Wrapping vinyl film in Gloss White. I also bought a handful of required application tools: several felt-tipped squeegees, a set of X-ACTO knives and blades, an adjustable heat gun, a lint-free cloth glove, a roll of fine filament vinyl cutting tape, and some 3M Adhesion Promoter. There were no ventilators, no spray guns, no body suits, no thinners — no toxic anything. I also didn't have to worry about overspray ruining my partner's plane — or the airport manager catching me and feeding me to the lions. Life was good!

THE NITTY-GRITTY

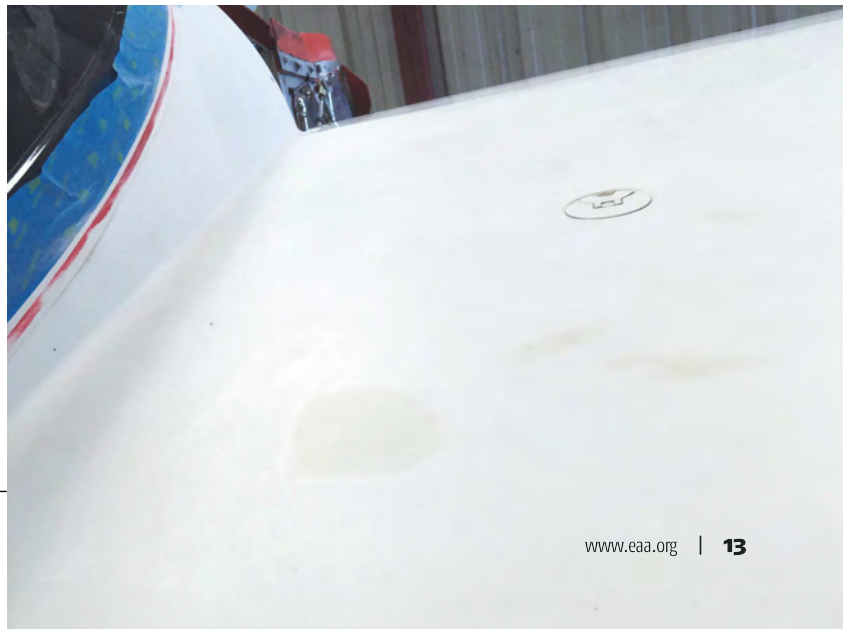
Everyone told me prep work is 90 percent of the project, but I think it's really more like 99 percent. I had never done any body work before, so I didn't know how much I really needed to do.

As soon as I got the vinyl, I was so excited that I immediately covered the access panel above the nose landing gear. It came out nice, though it had a noticeable amount of orange peel in the reflection. Scott had primed the plane for me, but I hadn't bothered to sand it.

The next easiest panel was the one over the canard, so I began by sanding this one with 220-grit sandpaper. It turned out much better than the nose gear panel so I knew all of the primed parts would need to be sanded. Upon further inspection, I noticed a few pinholes on the strakes that needed to be filled.

Next up, all the old pinstriping tape and N-numbers came off, which revealed aged paint and stripes underneath, These too would need to be sanded prior to vinyl application. I then began to sand.

Below: Each section had to be primed and sanded with 220-grit sandpaper before the vinyl could be applied.



PHOTOGRAPHY COURTESY OF **RANDY OTT**

My goal was not a perfect mirror finish, which I knew was above my paygrade. I just wanted something that looked acceptable. I started out with the 220-grit paper. The strakes are large surfaces — and they seemed to have a bit more orange peel — so I spent a few days hand-sanding them.

6LQFH, NQHZ WKHVH RRWKHUWKH¿QLVK WKHEHWWHUWKHIQGSURGXFW, HDFWLG WR IROORZ XS ZLWK JUDWKDQG VDQGLQJ 1RZ , ZDVOHWZLWKWKH SLQKROHV , KDG XVHG Bondo glazing compound RQWKHIQWLRUWR¿OOWKH ZHDYHRI WKH¿EHJODVVDUHDSSOLQJ WKHYLQ O VR, WWDUWG WR XVH WKDWRQ WKHH[WHULRU7KDWWZKHQ, UHDOLHGWKDWZKDW KDG WRRXJKZHUHD IHZ SLQKROHVZHUH ILQIDFWXQGHGVRI WKHP 2 DQRYHUWKHWDNHV , QHHGHG DEHWWHUVROXWRQ

I went to my local auto body supply store, and it recommended Dolphin paste. It's the consistency of cake icing and covers large areas well. It is ready to sand in 10 minutes and sands easily. I spent the next several days filling and sanding. The paint on the wing had deteriorated in several areas, so I filled and sanded there as well. This tedious process seemed to go on forever, but I knew the vinyl application was inching closer and closer.

It took a solid week of filling and sanding before it was *finally* time to apply some vinyl. I elected to do the right wing first. My logic was to do the wing that I would be looking at the least first — just in case I messed it up. In hindsight, I should have started with a smaller area. *A lot* of learning happened on that wing — which was good, though if you look close, you can see it. My words of wisdom: Don't get excited. Practice plenty on test surfaces, then apply with confidence.

FROM THEORY TO APPLICATION

The vinyl comes in a roll 60 inches wide. It has a heavy paper backing that is removed prior to application. This type of vinyl is applied without liquid lubricant added during the process, which is why you need felt-tipped squeegees. If you use an ordinary squeegee, you'll scratch your precious shiny vinyl as you apply pressure to remove the air from underneath.

The Avery vinyl is a consistent 3 mm thick and has a pressure-sensitive adhesive on one side. Older styles of vinyl were prone to sticking together, as well as adhering prematurely to the application surface. Thankfully, modern products have wonderful repositioning characteristics. You can remove the backing paper, put the adhesive side down on your substrate, and still move/reposition it on your surface. Contemporary vinyls feature a layer of glass microbeads on top of the adhesive, and these beads allow you to reposition the material as much as you like until you apply pressure and the balls submerge into the adhesive and stick. This is a fantastic quality, because I have learned that the more time you spend positioning your material, the better the result.

The vinyl itself is stretchable, to an extent, and incredibly resilient. It also has an impressive memory. It can be stretched and deformed, but when heated it will return to its original shape. If heated to a certain higher temperature, you can teach it to retain a new shape — which comes into play during the application process.

There are times when you'll want to use the stretchability characteristic to conform to complex curved surfaces. In such

The access panel on the nose was the first section to be vinyl wrapped followed by the panel over the canard wing.

Above: The vinyl stretches to conform to the shape of whatever you're applying it to.
Below: The Avery vinyl uses a pressure-sensitive adhesive allowing for repositioning over large areas.

PHOTOGRAPHY COURTESY OF **RANDY OTT**

A felt-tipped squegee was used to apply the vinyl to prevent scratches.

Above: I used an X-ACTO knife to trim unneeded material before application.
Below: A heat gun can be used to restore the shape of the vinyl if wrinkles appear.

PHOTOGRAPHY COURTESY OF **RANDY OTT**

instances, you will heat a large area, stretch it over the curved surface(s), apply the adhesive pressure, and then go over it again with the heat gun to set the new shape. Without this final heating the vinyl will slowly try to return to its original shape, which can lead to lifting at the edges.

TENETS OF VINYL WORK

I cannot overstate how much you need an extra pair of hands while working with vinyl. It is *not* a pleasant experience to end up with a 15-foot-long bunch of rolled-up material all stuck to itself. The second most important thing is: cleanliness. Your surface *must be clean*, free of all dust, grease, cleaner residue — everything! We used Simple Green over the entire area and then followed up with 90 percent isopropyl alcohol. You should feel *no* grit or dust when you run your hand over the surface. We found that even the closed hangar had a lot of dust floating around. If we washed an area down, we would have to re-clean it the following morning. Once your area is immaculate, it's a good idea to apply a thin layer of 3M Adhesion Promoter to all the edges of your work. I applied it in about a 2-inch thick band. This will help ensure no lifting of the vinyl around the edges.

Measure the amount of vinyl you need and lay it out flat on your surface. Cut away any unneeded material; it will only get in your way later. Remove *all* of the backing paper. If you were doing the wing, you could remove at least one-third of the backing area without fear of it tangling up. Then, with two people, pull the sheet taut. Keep the vinyl tight at all times and try to keep it from folding on itself. Lay it back down gently and smoothly on your surface. Next, apply light pressure to the corners to stick them down a bit. You will have to pull up and reposition those corners several times, so don't stick them down too hard.

Gently pull and tug on the edges of the material. Your goal is to have it lay over the surface like a sheet — with no waves or wrinkles. Once the sheet is down smoothly, heat the entire surface to remove any remaining wrinkles. Next, pull the vinyl gently and snugly down on the underlying surface before using your felt-tipped squeegee to push the air out and apply the adhesive.

There are micro air escape paths built into the adhesive. Always work the air out from the middle toward the edges. Be aware that there *must* be an escape path for the air; work it out with slow, even strokes. If you rush it, you will most certainly create air bubbles, which can be removed by lifting the surrounding vinyl up and off the surface until you reach the bubble, then reheating and squeegeeing the entire area until all deformations are gone. One person should be in charge of adjusting surface tension while the other is squeezing out the air and activating the adhesive.

Whenever you run into a problem with bubbles or wrinkles, use the heat gun to get the vinyl back into shape, and then re-apply it. Once you have applied that entire (one-third wing) section, pull the bottom backing away from the next one-third of the wing and cut it away. If the vinyl sticks to itself, just pull it apart (no matter how bad it seems) and heat the area; it *will* return to its original, smooth shape. Continue with the application. Repeat until you are at the end of the wing.

FINISHING TOUCHES

When attempting to tailor the vinyl to the curves of your Velocity, it is important to keep a few things in mind. Whenever you stretch the material, you don't want to just stretch it over a small area; you want it spread over a large surface area. For example, if you were coming to a corner or rounded contour, you would not want to heat a 2-inch band of vinyl to traverse the corner. You would instead want to heat a 10-inch band for before the corner *plus* a 10-inch band that would be applied beyond the corner. Then, you would gently stretch the entire 20-inch section around the corner/curve so that the material is applied evenly across the entire area. Small radius curves can be *very* challenging. If something doesn't work out, just pull it up, re-heat the vinyl, and try again. This is where the lint-free cloth glove comes in handy. The surface of the vinyl can get *very hot* when heated. At times, you'll need to heat the vinyl and then push it down into a recess before it cools. The glove allows you to do this, and provides a good amount of thermal protection for your fingers.

Once you have finished, you'll need to go over the entire surface again with the squeegee or a soft roller to activate *all* of the adhesive. Then, you'll need to take the heat gun and go over all of the surfaces where you had to stretch the vinyl. Once that's complete, it's time to trim off the excess vinyl. This can be done either with a sharp blade or with fine filament cutting tape. The tape is great because it allows you to make smooth, complex cuts without a knife. It's also easy to use. Simply lay down the tape where you want the cut to be — *before* you apply the vinyl. Next, lay the vinyl right over the top of it.

Once the vinyl is over the tape, just expose the filament, give it a quick tug, and it cuts a beautiful line in the vinyl right where you ran the tape. It's excellent for making straight lines or curves, and it works equally well on seams. When cutting with a knife, a sharp blade and a steady hand are key. I used an X-ACTO knife. Once you get the technique down, your finished product should look beautiful and will shine just like paint.

RUNNING THE NUMBERS

In the end I used about 100 feet of Gloss White vinyl. I did *not* cover the bottoms of the wings, canard, or belly of the plane. Full aircraft coverage would have required approximately 160 linear feet of material. My total expenditures for materials and application tools came in at less than $1,500. That figure includes the gold chrome accents, which are *very* expensive.

It took me about a month to do the project, working when I could. After prep work, I applied one element each day (i.e., a wing one day, a strake another day, etc.). One of the benefits of vinyl is that, unlike with paint, you can take your time and do one section at a time. If you mess up, just pull it off and start over. Time will tell how durable it will be and how it will hold up to our 200-mph slipstream. EAA

Randy Ott, EAA 431393, has been a pilot for more than 30 years and is a member of EAA Chapter 1432. He and his wife Helen travel often in the Velocity, and he hosts a YouTube channel documenting his love of flying.

OTHER LESSONS LEARNED

- On our trip to Oshkosh, we ran into some light rain. I had applied some Gold Chrome vinyl to the winglets but did not buy enough material to completely wrap around the leading edge, which left the edge exposed to the airflow. The rain worked like a sandblaster on that exposed area. Be sure to wrap the leading edges completely when using specialty vinyl materials.
- Sand off *all* marginal paint. My worst spots were caused when I pulled up the vinyl to reposition it and chips of the old paint came up with the adhesive. This happened in several areas and caused unsightly bubble rash that could not be fixed without removing the entire section and starting over.
- The nose cone is a bear. Evenly heat the entire area, and pull the vinyl over the nose in one action. I could not cover the nose without a seam. Don't be afraid of curves or seams. Be patient, and go slow.

PHOTOGRAPHY COURTESY OF **RANDY OTT**

PHOTOGRAPHY BY **AMY SAUNDERS**

Gyroplane POPULARITY

A LOOK AT SILVERLIGHT'S AR1

BY DAN JOHNSON

OVERSEAS A PHENOMENON IS unfolding; a new big thing in light aviation is crackling with energy.

The leading seller of light aircraft engines, owning 75 percent or more of the global market, is Rotax. Marc Becker and Christian Mundigler, representatives of the Austrian powerplant manufacturer, said they sell more 912 and 914 engines to gyroplane producers than any other aircraft segment by far.

While we have some national Civil Aviation Authority estimates for aircraft counting in other countries, differences in how nations register their aircraft make precise information devilishly hard to obtain. Thanks to Rotax's sharing of manufacturing data, however, we know how many engines manufacturers bought. If we assume each purchased 912 or 914 was installed on an aircraft delivered to a customer, we end up with some interesting data.

BY THE NUMBERS

AutoGyro, the German giant, has bought more than 2,000 of the four-stroke, four-cylinder engines; Magni of Italy bought 900 of the 912s; Spain's ELA adds another 700 to the list; and conservatively 500 more from other builders and countries, for a total of more than 4,000 engines. Much of this has been in fairly recent years, since around the time the U.S. sport pilot/light-sport aircraft regulation was released.

While gyroplane manufacturers overwhelmingly use Rotax, other powerplants are also in use by gyro makers, further expanding this field. Anyone can observe that 5,000 or more gyroplanes delivered over the past 10-12 years makes for a vibrant sector.

During roughly the same period, Americans bought 3,000 special light-sport aircraft (S-LSA) fixed-wing airplanes of all brands, and around 4,000 of all types of LSA. Gyroplanes globally have out-delivered LSA in the USA.

Perhaps to illustrate the chasm between old and new gyros, modern producers prefer the term "gyroplanes," while the older Bensen types are often referred to as "gyrocopters." The old and new are different in important ways, and the newest designs have good safety records as well as strong customer approval.

The Euro-style gyroplanes employ tails with larger vertical and horizontal surface areas firmly attached to the rest of the carriage. Other factors are also important, but the tail plane alone is a major part of why these machines are much more predictable to fly.

The Europeans continued the development far past an empennage. Companies across the Atlantic first partially enclosed the cockpit with lower-half fuselages and windscreens. They added better seating, instrumentation, controls, and generally improved fit-and-finish. More recently, designers have made fully enclosed models with increasing sophistication in both tandem and side-by-side seating.

These improvements clearly unearthed a ripe market around the world.

BACK HOME IN AMERICA

Meanwhile, back in the USA, the picture is different. One important element is the lack of ready-to-fly gyroplanes.

While going great guns overseas, in the United States AutoGyro has done reasonably well but performed modestly compared to all other countries. Its U.S. importer has delivered more than 100 units. A similar number may have been sold from other brands. The information is imprecise, as all the U.S. gyros have been registered as experimental amateur-built or experimental exhibition. This means registration is done with the builder as manufacturer, so counting the entries is challenging.

With or without exact numbers, even basic data shows the U.S. lags behind countries with a fraction of the population, such as Germany.

A key reason for this large difference is the FAA never granted special LSA privileges to gyroplanes. The industry was ready, having created and successfully balloted an ASTM standard for gyros. Approval was expected, but a dozen years into the new sector, the industry is still waiting. Industry experts are hopeful for positive changes emanating from conversations in 2016, but after the long wait, no one is certain.

Therefore, American gyroplanes are all assembled from kits, which results in some good and some less-desirable attributes.

Assembling a modern gyro from a kit is not as challenging as a homebuilt helicopter, and the process involves a few weeks rather than months or years. The FAA has been understanding, judging elements of a kit gyro in ways that make the process easier than experienced homebuilders might expect.

Most gyroplane sellers offer builder assistance centers to help ensure everything comes out perfect. This activity is well known and, done with care, stays easily within the rules.

Some gyro sellers have come to prefer the kit process. Using this method reduces their legal liability; the builder is the manufacturer. As EAAers know, kit building creates a deeper involvement and knowledge of the aircraft than with a fully manufactured aircraft purchase.

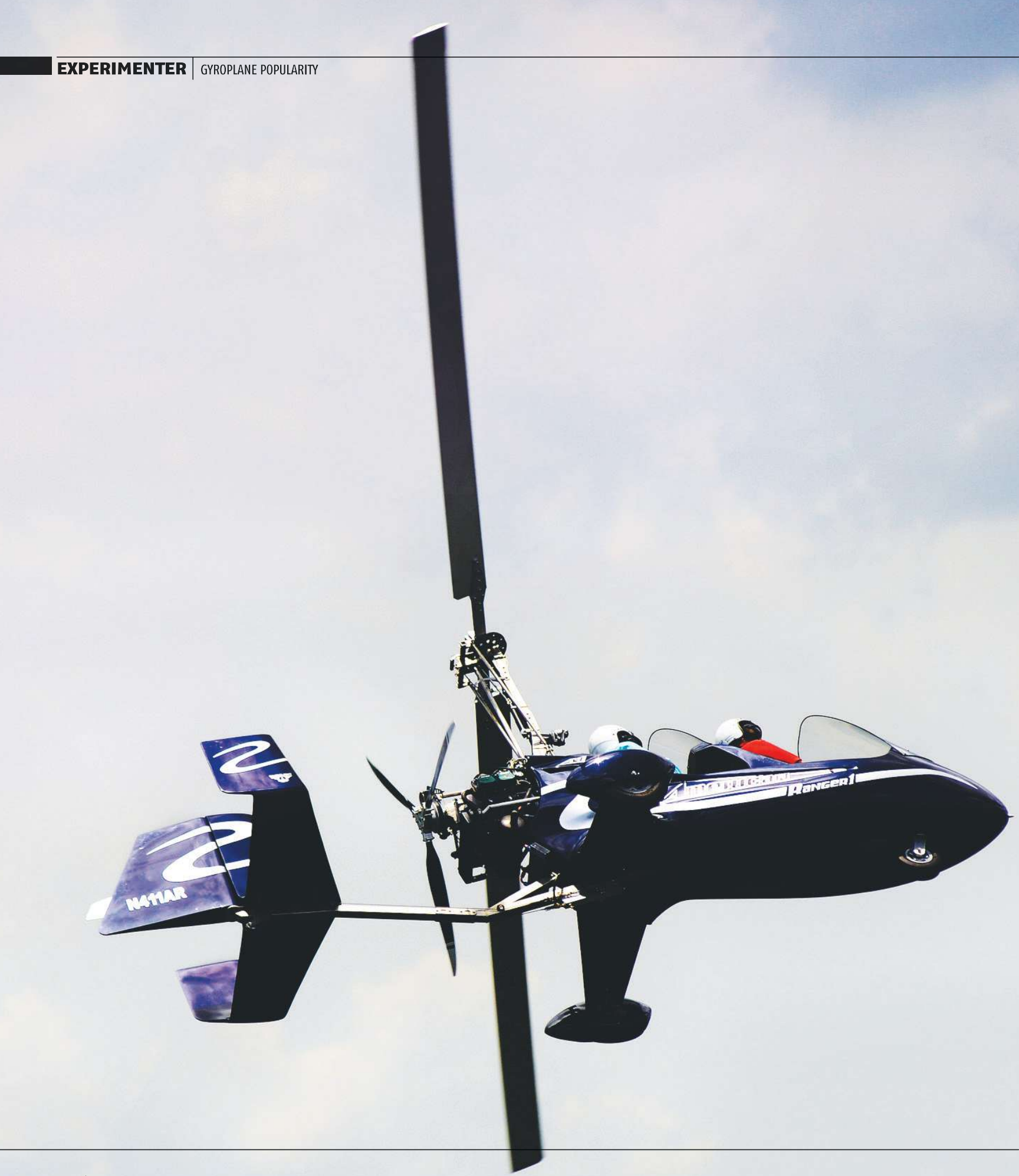
Importantly, kits also help hold down cost, putting a modern gyroplane within reach of many budgets.

The European approach produced sleek, fully enclosed, even side-by-side gyroplanes that function very well, flying mostly like a fixed-wing pilot would expect. Yet, as on all aircraft, more features and capability, along with more highly refined components, cause the price to rise. The most deluxe machines cost nearly what a medium-range S-LSA airplane does, yet a standard model is quite a value, with prices far below $100,000.

In 2016, the first U.S. producer came online, showing an American company can be competitive in this fast-growing market.

“The combination of mostly conventional control actions ... plus the ability of gyroplanes to operate easily in windy conditions, make these versatile aircraft for most recreational pilots.”

PHOTOGRAPHY BY **DAN JOHNSON**



PHOTOGRAPHY BY **AMY SAUNDERS**

WELCOME TO SILVERLIGHT'S AR1

After the "Bensen gyro" period and the years that followed, with a too-long list of accidents, the American gyro community entered the doldrums. Enthusiasts continued their developments but the industry withered. Overseas, sales would eventually explode, but in the USA only kit builders kept things moving forward at a steady, if reserved, pace.

After the sport pilot/light-sport aircraft regulation was announced at AirVenture 2004 and seeing the interest overseas, a few U.S. importers emerged to supply Euro-designed and -built gyroplanes. While they waited on FAA regulations to include fully built S-LSA gyroplanes, they helped Americans acquire foreign-built kit gyros.

So it went for a decade, but that changed in 2016 as Florida builder SilverLight Aviation debuted its new American Ranger 1, or AR1.

SilverLight, based at the Zephyrhills Municipal Airport outside Tampa, Florida, parlayed expertise in the ASTM program and experience importing European trikes, fixed-wing airplanes, and more recently gyroplanes into erecting an all-American company. While still involved in consulting to other producers (about ASTM compliance and facing an FAA audit) and selling weight-shift and fixed-wing imports, SilverLight now is focused on its new entry. Initial response has been warm, and company president Abid Farooqui envisions a good future.

SPECIFICATIONS

SilverLight Aviation
American Ranger 1 (AR1)

Aircraft Configuration	Pusher engine, tricycle gear, tandem seating
Empty Weight	628 pounds (912 ULS), 650 pounds (914 UL)
Gross Weight	1,232 pounds
Minimum Speed (V_{MIN})	20 mph
Maximum Cruise Speed	105 mph
Maximum Straight & Level Speed (V_H)	with 914 UL: 120 mph
General Cruise Speed	55 to 100 mph
Never-Exceed Speed (V_{NE})	120 mph
Takeoff Roll *(calm air, turf, pre-rotate to 250 rotor rpm)*	350 feet
Landing Roll	0 to 30 feet with proper technique
Rate of Climb *(sea level, standard conditions)*	725 feet/min (912 ULS)/850 feet/min (914 UL)
Fuel Capacity	17 U.S. gallons; welded aluminum
Rotor	Averso Stella, 27 feet 10 inches *(larger rotor system available for high-altitude flyers)*

GYRO FLYING

What is it like to fly a gyro? The simplest comment is that with only a couple exceptions, you fly a gyroplane like a fixed-wing. You use the stick and rudders similarly though not identically.

Visiting SilverLight was my third gyroplane outing — first in a Magni gyro, then an AutoGyro, and now the AR1. I came away from these experiences thinking two things: First, my fixed-wing skills are highly transferrable to gyroplanes, even better than in the weight-shift trikes I also enjoy. In pursuing a full gyroplane checkout, I would not have to learn many new tricks. Secondly, gyroplanes have some clear advantages.

Something almost everyone notices at air shows is that gyroplanes can fly in winds not advised for many other aircraft. The reason, according to my SilverLight instructor Greg Spicola, is the blades are spinning through the air at something like 400 mph. Therefore, a 25-mph crosswind is relatively insignificant. Combined with a higher wing loading, these aircraft are simply not as vulnerable to winds as most fixed-wing aircraft.

Abid's AR1 creation employs the positive attributes of the European designs, using an expanded, more effective tail arranged closer to the center of gravity thrust line. He explained this provides flight dynamics that reduce coupling between power and yaw and power and pitching. These changes, along with a high inertia rotor system and a faired fuselage, allow the AR1 to boast a better glide ratio and energy retention, making landings easier and more forgiving, even for beginner pilots.

The main caution I've heard for gyroplanes is not jamming the stick full forward in flight (this is ill advised in a fixed-wing aircraft, too).

Another gyro difference to keep in mind is that even after you land rather slowly, the rotor may still have quite a bit of spin remaining. If so, it is still making lift and failure to consider that when ground turning could cause an upset. This is similar to the care a taildragger pilot uses when landing in a brisk crosswind; that pilot must also handle the controls correctly.

Fortunately, control actions that work in an airplane will also work for the gyro. Once the rotor is well spun down, this problem disappears.

Aloft, the AR1 gyroplane was lively in all maneuvers. It can turn tightly and slow down impressively, almost regardless of winds aloft. In sufficient wind, hovering is possible.

Climb with two aboard was better than 800 fpm. Solo, it jumps to 1,200 fpm. Cruising can be done between 55 to 100 mph while the never-exceed speed is 120 mph.

Takeoff and landing is not vertical as in a helicopter but it is certainly impressive. In calm air and after you pre-rotate the rotor to 250 rpm, takeoff roll on a turf runway is about 350 feet. With any wind, this gets significantly shorter. With proper technique, landing roll can be zero to 30 feet.

An experienced gyro pilot can effect an emergency landing in very small areas. As we flew over open terrain, I asked Greg if we could make this or that field I saw that might suffice for a slower fixed-wing. His reply was that those were "normal" landing fields and he could put an AR1 down in a field that looked like a postage stamp to me.

The combination of mostly conventional control actions, very slow landing speed and distance, plus the ability of gyroplanes to operate easily in windy conditions, make these versatile aircraft for most recreational pilots.

On balance, gyroplanes are not the swiftest aircraft in the LSA sector. Cruise speeds of 87 knots will mean hours in the cockpit if you wish to travel a great distance. Fortunately, the cockpits are comfortable and bumps aloft don't feel as threatening. If need be, gyros trailer rather easily.

Another challenge is the amount of rotor-induced vibration. The machines are built for this, and many thousands flying successfully speaks to the engineering to withstand the rotary energy. I began not to notice the vibration in the space of a single hour of flying. However, it could be off-putting to someone accustomed to a heavier GA plane flown at higher altitudes in smooth air.

I've become intrigued with gyroplane flying so I find plenty of good things to say about them. However, one of the strongest arguments involves price.

SilverLight's AR1 costs only $65,000 with the 100-hp Rotax 912 engine. This is a kit, yes, but the build effort is modest, and for a modern, comfortable, well-flying aircraft, the price is within reach of most budgets.

Since the FAA has never chosen to allow S-LSA gyroplanes, kit building is your only option in the U.S. Unlike nearly every other country, gyroplanes like the AR1 can only be sold in America as an E-AB kit.

SilverLight's website states the company will offer the AR1 as a package, where builder assistance is offered to include airworthiness inspection fees plus the first two to three hours of test flight and tuning. An AR1 buyer travels to the Zephyrhills Airport to SilverLight's builder assistance center for a nominal amount of time. Abid added, "Our kit is easy and fast to put together, generally only taking two weeks to be ready for ground testing." A homebuilder can do all his or her own maintenance, with the savings that implies.

I recommend a visit to Florida, where you can check out the AR1 gyroplane. The flying is easy and the view is superlative. EAA

Dan Johnson, EAA 368861, closely follows light-sport aircraft, light kits, and ultralights worldwide. He publishes a website focused on affordable aviation at *www.ByDanJohnson.com*.

PHOTOGRAPHY BY **ALEX ISRAEL**

GYRO*COPTER* OR GYRO*PLANE*?

Gyros are small, rotary-winged aircraft that resemble helicopters in some ways. Both have a spinning wing above the occupants. However, gyros work by the air moving through the blades of the rotor disk; their rotors are not powered. Helicopters directly power the rotor, which makes them much different to fly.

Fixed-wing pilots initially need to know that flying a modern gyroplane is far more like flying an airplane than flying a helicopter, although an awareness of how the rotor functions is important in both gyros and helos.

Gyrocopters are regarded as an American invention. Igor Bensen was such an important pioneer that many fixed-wing pilots refer to all such flying machines as "Bensen gyros." This shows a lack of awareness about the present state of the gyro aircraft.

Starting in the 1950s, Igor hit on a good combination of ideas regarding how the thrust engine was mounted, a modest tail plane, and where the weight masses were located relative to the rotor. Thanks to Igor's engineering insight, the new sector flourished — for a time.

Igor's early gyros may have had components in the right proportion and the weight in right enough places to make his aircraft work. However, later American developers made changes that lacked adequate safety enhancements and the accident rate soared. This fact alone is why many, including some in FAA, think all gyros may be unsafe, but that is simply not accurate.

In the last couple of decades, things began to change dramatically — overseas. Europeans began to modernize older gyrocopter designs. They added solidly mounted tail planes with greater volume, which greatly stabilized these machines. Euro designers also significantly added sophistication: the latest digital instrumentation; many creature comforts, including full enclosures and side-by-side seating; handsome, faired fuselages; and top-quality in all components; and top-quality components such as optically excellent canopies.

No wonder they prefer to leave behind the old gyrocopter term for gyroplanes.

PHOTOGRAPHY BY **AMY SAUNDERS**

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GREAT GUSSETS

There's a right and a wrong way to apply them to your joints

BY BUDD DAVISSON

ALL YOU HAVE TO do to get an appreciative look from serious sports car types is to mention the name Colin Chapman. He was the engineering genius behind Lotus sports cars, which pretty much dominated Formula One (F1) racing through the '60s into the late '70s winning seven F1 Constructors' Championships, six Drivers' Championships, and the Indianapolis 500. Of interest to homebuilders is that he was also a pilot and applied a lot of aeronautical engineering, both structural and aerodynamic, to his winning cars. Many of them used steel tube truss chassis that looked a lot more than a little aeronautical.

One of Colin's more famous sayings was, "Adding power makes you faster on the straights. Subtracting weight makes you faster everywhere." His cars were winners because he worked hard at keeping the weight down and the handling up. He could have been talking about airplanes.

Speaking as a structural engineer, my hair stood on end because of all the structural rules of thumb that were broken in that single image.

Colin came to mind recently when I was trying to help a homebuilder sort out a problem on an airplane he was restoring. For reasons unknown, someone had moved the fuselage attach fittings for the rear cabane "V" back so they were several inches behind the cluster joint under them. In other words, the cabane strut came down mid-bay, and a couple of triangular gussets were welded in to "fix" the situation, thoroughly compromising the entire area. Speaking as a structural engineer, my hair stood on end because of all the structural rules of thumb that were broken in that single image.

I thought of Colin the instant I saw the gussets. He went out of his way to make his tubing trusses pure, with no triangular gussets anywhere. If some joint needed beefing up, he did it with "finger gussets," and there's a reason for that.

Tubing fuselages are not rigid and change shape in flight. Sometimes they change shape a lot. I saw the computerized finite element analysis of a popular rag and tube homebuilt that showed the design was well-done. It also showed nearly an inch deflection mid-fuselage at full gross and full gust loads. This is not even remotely unusual: The triangles represented by the fuselage bays in any similar airplane are constantly moving around.

One of the concepts behind triangulation is that all of the loads go into the apex of the triangles and are resisted by other tubes going into the same apex. The welds are there only to hold the tubes in place. They are not intended to resist the loads themselves, which are strictly compression (primarily) or tension (in less common flight regimes) going down the tubes themselves. No bending resistance is assumed in the joints. So, theoretically, the fuselage could be seen as a bunch of straight sticks held together by a single nail at each joint. And this is where triangular gussets can be a problem. Not a cure.

Triangular gussets transfer some of the loads brought about by the truss trying to change shape away from the center of the clusters to the outer edge of the gusset. In fact, they concentrate the loads right at the end of the gusset, and this leads to fatigue cracks that start right where the gusset ends. I found one leg of the engine mount on my airplane broken entirely through because of a crack that started at the edge of a factory gusset. This is why Colin used only finger gussets: He was using them to beef up the joints so they could take more load, but the loads stayed linear to the tubing member in question and load paths weren't compromised. In theory, a properly designed fuselage has no need of corner gussets.

Of course, there's not a rag and tube airplane flying that doesn't have triangular gussets somewhere. Many folks think a gusset makes the joint stronger. It does and it doesn't. But we use them anyway. This is particularly true of homebuilts. However, there are right ways and wrong ways, easy ways and difficult ways of applying gussets. Take a look at the photos (Be nice; don't make fun of my welds! I'm rusty.) and follow the captions, which point out some building techniques and a few structural concepts.

THE CLASSIC TRIANGULAR GUSSET

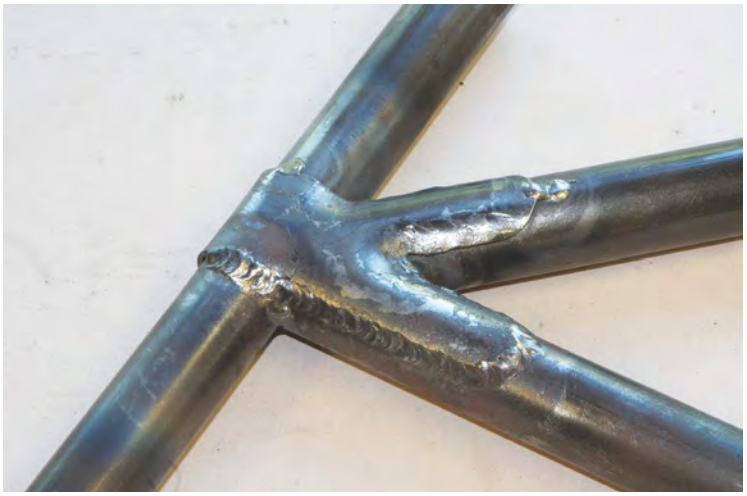
The purely triangular gusset is one of the biggest structural offenders, plus it is difficult to weld in place because of the sharp corners at the tips and the "blind" corner where the tubing joins. This photo clearly shows what happens when you try to tack the sharp ends. They melt away faster than you can feed rod in, and you wind up with a structural discontinuity. If you tack at the other end in the corner of the tubing joint and weld toward the untacked tips, when you get to the tip it's a real bear to keep it from disappearing as you weld it. The fix is in the next photo.

Don't make the tips of the triangle sharp. Round the tips so they have about a 1/4-inch straight perpendicular to the tubing. In this photo I had zero trouble placing a tack right at the end of the gusset legs. With that drop of steel there, I have the option of welding into or out of the corner because that edge is now much thicker and won't melt away when being welded. Also, notice the very tip of the gusset where it hits the tubing is cut away leaving a hole. Part of the hole is to clear the joint bead (which isn't there in the photo), but more important, it eliminates the problem of the torch trying to sneeze or blow back as you get into the corner because the hole gives the flame somewhere to go and there's no pressure buildup.

Many folks think a gusset makes the joint stronger. It does and it doesn't. But we use them anyway.

SURFACE GUSSET

A "surface gusset" (I don't actually know what they're called) gives the same strength as a centerline gusset but all of the welds are in shear 100 percent of the time. In the pure, centerline gusset the welds are alternately in compression (which is okay) or tension (which isn't okay). More important, a surface gusset is much, much easier to install. No blind corners, etc. This one wraps over the main tube, which would be necessary only if transferring a serious load.



FINGER GUSSET

A classic finger gusset. This strengthens the joint but doesn't introduce any stress concentrations, which any other gusset does. The fingers run down the tubes and wrap over the main tube so the loads all stay linear and spread out. The ends must be rounded so there's no sudden change of cross section area. Note the back, unwelded finger. They are formed by tacking the flat blank in place, heating it, and gently forming it to the tubing being careful to make the transition in the "V" smooth with no sharp corners. I got carried away on the one tack. My bad!

MAGNETIC 'EXTRA HAND'

Apropos of nothing: I stumbled across these magnet gizmos while having my tanks filled in preparation for doing this article. They come in a four-pack, two small and two large, and they do a beautiful job of holding tubing or gussets in whatever odd angle you want it, which is always a huge struggle. They would also work to hold tabs in place while tacking them. Do not do serious welding with them. Lots of heat kills them. Ask me how I know that. They're called V-pads and can be found via the link at *www.EAA.org/sportaviation* under This Month's Extras. EAA

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

PHOTOGRAPHY BY **BUDD DAVISSON**

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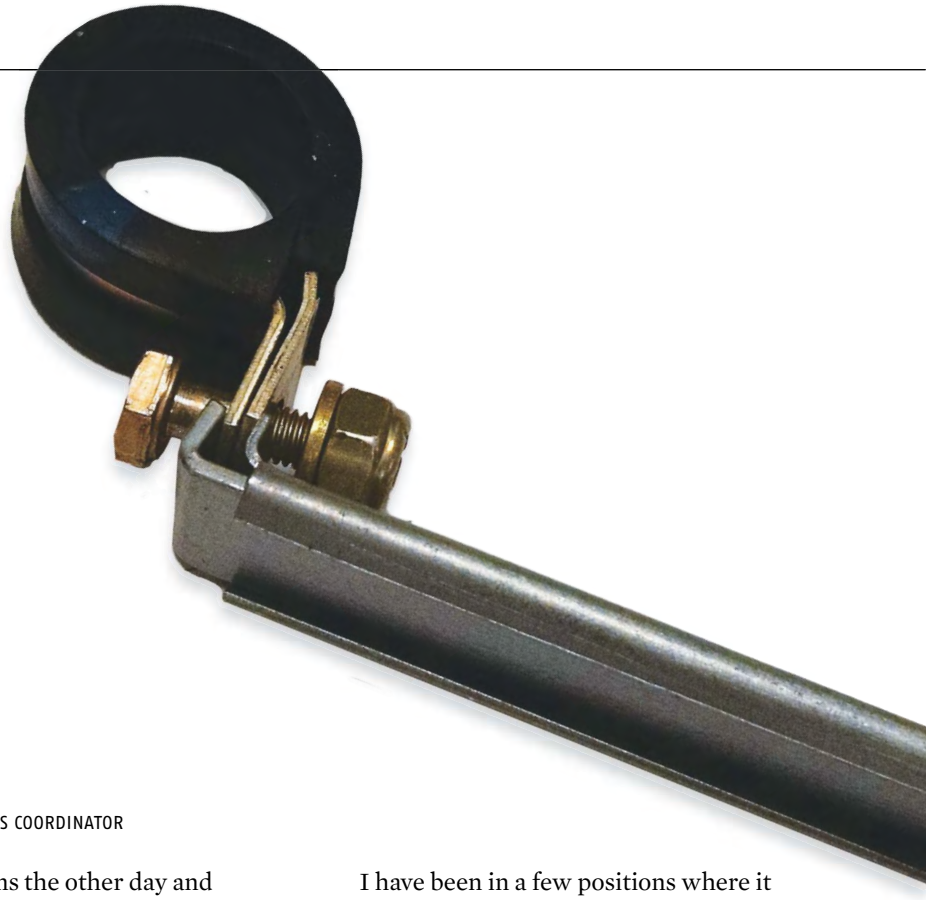
Want your own *EAA Sport Aviation* contributor hat? We'll send you one if you submit a hint that we run in this column. Send your tips to *editorial@eaa.org*.



HANDEE CLAMP

BY TRACY BUTTLES, EAA 839196; EAA SAFETY PROGRAMS COORDINATOR

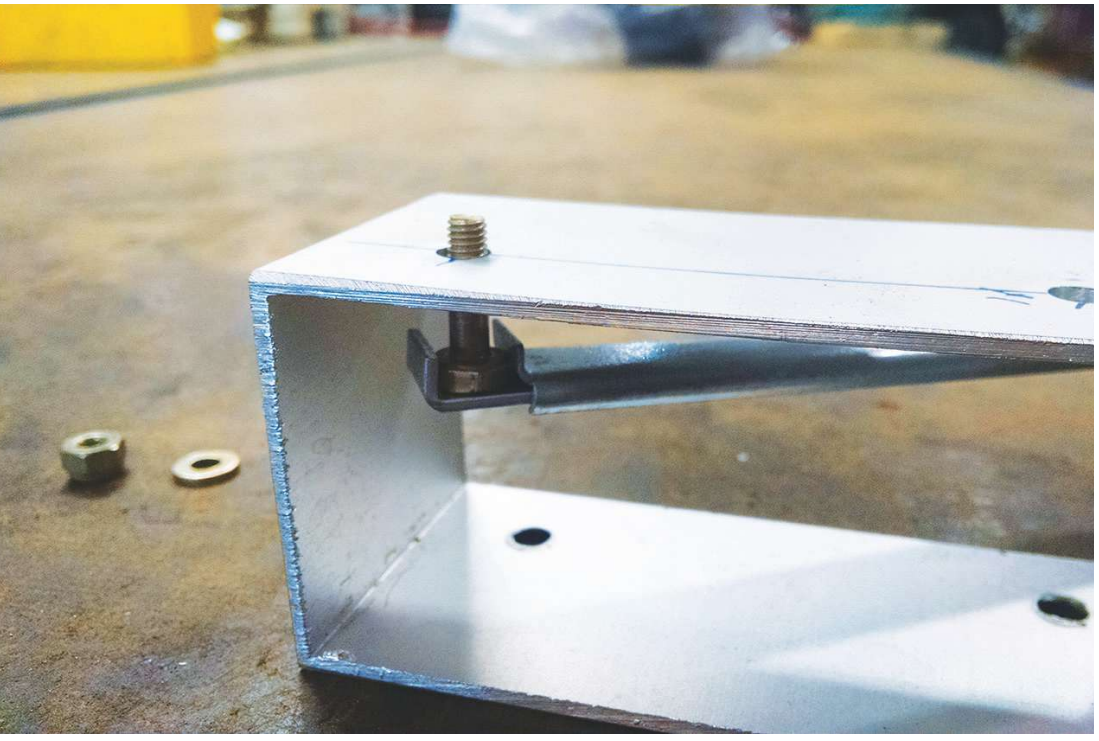
I SAW THIS DEVICE listed on the EAA forums the other day and decided to check one out. The seller, C&C Handee Clamp LLC, has since made the clamp available through the EAA store for $13.95.

A simple adjustable arm, with a 90-degree angle on the end, slides inside a sleeve with a fixed angle on the end of that sleeve, allowing you to secure anything ranging in size from about 1-1/8 inch down to nothing.

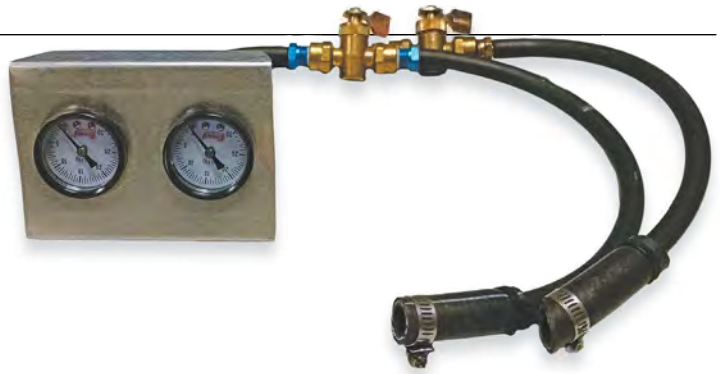
Not just bolts or nuts, but spring clamps, cotter pins, and even electric wires for soldering.

I have been in a few positions where it was difficult to hold a bolt or nut and be able to start. This little clamp fits the bill. With its adjustable clasping angles on the end I was able to hold a bolt and install it inside a difficult place to reach.

I was also able to hold an Adel clamp in position to get a bolt started, which is sometimes a difficult task.



PHOTOGRAPHY COURTESY OF **TRACY BUTTLES**



SIMPLE CARB SYNCHRONIZER TOOL

BY TRACY BUTTLES, EAA 839196; EAA SAFETY PROGRAMS COORDINATOR

OVER A PERIOD OF time the carburetors on Rotax 912 series engines will get out of sync mechanically, especially if you have a dual throttle setup through a bell crank. With the 912 it is easy to identify an out-of-sync condition because you will have a really rough idle. You can mechanically sync the carbs as per the Rotax maintenance manual, but you will need to hook the carbs up to a synchronizer. This will also need to be done on a new engine installation.

I had borrowed one from a friend, but I felt the need to keep one in my toolbox. Looking at the prices, I decided to make one. The tool is really quite simple — a couple of vacuum gauges and two shut-off valves to stop the pulsing of the needles as the engine runs, a few barb fittings, and some hose.

I used some scrap aluminum and made a 3-1/2-inch channel about 5 inches long, cut two holes for the gauges, and installed them. A couple barb fittings to hook up 1/4-inch hose to the shut-off valves, and more hose to reach the carburetors. At the end of the 1/4-inch hose, I used a piece of 1/2-inch inside diameter hose to adapt to the size of the Rotax cross-tube fittings. It just worked out that the 1/4-inch hose I had on hand would slide inside the 1/2-inch ID of the adapter.

Install the tool and synchronize your carburetors as per the Rotax manual. You must use the shut-off valves to slowly close off the line until the needles just stop bouncing. There is a fine line between stopping the needles from bouncing so much that you can't get a reading and shutting off the line completely so the needle doesn't move at all. I encourage all Rotax owners to check out the owner's page at *www.EAA.org/sportaviation* under This Month's Extras. The owner's website has a wealth of information and videos for maintaining your Rotax engine. EAA

MATERIAL LIST:

- Two 1-1/2-inch diameter Summit Racing analog vacuum gauges SUM-G3125
- Two ball valves with 1/4-inch thread, locally sourced; check McMaster-Carr
- Six barbed pipe fittings for 1/4-inch holes
- Two 6-inch sections of 1/2-inch hose
- Two 3-foot (or longer) sections of 1/4-inch hose

PHOTOGRAPHY COURTESY OF **TRACY BUTTLES**

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THIS AIR AMERICA OFFICER'S hat, previously worn by Capt. Neil G. Hansen, was donated by Neil along with an Air America challenge coin and a daily schedule for Air America flights. Air America was an airline run by the CIA during the Vietnam War, delivering supplies and flying medevac and other secret missions over dangerous territory. The risky missions flown by Air America crews earned them recognition as the world's most shot at airline.

Neil said he joined Air America after answering an ad in the newspaper. "I was treated first class during my entire trip from the United States to Asia," he said. "So good, in fact, that I was starting to worry about what was ahead." While flying for Air America, Neil logged time in a host of aircraft including the DC-6, C-123, C-46, DC-3, and the Do 28, many times taking off at 2 a.m. to fly munitions down to Laos with little to no time to plan the flight. He once crashed three times in a single day. Over the course of Air America's operational years, 242 pilots and crew members lost their lives.

Neil's hat was part of the official Air America uniform, although because of the area's tropical conditions many pilots chose to fly in shorts and a baseball cap. Challenge coins were often given by one service member to another upon meeting. If they met again and the recipient did not have the coin with him, he would have to buy the coin's patron a drink. EAA

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