EAA
Sport Aviation
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Vol.64 No.5 | May 2015

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Mad Monks Dash to Oshkosh
Record-setters from Mojave

Flight of Passage Redux
48 years later

Flying the Coupe
The twin-tailed treasure turns 75

So Many, So Few
75th anniversary of the Battle of Britain

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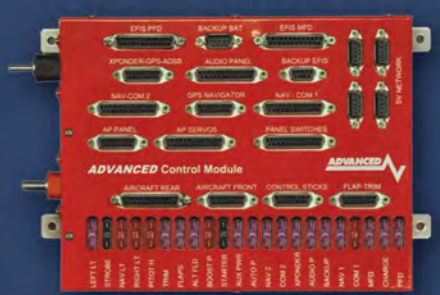

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Drones and Us

EAA will be vigilant

BY JACK J. PELTON

A MEMBER SENT ME a clipping from his small hometown newspaper. The headline at the top of the front page reads, "Ferrysburg to discuss park drone ban."

According to the article the leaders of this small Midwestern town have become concerned that drones could be a risk to others using the city parks, and that the cameras many drones carry could interfere with citizens' ability to relax and enjoy their parks.

Whether the civic leaders' concern is warranted or not it's clear to me there is a public issue with drones. And by drones I mean the multi-rotor copter unmanned aircraft system (UAS) that can hover and often carry high-resolution cameras.

Model airplanes and the people who build and fly them have a very long history of uneventful and peaceful coexistence with normal air traffic and the public. Model airplane enthusiasts keep their radio-controlled airplanes in sight, below 400 feet, and away from airports and public gatherings. And now that many in the traditional model airplane community have begun flying the multi-rotor copter drones they operate those the same way.

But the advanced electronics of the drone have the potential to change everything. The electronic stabilization eliminates the need to understand flying speed or turn radius and maneuvering envelope that are essential to fly a conventional radio-controlled airplane. It does take some practice to expertly control a copter-type drone, but nothing like the aeronautical knowledge required to handle a conventional RC airplane.

That means the copter type of drone can be bought and flown right out of the box by people who make no effort to learn about airspace, aerodynamics, and flight control. With no intention to add risk or annoyance to anyone the copter drone operator can unknowingly do both.

The unique capabilities of the multi-rotor drone also create vast opportunity for never before seen commercial uses. Everything from monitoring highway traffic to high tension power line inspection to agricultural analysis is suddenly possible at a very low cost. And those, and many, many more uses for drones, are worthy and make great economic and even safety sense.

But commercial drone operators need some sort of authorization and regulation to smoothly enter into the airspace system. We who fly all must demonstrate a level of safety and competence for our activities, and so should a commercial drone operator.

So at EAA our position is that the traditional restrictions on model airplane flying work just fine for the recreational drone flier. We support the "Know Before You Fly" online program created by the Association for Unmanned Vehicle Systems International (AUVSI), the Academy of Model Aeronautics (AMA), the Small UAV Coalition, and the FAA. That site can educate the new drone pilot on acceptable model airplane operation and also introduce him to the model airplane community. But for the commercial operator, and the operator of larger drones, we at EAA believe a minimum level of certification for both the aircraft and operator are necessary to preserve flying safety.

Is the risk of drones to our flying in conventional airplanes overblown in our own minds? I'm not sure. But on a recent evening as several of us gathered at a hangar on my home airport in Wichita we saw a copter-type drone fly right down the centerline of our runway at about 100 feet. We searched but couldn't see where the drone went, or spot an operator.

Most personal airplanes would probably survive a collision with a lightweight drone. But not all. And what about the pilot who spots the drone at the last minute and makes an aggressive avoidance maneuver close to the ground? Or what about a student on a solo flight? And what if...the list goes on.

At EAA we support the recreational flying of all types of model aircraft and recognize the long history of responsibility and safety of the model airplane community under the umbrella of an organization like the AMA. But you can be sure we are vigilant and ready to react to any and all threats as new technology changes the traditional relationship between UAS and our airplanes. EAA

PHOTOGRAPHY BY JASON TONEY

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DEPARTMENTS

ON THE COVER: A Hawker Hurricane skirts the White Cliffs of Dover in tribute to the 75th anniversary of the Battle of Britain. Photography by John Dibbs.

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.*

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To learn more about Garmin ESP-X with the G3X autopilot, and everyting else our Team X experimental experts are working on, visit Garmin.com/experimental.

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[1] Automatic flight control system limitations can prevent or delay the ESP-X system's ability to recover the aircraft in some situations.

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Garmin Autopilot ESP-X

WOMEN IN AVIATION

I LOVED THE MARCH ISSUE of *Sport Aviation*. The articles on women aviators and Jack Pelton's commentary that we need more women in aviation meant a lot to me. Marketing to women is essential to the growth of general aviation. In most households, Momma holds the purse strings. Once we win her over, she is eager to encourage all of her family and friends.

There are many reasons why women are underrepresented in aviation. Understanding these reasons and addressing them will help the industry thrive and grow.

Fear is one of the major issues to focus on. As a pilot examiner, I have tested several middle-aged men who have finally achieved a lifelong dream. They didn't start sooner because their mother (or occasionally, their wife) perceived aviation as being dangerous and refused to allow family funds to be used for flying. The individual had the time and passion but had to wait until much later in life because Mom refused to pay for such a "dangerous" activity.

A major fear issue is the fact that most accidents are caused by pilot error, and we all make errors. In fact, most of our fatal accidents are caused by gross misconduct, willful actions, or omissions and/or a blatant disregard for the regulations. Still an error but not likely the kind of error a conscientious person would make.

I started the Girls in Flight Training (GIFT) Academy five years ago. In 2014 I issued 90 pilot certificates of which 30 went to women. Small number to be sure, but proof that it can be done. On the surface that would appear to be a 30 percent increase in the total compared to the average. The truth is most of these women bring male family and friends, so marketing to women is likely to quadruple the customer base.

Thank you again for a great issue and a great organization.

–

Mary Latimer, EAA 1042527
Vernon, Texas

I THINK JACK PELTON (Tower Frequency, March) was right on when he said that to involve and include women and girls, "The most effective outreach must come from each of us guys who fly. When we are attentive to the interests, concerns, and even worries of the girls and women in our lives about all things aviation we make progress."

I so admire the women who fly in the military, set new flight records, enter air races, etc., but I believe there are other ways to involve women in aviation. I would like to suggest a more basic idea for involvement.

My husband got his pilot certificate in 1952. I was his first passenger, and it was my first airplane ride. We flew together for 61 years. Because I loved flying and he encouraged me and never frightened me, I got my certificate in 1967. We started our adventure with a Cherokee 180 and in 1972 became owners of his/our beloved Bonanza, which we owned for 40 years.

Over the years, we flew places far and wide, and I had the opportunity to have many interactions with other women in aviation settings. I learned that the reason so many women did not like to fly was that their "guy" frightened them to the point that they disliked the whole idea of flying. The "guys" flew in really bad weather, "racked" the plane around, used bad judgment, and were not in any way considerate of their passengers. No one explained to them what was happening or what could be expected during the flight.

Flying was a true passion for my husband, and I know how much he appreciated my love of it, too. It was a wonderful family experience that we shared. I also know how many pilots have wished to have the same support for their love.

–

Ellie Sheen, EAA 623903
Gettysburg, Pennsylvania

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BOEING

ALL ABOUT ABIGAIL

THANKS TO BRADY for his article in the March issue of *Sport Aviation* (Dream Build Fly). I can't tell you what an amazing gift he is giving his daughters, and I hope Abigail enjoys her first flight. Brady's article hit home with me because I grew up just like his daughter.

My dad would take me out to the airport at least once a week, and Oshkosh was considered an annual vacation spot. He had a Cessna 150, and he would put my car seat in the right seat so I could see a little better on our flights. I would always pretend I was the pilot and had dreams of being an astronaut one day. Often our trips included a lesson on how planes work, and while my friends were learning their ABCs, I was learning the phonetic alphabet.

SUBMISSIONS

LETTERS INTENDED for publication should be e-mailed to *editorial@eaa.org* or addressed to EAA/Letter to the Editor, P.O. Box 3086, Oshkosh, WI, 54903. Please include your EAA number, city, and state. All letters are subject to editing. Unpublished letters will not be returned.

I'm now 27, and I've had my pilot certificate for a few years. I fly for fun, and I've shared that gift with my boyfriend, friends, and family. While I'm very proud of my college degree, it is my pilot certificate that has given me my greatest sense of accomplishment. What Brady's article really made me appreciate is how supportive the aviation community can be. It's because of the pilots I grew up around that I never questioned that I could learn to fly, and those same people were there for me whenever I experienced flight-training challenges.

I just wanted to share that although Abigail is young, she will likely remember those early memories and will be so grateful for them. And now, even as an adult, I'm still looking up at the sky whenever I hear a plane.

–
Kate Hollingsworth, EAA 1116595
University Heights, Ohio

Seeing Versus *Seeing*

JUST FINISHED MAC'S column on "seeing" in the latest issue of *Sport Aviation* (Left Seat, March). Love it! His honest answer is correct. It can and did happen to me.

One hot evening on July 4, 2012, leaving Frankfort, Michigan (KFKS), and climbing through 6,000 feet on an IFR clearance to Chicago DuPage (KDPA) in a G1000-equipped Diamond Star DA40 the fuel pump failed leading to a fuel pressure problem and partial engine failure. I indeed had the MFD on the engine page, in this case to assure that the cylinder head temperature stayed below 385 degrees. In fact, I was so absorbed with the CHT reading I failed to notice *both* the fuel pressure needle on the display swinging erratically *and* the red warning light flashing on the PFD right in front of me.

It took my wife asking me if the swinging needle, red light, and chime were normal to get my attention. The engine quit at that very moment providing her answer. I was able to restore partial power with the electric fuel pump but, due to what was later attributed to vapor lock, it could not sustain sufficient or consistent fuel flow, so we ended up with an engine that would run at about 1900 rpm, then quit only to start again, etc.

Fortunately we were in solid VFR at 6,000 feet and about 10 miles north of Manistee, Michigan. That great big runway never looked so good. We declared an emergency and stayed as high as possible until directly over the airport at which time I was able to reduce power (the engine ran fine at idle) and circle down to land. EAA

–
Matt Kramer, EAA 1129395
Geneva, Illinois

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EAA Stands Strong in FAA Policy Update

Ensures operating limitations aren't more burdensome

EAA'S EFFORTS TO ensure that updated regulations do not create new barriers showed results with the FAA's newly issued revision of Order 8130.2, which governs the certification of aircraft through the direction it provides to inspectors and designees. Among other guidance, it provides the procedures for the certification of experimental aircraft and the operating limitations they will carry. Order 8130.2H replaced 8130.2G at the end of April, with the FAA also issuing guidance to assist inspectors in generating appropriate operating limitations for each aircraft.

EAA has been extensively involved in the revision process to this order in recent years, and successfully amended or reversed several provisions in the early Revision H drafts that could have severely hampered experimental aviation by assigning aircraft overly restrictive operating limitations. The new document contains some changes but largely preserves the status quo for homebuilts and other experimental categories.

In March 2014, EAA submitted extensive comments to the then-draft version of revision H that incorporated input from the Homebuilt Aircraft Council, Warbirds of America, and other concerned members. EAA then followed up with face-to-face meetings with the FAA in Washington, D.C., and during EAA AirVenture 2014 to ensure that the document was ready for use in the field.

The recreational aviation community came together to analyze this document and make sure all our concerns were addressed. EAA's strong working relationship with the FAA was important here, first because EAA could review early drafts of the policy change, and because it allowed honest discussion and collaboration to make sure our members' needs were served when FAA policy was updated.

EAA continues to work on clarifying the document's language and guidance so that it is applied evenly and correctly, and will be involved in future revisions.

PHOTOGRAPHY BY **JIM KOEPNICK**

KEEP PUSHING: PILOT'S BILL OF RIGHTS 2 AND AEROMEDICAL REFORM

AS OF PRESS TIME, nearly 20,000 letters from EAA members have been received in congressional offices urging support for the bipartisan Pilot's Bill of Rights 2 that includes vital aeromedical reform measures. That's terrific! It also helps EAA's advocacy team as we urge more lawmakers to sign as co-sponsors to the bill in the House and Senate.

There's something that works even better than thousands of e-mail messages, though—a personal call or note to your lawmaker's office, or chatting with your representative or senator (and their staff) during district listening sessions or public appearances. You can find contact information for your representative and senators through EAA's Rally Congress website (*govt.eaa.org*).

If your local lawmakers have already signed on as co-sponsors of the bill, be sure to thank them. If they haven't signed on yet, ask them to support their constituents who fly by backing H.R. 1062 (in the House) or S. 571 (in the Senate).

Your D.C. lawmakers will be in their home areas during the upcoming summer recesses. Many of them are at public venues, connecting with voters and constituents.

The Pilot's Bill of Rights 2 is a measure you have been demanding as an aviation community. It will take the help of every EAA member to get it passed. Don't let the opportunity pass you by.

UAS RULE COMMENTS: AIRSPACE PROTECTION TOP PRIORITY

IN APRIL, EAA submitted its comments to the FAA's proposed rulemaking regarding the operation of small unmanned aircraft systems (sUAS). EAA stressed that the top priority is that the proposed rulemaking preserves freedom of navigation for manned aircraft in all categories while safely integrating sUAS into the national airspace system. EAA also highlighted the importance of preserving pilots' rights during certificate action as a result of sUAS operation and stressed that there should be no further ADS-B equipment requirements for GA aircraft required by the introduction of sUAS into the national airspace.

This is a good start to rulemaking for sUAS operations, but EAA also believes there are areas of the rulemaking document that can be further elaborated or improved. EAA's comments were crafted to ensure the FAA understands the concerns of the GA community as they pertain to sUAS operation. EAA will continue to work with the FAA on this issue, as we are dedicated to ensuring the introduction of sUAS has no negative impact on the freedom to fly.

AVIATION DURING THE NATIONAL ANTHEM—IT CAN BE DONE SAFELY

BY SEAN ELLIOTT, EAA VICE PRESIDENT OF ADVOCACY AND SAFETY

LAST YEAR, THE FAA took note of the more visible and public appearances of experimental exhibition warbird aircraft and E-AB formation teams participating in stadium overflights. The agency raised a concern that the safety continuum applied across all aviation operations was not being adhered to under these circumstances. The FAA cited that stadium overflights are contrary to the current regulations regarding flight over densely populated areas and promptly acted to shut them down.

With government funding still only allowing for a few military fly-overs during our national anthem at major events, a significant hole remains in what has become a tradition to honor our nation and its colors at events ranging from NFL games to NASCAR races. Many experimental and warbird formation teams have the professionalism and desire to provide these flights that were once conducted by active and reserve military units. In support of that effort, EAA Warbirds of America and ICAS have taken steps to address the current shortfall and enable qualified formation teams to once again make those flights.

On March 26, ICAS President John Cudahy submitted a joint ICAS/EAA Warbirds of America petition to the FAA. That petition requested an exemption to the applicable FARs in question and, if granted, would allow for Warbirds and ICAS members to fly over stadium events after meeting an appropriate level of qualifications for both the pilots and the aircraft. Considerable thought and effort went into the development of those criteria and the petition itself. These efforts were led jointly by ICAS and EAA Warbirds of America, with a large degree of authorship coming from Warbirds board member and aviation attorney Jack Harrington.

We will keep you posted as this petition works its way through the FAA process. We hope to see relief for these teams sometime later in the year. Stay tuned. EAA

PHOTOGRAPHY BY **JASON TONEY**

Just Aircraft SuperSTOL Now Comes in XL

JUST AIRCRAFT JUST upsized its popular SuperSTOL airplane, adding 2 feet aft of the fuselage and 6 inches up. Called the Stretch XL, this version can now handle the new ULPower 520 engine series as well as Lycoming O-320 engines.

The original SuperSTOL is powered by the 100-hp Rotax 912 (approximately 165 pounds with accessories) or the 115-hp Rotax 914 (175 pounds). The Stretch XL can accommodate engines weighing up to 315 pounds. Appropriate engine mounts and redesigned cowlings will accompany the SuperSTOL Stretch XL kits.

Harrison Smith, who completed Phase 1 flight testing in the Stretch XL, says increases in rate of climb and cruise speeds are the result. "The additional length in the Stretch XL provides handling similar to a high-horsepower Super Cub," he said.

GARMIN OFFERS ESP SAFETY AID TO EXPERIMENTALS FOR FREE

GARMIN IS NOW offering its Electronic Stability and Protection-Experimental system (ESP-X) to owners of experimental airplanes as part of its G3X or G3X Touch avionics system.

The system continuously monitors airplane attitude and airspeed looking for unusual pitch and bank angles, or airspeeds closing in on stall or the redline limit. When the preselected limits are exceeded, indicators appear on the G3X flat glass display showing the pilot how to recover.

ESP-X also uses the servos of the integrated G3X autopilot to "nudge" the controls. The pilot can easily overpower the servo input if he is intentionally flying an unusual maneuver or airspeed, but the stick movement provides subliminal commands that help a distracted pilot recover.

If after ESP-X detects an unusual attitude or airspeed the pilot makes no input for 15 seconds the system assumes he has become incapacitated and engages the autopilot to hold wings level. The autopilot will raise the nose automatically to slow from an overspeed, and will gradually trade altitude if necessary to keep low airspeed above the stall. The system disengages within 200 feet of the ground.

Because ESP-X is designed for experimental airplanes, each owner can program the limits he or she is comfortable with instead of using a preset bank angle or airspeed to trigger the warnings. ESP-X can be turned off for training or intentionally unusual attitude maneuvering.

ESP-X is a free software update for owners who have installed the G3X or G3X Touch flat glass avionics system with the Garmin autopilot.

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

FAA GRANTS HONDAJET PROVISIONAL TYPE CERTIFICATE

ON MARCH 27 the FAA issued a provisional type certificate for the HondaJet, a major milestone on the way to final type certification and entry into service. Honda expects to receive the final full TC in the next few months and begin deliveries of the light jet with its unique over-the-wing engine mount technology.

"Provisional type certification for the HondaJet is a tremendous milestone for the program, and we are pleased to reach this significant step toward customer deliveries and entry into service," said Honda Aircraft Company President and CEO Michimasa Fujino. "Honda Aircraft has completed nearly all of the testing and reports required by the FAA, and we are very close to achieving final type certification for the world's most advanced light jet."

Honda has been flying four HondaJets in the certification test program and has amassed more than 2,500 flight hours. EAA AirVenture Oshkosh attendees have had numerous opportunities to see the HondaJet's development over the last 10 years, including the plane's world debut in 2005.

MERLIN LSA MAKES MAIDEN FLIGHT

GLASAIR AVIATION'S NEW special light-sport aircraft, Merlin, made a successful maiden flight at Arlington Municipal Airport, Washington, on April 7. Merlin is a composite high-wing, tricycle gear aircraft built to LSA certification requirements based on ASTM consensus standards.

Powered by a Rotax 912 iS engine, the airplane is equipped with Dynon's SkyView glass-panel and has an optional BRS parachute system available. Flight testing will continue throughout the coming weeks. Merlin will be the first certificated aircraft by the traditional kit maker.

According to the company, Merlin's 45-inch-wide cockpit offers ample side-by-side seating, outstanding forward and side visibility, and one of the largest windshields in the category.

BRIEFLY NOTED...

// THE FAA RECOMMENDS that aircraft owners who use hook-and-loop fasteners such as Velcro to mount an emergency locator transmitter (ELT) instead securely mount the units in their aircraft with a metal strap restraint.

In some recent accidents, ELTs secured with Velcro-like fasteners have come loose on impact, severing the antenna connection and making the units ineffective. The FAA is not issuing an airworthiness directive or withdrawing TSO authorizations, as manufacturers have made adequate design changes for these ELT units.

// HARTZELL PROPELLER'S NEW two-blade Bantam propeller is now FAA type certificated for use with the Rotax 912 and 914 four-stroke engine series. The props feature carbon fiber structural composite blades, hard nickel leading edges, and composite spinners and are available in various diameters ranging from 67 to 77 inches through Hartzell's Top Prop performance conversion program.

Bantam two-blade props are approved for 912 iS Sport (100 hp), 912 (80 hp), 912 (100 hp), and 914 (115 hp) engines. Lightweight Bantam two-blade propellers weigh only 25 pounds, including spinner.

// ASPEN AVIONICS' ATX100G single-band ADS-B transceiver is now shipping. The ATX100G transmits on the 978 MHz universal access transceiver (UAT) frequency, has an internal WAAS GPS sensor, and provides a solution for aircraft equipped with a Mode A/C or Mode S transponder without a compatible WAAS GPS navigation receiver. In addition, it receives ADS-B subscription-free weather and traffic and meets the ADS-B out mandate below 18,000 feet. ATX100G is now available for $4,995 through Aspen Avionics authorized dealers.

Additionally, Aspen's integrated Evolution angle of attack (AOA) indicator integrates AOA technology directly into its Evolution primary flight and multi-function displays. The AOA indicator, expected to be available in July 2015, calculates angle of attack from the flight envelope data received from the air data computer and AHRS in the Evolution 1000 PFD/1000 MFD and a certified GPS. Therefore it does not require additional hardware, external aircraft modifications, or sensors. EAA

PHOTOGRAPHY COURTESY OF **HONDA AIRCRAFT COMPANY** *AND* **GLASAIR AVIATION**

J. MAC MCCLELLAN

Make a Trip Plan, Not Just a Flight Plan

Preparing for delays

J. MAC MCCLELLAN

WHEN WE ARE IN training we make flight plans because the flight is the event. It's what matters.

Professional pilots also make flight plans because their involvement begins when they meet the passengers at departure and ends at the destination airport. The safety, comfort, and efficiency of the flight itself is what matters.

But when we fly ourselves, friends, and family somewhere we need to make a trip plan, not just a flight plan. It's a trip plan because we must account for and have plans to accommodate every task required to get from our front door to the actual destination. The flight itself is certainly the most important element of the trip, but we need to build in contingency plans to account for potential surprises without compromising safety or creating huge inconvenience.

No matter what you fly weather conditions are the largest variable in your trip planning. The more capable your airplane, and the more experienced you are as a pilot, the more adverse weather you can fly through without adding too much risk. But there are weather conditions that ground the most capable airplanes and experienced crews. If we needed a reminder of that, watching airline terminals full of stranded passengers all winter was enough.

When pilots think about weather, the ceiling and visibility are our first thoughts. If you fly VFR only, ceilings as low as a couple thousand feet can be a showstopper, and certainly visibility anywhere near 3 miles should keep you on the ground. But IFR pilots are also grounded by low ceilings and visibility, so those conditions are top of mind, too.

But when making a trip plan, not a flight plan, I think the first consideration should be winds aloft. Winds will determine how far you can go, where you may need a fuel stop, and even if you can complete the trip in a single day.

There are lots of flight-planning systems available that can tell you to the minute how long it will take you to fly from A to B in still air. That is the most useless information I can think of. The air is never still. And a headwind extracts a proportionally larger range and time penalty than an equivalent tailwind adds. Without a reasonable wind estimate your initial trip plan is nearly worthless.

Fortunately there is a free available solution to any certificated pilot at FltPlan.com. This online flight-planning and flight-plan-filing service has a database of 90 percent probability winds aloft based on history. Whenever FltPlan.com calculates a trip time out to as much as 180 days in advance, it applies the historical winds. Of course, the actual wind could be different, but 90 percent probability is a reasonable estimate and very useful for the actual trip plan.

When you file a flight plan on FltPlan.com, or look at its "quick info" feature

TBM 900

330 KTS

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MAX RANGE
1730 NM

CLIMB TO FL310
18 min45

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for trips more than a couple days in advance, it uses the historical winds to show you en route times and fuel burns. As the actual trip approaches it applies the winds aloft forecast as it becomes available and continues to update estimates as new forecasts are issued. I have used the service for years, and its time and fuel estimates are spooky accurate, often within two or three minutes on a three-plus hour flight.

FltPlan.com is advertiser-supported so it does not charge for the basic flight-planning and flight-plan-filing service. But you must register at the site because it is intended only for pilots, and needs your basic pilot, airplane, home base, and other information to automatically file IFR or VFR flight plans. The service operates online, or in the cloud for all I know, so you can access your plans on any device. The system doesn't care if you start on your desktop at home and then use your phone or tablet—any connection that gets you online puts you into FltPlan.com and all of its services.

The site was created by and is operated by very experienced pilots so its functions and operations make perfect sense, particularly to IFR pilots. In fact, the company now files a big majority of all non-airline IFR flight plans in the United States. Full weather information is on there, along with all charts, and the system also shows you what routing other pilots have filed, and ATC has issued, for the flight you are planning.

FltPlan.com also works fine for VFR and can file VFR flight plans perfectly. However, some VFR-only pilots I know are more comfortable with flight planners such as ForeFlight, which leans more toward VFR procedures. So I say why be exclusive? Buy a subscription to the flight planner you like best and you can still use FltPlan.com for its historical winds and many excellent features for free.

After I have the best possible idea of the winds and how long the actual flight will take I start to plan fuel stops. The two issues there are airport facilities and fuel price. When you fly IFR you want a fuel stop with good instrument approaches and longer runways so that comes first for me, and then the best fuel price. For VFR flying, instrument approaches don't matter, and most of us are willing to accept a shorter, narrower runway to get the best fuel price.

No matter what you fly weather conditions are the largest variable in your trip planning. The more capable your airplane, and the most experienced you are as a pilot, the more adverse weather you can fly through without adding too much risk. But there are weather conditions that ground the most capable airplanes and experienced crews.

But what if there is a delay because of weather, or some other reason? Or what if weather causes a diversion to a different route from your original trip plan? Those are key questions that you should ask yourself and then come up with a contingency.

For a trip to the Bahamas this past February my trip plan included an extra day en route. Part of the trip plan was taking our baby bulldog, Nigel, to Camp Bow Wow for boarding. That's the kind of task all trip plans include. So I decided to drop off Nigel on Thursday morning and take off in the afternoon with an overnight stay in Savannah. That splits the trip up nicely and gets us to Marsh Harbour in the Bahamas the following day with plenty of time to catch the early afternoon ferry to Hope Town on Elbow Cay.

The extra day en route also takes pressure off in case the weather is unacceptable. All of us make better decisions when the most conservative option isn't going to wreck, or at least markedly change, the entire trip.

As part of my normal trip planning I had been watching the overall weather patterns for several days before departure. You can't make a go decision or cancel a flight based on weather prog charts days in the future, but you can get ready. As it turned out one of those intense cold blasts with lots of snow and freezing precipitation was moving across the southeastern states just the day before our planned departure. We were lucky on our timing. A day sooner would have almost certainly been a scrub.

But trip plans can still go wrong, and this one did. We had a record cold night here on the shore of Lake Michigan at 6 below. When the line crew topped off our airplane I noticed fuel running out of a fairing under the left wing and dripping off the flap at an alarming rate. We were not going anywhere.

My home base shop, Executive Air Transport, got the Baron in the hangar and tracked the fuel leak to lose screws on one of the bladder tank access plates. Apparently the cold had shrunk the gasket and the screws were a little loose, too, and that was the leak. It was an uncomplicated fix and was done by late afternoon. The cushion in the trip plan allowed us to make an early morning departure the following day for an uneventful flight to Marsh Harbour.

As the vacation days slipped by too quickly it was time to start forming the trip plan home. This one is a little more complicated because unless you can fly in the flight levels, you have to clear customs in Florida upon return. That means a stop at Fort Pierce and then another en route fuel stop home.

With so many online sources for weather it was easy to keep tabs on the overall systems moving across Florida and the eastern United States. For a few days I monitored several weather patterns and forecasts. The first one was Florida and Gulf Stream weather because getting back into the United States is the least flexible part of the plan. If bad

weather were to block our flight all the way to Michigan in a single day, I would still have more options being in Florida instead of the Bahamas.

The other concern I had was weather and winds over the eastern mountains. The mountains in north Georgia, western North Carolina, and Tennessee are as high and rugged as any in the eastern United States, and bad weather can stick to them like glue. Strong winds, particularly from the northwest, can create dangerously severe turbulence. And you want to plan your fuel stop many miles south, or north, of the ridges to maximize your chances of good weather and smooth conditions.

As it turned out the day would have been a total no-go under VFR because the mountains and many miles to either side were blanketed by low clouds. But there was no convection expected, and the freezing layer was above a usable en route altitude, so the flight made perfect sense under IFR.

The trip plan included making the 8 o'clock ferry, clearing Bahamas customs, clearing U.S. customs, making a fuel stop, and landing early enough to fetch Nigel before the kennel closed. Complicated to say the least, but there were no showstoppers. Every leg of the multi-modal trip could have been delayed for a day or two without undue hassle.

We have all been warned forever that traveling in our airplanes can cause us to make bad and unreasonably risky decisions just to get where we are going. And the accident record shows we have taken risks with weather or fuel reserves or sundown or other factors to make a schedule. But a comprehensive trip plan helps you avoid that. Plans made days earlier in case you need to delay, divert, or abort are easier to abide by.

On the other hand, no single decision in your trip planning should be to complete the trip. We can only decide that it is reasonable to depart and go as far as we can. Or to fly to an intermediate stop. Waiting for some sort of "all clear" signal to a destination hundreds of miles away has its own risks because we tend to commit to completion of the trip.

Our airplanes are wonderful traveling machines that give us the freedom non-pilots can only dream of. But a big component of freedom is flexibility. If you build that into your trip plan, the pressure is off, the risk goes down, and the whole trip is a lot more fun and relaxing. EAA

J. Mac McClellan, EAA 747337, has been a pilot for more than 40 years holds an ATP certificate, and owns a Beechcraft Baron. To contact Mac, e-mail *mac@eaa.org*.

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MIKE BUSCH
COMMENTARY / SAVVY AVIATOR

Fix It Now...Or Fix It Later?

Dealing with mechanicals away from home

NOTHING IS MORE frustrating than dealing with mechanical problems on the road. It's always uncomfortable when you're far away from your usual support system—your trusted mechanic, your hangar, your toolbox. To add insult to injury, mechanicals invariably seem to occur at the most inconvenient time and place—like Sunday at Sheepdip County Airport when you've just gotta be back at work Monday morning. It'll be a miracle if you can find a local A&P at Sheepdip on a Sunday—and if you do, he'll probably be named "Bubba" and you might just get the uneasy feeling that Bubba knows he's got you.

It's natural to ask yourself whether it's really necessary to fix the problem before further flight, or whether it's okay to press on and get it resolved after you return home. There's a strong temptation to defer the maintenance until a more convenient time, and often that's a perfectly reasonable thing to do. But sometimes it isn't—witness numerous NTSB accident reports in which the probable cause is "pilot's decision to operate the airplane with a known deficiency."

So, do you fix it now—or fix it later? Is fixing it now really necessary? Is fixing it later really safe? It all depends.

WHAT'S WRONG, EXACTLY?

Your first question should be this: Do I know *exactly* what's wrong? Unless you are confident that you know the cause of a problem, you can't make an informed decision about how serious the problem is and whether or not it's safe to fly with it.

Often the cause is obvious—flat tire, inoperative radio, burned-out landing light bulb, noisy attitude gyro—and your decision is often straightforward. Sometimes, however, the cause is not so obvious. Are you absolutely certain about where that fine oil mist on the windshield is coming from? What that slight fuel odor in the cockpit really means? Why the engine seems to be running rougher than usual? Whether that dead No. 5 EGT indication signifies a non-firing cylinder or just a broken wire? In cases like these, you need to investigate further before making a go/no-go decision.

Experience teaches that even seemingly minor anomalies are worth investigating

PHOTOGRAPHY COURTESY OF **MIKE BUSCH**

before flight. I recall one time when I noticed a little "static" in my comm radios that I'd never heard before. It was so subtle that I'd have completely ignored it had I been flying any other aircraft but mine. But I knew my airplane well enough to know this wasn't normal, so I investigated further. After some experimentation, I discovered that the noise would disappear when I turned off the right magneto on the left engine. I pulled the top cowling on the left engine and discovered that the four nuts that secure the ignition harness to the right magneto were loose and backing off the studs—one was completely gone, and the other three were well on their way. Had I not followed up on the static in the radios, the harness could easily have fallen off the mag in a few more flight hours.

Another time, while flying home to California from Oregon, I spotted a tiny trickle of reddish liquid on the top of the left engine nacelle. Since the only red liquid I could think of was the red-dyed oil in the hub of my McCauley propellers, I decided to make a precautionary landing to investigate. It turned out that there was a major problem with the prop (due to an assembly error when the props were overhauled three years earlier) that could have resulted in loss of a blade in-flight—quite often a fatal scenario.

The moral: Don't fly with an anomalous symptom—even a seemingly innocuous one—unless and until you're satisfied you know exactly what's causing it. Once you have ascertained the cause, you can make an informed decision whether to fly now and fix later or vice versa.

SAFE TO FLY?

Okay, you have a problem, and you've determined its cause. Now, how do you decide whether or not it's safe to fly home with the problem? That's not an easy question to answer. Risk-assessment questions never are. It's a lot like asking if it's safe to fly in this weather. There are a lot of variables to consider, and every pilot's risk tolerance is different.

Personally, I'm reluctant to fly with *any* significant problem that affects the engine(s), propeller(s), landing gear, or primary flight controls. Some years ago, a Bonanza-owner friend discovered at run-up that one of his two mags was misfiring badly and elected to fly home with the bad mag shut off. He made it, but I still think it was a dumb stunt. I've known piston twin pilots who will tolerate a questionable mag check in one engine if the other engine is running fine, but I'm definitely not one of them—an engine failure in a piston twin can sometimes be more dangerous than one in a single.

All twins have dual alternators and dual vacuum pumps. Many singles also have backup vacuum systems and/or

backup alternators. Is it okay to fly with a bad alternator or vacuum pump if you've got another one that's still working? For me, the answer is yes *only* if the flight is day VFR, and a resounding no at night or in IMC. Your mileage may vary, of course, but it's wise to establish your own "minimum equipment list" (MEL) criteria for problems like this ahead of time, otherwise you may succumb to the siren song of get-home-itis.

One of my personal MEL rules is that my autopilot is a no-go item for me if the flight is in IMC, at night, or if it exceeds two hours in duration. The only exception is if there's another rated pilot in the right seat. I confess that my own mileage has varied on this one over the years: I used to fly my Skylane 40 years ago solo in nasty weather and believed that "real pilots don't need autopilots or dual vacuum pumps." My only defense is that I was young, stupid, and felt invulnerable at the time. Nowadays, I'm older and less bold, and won't make anything but a reasonably short VFR flight without dual vacuum pumps and George along. If that means fixing something on the road, that's what I do.

WILL IT GET WORSE?

Any time you consider flying with a minor mechanical problem, you need to ask yourself if you're confident that your minor problem won't turn into a major problem before you make it home. Will that noisy attitude gyro keep gyroing for another five hours? Will that small fuel seep stay small, or will it turn into a dangerous leak? If you stop-drill that windshield crack, will it stop growing long enough to fly back to home base?

Sometimes a quick-and-dirty temporary fix is adequate to get you home so you can put the aircraft in the shop and do a proper repair. I once flew to Louisiana for an overnight stop en route to a speaking engagement in the Cayman Islands. The next morning, I was horrified to discover that the pilot-side window was cracked from the lower-front corner of the storm window opening to the edge of the frame. I didn't feel safe flying in that condition all the way to the Caymans and back to California, but replacing the window would require downing the airplane for several days and no-showing my engagement. I wound up drilling two rows of 1/16-inch holes, one row on either side of the crack, and lacing the window back together with stainless steel safety wire. It was a truly ugly repair, but one that is FAA-approved (Advisory Circular 43.13-1B) and took me less than 30 minutes to accomplish. It held together just fine until I got back home and was able to order a new window and install it.

Another time, I discovered an electro-thermal de-icer coming loose from one of my propeller blades. I couldn't fly with it flapping, but couldn't easily down the airplane for a few days to get it replaced. After my best efforts to re-glue it failed miserably, I finally wound up securing it temporarily with duct tape—a decidedly unapproved repair, but one that worked long enough to get me home where I could install a new de-icer. I still shudder to think what would have happened if I'd been ramp-checked with duct tape on my prop! (I think the statute of limitations has run out on this one.)

It'll be a miracle if you can find a local A&P at Sheepdip on a Sunday—and if you do, he'll probably be named "Bubba" and you might just get the uneasy feeling that Bubba knows he's got you.

INTERMITTENTS

Intermittent problems are always the worst to deal with, particularly away from home. Invariably, such problems never happen when you're trying to show them to the mechanic. Since a mechanic cannot properly troubleshoot a problem that he cannot reproduce, he has only two options: confess he doesn't know what's wrong, or guess as to what might be wrong and replace one or more parts based on that guess. Mechanics hate to admit they don't know how to fix your problem, so more often than not they wind up guessing and hoping they get lucky. Frequently, such "shot gunning" winds up costing you time and money and very well might not cure the problem.

If your intermittent problem is potentially life-threatening—for example, intermittent oil pressure fluctuations—then naturally you have little choice but to deal with it right away, even if that requires guesswork, downtime, and expense. But most intermittents aren't life-threatening, and for those the best approach is often to be patient and wait until the problem worsens to the point that it can be reproduced and troubleshot systematically. For such problems, deferring maintenance until you get home is often the wisest course of action.

Sometimes, of course, the problem won't wait until you get home, and will worsen to the point you need to deal with it. Some years ago, I flew from California to New

PHOTOGRAPHY COURTESY OF MIKE BUSCH

England shortly after completing a heavy annual that involved replacing the turbochargers on both engines. The engines ran perfectly all the way to New Haven, Connecticut. Then, while climbing out from New Haven headed toward Boston, the right engine stumbled—once—for about a second. It then ran perfectly for the remainder of the 30-minute flight. After landing at Boston, I performed an extensive run-up and everything seemed perfectly normal. So although I was concerned about the earlier stumbling episode, I chose not to deal with it.

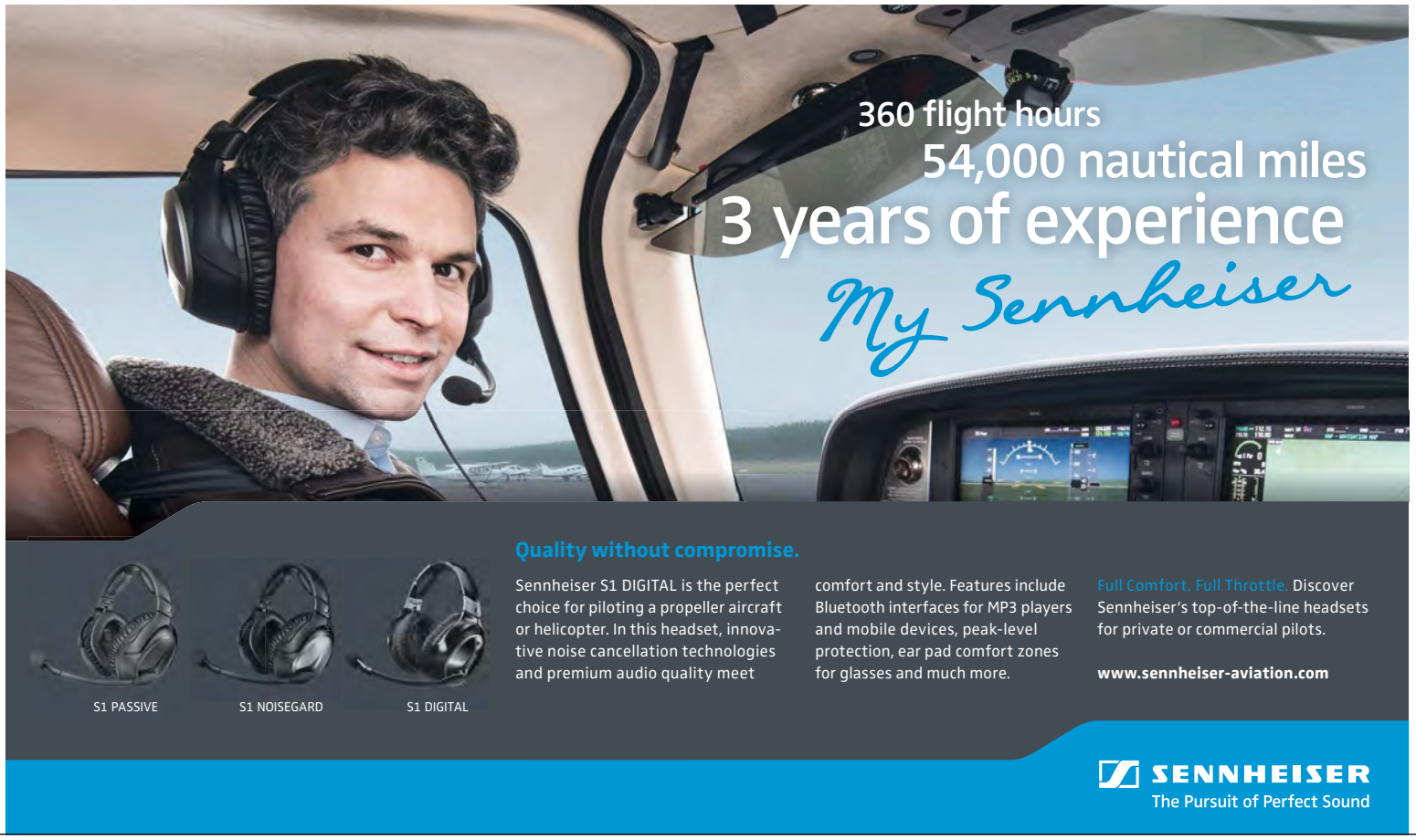
A few days later, while flying from Boston to Poughkeepsie, New York, the right engine started running very rough (as in change-of-underwear rough), and this time the problem wasn't intermittent. Shoving the mixture to full rich smoothed out the engine considerably. An in-flight mag check seemed normal. I elected to continue the flight to Poughkeepsie (although I probably wouldn't have if I'd been flying a single). By the time I landed there, I knew I had a definite, reproducible problem with the right engine, and knew that it was most likely fuel-related rather than ignition-related. That was enough information to go on, so I put the airplane in the maintenance hangar at the Poughkeepsie FBO, and 30 minutes later we found that the No. 4 fuel injector nozzle was partially clogged with what looked like a small glob of grease. Cleaning the injectors completely cured the problem.

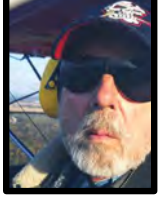
FIX OR DEFER?

Here's a brief checklist that may help you to decide whether to fix a problem now or let it wait until you get home:

- Investigate the problem and be sure you know exactly what's wrong before making a fix-or-defer decision. Even seemingly minor anomalies can be clues to major problems, so investigate them promptly.
- Once you're confident that you know exactly what's wrong, decide whether it's safe to fly home with the problem or whether it needs to be fixed now.
- Before deciding to defer maintenance, ask yourself if you're confident that your deferrable problem won't get too much worse before you get home.
- Consider making a temporary quick fix that will get you home safely, then doing a proper repair at home base.
- For an intermittent problem that isn't a safety-of-flight issue, the wisest course is often to be patient and let it get worse. EAA

Mike Busch, EAA 740170, was the 2008 National Aviation Maintenance Technician of the Year, and has been a pilot for 44 years, logging more than 7,000 hours. He's a CFI and A&P/IA. E-mail him at *mike.busch@savvyaviator.com*. Mike also hosts free online presentations as part of EAA's webinar series on the first Wednesday of each month. For a schedule visit *www.EAA.org/webinars*.





DAVE MATHENY
COMMENTARY / LIGHT FLIGHT

Big Wind, Little Wind

Some thoughts on micrometeorology

MY FIRST ENCOUNTER WITH the practical side of micrometeorology happened just an hour into my flying career. It was only a downward breath of wind, the sort of thing that larger aircraft just go through without noticing, like a giant trudging along, ignoring the affairs of the little people all around. I was passing low over a dense stand of evergreens in my new American Aerolights Eagle, which weighed all of 190 pounds empty, and realized I was unaccountably descending toward the trees. I cranked on the twist-grip throttle to give it all the power it had—all that was left in the single-cylinder Zenoah engine's 20 horses (little, goat-sized horses)—and just barely arrested the descent and got out of there.

In the 34 years since then, even though I've moved up to much heavier, faster aircraft (and back to lighter ones), I've made something of a study of the smaller air currents that affect those of us at the lightweight end of the flying spectrum.

Let's set aside huge winds, like those found in hurricanes, tornadoes, and thunderstorms—anything that inspires the news media to use the word *packing*, as in "packing winds of." And there's also no point in talking

ILLUSTRATION BY **DAVE MATHENY**

about those medium-strong ones that are enough to rock your car and make you have to concentrate to get back in your lane, because few pilots are willing to fly in those conditions. I study the little winds that blow when the giant is snoozing, so to speak—the milder disturbances you encounter in a very light aircraft on what was supposed to be a light-and-variable day, when the windsock is only moving fitfully back and forth. At times it won't even do that, but still we get bounced around. What's that all about?

BIG PICTURE, LITTLE PICTURE

When we first get into aviation we learn about big masses of air heating up and expanding (highs), and cooling down and contracting (lows), and moving from one place to another, steered by planetary winds. Forgive me for starting my discussion of little winds by writing about big winds, but hang in there. If you look at meteorological maps showing highs and lows, it will soon become second nature to see their generally orderly progression from west to east (in the Northern Hemisphere; east to west in the Southern).

This sort of major, continentwide stuff is what's behind the scenes on the nightly local news, weather, and sports show. The retail version will often come down to something like, "Tomorrow's weather will be partly sunny, with winds out of the west at 5 to 15." This is a hind-end-covering sort of prediction. Whatever materializes, from cloudy to clear, from dead calm to 20 mph winds, and from south to west to north, will be close. It won't get the weatherperson strung up from a tree. And most people could not possibly care less what direction the wind will blow from. Their only concern, reasonably enough, is whether they will have to fight the weather or be able to just ignore it.

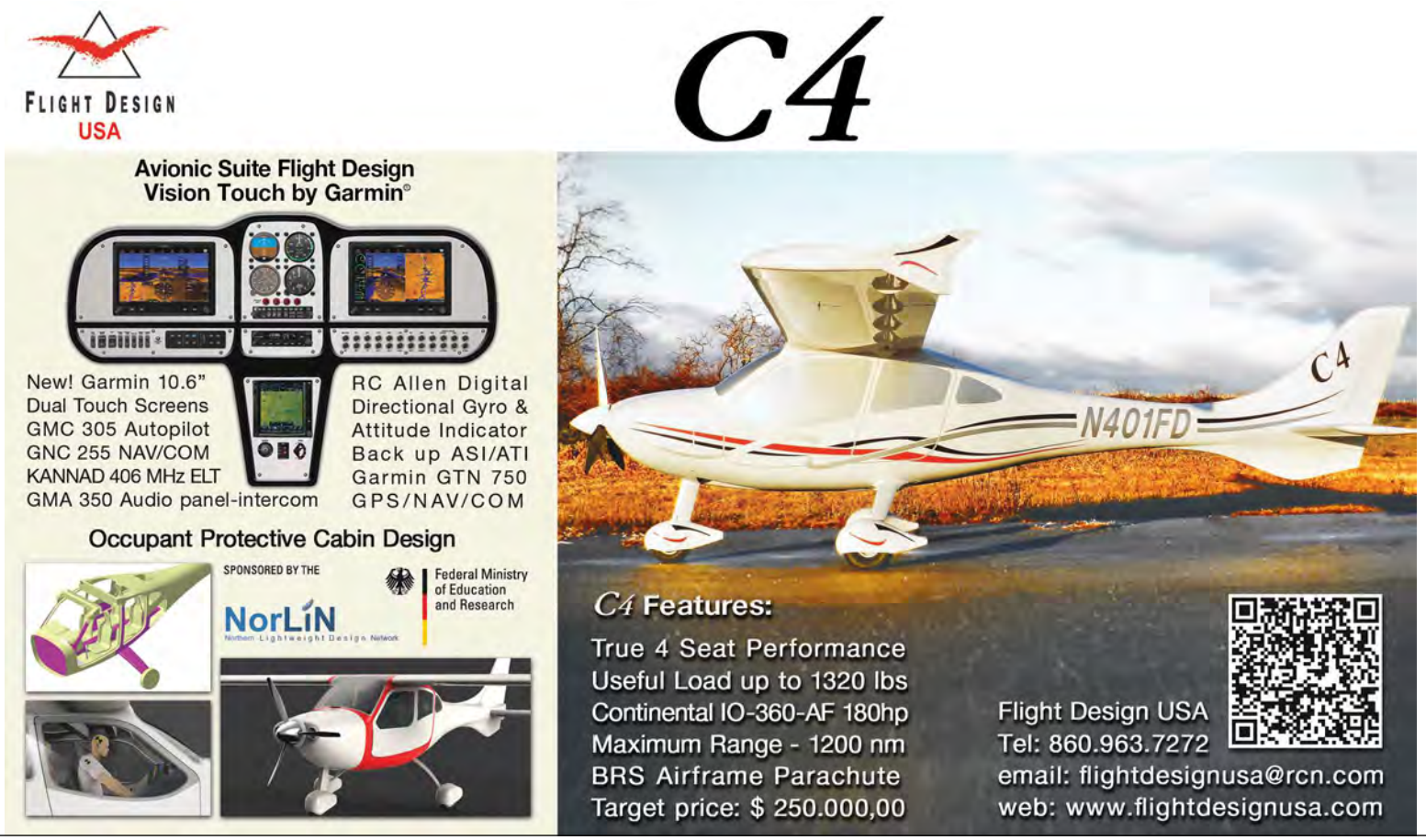
The usual news outlet-based weather forecast reflects the big-picture weather, the giant's weather. Local winds will be subject to that weather, as well. If, for example, a rip-roaring southerly flow is going on, the wind at your airfield will almost certainly be from the south, too, and in any case you probably don't want to mess with anything very strong.

In case it's not otherwise obvious, this article is directed at flying only in nice—to use a not very technical term—conditions. No storms, fog, rain, snow, or anything else ominous.

Fortunately for us, the giant's weather picture is still of value because it lets us know in general if we can fly or not. I consider a partly sunny, 5 to 15 forecast to be pretty promising. To start with, it means no thunderstorms or other nasty stuff. It's a good beginning. Such a day might turn out to be great for flying very light aircraft, especially in the morning, before the wind gets organized and starts to blow, and the late afternoon, when it slowly subsides.

THERMAL BASICS

What's true of the giant's air—expanding and flowing out, contracting and flowing in—is



largely true of the far smaller air masses that we deal with, air masses the size of an acre or two. Typically, the sun heats up the ground, which heats up the air right over the ground, like an egg in a frying pan. The egg, however, never rises up and floats away (which would be incredibly inconvenient), but the warm air does just that. It will be replaced by the heavier, cooler air surrounding it. That downdraft I encountered over the evergreens was likely what is sometimes called "tree suck," a hang-gliding term. The cool air among the evergreens is heavier and naturally sinks, drawing in the air above it. My escape was probably aided by the warmer, rising air beyond the evergreens.

When the warm bubble of air heats up enough, it will break loose and rise—a thermal. On a typical sunny day with clouds, the base of the clouds marks the level where the bubble has cooled off to the same temperature as the surrounding atmosphere at that altitude. At that point their moisture precipitates out and becomes visible as a cloud. You can visualize the average cumulus cloud as the visible top of a mushroom whose invisible stem is, or was, rising moist air.

The sometimes-powerful updraft inside that mushroom stem is called "cloud suck." If the cloud is big, and the updraft is strong enough, an aircraft can be drawn into a cloud. You do not ever want to be drawn into a cloud. Yes, I know sailplane, hang-glider, and paraglider pilots who will roll their eyes at the wussiness of that statement and will say that you can learn to handle it. They can, and do. But unless you have the hours and the skills, and an airframe that can take the violent stresses that may be thrown at it, don't try it. A mental image that has always stuck with me comes from an account I read of a hang-glider pilot who got sucked into a towering cumulonimbus cloud and whose body was found the next day on the ground: frozen, electrocuted, and wrapped in the fabric of the wing like a burial shroud. Don't get sucked into clouds.

Sunny days with clouds ("partly sunny" in the glass half-full parlance of the grinning weatherperson) and even moderate winds can be awfully rough on us little guys if the thermals are popping. Soaring pilots look for those thermals and need them. My first flight instructor, who was also a hang-glider pilot, once made a record-setting flight of over 150 miles by gliding from one thermal to another. He knew what he was doing. But when I find myself on a cross-country flight on one of those days, I generally stay down fairly low, where the air has not yet organized itself into well-defined thermals. Even so, you can get beaten up by irregular, gusty little horizontal puffs of wind that seem to be part of thermally days. Once, in my Quicksilver GT400, a sideways gust blew my baseball cap off my head and overboard. It must have gone through the prop; I froze for a moment, listening for strange noises from back there, but it was gone without a trace.

I consider a partly sunny, 5 to 15 forecast to be pretty promising. To start with, it means no thunderstorms or other nasty stuff.

ISLANDS IN THE STREAM

Whenever wind is flowing, terrain features will cause it to become turbulent, as when eddies in a stream form downstream from stones. The faster the water and the more irregular the rocks, the greater the eddies, to state the obvious. For this reason, among others, I avoid flying down on the deck if there's much of a breeze. Between these two avoidances—thermals up high and trashy air down low—it can be hard to find any comfortable altitude. So, in general, if there's much wind, stay on the ground.

I pay more attention to downstream eddies when the surface irregularity causing them is prominent. There's an airfield I like to drop into that has a beautiful, well-groomed east-west grass runway, but also a tall warehouse near the south side of the strip. I can handle a crosswind, but if the wind is out of anywhere from southeast to southwest, there's certain to be sudden and unpredictable air in the wind shadow of the warehouse. But the downstream turbulent area is easy enough to envision, and the runway is long enough that I can just avoid the part that will be in the wind shadow, both on landing and takeoff.

UPSLOPE, DOWNSLOPE

Hilly terrain has its own peculiarities. There will usually be an upslope breeze in the morning, when the sun has heated the valleys, making the air expand and push out and therefore up. By early afternoon, wind velocities above the slope can reach 10 mph or more. By that point, air over the valley may be sinking, so stick close to the slopes.

In the evening, the air above the slopes cools, shrinks, and slides downhill. Avoid the slopes then, but that also means there may be decent lift above the valley, where the air is pushing upward.

If you've got a large body of water, expect sea breezes during the day, when the sun heats the land and the air over it lifts. Cool, dense wind flows in from over the water. The opposite happens after sunset, when the land cools and surface breezes flow out.

TRUST YOUR FRIENDLY FLIGHT SERVICE BRIEFER

I've poked some fun at news outlet weather forecasts, but they do provide an overall, if mostly giant-friendly, picture. There are many sources, however. There's a smorgasbord of weather forecasts online, so numerous that there's no need to list them all here. And then there's the service our tax dollars pay for. If you're planning any flight, from local to cross-country, you can call Flight Service at 1-800-WX-BRIEF. Be ready with your planned departure time, N number if you have one, planned route, and altitude.

Note that local winds can be highly individual. I was approaching my home base once from the south at about 700 feet and gazing in wonder at two streams of smoke—as reliable a wind indicator as ever there was. One, about 9 miles north, rose straight up for a couple of hundred feet before bending sharply off to the northeast. The other, about 2 miles ahead, rose to the same altitude and streamed almost straight south. According to the forecast, the wind from the surface to 3,000 feet should have been from the west.

Both of these inarguable indicators told me the much more relevant fact that surface winds were calm. I could land in any direction I chose at my three-runway field. With nobody else in the pattern, I chose them all, and did touch-and-goes from all six directions.

Sometimes, when the giant's asleep, the little people can come out and play. EAA

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Maximizing the resources available to you for a safe flight

BY CHARLIE PRECOURT

I CAN STILL HEAR HIS VOICE 30 years later when I think about that flight. We were a two-ship of F-15s against four F-5 Aggressors. I was in a 7*g* descending left turn attempting to get into missile range on one of the Aggressors when my wingman hollered, "Pitch back hard left, bandit inside your turn, 4,000 feet high, 8 o'clock." Followed almost instantaneously by, "Fox two kill on the F-5 at 23,000 feet in a right turn through east" (meaning he'd fired an AIM-9 missile on a second F-5). I broke off my pursuit and picked up my Aggressor high over my left shoulder and pulled hard up into him, forcing him to flush past me. "Come hard right to south; I'm on your left, high," my wingman hollered. "Third bandit is 5 miles off your nose. I've got their number four 8 miles at 10 o'clock." In the next 30 seconds all four Aggressors had been defeated, largely due to his immense level of situational awareness.

I've thought a lot since then about how well prepared he was and how much information he was able to assimilate simultaneously. In fact he was more than my wingman. He was training me for upgrade to flight leader, instructing from the wing position in a very complex mission profile. And he taught me a great lesson in resource management, several years before the term "crew resource management" had come into being. In this scenario, he had successfully integrated information from the ground radar intercept controllers, from my earlier radio calls about what I was seeing on my radar, from what he saw on his own radar, and from what he saw looking outside, to create a clear picture of the threat situation and then act on it in a most impressive manner. He saved our bacon by using resources inside and outside his cockpit.

That was the early 1980s when our accident record in both military and commercial airline operations was nowhere near as good as it is today. Since then two key initiatives have made a huge difference in airline and military flight safety. One is on the machine side—big advances in design for reliability

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Photo: Evelyn Küpper

have made the machines far less likely to fail. The other is on the human interface side—what we have come to call crew resource management (CRM).

NASA held the first workshop on CRM in 1979 based on accident studies run out of NASA's Ames Research Center located at Moffett Field in Mountain View, California. It began to focus on decision-making, crew-coordination, leadership, and communication skills—all those things my "wingman" demonstrated so skillfully in that Aggressor engagement. Then in 1986 a progress workshop at Ames focused on specific training curricula to bring CRM skills more broadly into use in the cockpit. The research acknowledged that human error can't be eliminated, but errors can be trapped and managed with countermeasures before the consequences become unrecoverable. The military and airlines adopted these training principles, and the results have been nothing short of phenomenal.

At first it wasn't clear how this new CRM stuff was going to matter. We were after all trained to fly the plane; what did we expect to get out of this new approach? Like a lot of "new" stuff it was difficult to grasp the concept or its purpose. But in an early training session, a clever classroom demonstration turned on the light bulb.

The classroom instructor asked for a volunteer to take a chair in front of the group for a task saturation demonstration. The volunteer was given a plexiglass plate with a circle drawn in the middle. In the circle he was to balance a ball bearing. This was a crude simulation of the mental focus required to hand fly the aircraft. On his kneeboard he was given "controller" instructions to write down. The instructor quickly overwhelmed the volunteer, and the ball bearing went rolling on the floor.

Then the instructor asked what resources did our volunteer have that he wasn't using? After a bunch of blank stares the instructor took the plexiglass with the centered ball bearing and set them on the floor where they were on "autopilot," dramatically expanding our volunteer's bandwidth to take more instructions (the floor was a "resource" he didn't think to use). The point was that our "classic" pilot training focused on the "fly the aircraft" part, and we often missed the resources available around us to make life simpler, and safer.

For crewed aircraft, setting the plexiglass on the floor was analogous to delineating roles and responsibilities to spread the workload efficiently and avoid having any one crew member ever be task-saturated. Today's professional cockpits are a model of coordination and clear communication. A well-trained crew in a simulator seamlessly handling the most complex weather approaches at night with an emergency at hand is a thing of beauty to watch. But what does this mean for the single pilot? In recent years there has been a concerted effort to take the same principles and apply them to single pilot resource management or SRM.

At first it wasn't clear how this new CRM stuff was going to matter. We were after all trained to fly the plane; what did we expect to get out of this new approach?

If you're flying as a single pilot, your "crew" includes the controllers and flight service folks on the ground as well as the passenger you might have in the cockpit with you. How you use them is the key. Just as an airline crew or an F-15 formation flight maintains discipline using pre-coordinated roles and responsibilities, a single pilot can plan a flight with the same philosophy. It just takes a well-thought-out plan for how and when you will use each resource. When will you make calls to FSS and for what information? What will you ask of your passenger in the right seat—read checklist items, verify you have done certain things at critical times, or change radio frequencies for you? It can start as simple as, "Hit me if I am descending on final approach with the gear not down." Given a few simple tasks, just about any passenger can become a very reliable backup.

Making it a practice to have a "sterile cockpit" on departure and arrival came from CRM principles. That means no extraneous talking and no listening to the stereo or other unnecessary "inputs" when you're in a dynamic phase of flight and needing all attention on what the controllers are saying and where you're taking the airplane. Do you brief passengers of this importance? What kind of help will you ask of the flight controllers—routing, weather, airport information updates?

On fuel stops, ground crew and maintenance personnel come into your "crew" circle. Maintaining the mindset that you are their "flight leader" or "captain," providing them leadership to execute what you need and taking in information they can provide you, means you don't ever have to fly alone.

The best way to get your own SRM system going is to create your own "mission" checklists. These include all the things you need to remember that aren't on the manufacturer's aircraft checklist. I started mine by setting personal minimums: day and night acceptable ceiling and visibility, surface wind limits, minimum runway lengths, etc. Then I made a checklist of all the things I need to get from a weather brief, all the things I want to know about arrival airports, and so on. Then there's the passenger briefing; build a checklist for that. If I know I'm going to be flying IFR, I have a special pre-departure checklist to verify approach procedure functionality of all my navigation radios and displays. A special checklist for all the things I have to set up to properly fly an instrument approach, "briefing the approach plate." And the idea is to continuously improve these special checklists over time. They'll make you more efficient at planning and executing a flight and keep you out of trouble when you're in an unusual situation. And they'll make you an impressive pilot to watch when you have a new passenger or another pilot along.

You can get some pretty good help with this process at FAA's SRM website. Give the SRM concept a hard look. It can be a game changer.

Fly safe out there. 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.

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LAURAN PAINE JR.
COMMENTARY / PLANE TALK

Aviation Youth

BY LAURAN PAINE JR.

Teens mentoring teens.

THIS ISN'T A FLOWERY topic with a lot of really cool pictures, but I'll tell you what, it's one of the most important topics around so I'm going to throw it out there for you to mull over. I'm talking about involving young people in aviation. Like it or not, you know the bottom line: If we don't perpetuate what we do, what we do will wither. It's as simple as that.

Right up front, there are lots of people and EAA chapters reaching out to kids as we speak. And bless 'em one and all for that. They get it. And EAA's Young Eagles program is legendary in its goodness. All of that is not only necessary, it is vital. In this column I want to personalize these efforts.

At EAA AirVenture Oshkosh last year I attended a youth in aviation seminar. It was capably moderated by Bret Steffen, EAA's director of education. The *speakers*, however, were young people who are involved in aviation, 12 of them to be exact (11 boys and one girl). They passed around a microphone, made statements, and answered questions. The seminar was lightly attended. (I know, there were 50 other things going on at the same time. I get that.) But what these young people had to say is important—very important. I was impressed not only by their involvement but also by their acumen.

I'll get to their comments, but I want to start from the end of the seminar when Bret asked, "What are we doing right?" And the kids came back with "you asked us to talk to you" and "you encouraged us" and "you cared enough to ask." The takeaway from that is pretty obvious: They like caring and encouragement. Aviation comes with some bumps. Who among us doesn't need a pat on

PHOTOGRAPHY COURTESY OF **LAURAN PAINE JR.**

the back from time to time? Encouragement—*continued* encouragement—must be integral to everything we do with youth in aviation.

When asked how the kids got their start in aviation, the majority of them said it happened at an early age: they saw an airplane; they built a model; a parent encouraged them; there was an airport nearby; a pilot friend took them for a ride. Parental support is integral, but parents can also be a detriment. "I offer rides to my friends, and their parents won't let them go," one boy said. It's a tangled web sometimes, but the antidote is what it has always been in aviation: perseverance. The kids know that, and that's why, again, encouragement is so important.

The early age beginning thing made me think back to a few years ago when I gave a hangar tour to an energetic bunch of kindergarteners. I had aluminum pieces, Cleco pliers, Clecos, a handheld radio, and balsa wood gliders for them. They took to it like ducks to water, with enthusiasm, no hesitation, bright-eyed with big smiles. But I'd venture to say their exposure to aviation since then has been nil; public education these days generally gives pretty short shrift to aviation. But I was thinking, those kids must be in the fourth grade by now. I'd love to see them again and hold up a Cleco to see if they remember. If they do, that wouldn't just make my day; it would make my year! Start 'em early!

Some other things the kids mentioned that kept them in aviation: freedom, travel, adventure, satisfaction, variety, and the fact that it's "cool" and *fun*. Aviation gives spice to life!

Here's another little tidbit from the kids: They want to be involved. We can't just welcome them and pat them on the head; they want to be a part of the community. Give them responsibility; they love it that you trust them. Get this: One of the youths, 17, had flown from the San Francisco area to Oshkosh with his brother, 14. Just the two of them. In a borrowed Cessna 180. What did the 17-year-old say about that? "People trusted me. No way I was going to let them down."

The young aviators also spoke of some of the deterrents they face, No. 1 being cost. That's long been a restraint; aviation is not cheap. Never has been. I understand: been there and done that. It's a quality endeavor, and quality is seldom cheap. But it is a worthwhile endeavor. Sometimes you just have to bow your head and find a way. We have to be upfront about that. The kids like honesty as much as they like encouragement. They mentioned available

scholarships, too, and were very appreciative of them, but lamented the fact that so many seemed to go to just the "straight A students." I know what they're saying: Don't overlook the fire in their bellies. They also spoke of intimidating airports with tall fences.

Another discouraging factor is their peers. The instant gratification crowd that often says, "Flying is just so hard." I'm sure glad the Wright brothers didn't have that attitude.

Here's something the kids mentioned several times: social media. Kids use it these days—a lot! I don't. The soup can on a string went out a long time ago, and I've finally come to grips with that. But today social media is how kids connect with other like-minded kids. It's very important. They can go there and "speak the language." (To the "techies": If you build it, they will visit it.) As one youth said, "Kids have to *know* about aviation to get involved in aviation." Social media is a way for them to learn.

Sense of community and belonging was also mentioned several times by the kids. We "graybeards" rather take that for granted. But our world was different; there was a much stronger sense of community years ago with strong families and small towns. Today? Not so much. Much of that has been torn asunder by monolithic cities and impersonal technology. But humans have always been a bonding species. Bad bonding is called "gangs"; good bonding is called "community." Much to the delight of the kids, aviation is a bonding community. They love it; they crave it; they need it. They feel a belonging many have felt no place else. They mentioned that several times. Take them in, embrace them, and they will stay.

More recently, at the invite of my friend Jerry VanGrunsven, I attended the start of Teen Flight IV, which is the fourth iteration of teens building an RV-12 in Oregon. Guess who were the mentors for those kids? The Teen Flight III kids. Kids teaching kids. It's a beautiful thing to see: teens leaning over a bench, one teaching the other to dimple and rivet. Chatter, teen to teen. Role models of the same age. "This hinge is gonna work, but it's gonna look really, really bad," Ethan, of Teen Flight IV, said. "Dangit! I screwed up!" His Teen Flight III mentor replied, "More importantly, you learned something." Such wisdom isn't just reserved for adults.

Tori checks an edge.

Aric, a kid I mentored in Teen Flight I, now works for Boeing. Justin, from Teen Fight II, recently completed the first flight of an RV-12 that he and Richard Graves (a "graybeard") built. Justin has 70 hours in the RV-12; he knows the airplane. I asked Justin, who I had not seen in a while, "I thought you'd be flying F-16s by now." He said, "I'm still in high school." Oh yeah...that.

I'm not smart enough to predict the future of general aviation. It may very well shrink. But I do know this: Judging from the aviation youth I've visited recently, general aviation will be in good hands. 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*.

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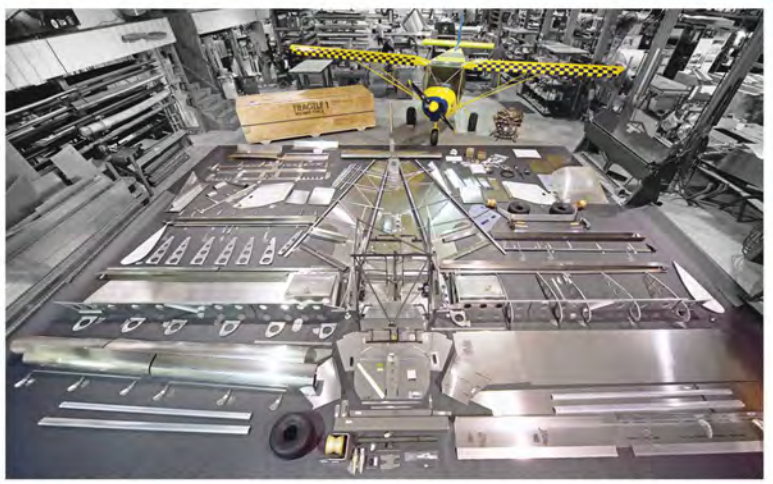

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JEFF SKILES
COMMENTARY / CONTRAILS

The Goodyear Blimp

A super colossal, gargantuan, humongous, bag of gas

BY JEFF SKILES

EAA AIRVENTURE OSHKOSH continues at full throttle just off in the distance. The air show has only just ended, yet here on the vast expanse of Pioneer Airport, the world is serene. I stand alone gazing across the manicured grass at the EAA museum waiting expectantly with only a little bit of trepidation for what is to come. I hear the roaring sound of engines in the sky, and as I turn to look, 14 men—big men—pour out of a trailer and run onto the field arranging themselves in the form of a giant horseshoe. In the heavens above a great gasbag pirouettes and points its bulbous snout toward the ground. It dives at an uncomfortably steep angle as if trying to bury itself in the sod of Pioneer Airport. The engines roar again as the ship hurtles to the ground, but then the nose rises dramatically, and it rounds out for a featherlike landing. The men assembled on the ground grab for the railing that runs around the base of the gondola and the ropes dangling from the nose. They steady the blimp with their weight and muscle as another flight of the Goodyear blimp comes to its conclusion.

A ladder appears and passengers begin to deplane (deblimp?). As the airship is relieved of their weight the men outside take a stiffer grip on the ropes and railing, holding the blimp to the ground. The passengers climb out, and I, along with four others, quickly scramble aboard to even out the weight. The door is closed and in unison the men outside lift the blimp as high as their arms will reach, then they pull the gondola to the ground again bouncing it on its lone tire before letting go. The blimp is propelled into the air by this action, and our pilot throttles up the two engines and then heaves mightily on the big round wheel at his side. The blimp cants noticeably upward and staggers off into the air.

Another landing, another takeoff, and another group of excited passengers, such is the life of the Goodyear blimp, flight after flight hopping rides, circling stadiums, providing aerial TV coverage, and all the while displaying the blue and yellow colors of Goodyear and its 115-year-old logo—the winged foot of Mercury.

Goodyear has been manufacturing blimps and dirigibles since the very early days of its existence. The corporation formed an aeronautical division more than a century ago to manufacture rubberized fabric coatings for aircraft and lighter-than-air ships. Goodyear built its first blimp only a few years later, beginning a long history that continues to this day.

PHOTOGRAPHY BY **BRADY LANE**

WHAT'S A BLIMP?

Not surprisingly the body of a blimp is basically a gigantic polyester fabric bag. The only solid parts of the blimp are the gondola, the tail structure, and the aluminum battens that provide stiffness to the nose. The Goodyear blimps are technically referred to as non-rigid airships. However, they will soon be replaced by the new semi-rigid airships built in partnership with the Zeppelin company of Germany.

ANATOMY OF A BLIMP

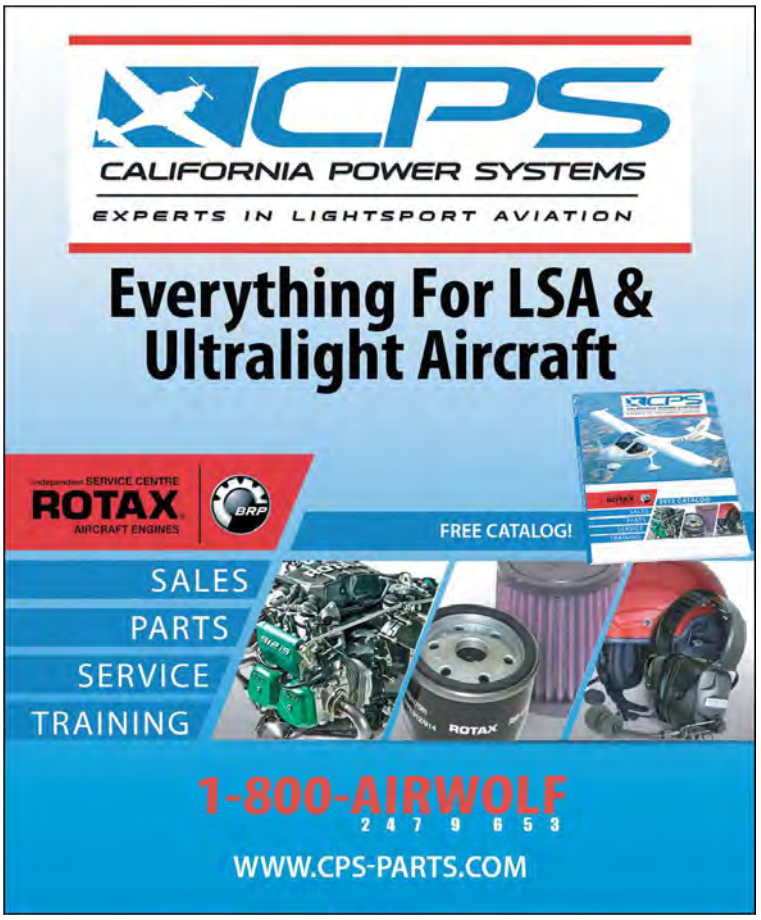
The Goodyear Blimp's maximum weight is just under 13,000 pounds, surprisingly light when you consider that the bag is almost two-thirds the length of a football field, but once helium is added it achieves neutral buoyancy and weighs nothing at all.

The blimp's bag is filled with helium except for two ballonets, a French word meaning "small bag" that quite literally defines their purpose. Arranged fore and aft within the blimp's main bag the ballonets contain air that is forced in by the wash from the propellers and whose exit is controlled by cable-operated valves. As the airship ascends the helium inside expands. This expansion is compensated for by letting air out of the ballonets. Likewise on descent expanding the ballonets with outside air allows the blimp to maintain its full-figured Rubenesque form. The ballonets can also be used to trim the blimp because air is heavier than helium. More air in the front ballonet and less in the rear will make the airship fly nose low and vice versa.

A blimp must be in motion to maneuver. It requires airflow over its tail surfaces to pitch and yaw. It also develops aerodynamic lift from the bag while in motion, allowing it to climb. All of this is not a problem while flying, but it does make landing more of a challenge. A blimp pilot can't land at 50 mph and count on using brakes to slow to a stop. Instead a blimp landing is a bit like docking a seaplane. You need enough speed so that the rudders and elevators have control to maneuver, but not so much that you careen into the ground scattering the assembled ground crew like bowling pins.

BLIMP SCHOOL

The controls of a blimp are quite different from an airplane. There is no yoke or stick, only rudder pedals and a large wheel mounted to the side of the pilot's seat like that of a wheelchair. The rudders have significantly greater throw than those on an airplane and all controls are used to maximum effect while in the air, which makes flying the blimp somewhat of a workout. Several turns of the wheel can make the airship dive at the ground at an alarming angle, and the opposite for a climb. Thirty degrees



up or down is the normal operating envelope for the Goodyear blimp. A light aircraft would probably never see more than 10 or 15 degrees of pitch change on a typical flight.

The only means to turn the blimp is to yaw the great bag overhead. There is little finesse involved; simply punch the rudder all the way to the floor, and the airship slowly lumbers off in the direction you desire. The blimp is inherently stable with the weight and mass of the gondola hanging below the bag, and it will never roll inverted. About 30 degrees before your rollout heading, apply full opposite rudder. The bag will ponderously roll level. While directional control is fairly straightforward, pitch is not. New airship pilots like me will tend to over control resulting in a continuous phugoid oscillation as the nose hunts up and down. Landings are an advanced maneuver best left to professionals.

In the heavens above a great gasbag pirouettes and points its bulbous snout toward the ground. It dives at an uncomfortably steep angle as if it is trying to bury itself in the sod of Pioneer Airport.

The Goodyear blimps each travel with a crew of 21 people: four pilots, 16 ground and maintenance personnel, and one public relations representative. A caravan of support vehicles accompanies the blimps wherever they go. The blimp itself is capable of a maximum speed of 50 mph but will travel at a more pedestrian pace of 35 mph to keep from outrunning its support staff. If a pilot had to set the blimp down without the crew, it would require venting helium and deflating the bag.

THE FUTURE OF AIRSHIPS

Blimps are costly to operate, and their days may be numbered. It's not the airships themselves so much as the size of the ground crew that is changing the landscape of lighter-than-air flight.

In the next few years the Goodyear blimps will be making their final ascents. Their retirement is on the horizon, and they are the last of more than 300 such airships produced by Goodyear over the last century. A renewed partnership with the Zeppelin company is replacing these iconic symbols with Goodyear's first semi-rigid airships. These are Zeppelin NTs, and they are not blimps but dirigibles. The Zeppelins will be built in America, and the first of this new fleet, *Wingfoot One*, is already flying. It and its sister ships will carry on the tradition of Goodyear airships for years to come. EAA

Jeff Skiles, EAA Lifetime 336120, is an ATP and CFII-ME who has been an airline and light airplane pilot for almost 40 years. He previously owned a Cessna 140 and a Waco YOC and currently flies a Cessna 185. Jeff can be reached at *JeffreyBSkiles@gmail.com*.

A JOURNEY THROUGH TIME – WITH RIMOWA

The 1920s marked the beginning of modern air travel and the golden age of Hollywood. In 1919, Hugo Junkers presented the world's first all-metal commercial aircraft. It was made using the aircraft aluminum alloy discovered by Alfred Wilm in 1906. In 1950, RIMOWA presented its suitcase with the unmistakable grooved design made of the same material – at the time, it was the lightest suitcase in the world. RIMOWA was a real pioneer in the sector, starting the trend for lightweight luggage back then.

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PHOTOGRAPHY BY **TYSON V. RININGER**

ERCOUPE EVANGELIST

FOR THE LOVE OF THE 75-YEAR-OLD DESIGN

BY JIM BUSHA

WHEN SYD COHEN, EAA 98446, of Wausau, Wisconsin, took his first airplane ride in an Ercoupe, he became enamored with the type and has become a well-known leading crusader and activist in the Ercoupe community.

"I finally got my first ride in 1967," Syd said. "At the time I had put flying off to the side as life kind of took over." Syd said he loved aviation growing up but because he wore glasses assumed he wouldn't be able to get a pilot certificate. "Of course I found out later that wasn't the case," he said.

While teaching at an industrial high school in the late ’70s and early ’80s, Syd stumbled across a 1946 C model Ercoupe for sale. “It was painted mostly white at the time with a thin red and blue stripe down the side with big N numbers,” he said. “I convinced some of the other teachers to go in with me to buy this airplane, and five of us formed a flying club. We bought it for $6,500 and had enough money in reserve for any maintenance issues that might creep up.”

After five years of airplane ownership most of the group decided to get out of flying and voted to sell the airplane. All of them agreed except one of the members—Syd was the lone dissenting vote.

“I had been flying that Ercoupe the most and having a ball with it,” Syd said. “Mostly I gave rides and traveled to small fly-ins with it. I really don’t like to fly by myself and get a real kick out of sharing the experience of flight with others. So I guess I was the rebel in the group, and I bought out all my partners.”

Because Syd was now the sole owner he was free to do what he wanted with the Ercoupe. The first order of business was stripping the paint off, which revealed some issues.

“In 1994 during some routine maintenance I noticed some ripples in the belly skin and pointed those out to my mechanic,” Syd said. “After pulling the metal off we saw that the ribs underneath had buckled due to hard landings from who knows when. I had been the seventh owner of the Coupe, so it was anyone’s guess when the damage occurred.”

As Syd and his mechanic removed the ribs they noticed an issue with the rear spar. “Like many airplane restoration stories it seemed that we were chasing one problem after another,” he said. “Needless to say I didn’t get the Coupe flying again until 2000.”

It was during the rebuild process that Syd decided to convert his C model into a D model. The big difference was the fact that a C model was certified for a gross weight of 1,260 pounds and the D model allowed for a weight increase to 1,400 pounds with very little work involved.

“At the time I had already been friends with the designer of the Ercoupe, Fred Weick, and I asked him what the difference between the two was,” Syd said. The D model had a stainless steel skin stretching from the top of the vertical firewall to the windshield under the cowl. “The other issue was limiting the elevator up travel to 9 degrees rather than the 13 degrees found on the C model,” Syd said. “Also during that six-year ‘short maintenance repair and inspection’ we ended up replacing over 90 percent of the parts with all new ones. I am basically flying a brand new airplane,” Syd said.

FLYING THE COUPE

“The Ercoupe is such a well-engineered airplane and a real delight to fly,” Syd said. “The ailerons, rudders, and nose wheel are all interconnected. You simply turn the yoke one way or the other like you would in any other airplane to activate the ailerons, but you are also turning the rudders and the nose wheel.”

Syd said the airplane was designed to be safe, and the interconnection was meant to

PHOTOGRAPHY BY TYSON V. RININGER

The twin tails of the Ercoupe give it its distinctive look.

make it spin-proof. "It's impossible to spin it because you cannot cross-control it," he said. "It's also a very difficult airplane to stall—it just wants to mush along. The fuel system is foolproof, too—it is either on or off. The whole airplane was designed to be as simple and safe as possible to fly."

Syd claims that his Ercoupe lifts off right around 60 mph and climbs out at 70 mph. For cruise Syd likes to set his throttle around 2400 rpm and sees 108 mph true airspeed at that setting.

"My Coupe is a very clean in the sense that I don't have wheel fairings or landing lights on the gear," he said. "This equals a reduction of over 3-1/2 miles an hour. I also don't have a big venturi hanging off the side of the fuselage because that will cost you another 4 mph. All of these things may look nice, but all of them contribute to drag and a reduction in airspeed."

INTRODUCING YOUTH TO AVIATION ONE RIDE AT A TIME

As a teacher by trade, Syd would often find himself looking outside of his classroom window and saying to the class, "Hey, it's a beautiful day out there; anyone want to go flying after school?"

"I got a lot of takers, and of course this was way before the EAA Young Eagles program began," Syd said. "I don't know who had more fun on those flights—me or the kids that went flying for the very first time. Officially I have flown close to 1,200 EAA Young Eagles flights, but from the day I began giving rides it's well over 2,100 now.

Syd gave Jake Lasee of Mosinee, Wisconsin, his Young Eagles flight when he was 12. Today, Jake is taking flying lessons in the Ercoupe and camps with it at AirVenture.

EAA VINTAGE TO CELEBRATE ERCOUPE 75TH ANNIVERSARY

One of the EAA AirVenture Oshkosh themes for 2015 will be the gathering of Ercoupes from around the country as they descend en masse on Wittman field in Oshkosh. A special parking area near the VAA Red Barn will showcase upward of 75 pristine Ercoupes as they help celebrate the 75th anniversary of their type.

Syd has flown close to 1,200 Young Eagles in his Ercoupe.

PHOTOGRAPHY BY **TYSON V. RININGER**

"Sure it might cost me a few bucks for gas and my time is all volunteered, but in reality I am repaid with huge smiles, high fives, and hugs from the kids I have flown. I have more fun than they do I think!"

Syd said some of his former students have reconnected after years to thank him for giving them a ride and sparking their interest in aviation. "It all comes back full circle because that's exactly how I started in aviation—at the controls of an Ercoupe," he said.

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.

The open-air cockpit feel and side-by-side seating make the Ercoupe a joy to fly.

THE ERCOUPE STORY

BY PAUL GLENSHAW

THERE'S A PEACEFUL, vacant lot in Riverdale, Maryland, where a factory once stood. It belonged to the Engineering and Research Company, or ERCO, and it's where the Ercoupe was born. Before it was torn down in 2014, one could look at the old factory with its art-deco entrance and distinctive stepped, pointed roof and easily imagine the beehive it had once been. At one point, 35 Ercoupes were rolling out the door every day. Though ERCO is gone, the Ercoupe, its most famous and successful product, still thrives. It's a testament to the genius of Fred Weick and Henry Berliner, who together made their ideals of safe flying come true. It all began in Fred's house in Hampton, Virginia, in 1931.

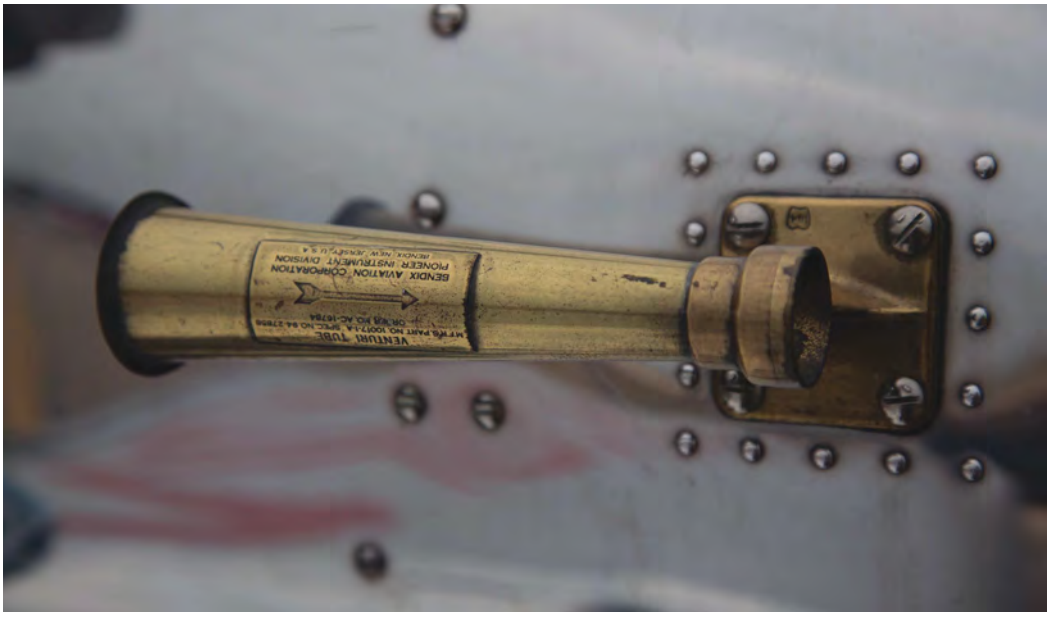
Fred was a well-respected engineer for the National Advisory Committee on Aeronautics (NACA) leading the wind tunnel section at Langley Field in the Tidewater region of Virginia. His career was already impressive. His seminal 1930 study *Aircraft Propeller Design* was considered the authoritative text on propellers for decades. He led the development of the revolutionary NACA low-drag cowling for radial engines. He had flown speed tests with Charles Lindbergh in a modified Lockheed Sirius in 1930. But the project that led to the Ercoupe grew out of an extracurricular exercise.

Fred had been holding informal after-work seminars for his team members to present lectures on lightplane flying, among other topics. He was inspired to conceive an "actual experimental airplane suitable to the private flyer." On November 4, 1931, 12 of his colleagues came over to his house to start hashing out ideas. Three concepts were developed as models that they tested in glides at the Langley Full-Scale Tunnel. The winner was a pusher, partly inspired by a visit Fred had made to Dearborn, Michigan, to visit Bill Stout and his Skycar. Fred's design became known as the W-1—a high-wing monoplane with two tandem seats. Work on the full-scale machine began in Fred's garage. His wife, Dorothy, sewed the fabric for the wings, which were doped in their bedroom. The airplane was completed by the end of 1933. It was great timing.

In January 1934, the Bureau of Air Commerce sent representatives

Syd upgraded his engine to a C-85.

to NACA's lab at Langley looking for assistance in developing a safe airplane that could be marketed for as little as $700. Fred told them about his homebuilt, and soon they were all in the garage looking at the still-to-be-assembled W-1. Soon after, the Department of Commerce officially ordered NACA to test the W-1 to develop the specifications for its project. It went through a full set of wind tunnel and flight tests, including flights made by Fred himself. He soon discovered it had remarkable STOL characteristics, that the aileron and rudder controls could be interconnected, and that it was resistant to stalls and spins. Another key innovation was introduced: tricycle landing gear with a *steerable* nose wheel. The W-1 was eventually sold to the Department of Commerce and with further modifications became the W-1A during development by Fairchild. What Fred had learned was not overlooked.



Enter Henry Berliner who had developed the successful ERCO, in his hometown of Washington, D.C. He and Fred had crossed paths before—to explore propeller designs for the USS Akron airship. Henry had been a helicopter pioneer, making some of the first controlled vertical flights at College Park, Maryland. He founded Berliner Aircraft in 1926 to build fixed-wing machines and was one of the first to use NACA's low-drag cowling. In 1930, Henry founded ERCO to manufacture aircraft parts with a suite of sheet metal presses, flanging machines, and automatic punching and riveting machines. But the airplane builder in him was still there, and in 1936 he decided to enter the light aircraft market. He made Fred an offer to design ERCO's first aircraft, based on the W-1. Fred joined Henry in Washington.

TOMORROW'S PLANE—TODAY!

PHOTOGRAPHY BY **TYSON V. RININGER**

Fred's project was called the Model 310 (named after its ERCO job ticket number). Henry had made several requirements for the design—specifically that it be a tractor, not a pusher like the W-1, it needed to be able to get in and out of "the smallest ordinary airports," and, like Fred, he wanted something safe and easy to fly.

The Model 310 made its first flight on October 1, 1937. It was a low-wing monoplane with a single tail, tricycle gear, 40-hp Continental engine, and was made mostly out of aluminum, taking advantage of ERCO's in-house machining capacities. Although it had three separate controls at first, Fred soon interconnected pitch and roll. His former colleague from NACA, Bob Sanders (who was also Henry's nephew), did most of the test flights. The aircraft performed well but had a decided tendency to turn to the left in low-speed, full-power climbs. Fred eventually changed the single tail to twin rudder fins out of the slipstream. He also canted the engine slightly downward and to the right. As the tests progressed, perhaps the Model 310's most important features came forward: It was resistant to stalls and could not be spun.

In 1938, Henry moved ERCO to a spacious new home in Riverdale, Maryland, barely a half-mile from the College Park airport, the site of his helicopter work. Fred immediately began work on a production prototype, which was completed by late 1939. ERCO received official certification from the Civil Aeronautics Authority in January 1940, with an auspicious distinction. The ERCO design was "characteristically incapable of spinning." Production began soon after, with the new machine renamed the Ercoupe. (In his autobiography, Fred points out that at ERCO, it was always pronounced UR-coupe, not AIR-coupe.)

The new airplane's distinguishing features were all there: available with two or three control systems, steerable nose wheel, hand brake, steering wheel-type yoke, and that most distinctive Ercoupe feature—no rudder pedals (although it could be ordered with rudder pedals, according to Fred). ERCO's marketing department went to work: positive reviews came out and orders came in. The Ercoupe was in production, selling for $2,590 for the standard model with one control wheel and no rudder pedals. The first production Ercoupe was sold to George Brinkerhoff at the College Park Airport next door. It is now in the collection of the National Air and Space Museum.

The Ercoupe's prewar career was very brief, ending in January 1941 when aluminum alloy became prioritized for military purposes. Only 112 aircraft had been built. ERCO contracted for Boeing and others during the war, and the Ercoupe was put on the back shelf. But an extraordinary military test was made with an Ercoupe. In August 1941, an Ercoupe equipped with rockets made the first jet-assisted takeoffs at Muroc Army Airfield.

In 1944, Henry began to prepare for ERCO's postwar period, which he based on the Ercoupe. He joined forces with Oliver Parks

of St. Louis, the founder of the Parks College of Aviation and a born salesman. Oliver made his reputation on safety in flying, and his fortune with military contracts. He too saw great opportunity in the postwar period, with thousands of veteran pilots returning home, presumably eager to keep flying.

In fact, Oliver had written an article for the December 1944 issue of *Flying* magazine in which he envisioned a world of flying convenience for the average citizen, all based on the industry giving the postwar amateur pilot "a two-control, stall-and-spin-proof plane, which anyone who can drive a family car can fly with comparable lack of risk. Ercoupe typifies the kind of plane I mean."

He hatched a retail marketing plan for which the Ercoupe was perfect—selling the safe, easy to-fly aircraft in a decidedly comfortable, inviting environment: the department store. "Salesmen for refrigerators, vacuum cleaners, radios, houses, automobiles—to name only a few—are preparing to go after the postwar market with intensive campaigns," he wrote. "None [of the competition] that I have heard plan to sit on their fixed bases and wait for Joe to come and see them. And if aviation continues the prewar come-and-get-it attitude, aviation—not Joe—is going to suffer. We must go after him with the most intensive, streamlined, ultra-modern sales program in the nation's history."

Macy's Inc., Marshall Field & Company, J.C. Penney Co., and many more signed up to sell Ercoupes. The marketing was intense: full page ads in newspapers, fancy showrooms, radio spots, and celebrity endorsements (including radio star Edgar Bergen and movie star Dick Powell). There was even Ercoupe swag: matches, lighters, and key chains.

It all worked beautifully—at first. Sales began in October 1945, and projected sales grew exponentially. Henry predicted 10,000 orders the next year and ramped up production at ERCO from one part-time shift to three full-time shifts going 24 hours a day. Fred planned for the airplane's development. His drawing board soon saw the development of a four-place Ercoupe and a twin-engine Ercoach.

Then it was over. The production boom was as dramatic as it was brief. "During a single week in September the airplanes on the field built up from 100 to 300," Fred wrote. "The dealer's pipelines had filled up, and they just could not handle any more volume." It turned out that the market for other goods, like the refrigerators, was much higher than that for airplanes. Berliner wound down production, even closing the Riverdale plant for a month.

While the business end was a bust for Berliner, the airplanes were out there and Ercoupe stories began to collect quickly. The College Park Aviation Museum's archive holds scrapbook after scrapbook of clippings from the late '40s and '50s packed with incredible tales. There was the pair of fifth graders (Jimmy Bodard, 11, and Ronald Peterson, 12) who stole one and flew it across most of Oklahoma before running out of gas and landing in a field. William F. Buckley Jr. nosed one over at his sister's prep school. And there's more than one dramatic story about non-pilot passengers who successfully landed an Ercoupe after the pilot passed out. *Catholic Digest* featured Sister Maxime who soloed one. Even the Secretary of the Interior, Henry Wallace, soloed in an Ercoupe, and mistakenly flew it to Baltimore when he meant to land in D.C.

Still, it wasn't making money for ERCO. Berliner eventually sold the Ercoupe—plans, machining, everything—to Bob Sanders, who continued production through the 5,000th Ercoupe in 1948. Bob held on until 1952, when he sold out to Univair in Colorado. A series of owner/manufacturers followed: Forney (who changed the name to Aircoupe), then the Air Products Company, then Alon, Mooney, and finally back to Univair who holds the type certificate today. Along the way, modifications were made. Some planes had three-axis controls, and Mooney did away with the trademark twin tail in favor of the Mooney rudder with the vertical leading edge. In all, there were 20 variants produced through 1970, when Mooney ended production.

Henry never returned to light aircraft manufacturing, but Fred's career continued, notably as a pioneer in agricultural aircraft and as the designer of the Piper Cherokee. The Ercoupe's remarkable story is still unfolding. According to the Ercoupe Owners Club, about 2,000 still fly all over the world. There have been many variations: Ercoupes with floats, skis, folding wings for driving on the road, even a twin fuselage version. The Club hosts an annual Weick Memorial Fly-In and boasts more than 1,000 members.

The College Park Aviation Museum at College Park Airport is now the closest one can get to the Ercoupe's original home. Although the museum proudly displays two Ercoupes—one hanging and one cutaway, with an exhibit to match—the legacy of the airplane is alive and well in the sky, which is where it's meant to be. EAA

Paul Glenshaw is a freelance writer, aviation historian, film producer, artist, and photographer who lives in Silver Spring, Maryland.

PHOTOGRAPHY BY **TYSON V. RININGER**

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VEHICLE PURCHASE PLAN

Five of the MoVenture aircraft: Wasabi, *Tango 2, Catbird, Glasair II, and Long-EZ.*

PHOTOGRAPHY BY **TYSON V. RININGER**

MOJAVE'S MAD MONKS AIM FOR OSH

BY JAMES WYNBRANDT

HOW CAN A FORMULA ONE Air Racer with an 8-gallon fuel tank fly 1,500 nm nonstop? Elliot Seguin, EAA 841245, owner and builder of *Wasabi Siren*, asked himself that last spring after noting the absence of a sanctioned point-to-point speed record between Mojave, California (his home base), and Oshkosh, Wisconsin. The question was more than idle curiosity. "For me, Oshkosh is the center of the whole universe," Elliot said, recounting the visits he's made every year since age 8, when he camped under the wing of the family's Globe Swift with his father. He invokes the name of the founder of his employer, Scaled Composites, when explaining why finding an answer was so important. "As Burt [Rutan] says, 'It's not really an airplane until you've flown it to Oshkosh.'"

Whether or not that statement sounds reasonable to you, it resonates with lots of the airplane addicts drawn to the Mojave area. Elliot's quest to get *Wasabi* to Wittman field in one hop for EAA AirVenture Oshkosh 2014 quickly became a group enterprise: members of a loose fraternity of local pilots and homebuilders who call themselves "the Mad Monks Squadron."

ATTACKING THE AIR WITH A CLUB

The group, nameless until appearing in the credits of Disney's 2013 animated feature *Planes* (their aircraft dubbed the cartoon airplanes' sounds), coalesced around engineers at Scaled and other aerospace types who create cool aviation things at work and build and fly their own dream machines the rest of the time. The name is borrowed from Tom Wolf's *The Right Stuff*, spoken in reference to the era's barrier-busting engineers and test pilots at Edwards Air Force Base, just 15 nm from Mojave.

"It's not like there's a members list," said Justin Gillen, owner and builder of a Tango 2, offering this basic eligibility test: You're a member "if you're hangared out here and working on your airplane or out flying when it's 20 degrees."

Pilots from nearby airports—Antelope Valley, Palmdale, Lancaster, Tehachapi—also belong. They share camaraderie and competitiveness, as they vie with each other and help one another to push performance envelopes and do "bad ass stuff," as they call it. And, according to charter member Doug Dodson, who flies a Glasair II-S FT, "Elliot is the maddest of the Monks."

Their *joie de vol* reached its apex at the annual Mojave Experimental Fly-In. At the

Justin Gillen flew his Tango 2 with Jenn Whaley keeping an eye on Wasabi *in the passenger seat.*

Elliot's quest to get Wasabi to Wittman field in one hop for EAA AirVenture Oshkosh 2014 quickly became a group enterprise: members of a loose fraternity of local pilots and homebuilders who call themselves "the Mad Monks Squadron."

Elliot Seguin set a speed record for the Mojave to Oshkosh flight in Wasabi.

April 2014 event, five experimental aircraft attempted to break nine National Aeronautic Association records (a record number of record-breaking attempts in one event itself, according to organizers), and claimed seven new benchmarks, including the speed record over a 5,000 km closed circuit (211 mph) claimed by Zach Reeder, a Scaled project engineer, flying the legendary Rutan Catbird.

The fly-in's "great kinetic energy" inspired Elliot to consider getting his name in the record books on his way to EAA AirVenture 2014, he said, notwithstanding *Wasabi*'s half-hour endurance. He first sought the counsel of *Wasabi Siren*'s co-designer and co-builder, his girlfriend Jenn Whaley, a Scaled office manager. Designed primarily for racing and completed in 2013, Jenn said adapting *Wasabi* for long-distance flight "was always in the back of our minds."

"When we built the wings, we kept them open so we could modify them later if we wanted," she said. Later was now.

If he was going to attempt the flight, Elliot wanted someone on his wing. He asked fellow Monk and Scaled colleague Justin, EAA Lifetime 1017487, if he was interested in coming along with the Tango 2 (the *Tango Time Machine*). "Just to have eyes on him, to be the sag wagon," Justin recalled, using the bicycle touring term for a support vehicle. But few of even the most efficient experimental aircraft have a 1,465 nm range with reserves. Justin had chosen the 160-hp engine option (the lowest) for maximum fuel economy when building his Tango, but his tanks held only 58 gallons—not enough for the mission. If Elliott had to modify his airplane, so would Justin.

MO FOR THE MISSION

Endeavors like this don't stay quiet long in Mojave, and Elliot said news of the quixotic scheme "spread like wildfire." Even so, EAA AirVenture was barely three months away, and almost all of the pilots interested in participating would have to modify their aircraft for the flight—exactly the kind of challenge squadron members thrive on.

"Oshkosh is like the mecca for us all," said Zach, the Catbird rebuilder and caretaker (along with Jim Reed). Zach, EAA 777411, said the pilots involved enjoyed the challenge of extending their planes' performance. "It was kind of a neat goal for a lot of guys to push their airplanes," he said.

Brandon Cangiano, an aerospace engineer and Lancair Legacy builder and pilot, overheard talk of the mission at work one day. "I went back to my desk, crunched some numbers," he said. He figured with another 20 gallons of fuel onboard, he'd have the necessary reserves. Doug, the Glasair II pilot, rushed for "a sharper pencil to see if my plane can do it" when he got wind of the plan.

Dustin Riggs, who'd arrived in Mojave four years earlier with no pilot certificate and little more than vague dreams of getting involved in aviation, would fly Dick Rutan's globe-girdling Long-EZ, *Ol' Blue*, which Dustin, EAA 1106968, had meticulously rebuilt after becoming the legendary aviator's acolyte.

Word of the plan reached EAA headquarters, and soon the group had an invitation to make a group

PHOTOGRAPHY BY **TYSON V. RININGER**

Wasabi *and Tango 2* Tango Time Machine *in formation during AirVenture 2014.*

PHOTOGRAPHY BY **TYSON V. RININGER**

You're a member "if you're hangared out here and working on your airplane or out flying when it's 20 degrees."

Zach Reeder rebuilt the legendary Rutan Catbird.

arrival during the daily air show, and a name they'd adopted for their endeavor: MoVenture.

Meanwhile, feverish modification work was underway, as auxiliary fuel tanks and pumping systems were designed, tested, and installed. Elliot and Jenn, EAA 1034345, added a single 42-gallon tank that ran wingtip to wingtip, forward of the spar, from which Elliot would pump fuel via two parallel transfer systems (for redundancy) into the 8-gallon header tank that fed *Wasabi*'s engine.

Doug, EAA 392878, built a 15-gallon transfer tank he put in the baggage area of his Glasair, while Justin fashioned a booster seat from his 15-gallon auxiliary system for his passenger, Jenn, who wanted to keep an eye on Elliot and *Wasabi* during the flight.

Brandon, EAA 702410, had concerns beyond the 20 extra gallons his Lancair needed, especially after word came that the MoVenture Monks would be honored with a parking spot on Boeing Plaza, the heart of EAA AirVenture. "I built the Lancair for flying rather than showing, and there was a bunch of stuff I never got around to finishing," Brandon said, citing the mismatched color of the Lancair's tail and myriad other cosmetic details he was loathe to display in such a hallowed homebuilding setting. "That would be horrible. You look at some of the Lancairs there, they're perfect, gorgeous." He had to prepare the Legacy not only to fly to Oshkosh, but to be seen there.

Zach, sitting in the Catbird pilot's seat, had the opposite fuel problem: three of the four 32-gallon auxiliary tanks installed for his record-setting 5,000 km flight had to be removed to make room for passengers: his girlfriend, Rebecca Pontius, founder of a community nonprofit group; and Justin's girlfriend, Niki Dugue, a Scaled design engineer who'd helped build the Tango.

Hours were spent flight planning, determining airspeeds and altitudes, and considering all facets of the 10-hour-plus flight: the snacks to carry, oxygen and hydration needs, and how to relieve oneself in flight, a particular challenge in the coed cabins. Zach, accustomed to hours aloft ("The Catbird doesn't stop for gas," he said), made sure his crew practiced on the ground and was comfortable with all these procedures. "I like to drink a lot," he said, noting dehydration's amplifying effect on hypoxia. "I was worried people wouldn't drink enough water because they didn't want to pee."

Zach Reeder flew Catbird with Rebecca Pontius and Niki Dugue in tow.

To account for performance differences, MoVenture would have staggered departures, calculated for a rendezvous over the Mississippi River at La Crosse, Wisconsin, and a group arrival at Oshkosh during air show prime time. *Ol' Blue* would take off at 3 a.m.; *Wasabi*, the Tango, and the Glasair at 4 a.m.; and the Catbird and the Lancair at 5 a.m. They could count on good weather at departure, given the area's placid summer patterns, but had to consider the possibility of afternoon convective activity from rendezvous to destination. For final preparation, the MoVenturers underwent formation flight training together once modifications were complete; most lacked formation flying experience.

The MoVenturers underwent formation flight training together before flying to Oshkosh.

Justin Gillen, an engineer at Scaled Composites, built and flies the Tango 2.

MOMENT OF TRUTH

The group gathered on the ramp at Mojave airport in the wee hours of July 28. *Ol' Blue* had a fuel pump problem on start-up and had to scrub its 3 a.m. departure. Elliot preflighted *Wasabi*. He'd had little sleep, endlessly reviewing checklists and contingencies in his head. "I was real nervous," he admitted. *Wasabi* had never been this heavy for takeoff—20 percent over its maximum standard weight—and more critically, the wingtip-to-wingtip tank design created the possibility that the fuel load could push the aircraft in a lateral direction that it might not have enough rudder authority to counteract or braking action to stop before it departed the runway.

"I did a really slow power application, because P-factor would be the biggest exciter of directional instability," Elliot said. Moments later he found himself looking down at the runway lights from the air, turning on course, and thinking, "Holy smokes, we're going to do this!"

They'd plotted individual GPS departure routes for separation until a join-up at 15,500 feet, but the plan collapsed almost immediately. "All the terrifying stuff happened in the first hour," Elliot said. Just miles to the east, air mass thunderstorms filled the normally clear skies, and *Wasabi*, the Tango, and the Glasair dodged cells trying to stay VFR, lightning providing the only illumination. Justin had ADS-B aboard the Tango and kept the others informed of their relative positions. It wasn't until just before reaching Las Vegas, as the sun came over the horizon, that each cleared the weather. An hour later *Wasabi* and the Glasair had formed up on the Tango, Justin handling the radios for the flight of three. By then the Catbird and the Lancair were en route, and even *Ol' Blue* was finally airborne, Dustin having fixed the balky pump, all in radio communication, despite the distance separating them.

The journey was also unfolding on the Internet, as GPS Spot Trackers onboard the aircraft identified their positions for display on the MoVenture website. From the Catbird, serving as the mission's command platform, Rebecca took and e-mailed photos that were posted on the site in near real-time, while Niki made hourly calls via satellite phone with their arrival coordinator, Doug's wife, Gail, already at EAA AirVenture.

Aboard *Wasabi*, which unlike the others had no autopilot, Elliot kept the ball centered and tracked his fuel

PHOTOGRAPHY BY **TYSON V. RININGER**

Dustin Riggs meticulously rebuilt Dick Rutan's Long-EZ Ol' Blue.

consumption, pumping 2 gallons from the wing into the header tank every 30 minutes. At 15,500 feet, using about 50 hp from the 160-hp O-200 engine, *Wasabi* was burning some 4 gallons per hour. Hours ticked by.

Nearing the rendezvous waypoint—the Mississippi hidden beneath a solid undercast—the two flights prepared for their join-up, with the Tango's ADS-B showing both converging on the spot simultaneously. In his Lancair, Brandon was diligently scanning his 12 o'clock position. "Right in front of me were three airplanes in a row, exactly where I expected them to be," he said.

"We couldn't have asked for any less drama," said Jenn, who watched the Catbird and the Lancair join the formation from behind. "I can't even explain how weird it was. You're sitting in the airplane and thinking, 'This is exactly what we briefed, and it's happening.'"

The Catbird took point position on the right of the five-ship formation, and the Legacy formed up on the left. Everyone checked in with sufficient quantities of fuel and oxygen. Chatter on their 122.75 common frequency turned to the undercast. "We were debating how to get through, and this big opening just popped up in front of us," Niki said.

Doug, leading the formation, recalled nosing over into the hole, "and everything went from bright blue to green." For a desert dwelling group like the Monks, the experience was almost overwhelming. "To come out of the clouds, like this hole in the sky was made for us, and see green pastures and water was magical," Rebecca said.

Continuing onward, after nearly 10 hours in flight, their objective was almost in sight. "Elliot pointed it out first," Justin recalled. "I think his transmission was, 'Hey, is that Winnebago?'"

WHERE MOVENTURE AND AIRVENTURE MEET

Justin had been using his tail number, N131RG, to lead the flight, but now, switched to the air show controllers, he checked in using the group's mission name: MoVenture. They would perform a fly-by in formation down the flightline and then circle to land, but first they had to wait for a lull in the air show—their anticipation, and in some cases bladders, at the bursting point. Vectored to a

RUTAN LEGACY DAY

Burt Rutan, the visionary aircraft designer whose innovations made history and changed the aviation world, will be back at EAA AirVenture Oshkosh in 2015 to commemorate the 40th anniversary of his iconic VariEze aircraft. EAA has designated Tuesday, July 21, as Rutan Legacy Day honoring the legendary designer's return to Oshkosh, with all owners of Rutan-designed aircraft invited to participate.

Rutan's designs have been groundbreaking for more than 40 years, beginning with the VariViggen in the early 1970s through the concepts that became the SpaceShipOne and SpaceShipTwo vehicles that are launching the era of space tourism.

His use of canard wings and composite materials changed the look and efficiency of homebuilt aircraft, with more than 1,000 airplanes based on his designs now flying in the United States alone.

"There are few individuals in the history of aviation who can match Burt Rutan's imagination and accomplishments," said Jack Pelton, EAA chairman of the board. "His presentations are eagerly anticipated whenever he is in Oshkosh. Although he officially 'retired' several years ago, his innovative mind continues to push forward with new concepts and ideas that he'll share at EAA AirVenture in 2015."

Rutan is perhaps publicly known best for his SpaceShipOne design, which in 2004 won the $10 million Ansari XPRIZE as the first successful private spacecraft. He also designed the Voyager, which in 1986 became the first aircraft to fly around the world nonstop on a single tank of fuel. That accomplishment earned him, along with pilots Dick Rutan and Jeana Yeager, the Presidential Citizens Medal. Burt Rutan was also named to the National Aviation Hall of Fame in 1995 and EAA's Homebuilders Hall of Fame in 1998.

His VariEze aircraft first flew in May 1975, with the prototype causing a sensation at that year's EAA Oshkosh fly-in. That canard design evolved into other Rutan aircraft innovations, such as the Long-EZ, that are still being built today. Rutan's multitude of interests has also led him into successfully exploring space flight and into electric flight.

THE SKIGULL

After retiring in 2011, Burt Rutan did not embark on any new designs or builds and even wondered if he had the persistence to develop another aircraft. His highly innovative spirit would not stay still, however, as he then spent two years doing preliminary designs on what would become the SkiGull. Burt, working out of his garage in Coeur d'Alene, Idaho, claims this airplane will be his last project.

The SkiGull, which is being featured in the antennaFILMS documentary *Looking Up, Way Up: The Burt Rutan Story*, is described as a motorglider that can land on a variety of surfaces (water, snow, unimproved land, etc.) allowing access to remote areas like never before.

"Imagine an aircraft able to land in large swells near any ocean shoreline, ride the waves to the beach, from where you could hike in for lunch and gas," Burt said in a statement released by antennaFILMS. "Imagine also going to snow fields anywhere there is around 400 feet of relatively smooth snow, or to a dirt patch right at Puma Punku, or any part of the Amazon, including the tiny rivers that feed it. Imagine doing an eight-month exploration trip around the world without ever going to an airport."

One of Burt's longstanding policies is to not release any drawings or images of his designs until they fly, and accordingly he's not releasing any for SkiGull before test flight but has released some general teasers.

The design features a retractable ski system that will allow SkiGull to operate in most beach waves, large ocean crests, and very rough lake/river water. Without the skis it can operate from water, but it would then be severely limited to relatively smooth water, like other seaplanes.

It will be a two-place aircraft completely compatible with seawater so it will be made entirely with composites or titanium, and no aluminum.

Since the aircraft has not flown, Burt currently estimates it should have the range to fly from California to Hawaii without ferry tanks, and cruise at 170 knots.

"I know it sounds like Walter Mitty, but if it flies well, Tonya (Burt's wife) and I will explore the world with it, visiting the places you cannot easily get to any other way," he said.

Doug Dodson built a 15-gallon transfer tank so his Glasair II could make the nonstop trip to Oshkosh.

pair of successive holds, they watched smoke trails being painted in the sky while circling south of Wittman field. After half an hour, the air boss uttered the unforgettable words, "MoVenture, the airspace is yours." Justin aimed for the approach end of Runway 36, flanked by his Monk mates.

"It's an unreal experience," Brandon said, recalling the moment. "There aren't too many people who get to fly right down the air show centerline of Oshkosh during an air show. That's not for mortal men—that's for Yeager and Hoover. But for plain old guys from Mojave?"

The air boss invited them to make a second fly-by. With the MoVenture journey almost complete, a new adventure was about to begin, of basking in a heroes' welcome, of watching the daily air show from their honored parking spot on Boeing Plaza, and even posing for group photos in formation in the skies over EAA AirVenture. But for now, this final moment belonged to the man who inspired the implausible mission, and new NAA/FAI speed record holder

Justin had been using his tail number, N131RG, to lead the flight, but now, switched to the air show controllers, he checked in using the group's mission name: MoVenture.

(260.00 kmh) for the Mojave to Oshkosh flight, Elliot Seguin.

"When I rolled out on final for that low pass, coming over the fence, I'm at race speed, hauling ass, knowing Jenn is in the airplane behind me," Elliot said. Suddenly a sight on the ground brought him back to his very first visit to Oshkosh. "I could see the spot where me and my dad had sat under the wing, eating cheese curds and watching the air show!" he said, his voice still filled with wonder. "Holy smokes!" EAA

James Wynbrandt, EAA 568059, is a multiengine, instrument-rated pilot who lives in New York City.

PHOTOGRAPHY BY **TYSON V. RININGER**

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RETRACING THE Flight OF PASSAGE

PHOTOGRAPHY BY **MICHAEL KELLY**

FLYING THE '48 CUB SPECIAL, 48 YEARS LATER

BY SPARKY BARNES SARGENT

Take a bit of nostalgic inspiration, combine it with opportunity, add a little help from friends and family, lace it with a charitable cause, then swirl them all together with cerebral and visceral persistence, and pretty soon, a concept evolves into an experience. For Chris and April Nesin, that experience subtly evolved into its own multifaceted entity: "Retracing the Flight of Passage."

It's fair to say that without N4971H, things just wouldn't have been the same. This particular 1948 Piper PA-11 has fully lived up to its moniker, Cub Special. Special because it has served as a humble yet remarkable gateway to personal discovery. In the mid-1960s, teenage brothers Kern and Rinker Buck restored this PA-11 under the watchful eye of their father, who had been a barnstorming pilot and taught them to fly.

IN JULY 1966, THE TEENAGERS flew N4971H from New Jersey to California in six days, thereby becoming the youngest aviators to fly across the United States. Thirty-one years later, Rinker's memoir, *Flight of Passage*, was published. In the book, Rinker frankly describes the challenges they encountered while flying, and the revelations they had while sorting out the dynamics of their relationship with each other and their father.

CUB CONVERT

Rinker's memoir, along with a flight in a J-3 Cub, captivated and inspired corporate pilot Chris (EAA 516893) in a way that surprised him.

"In 2000, my friend Jeff Russell bought a J-3," he said. "I tried to con him out of it and told him to buy a real airplane."

Jeff gave Chris a ride and, a week later, a copy of *Flight of Passage*, which he read in five days. "That's a record for me, because I've only read about 20 books in my whole life," he said. "I had a similar relationship between my brother and father growing up. I had just lost my dad a few years prior, and the story kind of resonated with me. Rinker's descriptions of flying out west stayed in my head, and I decided that someday I was going to fly to the West Coast."

Chris ended up buying that J-3 and has logged 700 hours in it. That's quite a contrast to his professional career flying a Cessna Citation Sovereign, but he thoroughly enjoys it. During a trip with SuperCub.org in 2011, Chris discovered he couldn't climb above 4,000 feet in the J-3. He started searching for a 90-hp PA-11 or Super Cub, and one day he saw N4971H advertised as a project on Barnstormers.com.

Chris Nesin restored the Buck boys' '48 Cub Special and re-created the Flight of Passage.

"Owner Ken Burton was selling it, and Ken was mentioned at the end of the book when Rinker went back to fly the airplane again," Chris said, smiling. "I was given the option to buy it, and crazily jumped on it!"

Hence, 48 years after the Buck brothers' flight, this '48 Cub Special was once again destined to fly across the Lower 48. But first, it had to be restored.

RESTORATION

Chris commenced by hauling the airplane home to St. Louis that fall. "The wings were off already," he recalled. "We had to flatten the tires to get it in my tiny one-car garage. We stripped it, took all the parts off, and took meticulous notes and pictures."

He posted a message on the Super Cub forum soon after he bought the PA-11: "I just bought a nice project from the nicest guy, Ken Burton. A great project PA-11. But more importantly, 4971H has a great history. Yes, folks, I own the Buck boys' airplane."

Immediately, pilots and restorers who were enamored with Rinker's memoir and N4971H began offering assistance with the project. "I had two and a half years of nonstop help, and I did a lot of the work myself," Chris said. "People would take

PHOTOGRAPHY BY **SPARKY BARNES SARGENT** AND **MICHAEL KELLY**

weeklong vacations and come help me work on the plane. I spent five months with Steve Pierce of Pierce Aero in Graham, Texas."

Chris calls himself a "sentimental guy," so it was difficult to decide whether to replace a major part of N4971H: the fuselage. "After we sandblasted [it], it was a tough decision whether to buy a new Univair fuselage or repair this one," Chris said. Ultimately he decided to keep most of the original parts. "Steve pointed out what I needed to do, showed me techniques, and hired an aircraft welder to come in and put it all together," he said. "We replaced about 55 feet of tubing—about a third of the fuselage."

The most challenging aspect of the restoration was the wings. "I treated the corrosion with Alumiprep No. 33 and spent a lot of time scrubbing," Chris said. "We saved every wing part except the two innermost ribs, which had lots of holes drilled in them. It was probably eight months' worth of work, but I think original means having as much of the original airplane as you can."

MODS

While Chris strove for originality with the PA-11, he did install some STC mods, which included Dakota Cub Aircraft stabilizer trim system, Steve's Aircraft gascolator assembly, Kannad 406 AF-Compact ELT, Grove Aircraft disc brake assemblies, and a Brackett air filter. F. Atlee Dodge Aircraft Services' STC mods included pilot's seat-belt attachment bracket and shoulder harness system, PA-18 horizontal trim system, and a one-time approval for the PA-18 baggage compartment.

"I also installed the Atlee Dodge float fittings on the fuselage, because I figured that if I want to play with the plane on floats later in life, then now was the time to put the fittings on it," Chris said.

KERN BUCK'S REFLECTIONS

Chris Nesin contacted Kern Buck about his restoration plans for N4971H about three years ago, and Kern said he was pleased to learn the plane would be preserved. "I didn't learn that he planned to fly it across the country in a reprise of our trip until June of [2014]," he said. "My interest galvanized at that point." The two, along with Kern's brother, Rinker, met at Candlelight Farms Airport. "[I] was delighted to see the depth of the restoration Chris and April undertook on the airplane," Kern said. "Chris was gracious to allow me to fly the airplane. I was thrilled to have that reunion."

That meeting revived many memories for Kern. "The adventure of the flight across America is what continues to hold my interest to this day," he said. "Watching the ever-changing texture of America appear before us as we crossed the country at low altitude was a thrill which has no equal. More pilots, young and old, should undertake the adventure."

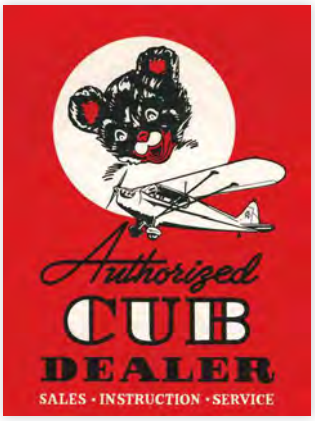
Kern considered a career in aviation but opted to become a lawyer instead. He has "flown continuously over the years" and worked as a flight instructor at Princeton Airport in New Jersey for two summers in the late '60s. He has now logged 2,000 hours.

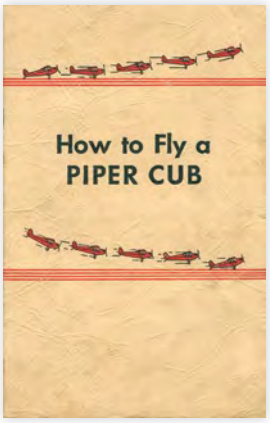
"Flying has helped me become a better lawyer, and gives me great relaxation," Kern said. "Flying compels us to think under pressure, when there are competing interests at stake, and lawyers must evaluate competing interests when making decisions in a case."

Kern said the most enjoyable flying of his aviation career was during the summer of 1988, when he towed banners over Fenway Park and around Cape Cod. "Much of the work was tucked into tight spots just north and south of Logan airport along beachside communities," he said. "Rinker was working in New York City for an advertising magazine at the time, and I invited him to Boston to fly with me over Fenway. This resulted in a cover story for his magazine, and also gave Rinker the inspiration to write *Flight of Passage*."

DID YOU KNOW?

The PA-11 Cub Special was introduced in 1947 and incorporated many changes from its J-3 Cub predecessor. The PA-11's most visible features included a newly designed nose bowl, boot cowl, instrument panel, and windshield. It also had streamlined front struts, an elevator bungee, and significant changes to the seats and cabin interior. The aircraft was first powered by the Continental A-65-8, and the Continental C-90-8 became an option in early 1948. The PA-11 was also capable of agricultural dusting or spraying. Further development of the PA-11 Cub Special led to the PA-18 Super Cub. — *Historical information courtesy Clyde Smith Jr.*





"I received a lot of help and tips from numerous people, and a guy from Wisconsin sent beautiful plywood floorboards to me."

The airframe was covered with Ceconite 102 and finished in a 1959 Super Cub scheme with Daytona White and Santa Fe Red. The paint scheme is the same as it was in 1966—with the exception of the starbursts on the wings, which were omitted. "Charles Aaron of Eton, Georgia, really wanted to do the covering, paint, and final assembly, so I brought it down to him and helped him as much as I could," Chris said.

THE FLIGHT

The first flight after restoration was on June 13, 2014, and on June 17, he and April flew to the Sentimental Journey Fly-in in Lock Haven, Pennsylvania. Chris planned to retrace the Bucks' route as closely as possible and simultaneously share it via the virtual world. He felt he owed it to all those passionate fans who had helped him.

The Nesins began their cross-country flight on June 21. The perfect send-off came when they landed at Candlelight Farms Airport (11N) in New Milford, Connecticut, where they spent several enjoyable hours talking and flying with Kern and Rinker Buck. At each stop along their route, local reporters and plenty of people came out to see the young couple and their Cub Special—thanks to coordinated efforts of folks from SuperCub.org and the Hatcher Foundation.

Chris didn't push N4971H very hard during the flight; they cruised along at 85 mph at 2100 rpm, burning about 4 to 4.5 gallons per hour. Most of the time, they were at 500 feet AGL, and they flight planned for 250 miles (four hours) each day. Kern and Rinker made their flight without a radio and used only a compass and charts for navigation. Chris opted to take his iPad, with ForeFlight and a Stratus ADS-B receiver. He also had a GPS, but only used it when necessary for safety in restricted airspace areas. They also made use of a radio, for good reason. "Some of the airports the Bucks

Above: *Kern and Rinker Buck strike the same pose in 2014 as they did in 1966.*

Right: *Rinker, Chris, Kern, April, and Lenny the Flying Dog enjoy a visit to Candlelight Farms.*

PHOTOGRAPHY COURTESY OF **EAA ARCHIVES** AND **CHRIS AND APRIL NESIN**

RETRACING THE FLIGHT OF PASSAGE—A CHARITY FLIGHT

In early 2014, April Nesin began working with Hatch's House of Hope in Chattanooga, Tennessee, as a clinical psychologist. "The Foundation knew about the flight we'd planned, and they were happy to partner with us and allow me the time off to participate," April said. "I do a lot of cognitive testing since cancer treatments can affect the way children learn, and I do therapy with kids who have cancer and their families. The Foundation primarily provides mental health services in the Chattanooga area right now, but our vision and goal is to help provide services throughout the country. We funded a grant program this year, and we're only 5 years old."

April and Chris embraced the opportunity to promote awareness of the Austin Hatcher Foundation for Pediatric Cancer. "The nonprofit's mission is to erase the emotional effects of pediatric cancer for all those who are touched by it, and to optimize each child's quality of life," Chris said. "The lasting effects of childhood cancer go way beyond the physical treatment. So we did this trip not just to raise money, but really to raise awareness of the Foundation and what they do."

April also emphasized awareness of pediatric cancer as motivation for the flight. "We've all been made aware of breast cancer, and we know what the pink ribbon symbolizes," she said. "But very few people know that the yellow ribbon is for childhood cancer. I just want people to look around and know that there are little kids going through all those things that we think are horrible as adults—and sometimes they go through treatment for several years. We just need to gather around them and their families, and help them in the ways that we can."

For more information, visit *www.HatcherFoundation.org*.

PHOTOGRAPHY BY **MICHAEL KELLY**

"Yes, folks, I own the Buck boys' airplane."
—Chris Nesin, owner and pilot

went to are now towered—such as Yuma, Arizona, and Brown Field in San Diego," Chris said.

April admits that she was nervous prior to the flight, especially since she was prone to motion sickness. But she was able to accompany Chris throughout the 12-day flight. "[I] was tweeting most of the time and trying to be in contact with reporters or other people we needed to meet," she said. "I was certainly nowhere as useful as Rinker was!"

Just as the Buck brothers discovered more about themselves during the flight with N4971H, April learned more about herself and her relationship with Chris—even after 16 years of marriage. "I learned to face my fears, and I think the trust between us grew deeper as we were together for that amount of time in that very tiny airplane," she said. "It was a very meaningful experience and an amazing way to celebrate the time we had invested in putting that plane back together in a way that would honor the Buck boys."

Those who have read Buck's memoir will likely remember the "freaking water bag" Tom Buck made his sons carry (a Depression-era water bag lashed between the gear legs on their flight). "Many people gave us water bags for our flight, and we always had one in the plane for 'decoration,'" April said, laughing. "However, there were actually a couple of 115-degree days when we were flying across the desert, and we were thinking maybe we really should have put some water in that water bag!"

Chris' mom, who followed behind the plane in an RV, also had a decorative water bag and traveled with family pet Lenny the Flying Dog. "[They] met us every day at our destination, and we stayed with her most of the nights," April said.

UNLIKELY PARALLELS

As a clinical psychologist with Hatch's House of Hope in Chattanooga, Tennessee, April had a surprising revelation during the flight. She found herself comparing the cross-country trip to the journey that families undergo when they are affected by pediatric cancer. She drew parallels between the difficult journey the patients and their families undergo and her own trepidations about the flight. "If it was a particularly turbulent day or we were in the mountains and it was a little bit nerve-wracking for me, I really thought about all of those new experiences and fearful things that I see kids with cancer face every day, and if they can do all of those hard things, I can [learn to] enjoy this amazing flying experience," she said. "There were times when I felt very helpless during the flight and couldn't contribute anything, and I think parents frequently feel very helpless when their children have cancer."

TERRIFYING MINUTES

Rinker and Kern had their terrifying times during their flight, and so did Chris and April. "My terrifying event was when we hit redline on the oil temperature," Chris said. "We were flying low, so we figured we'd start climbing—but it was so hot we could just barely climb. If we went full throttle, we'd really heat up. So we kind of limped from Wink, Texas, to Carlsbad and of course, just like in the book, we stupidly were not following roads, but we made it."

Chris mentioned flying through the Guadalupe Pass in western Texas as another noteworthy experience that was similar to the Buck boys'. "Rinker writes about flying through the Pass as an awesomely terrifying experience and difficult to do," he said. Chris explained that they encountered a number of downdrafts while flying through, and some were strong enough to turn the aircraft 30 to 40 degrees nose up, nose down, left, and right. "Basically, if you flew it wrong like I did or as inexperienced as maybe a 17-year-old would, it can be very terrifying," he said.

Specifications for N4971H s/n 845

1948 Piper PA-11 Cub Special

Tandem seating: pilot in front
Length: 22 feet 4 inches
Wingspan: 35 feet 2 inches
Height: 6 feet 8 inches
Empty weight: 783 pounds
Gross weight: 1,220 pounds
Useful load: 437 pounds
Engine: Continental C-90-8F, 90 hp
Wing tank fuel capacity: 18 gallons
Maximum speed: 112 mph
Cruise speed: 90 mph
Landing speed: 50 mph
Range: 300 miles

PHOTOGRAPHY BY **SPARKY BARNES SARGENT**

Retracing the Flight of Passage

How long, how many?

1 month
26 states
7,258 miles
99.8 hours
141 landings
459 gallons of gas
3 oil changes
7 wingmen
420 gigabytes of pictures and video
324 electronic device battery charges
Highest airport: Greater Green River Intergalactic (4U8)—7,182 feet
Lowest airport: Calexico (CXL)—6 feet

"Chris tried to emulate the way he thought the Buck boys flew it, and I felt like we were too close to the mountains—we lost 3,000 feet in just one minute, and then it got really turbulent," April said. "I was screaming bloody murder and probably shouting some things that were not G-rated—and he was laughing. It probably only lasted a minute, but for me not being a pilot it was the scariest part of the flight!"

TREASURED MOMENTS

One thing that made "Retracing the Flight of Passage" a pleasantly memorable experience was sharing it along the way. "I had seven pilots flying along with me in Super Cubs and J-3s during different legs of the journey, and that was a lot of fun," Chris said. "I wanted to share the experience with as many people as possible—whether online or off my wingtip—because so many people helped me, and so many will never be able to make the entire trip themselves."

"Every day there were wonderful moments, seeing the country and the way the terrain changes," April said. "It was amazing and inspiring—from the rolling hills of Pennsylvania, to the Plains, the mountains, and the desert."

April said one of the most interesting parts of the trip was flying along the Mexican border. "It seemed so strange to see an actual fence along the border—it went for miles and miles, and on our side, it was desolate and arid, and on their side, it was metropolitan or lush with vegetation," she said. "It was remarkable."

For Chris, the most significant experience was meeting Rinker and Kern. "I flew with them both and had so much fun, and both of them are very supportive of the Hatcher Foundation," Chris said. "The Buck brothers are super nice, and they were the inspiration behind our flight—Rinker for documenting it, and Kern for having the crazy inspiration to fly across the country at age 17. That's phenomenal!"

After April and Chris completed the cross-country, they flew up the California coast to Palo Alto. Then April boarded an airliner and went back to work in Chattanooga. "Lenny the Flying Dog took my place with Chris in the airplane," she said. "They flew back a different route across the country in five days; he was back home on July 13."

Not long after that, Chris flew to EAA AirVenture Oshkosh, where N4971H garnered more adulation from enamored admirers. Perhaps they and others will likewise be inspired by the spirit of adventure and the accompanying intrigue of self-discovery. For details and photos of Chris and April's flight, visit *www.FlightOfPassage.com*. EAA

Sparky Barnes Sargent, EAA 499838, holds a commercial glider certificate with private single-engine land and sea ratings, and she personally restored her 1948 Piper Vagabond.

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SO MANY, SO FEW

How many of these laughing lads survived the Battle of Britain? Some would fly as many as three or four sorties a day to fend off an enemy who was determined to extinguish their way of life. The price of freedom is often high.

PHOTOGRAPHY COURTESY OF **JOHN DIBBS**

REMEMBERING THE BATTLE OF BRITAIN

BY BUDD DAVISSON

Seventy-five years ago this summer one of the most pivotal conflicts of the 20th century began and ended. The future of Europe, and the world in general, hung in the balance. If the Battle of Britain had gone poorly, if nearly 3,000 aircrewmen, not all of whom were pilots, hadn't stood the line and Britain had fallen, the world today would be a totally different place. We tend to forget what was actually at stake.

Without England, the United States and its few surviving Allies would have been without an effective foothold anywhere on that side of the Atlantic. Without England, where would we have based our aircraft? How would we have worn down the enemy without England at our side? Where would we have built up our invasion forces as we readied ourselves to break down Fortress Europe's front door?

Churchill's famous quote "Never in the field of human conflict was so much owed by so many to so few" may have been aimed at England, but it was actually applicable to the entire world.

THE BATTLE OF BRITAIN STARTED IN FRANCE

Technically, WWII started September 1, 1939, when Hitler blitzkrieged his way into, and across, Poland. Then he steadily gobbled up the rest of Europe.

On May 10, 1940, the blitzkrieg came to Belgium, Netherlands, Luxembourg, and France all at the same time. On the same day, Churchill officially became the prime minister of England. The speed of battle was blindingly fast. Unbelievably, it took only a little more than two weeks for the forces of the Third Reich to bottle up the majority of the French and English forces in a small area around the port of Dunkirk. With the sea behind them and massive enemy forces surrounding them, surrender appeared to be the only option. The Luftwaffe dropped leaflets explaining the hopelessness of the Allied situation. Reportedly, most were used for toilet paper.

What the enemy didn't realize was that Britain, an island nation, saw the sea as a pathway, not a barrier. When, for unknown reasons, the enemy hesitated for three days, the Allies had time to act. On May 26, the battle at the perimeter around Dunkirk again became an intense, slow, hotly contested retreat to the sea. However, unknown to Nazi high command, the day before, on May 25, the British War Office had officially decided to evacuate the trapped troops by any means possible. Word was flashed across England that anything that floated—motorized row boats to ferry boats—would be pressed into service to cross the English Channel and bring the troops home. The result was that in nine days, May 27 through June 4, 338,226 men escaped, including 139,997 French, Polish, Belgian, and Dutch soldiers, aboard 861 mostly civilian vessels (of which 243 sunk during the operation).

While this was going on, the British Royal Air Force was continually overhead going head-to-head with the best that Goering's Luftwaffe had to offer. Sources differ, but the RAF lost approximately 150 fighters over Dunkirk alone, and the Luftwaffe lost 200. That one brief contest cost both sides dearly in both aircraft and pilots. More importantly, it set the stage for the Battle of Britain to begin.

Front office of a Hurricane.

PHOTOGRAPHY BY **JOHN DIBBS**

The svelte Spitfire grabbed much of the glory of the Battle of Britain, but it was the functional-appearing Hurricane that was the true workhorse, gaining more victories and sacrificing more pilots to the fight.

FIRST, THE LULL

Amazingly, from the first Wehrmacht push into France to the final desperate rescue operations at Dunkirk exactly 26 days had elapsed. They were incredibly costly days for both sides. It is estimated that the RAF alone lost 944 aircraft, which included 67 Spitfires and 386 Hurricanes. The Luftwaffe lost about 1,400 to all causes, of which about 800 or so were fighters. All combatants were reeling from the precedent-breaking intensity of those three weeks, so both sides retired momentarily to neutral corners for several weeks to lick their wounds and attempt to rebuild their fighter forces. Production on both shores was working 24/7 to crank out combat aircraft, especially fighters, as fast as it could.

On the Luftwaffe side, Germany not only had to replace aircraft, but also was busy occupying airfields it had captured and was setting up its structure for the next phase of the battle. The lull gave Britain much needed time to prepare. Churchill is widely quoted as saying, "The Battle of France is over. The Battle of Britain is about to begin." How true that statement was.

THE BATTLE IS JOINED

Essentially the Battle of Britain progressed through four phases, each about three weeks long. The first began on July 10; the Luftwaffe intensified its actions against shipping with the intent of cutting off England's supplies and drawing the RAF into battles over the Channel to eliminate it in dogfights. On July 16, Hitler initiated preparations for the invasion, named Operation Sea Lion, but by August 1, little progress had been made, and he demanded the RAF be eliminated by September 15.

On August 13 Goering began concentrating on radar sites and the airfields of southern England and declared the date as Eagle Day. The third phase began September 7 when the Luftwaffe began a nine-month blitz against London. This took pressure off the southern fighter units, which were relocated north of London to provide as much protection as possible.

Fighter bomber attacks continued throughout the day on October 1, and a fierce nighttime bombing campaign against London began that continued until May, reducing much of the city to rubble and killing an estimated 40,000 civilians. Tit-for-tat campaigns against civilian centers ensued on both sides.

Even though the Luftwaffe enjoyed a huge numerical advantage in the Battle of Britain, especially at the beginning, the campaign was never easy. It was exactly the opposite of what it had experienced in France. Best estimates place the initial RAF Fighter Command fighter strength (after being depleted in France) to be slightly over 600 aircraft (many more Hurricanes than Spitfires), while the bomber/fighter force facing it numbered nearly five times that: just under 3,000 fighters and bombers were poised to leap across the channel.

The Hurricane was essentially an old fashioned rag-and-tube biplane with one very fat wing that housed eight .303 Browning machine guns and let it turn tight in a dogfight.

PHOTOGRAPHY BY **JOHN DIBBS**

However out of balance the good guy/bad guy ratio may have been, England had the obvious home-court advantages: A damaged RAF aircraft was probably in sight of a suitable landing spot, and if over land, an airman that bailed out wasn't lost to the fight as would be the case with an enemy airman. Even if over the channel, air-sea rescue was ready and waiting. The latter was critical because the RAF was drastically short of pilots. However, the saving grace for England was the command structure it had in place.

THE ORGANIZATION

Although Fighter Command was facing a much larger aerial force with combat experience stretching all the way back to the Spanish Civil War, RAF's ability to command its own sometimes-inexperienced forces helped close the gap. This ability was based largely on real-time reporting of the enemy's position by both radar stations and aircraft spotters all over the southeastern part of England. The radar stations faced the channel and gave warning when aircraft were inbound, but it was the telephones in the hands of hundreds of volunteers scanning the skies that gave them timely information.

The RAF and Women's Auxiliary Air Force ground staff were the central "computer" that absorbed the massive amount of information gathered and coalesced it into meaningful plots that let Fighter Command accurately invest their valuable aircraft and pilots with little or no wastage. When pilots took off, they knew exactly where the attacking force could be found. The scenes we see in the movies of ladies with pool cues pushing little airplanes around on a gigantic tabletop map were central to what helped make England victorious.

THE PILOTS

A Spitfire could be patched up and put back into the fight quickly, but a pilot needed rest, even if he wasn't wounded, as many were. Even worse, roughly one out of six of the airmen engaged in the Battle of Britain were killed or mortally wounded during the battle. Many more were wounded but returned to combat. Unfortunately, training a replacement pilot takes a lot longer than building an airplane, and the raw material is harder to find. So, the pilot shortage became critical faster than the hardware shortage did. In fact aircraft production soared while the battle raged on.

Rushing the training of pilots, however, had its limits. Although it was ramped up to the point that new pilots went from Tiger Moths to Spitfires in amazingly short times, few newly trained pilots actually made it into the Battle of Britain. For the most part, the nation had to rely on the pilots at hand, the supply of which dwindled every day. RAF High Command feared it couldn't win the war of attrition simply because of the numbers.

What may have saved England during the Battle of Britain was a rapid, and continual, influx of pilots from other nations. Nearly 600 pilots came from other countries; they composed one in six of the total pilot population. Some came from other parts of the British Empire, but many, like Poles (145) and Czechs (approximately 86), joined the fight to help free their homelands. Others were helping defend the empire, like New Zealand (approximately 130) and Canada (112). In total, 15 nations were involved. Even tiny Barbados was represented!

It is estimated that during the Battle of Britain the Luftwaffe lost nearly 1,700 aircraft and 2,500 aircrewmen. England lost 1,087 aircraft, almost all fighters, and 903 pilots, 481 of whom were killed. It was a costly battle.

THE AIRCRAFT

There were a limited number of mechanical participants in the Battle of Britain. The home team fielded Hurricanes and Spitfires, while the Luftwaffe flew Heinkel He 111, Dornier Do 17, and Ju 88 twin-engine bombers that were protected by hundreds of Messerschmitt Bf 109Es. Ju 87 Stuka dive bombers filled in between the bombers, and Bf 110s helped protect them until the Luftwaffe realized how easily Spits and Hurricanes were picking them off.

Another major home-field advantage enjoyed by the RAF was that the fighters on both sides had originally been envisioned as point defense dogfighters. No thought had

BRITAIN'S SECRET WEAPON: RADAR OR METHODOLOGY?

The concept of the importance of radar used during the Battle of Britain sometimes gets distorted with time. It wasn't the radar that was so important, but the way Britain used it that made the difference. Germany had radar, too, and in most ways, theirs was better, but they didn't use it effectively and were far more concerned with offensive use rather than defensive.

The British Chain Home radar system was high frequency (HF) and had only a fixed 100-degree coverage arc. So, located on the shores, it could see what was coming but couldn't track the targets after they were past. It was limited in its effectiveness. Plus, the signal didn't return to the transmitting antenna, as is usually the case with other forms of radar. A second set of antennas on the radar station received the signals, which made for extremely large, easy to attack, antenna arrays. It was crude, but the way in which it was integrated into the U.K. information-gathering network made it effective enough to give fighter squadrons a 20-minute warning all by itself. However, a major advantage was given the RAF through monitoring the HF communications between enemy bomber strings and their headquarters, which let those in the United Kingdom know almost two hours ahead of time that bombers were on their way. Eventually, using captured decipher machines, they would get numbers of aircraft, destination, and routes through aircraft conversations over their radios.

Once the enemy made landfall, the hundreds of observers, with their binoculars and telephones, continually updated central command on the whereabouts of the attacking force and what, and how many, aircraft were included.

It was organization that allowed David to beat Goliath.

Spitfire

Hurricane

Messerschmitt Bf 109E


Heinkel He 111

been given to them venturing far from home. The Messerschmitts, however, had no choice. If they were going to eliminate the RAF, they had to fly a distance to even get to the battlefield, which worked very much to their disadvantage.

The Spitfire and Bf 109E both had about 100 U.S. gallons of fuel internally, which gave the Messerschmitt only about a half-hour to fight before having to scurry back across the channel. The Spitfire, however, could take off and 10 minutes later be on a Messerschmitt's tail or hammering away at a Heinkel or Junker. It is unknown how many 109s ran out of fuel and wound up in the channel, but it was more than a few.

SPITFIRE

Few airplanes in history have been so continually modified and improved as Reginald Mitchell's beautiful Spitfire. It grew in power and sophistication even between the Battle of France and that of Britain. Its strong points, when compared to the other homegrown fighter, the Hurricane, were that it was faster and climbed better. In fact, in most areas it was slightly better than the Bf 109E. Its downside was that it was one of WWII's most complex, most labor-intensive airplanes to build. Its performance was a function of its beautiful aerodynamics, which were the result of its beautiful shape. This was also the source of its complexity: compound aluminum skins slow down the building process. It was also a more complicated airplane to fly well. But, when flown well, it was an opponent to be reckoned with.

HURRICANE

The Hurricane was old-school engineering. Essentially it was a biplane with one wing. The fuselage was a maze of tubing trusses stabilized by tension wires, much like the biplanes before it. Its unbelievably fat wing not only generated a lot of lift, but also gave plenty of room for four .303 machine guns per wing and was blacksmith simple to both build and repair. The Hurricane may have been slower than the Spit, but the same fat wing that slowed it down also let it turn on a dime and could match the Messerschmitt in a flat fight. However, the Merlins in the Spitfire and Hurricane were carbureted, where the Daimler-Benz in the Messerschmitt was fuel-injected: push the nose of a Spit or Hurricane down hard and its Merlin will cough and bark, losing power for a few seconds. In the same situation the DB 601 doesn't miss a beat. In a fight, a few seconds is a lifetime.

It's worth mentioning that although the Spitfire is the acknowledged superstar of the Battle of Britain, well over half of the U.K. fighters involved were Hurricanes, especially early in the battle. The less-than-elegant appearing Hurricane also claimed more victories than the more-than-svelte Spitfire.

MESSERSCHMITT BF 109E

The Bf 109 was the first mass-produced, modern monoplane fighter, but it was a bear to land, whereas both of its worthy opponents were a piece of cake on the runway. This made them much easier for new pilots to fly. It also had a higher wing loading so in the initial turn of a fight, it couldn't be pulled into as tight a turn as the other two. Especially the Hurricane. However, as the *g*-forces slowed the fight down, the Messerschmitt's leading edge

PHOTOGRAPHY BY **JOHN DIBBS**

However out of balance the good guy/bad guy ratio may have been, England had the obvious home-court advantages: A damaged RAF aircraft was probably in sight of a suitable landing spot, and if over land, an airman that bailed out wasn't lost to the fight as would be the case with an enemy airman.

slats popped out, letting the pilot pull until he could safely, and under complete control, fight effectively while in stall buffet. In a real knife fight, that was important. The other two airplanes weren't as mannerly, when super-slow, but they had much better visibility because of their canopy design. Later in the war, Bf 109 canopies were modified to give better visibility all the way around. In terms of speed and general performance, the Bf 109E and Mk I Spitfire were close enough to being the same that the advantage was given to the pilot who knew his airplane and the tactics of aerial combat best. In other words, experience counted.

THE AXIS BOMBERS

The primary Axis bombers during the battle were the Heinkel He 111, Junkers Ju 88, and the Dornier Do 17, all three of which would be considered a "medium" bomber as they carried 4,000 pounds of bombs, only a little less than a B-25. When they came streaming across the channel by the dozens, there would be Bf 109s layered above and below them in an attempt to get at the Spitfires and Hurricanes. Goering's mission statement from Hitler was to knock the RAF out of the sky, so the Messerschmitts were there to kill fighters as much as to defend bombers.

Luftwaffe bombers were notably lightly armed. Especially when compared to the rash of heavy caliber machine guns seen on American bombers (10-11 .50 calibers on a B-17) and the multi-gun .303 turrets on U.K. bombers. The single 7.92 mm (approximately .31 caliber) guns placed here and there on Luftwaffe bombers seldom dissuaded a determined Spitfire or Hurricane pilot.

AFTER THE BATTLE

Although "the few" were the guardians on the ramparts that repulsed Hitler's gang, in the long run, it was the combination of warriors and civilians desperate to save their homeland that turned the tide of battle. While dogfights raged within sight of the very factories that produced the airplanes, guns, and ammunition, the civilians, young and old, men and women, emerged from their bomb shelters and continued producing for the war effort. For them, war was not a flickering black and white image on a newsreel. It was their reality. The Battle of Britain was actually the Battle *for* Britain. Only a few actively involved in it recognized the worldwide importance of a victory. And only a few cared. They were watching an invader intent on reducing their homes and their lives to rubble. And they were going to have none of it.

Churchill spoke for the whole nation when he said, "We shall fight with growing confidence and growing strength in the air, we shall defend our island, whatever the cost may be, we shall fight on the beaches, we shall fight on the landing grounds, we shall fight in the fields and in the streets, we shall fight in the hills; we shall never surrender."

Thanks to the few, they didn't. EAA

Budd Davisson, EAA 22483, 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*.

FACTS

A Horrible Numbers Game

On average the RAF lost approximately 10 pilots (five killed and five wounded) every day the battle raged on. During its peak, the actual numbers were much higher. They were also losing approximately 10 airplanes a day. During the same period, the Luftwaffe lost approximately 25 aircrewmen a day and 16 aircraft. It was a war of attrition, and it was a question of whether England or the Luftwaffe would run out of men and/or machines first.

Production Compared

Although sources often disagree on everything about the Battle of Britain, the RAF lost approximately 1,087 aircraft during the 120 days of the battle and the Luftwaffe lost 1,652. However, even though Britain was under continual attack, it produced 2,354 new aircraft (mostly fighters) compared to the Luftwaffe's 975.

The Types Lost

Reportedly, there were 601 Hurricanes lost compared to 357 Spitfires, while the Luftwaffe lost approximately 74 Ju 87 Stukas, 281 Ju 88 bombers, 171 Do 17s, and 590 Bf 109s.

Hurricane Versus Spitfire

The Hurricane often stands in the shadow of the Spitfire. The facts say otherwise.

	Spitfire	Hurricane
Average Strength:	38%	62% (July 1–Sept 30)
Enemies Shot Down:	43%	57%
Bf 109 Shot Down:	49–54%	51–46% (depending on period)
Combat Losses:	39%	61%

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Summertime Fun

Facing the warm weather challenges

BY ROBERT N. ROSSIER

FOR MANY OF US, the coming of summer is a welcomed relief from the bitter cold insult of winter, but along with the warmth comes a few challenges. Once again, we can expect to face soaring temperatures, haze, and thunderstorms that pop up like popcorn. With a little forethought, planning, and prudent flying techniques, we can readily manage the worst of it.

FLYING HIGH—DENSITY ALTITUDE

While warm temperatures aren't necessarily a problem, they do affect the density of the air, which in turn affects aircraft performance. Even at lower elevations, hot, humid weather can sap performance and paint us into a tight corner. And the higher we go, the worse the problem becomes. Remember that aircraft performance relates to density altitude rather than field elevation. For every 10 degrees above the standard temperature for field elevation, density altitude increases about 600 feet. The reduced air density means less power is generated by the (nonturbocharged) engine, the propeller is less efficient at moving air, and the aircraft must accelerate to a higher (true) speed to gain the same lift in less dense air. That adds up to a longer takeoff run and a shallower climb angle. On landing, the extra speed (increased true airspeed) translates to increased landing distances.

The remedy here is to pay careful attention to the temperatures, and use the pilot's operating handbook (POH) to

PHOTOGRAPHY BY **TOMASWORKS** (WWW.THINKSTOCKPHOTOS.COM)

verify the expected performance under the prevailing conditions. If conditions put performance at risk, we should consider flying early in the morning or in the evening when the temperatures are cooler. We should also do whatever we can to lighten our load, and use short-field technique when needed for takeoff and landing.

One way to prepare is to practice those short-field techniques, being careful to avoid common mistakes like improperly configuring the aircraft, dragging the brakes on takeoff, and letting our airspeed wander. Always be sure to consult the POH for the correct flap setting for takeoff. In high density altitude situations, it may be necessary to lean the mixture for maximum takeoff performance. Once we release the brakes for takeoff, we must keep those heels on the floorboard and away from the toe brakes. Good airspeed control is also essential on landing. Every knot of excess airspeed over the numbers puts our touchdown point a hundred feet farther down the runway.

Even at lower elevations, hot, humid weather can sap performance and paint us into a tight corner. And the higher we go, the worse the problem becomes.

BEATING THE HAZE

Another summer challenge we face is the reduced visibility that can come with hazy, hot weather. Poor visibility makes it more difficult to see traffic, and can hamper our attempts at effective navigation.

Several strategies can help even the odds for collision avoidance in hazy conditions. First, we can use the landing light to make ourselves more visible, especially in the traffic pattern or other high-traffic areas. I've seen situations where it was nearly impossible for a pilot on the ground to spot an aircraft less than a mile out on final when it didn't have the landing light on. Use that landing light; it's cheap insurance.

Another simple way to improve collision avoidance is to use ATC flight following services. Granted there are times when airspace becomes oversaturated and overwhelmed controllers may refuse the service, but generally controllers would rather be talking with us than guessing at what we're doing.

Several strategies can be used to help us rise to the challenge of hazy weather navigation. First, we can reduce the stress of navigation by using GPS. If you don't have GPS, consider adding one to the aircraft equipment, or to your own ensemble of carry-on gear, to make navigating easier and less stressful. Spending less time on navigation leaves us more time to scan for traffic. If a GPS is not in the cards, we can still sharpen up on our pilotage, fine-tune our radio navigation techniques, and choose easier routes to navigate.

When it comes to pilotage, the best skill builder is practice. The more frequently we exercise our pilotage skills, the more familiar we become with the region where we fly, and the better our performance becomes. One way we can improve our success rate with pilotage is to choose routes that offer better landmarks. The more features we can use to piece together the positional puzzle, the better our chances of getting it right. Traditional, old-school radio navigation can also help reduce the burden, providing a good backup to our pilotage. A VOR radial or DME distance will help us confirm our position, and give us a higher degree of confidence.

CONVECTIVE CHALLENGES

Thunderstorms are an unfortunate fact of summertime life in many regions, and they are nothing to mess with. Thunderstorms are life-threatening hazards at altitude, bringing severe turbulence, wind shear, up- and downdrafts, and hail. Aircraft can sustain severe in-flight damage or be literally torn apart. But the dangers can be just as great for aircraft taking off or landing in the general vicinity of thunderstorms. Among the hazards of

convective weather are gusty winds, low-level wind shear, and microbursts (wind shear and severe downdrafts), and these conditions can exist 10 miles or more from a cell. Surface conditions can change quickly, leaving us low, slow, and without a good out. Among the best defenses we have against summer thunderstorm activity are early morning flight plans, thorough weather briefings, and datalink weather services for the cockpit.

Generally speaking, mornings are the best time to fly if we want to avoid thunderstorms. As the day wears on, uneven heating of the Earth's surface from the summer sun results in updrafts that, given sufficient humidity (read that as instability), generate those cumulus clouds that can evolve into something more ominous.

When it comes to pilotage, the best skill builder is practice. The more frequently we exercise our pilotage skills, the more familiar we become with the region where we fly, and the better our performance becomes.

Another obvious solution is to know where the convective activity is occurring. While many pilots already enjoy the benefits of datalink weather services like XM and ADS-B, it's essential that we remember that the radar images we receive via these systems can be as much as five minutes or more out of date. A few minutes might not sound like much, but thunderstorms are highly dynamic, and even a few minutes can paint a vastly different picture. The point we must keep in mind is that the datalink radar images should be used to avoid severe weather, and never to navigate through it. Checking with Flight Watch (122.0), listening to recorded weather data (ASOS, AWOS, ATIS, HIWAS, etc.) as well as pilot reports can also help keep us informed when conditions are volatile.

Thunderstorms aren't the only problems to worry about. One of the more innocuous looking forms of dangerous summertime weather is virga—rain that evaporates before reaching the ground. What some pilots might not realize is that virga can create serious downdrafts and dry microburst activity. So while it might look safe to fly near or beneath virga, doing so can put us squarely in the crosshairs of disaster.

Summer is almost here, and with it we'll be enjoying plenty of warmth and fun in the sun. With a little bit of forethought and planning, we can avoid the unique challenges that float in on warm summer breezes. 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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Midair!

See and be seen

BY JOHN MILLER, EAA 574883, TUSTIN, CALIFORNIA

EVER SINCE I GOT MY private certificate the biggest concerns I had about flying were engine failures and midairs.

The concern about engine failures has subsided over the years with engine-out and dead-stick practice sessions. However, I could only hope the "see and be seen" mantra would prevent midair collisions.

In March 2002 my worst flying fear was realized. A friend and I had landed at a well-known Southern California airport parachute jump site. Our ultralight flying club uses a dirt strip parallel to the jump plane runway.

We had breakfast at the airport restaurant and were preparing to depart west to our home airport. Unknown to us, while we were preflighting our aircraft, a Beechcraft Baron had been doing low passes on the main runway so someone on the ground could check if his gear was all down because he didn't have "three in the green."

After liftoff, we began a climb to the ultralight pattern of 500 feet where we would level off until we were well clear of the 1,000-foot GA traffic pattern.

My friend was at my two and a bit higher than me. His voice on the headset warned, "I just saw a twin go below and behind me!"

I immediately shifted my focus out of the right side of the aircraft and saw—at the same altitude—a twin Baron bearing down on me.

I didn't even have time to move the stick. I remember seeing three sets of eyes looking at me with that "deer in the headlights" look as the Baron passed just under me. Evidently the Baron pilot saw me just before I saw him and quickly dumped the nose.

As the Baron passed under me I could hear its engines over mine, and I felt something hit my aircraft from underneath. My aircraft rolled right, and I found myself upside down with the nose at about 45 degrees to the ground.

I must have been squeezing the stick hard keying the transmitter because my friend said he heard me say, "Midair! I'm going down!"

ILLUSTRATION BY MATT BELLISLE

I managed a split-S and pulled out about 100 feet above the surface. I was waiting for the aircraft to begin shedding parts as I looked for a suitable landing spot.

My friend had seen the midair and turned back to fly around me and look for damage. He reported none and the aircraft was behaving normally, so I opted to return to the field where I might have more assistance if the landing didn't go well.

Finding no apparent damage we prepared to leave the airport when the airport manager drove up in his old pickup and asked if one of us had just had a midair.

We recounted the event, and he asked us to get in the truck. He drove us to the GA parking ramp, and there was the twin Baron with a tire skid mark about 18 inches down the left side of the rudder. The contact point was slightly bowed out on the opposite side of the rudder.

It appeared the Baron's rudder traveled just behind my prop, missing the right front main gear and striking the front of the left tire, causing the gear to extend outward and stretching the gear bungees. The left gear bungee under the pilot seat had pulled the gear back into position, causing the bump I had felt.

Fortunately two movable objects, his rudder and my left main gear tire, absorbed most of the impact.

The contact with my left tire and the wake turbulence caused by the close passage of the Baron had caused my little aircraft to roll on its back and point earthward.

When we walked up to the aircraft the pilot was underneath the panel trying to determine why he couldn't get three-in-the-green.

I said, "You don't seem too concerned that we almost saw God today." From under the panel he mumbled something about "no harm, no foul."

When I mentioned that I would be filing a report he suddenly became interested and suggested that we just forget it and he'd take care of the damage to the rudder.

I reminded him of the requirement to report such accidents, but he suggested we just keep it to ourselves. It seems he had just been assigned a position of corporate pilot and didn't want this mark on his record.

I called the local FSDO, and she asked if we had actually made contact midair. When I said we had, she said, "You need to contact the NTSB now!"

I called the NTSB and was asked if there were any injuries and about the damage to either aircraft. I reported no damage or injuries , but I did mention the tire skid mark on the rudder. I suppose they were still busy with 9/11 because he sighed and said it would be okay to file a NASA report (ASRS).

I filed the report and received a receipt I keep as a reminder of the importance of seeing and being seen. EAA

SUBMISSIONS

SHARE YOUR CLOSE CALL so we can all learn from the experience—send your story to *editorial@eaa.org*.

Restoration of N96386

Taylorcraft BC-12D

BY KEITH WALKER, EAA 672683; CHARLESTON, ILLINOIS

MY WIFE AND I PURCHASED N96386, a 1946 BC-12D Taylorcraft, from Robert and Jean West in 2006. They had owned the plane since the late '60s or early '70s. I hangared and flew the plane out of Coles County Memorial Airport (KMTO), Mattoon, Illinois, until April of 2010 and then decided to do a total restoration.

The restoration was supervised by Tom Baker Jr., an A&P/IA of Olney, Illinois. He and his father were a wealth of knowledge on Taylorcrafts and provided good information whenever I had a question. Since this was my first experience with aircraft restoration, I did the tail group first in order to become familiar with dope and fabric techniques. The project was done in my shed where I had built a 24-by-9-by-7 paint booth from polyvinyl chloride (PVC) pipe, covered with plastic sheeting with an inlet filter on one end and a discharge fan on the other. I removed the covering, inspected for straightness, and had the rudder, elevators, and the stabs sandblasted, which I then painted with two-part white epoxy primer. I used the Poly-Fiber covering system with Poly-Bush, Poly-Spray, and Ranthane paint for the final color, following the manual by Jon Goldenbaum.

I welded up a fixture to support and rotate the wings (and fuselage) while covering and painting them. We stripped the covering off and disassembled every individual part. I straightened the wingtip bows and all the ribs. I made new wood spars for the wings and ailerons out of blanks from Aircraft Spruce. New leading edges and wing tanks were installed. All metal parts were cleaned and painted with two-part epoxy primer. After the wings were assembled and trammeled they were covered, rib stitched, taped, and painted.

I then brought the fuselage home and removed everything down to bare tubing. I punch tested the tubing everywhere there might be corrosion, made sure the drain holes were open in the landing gear brace struts, and checked all the fittings on the wing, strut, landing gear, and fuselage for

PHOTOGRAPHY COURTESY OF KEITH WALKER

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*.

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E-mail: *editorial@eaa.org*

stress cracks and corrosion before and after sandblasting. I painted the fuselage and landing gear with two-part epoxy within two hours of sandblasting. I drew the paint scheme myself and chose Sunset Ivory with Boston Maroon as the trim color. The paint scheme is a slightly different design from Taylorcraft's design.

I sent all the instruments out to be reconditioned and proceeded to check all phenolic guides for the cables and replaced copper tube guides for the trim cable. I built new glove boxes for the dash and new phenolic guides and new U-joints for the yoke shafts. I replaced all the bronze bushings throughout the plane and installed all new control cables and turnbuckles. All new AN hardware was used, and I made and replaced all wood structures. I purchased a new firewall, boot cowl, lower cowl, and hood blanks from David Wenglarz and cut and fit them to the fuselage. I also made new windshield fairings front, top, and sides and new landing gear fairings. I fabricated a tool to install new bungee cords, which made this job simple. I installed a Flottorp wood propeller and inside installed shoulder harnesses and seat belts manufactured by Hooker for safety as well as new seats and a headliner from Baker's Upholstery. I installed new wing tanks, 24 gallons total, and put FAA-approved AeroLEDs strobe and position lights in the wingtips. I also included new tires and tubes, and new brake linings for the Shinn wheels.

I cleaned and painted the A65-8 engine, which had 150 hours since major overhaul. I had the carburetor rebuilt and installed a new stainless exhaust system. I towed the fuselage back to the airport with the engine and tail group on, and with the help of friends we installed the wings with new lift struts. My friend Giles Henderson did a weight and balance with electronic scales. The total weight of the plane without wheelpants was 791 pounds, and 800 with wheelpants.

The only physical help my wife and I had in this project was removing and installing the wings. We spent 30-35 hours a week for three years and five months until on October 1, 2013, the restoration and a fresh annual inspection were signed off. The initial test flight, which I made that same day, was indeed a very rewarding and special moment.

In July of 2014 Giles and I flew up to EAA AirVenture Oshkosh. We arrived around noon on Wednesday and were directed to Row 113 at the south end of Runway 18. I registered to be judged in the Classic Aircraft division. Oshkosh was an enjoyable experience, and 96386 was awarded Outstanding Taylorcraft.

E-mail Keith at *wingwalkers@consolidated.net.*

NEW YORK *VAN'S RV-4*

MY RV-4 TOOK 12-1/2 years of building. For power I installed a new A-360-A1A Lycoming with roller lifters with a fixed-pitch Sensenich prop. Inside I have a Dynon EMS and EFIS, a Garmin 196 that runs the autopilot, Garmin SL40 comm radio, and GTX 327 transponder. The vortex generators bring the stall in landing configuration down to 41 knots, and with no flaps it's 46 knots. The vortex kit was purchased from Larry Vetterman. The paint job was done by Lancaster Aero.

Tony Tomasulo, EAA 9008487; Buffalo, New York
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SOUTH CAROLINA *VAN'S RV-8*

MY FASTBACK RV-8 is a project that was started many years ago by Axel Alvarez in Southern California. Fast-forward to EAA AirVenture Oshkosh 2009 when I was a member of the 37-ship RV flight team recognized by Guinness World Records. Tad Sargent, a fellow member and Team RV associate, agreed to assist me in completing this project. In July 2013 N944RR took flight. Much of the plane came from Tad's RV-7, which was destroyed in the 2011 tornado at Sun 'n Fun. With the rebuilt Lycoming 180-hp engine, rebuilt Whirl Wind prop, and GRT EFIS, the plane is full IFR including hands-off approaches. I recently added ADS-B with assistance from James Clark in Columbia, South Carolina, which adds another dimension. Credit goes to Tad for awesome construction work and Bobby Potts of Tuscaloosa Interiors for an incredible paint job.

Bill Crothers, EAA 281697; Fort Mill, South Carolina
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OHIO *KITFOX SUPER SPORT 7*

THE KITFOX SUPER SPORT 7 was built in my home garage until ready for first engine start. Then wings were folded and it was trailered to the airport. The build took 24 months and 2,500 hours—about 25 hours per week.

For power I installed a Rotax 912 ULS (100 hp) engine, and inside I have a Dynon D180, Garmin GTR 200 comm with intercom, Garmin GTX 330 transponder, and iPad Mini with ForeFlight and GPS for navigation. For paint scheme I choose blue and silver on white with a checkerboard nose and tail.

I toured the Denney Aerocraft factory in 1991 but never thought I had the knowledge or skills to build an airplane. I started volunteering on the Champaign Aviation Museum B-17 project in Urbana, Ohio (20 miles from where I live), in 2010.

I may have built my Kitfox, but I could not have done it without my team of advisers, which includes the Champaign Aviation Museum B-17 builders, the McBeans at Kitfox Aircraft, the EAA avionics/electronics instructor, and my hometown hero Dr. Gary Contner, O.D., a previous homebuilder. The number one thing I learned about building a first plane? I didn't need to know how to build a plane; I simply needed to surround myself with those who did.

Jeff Huber, EAA 1076928; Bellefontaine, Ohio
E-mail: *jhuber555@gmail.com*

KANSAS *PIPER J-3 CUB*

MY PIPER J-3 CLIPPED Wing Cub was built in 1946 and was converted to a clipped model in 1955 by Harold Krier who taught himself aerobatics in this airplane and started The Blue Sky Airshows. The airplane was bought as a project from Jake Leatherman, of Scott City, Kansas, who hit a tree landing at his girlfriend's house. Jake is 99 now and doing well. He has maintained a watch on this airplane through the years and has seen it recently since the rebuild.

I have owned this airplane in flying condition since 1992. It had the life of an air show airplane with abuse and deferred maintenance. It was finally time to make a decision to park it or restore it in order to fly safely.

A 20-month restoration ensued. The project was split up between my home and the mechanic I hired in Ashland, Kansas. Final assembly was at Cook Airfield (K50) in Derby, Kansas.

PA-18 elevator control system, PA-18 rear seat and baggage area, PA-22 balanced tail feathers, a Rolls-Royce O-200 engine with 9.0-to-1 pistons, battery, and starter. I included an XCOM radio/intercom and a stock 12-gallon fuselage fuel tank with a fuel sight gauge instead of cork and wire gauge. I also added front and rear shoulder harnesses.

During the rebuild I took one workshop from Clyde "The Cub Doctor" Smith, and I also worked with Marc Krier, Harold's nephew who is an expert on all things Cub. I would also like to thank Eric Strodtman who is a master at fabric, welding, and sheet metal. EAA

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Tailwheel Tow Bar

BY ED TROPPER, EAA 208638; ERIE, PENNSYLVANIA

MY TIP IS FOR TAILWHEEL owners. I have built and still own an RV-4 and a Waiex, both tailwheels. I use this feature on both, and it works well. The axle bolts are 5/16 inch, so I install a longer bolt than what is called for and put on an appropriate number of washers to have the axle bolt protrude far enough on both sides of the tail wheel to use a Cessna type tow bar. The extra drag is negligible, and the tow bar is inexpensive. The tow bar spring will have to be shortened. Using this approach, the aircraft does not have to be lifted, and it can be steered. Commercially available tailwheel tow bars are expensive, bulky, and awkward for homebuilt aircraft.

Instead of a slug of washers, a bushing of the same length might look cleaner.—Ed.

ANOTHER WAY TO CLAMP TUBING

BY RON GEPPERT, EAA 657582; MANKATO, MINNESOTA

THE "QUICK RELEASE Bar Clamp for Tubing" hint in the January *Sport Aviation* is a great improvement over a C-clamp. Rather than attempting to cut steel tubing lengthwise and welding it to a clamp, I use a short length of channel that provides a nice flat surface for the clamp pad. Using the channel allows for more flexibility on different-sized tubing, plus not welding allows the clamp to be used for other purposes. Depending on the application, securing the clamp may require some juggling, but it's the price one pays for not permanently modifying a clamp. I am not implying this is the best way to secure round stock, just another way. The channel can be either aluminum or steel. The photo shows that the piece of angle self-aligns and can be used with a variety of clamp styles to include a bench vise (I am using steel 1/2-by-1-by-1/8 inch). A "v" in the opposite clamp pad is also useful but not necessary, plus one can use another angle on the other side if needed.

BLIND COTTER PIN INSTALLATION

BY HANS FRIEDEBACH, EAA 6697; FORT MYERS, FLORIDA

PROBLEM: TRYING TO install a cotter pin in a bolt when you can only see the bolt end but not the hole for the cotter pin.

Solution: On the end of the bolt or stud, take a marker pen and draw a line across the end that lines up exactly with the hole for the cotter pin or safety wire. Now start the castle nut on, and torque it down. Line the slots on the castle nut up with the guide mark that you made on the end of the bolt.

Now the pin or safety wire will slip right through.

GOT A HINT?

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 *cbecker@eaa.org*. EAA

PHOTOGRAPHY BY **JASON TONEY**

Taildragger Dilemma

Toe-in, toe-out, or zero?

BY BUDD DAVISSON

THERE IS NO WAY to have a conversation about building conventional-gear (read that as "taildragger") homebuilts without getting into the seemingly obligatory argument about the best way to set the main gear's toe angle: in, out, or neutral. There's more than just a little confusion about it. And more than just a few different points of view.

The basis of the conversation is centered on what improves the ground handling and what deteriorates it: toe-in, toe-out, or toe neutral? And then what about camber?

The truth is that you can Google the subject and come away very confused: Even though toe-in is almost never recommended (more on that later), it's sometimes difficult to get two people to agree on whether it should be toed out or neutral. And how do you measure it? And, when do you measure it: At gross? Empty? Tail up? Tail down? It's difficult to get a consensus of opinion on any chat group (mostly because of the lack of real authorities in the conversation), and purely technical information is hard to come by. So, I collected information from folks who deal with taildraggers on a daily basis. The aircraft types involved range from Pitts to Bearhawks, Pacers to Glasair Sportsman.

IN, OUT, OR NEUTRAL?

Why is toe-in (pointing toward the middle) almost never recommended by those who know? Bob Barrows, professional engineer/designer best known for the Bearhawk series of utility aircraft, didn't mince words. "Toe-in causes tire wear and gives the airplane more tendency to ground loop," he said.

That short sentence gives lots of motivation to set the gear at any angle that isn't pointed toward the middle of the airplane.

The reason toe-in leads to the least desirable outcome of a landing is that the tires are already pointed in the direction of a turn. So, when the nose wanders off center, the tire on the outside of the turn is side-loaded on the outside, which makes it "want" to turn more because of the geometry. That having been said, however, it is known that some experts in specific types, like the Piper Pacer, call for 1 degree of toe-in. That, however, is atypical for tubing V-gears. Van's says that on tapered rod and spring gears a little toe-in compensates for the drag load on the tire that induces a little toe-out because of gear deflection.

With the tires aimed away from the center of the airplane in toe-out, the tire wear Bob mentioned is also in evidence. It is usually indicated by worn stripes around the inside of

the wheel because the tires are scrubbing rubber off when going straight. However, the tires also slightly resist a turning tendency, and according to Bob, toe-out gives a "slow turning response."

The tendency to slow down a turn is why many say a little toe-out is a good thing. Adds stability and all that. This may be the reason why Glasair reportedly dictates 1 degree toe-out on its Sportsman. Van's mentions that the gear will track out during rollout until it's pulled back in by the gear, which causes an oscillation and excess wear.

The most common response from almost all "experts" was that neutral toe angle was the most desirable, with a few leaning a little toward a hair of toe-out. This included Bob, Aviat, and a number of users. So, the overall consensus of opinion from those in the know is that you can't go wrong by setting the gear up neutral, although, as Van's points out, with some gear, a neutral setting will result in just a little toe-out because of tire drag, which is why on a flexible gear leg, a hair of toe-in is desirable.

MEASUREMENTS

According to Bob it doesn't make any difference whether measurements are taken level or tail down, as long as the gear attach points are in line with each other and parallel to the ground. The only time the geometry will change when changing the attitude is when there is some camber angle in the wheels (leaning in or out). That having been said, there undoubtedly are some gear designs that change toe-in/-out when the tail is up or down.

"All measurements should be done at normal flying weights because toe-in/toe-out will sometimes change with gear travel in the three-point position," Bob added.

Van's opinion differs. "It doesn't matter—it's measured with the airplane on jacks and the weight off the gear. Off the gear because we are setting toe-in or neutral to compensate for the loaded dynamic condition. If you could replicate the dynamic drag load at your desired weight, then you would set the aircraft neutral."

The difference in the way individual designers look at landing gear geometry appears to be connected to whether they are talking about steel tubing, pivoted-V landing gears, which are nearly rigid and pivot in place, or leaf spring and tapered rod gears, which have leg bending/deflection both vertically and fore and aft (due to wheel drag).

Universally, the first move when measuring anything on an airplane is to establish a centerline to use as a datum. For measuring the landing gear, you'll need a centerline that extends fore and aft from the landing gear, so two centerline points need to be established under the fuselage. Dropping a plumb bob or the equivalent (a nut on a string) from the middle of the crankshaft is a start (assuming no offset). Then drop a plumb bob from a center point somewhere behind the gear. Snap a chalk line on those two points and you have your centerline. Make sure the airplane is firmly chocked.

Clamp a long length (4-8 feet) of something absolutely straight (aluminum extrusion, good 2-by-4, etc.) either to the brake disc

(using spacers) or the outside of the tire. Note that the brake disc mounting is more stable. Mark the axle point on the measuring stick, then measure the distance from the front end of the stick to the centerline and compare to the distance at the back end of the stick. Ideally, they'll be exactly the same (if they're identical, immediately go out and buy lottery tickets because you'll never get luckier). What we're mostly concerned with is that they be within tolerances. Bob and most others said half a degree in either direction was fine.

How do we measure half a degree? By remembering a high school geometry rule of thumb: 1 degree gets 0.017 inch farther away from center for each inch we travel down the measuring stick. So 1 degree at the end of a 48-inch stick would be 0.82 inch off center (that's the tangent of the angle in case anyone cares). A half degree would be 0.41 inch, so keep the end of the measuring stick that close and you're golden.

WHAT IF IT'S WRONG?

The various types of landing gears can be adjusted, after installation, via various methods, some of which look crude. However, it's important to remember that all of the adjustments are quite small. A full degree change (0.82 at 4 feet) is only a movement at the axle tip (6 inches) of about 0.1 inch, so go easy with the corrections.

When correcting toe-in/-out on a tubing V-gear, it's not unusual to use a long piece of pipe slid over the axle, the fuselage tied down, and the gear "sprung" in the desired direction a little at a time. Bob prefers the weld cluster above the axle be heated and just a little pressure put on it with a long tube over the axle. The measurement at the front of the measuring stick is constantly monitored, and the proper dimension slowly crept up on. Don't make big movements.

The axles on the various types of spring gears are usually bolted on, and these are aligned by using tapered shims between the axle stub and the gear leg mounting plate. Again, the dimensions at the end of the fore/aft measuring sticks are watched closely.

A tapered rod gear, such as used on RVs, is much more difficult to change, if wrong, because the angles are set when the leg is drilled in the mount. New parts are often called for in this case.

THE EFFORT IS WORTH IT

There is nothing more aggravating (and sometimes scary) than a tailwheel airplane with poorly aligned landing gear. Fortunately, the effort required to get the gear geometry matched right and left and aligned with the centerline is minor compared to the payoffs. So, spend a little time with a tape measure. You'll never regret it. EAA

Budd Davisson, EAA 22483, 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*.

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Why Andrew Marvin is a Young Eagles Volunteer

Andrew Marvin (far right) of Petoskey, Michigan, took his first EAA Young Eagles flight with his Boy Scouts troop when he was about 9. "I had a blast," he recalls, "but I really didn't think too much about it at the time. It was such a foreign concept to me that I could actually fly."

But that changed when he was 14 and his great uncle purchased a plane and cottage near his home. "I started flying with him occasionally," Marvin says, "and got really interested in aviation."

At 16, Marvin found a flight instructor and joined a flying club. He soloed at 16, and shortly after his 17th birthday in May 2011 earned his private pilot certificate.

Marvin is now helping others catch the flying bug as a Young Eagles pilot. "I love looking over and seeing the wonder on their faces," he says. "I'm not much older than some of the kids I take up, so hopefully they understand that if I can do it, they can too."

EAA Young Eagles®

Visit **EAA.org/YoungEagles** for more information or to become a Young Eagles volunteer pilot.

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All EAA members are invited to share their passion for aviation with a new generation during EAA's 22nd annual International Young Eagles Day!

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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*.

SPECIAL BREEDS

Looking to take your passion to new heights? EAA's independent special interest communities may be exactly what you're looking for.

If loops, rolls, hammerheads, and lomcevaks are your kind of flying, the EAA International Aerobatic Club may be exactly what you're looking for. IAC chapters throughout the United States promote aerobatics at a local level and host aerobatic critiques, seminars, and competitions.

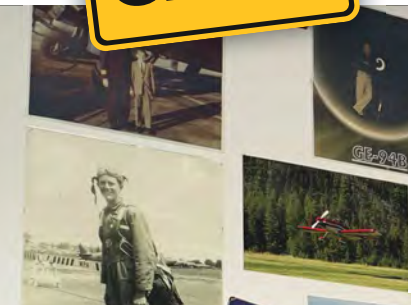
If you fly, restore, or simply enjoy vintage aircraft and aviation, check out the EAA Vintage Aircraft Association. VAA members are passionate stewards of the history of aviation and are dedicated to preserving, promoting, and sharing that history with like-minded people from around the world.

"Keep 'em Flying." That's the motto—and the mission—of EAA Warbirds of America, the division that provides programs and services to those interested specifically in former military aircraft.

For more information, visit *www.EAA.org*.

PHOTOGRAPHY BY **DAVID CARLSON**

EXCLUSIVE PARKING
PILOT CAVE



Pilot: Joe Waltz, EAA 583321, and Jimmy Crawford, EAA 1024971
Location: Lone Star Executive Airport (KCXO), Conroe, Texas

THIS PILOT CAVE HANGAR located at 44E-4 at Lone Star Executive Airport, Conroe, Texas (KCXO), measures 38-by-43 and belongs to both Joe "Traash" Waltz and his best bud and hangar mate, Jimmy "Mudbug" Crawford. Joe currently owns a red, white, and black RV-8 affectionately named *Traashcan II*, while Jimmy owns a silver RV-4 he calls *Mudbuggie*.

"We both belong to EAA Chapter 302 and spend most of our free time here," Joe said. "Thankfully, our wives are very supportive, and when they ask where we are going all we need to say is 'the little,' as in little airport. Some wives refer to it as the adult day care center. The hangar area is always abuzz with some sort of activity, which makes it a fun place to hang our hats. Inside we have individual work areas and tools along with an assortment of airplane camping gear."

For the last five years EAA Chapter 302 has proclaimed its little slice of aviation heaven as the unofficial "meeting and gathering place for aviation connoisseur and airport bums." It has more than 30 RVs and numerous other experimental and production GA aircraft at CXO. There's always some type of activity going on there, whether flying, building, maintaining, modifying, or socializing. Its unofficial events include coffee and doughnuts every Monday at 10 a.m., lunch every day, officers' call at 5 p.m. (announced by the signal of a WWII handheld air-raid siren), and steak night when the moon is full. EAA

Do you have an interesting pilot cave? Send a snapshot to *editorial@eaa.org* to share your aviation space with fellow *EAA Sport Aviation* readers.

PHOTOGRAPHY COURTESY OF **JOE WALTZ** AND **JIMMY CRAWFORD**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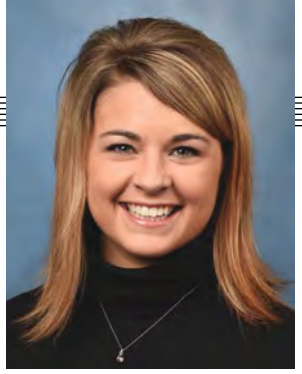

Name: Candice Lane, EAA 1136610
Position: Business Development Coordinator

WHO'S WHO AT HQ

What do you enjoy most about your job? I love the fact that the bottom line of our team is to position the right partners with EAA to keep the organization growing financially so that we can fund programs such as Young Eagles. Each day I know that what I am working toward is an important goal to our members, and that is very satisfying.

If you could fly any airplane, what would it be? I would love to fly a powered parachute! I love the fact that there is very little cover around you; it's just you and the air. Once I was able to fly in a Piper Cub with an open door, and I loved the fact that I could have my whole arm outside of the plane.

Most memorable EAA experience? The most memorable experience for me by far is my involvement with the Yellow Ribbon Honor Flight held during EAA AirVenture Oshkosh 2014. I felt such a tie to the purpose of this flight as members of my family are Vietnam veterans. To say the day of the event was hectic is an understatement. It was an intense, emotional day where everything that could have gone wrong did. But the countless hugs, thank-yous, and tears I shared with the veterans made every moment worthwhile. I was able to participate on an Old Glory Honor Flight as a guardian this past October and am very excited to once again be working with the team for our Yellow Ribbon Honor Flight during EAA AirVenture 2015.

Describe your first airplane ride: As an employee of EAA, you are able to participate in an Eagle Flight. When I did mine, I definitely freaked out a little *too* much, and said some not-so-nice words. I felt lucky that it was just the pilot and me in the plane together, until I realized that the control tower had heard everything I said! Quite embarrassing, to say the least.

Dierks Bentley Opens AirVenture

Country singer to headline opening night concert

COUNTRY MUSIC STAR Dierks Bentley will kick the EAA AirVenture Oshkosh 2015 week off to a flying start when he headlines the opening night concert on Monday, July 20. The concert, presented by Ford Motor Company with additional support from Cirrus Aircraft, is free to all EAA AirVenture attendees that day and will be held on Boeing Plaza following the afternoon air show.

Bentley is an avid pilot, owns and flies a custom Cirrus SR22T Xi, and has attended EAA AirVenture Oshkosh as an aviation enthusiast. "Dierks brings the energy and enthusiasm that complements the full week of aviation excitement that will be featured at EAA AirVenture," said Rick Larsen, EAA's vice president of communities and member programs.

He has been nominated as an Academy of Country Music (ACM) top male performer and is seven albums into one of country music's most respected and most unpredictable careers. Bentley's No. 1 selling album *RISER* spawned two consecutive No. 1 hits, "I Hold On" and "Drunk on a Plane." His latest single, "Say You Do," is also climbing the Top 10 charts.

Bentley's six previous studio albums have sold more than 5 million copies, notched 12 chart-topping singles, and earned 12 Grammy nominations. Additionally, Bentley's seven ACM nominations were the most of any male artist this year.

This is Ford's 15th year as exclusive automotive partner with EAA, and this will be the 10th annual opening day concert it has sponsored at Oshkosh to kick off aviation's annual reunion.

For more information, including advance purchase for admission, camping, and parking, visit *www.EAA.org/airventure*.

PHOTOGRAPHY COURTESY OF **DIERKS BENTLEY** AND BY **JASON TONEY**

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EAA AIRVENTURE CUP RACE 2015

APPLICATIONS TO ENTER the 18th annual AirVenture Cup Race are now available online. The race is scheduled for Sunday, July 19, with the starting line in Mount Vernon, Illinois, and the finish line in Wausau, Wisconsin. Pilots interested in participating in this year's event are encouraged to apply as soon as possible at *www.AirVentureCupRace.com*.

Pre-race activities at Mount Vernon Outland Airport include media day on Friday and an airport open house and EAA Young Eagles rally on Saturday.

The race will launch at 9:30 a.m. Central time Sunday. Since this is a timed race, participants compete against the clock divided into categories based on their certification, landing gear configuration, and engine size. Each class has first-, second-, and third-place awards. All event activities are subject to the weather.

WARBIRD OWNERS URGED TO JOIN IN AUGUST WWII FLIGHT TRIBUTE

WORLD WAR II VINTAGE aircraft will be taking to the skies over communities across America on the weekend of August 15-16, 2015, as part of a nationwide commemoration of the 70th anniversary of the end of WWII. EAA Warbirds of America has partnered with "The Spirit of '45" initiative and its World War II Airpower Legacy Project to recognize and honor those who contributed to the war efforts.

The project's goal is to pay tribute to the pivotal role American airpower played in achieving victory in the most destructive war in history, and to stress the importance of ensuring these historic aircraft are preserved so that they can continue to educate and inspire future generations.

The WWII Airpower Legacy Project is a grassroots initiative led by the Air Force Association, the EAA Warbirds of America, the Commemorative Air Force, and a growing community of air museums and private collectors.

Owners of WWII aircraft are encouraged to register to participate so they can be included in a map to help publicize the flyovers. Other groups are developing plans for similar "signature" projects commemorating the 70th anniversary this year to honor America's WWII legacy. For more information, visit *www.SpiritOf45.org*.

PHOTOGRAPHY COURTESY OF **GEOFF SOBERING**

NOTICE OF ANNUAL BUSINESS MEETING

IN ACCORDANCE WITH the seventh restated bylaws of the Experimental Aircraft Association Inc., notice is hereby given that the annual business meeting of the members will be held at the Theater in the Woods on Wednesday, July 22, at 8:30 a.m. at the 63rd annual convention of the Experimental Aircraft Association Inc., Wittman Regional Airport, Oshkosh, Wisconsin.

Notice is further given that the election will be held as the first item on the agenda at the business meeting. Six Class I directors (three-year terms) shall be elected. The Class I candidates are as follows:

Warren R. Baier
Joe Brown (Class III-Incumbent)
Barry E. Davis (Incumbent)
David Pasahow (Class III-Incumbent)
Darren Pleasance (Class III-Incumbent)
Paul G. Schafer
Dan Schwinn (Incumbent)
Brandon Scott
Louis C. Seno Jr.
Alan Shackleton (Incumbent)
Eric K. Whyte

Jim Phillips,
Secretary, EAA Board of Directors

B-52 TO DOMINATE BOEING PLAZA

A BOEING B-52H Stratofortress bomber will be a prime attraction at EAA AirVenture Oshkosh 2015 when it lands at Wittman Regional Airport and remains on static display for the duration of the event. It marks the first time a B-52 will be on ground display during the event, although similar aircraft have done flybys at Oshkosh on several occasions.

B-52s have been the backbone of the U.S. Air Force bomber fleet for more than 50 years. The aircraft will arrive from the U.S. Air Force Reserve's 93rd Bomb Squadron of the 307th Bomb Wing based at Barksdale Air Force Base in Louisiana.

The B-52 first flew in 1954 and entered active military service a year later, making this its 60th year in service. It has received regular upgrades to modernize its flight equipment and capabilities, with the B-52H models still active through its assignments at Air Force bases in Barksdale as well as Minot, North Dakota.

Aerial refueling allows the B-52 to fly a range limited only by crew endurance. In 1996, the airplane flew a 34-hour, 16,000-mile combat mission from Louisiana to Iraq. Without refueling, the aircraft has a range in excess of 8,800 miles with a five-person crew.

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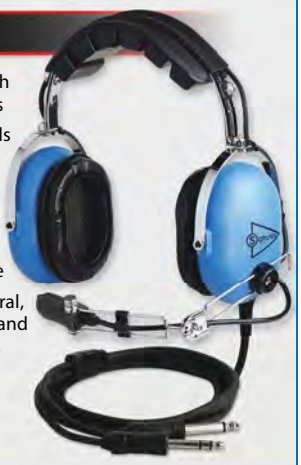

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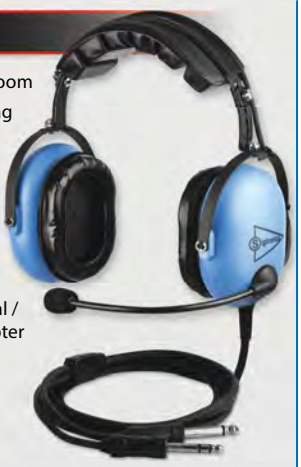

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F-22 RETURNS TO AIRVENTURE IN 2015 FOR HERITAGE FLIGHTS

THE LOCKHEED MARTIN F-22 Raptor will return to EAA AirVenture Oshkosh this summer. It will be part of the U.S. Air Force Heritage Flight, which matches modern fighter aircraft with historic warbirds for air show demonstrations. These formations have created unforgettable moments in past EAA AirVenture air shows.

In addition, the F-22 will be flown by Capt. John Cummings, an Appleton, Wisconsin, native who is the 2015 demo pilot for F-22 nationwide.

The F-22 is tentatively scheduled for an appearance during the latter half of EAA AirVenture week. More details about the Raptor's appearance will be announced as they are finalized.

EAA NAMES THEME DAYS FOR AIRVENTURE

THEMES OF EAA AirVenture Oshkosh 2015 touch everything from innovation to homebuilding to history, and feature some of the most notable personalities in aviation along with unique aircraft. The lineup includes:

Monday, July 20: Opening Day Celebration—The World's Greatest Aviation Celebration opens with forums, air shows, and country star Dierks Bentley performing on Boeing Plaza.

Tuesday, July 21: Rutan Legacy Day—Legendary designer Burt Rutan returns, and all owners of Rutan-designed aircraft are invited to participate.

Wednesday, July 22: Honoring Apollo 13—Featuring astronauts Jim Lovell and Fred Haise, along with Mission Control's Gene Kranz and other members of the NASA flight team.

Thursday, July 23: Gateway to Innovation—The latest and greatest in aircraft design, unmanned aerial systems, and more!

Friday, July 24: Salute to Veterans—Honoring those who served and are serving, with a special Friday night concert on Boeing Plaza.

Saturday, July 25: World War II Tribute—From the 75th anniversary of the Battle of Britain to the 70th anniversary of the end of the war, a look at the era through the eyes of aviation.

Sunday, July 26: Only on Sunday—See aircraft flying in one place that can only be seen at Oshkosh and on this day!

Activities for each of these days will be announced as they are confirmed.

PHOTOGRAPHY BY **DEKEVIN THORNTON**

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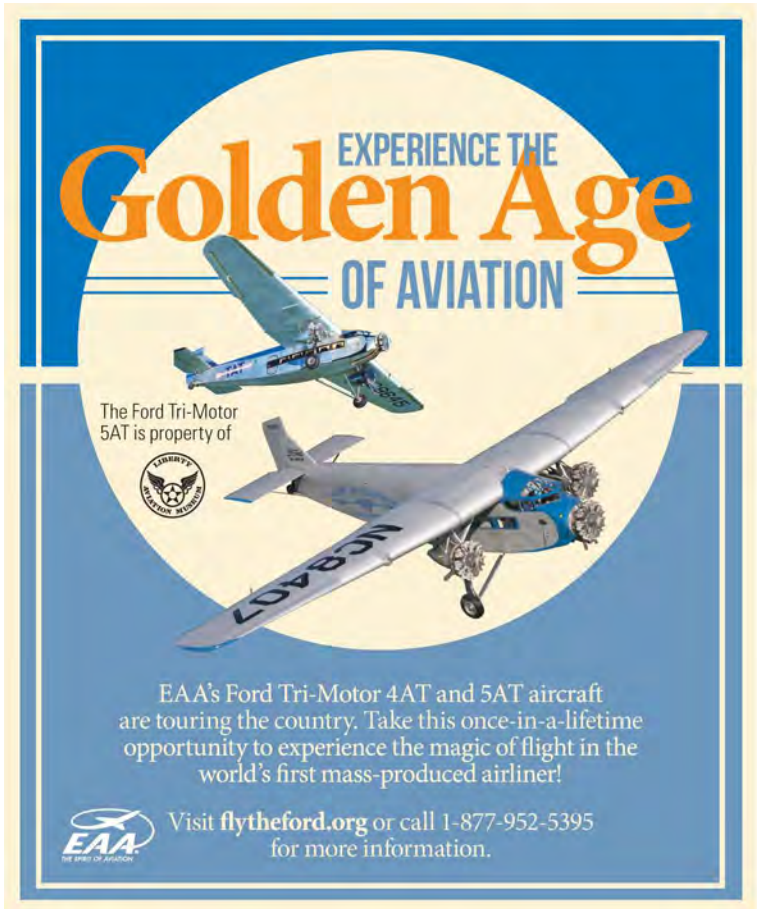

VALDEZ STOL DEMOS ARE BACK

MORE THAN A DOZEN specially modified short takeoff/landing (STOL) aircraft will be back at Wittman Regional Airport showing their unique capabilities to EAA AirVenture Oshkosh 2015 attendees.

The STOL aircraft, including homebuilts and specially modified production airplanes, are based on aircraft that provide supplies to the rugged and far-flung outposts throughout Alaska whose demanding terrain requires takeoffs and landings on rough runways often less than 500 feet long.

The Valdez STOL activities will include flight competitions during the afternoon air shows on July 20-21, competition finals prior to the July 22 night air show, and fun flying at the ultralight airstrip on July 23 (mid-day) and July 24 (evening).

These flying activities are made possible with support from presenting sponsor CubCrafters, one of the nation's leading backcountry aircraft manufacturers, and supporting sponsor Better Aircraft Fabric. *EAA*

Special thanks to Sensenich Propellers for the donation of the propeller for the 2015 EAA Sweepstakes J-3 Cub. Sensenich Propellers has designed and manufactured props for more than 80 years, and this classic wood propeller is one of many available for Cubs. Sensenich propellers are available in wood, metal, and ground-adjustable composite, with patented quick-indexing hubs.

PHOTOGRAPHY BY **DEKEVIN THORNTON** AND **JASON TONEY**

Flyby

Pilot and Mechanic Sees the Difference

Texhoma, OK - Ted Fields has been involved in aviation since 1950. That was when he joined the AirForce. He was stationed in Caribou, ME when he decided to take flying lessons. Ted's first lesson was in July of 1957 and his first solo was in October of 1957.

Ted worked as an aircraft mechanic in the Air Force, servicing hydraulic and pneumatic systems on the B-52 and KC-135 frames.

After a stint in Higginsville, MO, he was moved to Schilling, MO to work on the Atlas missile project, and was then transferred to North Dakota to work on the Minutemen missiles. Ted continued his pilot training and received his private certificate in February of 1971 and his commercial certificate in May of 1972. He still has his commercial and A&P certificates and has logged 1081 hours flying time as of March 2015.

Ted has owned and flown four different Tri Pacers, was partners in a Piper Arrow, owned a Tailwind, KR2, RV6A and a Sport Hornet. He currently owns a Piper PA 22 108 Colt.

In February of 2010, Ted was awarded the Wright Brothers "Master Pilot" Award in for fifty years of flying without any incidents or accident.

We caught up with Ted to see how he was doing with Claroxan – the once daily tablet for healthy eyes and here is what he had to say:

"I am 84 and I enjoy flying to this day. I read about your product in all those flying magazines and wanted to give it a try.

I took it for a year and visited my doctor. My left eye got better and my right eye stayed the same.

I told my doctor about it and even showed him the bottle and he told me it wouldn't hurt to keep taking it.

My wife was having some problems with her vision so I started her on the Claroxan too. Nothing compares to Claroxan."

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Pilot Preferred

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Phil Witter

"I highly recommend this product for its true value of healthy vision, which is something every pilot needs in the traffic congested skies. I also appreciate the support and feed back that I receive from Pacific Health, which is truly unique, as opposed to many other companies out there. There is something to say about that personal service."*

John Sylvester

*"I started taking Claroxan to preserve my eyesight. At 53 it is something to consider and with my profession it is important to keep that in mind. I noticed during my last medical exam that my near vision was clearer and that's really essential to getting things done quickly and accurately in the cockpit."**

Joe Hopkins

"I started using Claroxan daily in June of 2013 and on my most recent 2nd class medical test, I was able to pass the color portion! I am 62 years old this July, working on my CFI and can't wait for my check ride."

James Callaway

"I take Claroxan daily and I have for the past eight years. It really helps my vision. It really helps most when I am flying and driving. The vision adjustment is great.* I see a complete difference in my vision.*

*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure or prevent any disease.

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Gone West

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

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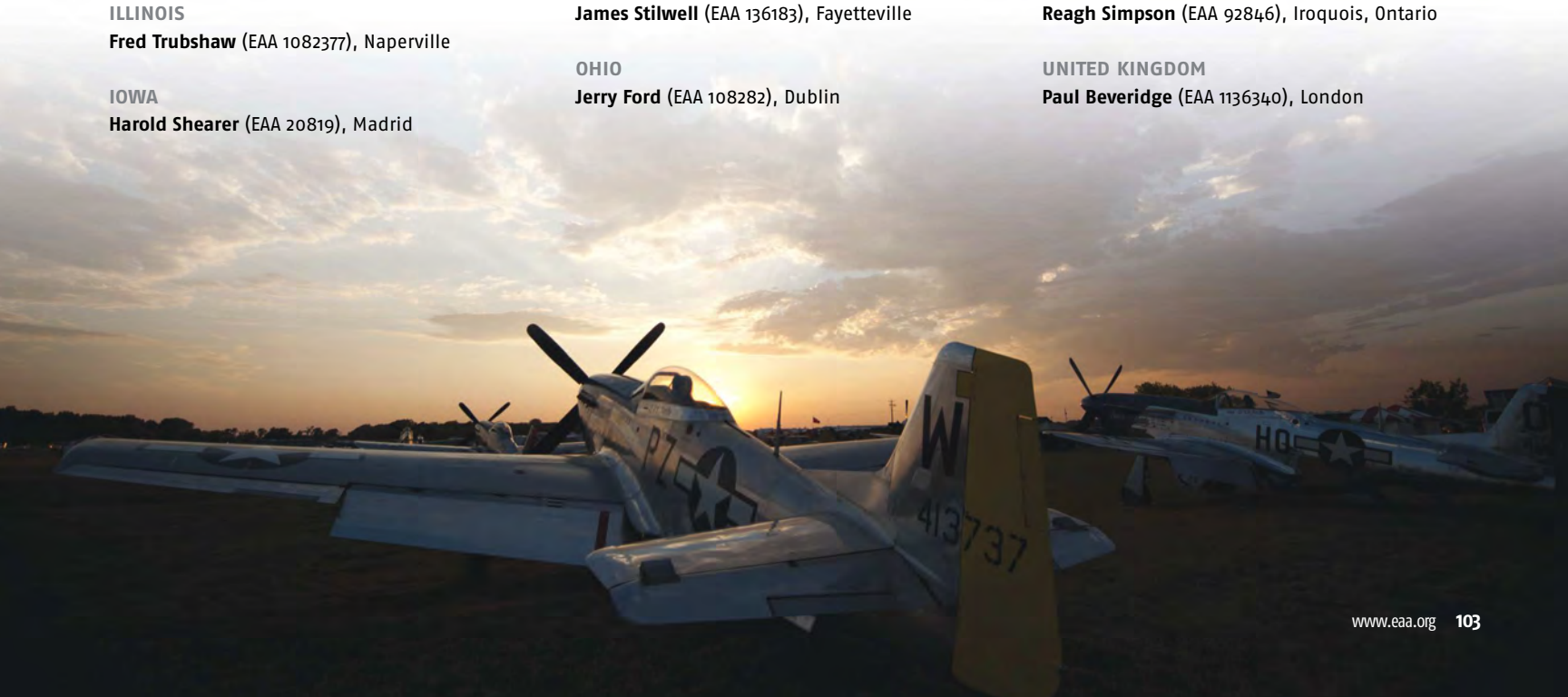

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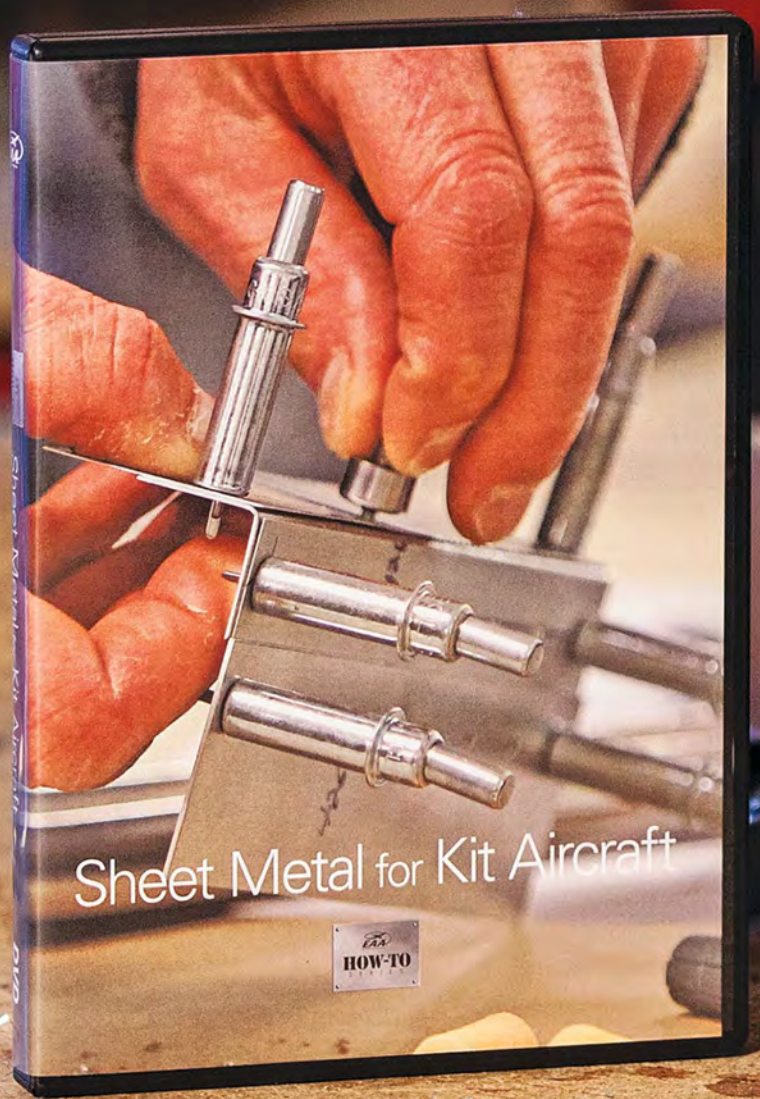

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My Aviation Journey

BY JIM REDDICK, EAA 137289; LEBANON, TENNESSEE

PICTURE A SIMPLER TIME—it's 1979 on a warm spring afternoon in Titusville, Florida, and I'm in the eighth grade. The Andrew Jackson Middle School "Big Red" band is practicing marching on the school playground preparing for our annual marching competition. The band stops, and the band director Ron Youmans barks orders through a megaphone. A few moments later the cadence resumes, and the band moves simultaneously—except for me. Immediately a whistle blows. "Reddick, what are you doing?" Mr. Youmans yells. I reply, "I was watching a bird." "What?" he yells back."I said I was watching a bird," I say. "Get off the field," he screams. "Kevin, take Reddick's place! Reddick, you are *out*!"

I walk off the field to the sound of chuckles from my peers. My shoulders are slumped, and I'm dragging my trombone along on the ground behind me. The trombone slide comes off. Laughter breaks out, and I consider leaving the slide but quickly retrieve it and leave humiliated.

I wasn't just watching a bird. What they didn't know is that I had been flying radio-controlled sailplanes on this same playground for months every weekend. I had learned to spot the subtle updraft of a thermal, but I could never get my sailplane to ride one into the clouds. This bird was doing it effortlessly. And what I had just realized was that the bird was staying in a very tight turn—maybe only

PHOTOGRAPHY COURTESY OF JIM REDDICK

40 feet in diameter. Was I turning too slowly and flying out of the thermal? Were these little schoolyard thermals smaller than I envisioned? *This* is what had my 12-year-old attention, not marching in a field playing a trombone.

I have had a love affair with aviation for as long as I can remember. I joined EAA in 1979 and became EAA member 137289 thanks to Cody Jackson, a caring eighth-grade teacher who heard about the whole bird/trombone event and thought I might be interested. Mr. Jackson lent me an *EAA Sport Aviation* magazine and a full set of plans to a Bowers Fly Baby, and I was hooked. A few years later when I was in high school he lent me a set of plans to an Osprey, and I scratchbuilt a giant one-third scale model. Mr. Jackson was one of the good ones.

In 1981, I was 15 and took my first flying lessons. I soloed shortly after my 16th birthday. I was on track to get my certificate, but the reality of the cost was catching up. At that point I had personally spent about 1,500 hard-earned dollars. My parents were supportive, but they were not about to pay for flying lessons, and $1,500 represented close to 120 mowed lawns. Plus I wanted to restore an MG so that I would have a cool car to drive.

I wasn't just watching a bird. What they didn't know is that I had been flying radio-controlled sailplanes on this same playground for months every weekend. I had learned to spot the subtle updraft of a thermal, but I could never get my sailplane to ride one into the clouds.

That was the first time that recreational aviation would take a back seat to the other priorities in life. But EAA was still impacting my life even though I wasn't a pilot.

Around that time, *EAA Sport Aviation* ran a feature article on Ralph Moore's award-winning Shoestring. Ralph was from Titusville, and I discovered that he lived very close to me. I rode my bicycle to his house and met him and got to see the Shoestring a short time later. It was the first time I had ever seen anything hand-built to absolute perfection. Ralph's adherence to detail and finish was something that really stuck in my formative mind. It came in handy years later when my boys and I completely rebuilt a 1959 Triumph TR-3 roadster, which took second place in the country. I can attest firsthand that EAA spills over into other avenues of life, even if we are not flying.

I went on to become an engineer, but in the years that followed, college, careers, houses, children, little league, even cars and boats all took priority over flying. But EAA and aviation were always a part of my life even if I was just a spectator. My boys and I escaped the southern summer heat and attended EAA AirVenture Oshkosh several times. We walked among the homebuilts picking out our favorites. We pitched our tent in Camp Scholler and showered in the big red building. My boys learned to appreciate the beauty of color sanding and the sound of a perfectly fitted canopy closing. We all learned how to spot a champion. Good times, good memories.

Flash-forward to New Year's Eve two years ago. I was visiting some friends in Tampa. The subject of New Year's resolutions came up, and everyone rattled off what they wanted to change in the coming year: running a full marathon, taking horseback riding lessons, working less, etc.

Then everyone looked at me. "I'm going to get my pilot's certificate before my 50th birthday!" I heard myself say. It just came out. In front of people that would hold me accountable. I was 48, my children were grown, my business was doing okay, and I was in good health. It was finally time.

So once again I pursued the elusive task of getting my certificate. I was surprised when I first started back flying that I wasn't as bold as I was when I was 16. Somewhere along the way I had discovered my own mortality. It took a while to get my nerve back! I took being a student pilot very seriously and scored a 95 on my written exam. I recognized that basically anyone can steer an airplane around the sky with a bit of practice, but becoming an aviator was an entirely different thing. And I wanted to be a competent aviator.

A few weekends ago, on a Friday, I took my checkride. Two days later I turned 50.

I believe that if most of us wait until everything is perfect to pursue getting a recreational pilot certificate we will probably be waiting forever. For me flying will always be expensive and time-consuming, but we only get this one life. I'm looking forward to being in my 50s.

So if you find yourself in your mid-30s, starting a career, with two children and your first house mortgage, and it looks like you will never get to pursue your dream of becoming a pilot, *do not* lose heart. Be patient. Enjoy your family. And in the meantime, use our wonderful homebuilding community as I did to demonstrate perfection and determination to your children. Just stay involved as a spectator until your time arrives.

And as a final statement I would just like to say that the trombone is an overrated instrument. And, yes, I was totally correct about the whole thermal thing.

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CHAPTER VIDEO MAGAZINE

GO ON TOUR WITH EAA's One Week Wonder Zenith CH 750 Cruzer during its recent Florida chapter stops in the May issue of EAA's Chapter Video Magazine. Then get a look at Rotax's latest offering, the 912 iS engine. This month's video also features a Hint for Homebuilders segment on checking propeller blade tracks. A link to download the video was e-mailed to chapter officers on May 1. If you are a chapter officer and did not receive the e-mail, please contact *chapters@eaa.org*. EAA's Chapter Video Magazine is proudly sponsored by Dynon Avionics. EAA

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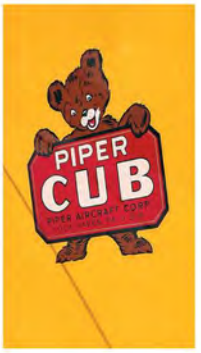

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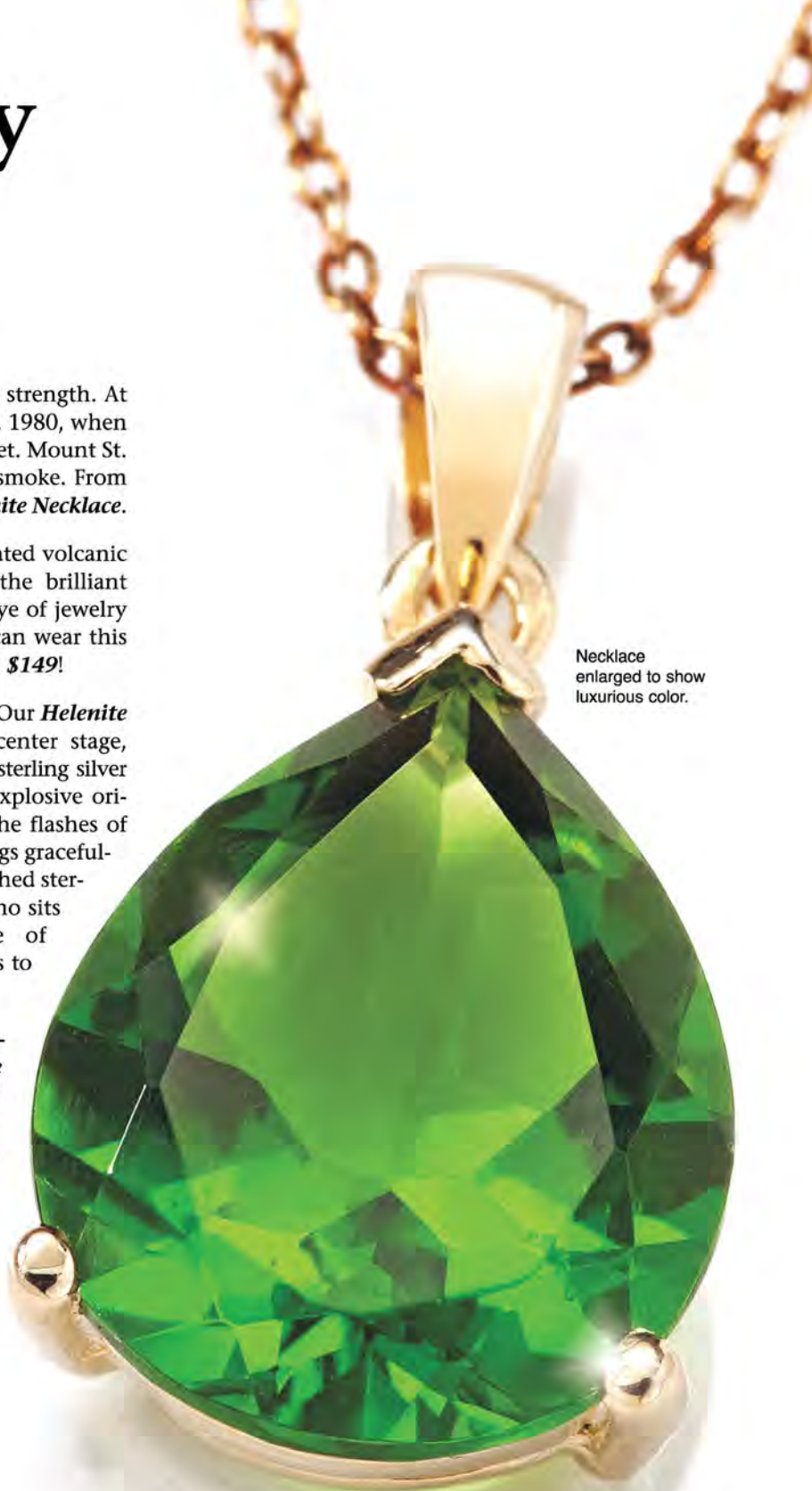

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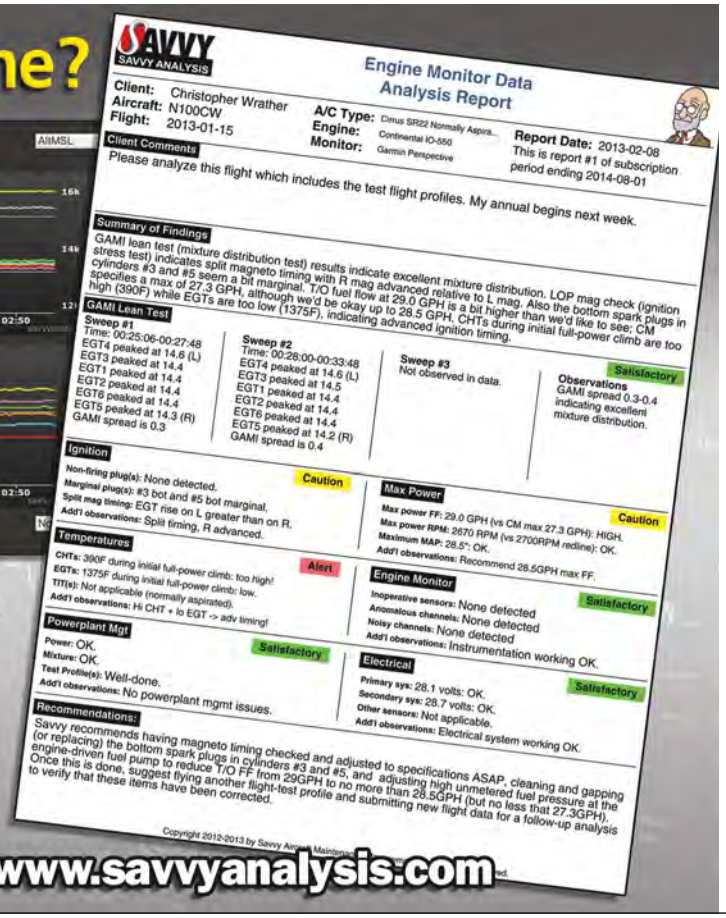

Engine Monitor Data Analysis Report

Client: Christopher Wrather
Aircraft: N100CW
Flight: 2013-01-15
A/C Type: Cirrus SR22 Normally Aspira...
Engine: Continental IO-550
Monitor: Garmin Perspective
Report Date: 2013-02-08
This is report #1 of subscription period ending 2014-08-01

Client Comments
Please analyze this flight which includes the test flight profiles. My annual begins next week.

Summary of Findings
GAMI lean test (mixture distribution test) results indicate excellent mixture distribution. LOP mag check (ignition stress test) indicates split magneto timing with R mag advanced relative to L mag. Also the bottom spark plugs in cylinders #3 and #5 seem a bit marginal. T/O fuel flow at 29.0 GPH is a bit higher than we'd like to see; CM specifies a max of 27.3 GPH, although we'd be okay up to 28.5 GPH. CHTs during initial full-power climb are too high (390F) while EGTs are too low (1375F), indicating advanced ignition timing.

GAMI Lean Test — Satisfactory
Sweep #1 Time: 00:25:06-00:27:48
EGT4 peaked at 14.6 (L)
EGT3 peaked at 14.4
EGT1 peaked at 14.4
EGT2 peaked at 14.4
EGT6 peaked at 14.4
EGT5 peaked at 14.3 (R)
GAMI spread is 0.3
Sweep #2 Time: 00:26:00-00:33:48
EGT4 peaked at 14.6 (L)
EGT3 peaked at 14.5
EGT1 peaked at 14.4
EGT2 peaked at 14.4
EGT6 peaked at 14.4
EGT5 peaked at 14.2 (R)
GAMI spread is 0.4
Sweep #3 Not observed in data.
Observations: GAMI spread 0.3-0.4 indicating excellent mixture distribution.

Ignition — Caution
Non-firing plug(s): None detected.
Marginal plug(s): #3 bot and #5 bot marginal.
Split mag timing: EGT rise on L greater than on R.
Add'l observations: Split timing, R advanced.

Max Power — Caution
Max power FF: 29.0 GPH (vs CM max 27.3 GPH): HIGH.
Max power RPM: 2670 RPM (vs 2700RPM redline): OK.
Maximum MAP: 28.5": OK.
Add'l observations: Recommend 28.5GPH max FF.

Temperatures — Alert
CHTs: 390F during initial full-power climb: too high!
EGTs: 1375F during initial full-power climb: low.
TIT(s): Not applicable (normally aspirated).
Add'l observations: Hi CHT + lo EGT -> adv timing!

Engine Monitor — Satisfactory
Inoperative sensors: None detected
Anomalous channels: None detected
Noisy channels: None detected
Add'l observations: Instrumentation working OK.

Powerplant Mgt — Satisfactory
Power: OK.
Mixture: OK.
Test Profile(s): Well-done.
Add'l observations: No powerplant mgmt issues.

Electrical — Satisfactory
Primary sys: 28.1 volts: OK.
Secondary sys: 28.7 volts: OK.
Other sensors: Not applicable.
Add'l observations: Electrical system working OK.

Recommendations:
Savvy recommends having magneto timing checked and adjusted to specifications ASAP, cleaning and gapping (or replacing) the bottom spark plugs in cylinders #3 and #5, and adjusting high unmetered fuel pressure at the engine-driven fuel pump to reduce T/O FF from 29GPH to no more than 28.5GPH (but no less that 27.3GPH). Once this is done, suggest flying another flight-test profile and submitting new flight data for a follow-up analysis to verify that these items have been corrected.

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O Canada

Our neighbors to the north took center stage in the May 1965 issue of ***EAA Sport Aviation***, which featured Russ Norman and George Ellis' EAA Biplane, the first to fly in Canada. Russ and George, members of EAA Chapter 65, built the CF-106 exactly to the plans, except it was powered with a 65-hp engine. According to the article, the "boys have had feelers out for a 90 hp engine which should bring the performance up to standard."

In getting members excited for the Rockford fly-in, an editor's note mentioned plans for a gathering of warbirds, alongside a primer on the newly formed Warbirds of America. "We are sure EAA members would be pleased to view a fine collection of World War II combat aircraft," the note read; today, the Warbirds area is a popular stop for the 500,000-plus EAA AirVenture Oshkosh attendees.

INSIDE THE ISSUE

Highlights from May 1965

PG. 14

After flying with Volmer Jensen and talking with John Thorp and other EAA members at Rockford 1964, Frank Hamlin opted to convert his homebuilt Volmer to a tractor configuration.

PG. 26

According to the What Our Members Are Doing section, Russ Swanson of Spokane, Washington, possessed "one of the finest Great Lakes biplanes in the country." The aircraft is still registered.

PG. 31

Norman Desrosiers decided to build his Jodel D-11 Little Ludy *after being bitten by the homebuilding bug in 1958 when he read his first* Sport Aviation.

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