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Homebuilt Gliders «
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Investigating «
Static Stability

Midget Mustang Magic
Reviving Jim Lloyd Butler's '60s Champion

Oshkosh Countdown

BY JACK PELTON

WINTER HAS BEEN BRUTAL so far, even by Wisconsin standards. For days in January the temperature never reached zero for a high. Howling winds drove wind chill temperatures to life-threatening lows. So it must be time to get ready for Oshkosh.

When I look at the blanket of snow and ice covering EAA's Oshkosh show grounds and the rest of Wittman Regional Airport, it's hard to believe that in less than six months thousands of airplanes and hundreds of thousands of pilots and airplane enthusiasts will be here. But it's true. And it's what we here at EAA work so hard year-round to prepare for.

It's not too early for you to be making plans for your trip to Oshkosh, either. There is much to do.

At the top of the list is completing whatever project you are working on. Some of you are in the final stages of finishing your homebuilt airplane. Others are reassembling an antique or classic after a painstaking restoration. And all airplane owners need to make sure the annual inspection and other maintenance items are up to date.

We pilots need to make sure our flying skills will be in as good a shape as our airplanes come Oshkosh time. While winter weather makes it hard for many of us to get into the air, we can always use the time to refresh our knowledge by hitting the books, or more likely getting online.

EAA and many others offer a steady stream of online tutorials, training sessions for new ratings, and webinars that delve deeply into every aspect of flying. It's important to review everything from the rules of the air to the latest safety alerts.

If winter forces you to stay on the ground for extended periods, it's a good idea to make a sensible and conservative plan to begin flying again when the weather breaks. Consider flying with an instructor for the first time or two. And certainly be careful not to make those first couple spring flights in strong winds or other challenging conditions.

Now is also the time to lock in your plans for your stay at Oshkosh. AirVenture tickets are available online at *www.EAA.org* and can save you both some money and waiting in line time if you buy now.

Planning your housing at Oshkosh can never start too early. The number of people camping at Oshkosh continues to grow every year, and I promise you an even better experience this year. We will have more entertainment on the show grounds every evening, more food and beverage service into the evening hours, and two big night air shows on Wednesday and Saturday.

It's too early to know exactly which aircraft and performers will be at Oshkosh this year, but I can promise you the lineup won't disappoint. I've been hearing about several newly completed homebuilts, extremely rare warbird restorations, and one-of-a-kind antiques that we expect to fly in. The U.S. Air Force Thunderbirds are scheduled to make an appearance for the first time. And the aviation industry is working hard to unveil many new aircraft, accessories, and services during the show. All of general aviation keys its new product announcements to Oshkosh.

As a Southern California native, seeing a Wisconsin winter up close is new for me. But I now can understand how winter's cold and snow will make Oshkosh that much sweeter this summer. I can't wait. I hope you feel the same. See you soon in Oshkosh. EAA

On the cover: Jim Lloyd Butler's award-winning Midget Mustang has been brought back to life. (Photography by Phil High)

Photography by Jason Toney

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Features

Departments

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EAA Advocacy in Action

Wonderful opportunity

BY CHARLIE BECKER

WHEN YOU JOIN EAA, you are joining a membership organization. You receive many tangible benefits for joining. Each month, *EAA Sport Aviation* magazine arrives in your mailbox, and *Experimenter* hits your e-mail inbox. These are great benefits that inspire, entertain, and educate you. But I would argue the number one benefit you receive is EAA's advocacy for sport aviation.

I devoted two days this past week to participate in EAA's annual summit with the FAA's top leadership team here in Oshkosh, Wisconsin. The fact that the FAA's top leaders take the time to come to EAA headquarters in the middle of January, in arctic temperatures, says quite a bit about the mutual respect that we have built up over the years. With the ability to have the FAA's undivided attention, this is a wonderful opportunity to make progress on the big issues impacting sport aviation.

When you look back 61 years ago to when EAA was formed, there was no homebuilt movement, and "sport aviation" was a blip on the radar. In fact, experimental amateur-built (E-AB) aircraft had just recently been authorized and could not even legally carry a passenger!

Paul Poberezny, EAA's founder, established early on that EAA would work with rather than against the Civil Aeronautics Administration (CAA), now known as the Federal Aviation Administration (FAA), to achieve greater opportunities for people to build and fly. In fact, at the first EAA meeting on January 26, 1953, the main speaker was CAA employee Tony Maugeri. Fundamentally, Paul was a "people person," so he worked to build productive personal relationships with the CAA/FAA.

Within the first year of EAA, the first major expansion of homebuilt privileges was achieved by getting the CAA to allow a homebuilt aircraft to carry a passenger. EAA's own Steve Wittman received approval to carry a non-revenue passenger in his Wittman Flying Carpet, which later became the Wittman Tailwind. In the article announcing the change, EAA stated, "The EAA and its members feel that we have been given a wonderful opportunity by the CAA, but we also have to protect this right from individuals who may, through faulty construction, exceeding design limitations, and violating other Civil Air Regulations, cause this right to be taken away as it has in the past."

Over the years, EAA members have continued to demonstrate that this "wonderful opportunity" was not abused and that we could be trusted with more and more privileges. We have demonstrated this commitment to build and fly safely with our volunteer safety programs. The Technical Counselor program works toward a "zero defect" aircraft at the time of certification by voluntary, in-process inspections. Our Flight Advisor program works with our builders to make sure that a safe and well-thought-out approach to test-flying the aircraft exists. Because of this type of commitment to safety that EAA members have demonstrated, it has allowed your advocacy staff to push for more and more opportunities for E-AB.

Today, we enjoy building homebuilt aircraft that have no restriction on the number of passengers. We are able to use any materials and engines we desire. We can fly aerobatics and under instrument flight rules. We have truly made the most of our "wonderful opportunity" to build and fly homebuilts.

So let's keep what we have earned by building and flying safely. Take advantage of our safety programs to not only help yourself but also to protect the homebuilt movement. This, along with your membership, is what our advocacy staff needs to maintain our freedom to build and fly. EAA

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Unger to Continue Offering Plans for the Breezy

WITH LAST YEAR'S PASSING of Carl Unger (EAA 2515), Breezy co-designer and fixture of the AirVenture Oshkosh flightline, there was concern over the status of Breezy plans. Would the iconic aircraft so closely aligned with the EAA homebuilt movement still be available? It is not uncommon for the availability of plans to become an issue after the passing of a longtime designer.

We are pleased to report that that is not the case with the Breezy. Carl's son, Rob Unger, EAA 585561, has picked up where his dad left off. Rob is also fully committed to keeping the Breezy plans available for future generations of EAA members to enjoy building. This year, 2014, is the 50th anniversary of Breezy, and at EAA AirVenture Oshkosh 2014 we're working with Rob to celebrate the golden anniversary of the Breezy design.

We encourage anyone with a flying Breezy to join us at Oshkosh. A dozen owners have already committed their aircraft to the event. For more information on the celebration, Rob has set up a Breezy page on Facebook. For more information on the plans or the Breezy 50th celebration, you can contact Rob Unger at *rubreezy@msn.com*.

AirVenture Advance Purchase Camping Now Available Online

AIRVENTURE ATTENDEES planning to stay at the drive-in Camp Scholler campground during EAA AirVenture Oshkosh 2014 now can prepurchase camping for prime arrival dates. AirVenture is set for July 28 to August 3 at Wittman Regional Airport in Oshkosh, Wisconsin.

Advance camping purchase for Camp Scholler provides the convenience of express registration at the campground entrance through specially designated gates.

To access the advance ticketing area, visit *www.AirVenture.org*.

Along with camping and admission, you can also purchase flight experiences on the B-17 and Ford Tri-Motor in advance, admission to the Aviators Club area, special AirVenture gear, and weekly or daily parking.

Spending Bill Funds Unleaded Fuel Testing

IN JANUARY, CONGRESS passed the Omnibus Appropriations Bill of 2014, which included language that funded the Piston Aviation Fuels Initiative (PAFI), a key step in the road toward transitioning to a high-octane unleaded piston aviation fuel. The appropriation is slightly above the requested level through fiscal year 2014, and the fact that current FAA budget authorization is for a three-year duration means this level of funding would also likely continue at least through fiscal year 2016.

PAFI is an FAA/industry partnership charged with evaluating candidate fuels and developing data to support fleetwide certification for their use.

"This is a crucial program for the health and long-term viability of general aviation," said Doug Macnair, EAA vice president of Government Relations. "Funding PAFI at the requested level keeps us on track for a managed, sustainable, and safe transition to a high-octane unleaded replacement for 100 low lead."

The spending bill contained other measures to help GA, including funding for the contract tower program and a renewal of language prohibiting user fees.

Three Aviation Areas on NTSB Most Wanted List

THE NATIONAL TRANSPORTATION SAFETY Board's (NTSB's) Top 10 Most Wanted List of Transportation Improvements for 2014 contains three major items for aviation safety: hazardous weather awareness, helicopter operations, and cockpit distractions.

The Most Wanted List establishes the board's priorities and typically includes focus items from its areas of responsibility such as aviation, highways, maritime operations, pipelines, and rail systems. Last year's list included "improving general aviation safety" as a major item, citing a GA accident rate that was "6 times higher than for small commuter operators and 40 times higher than for transport category operations."

EAA responded to the call by expanding the role of the EAA Safety Committee, enlarging the safety article section in *Sport Aviation*, furthering development of the Type Club Coalition, and working with its chapters to encourage increased use of technical counselors and flight advisors for experimental amateur-built aircraft.

The NTSB noted that a failure to recognize or take appropriate steps to avoid hazardous weather is a "frequent cause or contributing factor" to GA accidents. The board also stated accident investigations and safety studies in all modes of transportation underscore "the dangers of using portable electronic devices while operating a car, train, plane, or marine vessel." Helicopter operations were added to the list due to the "overwhelming growth and demand" for helicopter services.

"Hazardous weather is a perennial causal factor in aviation accidents, and we agree with the NTSB that there is significant work to be done in educating the pilot population in ways to avoid weather-related risks," said Sean Elliott, EAA vice president of Advocacy and Safety. "We will work closely with our safety committee, safety columnists, and chapter leaders to get the message out about how lack of knowledge and poor decision making related to weather contribute to what are very often preventable tragedies—and more importantly, how to avoid those tragedies entirely."

EAA to Participate in AOPA Regional Fly-Ins

EAA WILL BE PARTICIPATING in the series of AOPA regional fly-ins in 2014, providing attendees more opportunities to get involved in aviation and discover more about the many activities and programs available through EAA.

EAA's participation in the fly-in series was among the items finalized during the mid-December meeting between EAA and AOPA leadership in Oshkosh. AOPA will also increase its participation at EAA AirVenture Oshkosh this summer.

The complete schedule of EAA activities and outreach will be finalized in the coming weeks, but it will be part of the fly-in series announced by AOPA at:

San Marcos Municipal Airport, Texas (HYI) – April 26, 2014
Indianapolis Regional Airport, Indiana (MQJ) – May 31, 2014
Plymouth Airport, Massachusetts (PYM) – July 12, 2014
Spokane Felts Field, Washington (SFF) – August 16, 2014
Chino Airport, California (CNO) – September 20, 2014
Malcolm McKinnon Airport, Georgia (SSI) – November 8, 2014

Valdez STOL Aircraft to Showcase Unique Capabilities at EAA AirVenture 2014

SPECIALLY MODIFIED AIRCRAFT, originally created for Alaskan bush-pilot necessity, will be part of the Valdez STOL (short takeoff and landing) flying activities at EAA AirVenture Oshkosh 2014.

Demonstrations featuring the unmatched capabilities of the airplanes that compete at the annual Valdez Fly-In & Air Show in May each year will be held several days at Oshkosh. More than a dozen of these aircraft, including homebuilt and specially modified production airplanes, will be participating at AirVenture 2014. They are based on aircraft that provide supplies to the rugged and far-flung outposts throughout Alaska. The demanding terrain in that state requires that aircraft take off and land on rough runways often less than 500 feet long.

Along with flying demonstrations during AirVenture's daily afternoon air show July 28 to 30, the Valdez STOL aircraft will stage a "fun flying" demonstration from the grass ultralight runway on Friday evening, August 1. In addition, the aircraft will be on display in special parking areas and on the main showcase ramp at Oshkosh, with pilots and builders part of forums and evening programs throughout the week.

Further details and schedules of the Valdez STOL aircraft activities will be announced as they are finalized. Visit *www.AirVenture.org* for additional information, including advance ticket and camping purchases. Click here to see the Valdez STOL aircraft in action. EAA

Photography by Jim Koepnick

Quicksilver EMG Makes First Flight

ADVENTURE AIRCRAFT, a subsidiary of Rainbow Aviation, announced the successful first flights of its new Electric Motor Glider 6 (EMG-6). This aircraft is a joint collaboration between Adventure Aircraft and Quicksilver Aeronautics. The EMG-6 flew on December 20, 2013, at Corning Municipal Airport in Corning, California, and was piloted by aircraft designer Brian Carpenter. The glider was towed aloft by a 400-cc Honda quad runner.

Although the aircraft is equipped with a small electric motor to fit into the FAR Part 103 category (allowing for flight without an FAA pilot certificate), all of the initial flight tests were conducted as a pure glider without any of the drag reduction enhancements and without the use of power.

Flight testing will continue into the spring with a multitude of different configurations: pure glider, glider with a single-engine electric sustainer motor, 40-hp single-engine, twin-engine, and tri-motor configurations. Testing will continue by evaluating several combinations of speed fairings, gap seals, and cockpit enclosures, most of which will be manufactured from lightweight carbon-fiber materials.

The EMG-6 aircraft can be built as a single-place, FAR Part 103 ultralight and then legally converted at a later date into a two-place experimental aircraft. The folding wing and folding tail design reduces the machine's storage footprint, making it possible to fold the aircraft and store it in your garage at home.

With a gross weight design limit of 750 pounds, theoretical flights lasting as long as three hours are possible using current battery technology. The prototype aircraft will be flown initially with two 20-hp brushless Predator 37 motors manufactured by Plettenberg of Germany. The motors, controllers, batteries, and propellers are all off-the-shelf components currently used in the giant-scale, radio-controlled aircraft industry. Adventure Aircraft also feels there are several other viable powerplants that are currently available.

This aircraft can be built as an experimental amateur-built aircraft, and it can be flown with a fixed-wing sport pilot certificate without a glider rating as long as the aircraft is flown as a single-place aircraft. Additionally, a glider pilot can fly it as an electric-powered glider with multiple engines without a multiengine rating. No medical certificate is required.

Adventure Aircraft hopes to offer an entry-level kit near a $10,000 price range and is diligently working on a fast-build kit requiring less than 80 hours to assemble.

While Adventure Aircraft currently uses a four-wheeler to tow the prototype, thousands of aircraft are capable of towing the EMG-6 (with a tow speed range from 30 to 60 mph). Learn more about the EMG-6 at *www.ElectricMotorGlider.com*.

Newly Approved SeaRey Elite

THE ELITE VERSION OF Progressive Aerodyne's SeaRey light-sport amphibious airplane received FAA certification in December. It's powered by the turbocharged Rotax 914 and offers a large sliding canopy that can remain open while flying, GPS, angle of attack and gear position warning systems, wide cabin, and more.

"We are so pleased and excited about being able to offer our SeaRey light-sport amphibious Elite to the market," said Adam Yang, company CEO.

The first SeaRey flew in November 1992, and kits were offered by the family-owned business. Progressive Aerodyne is now in full production of two configurations of Searey amphibious airplanes, the SeaRey and the SeaRey Elite. In addition, the company continues to manufacture kits.

For more information, visit *www.searey.com* or call 855-732-7395.

Photography courtesy of Adventure Aircraft

Murphy Aircraft for Sale

MURPHY AIRCRAFT MANUFACTURING Ltd. of Chilliwack, British Columbia, is on the market, according to company founder and President Darryl Murphy, who started the company in 1985. Asking price is in the $2.5 million to $4 million–dollar range, depending on how much of the manufacturing machinery the buyer wants to purchase.

"After 30 enjoyable years running Murphy Aircraft Manufacturing Ltd., I am approaching retirement, with the desire to spend more time with family and pursue other interests," Murphy said. "To that end, I find myself in the position of wanting to sell Murphy Aircraft Manufacturing Ltd."

The package includes all eight aircraft models and three sizes of straight and amphibious floats, existing inventory, and quick-build jigs for the Renegade and Moose. "With strong signs of economic recovery in North America, the time is right for someone else to take over," Murphy said.

Murphy has sold nearly 2,000 kits all over the world, led by the Renegade and Moose models, which are known for being capable, roomy bush aircraft with high useful loads.

Murphy Aircraft will continue to supply new kits and service parts throughout the changeover to new ownership and anticipated expansion. Patterson AeroSales, which handles all Murphy kit sales and marketing, will continue to accept and process orders for delivery positions now and throughout the expected year-long transition to new ownership.

Interested parties should contact Murphy at *dmurphy@murphyair.com*.

New and Improved Diagnostic Software for Rotax 912i Series Engines

ROTAX HAS RELEASED a new version of the BRP Utility and Diagnostic Software (aircraft version) which runs on Windows. The software package allows users of the 912iS to download engine log files, update engine control unit firmware, and monitor engine functions in real time for diagnostic purposes—a great asset for field maintenance. This updated version includes an optimized graphical user interface (GUI) and other improvements. Use of this software requires an optional BUDS set (USB interface and cable) available from your Rotax supply network.

Download the Service Instruction here.

CPS Announces Spring 2014 Rotax Class Schedule

CALIFORNIA POWER SYSTEMS (CPS) has announced its spring schedule of Rotax maintenance classes.

The Rotax Two-Stroke Service Course is for technicians wanting to rebuild or maintain all water-cooled and air-cooled two-stroke Rotax aircraft engines. Emphasis is on students being able to perform a complete engine rebuild with failure analysis and a focus on preventative maintenance. The course will be held February 28 to March 1.

The Rotax 912/914 Service Class is for technicians wanting to service 912 series engines or owners wanting to do their own scheduled maintenance. This course will give any FAA A&P mechanic or light-sport aircraft repairman certificate holder the credentials to perform all scheduled maintenance and level one troubleshooting procedures. This class will be held March 2 to 3.

The Rotax 912/914 Maintenance Class is for technicians wanting to perform more in-depth maintenance tasks on 912 series engines. The class focuses on troubleshooting faults, removing major components for shipment for heavy maintenance–rated technicians, and reassembly. This class will be held March 4 to 5.

The Rotax Two-Stroke and 912/914 Renewal Course is for current iRMT certificateholders. The renewal program will cover all new materials released within the past 24 months. This is the most inexpensive and informative way to get a 24-month extension on your current certification. The course will be held March 6.

CPS
CALIFORNIA POWER SYSTEMS
EXPERTS IN LIGHTSPORT AVIATION

The Rotax 912/914 Heavy Maintenance Class is designed with professional mechanics in mind who are looking to make a living as a Rotax repair technician. The class covers a complete field-level teardown, inspection, and reassembly. The class will be held March 7 to 9.

All classes will be held at CPS' training facility at the Chino Airport (KCNO). For detailed information and future schedules for any Rotax classes, visit the CPS website at *www.CPS-Parts.com/menus/rtx/zclasses.html*. Call 1-800-AIR-WOLF (247-9653) or 951-549-7786. EAA

Sport Aviation

Craig and Sandy Gainza's *Pirate Cub*

BY LYNNE WAINFAN, EAA LIFETIME 504081

Photography by Michael Steineke

Pirates

"IT'S NOT EVERY WOMAN whose husband will spend three years building her a plane," Sandy Gainza said. A commercial pilot, Sandy fell in love with her husband Craig, EAA 535956, more than three kids ago. Next, she fell in love with the American Legend Cub after riding in one in 2009.

Craig watched her take her ride and observed, "She came out of the airplane grinning ear to ear." Next, Craig tried on the plane and was pleasantly surprised that he fit—in the front and back seats. At 6-foot, 3-and-a-half inches tall, he was used to cabins being too small for him. When he had sat in an original Piper Cub, his knees had been pressed against the instrument panel. The Legend Cub that Sandy liked had a cabin that's 28.5 inches wide by 50 inches tall.

Craig and Sandy Gainza

Aside from Sandy's enthusiasm and Craig's roomy fit, a few other considerations tipped the scale in favor of buying the kit version of the Legend Cub, called the Texas Sport. For one thing, the Gainzas' youngest daughter was off at college, so the couple would have more time to build and fly. Plus, Craig and Sandy had built a Lancair and were looking for "the anti-Lancair," an airplane that would be completely different. A periodontal dentist by trade, Craig has an unusual motivation for building airplanes after work: "I spend my whole day working inside a 3-inch hole. I wanted to spend the rest of my time working on something bigger."

So after a careful consideration of all the factors (but really justified by making Sandy happy), Craig told her, "If you want this airplane, I'll buy it." Sandy said, "I could see he wanted to build one." It was settled. The Gainzas ordered a Texas Sport kit in 2010.

Here's the way the purchase works. American Legend Aircraft Company builds factory-complete aircraft, including the Legend Cub. The Legend Cub airplane has been certificated as a special light-sport aircraft (S-LSA) and is used by a number of flight schools for tailwheel training, among other things. The American Legend Aircraft Company also sells kits. The kitted airplane is called the Texas Sport (sometimes called the Texas Sport Cub). When the company gets an order for a kit, they pull one of their uncompleted Legend Cub airplanes off the line. Since the Texas Sport that is to be assembled by the user

The Gainzas' Pirate Cub is the E-LSA version of the American Legend Aircraft Legend Cub. A big advantage of E-LSA is that any owner, including non-builders/second owners, can take a 16-hour repairman training course to become the repairman for that aircraft. The downside is the aircraft must be built exactly like the S-LSA version without modifications.

Photography by Michael Steineke

In addition to traditional round instruments, Craig added a Garmin G3x flight display and TruTrak autopilot.

is not built by the factory, it is not a certificated S-LSA like the finished factory-built planes. Instead, the amateur-assembled aircraft must be certificated as an experimental light-sport aircraft (E-LSA), and must conform to one of the factory-built S-LSA.

As a side note, just because you assemble the E-LSA airplane, you are not the repairman. To get a repairman certificate, you must take a 16-hour training course.

The Texas Sport is constructed very differently than the Lancair; instead of using composite materials, the builder constructs the plane mostly out of aluminum. Two items inside the cabin of the Gainzas' new airplane look decidedly nonaluminum. The immediately obvious one is the wooden floor. It is the color of maple and is absolutely perfectly finished—shiny enough to make me put on my sunglasses. The other nonaluminum parts were the carbon composite wing roots, interior door thresholds, and window pillars. Oops! Those weren't composite—they were decals from a Pep Boys automobile parts store.

In addition to the differences between building the Lancair and the Texas Sport, there are significant differences in flying the planes, too. Sandy, a conservative pilot, was interested in a plane with a lower in-flight workload. "There's nothing like the Lancair to get to Oshkosh in one stop, but it's a lot more pressure to fly," she observed. The air traffic control workload involves a lot of talking, and handoffs come quickly at such fast airspeeds. The Lancair cruises at 330 mph.

Craig was also thinking about the speed differences in flying the Texas Sport. "There's something romantic about flying

Craig Barnett of Scheme Designers (www.schemedesigners.com) created the Pirate Cub logo for Craig and Sandy.

low and slow, especially late in the day," he said. Sandy agreed, saying, "The Lancair is exciting and beautiful, but I have a 100-mile-an-hour brain."

Other differences from the Gainzas' Legend Cub include the Lancair power (100 hp versus 350 hp), gross weight (1,320 pounds versus 3,550 pounds), useful load (475 pounds versus 1,350 pounds), two-person versus four-person seating, cruise speed (97 mph versus 330 mph), and stall speed (35 mph versus 75 mph).

A few things are the same between the Gainzas' Lancair and the new plane. Both have a 35-foot wingspan and a

The cabin of the Legend Cub is 28.5 inches wide and 50 inches tall, much roomier than the original Piper Cub.

Craig chose the optional Continental O-200D engine because of his good experience with the Continental engine in their Lancair IV-P.

comparable length—22.5 feet versus 25 feet. The most obvious similarity in Gainzas' airplanes is the outstanding workmanship that the two planes share. Their Lancair IV-P won the reserve grand champion award in 2006, and their Texas Sport was named a kit champion (Bronze Lindy) at EAA AirVenture Oshkosh 2013.

Craig said that the Texas Sport's amazing finish was more difficult than that of the Lancair. "With composites, I can fill and sand the mistakes," he said. "The fabric world is not so forgiving." Craig's commitment to outstanding workmanship is round-the-clock: "I'm a perfectionist; I couldn't sleep at night if I didn't do a great job on the teeth I work on. It's like that with the airplanes I build; I couldn't sleep at night if it wasn't just right." He reports that his perfectionism is for himself: It isn't so important to him that others are impressed with his workmanship—it's important to *him* to make a nice-looking airplane.

After Craig ordered the Legend Cub kit, he knew that he needed to educate himself on a new construction technique: fabric covering. He took a fabric covering workshop at AirVenture and realized he needed to learn a bit more. So he called up the local junior college and got four more days' instruction from one of the teachers. The admittedly perfectionist Craig observed that the instructor wasn't very careful.

When Craig was notified that his Texas Sport kit was ready for delivery, he opted not to participate in the company's three-week fast-build program, saying that, "Part of the enjoyment of this experience is the build." He moved the kit into the shop in the garage that he had used for the Lancair. Craig had originally built the shop there instead of in a hangar in order to be close to the family. Then he settled into a regular routine. He had Wednesdays off, and spent them building. He also worked on the airplane one full day each weekend—sometimes two. Sandy helped with the build but acknowledged that Craig did the vast majority of the work.

Craig praised the American Legend Aircraft Company for its product and service. The kit was top-notch with good quality. "It was one of the cleaner kits I've seen," he said. Craig reported that the fit and the welds were quite good.

Photography by Michael Steineke

He also said that he was pleased with the company's customer service. Craig received a manual with photos, but the inevitable questions would arise as he built. He said that American Legend answered the phone promptly and always had the answers he needed.

Craig was also impressed with the structural design of the Texas Sport. The original Piper Cub had at least one accident where the cabin was crushed from the top. The Texas Sport had been beefed up structurally to improve its safety. American Legend had put a cage over the cabin, including a bracing bar over the seats. Craig said that the bar is strong enough to handle pull-ups, and it provides a good grab bar for getting in and out of the airplane. By the way, unlike the original Cub and Super Cub, the Texas Sport has two doors.

Craig explained his choice of the 100-hp Continental O-200D. "We had a Continental TSIOF-550-E1B for the Lancair, and we'd built a relationship with Continental." This relationship carried over to the new engine. "The support was so great during the Lancair installation, I had to buy another Continental." The O-200D is very lightweight and had been chosen by Cessna for the Skycatcher. Craig gave Continental some lead time when he ordered the engine and was pleased that it arrived before he needed it.

Although Craig liked the airplane's design and kit construction, he made a few cosmetic changes to the airplane. "Cosmetic, mostly, but it's as stock as possible," he said. Craig also researched finishing materials and reduced the weight of primer and paint. He used the weight savings to put in an autopilot and upscale avionics—a Garmin G3X and a TruTrak GX autopilot. Craig, who is also a pilot, chose these specific brands because they would improve the flying experience and because Garmin and TruTrak were having a package deal at AirVenture.

The only tricky part of the build was the engine cowling. The airplane was originally designed for a 65-hp engine, but Craig's 100-hp engine was a little bigger. Getting the cowling to fit well and be straight was one of the build challenges. Craig ended up buying the cowling from American Legend.

Excellent attention to detail result in the Gainzas' Pirate Cub being named a Kit Champion at EAA AirVenture Oshkosh 2013.

The build went smoothly. Craig's day job involved working with his hands, and he carried that skill over to the Sport Cub. The project was completed in three years at Craig's two to three days per week pace.

Craig wanted to come up with a theme for the airplane. "It's a Cub, but it's really a Cub that's been modified and improved—it's been pirated," he explained. "That's where we came up with the name, the *Pirate Cub*." The Gainzas had worked with graphic artist Craig Barnett on the Lancair paint scheme, going through hundreds and hundreds of designs. Craig called Barnett and told him they had a new plane, and Barnett devised a *Pirate Cub* logo that would be used again and again: on the airplane, on the blanket the Gainzas spread on the ground for watching the air show, and also on hats. Surprisingly, Barnett got this logo right on the very first design. He also devised the graphic design for the entire airplane. Sandy had declared that the airplane would not be Cub yellow.

Once the *Pirate Cub* was completed, it was time to get it registered as an E-LSA. This part of the process did not go well. "One thing we learned was to never use the word 'kit,'" Craig said. "What we might call a kit in the E-LSA category is more accurately called an unassembled aircraft." Craig said that the FAA's "allergy" to the word "kit" is because E-LSA registration is very different from experimental amateur-built aircraft certification. "With E-LSA, you have to conform to what the manufacturer has done. That's taking parts and putting it together just like they [the manufacturer] meant for it to be put together. The experimental amateur-built category allows modifications all the way through the process." Once an applicant uses the word "kit," then the implication is that the builder might have made modifications along the way. This is not allowed under E-LSA regulations. Another registration challenge was that the FAA representative tried to convince Sandy that the E-LSA category of airplane no longer existed. Fortunately, the Gainzas were able to educate the FAA.

Even though the *Pirate Cub* was built for Sandy to fly and she has almost 1,000 hours with a commercial rating, the Gainzas decided that a professional pilot would flight-test the tailwheel airplane. "Airplanes need to be respected, just like people," Craig said. They selected Pete Zaccagnino, founder and president of High Performance Aircraft Training. Zaccagnino has flown more than 250 first flights of homebuilts and gives training either at his location in Florida or at the customer's airport. The *Pirate Cub* only required 5 hours of flight testing because of the E-LSA certificate. Sandy reports that Zaccagnino's methodology was very rigorous and organized. He completed the testing in two days and then started training Sandy to fly the *Pirate Cub*.

Sandy had prepared to fly the *Pirate Cub* by flying other taildraggers: two different types of Citabrias, an original Cub, and a Husky. When she flew the *Pirate Cub*, she found that the control inputs were easier than the other planes, and "It was almost impossible to stall. If you do, it's a nonevent." The responsive controls give the airplane a quick and easy recovery. "It flies beautifully." Craig loves flying with Sandy. "Windows open, doors down—it's such a nice feeling," he said. "She's happy flying the plane. I'm happy that she's happy." But Sandy cautions, "The main thing you have to watch out for when you're new to it is ground looping and accidents on the ground. It's not the flying—that's not complicated—but landing it is another story. I feel like I have a lot to learn on that, how to do it correctly." Sandy has landed in conditions with a crosswind component of around 10 knots, but she said that anything over 5 knots is an adventure.

Sandy flew the *Pirate Cub* to Oshkosh solo. It was a "Lindbergh moment" landing at AirVenture. Sandy had plotted her course from northern California so as to avoid the high mountains and to land at small airports without much crosswind. The airplane's 260-foot landing distance and 310-foot takeoff roll made even those small airports look big. The *Pirate Cub*'s maximum useful load of 500 pounds allowed the petite Sandy to carry enough baggage for the trip to Oshkosh. A 38-mph stall speed takes a lot of worry out of the landing experience. The flight from northern California took 24.1 hours—not bad for an airplane with a no-reserve range of 315 miles that cruises at 97 mph.

Sandy and Craig had very different motivations for participating in the *Pirate Cub* project. Sandy said she wasn't interested in building an airplane at all until the couple were halfway through the Lancair build. Although she helped a little with the building, the flying is the exciting part for her. Craig is the opposite: "Flying is the icing on the cake, but building is the cake." EAA

Lynne Wainfan is a private pilot. Along with Barnaby Wainfan and Rick Dean, she helped built The Facetmobile experimental plane, which Barnaby designed. An aerospace engineer and former manager at Boeing Space, Lynne now teaches at California State University, Long Beach.

Photography by Michael Steineke

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Photography by Phil High

Considered to be one of the finest pieces of sheet metal craftsmanship ever created, Jim Butler's 1964 champion had disappeared from sight until rediscovered by Lew Shaw.

Return of a Homebuilt Legend

The Jim Lloyd Butler Midget Mustang: Champion 1964

BY BUDD DAVISSON

Put on its nose at some point, the Midget Mustang's original landing gear was replaced by Shaw with Grove gear legs, which are gun-drilled and airfoiled.

There is no filler or fiberglass in this photo: it is all formed aluminum.

IT IS OFTEN SAID, and widely believed, that the beauty of art is in the eye of the beholder. Hence the classic debate about "What is art?" However, once in a while an artist will render his medium in such a way and to such a degree that his work is universally recognized as "art," regardless of how it is defined or who is viewing it.

Such is the craftsmanship of Jim Lloyd Butler (1919-2008). Like so many artists before him, he has left us sculptures that challenge the eye to find defects, and he set standards that will forever be judged as among the highest ever set. This is especially so, because the sculpture is an airplane and the medium is aluminum.

The name Jim Lloyd Butler is normally only known within the ranks of hardcore homebuilders who have more than a little gray in their hair. That's because his sculptures predate the last generation or two of EAA homebuilders. He was one of the few to ever gain champion status at the EAA's national convention three times, first at Rockford (Illinois), in 1964, then again two years running—'73 and '74—at Oshkosh with a different airplane. (More recently, Paul Muhle has shared that honor as well.)

Unfortunately, though, even those who know Butler's name haven't seen one of his signature Midget Mustangs (MMs) for many years. That changed this year, when Lewis Shaw, EAA Lifetime 54176, a confirmed practitioner of all possible types of sport aviation from Dallas, Texas, arrived at EAA AirVenture Oshkosh 2013 and put his newly restored Jim Butler '64 grand champion on display. For many newcomers to sport aviation, it was difficult for them to believe the airplane was aluminum and not composites. Such flawless surfaces are not normally associated with aluminum. However, "flawless" is the most common adjective applied to Butler's work. And owner/restorer Lew Shaw knows that.

Lew said, "Building a Midget Mustang from scratch, without kits, was and is simply a heroic effort that few of us can accomplish, and today few have the time or the determination to do it to the level Butler did. Not to mention the skill. And he did it all by himself. Every bit of it. There was no community of builders for the Midget. No chat groups. Further, it should be mentioned that at the time, complete plans for the airplane didn't really exist.

Photography by Phil High

So, from doing his own plans for the control and fuel systems, to the jigs, to making the rollers bend the amazing leading edge, to blowing the canopy, he did it all. He was a body shop guy, bringing life back to bent and broken fenders without Bondo or epoxy. And that's the way he built his airplanes. No filler. No excuses. His second MM-1 that won in both '73 and '74 clearly showed his attention to detail because he polished everything, including the hand-hammered cowl, which under the paint his first Midget had as well.

"In those days, to have your own Midget Mustang, you had to be so obsessed, so dedicated, and so determined that only the most undistracted could complete the journey. You had to focus on solving each problem completely to reach the end, one part at a time. There was no instant gratification or quick-build kit, no matched drilled parts, no easy slab sides for the fuselage. You didn't build a Midget Mustang. You built a part, a rib, or the form to make a rib. I don't think Butler ever looked at a piece of aluminum and saw an airplane. Like a chunk of stone was for Michelangelo, he saw a rib hidden inside the sheet and had to figure a way to reveal it."

Butler's nephew, Jamie Kent, remembers, "Number one was started in a converted chicken coop that leaned against a barn on my grandfather's place. The fuselage and wings were mostly built there before he moved them to a garage/workshop he built behind his own house.

"He was a fix-it kind of guy and had many mechanical skills he picked up from his father and in his jobs, not to mention having a truly logical and imaginative mind. He was a real thinker with a dry sense of humor."

Jamie is a professional machinist, so he knows whereof he speaks when he said, "Jim's machining skills were phenomenal. He would think out how to accomplish a task with what machinery he had, and that was limited. He would do things that were out of the box, considering what he had to work with.

"After he lost his medical, he sold the retract [gear airplane], but he started building running model engines of various types. As I recall, he built nearly 200 of them. He built what is reputed

Lew Shaw

Intending on flying the airplane to as many air shows as practical to spread the Jim Butler legend, Lew Shaw opted for more modern instrumentation.

to be the only scale Wright Flyer engine that ran. It is now out west in a museum."

The Butler retractable Midget Mustang that was grand champion both in '73 and '74 never left the public eye. Lew bought it, and when he saw that fellow Mustang lover and close friend Nancy Pierce of Dallas loved the airplane as much as he did, he let her buy it (while he retained flying rights). He knew Nancy was going to provide a good home for it. She still has it.

The first Butler grand champion, N955Z, however, didn't share the good fortune of the retract. In fact, for all intents and purposes, except for a few locals knowing of its existence, it disappeared. All that appeared to remain of the airplane was its legend—and the image it had left in many minds via a cover on the December '64 issue of *Sport Aviation*. Enter Lew Shaw.

Before hitting a home run in real estate and construction, Lew had a ridiculously intense background in aviation. Initially he was turned down for flight training while in the U.S. Air Force (USAF), but that didn't stop him. He borrowed the money to learn to fly and eventually badgered the powers-that-be into letting him into flight training. While he was in flight training, he bought a Swift, which led to a long string of sport aircraft and warbirds that greatly expanded after he got out of the Air Force.

Lew said that from his earliest days as a pilot the Midget Mustang always flitted around the edges of his thoughts. "There are few designs that have brought more dreams to pilots than the Midget Mustang. 'Out of the sun, with the piper on, tracking the evil Nazi in his Messerschmitt attacking the bomber stream...' (quoting from *The Rise of the Fourth Reich*).

"I drooled over Butler's retract plane at Oshkosh in the early '70s, asking a lot of silly questions. But when I looked at it the next day, he had one wing folded, and I almost fell over! Where was the joint line on the wing? Unbelievable craftsmanship! I had bent metal pieces for my Swift. I put the first P-51-style gear leg fairings on one. But I had never seen any workmanship like Butler's Midget Mustang. And I still haven't seen better.

Jim Butler modified his second Midget Mustang, also a champion airplane, to have folding wings and retractable landing gear and left it polished and unpainted.

The name Jim Lloyd Butler is normally only known within the ranks of hardcore homebuilders who have more than a little gray in their hair.

That's why, when the airplane came up for sale, I pounced on it. I had to have it in my hangar.

"I knew about his first airplane, but I had yet to meet anyone who knew what had happened to it. Then, while on a trip to Phoenix about 15 years ago, I was hangar-bumming on a weekend and saw a distinctive tail sticking up from an open 16-by-4-by-4 box. I asked if it was a Midget Mustang. The owner told me it was an EAA grand champion Midget built by Lloyd Butler. That was it! I had to have the first one he built if for no other reason than to preserve it. I absolutely couldn't believe I'd stumbled across it!"

According to Lew, the airplane had been put on its nose with various attempts at fixing it, none of them holding up to the quality of the original work. However, he said, "I was told all the parts were there; of course, they weren't...so I made a deal that started a very long rebuild."

The airplane had no corrosion because, Lew said, "The build work by Butler was so thorough as to keep the airplane going for 100 years. But it had post-Butler work on it that needed to be redone, and all the systems and small parts were missing. I tried to do some work on it myself with my mechanic, but that and other efforts went nowhere. Finally, after five years of start and stop, I hired Nelson Ezell, EAA 484845, in Breckenridge, Texas, to finish it. He did it for two reasons: friendship of 25 years and to help preserve the work and beauty of Lloyd Butler as it deserves."

Working on an airplane like the Midget Mustang was far outside of Nelson's normal field of endeavor. Known internationally for his warbird restorations (see *www.EzellAviation.com*), he has brought dozens (maybe hundreds) of warbirds back to life, from Mustangs and Bearcats to the fantastically detailed Red Bull P-38. Often the aircraft he begins with are barely recognizable as airplanes. So, the Butler Mustang looked wildly out of place in his huge rebuild facility. However, among Lew's long list of owned aircraft are four P-51 Mustangs (the full-sized kind), most of which had spent time in Nelson's shop. Both Nelson and Lew appreciated high-quality work, so the baby Mustang became a "fill-in" project that was fit in between the major warbird projects as time allowed.

Lew said, "Although the airplane had suffered from the years of storage and handling, it had been modified very little. Just the carb inlet and the panel were different. I didn't change it, either. I wanted to keep it simple, like a sport plane should be. Modern safety features like better brakes, exhaust, and fuel systems were included in the rebuild, but a small transponder, a small transceiver with a GPS, and an all-in-one engine and nav unit made the airplane more usable."

Photography by Phil High

The engine is a Mattituck-modified Continental 0-200 with Airflow Performance fuel-injection and a four-into-one exhaust system.

The MT composite, electrically controllable propeller greatly improved the airplane's performance both on takeoff and cruise where it indicates 160 mph at 5.7 gph.

If one were to put the '63 Butler Midget Mustang next to other, more modern MM-1s, it would be difficult to notice any differences. However, since Butler didn't have plans and was a devoted and imaginative craftsman, internally there are lots of subtle differences. With no fully developed plans to follow (the designer, Dave Long, died before he produced them), Butler just used his common sense and abilities to fill in the gaps. So the fuel system, control systems, and other internal parts differ from what are now accepted MM-1 designs.

There is no fiberglass on the airplane. The wingtips, for instance, are aluminum, hammered in two pieces, the now invisible gas weld where they join runs down the centerline.

Although it's not known exactly what alloy Butler used, when free-forming the cowl, in all probability it was the favorite of most aluminum craftsmen—3003. With no in-process photos to tell us Butler's secrets and not being able to peek inside the cowl, one could conclude that the inlet areas were probably formed separately from the cheeks themselves, then welded together. The cheeks were formed in manageable sections, hammered into shot bags, and finished on a Butler–designed and built English wheel to match a skeletal wooden form. Then all the sections were gas welded together. As shown in the polished surfaces on his second, retractable gear, MM-1, he used no filler to hide imperfections.

Inasmuch as it is known that there is little or no filler on the airplane, one has to marvel at the way in which Butler was able to skin the wings and fuselage with no deformation whatsoever at the rivets. Also, while at Oshkosh 2013, the weather conditions changed from sunny and warm to cloudy and cool, yet the skins never appeared to change. They were always drum-tight without a hint of waves.

The engine, an O-200, was built by Mattituck, which installed an Airflow Performance fuel-injection system and a four-into-one exhaust, both helping to boost the engine an unknown amount. According to Lew's pilot, Chris Gardener, who brought the airplane into Oshkosh, the engine/prop combination must be right because it is very smooth.

The airplane had no corrosion because, Lew said, "The build work by Butler was so thorough as to keep the airplane going for 100 years.

At 6 feet 2 inches tall with a 36-inch inseam, Chris looked out of place standing next to the airplane at Oshkosh. It was easy to picture him folded up like a pocketknife in the airplane, but he said it wasn't uncomfortable at all, and he made the Dallas to OSH flight in one day.

"Two-hour legs are comfortable, both fuelwise and physically," he said. "The controls on the airplane are quite quick on all axis, but it is actually fairly stable and presented no problem on my cross-countries."

Chris had flown aircraft such as Pitts and Extras prior to the MM-1, so he was prepared. But, as hundreds of other Midget Mustang pilots have reported, it wasn't at all difficult to fly.

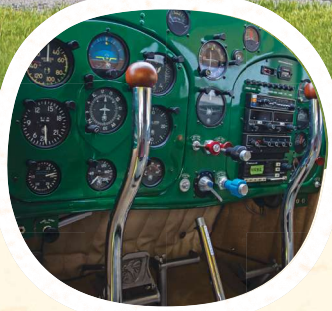
"On my first flight, I didn't know what to expect," Chris said, "but it was really quite civilized and performs really well. The composite MT electric prop uses a rheostat to set the rpm, and it really holds the rpm and is fairly quick to auto-adjust unless you're making hard pitch changes. Then it gets just a little behind.

"It stalls at 80 mph indicated clean and around 65 to 69 with full flaps, 25 degrees, down. It cruises at about 160 mph indicated, and I fly downwind at 120 and final at 100 mph. We're over the fence at 85 to 90 mph, and it generally pays off at 78 to 80 in flair. Three-point landings work well and it tracks really straight. The tail wheel is directly linked to the rudder so it reacts quickly; but you don't really need to do much with the rudder on rollout. I should mention that we have Grove gear legs on it that are gun drilled, airfoiled, and polished. They are running on Grove wheels and brakes, and the geometry must be almost perfect because of the way it handles on the runway."

One of the big disappointments for the Butler Mustang crew at Oshkosh was that it didn't get both of Butler's Mustangs to the event. Nancy Pierce was flying her Butler retract MM-1 and had left with Chris, both planning on displaying the two airplanes together. Unfortunately, her airplane developed a mechanical problem and had to abort. Maybe next year the two will make it and we'll be able to enjoy the artifacts left behind by Jim Lloyd Butler, a man who lived to create aerial art. EAA

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

Photography by Phil High



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EAA
THE SPIRIT OF AVIATION

Gliders and Sailplanes 101

A short course for experimenters

BY MURRY I. ROZANSKY, EAA LIFETIME 48039

Photography by Jim Koepnick

This Pipistrel Sinus motorglider is one of several motorgliders powered by four-stroke Rotax 912 engines. This aircraft is certificated as a special light-sport aircraft.

A Piuma Project glider get-together. Piuma's are light, plans-built, mostly wood, one- and two- place motorgliders.

This is a ULF-1 glider; it is a foot-launchable, plans-built, wood ultralight sailplane from Germany.

The ULF 2 is a very light, plans-built, wood motorglider from the same designer.

GLIDERS AND SAILPLANES are potentially the lowest cost way to fly. In this review, we will address rigid-wing, aerodynamically controlled, wheeled landing gear gliders, not the floppy wing and/or weight-shift-controlled gliders. EAAers are uniquely positioned to make lower cost flying and flight training possible with homebuilt gliders and launching methods.

AN INTRODUCTION TO THE LANGUAGE AND TERMS OF SOARING

Gliders are normally thought of as unpowered aircraft, but that would make one type of glider, the motorglider, a bit problematic. Gliders are powered by a force that never sleeps—gravity. In normal flight, they are always going downhill relative to the air. Just like most sailboats, many gliders and sailplanes have auxiliary engines. The terms glider and sailplane are often used interchangeably, but there is some distinction. A sailplane is a glider that is efficient enough to sustain flight by the use of natural-lift phenomenon. The space shuttle is an extreme example of a rocket-powered motorglider. With the engines off, there is no question it is gliding down for a landing. A sailplane, on the other hand, comes down slowly enough that a skilled pilot can find air that is going up faster than the sinking speed of the sailplane so that altitude can be gained without an operating powerplant.

The difference between a glider and a sailplane is their efficiency. The measures of efficiency for gliders and sailplanes are minimum sink and maximum lift-to-drag ratio. A minimum sink speed of less than 3 feet per second (fps) is desirable for a sailplane; less than 2 fps is much better, and less than 1 fps is the Holy Grail. A max lift-over-drag (L/D) ratio at least in the mid 20s is desirable in a sailplane. L/D is the equivalent of the glide ratio: 40-to-1 or better is not uncommon in competition sailplanes. The current record is about 70-to-1. That is more than a mile of still air glide for each 100 feet of altitude. As areas of natural lift can be quite small, the ability to circle tightly is important, which means being able to fly at quite low airspeeds. Sailplane stall speeds are often well under 40 knots.

The range of wing loadings for gliders runs from 2 to 4 pounds per square foot for ultralight-like gliders to 5 to 7 pounds per square foot for medium performance and training gliders to more than 10 pounds per square foot for ballasted competition gliders. One of the obvious characteristics of gliders and sailplanes are their long wings. When an aircraft has sufficient power to fly fast when one of the drag components, induced drag, is low, short wings work fine. It is obvious that flying fast takes more power. It may not be obvious why flying slowly also takes more power. As the angle of attack increases, to produce more lift at lower speeds, more of the air from underneath the wing leaks around the tips, increasing the tip vortices. That is the source of induced drag that increases rapidly as the aircraft slows down. The most direct way to decrease induced drag is to increase span. It is rare to find a sailplane with less than a 40-foot span. Fifteen-meter (49

Photography courtesy of Murry Rozansky

feet) and 18-meter (59 feet) spans are common in competition sailplanes, with more than 100 feet in the largest open-class competition sailplane.

Sailplanes are called "sun ships," as the energy for natural lift comes from the sun. Wind is the result of solar energy combined with the rotation of the Earth. The first kind of lift used by the glider pioneers was wind against a slope, called *ridge lift*. The second kind of lift that was discovered was *thermal lift*. Solar radiation heats the ground and thus the air immediately above the ground. Bubbles or columns of that hot air break loose and rise in the cooler surrounding air. This is how hot-air balloons work and why you see hawks circling, using solar energy to fly. The soaring birds always have been the living models for sailplanes.

The third type of lift that was discovered was wave lift. Under certain atmospheric conditions, wind at more or less right angles to a mountain(s) will set up vertical waves that go high into the atmosphere and have several cycles downwind of the mountain(s) that trigger them. By flying in the up-traveling part of the wave, very high altitudes can be achieved. The current sailplane altitude record is more than 50,000 feet. The Perlan Project will attempt to take the record to 90,000 feet. If you have the right mountains, such as the Andes, very long sailplane flights are possible in wave conditions. I believe the current record is more than 1,500 miles.

There are different ways of launching gliders. One of the earliest was picking up a hang glider and running down a hill or off a cliff. That gave way to a bunch of guys pulling at the ends of a V-shaped rope and accelerating the glider to the launch point. Later, bungee cords were used to catapult the gliders. Cars and—even on occasion—horses with towlines were used. Today, ground launching using engine-powered winches is the favored method in many countries for its low cost, low noise, and suitability for flight training. In the United States, tow-planes are the most common launching method. Each method has its advantages, disadvantages, and training requirements.

There also are gliders and sailplanes with engines. The main reason is to give independence of operation as there are relatively few airports that have provisions for launching gliders. Engine-equipped gliders can operate from almost all general aviation airports. The two main types of powered gliders are the self-launching sailplanes (SLSs), which look like conventional sailplanes but have retracting props on masts that pop out behind the wing for launching and the occasional save from an out landing.

The other type of powered sailplane is a motorglider. Unlike the SLS, which typically have two-stroke engines and look like sailplanes, the motorgliders look like long-winged light planes and have four-stroke engines. There are some that are blends of the two types. Sometimes called touring motorgliders, they can be used for very efficient powered flight, and when there is natural lift available, the engine can be shut down for silent flight. Efficiency is the reason why some light-sport aircraft look like short-wing motorgliders. Efficiency is also the reason airframes of powered sailplanes are used for many of the pioneering efforts at electric-powered flight.

DIFFERENCES BETWEEN GLIDERS AND LIGHT POWERED PLANES

The long wings of a glider/sailplane make it more reluctant to roll and more dependent on an effective use of the rudder for coordinated flight than its short-winged brothers. While skids under the nose are still sometimes used for brakes in the lightest gliders, almost all now have a mono wheel near the center of gravity and equipped with a brake; some have tail wheels, some nose wheels, and some both. Tip wheels or skids are used to protect the wingtips when roll control power is lost on landing. The mono wheel landing gear has become standard because of its simplicity, light weight, and low drag. Most high-performance sailplanes have a retractable main gear. Due to landing gear geometry and very low stall speeds, gliders are normally flown onto the ground at above stall speed, like a wheel landing in a powered taildragger.

The touring-type motorgliders have the normal light plane types of landing gear. One control that is normal on gliders/sailplanes but rare on conventional light planes is spoilers. Gliders/sailplanes can be so efficient that they do not want to come down, which makes landing difficult. Spoilers are drag and lift-reduction aerodynamic surfaces that can be used like the power plane's throttle to control the descent rate without airspeed changes. Almost all sailplanes are designed to be relatively easy to disassemble for trailering and compact storage.

THE GLIDER'S ROLE IN THE EARLY DEVELOPMENT OF FLIGHT

Sir George Cayley, an English gentleman, was one of the first to look at flight in a scientific manner in the 1800s. He built a man-carrying glider in the 1850s. A young family member is reported to have been the first glider passenger in recorded

The Silent II Electro has a small electric motor in the nose and has self-launching capabilities. Electric flight is available now!

history. The second was his coachman, who after his flight gave notice, saying, "I was hired to drive horses, not to fly." You noticed I said passenger; Sir George had not worked out all the problems of control. His glider was essentially a free-flight glider. In the late 1800s the most influential glider builders were Otto Lilienthal and his brother. Otto had more than a thousand successful flights in his hang gliders until his last. Before he passed away, he said, "Sacrifices must be made." The limitations of weight-shift control and legs as landing gear are being relearned even today. Lilienthal's work was very influential on the Wright brothers and other early aviation pioneers. Building and learning to fly their gliders first was the real key to the Wrights' success in 1903.

THE DEVELOPMENT OF SOARING AND SAILPLANES BETWEEN THE WARS

One of the unintended consequences of the Versailles Treaty after World War I was the development of gliding and soaring in Germany. The treaty and economic conditions greatly restricted power flying in Germany, which led to the formation of glider clubs as an outlet for the then growing interest in flying. After 100 years, we now take flying pretty much for granted, but in the post-World War I era, it was "a really big thing." Of interest to EAAers is the fact that many of the early gliders were homebuilts. One of the leading sailplane designers of the interwar period was Dr. Alexander Lippisch. His career in aviation was sparked when he saw the Wrights' flight demonstration in Berlin before WWI. In the early days of World War II, he designed the Messerschmitt Komet, a rocket-powered motorglider that achieved more than 600 mph in 1941. The Me 163 was the first of the rocket-powered X-planes that led to the space shuttle motorgliders.

The rapidly increasing performance of gliders and the discovery of thermal lift made cross-country flights possible.

The Marske Monarch is a very light floater type, tailless sailplane of cloth-covered composite construction. It is available as a kit.

Glider clubs were also instrumental in generating a skilled pool of pilots, aircraft designers, and technicians for the Luftwaffe to come. There were similar glider activities in the United States and other countries, but Germany is still a leader of glider development and flying.

THE COMPOSITE REVOLUTION AND SOARING TODAY

There were some attempts before and after WWII to bring laminar flow out of the theoretical world and the wind tunnel and onto practical wings of wood and metal construction. This met with limited success until composite materials were experimented with in Germany in the late 1950s. Series production of fiberglass sailplanes with extensive laminar flow wings began in Germany in the early 1960s. The fact that sailplanes are raced has led to the refinement and improved performance of the top-level competition sailplanes of today. Many of the aerodynamic and structural improvements we see in aircraft today were pioneered in sailplanes.

THE ROLE OF HOMEBUILDING IN GLIDER DEVELOPMENT

Certainly, Sir George and the Lilienthal and Wright brothers started out as glider homebuilders. I mentioned that many of the club ships of the interwar era were homebuilt. The original name of our group was the Sailplane Homebuilders Association. The availability of used sailplanes at reasonable prices reduced the interest in homebuilding gliders. That is what led to our name change to the Experimental Soaring Association. There still is strong interest in homebuilding sailplanes, both with and without engines, as a way to achieve efficient, economical, and fun flying. There are plans- and kit-built gliders, sailplanes, and motorgliders available today, and if we can grow this part of the homebuilding movement, more will be available in the future.

THE POTENTIAL FOR HOMEBUILT GLIDERS AND SAILPLANES TO RE-ENERGIZE PERSONAL FLIGHT

Flying is expensive. One of the major costs is the aircraft engine, but "Gliders don't need no stinkin' engines!"

They also need little if any avionics. Experimental amateur-built (E-AB) gliders should be the least expensive way to fly. The complication is the need to get them up initially. In the United States, aero towing is the most common launching method for gliders. The cost of operating the towplane with its aircraft engine adds significantly to the cost of gliding. Will the FAA let us tow gliders with E-AB towplanes? A more economical launching method common in other parts of the world is ground launching. It can be as simple and inexpensive as a towline and a pickup truck. If the flight volume justifies the cost of a winch, which has an automotive-based engine to power a drum of cable, the cost of launching can be very economical. The tradition in American glider clubs is to build their own winches, which sounds like homebuilding mixed with hot-rodding to me.

Photography courtesy of Murry Rozansky

HOW EAAERS CAN SOAR

You've taken a step by reading this article. Follow the links on the following page to learn more about the variety of gliders and sailplanes, and do your own searching. The Soaring Society of America (SSA) website has a list of clubs and commercial operations where you can get a ride in a sailplane. One of the things you can try if you have access to a light plane that has a low stall speed and good low-speed handling characteristics is power-assisted soaring. Set the power a bit above idle and increase it until you have matched a sailplane-like sink speed. Then go find those bumps that you would rather not find in powered cross-country flying, as they are likely thermals, and try to climb in them. There are excellent books available for beginning pilots and for pilots seeking a glider rating. Check the SSA, Cumulus Soaring, and Knoff & Grove book listings.

The next step would be to get a glider rating or glider private certificate if you are not already a rated pilot. If your timing is right, the glider rating acts as a flight review. Another benefit of flying gliders is the self-certificated medical without the "catch-22" of the light-sport aircraft medical. Many clubs are looking for new members and are usually the least expensive way for flight training and flying.

Hopefully I have tickled the urge to soar in some of you. Keeping a plane up without an engine is a challenge that will keep you engaged, improve your brain, and make you a better pilot.

HOMEBUILT GLIDERS AND SAILPLANES AVAILABLE TODAY

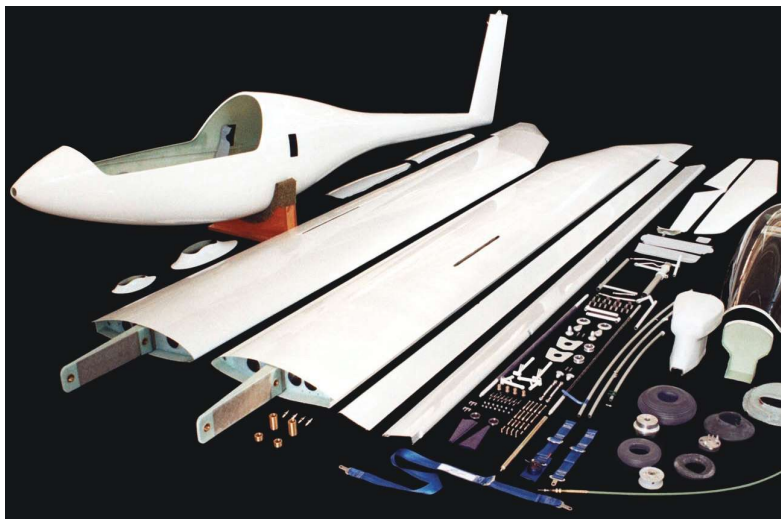
Let's start at the very light end. In the early days of gliding, people learned to fly in single-place primary gliders that were the most basic flying machines. They consisted of cloth-covered wood wings, tail surfaces, a seat, and a skid to land on...with a minimum of structure to tie them together. Mike Sandlin's "Airchairs" have updated the idea of the primary glider. His designs are cloth-covered aluminum structures that are light enough to car top and fly from hang glider sites. They are designed for low-cost garage construction. Mike has taken a noncommercial approach; plans are available for free on his website: http://M-Sandlin.info. No one has done more to advance low-cost flying than Mike Sandlin.

While the late Jim Maupin's designs are no longer marketed, Windrose, Woodstock, and Carbon Dragon projects and plans are out there. The Windrose is a composite SLS. Woodstock is a light, wood sailplane. The Carbon Dragon is cloth-covered wood with selective use of carbon reinforcement. It is an extremely lightweight sailplane that is capable of being foot launched. Its low sink and flying speeds have allowed the discovery of new types of lift and flying techniques such as micro-lift and dynamic soaring. Jim's design partner was Irv Culver, a sailplane designer and key member of the "Skunk Works." Visit www.IHPA.ie/carbon-dragon/ or www.CarbonDragon.us/ to find information for these designs.

There are other homebuilt designs that are no longer marketed that have plans or projects which can be found.

A beautiful example of the plans-built Woodstock glider designed by Jim Maupin and Irv Culver.

A Marske Monarch on final. The most successful flying wing and tailless aircraft have been sailplanes.



The components of Silent glider kit; it looks like it would go together quickly, especially the unpowered version.

One of our sister divisions is the Vintage Soaring Association (www.VintageSailplane.org/index.shtml). They are the folks to contact for those interested in restoring or re-creating classics, some of which were originally built from plans.

Dieter Reich's ULF 1 and 2 are cloth-covered wood ultralight glider and motorglider designs from Germany. The ULF 1 is capable of foot launching like the Carbon Dragon. Learn more at www.EEL.de/english/ulf-1_description.htm.

Mark Calder's Robin is an ultralight motorglider similar in concept to the ULF 2. The prototype should be flying soon. Mark is planning on making kits available. Visit http://RobinUltralight.blogspot.com/.

The Mitchell B-10 and U-2 by Don Mitchell were pioneering efforts of the early days of high-performance, more airplane-like ultralights. Plans for these very light cloth-covered wood flying-wing motorgliders are still available. Visit http://home.Earthlink.net/~mitchellwing/u2.html or www.TWITT.org/MitchellHistory.html.

Jim Marske's Monarch and Pioneer 3 are slightly forward-swept, flying-wing sailplanes of composite construction. The Monarch is a "very" light open-cockpit glider. The Pioneer 3 is a 15-meter sport-oriented sailplane of quite high performance. Both have the benign flight characteristics for which Jim's designs are known. Read more at www.MarskeAircraft.com/8539.html or KollmanWings.com/About_Us.html.

Tiziano Danieli's Piuma Project consists of single- and two-place "very" light motorgliders of mostly wood construction (www.PiumaProject.com).

The Cumulus is a cloth-covered aluminum "very" light motorglider (www.Ultralight-Soaring-Aviation.com).

Bob Kuykendall's HP-24 is a high-performance, 15- to 18-meter composite sailplane built from a kit. Bob started on the glider road by supporting the builders of the late Richard E. Schreder's HP series of mostly aluminum plans and kit-built sailplanes (http://en.Wikipedia.org/wiki/Richard_Schreder).

The Choucas is a two-place, side-by-side touring motorglider of the Fauvel flying-wing type of mixed construction. The Exel is a light, single-place, self-launching sailplane of composite construction. These French designs are available in kit form. Visit www.Alpaero.com.

The Alisport Silent series are light-composite, high-performance sport sailplanes available with engines for self-launching or unpowered. An electric version is now available (www.Alisport.com/eu/eng/index.html).

The Xenos is the touring motorglider member of the Sonex family of aluminum kit planes. The side-by-side two-place gives up a bit of cruise speed to its short-winged brothers, but it can stay up with the engine off. Visit www.SonexAircraft.com/aircraft/xenos.html.

The Europa also has a touring motorglider version of its composite kit plane (www.Europa-Aircraft.com/motorglider) as does the Whisper (http://WhisperAircraft.com/wcont).

Many of the designers of these aircraft are or were members of the Experimental Soaring Association.

A Mitchell U2, plans-built, mostly wood ultralight flying wing motorglider.

ORGANIZATIONS

Soaring Society of America: www.SSA.org
Experimental Soaring Association: www.ESoaring.com
Vintage Soaring Association: www.VintageSailplane.org/index.shtml
Touring Motorglider Association: www.TouringMotorgliders.org
Experimental Aircraft Association: www.EAA.org
Cumulus Soaring: www.Cumulus-Soaring.com
Knoff & Grove Soaring Supplies: www.eGlider.org

INTERESTING VIDEOS

Airchair at Torrey Pines: www.YouTube.com/watch?v=fzNKEhVKtJA
Bungee launch: www.YouTube.com/watch?v=K6fv-TNyrqs
Carbon Dragon: www.YouTube.com/watch?v=XKowuWZKJ5k
Winch launch: www.YouTube.com/watch?v=v2Qh95I_YM0
ULF 1: www.YouTube.com/watch?v=F0L7juR2gKY
ULF 2: www.YouTube.com/watch?v=cGtRRkzCyKo
U-2: www.YouTube.com/watch?v=Os58YgpwOEU
Monarch: www.YouTube.com/watch?v=ijCnLaRf5Eo
Pioneer 3: www.YouTube.com/watch?v=4QoxSigUdzk
Choucas: www.YouTube.com/watch?v=yjGW_rOKhk8
Silent 2 Electro: www.YouTube.com/watch?v=ZZrKBzszSFk
Xenos: www.YouTube.com/watch?v=xc_PBSD2qDQ
Whisper: www.YouTube.com/watch?v=kM5pd12-w2A

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Sailplane design: www.SeqAir.com/TheGlider/TheGlider.pdf
Bass Akwards: The truth about taildraggers: www.EAA.org/experimenter/articles/2010-11_bass.asp EAA

Murry I. Rozansky is the president of Experimental Soaring Association, a division of the Soaring Society of America.

Photography courtesy of Murry Rozansky

Standard Category | Vintage | Aerobatics | LSA | Homebuilts | Warbirds | Seaplanes | Powered Parachutes & Trikes | Gliders | Helicopters

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SeaRey 'Hull Number 1' Restoration

An outline of its restoration challenges

BY BOB GIBSON, EAA LIFETIME 583744

EAA CHAPTER 282 WAS founded in the 1960s at Clearwater Airpark (KCLW), located in the Tampa Bay, Florida, area. Since its founding, members have completed more than forty aircraft—plans-built, kits, and the restoration of certificated aircraft. The chapter has recently completed restoration of a Stits Playboy and is now working on an open-cockpit aerobatic Acroduster Too biplane. I have been a member of Chapter 282 since the late 1980s.

In October 2013 (perhaps in a moment of temporary insanity), I agreed to become a partner with two other Chapter 282 members—Jim Porter, EAA 450902, and Cindy Hardeman, EAA 1000463—to restore a SeaRey amphibian, N864BW.

Why an amphibian? We live in Florida with 30,000 lakes and surrounded by 1,350 miles of coastline on the Gulf of Mexico and the Atlantic Ocean, so why not an amphibian?

There are lots of amphibians to choose from—why a SeaRey? Besides regarding it as a fun plane, we have a lot of significant project support within easy reach. Using SeaRey cruise speeds as a reference:

- Support from the airframe manufacturer (Progressive Aerodyne – Tavares, Florida) is 50 minutes away.
- Support for the Terra radios (Gulf Coast Avionics – Lakeland, Florida) is 25 minutes away.
- Support for the Rotax engine (Lockwood Aviation – Sebring, Florida) is 40 minutes away.

Progressive Aerodyne (PA) started producing SeaRey kits in 1992. To date, they have sold more than 600 kits and assembled aircraft. Some preliminary research revealed that our restoration aircraft was Hull Number 1. It appears that the first owner and builder, William (Bill) Widden, built and flew N864BW for about 500 hours, including some flights to the Bahamas. The second owner put about 400 hours on it. The third owner purchased it with the intent of restoring it (and actually completed construction and covering of the tail feathers); but he had to move, so he sold the package to our team.

Since the SeaRey is an amphibian, we suspected that we would have our share of corrosion-related issues to deal with. As a starting point, we decided to strip the wings to inspect the condition of the structure—and were *very* surprised at how little corrosion we found on the aluminum parts. The inboard ribs were made of wood and were not in good condition, so we have fabricated replacements from marine-grade plywood.

The upside of having Hull Number 1 is that it will serve as a testament to the durability of the SeaRey product line and will serve as the "elder statesman" of the SeaRey fleet; the downside is that, since it was the very first SeaRey kit produced, it has absolutely *no* upgrades or improvements that were implemented to the fleet going forward! Realizing this shortcoming, Jim Porter and I made an exploratory trip to the PA factory in Tavares. Members of the PA technical team worked with us to review our wing and to recommend those

Photography courtesy of Bob Gibson

upgrades that were relevant to our project. We purchased those wing upgrade items at the factory and hauled them back to our project hangar at KCLW.

We are fortunate in having a *lot* of interested EAA Chapter 282 members who have pitched in to restore the project hangar, disassemble the wings, clean and corrosion-proof parts, and help with essentially anything else we need. I see this can-do attitude by our members as typical of the Chapter 282 culture.

As a team, we are trying to strike a balance between doing those upgrades that will enhance integrity of the aircraft and not going overboard on bells and whistles. It's going to be a functional, reliable, fun airplane, but it probably won't win best of show. There are lots of individual decisions to be made as the restoration progresses, but we will make those decisions as we approach each item.

While the rest of our team focuses on the restoration of the wings, I have the lead on dealing with all electrical/wiring/avionics work. I've started on restoring the nav/strobe/wing wiring.

Other big tasks or decisions facing us include:

- *Aluminum corrosion protection*. We realize that extensive corrosion protection will add weight, but this aircraft is going to live in a Florida coastal environment where, for six months of the year, it will be subject to 90-plus-degree temperatures and 90-plus-percent relative humidity.
- *Instrument panel*. We will rearrange the panel layout to allow an iPad mini in the center of the panel for GPS/moving map display.

Why an amphibian? We live in Florida with 30,000 lakes and surrounded by 1,350 miles of coastline on the Gulf of Mexico and the Atlantic Ocean, so why not an amphibian?

- *Main landing gear retraction*. Will we convert it from manual to electric?
- *Bow cover*. Should we convert it to "quick access" for easier servicing of the electrical system and instrument/avionics panel?
- *Engine*. We have not yet test-run (or opened) the engine, so we are not sure of the extent of work required to return it to service.
- *New prop*. The old prop is too worn/damaged to return it to service. Newer props are also lighter and more efficient.
- *Panel-mount avionics*. Are our old Terra radios reliable enough to use, or will we be chasing nuisance problems?
- *Tail boom*. Full inspection: repair/replace?

With lots of help from our fellow Chapter 282 members, we might be able to have Hull Number 1 ready for test flights (and sea trials) by January 2015. Once operational, we will probably have to start purchasing WD-40 in 5-gallon drums! You can follow our progress by reading a monthly installment in the *EAA Chapter 282 Newsletter* at www.EAA282.org. EAA

(L-R) Bob Gibson, Jim Porter, and Cindy Hardeman have joined forces to restore SeaRey Hull No. 1.

1. Initial progress ... we have access to the tank.

Fuel Tank or Fuel Cell Repair/Resealing

Get all the old sealant out!

BY JERRY FISCHER, EAA 771431

THIS IS A PROCESS that requires more patience than skill. Access to the inside of a fuel tank is obtained by either removing the rear baffle as in the case of some tanks, or the skin that exposes the entire fuel cell for proper removal of *all* old sealant.

The process starts with carefully removing the rivets that attach the access skin or baffle. If you are careful you can reinstall using the same diameter rivets or go oversize where necessary when reinstalling parts.

After removing the skin, you need to ventilate the area while applying the stripper to the sealant. A fan and open area are best. Apply stripper and MEK wearing a mask designed to filter organic compounds, as well as rubber gloves, a long sleeve shirt, and *most of all* eye protection/face shield.

It is best to apply these stripper products in temps above 60 degrees F. as the chemical process works better above this threshold. Remove any loose sealant using a paint scraper and bristle brush until the majority of the sealant is removed. For any hard to reach places, I use a rotary tool (Dremel) with a combination of small wire brush attachments to finish the removal. You can also remove any remaining sealant using a drill with wire brush attachments, being careful to apply as little pressure as needed to remove it.

After all sealant is removed, wash all areas of the tank with denatured alcohol and let it dry thoroughly. I recommend the Pro-Seal that has a two-hour working window. This product can be applied to a larger area and has less risk of setting up prematurely. You can use the half-hour cartridge in a pneumatic applicator or caulking gun if the working time to apply sealant permits. *You do not* want to get in a hurry at this point as a leak or seep will be your outcome.

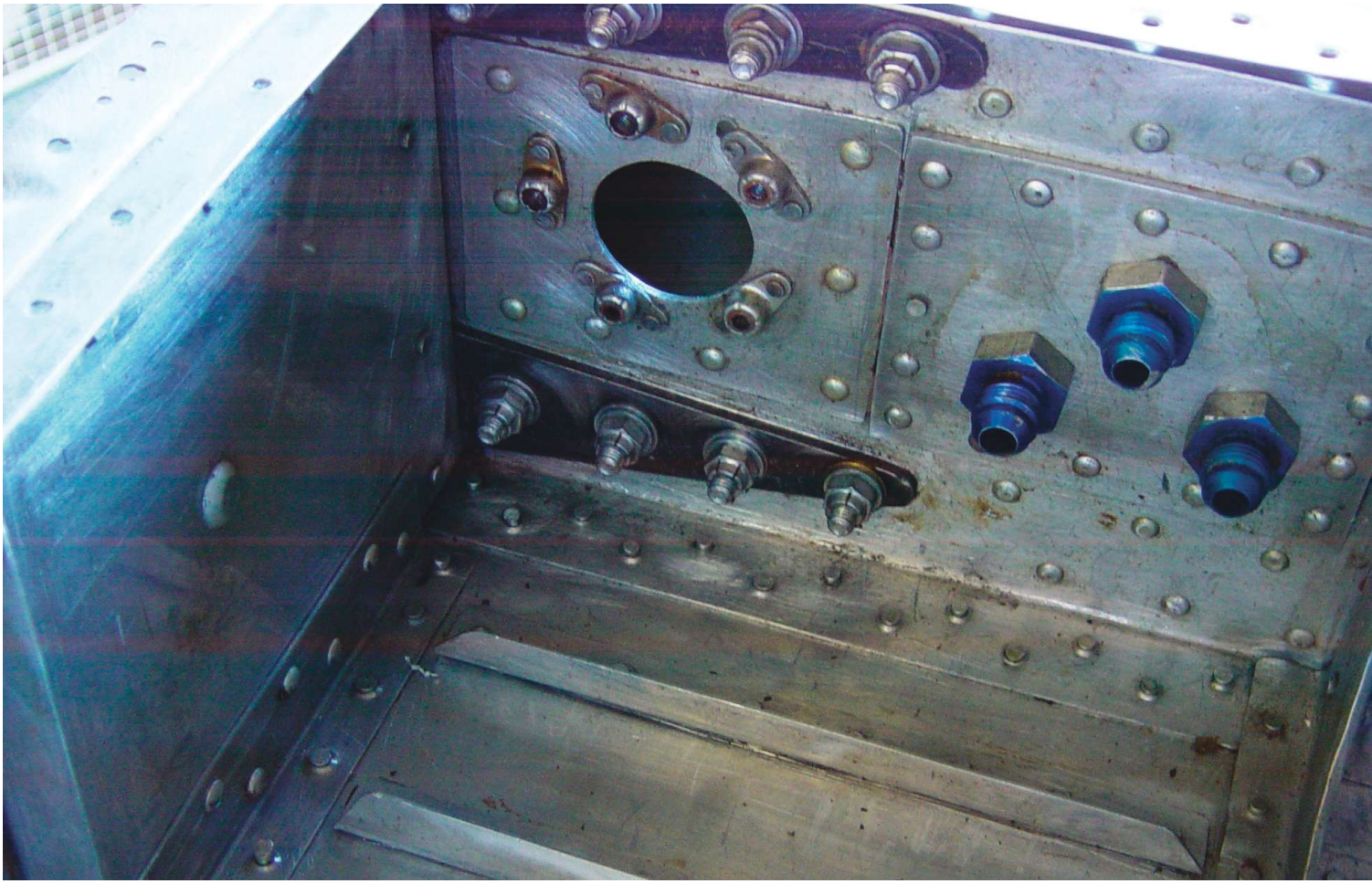
I have added some pictures of my RV-1 to illustrate the steps in the process.

Good luck and happy flying. EAA

Photography courtesy of Jerry Fischer

2. Almost there with the cleaning.

3. After using Pro-Seal on the fuel filler and vent.



4. The fittings after cleaning.

HINTS FOR HOMEBUILDERS VIDEOS

HERE'S FOUR OF THE MORE THAN 400-PLUS HINTS FOR HOMEBUILDERS VIDEOS AVAILABLE ON WWW.EAA.ORG

Masking Surfaces for Painting
Bob Koehler shows different products to use when masking off areas prior to painting. Bob is an A&P mechanic and EAA SportAir Workshop instructor.

Custom Bucking Bar
Completing a homebuilt aircraft can sometimes require fabricating custom tools and a unique process. Fred Stadler demonstrates the use of a custom bucking bar and a bucking process designed by EAA's master craftsman Bauken Noack.

Cutting Plywood Gussets
Timm Bogenhagen from the EAA staff shows you a simple yet speedy way to stack and cut many wooden gusset pieces with one cut.

Laying a Bead of Resin Microspheres with a Caulk Gun
Mark Forss of EAA's SportAir Workshops demonstrates three simple techniques for installing a bead of resin microsphere mixture for constructing joints and fillets in composite work, and demonstrates how to construct a production bead layer.

Tommy's Airpark near Springfield, Illinois, also has a go-kart racing track.

Adventure Flight to Tommy's Airpark

BY DAN GRUNLOH

MY FLIGHT TO THE 24TH annual Midwest Ultralight/Light Aircraft Rendezvous held August 23 to 25 at Tommy's Airpark, southeast of Springfield, Illinois, was about as perfect as a flight can get. Sport aviation is one of the few activities that provides an opportunity for true adventure. Much of our life is organized, regimented, and predictable. With flying, the adventure begins at every takeoff, but nothing does it better for me than flying with others in a group and traveling to a distant fly-in to see other airplanes and pilots. For this to work, aviation has to be affordable, or there will be no others to fly with you. That's where ultralights and light-sport aircraft come into the picture. I've had the occasional pleasure of flying somewhere with five or more light aircraft to attend a regional fly-in. Cruising along on a cross-country flight in nice weather at 1,500 feet with your flying buddies around you is the greatest fun you can have in aviation.

On this trip, I was flying with a longtime friend and pilot, Rob, in an Eipper GT 400. He has flown all over the state of Illinois but had never been to Tommy's fly-in due to conflicts and weather. I've introduced numerous chapter members to this trip and always enjoyed it because the landmarks are sparse but unmistakable; and it's just long enough to make it fun. At about 90 miles, it's a stretch to do under ultralight rules, but it's easily accessible for light planes on a one-day, out-and-return flight. Rob and I flew mostly side-by-side about one-half mile apart and at the same altitude. Flying closer together adds to the workload, and flying in trail reduces the effectiveness of having a buddy for the last pilot in the string. For larger groups, I prefer flying in pairs in trail. It is much easier than a V-formation. A loose gaggle is the worst as you can spend the entire trip looking around trying to find your buddies and saying, "Where are you now?" on the radio.

GETTING THERE IS HALF THE FUN

I also love this trip because it serves as a reminder of the time not so long ago when pilots were "pilots" (in the nautical sense) instead of operators of onboard guidance equipment. There are no roads along the course to follow. We are flying diagonally across the patchwork of landscape that is Illinois. On one of these trips, a newcomer to the group began calling for help on the radio because he couldn't find Tommy's Airpark on his GPS. We knew the airport identifier (9LL5), but we almost didn't want to tell. The pancake-flat prairie horizon was interrupted by a pair of obvious and distant white bumps exactly on our course; they corresponded to a black square on the aeronautical chart labeled "plant." It was a pair of huge LP gas storage tanks. Obviously the caller had neither chart nor line. We only had to relax and fly toward them. About 30 minutes beyond the tanks is a large lake with a nuclear powerplant that you can't miss, and the final stretch has other unique landmarks. Once on course with ground speed verified, I like to turn off the GPS and fly by pure pilotage. It's fun and easy, and I feel a little more sense of adventure by doing the actual piloting. That's not to take anything away from the GPS. I use it on every flight.

Airpark owner Tommy Georges is a radio-controlled (RC) aircraft enthusiast who became a private pilot and an

Photography by Dan Grunloh

advanced ultralight instructor under the old exemption program. He was a dealer for Mini-Max, Quicksilver, Titan, and others. The 2,200-foot sod strip began with an RC field on the south end and gradually expanded to hangars, a go-kart racing track, and a residence and workshop near the south end. Besides building airplanes, Tommy's hobbies include building motorcycles and other interesting custom ground vehicles. The long running fly-in is organized and run by members of EAA Ultralight Chapter 88 (Edinburg, Illinois), also known as the Midwest Illinois Crophoppers.

A newly restored CGS Hawk flown in from 60 miles away.

The fly-in draws about 60 aircraft each year in late August, including ultralights, light-sport aircraft, home-builts, and vintage and general aviation (GA) aircraft that can handle the sod runway. Some of the ultralights still go "crophopping." When the corn and soybeans are young, the entire area is a safe emergency landing zone. However, in late August those ripening ears of corn are bound to hurt as you go in, so I would avoid them. The dedicated members of this small chapter put on a well-organized three-day fly-in with a food vendor, public address system, and announcer. They have raffles, prizes, and contests for both the pilots and the kids. Tommy once said he regrets the event is sometimes called the Tommy Georges' Fly-In when it is the chapter members who do the work. In fairness, Midwest Illinois Crophoppers Ultralight/Light Aircraft Rendezvous *is* a mouthful.

ABOUT THE KIDS

EAA has long recognized the importance of stimulating interest in aviation with youth programs such as the EAA Air Academy camps, Young Eagles, and KidVenture at Pioneer Airport during EAA AirVenture Oshkosh. This chapter does

Tommy Georges doing the annual candy drop for the kids.

Photography by Dan Grunloh

A Vans RV-4 on the flightline attracts attention.

a great job with the kids, and I see more youngsters here than at many fly-ins. Activities include a traditional candy drop by Tommy Georges in his two-seat Phoenix. With safety in mind, the kids are assembled near the runway (under the control of adults) while Tommy makes a flyby or two before actually dropping the treats. After the plane has passed by, the kids are released to scoop up what they can. Some of us might be too old to remember why, but the activity seems quite popular with the kids.

A little ways away, a young girl was grinning while trying out the cockpit of a mock P-51 Mustang brought in on a trailer. It's hard to believe that in 15 years she will be a high school senior looking for a career. Her grandpa had flown his light plane to the event. All those kids are experiencing grassroots sport aviation at an early age in a way that is bound to influence the future.

POWER CAMPING

I brought my camping gear on this trip. It gives you more choices and takes away the worry about getting back home before dark. Modern technology and materials make it possible to have a lightweight kit that includes tent, bed, and kitchen; and it fits in a large gym bag. With a butane microstove to heat water, you can make tea, hot soup, or a hot breakfast. Mostly I never have to cook, but it's good insurance if you miss the ride into town or arrive too late for supper. My bag includes a couple foil-sealed

The Magni M-16 gyroplane flown by Greg Gremminger.

freeze-dried meals intended for high-altitude climbers or long-distance trekkers.

My flying buddy Rob headed home late in the afternoon, but I stayed and flew locally all the way to sunset. By camping overnight, you get more time to explore the local area and make new friends. Tommy's Airpark is located on a large lake, leaving plenty of interesting area to explore. When flying out on a trip

like this, don't simply tie down all weekend. Take time to see the local sights. I decided to visit nearby Taylorville Airport, a place I had never been to in 25 years of flying in Illinois. I discovered a 24-hour credit card fuel pump and a deluxe pilot lounge I could live in, at least overnight—everything you need but a bed. What a great stop it would be for anyone traveling cross-country.

Little girls like airplanes, too.

RETURN TRIP ALONE

I was up at dawn the next morning. There's not a lot to do late in the evening when camping under the wing, so it's easy to wake up early. I packed up the still damp tent, wiped the heavy dew off the wings, and preflighted the trike. I was ready to take off 20 minutes after sunrise, but I was not the first to fly. Late summer dawn flying is perfect for local crophoppers and those heading home. The flight toward the rising sun in the morning haze limited my visibility to about 5 miles, so I couldn't make out my favorite conspicuous landmarks. Once confirmed on course by GPS, I flipped it off and enjoyed the challenge of flying home solely by compass for a time. How often do we get to do that? There were no controlled airports I could easily stumble into and I was flying above the highest obstacle in this quadrant. For a while I didn't know my exact location or recognize any landmarks, but I resisted the temptation for a reassuring glance at the GPS screen. It was my way of putting a little piloting (and adventure) back into my aviation. See more pictures from Tommy's Airpark in this EAA picture album from 2010.

Please send your comments and suggestions to *dgrunloh@illicom.net*. EAA

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

A Ragwing Special powered by a Rotax 503.

Photography by Dan Grunloh

Static Stability Intro

Does your airplane return to its pre-disturbed condition?

BY ED KOLANO

NON-MANEUVERING LONGITUDINAL static stability is a mouthful to say, and like many things with long titles, it just ain't that complicated. Still, "static long-stab" is an important stability characteristic, and it could be a bit insidious in how it affects your flying.

Quick review: Static stability addresses whether your airplane *initially tends* to return toward its pre-disturbed condition. For example, when you move the pendulum of a grandfather clock away from its hanging position and release it, its first move is back toward its hanging position. This is positive static stability.

Dynamic stability addresses whether your plane actually does return to its pre-displaced condition and how it does or does not get there. Release that clock pendulum, and it will swing back and forth several times, eventually coming to rest at its original position—positive dynamic stability.

While static and dynamic stability are the two basic kinds of stability, there are additional classifications for the longitudinal (pitch) axis and the lateral-directional (roll-yaw) axes. This discussion is limited to non-maneuvering longitudinal static stability. Specifically, we're going to explore how an airplane reacts to changes in airspeed.

Let's say you've trimmed the plane for 100 knots in straight and level flight. You'd expect to hold a little back-stick to fly 90 knots and a little forward-stick to fly 110 knots, if your airplane exhibits positive longitudinal static stability. Holding back-stick implies that if you let go, the plane would initially tend to accelerate back to its initial trimmed airspeed and vice versa for the forward-stick, faster airspeed case.

If you have to push the stick to maintain 90 knots in an airplane trimmed for 100 knots, your airplane would be statically unstable at that flight condition. The implication here is that if you release your push, the plane's initial tendency would be to decelerate more, moving further away from its trimmed airspeed. Clearly that's an undesirable, nonintuitive situation.

If you released the stick and the plane remained at 90 knots or 110 knots when it was initially trimmed for 100 knots, it would *appear* to exhibit neutral static stability, because other factors—such as control system friction—might be overpowering your plane's static stability.

Figure 1 shows a static stability plot for airplanes with positive, neutral, and negative static stability.

WHY NOT RETRIM?

Why would you fly off-trim? Well, you always fly off-trim, until you retrim. Whenever you change your flight condition, the airplane's trim requirement probably changes, and you retrim after establishing the new condition.

For example, you approach the downwind leg of a landing pattern at 100 knots and slow to 80 knots on downwind. Power and airspeed changes often cause pitching moments, which you counter by trimming. When those moments are balanced, you don't have to hold forward or aft stick to remain at that airspeed. After you slow to 80 knots, you know you have to retrim because you're holding back-stick. This is probably the most important aspect of long-stab—the stick force cue that tells you the airplane is not at its trimmed airspeed.

Pilots receive information through every sensory channel. We process and react to these separate puzzle pieces without even thinking about them. Some cues to an in-

advertent airspeed change are wind noise, engine noise, vibration changes, coordinating rudder requirements, and stick force.

During cruise flight, this stick force cue has limited utility because you're not typically holding any stick force here. Once established at your cruise altitude and airspeed, you trim out the stick force. If your airspeed deviates, you wouldn't know it through stick-force feedback because you're flying "hands-off." Under these conditions, the airspeed indicator and altimeter will most likely be your first clues to an inadvertent airspeed deviation.

There are other phases of flight where stick-force feedback can be your primary cue to an airspeed deviation. Let's say you're on a long final approach to land at Oshkosh during EAA AirVenture Oshkosh. Three airplanes are ahead of you, and who knows how many are behind you.

The radio is jammed with the controllers telling: the plane on the runway to take it to the end; the plane about to touch down that it needs to remain aloft until the orange dot; the guy behind him to land on the runway's left side; and the guy between that guy and you to slow down and take the right side. He's also barking out similar orders to a few planes behind you.

Naturally, most of your visual attention is directed outside the cockpit. You're sacrificing your normal instrument scan to enhance seeing, avoiding, and following the controller's directions. If you find yourself holding back-stick during all this head-on-a-swivel activity, it probably means you've slowed down. Your airplane's positive static stability tells you that through stick-force feedback.

Another example is approaching minimums during an actual instrument approach. While in the clouds, you establish a steady airspeed/power/glideslope relationship, and all of your visual attention is directed toward your flight instruments. As you approach your go-around decision, you start to look outside for the runway.

If you're barely emerging from the cloud base, catching an occasional glimpse of ground beneath you but still not seeing the runway ahead, you might devote more attention looking for the runway and less attention to your instruments. Noticing you're pushing on the stick tells you you're flying faster than your established approach speed and you've probably pushed your plane below the glideslope or minimum descent altitude.

Piloting chores during these critical phase-of-flight examples are more difficult in an airplane without positive static stability.

NEUTRAL AND NEGATIVE STABILITY

An airplane with neutral static stability provides no force cue at all to a changed airspeed. Such an airplane maintains whatever speed you like hands-off. In this case, you have to rely on alternate cues, such as noise and vibration changes, and keep a diligent eye on the airspeed indicator.

On the plus side, you never have to trim a neutrally stable airplane. You'll have to move the stick forward or aft to cause an airspeed increase or decrease, but once at the desired airspeed, you can simply release the stick. Some military fighters are designed with this feature. Not having to retrim as the pilot accelerates 300 knots to engage a target reduces the pilot's workload. Not really the same motivation in the homebuilt world.

Let's say you've trimmed for straight and level flight at 100 knots. Then you slow to and maintain 80 knots without retrimming. Your airplane has positive static stability, so you must hold, say, 5 pounds of back-stick force. If your air-

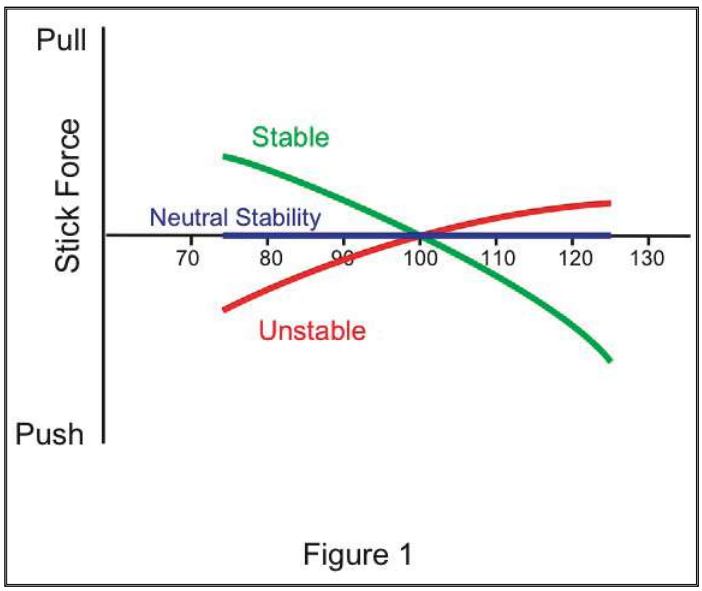


Figure 1

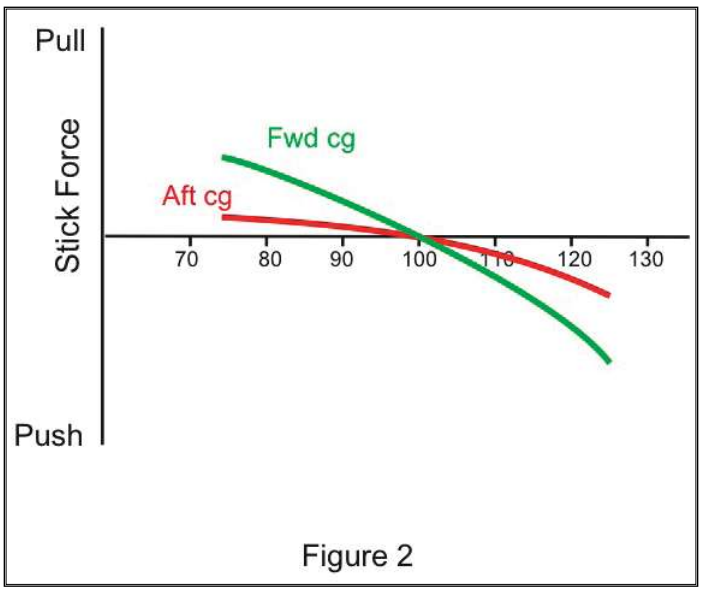


Figure 2

Illustration courtesy of Ed Kolano

plane has 6 pounds of friction in its longitudinal (pitch) control system, you might be able to release the stick at 80 knots and the airplane will stay at 80 knots. In this case, the friction masks the airplane's positive stability and makes it appear to be neutrally stable.

If you slow to 70 knots, where it takes 8 pounds of back-stick, you'd have to keep some pull force on the stick because the required stick force is greater than the friction that is helping to hold the stick back. This airplane appears to be neutrally stable within a band of airspeeds around the trimmed airspeed and positively stable outside that trim speed band.

Establishing an exact speed within that trim speed band can be difficult and frustrating. It turns into a game of trial and error, nudging the stick, waiting to see what airspeed eventually settles out, and then nudging again. Frustrating.

You can fly a statically unstable airplane just as you can balance a broomstick vertically on your up-turned palm. How long you can do it is another story. Balancing the broomstick takes total visual concentration and constant hand-eye coordination. Fortunately, statically unstable airplanes are usually only mildly unstable and usually only in a particular configuration. Still, the pilot must dedicate more time to airspeed control in these airplanes, and that means less time is available for other necessary piloting tasks. And yes, a few popular kit planes have mildly unstable characteristics during certain flight phases.

The farther aft an airplane's center of gravity (CG), the less stable it is. This is why there are limits to the aft end of the allowable CG range. Figure 2 shows the effect of CG on a static stability plot. The forward CG limit is usually determined by how much nose-up authority the elevator has. The worst case for the forward CG limit is typically the landing flare in ground effect with the gear down and flaps down, all of which create nose-down pitching moments that the elevator (also less effective in ground effect) must overcome during the flare.

HOW MUCH IS ENOUGH

How much stability is good is a good question. The airplane should be stable enough to provide reasonable stick force cues to an off-trim condition. It should be stable enough to remain at its trimmed airspeed rather than wander off. But it shouldn't be so stable that it takes two hands on the stick to fly a temporary off-speed condition.

The Federal Aviation Regulations require general aviation airplanes to have positive static stability under most flight conditions: "The airplane must be longitudinally, directionally, and laterally stable…In addition, the airplane must show suitable stability and control 'feel' (static stability) in any condition normally encountered in service, if flight tests show it is necessary for safe operation."

Release that clock pendulum, and it will swing back and forth several times, eventually coming to rest at its original position—positive dynamic stability.

How much "control feel" is suitable? According to the regs, "The stick force must vary with speed so that any substantial speed change results in a stick force clearly perceptible to the pilot."

The stick force versus airspeed gradient is not a true measure of an airplane's static stability, but it is an operational cue pilots use. You can increase the stick force by adding springs to your longitudinal control system; this doesn't make the airplane more stable, but it can provide a more obvious force cue to the pilot.

Adding springs is not a simple solution because they will affect every control input you make; and the results may be good for static stability feel and bad for dynamic stability, flutter, and other airplane behaviors.

The regulations also address the trim speed band. General aviation airplanes must have a trim speed band no larger than 10 percent of the trimmed airspeed. In other words, when the airplane is trimmed for its 70-knot final approach speed, it can have a 7-knot trim-speed band, and when it's trimmed for its 180-knot cruise speed, it can have an 18-knot trim-speed band. Neutral and negative static stability are not allowed in certificated general aviation airplanes.

What's right for your airplane depends on how you fly your airplane. Neutral static stability might be good for an aerobatic airplane that undergoes large airspeed changes quickly when maneuvering.

IFR pilots could benefit from an airplane with off-airspeed stick force cues should they inadvertently neglect the airspeed indicator in favor of the ILS needles during an instrument approach.

Day VFR fliers can get by with a mildly unstable airplane, but they should be aware of that instability and maintain a rigorous airspeed indicator scan, particularly near the ground or other airplanes.

Okay, that's the primer for longitudinal static stability. Next time we'll talk about flight testing techniques, starting with the trim-speed band determination. EAA

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