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EXPERIMENTER

The Spirit of Homebuilt Aviation I www.eaa.org

A Mazda-Powered Mustang II
Bob Roger's delight

MW Fly Engines
New Italian-built bolt-on engines

The Lure of Video
Making inflight movies

An All-Wood Wonder
The Amazing GP-4!
A George Pereira design

See You at Sun ’n Fun

BY JACK PELTON

AFTER THE ENDLESS WINTER cold and snow much of the country has endured I bet you’re looking forward to spring and the annual trip to Sun ’n Fun as much as I am. The show opens on April 1, so the chilly weather that has frequently settled as far south as central Florida should be long gone by the time we get to Lakeland.

As you may know, Sun ’n Fun was founded as an EAA chapter fly-in 40 years ago as a midwinter getaway for pilots. The event grew and became the second largest fly-in, after Oshkosh, and has for many years been an independent event. We still enjoy a cordial relationship with Sun ’n Fun, and many of the volunteers who make the show possible are EAAers.

Sun ’n Fun continues to welcome all EAA members to Lakeland with a discount on admissions. Be sure to bring your EAA membership card along to qualify for the reduced rate.

EAA will be exhibiting at the show with a variety of logo items for sale and membership staff on hand to renew your membership and answer questions. You can also enter the EAA Classic Sweepstakes and have a chance to win a beautifully restored Fairchild 24H.

The Blue Angels will fly on Friday, Saturday, and Sunday, April 4-6, and all EAA members are invited to enjoy the performance from a special EAA hospitality area on the warbird flightline. The view is the best, and admission to the EAA venue is free to all members. Just have your member card with you.

Sun ’n Fun is the first chance to show off your airplane this year, no matter what it is you fly. And for many of us closed in by the extreme winter weather, it’s also the first long cross-country flight of the year. By April the Florida flying weather is usually pretty good, but weather can always present a challenge for pilots who are not prepared.

We are lucky to have so many sources of up-to-date weather information available today. Dozens of online services feed the latest weather radar images, textual reports, and forecasts into our mobile devices. Satellites send near real-time weather down to displays in our cockpit while in flight. And for not a lot of money you can buy a receiver that picks up the subscription-free weather the FAA is sending over the new ADS-B ground station network. There is no reason to be surprised by the weather during your trip.

But it’s vital that we be realistic about our own capabilities and those of our airplanes. After the long winter it’s crucial that we refresh our skills before launching on the trip to Lakeland, and maybe even log some time with a flight instructor to make sure we are ready.

It’s also important to understand the safe limits of our airplanes. No matter how skillful we may be as pilots, airplanes have finite performance capabilities. Winds and turbulence, for example, that are an annoyance for more powerful and heavier airplanes may simply be beyond the capabilities of lighter craft no matter how good the pilot may be.

And speaking of wind, I urge you to be very conservative in your fuel planning for the trip. It is both a tragedy and an embarrassment that so many GA pilots end up making forced landings for the totally avoidable reason that they ran out of fuel.

The wind is blowing snow around as I write this, and you can be sure the Wisconsin tundra is thoroughly frozen. But spring is within sight, and Sun ’n Fun beckons us to fly south. I can’t wait. And I look forward to seeing you in Lakeland. EAA

On the cover: Mike Mahar’s all-wood GP-4. (Photography by Jim Koepnick)

Photography by Jason Toney

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Charlie Becker (left) and Jerry Paveglio working on the EAA staff-build Zenith CH-750. Keep up to date on the progress of the EAA employees' Zenith project on this blog.

Be a Doer

BY CHARLIE BECKER

"IT IS NOT THE CRITIC *who counts; not the man who points out how the strong man stumbles, or where the doer of deeds could have done them better. The credit belongs to the man who is actually in the arena, whose face is marred by dust and sweat and blood; who strives valiantly; who errs, who comes short again and again, because there is no effort without error and shortcoming; but who does actually strive to do the deeds; who knows great enthusiasms, the great devotions; who spends himself in a worthy cause; who at the best knows in the end the triumph of high achievement, and who at the worst, if he fails, at least fails while daring greatly, so that his place shall never be with those cold and timid souls who neither know victory nor defeat."*

This is an excerpt from Theodore "Teddy" Roosevelt's speech "Citizenship in a Republic," delivered at the Sorbonne, in Paris, France, on April 23, 1910.

I wanted to share this quote with you because I believe we homebuilders are the "man in the arena." We are the ones pushing our limits. We are doing something meaningful. The challenge of a difficult project is part of the appeal.

You can't build an aircraft sitting in front of the TV. People lacking ambition do not decide to build aircraft. And yet, some of us who choose to build will not complete our project. We will try and we will fail. But, as Teddy said, at least we are "daring greatly." I would argue that even an uncompleted project is not a failure. You will have expanded your knowledge of aviation. You learned to use your "hands and mind" together to create. A valuable lesson in today's society of premade everything.

We who have chosen to take on the task of building an aircraft are trying to accomplish something that probably less than 100,000 people in the history of the world have ever accomplished. Even with today's quick-build kits, it still takes a serious effort to overcome the series of problems that confront us during the building process. By choosing to build you are choosing to fight, to battle, to overcome. You will make mistakes and you will persevere.

You can't build an aircraft sitting in front of the TV. People lacking ambition do not decide to build aircraft.

The beauty of EAA is we are not alone in the arena. We are part of a community of people who are all in the arena together pursuing a higher goal. So we do not have to solve every problem on our own. We can turn to other members in time of need. By being a part of EAA, we are greatly increasing our chance of victory.

If you are not yet in the arena, come join us. Be a doer.

Thanks to William Wynne, aka "The Corvair Authority," who first made me aware of this quote. And thanks to fellow builder John Egan for inspiring this article. EAA

Photography by Jennifer Bowen

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EAA, FAA Review Full Agenda at Summit

SENIOR EAA AND FAA officials discussed important issues at the 10th annual Recreational Aviation Summit held in Oshkosh on January 28 to 29.

The session brought more than a dozen top FAA directors and managers to Oshkosh, the only time during the year that the agency sends such a group to a specific aviation organization's headquarters for in-depth discussions on major GA topics. FAA officials from aircraft certification, flight standards, accident prevention, the small airplane directorate, and other areas were represented. EAA Chairman Jack Pelton led the EAA team, which included senior leaders and representatives from all interest communities within the organization.

"These two days are very important for EAA members because it allows us to have the FAA management and policy teams get away from Washington and focus directly on the issues that are most important to our members," said Sean Elliott, EAA's vice president of Advocacy and Safety. "One impressive highlight was how open the FAA team was to emerging technology for creating opportunities and for that to be implemented across various segments of general aviation."

Among the issues discussed during the summit's two days were:

- allowing electric propulsion for ultralights and light-sport aircraft and clearing regulatory hurdles that prevent today's electric motor technology from emerging
- current conflicts in regulations that limit the availability to provide flight training for ultralights and other low-mass, high-drag aircraft, so those areas of aviation can become more vibrant and safe
- an option for use of an additional qualified pilot during homebuilt flight testing, which would add an additional opportunity to enhance safety and best practices in those initial flying hours
- incompatibility issues for automatic dependent surveillance-broadcast (ADS-B) and NextGen technology, where pilots are spending significant dollars for future mandated equipment but cannot be sure that it is supplying the correct data
- Warbird operating limitations that potentially hinder how warbird owners can use their aircraft or add significant cost and complexity to their maintenance and operation.

"These were just a few of the items discussed in detail with the FAA team," Elliott said. "More importantly, the winter summit also gives a detailed action plan that allows us to follow up with the FAA in the coming weeks and months to ensure that these important items don't fall through the cracks."

EAA officials also again expressed the urgency of improving the medical certification system, as presented by EAA and AOPA nearly two years ago as an exemption request, and more recently in Congress as legislation that would eliminate the need for a third-class medical for many recreational aviation activities. While the exemption request is being reviewed, the FAA has asked EAA and its members to help compile data as part of an ongoing safety measurement and enhancement effort.

WomenVenture 2014

WOMENVENTURE WILL be held on Wednesday, July 30, 2014. Organized annually during EAA AirVenture Oshkosh, the day celebrates women's contributions to the aviation industry and hopes to inspire and encourage more women to get involved in aviation. Events during the day will include the annual Women in Aviation Connect Breakfast and group photo on the West Ramp Plaza. T-shirts will again be distributed to all women participating in aviation, either as a vocation or for recreation, to wear during the annual photo at 11 a.m. on West Ramp Plaza. After the photo, participants are invited to M&M's Theater in the Woods for the second annual WomenVenture Power Lunch to enjoy dynamic speakers and additional networking.

To learn more about the activities planned and to register for the Power Lunch, visit *www.AirVenture.org/WomenVenture*.

Help Build an Airplane in 7 days at Oshkosh

AT EAA AIRVENTURE OSHKOSH 2014, attendees can share the experience of building an airplane through the One Week Wonder project. During the week of AirVenture, volunteers will be assembling a Zenith CH 750 kit aircraft. The goal is to completely construct and taxi the aircraft by the end of the week.

"The One Week Wonder will show how today's advanced kits and technology make aircraft building accessible and affordable, especially with the support from many EAA programs and members," said Charlie Becker, EAA's manager of homebuilt programs. "It's a fun, interactive opportunity that will show thousands of people exactly how an airplane goes together."

The One Week Wonder project will also allow EAA to showcase how a person can build his own airplane, the technical achievements along the way, and EAA support programs available for aircraft builders. AirVenture attendees will be able to add their own "hands-on" moment in the construction project and sign the logbook as one of the builders.

The One Week Wonder display area will be located near the EAA Welcome Center at the main crossroads of convention grounds. Another display will include the recently completed Zenith CH 750 that was built by EAA employees. There will also be interactive displays that highlight the aircraft construction process, the variety of aircraft available for builders, and information about getting started on an aircraft project.

EAA Family Loses Two Memorable People

THE EAA FAMILY RECENTLY lost two people closely linked with its history and growth—Leo Kohn, EAA 4, and Henry Ogrodzinski, EAA 127183.

Leo, one of EAA's founding members, died on January 17 at the age of 87. He had the foresight to take photos at EAA's first meeting in Milwaukee on January 26, 1953, and soon became EAA's first official photographer. He later became the organization's first full-time employee, maintaining the connection with EAA members and chapters while Paul Poberezny was still working full-time for the Wisconsin Air National Guard.

Leo was a well-regarded aviation photographer and historian throughout his career, most recently serving as a director of the Mitchell Gallery of Flight museum in Milwaukee.

Henry Ogrodzinski chauffeurs Paul Poberezny in Red One at EAA AirVenture Oshkosh 2013.

Leo Kohn

Henry, the president/CEO of the National Association of State Aviation Officials (NASAO), passed away on January 22 at age 65 after a courageous battle with cancer. Henry was EAA's media and public relations director from 1982 to 1987, just as the organization was emerging as a leader in the entire general aviation community through its government efforts and increasing visibility of the annual EAA Oshkosh fly-in.

After departing EAA, he had also worked with Gulfstream Aerospace Corporation, the General Aviation Manufacturers Association, and the United States Air and Trade Show in Dayton, Ohio, prior to joining NASAO.

EAA's deepest condolences go to Leo's and Henry's families. EAA

Photography by Jim Koepnick

Zenith Workshops Offer Insight Into Aircraft Kit Building

ZENITH AIRCRAFT HAS scheduled builder workshops for March 6-7 and April 24-25 at its factory in Mexico, Missouri. The workshops are popular with sport aviation enthusiasts who have contemplated building their own aircraft but were not sure if they could manage the required skills, workspace, and tools. During each workshop, participants construct a Zenith rudder from a standard kit.

Participants also learn how to read drawings and work from assembly instructions as well as how to identify kit inventory. They also learn the procedures for drilling, deburring, and blind riveting. In addition they cut, file, and fit metal parts. In the end, they have an assembled rudder that is ready to install on an airplane.

"The rest of the airframe is constructed the same way as the rudder using pretty much the same tools," Sebastien Heintz, president of Zenith, said. "People get far more out of the workshops than just a rudder. They go home with the knowledge and skills they need to finish an airplane. Most importantly, they learn that building is easy, enjoyable, and something that can engage the whole family. Many of our prospective builders bring their wives, who often encourage them to move forward with the rest of the airframe. With modern technology, aircraft construction has become much simpler than most people imagine."

Workshop fees are $375 for each rudder kit. Additional helpers can participate for free. To learn more about the workshop program visit *www.ZenithAir.com*.

Van's Issues Service Bulletins

VAN'S AIRCRAFT ISSUED TWO service bulletins regarding potential cracking issues for select models in its product line. SB14-01-31 was issued for all owners of RV-6/6A, -7/7A, and -8/8A aircraft—flying or under construction—to check for cracking near the bend in the horizontal stabilizer front spar.

14-01-31: Cracks in the forward spar of the horizontal stabilizer have been found emanating from the stress relief notch at the inboard end of the spar flanges. Owners should conduct an inspection before further flight and at each annual condition inspection until such time that the SB has been complied with in its entirety.

SB14-02-03 was issued for owners of all flying RV-3, -4, -6/6A, -7/7A, and -8/8A aircraft to inspect for cracking in the elevator spar web near the elevator attach points.

14-02-03: Cracks have been found near the rivets attaching the nut plates that hold the elevator rod ends to the E-702 spar and E-610PP or E-611PP spar reinforcement plates. Owners should conduct inspections before further flight. If cracks are detected, the E-00001A and E-00001B hinge doubler repair must be installed at the cracked hinge position before further flight.

Wicks 4130 Tubing

WICKS AIRCRAFT SUPPLY has purchased Dillsburg Aero Works' supply of 4130 tubing and has added tons of new 4130 to its existing stock.

A variety of 4130 seamless round tubing in full lengths and cut to order is now available. Wicks is also offering deep discounts on full mill runs for OEMs, designers, and motor-racing industry customers.

Wicks is gathering orders for free delivery at the Sun 'n Fun Fly-In and International Expo.

Prepaid orders can be picked up at the show. Other items like bolts, grommets, or washer kits, tools, fabric, fasteners, tires, plumbing, and bungee material are also available for prepaid pickup at the show. For more information visit *www.WicksAircraft.com* or call 800-221-9425.

Photography courtesy of Zenith Aircraft Ltd. and Sonex Aircraft LLC

Sonex Offers Ultra Quick-Build Kit for SubSonex Jet

SONEX AIRCRAFT LLC has a new purchase option for the SubSonex personal jet. Originally offered only as an ultra quick-build kit in the experimental exhibition category, customers will now have the option to choose a new quick-build kit that is in compliance with experimental/amateur-built (E-AB) standards.

Sonex also announced that the introductory pricing for the SubSonex jet announced at EAA AirVenture Oshkosh 2013 will be extended through March 31, 2014.

"Immediately after announcing the SubSonex kit deposit program at Oshkosh 2013, customers voiced their desire for an E-AB-compliant kit," Sonex President and Founder John Monnett said. "Our extension of the introductory pricing will allow those customers to place their E-AB kit orders with the same guaranteed special pricing structure. This option is primarily being offered to help those outside of the United States import and gain approval for the SubSonex in their home countries, with most countries offering a clear path for certification of homebuilt aircraft."

The SubSonex JSX-2 quick-build kits will come at a slightly lower price, $120,000 versus $125,000 for the experimental exhibition ultra quick-build kit, and all deposit holders will have an opportunity to select the kit of their choice upon placing firm orders later this year.

Orders placed after March 31 will be at the full retail kit price of $135,000 ($130,000 for the E-AB kit).

SubSonex jet E-AB builders will have to construct a few more parts of the aircraft, including construction and installation of items such as the tail surfaces, control surfaces (ruddervators, ailerons, flaps), and windshield. A pending FAA National Kit Evaluation Team audit will confirm the final list of tasks required for completion by the builder.

To aid customers in their decision-making process, Sonex Aircraft has prepared a downloadable experimental exhibition versus E-AB summary available at *www.SonexAircraft.com/subsonex/SubSonex_E-E_vs_EAB_Comparison.pdf*.

The JSX-2's development since AirVenture 2013 remains on schedule. "With design and prototyping activities closing in on the final detail phases of systems installations, we anticipate coming very close to the original target for the first flight of JSX-2, anticipated for the March/April 2014 time frame (weather permitting)," Monnett said.

Sonex also announced further developments regarding the letter of authorization (LOA) qualification for SubSonex pilots. SubSonex primary test pilot Bob Carlton has obtained approval for a PBS TJ-100 turbojet training program using his two-place TJ-100 powered BonusJet sailplane operated by his primary business, Desert Aerospace. Any prospective pilot looking to learn the flight operations of the TJ-100 engine may train with Bob in the BonusJet with no requirement to hold a glider pilot certificate. This development is important, as it will serve to greatly simplify the requirements for pilots to obtain a SubSonex LOA.

More information can be found on the Sonex website, *www.SonexAircraft.com/subsonex*, including a new JSX-1 flying video featuring in-flight commentary from test pilot Bob Carlton.

Nominations Sought for Tony Bingelis, Spirit of Flight Awards

Nominations are now being accepted for two awards presented annually at EAA AirVenture Oshkosh—the Tony Bingelis Award and the Spirit of Flight Award.

The Bingelis Award honors the memory of the late Tony Bingelis, EAA's highly regarded homebuilding authority, author, and former columnist in EAA Sport Aviation. The award recognizes people who have made significant contributions to encourage the building of aircraft, including the promotion of safety, and for maintaining the values of EAA. A nominee must have been an active and current EAA technical counselor for five consecutive years. Download a nomination form.

The Spirit of Flight Award was established in 1997 by the Society of Experimental Test Pilots and Scaled Composites to recognize an EAA member who best exemplifies the spirit of research, development, or flight testing. Nominees should promote air safety, strengthen the influence of the test pilot on aeronautical progress, and continuously evaluate the adequacy of flight equipment. Download a nomination form.

If you have any questions, please call the EAA Safety Programs Office at 888-322-4636, ext. 6864. Nominations must be made by March 31, 2014.

Bob Rogers' Lone Star Mus

His choice to install the rotary engine required him to "field-engineer" a wide swath of details.

BY STEVE ELLS

tang II

Photography by Michael Kelly

WHAT DO YOU GET when you combine a professional man with a can-do spirit and a large allotment of perseverance, a set of plans for an aerobatic two-place, all-metal airplane, a few factory-built assemblies, a bunch of metal-working tools, and a supportive and understanding spouse, then stir it steadily for 17 years?

The answer is N62BT, a Mazda rotary engine–powered Mustang II. This sleek and silver little beauty is the result of slightly more than 7,000 hours of weekend work by Bob Rogers of Plano, Texas. Add in a wrecked 1986 Mazda RX-7 engine and you complicate the project even more.

Bob purchased a salvaged 1986 Mazda RX-7 automobile for $1,000 to get the Mazda 13B engine. He later sold the car body for $800, but converting the engine added years of work to his project.

Bob's Mustang II is a side-by-side two-place that sits smartly on conventional landing gear. Its wingspan is 24 feet, 5 inches. It has an empty weight of 1,305 pounds and a gross weight of 2,050 pounds, which yields a useful load of 745 pounds. Fuel capacity in the two wing tanks and a fuselage tank totals 59 gallons. A 200-hp turbocharged Mazda 13B rotary engine pulls N62BT along in cruise at 170 knots while burning 12 gallons per hour.

N62BT has three-axis electric trim, a Navaid AP-1 wing leveler/tracker autopilot, a Garmin SL 40 Comm, a Terra TXT 760D Comm, a Terra TN 200D Nav, and a Terra TRT 250 D transponder. Bob bought the Terra radios because of their small size, long before the company went out of business. He said they work fine, and he knows where to get them repaired if it ever becomes necessary. A small HP iPAQ is used for moving-map GPS navigation and display of XM weather tracking. Bob selected Anywhere Map for his flight software. The autopilot will track either the GPS or a VOR/ILS course.

According to Teri Ann Rogers, her husband started flying before he got his driver's license. "He used to ride his bicycle back and forth to the airport," she said. On their second date, Bob courted Teri Ann by asking if she wanted to go to San Antonio for lunch. When she realized he was going to fly her there, she thought to herself, "Hey, this guy is pretty neat."

Bob, an attorney who spends his days keeping an eye on banking practices for the Federal Deposit Insurance Corpora-

Bob and Teri Ann Rogers enjoy flying their Mustang II around the country.

Photography by Michael Kelly

Bob chose the Mustang II design because he liked the shape of the wings and and that it had a sliding canopy.

tion (FDIC), first visited EAA Oshkosh in 1989. "That's when I decided I could build an airplane," Bob said. "I narrowed the choice down to an RV-6 or the Mustang II." The Mustang won out because he liked the look of the Mustang wing and because it had a sliding canopy. To get more headroom, Bob modified a Thorp T-18 canopy to fit. The nose bowl is also from the T-18.

Bob and Teri Ann laughed at their own inside joke about building time as they recalled the oft repeated phrase, "It'll take from three to five years." In the end it took more than 17 years—with fully one-third of that time spent on modifying and installing the engine, Bob said. When he checked in at the AirVenture 2013 homebuilt registration center, the staff handed Bob a Perseverance Award.

If you're wondering why it took 17 years, the simple answer is because Bob worked as time permitted and only on weekends. He also said that his choice to install the rotary engine required him to "field-engineer" a wide swath of details required to convert the Mazda automotive engine into a dependable aircraft powerplant.

AN AMAZING TALENT

When Bob started building his Mustang, few preformed parts were available. "I bought all the preformed parts I could," Bob said. These included wing ribs, the center section main spar, and major bulkheads. Bob was working on forming some smaller fuselage bulkheads when Robert Bushby, the developer of the Mustang II, stopped by Bob's shop for a look-see. "Bushby took pity on me (upon seeing Bob's attempt to form a bulkhead) and sent me one of his bulkheads," Bob joked.


Instrumentation in Bob's Mustang II includes a three-axis electric trim, a Navaid AP-1 wing leveler/tracker autopilot, a Garmin SL 40 Comm, a TerraTXT 760D Comm, a TN 200D Nav, and a TRT 250 D transponder.

As Bob showed me his instrument panel, he remarked that he had built the altitude hold module from instructions he found on the Internet. The design uses an air pressure sensor to detect altitude changes and then sends correcting signals to an electric servomotor at the elevator trim tab.

He also decided that the outward-hinged cowl flap design created too much drag when it was opened, so he designed and built a lower cowl door panel that slides fore and aft to control the engine-cooling airflow. The size of the opening is pilot-controlled by a panel-mounted toggle switch.

Bob also developed a way to increase the baggage compartment area behind the seats. It now extends an additional

This logo on the turtledeck of the aircraft is a nod to the couple's home state of Texas.

24 inches into the tail cone. He originally chose seats from a Mazda Miata, but they were too heavy. He ended up using seats designed for the Lancair IV, which were expensive but very light.

An accompanying photo shows the Mustang II on a set of scales as Bob crawled around taking measurements to determine engine mount spacing required to stay within the Mustang II weight and balance envelope. A weight can be seen hanging from the front of the 13B engine to simulate uninstalled components and the prop.

According to Bob, the stock turbocharger was inadequate, so he installed a bigger one. Since this mod resulted in the oil return line exiting the turbo below the level of the engine oil sump, Bob fabricated and installed an oil collection sump and plumbed and installed a cockpit-controlled oil return pump. Then he discovered that he needed the return pump to control two flow modes—a low oil flow rate for lower engine speeds and a higher rate for cruise engine speeds. The solution: a high-low switch and two rows of DIP switches that control the on-off timing of the return pump at the low switch setting. These are mounted in the instrument panel.

THE CHRISTMAS GIFT

Teri Ann jokes that although they've been married 32 years, they've only been together for 15 because she was gone half the time on her job. Teri Ann recently retired from Delta Air Lines as a flight attendant. "I chose weekend trips so he could be at the airport from Friday until Sunday and never come home," said Teri Ann.

One year, Teri Ann asked Bob what he wanted for Christmas. After getting his answer, she started shopping around for a good deal on 2,000 clecos. In addition to learning the ins and outs of sheet metal fabrication, Bob also learned to work with composites. "I didn't like the idea of an aluminum fuel tank located behind the instrument panel and above my lap, so I built one out of Kevlar," Bob said, figuring that Kevlar, a tough aramid fiber, would make the tank more impact resistant. That decision cost 3 gallons of capacity—down from 25 to 22 gallons—but Bob is more comfortable with the added security of the Kevlar tank.

Photography by Michael Kelly

THE POWERPLANT

The idea to use the two-rotor Mazda 13B engine seemed like a good idea at the time, Bob said. "I bought an old RX-7 for $1,000, took out the engine, and sold the car as salvage for $800." He figured that since a brand-new 13B engine cost about $4,000 and since maintenance costs would be less expensive, he'd come out ahead. "I originally thought I would be able to burn auto fuel," Bob said. However, acts by Congress mandating the blending of ethanol in auto fuel ended that option.

REAL WORLD SOLUTIONS PRODUCTS

Since the takeoff and cruise rpm of the rotary engine is too high for direct drive of the propeller, Bob installed an RD-1 redrive, also known as a propeller speed reduction unit (PSRU), from Tracy Crook's Real World Solutions (RWS). Crook retired in 2013, but manufacture of the unit may be assumed by CG Products. The redrive's 2.176-to-1 ratio results in a prop speed of 2,757 rpm at maximum 6,000 engine rpm. A 68-inch diameter (84-inch pitch), two-blade, carbon-fiber P-Tip prop from Prince Aircraft turns in left-hand rotation due to a rotation reversal by the RD-1 gearbox.

RWS also provided the engine control units, the dual fuel pumps, and the apex seal lubrication system.

Bob explained that the stock method of using engine oil to lubricate the apex seals eventually results in carbon buildup in the combustion chambers. Bob chose to install an RWS system that lubes these seals with two-stroke oil, which doesn't carbonize under high temperatures. In addition to the apex lubrication system, Bob also had to fit the coolant radiator, two stock Mazda oil coolers, two ignition systems for the dual spark plugs fitted to each rotor, dual alternators, an Aviation Development Corp. oil filtering system, and a bunch of warning sensors under the cowling.

One of the best features of the custom-made cowling is the wide engine access doors. When Bob opened the left door,

Bob measures to determine the engine mount spacing needed to keep the aircraft within the Mustang's weight-and-balance envelope.

I thought to myself, "The only thing I see that provides a hint that I'm looking at an airplane are all the blue anodized aircraft-style hose fittings." Yet it all seems to work.

Bob said that he aims for 43 to 45 inches of manifold pressure for takeoff and said the turbo provides 30 inches of boost up to 17,000 feet. His other engine management target is to keep the engine coolant below 200°F.

Bob said the Mazda engine exhaust noise is muffled when it's routed through the turbine wheel of the turbocharger, but "it does have its own unique sound." The exhaust note is so unusual that it always causes heads to turn when the engine is powered up. Bob estimated the installed engine, RD-1 redrive, and propeller weight at 360 pounds.

Engine fuel-air mixtures are managed by reference to a visual-style mixture indicator mounted on the upper left corner of the instrument panel. An RWS EC-2 Programming and Control Module (PCM) incorporates two separate engine controllers. The PCM controller allows Bob to fine-tune the fuel-air mixtures, richen the programmed mixture for cold starts, and manually select either the A (primary) or B (secondary) engine control unit as needed for operation or troubleshooting. It's mounted on the lower instrument panel.

The PCM units control the timing and length of opening of the fuel injectors (two on each rotor—one for low-speed ops and both for ops above 16 inches MAP) and the timing of the firing of the ignition coils. The coils are made by Delco and are used on many GM products, including the Corvette engine. The PCM references data from a crank angle sensor, an outside air temperature sensor, and an engine manifold pressure sensor. Engine fuel-air mixtures are optimized during flight using either a fuel-air gauge with an oxygen sensor probe and/or a conventional exhaust gas temperature probe.

Bob installed an aftermarket knock sensor to detect the onset of detonation. He told of calling his neighbor Tom over to hit the engine with a hammer during one knock sensor testing session. After he was satisfied, he wired the sensor to sound an audio alert through the audio panel whenever knock (incipient detonation) takes place. Bob admitted that he'd heard the warning once or twice at really high power settings.

PILOT-DEPENDENT OPERATION

A row of toggle switches is aligned along the upper right edge of the panel. These switches give Bob the option to select and test Battery Contactor 1 or 2, Alternator 1 or 2, Fuel Pump 1 or 2, and the primary fuel injectors or the secondary injectors on rotors 1 and 2. All these options are tested prior to flight. Another switch temporarily disables each set (leading or trailing) of spark plugs on the rotors. This step is similar to testing the magnetos on a conventional aircraft engine. During takeoff Bob moves all switches to the up position.

After an explanation of the switches, Bob told me about "another neat thing I did." This man enjoys showing off the culmination of his work. He showed me the aural and lighted annunciator system he built. The system sends a tone to the avionics audio panel and turns on a panel-mounted light if any of several engine parameters are out of limits, including low water, fuel, oil, and voltage.

N62BT rolled out of Frank Waggoner's paint shop glistening under new paint featuring a silver base coat with red and blue accent stripes. A galloping mustang sporting the colors of the Texas flag adorns the vertical stabilizer and rudder.

Bob has logged more than 80 hours since March 18, 2009, when N62BT first flew. "I haven't had any problems," Bob added.

I asked him if in hindsight he would have done anything differently. "If someone came to me for advice and I were to look back, I'd tell them to put in a Lycoming engine," said Bob. "I had to deal with a lot of uncertainties and if your time counts for anything, putting in the Mazda is just as costly as the Lycoming even though this engine works great," he continued.

Bob logged many hours in rental fleet airplanes before the first flight in his Mustang II. He couldn't be happier with the result of his years of building. "It's a fun airplane to fly; it responds like it's reading your mind," he said.

Links to various product suppliers:
www.princeaircraft.com/default.aspx
www.rotaryaviation.com/
www.youtube.com/watch?v=krEfY8OixqI first flight EAA

Steve Ells (*www.EllsAviation.com*) has worked on airplanes since 1966. He holds an A&P, IA, Commercial, with ME and Instrument ratings. He has written for the Cessna Pilots Association, the Aircraft Owners and Pilots Association, the Experimental Aircraft Association, and is presently on staff at the Cessna Flyer and Piper Flyer magazines. He flies "Papa," a 1960 Piper Comanche and lives in California and Ohio with his wife Audrey.

Photography by Tyson Rininger

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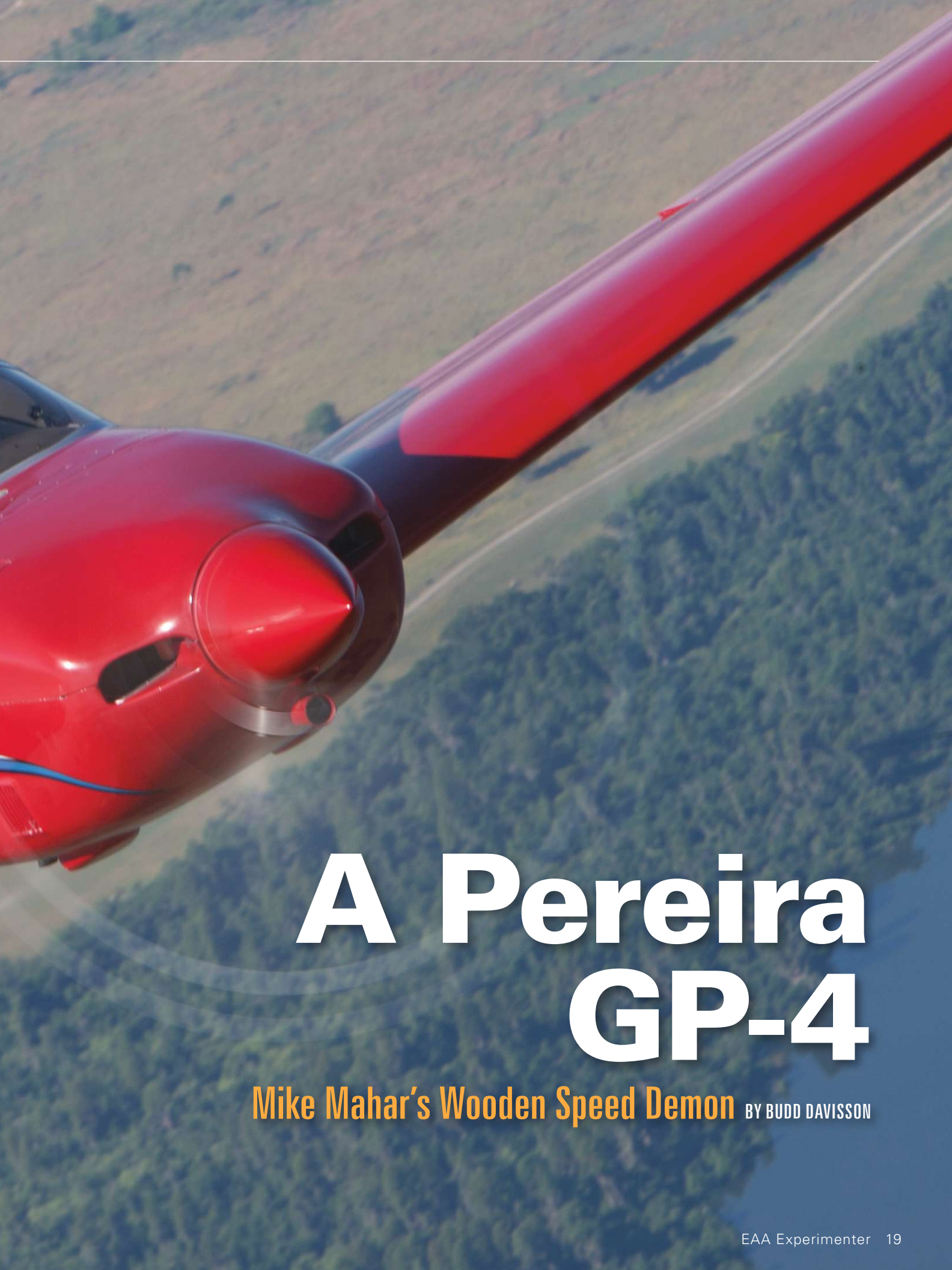


A Pereira GP-4

Mike Mahar's Wooden Speed Demon

BY BUDD DAVISSON

As witnessed by the different cowlings in the following photos, Mike Mahar's GP-4 will always be a project in process. Mike had built a Lancair IV and Legacy, but picked the all-wood GP-4 because he could scratch-build it and keep the cost down.

The airplane flew with a temporary panel and interior for several years, while Mike figured out exactly what he wanted.

"AVIATION LITERALLY SAVED ME. For one thing, it forced me to conquer words. As a kid, I was an undiagnosed dyslexic and was well into high school and still couldn't read. Then I discovered airplanes, and my life began to change."

That's Mike Mahar, EAA 508055, talking, and as he spoke, he was sitting in front of his gorgeous GP-4, designer George Pereira's contribution to the world of incredibly sexy-looking, super-high-speed airplanes.

Mike said, "When I was a kid, the words on the page made no sense to me, so I had no interest in them. No matter how much the nuns beat on me, words just didn't work for me, and I was going to make no effort to figure them out. Numbers, on the other hand, were easy. Numbers made total sense, so I gravitated to them and away from words. Then I saw a Piper Cub, and my life began to turn around. When I learned that I could actually learn to fly the Cub, it dawned on me that I could do something that was really cool, and that appealed to me. But to realize that dream meant I had to make friends with the written word, something that wasn't at all easy for me. However, flying hung out there like a carrot on a string, and I was willing to do whatever it took to get it.

"I soloed the local Cub when I was sixteen, and it was and still is one of my proudest moments. Among other things, it meant I was gaining on reading."

When Mike graduated from high school, his problem with reading narrowed his job prospects, but his folks found him a job in a tool-and-die shop with about 200 employees.

Mike said, "I was such a natural with numbers—I was quickly helping machinists by figuring out the numbers for what they were machining. That led to promotions until I was the company's numbers guy.

"Outside of work, I got into Dragon sailboat racing and kept pushing my flying. That was about all I did until I got married and the kids came along. I know it's a cliché, but during that period of time, there just wasn't enough money to do it all."

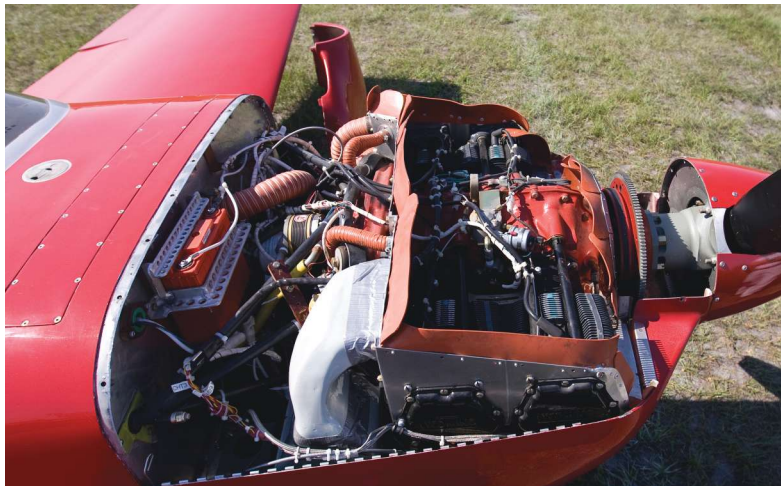
In everyone's life, there is a blurry, foggy area that is filled first with homes, kids, mortgages, long workdays, and the feeling that you'll never get far enough ahead to be able to fly again.

But invariably everyone makes it through that period to the other side where aviation is waiting for them. In Mike's case, that also included starting his own machining company in his hometown of Cleveland, Ohio, that specializes in making molds for the plastics industry.

Mike said, "I finally got back into flying again and decided to build a Lancair IV-P. So my first homebuilding experience was with high-performance types. We ran that Lancair all over the country and off to Tortola (British Virgin Islands) and many times to Vancouver, British Columbia. Then I helped a friend, Rob Logan, build a Legacy. We finished it and test-flew it, and he's been flying the airplane for 12 years. After Rob's airplane, I helped Aaron and Bernie May finish their Legacy. I test-flew that and then flew it with Bernie while he was trying to sell it. It was at that point that I faced up to the fact that it was time I have my own airplane."

Inasmuch as Mike had spent almost all of his most recent flight time in airplanes that cruised well more than 200 mph, he wasn't about to build a Pietenpol. If he was going to own an airplane, it had to be capable of carrying him across country at much higher than normal speeds.

"It also had to be something that I could totally scratchbuild to keep the cost down," he said. "I could build almost anything with all the tools I had in my business, but I didn't want to drop a huge amount of money right up front for a kit. That's one of the reasons I almost immediately homed in on George Pereira's GP-4. It was the design that got the most performance out of the least horsepower. Plus, I really liked its looks. Being all wood, I knew it was going to be a longer build, if nothing else because wood airplanes always have a higher parts count; and in the GP-4, that is especially true. The GP-4's tapered wing adds to its performance and parts count, but it also was really attractive to me. I can't stand Hershey bar wings. But because this wing is tapered in both directions, that means there are no 90-degree intersections in its structure and virtually every part is unique. There are no duplicates. For instance, you can't stack up some plywood and band-saw dozens of ribs out at



Designer George Pereira wanted to build the fastest airplane he could using the 200 hp IO-360-A1A.

Mike modified the fuselage sides subtly using thin layers of foam to give the airplane's sides a more rounded appearance.

Photography by Jim Raeder

"I could build almost anything with all the tools I had in my business, but I didn't want to drop a huge amount of money right up front for a kit."

the same time. Plus, the spar is 24 feet long and it's one piece. This is definitely not an airplane you're going to build in a back bedroom. My business has 22,000 square feet of shop space, so I isolated an 80 by 50–foot area in the middle and set it up to build airplanes.

"A woodworker friend of mine told me how to build a good worktable, 24 feet long and 4 feet wide, and that worktable was a godsend. It was made of 4-inch by 3/8-inch angle iron and topped with three layers of 3/4-inch plywood and chipboard. We routed one edge so it was perfectly straight to use as reference. This thing was so stout, you could have put a Buick engine on it and driven it to Sun 'n Fun. It gave me an absolutely true, stable surface to build on, and that was critical."

Besides being 24 feet long, the main spar was a project that used a lot of Mike's boating experience. It was a box spar, meaning it had front and back faces joined by intercostals, with the top cap being seven laminations thick and the bottom having five laminations. Each lamination was a half-inch thick! Not only was the spar tapered in both the front and top views, but the dihedral was built into it. Building the jigging to hold everything in correct position entailed as much work to do right as building a complete wing on many other aircraft.

Mike added, "The wings are skinned with 3/32-inch plywood that I brushed with very thin resin before closing the wings. I then covered them with super-thin fiberglass. I epoxy-primered that, block-sanded it, and filled the low spots with micro balloons. At the most, the buildup is ten to fifteen thousandths of an inch thick in some areas.

"The fuselage is much easier to build than the wings. It's a basic box fuselage, and you can build the sides laying flat on the table and stand them up. That, however, makes the fuselage look too flat and square. So I took long pieces of 0.2-inch-thick, 18-pound foam and milled it into a very slight curve on a CNC machine. I glued that to the sides of the fuselage which, when covered, makes the fuselage look much better. At least to my eye it does."

The cockpit canopy is framed in tubing and slides on rails that are actually just chrome-plated square tubing with a slot cut in it. Mike said that the canopy tries to "fly," so to keep it in place, a crosspiece behind the seats engages with locks in the fuselage, which reduces the gap seals and keeps the canopy firmly down.

In keeping with his goal of building the airplane inexpensively, when it came time to hang the most expensive part of any airplane from the firewall, Mike again decided to trade elbow grease for savings.

Mike said, "The engine is a Lycoming IO-360-A1A, but it wasn't the prettiest engine you've ever seen when I bought it.

Mike Mahar and his GP-4. Mike is a hard-core builder who delights in scratch building because, "You have to love solving problems by yourself."

Wanting to get all three gear doors closed as tightly as possible, Mike designed a separate system that uses a small hydraulic cylinder that is sequenced to close the doors after the gear is up.

It was out of a Mooney and had been sitting in Charlie Jentus' basement for years, so it was about as rusty as an engine can get. In fact, I had to mill the cylinders off just so I could get the wrist pins out. About all I used was the case and the crank. Everything else was new. At this point, Dan Hopkins and I went to the Lycoming school in Pennsylvania to learn how to assemble and disassemble the engine. Then we assembled the engine with the help of a mechanic in northern Ohio."

One of the problem areas in any high-performance airplane is getting the landing gear to retract in such a way that all of the gear doors close perfectly flush with the belly of the airplane. It's the rare airplane that has tight gear doors, but Mike was determined that his would be one of them.

"I played all sorts of games with the landing gear and the doors," he said. "For one thing, as designed, there is supposed to be a long, tapered bump in the wing walk, which is stiffened by carbon fiber, by the way, for tire clearance. On mine I just faired the wheel in a smaller-than-designed bump. It looks better.

"The gear doors were a real chore to get closed exactly flush because when you're swinging the gear in the shop, there is no air load on anything; so the exact rigging changes when the airplane is flying. For instance, to get the inner, main gear doors and the nose-gear door to snap shut and be nice and tight, I put in a small 3/4-inch cylinder that was actuated by an electric valve that was signaled by the up-gear switches. When the gear is up, the switches turn on the electric valve. The valve lets the hydraulic pressure actuate the small cylinder that pulls on three small cables that pull the two inner main gear doors and the nose gear door closed. On that cylinder, there is a switch and when the cylinder reaches the closed position, the switch turns off the hydraulic pump.

"It's this kind of thing that makes scratchbuilding so different than building kits. You have to love solving problems by yourself. I'll still be changing and improving stuff on the airplane until I'm 95 years old."

THE GP-4 AND GEORGE PEREIRA

AN ANNIVERSARY WITHIN AN ANNIVERSARY

Although we are celebrating the 30th anniversary of the first flight of the Pereira GP-4, super-fast wooden wonder, this year, what we should be celebrating is the 70th (that's right, 70th) anniversary of George Pereira's introduction to flight training.

George recalled how he got started flying: "I was a freshman in college on a football scholarship and absolutely hated it. It was 1944 and World War II was in full swing; so I volunteered for flight training."

In short order, George traded his college campus for a U.S. Army Air Forces base outside of Foggia, Italy, from which he piloted a B-17 on raids into German territory.

When the war was over, George returned to Sacramento, California, got married, and eventually established a chain of building supply companies. George said, "I needed to be able to visit those stores on a regular basis, and they were spread over a wide area in Northern California, so I got back into aviation and bought a Mooney 21, which I flew often. In fact, out of boredom, I'd often fly over the coast and lakes around the San Francisco Bay area. I found myself thinking a lot about how nice it would be to have a personal airplane that would let me land on the water.

"At the same time, I got involved in building racing boats. These were ski-type boats using V-8s for power, so I got my feet wet, literally, in designing hulls.

"Eventually, I retired out of the building supply business and spent much of my time designing airplanes, the Osprey I flying boat being the first. The Navy even evaluated it. It appeared in a number of magazines, and I started getting requests for plans. Soon I found myself in the homebuilt plans business. At the same time, I redesigned that first plane into a two-place amphibian, recognizing that an airplane that couldn't land on a runway as well as water wasn't very practical. To date, I've sold more than 1,700 sets of plans, and lots of the aircraft are flying."

"In the early 1980s, I decided to build an airplane for cross-country flying. At the time, anything that did 200 mph was considered impossibly fast, so I set that as my minimum performance number and started educating myself on what it would take to go that fast behind what then was a new engine, the 200-hp IO-360-A1A."

The final design was the GP-4, a sleek, tapered-wing, retractable-gear speedster made entirely of wood. He said, "When I looked around, I saw a lot more guys with woodworking shops rather than metal or rag and tube talents. Plus, I was very familiar with wood, so that's the way I went with the airplane. So far I've sold more than 650 sets of plans, and there are more than 55 airplanes flying all over the world, from Norway to New Zealand."

Congratulations, George, on 30 years of helping homebuilders realize their dreams. And thanks for your service in WWII.

Photography by Jim Raeder

So, now the airplane is finished. Or close to it. Is it everything he hoped it would be?

"It's a mover, no doubt about that. On takeoff, you need to get the gear up and locked under 100 knots because of the gear doors. Then you're climbing as fast as you want to. It'll touch 2,000 fpm at 130 knots, but I'm usually using a cruise climb of 150 knots, which gives 1,100 to 1,200 fpm, which is plenty. I often just climb until I run out of throttle, which is usually around 6,000 to 8,000 feet, at which point I'll be cruising at 210 knots true or the 240 mph George Pereira said the airplane will do. At that speed I'll be burning 11.5 gph. If I bring it back to where it's burning only 9.5 gph, it's doing 190 knots TAS, which is still pretty fast."

Mike said that between the light landing gear, which has springs only, with little dampening, and the airplane's over-the-fence speed of 90 knots, he avoids unimproved runways. "It touches down at about 65 knots, with the flaps which are split flaps, at 30 to 40 degrees."

Mike is one of the first to admit that scratchbuilding a wooden airplane takes longer than building one of metal or rag and tube. However, he is one of those guys that, when he sees how something goes together and understands the project, he throws himself into it completely. He also said the project was made easier because George Pereira is a really good guy and was always there to answer questions. Plus, there's a really good materials list available, and both Aircraft Spruce and Wicks Aircraft Supply have good materials kits for it. That saves a lot of time and money.

"It's a mover, no doubt about that. On takeoff, you need to get the gear up and locked under 100 knots because of the gear doors."

When he was working on the airplane, Mike said, "I'd come in at 0600 and leave at 9 p.m., seven days a week, unless I was racing boats or snow skiing. I'd take 30-minute naps when needed, but I was determined to get this thing done in a reasonable time. I didn't want it to be one of those 10-year projects you read about. Dan Hopkins helped me a lot, and he's now building another GP-4 in my shop, putting all of the tooling and knowledge that we've acquired to good use."

For the record, it took Mike a total of two years to get his GP-4 into the air, although the interior and panel were works in progress for a while. Two years!

It's amazing what dedication and talent will do. Oh, by the way, Mike said he no longer has trouble reading. We're not surprised. 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*.

Designer George Pereira has an eye for sleek and aerodynamically clean lines. The result is a cruise speed of 210 KTAS.

Photography by Jim Raeder

The U.S. Sport Aviation Expo in Sebring, Florida, starts off the aviation year each January with an exhibition-only event focusing on homebuilt and light-sport aircraft (LSA) kits and ready-to-fly aircraft. It's a great venue for checking out all the available aircraft, avionics, headsets, and other accessories. Next year's event will be held Wednesday, January 14, through Saturday, January 17, 2015. Info: www.sport-aviation-expo.com

RANS newest design, the S-20 Raven, made its debut at the Sebring Expo, having been flown cross country from Kansas for the event. It's available as a kit ($25,500 firewall aft) or as a ready-to-fly aircraft ($112,000 as equipped at Sebring). Power for this aircraft is a Rotax 912S, but a ULPower engine will be the next one installed. Info: www.rans.com

Expo organizers extended a special welcome to homebuilt aircraft owners this year and set aside a special area for homebuilt owners to camp with their aircraft in addition to a special area for them to display their aircraft.

Stewart Covering Systems presented a workshop throughout the four days of the Expo introducing attendees to this new covering system. Info: www.stewartsystems.aero. Other forums covered aircraft insurance, Rotax engines, and numerous other topics of interest to homebuilt and light-sport aircraft pilots and builders.

EAA hosted a booth for members to renew their membership and have questions answered. Here, Homebuilding Community Manager Charlie Becker answers questions for a member while Heidi Hamm, manager of program fulfillment, assists a member in renewing his membership. Charlie also presented a keynote speech during the event highlighting how homebuilding has helped save general aviation.

Chip Erwin puts it right up front on his website (www.aeromarine-LSA.com): "Everything you need...and not much else." The catchy phrase clues you in to his latest aircraft production: the ultralight Zigolo motorglider. The new ready-to-fly ultralight is somewhat of a throwback to the original, low-cost, minimal structure approach to simple flight that changed everything back in the early 1980s. Powered by either a 25-hp, single-cylinder engine or an all-electric powerplant, the Italian-designed Zigolo will be assembled from components and sold ready-to-fly for $16,000, or $18,000 with electric power. A 100-hour quick-build kit is just $14,500. These prices are all-inclusive of engine, prop and a novel, pneumatic airframe rescue parachute. This nifty lifesaver deploys with a powerful spring-loaded mechanism instead of the traditional pyrotechnic-charged 'chute.

The Super Petrel LS also made its debut at the Sebring Expo. The biplane amphibian was having fun flying off nearby Lake Jackson in the city of Sebring. Jerry Scheid is bringing this first-of-its-kind Super Petrel LS to the U.S. market. Scheid has established PS-Bird LLC to represent it. Call 386-760-4140 for more information.

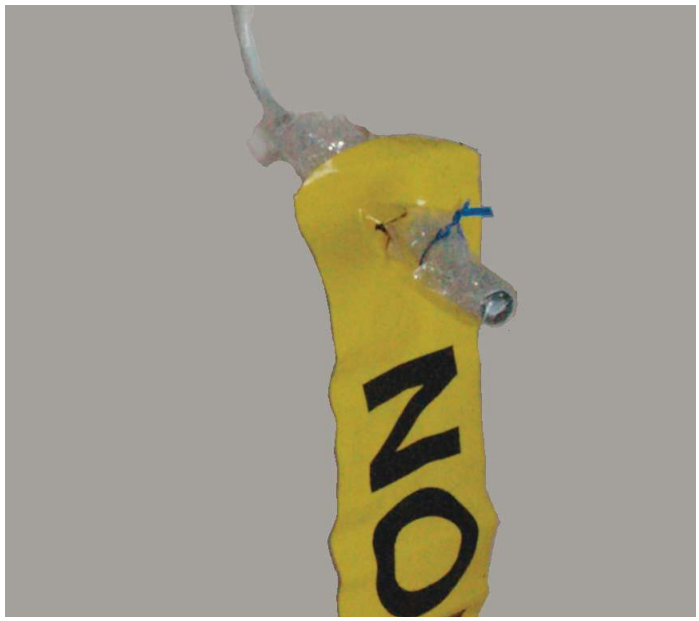
Autogyro USA displayed and flew their Calidus and MTO Sport model gyrocopters often throughout the weekend; when the winds were blowing, they were often the only aircraft in the air. Visit the company's website to learn more about building the autogyro of your dreams. Information at www.autogyrousa.com.

Photography by Jim Koepnick and Jim Lawrence

Poor Man's Pitot Cover

Make your own

BY CY GALLEY



HERE IS A POOR MAN'S pitot cover. If you have ever forgotten your cover, this solution is for you. As you know, some bugs and insects love to crawl into tiny holes and crevasses. Spiders will build their nests in your pitot and plug it. If you have a taildragger, many of their pitot tubes slant backward, so rain will run in and plug them. This happened to me at EAA AirVenture Oshkosh. The tower gets perturbed if you shut down on the runway, but that's not nearly as stressful as if you take off without an airspeed indication. One can avoid all this heartburn by using the poor man's pitot cover.

You can make a very good cover out of a sandwich bag, some construction warning tape, and a twist tie. You can substitute almost any thin plastic, wire, or rubber band.

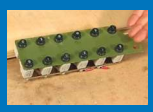
Cut an "X" as shown, which will be about the same diameter as the pitot. Wrap the bag around the pitot assembly. Slide the hole in the warning tape over the bag. Then secure it with the twist tie.

When it's time to go flying again, just roll up the warning tape, put it in the baggie, and secure it with the twist tie. This quick fix is low cost and lightweight and takes up little room. In addition, if it is lost or borrowed, you can quickly make up another one. EAA

HINTS FOR HOMEBUILDERS VIDEOS

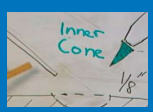
HERE'S FOUR OF THE MORE THAN 400-PLUS HINTS FOR HOMEBUILDERS VIDEOS AVAILABLE ON WWW.EAA.ORG

Overview of Bolt Torque Issues
Dave Clark from the Vintage Aircraft Association and an A&P instructor at Vincennes University provides an overview of issues associated with either under or over-torquing a bolt, including torque wrench usage.



Installing Circuit Breakers
In this video, Dick and Bob Koehler show how to install circuit breakers for your panel. Dick and Bob are both Technical Counselors, A&P aircraft mechanics with Inspection Authorization (IA), and SportAir Workshop instructors.

Bending Wood Capstrips
In this tip, Earl Luce demonstrates an easy method for prebending your wood capstrips. Earl is an EAA SportAir Workshop instructor and a volunteer EAA Technical Counselor.



Welding By The Numbers
Dr. Joe Maj, an AirVenture volunteer in the gas welding workshops and SportAir Workshop instructor, shares his three key numbers for gas welding success. If you adopt these three key numbers, you will learn how to gas weld much quicker and easier.

Photography by Cy Galley

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Maurice Fry preparing for a test flight in the Aeronca TG-5.

Return of the Nine-Day Wonder

Aeronca's TG-5 training glider

BY CRAIG MACVEIGH, EAA 614781

AMONG THE UNSUNG HEROES of World War II were the contributions of the Allied glider programs. There is a handful of the large Waco CG-4 cargo gliders still in existence, but even fewer of the training gliders. A couple of Taylorcraft TG-6 gliders are displayed in museums around the country. The Western Antique Aeroplane & Automobile Museum in Hood River, Oregon, has one it occasionally flies. Reportedly, there are some Piper TG-8 airframes still around, rumored to be in private collections and some that continue to fly, cloaked as J-3s. But there are no Aeronca TG-5 gliders. The Aeronca airframe was different enough that it was not easy to convert into a powered plane after the war. So they were stripped of parts and left to rust away from memory.

BIRTH OF THE NINE-DAY WONDER

During World War II, America began the development of an assault cargo glider program. But it was discovered that existing high-performance gliders did not reflect the flight characteristics of the assault gliders. A way to train assault cargo glider pilots was needed. Charles Stanton, then the head of the Civil Aeronautics Administration (CAA), proposed an idea to convert two-seat liaison aircraft into training gliders. His idea was to remove the engine and create a third seat, thus maintaining the weight and balance.

On May 11, 1942, Stanton made a call to the Aeronca factory. After a quick discussion with Lee Smith, vice president of Aeronca, the company jumped on the proposal. Over the next several days, Aeronca's design team, led by Ed Burns, engineered the model G-3 training glider, based on the TA/O-58 (L-3) tandem airframe.

While the design was progressing, construction was underway. On May 20, the completed airframe, with Aeronca test pilot Maurice Fry at the controls, was towed by a car to a height of 20 to 30 feet. A mere nine days had passed since the phone conversation between Stanton and Smith.

On May 21, flight tests were flown by Maurice Fry and Major Barringer. These flights were made with one to three crewmen on board. The following day, Major Barringer flew the G-3 under tow 500 miles from Middletown, Ohio, to Washington D.C. Flight tests were continued by the CAA and U.S. Army Air Forces. On May 26, the G-3 went back to Middletown to have spoilers developed and installed. On June 6, the order was finalized for 250 TG-5 airframes.

Photography courtesy of Craig MacVeigh

Three of these airframes were later transferred to the Navy, designated as LNR-1. Aeronca had proved Charles Stanton's training glider concept. Taylorcraft's TG-6 and Piper's TG-8 followed shortly.

REBIRTH OF THE NINE-DAY WONDER

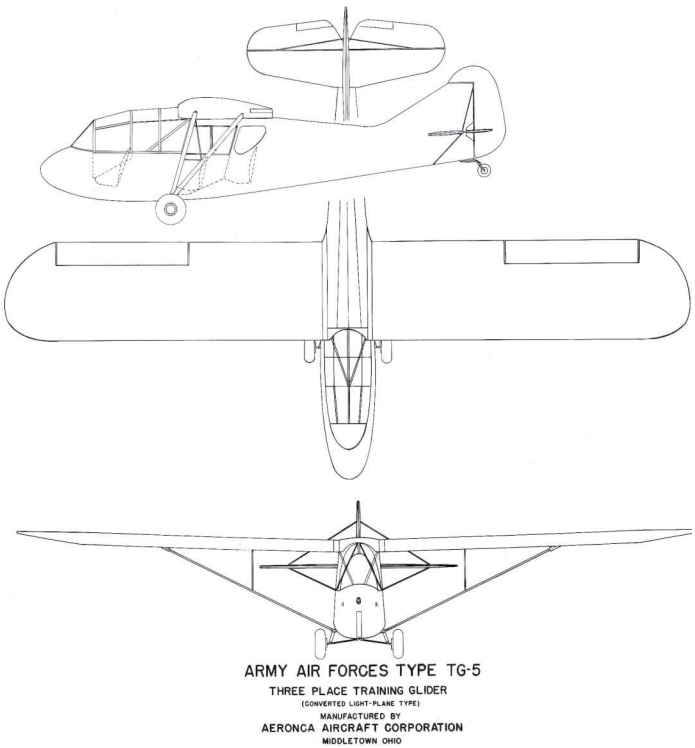
I love all things Aeronca, and I own several Aeronca aircraft, including a 1930 C-2N. I have been gathering TG-5 glider parts for more than 20 years. I first saw a picture of Ed Burns sitting in the prototype nose section and knew I had to find one. To date, the nose assembly has been the last major portion of the airframe to elude me. I keep thinking I'll see one hanging on the wall in some little bar outside Yuma, Arizona, but I haven't yet. However, I have been successful in finding some parts. I've received calls that someone in Spokane found some spoilers that were on a set of wings they put on an L-3 decades ago. And I was looking at pictures of a friend's project and found a rear instrument panel in his parts pile, so I know needed parts are still out there.

Pictures and technical support have come from visits with John Houser, a former Aeronca engineer. Drawings are available from the National Aeronca Association. Magellan Aerospace, formerly Aeronca Inc., has also provided support. Guidance and encouragement also comes from my mentor, Tom Murphy, who restored the flying TG-6 prototype.

I'm currently working to complete two flying TG-5 airframes. The first may fly in 2014. I look at it and think since

The TG-5 airframe getting a new nose.

The production TG-5 in flight.

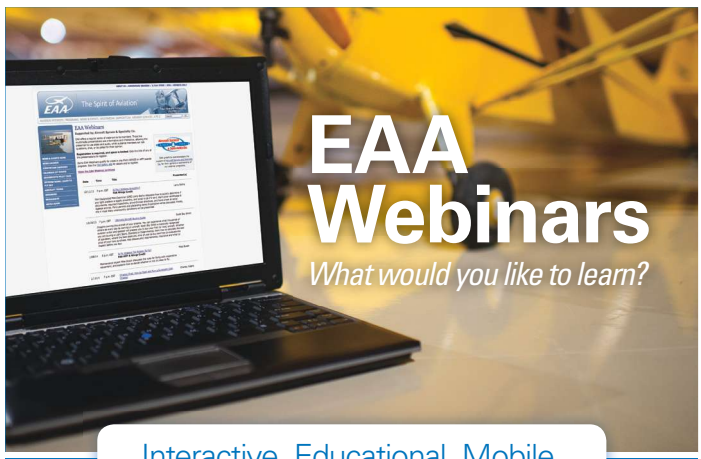


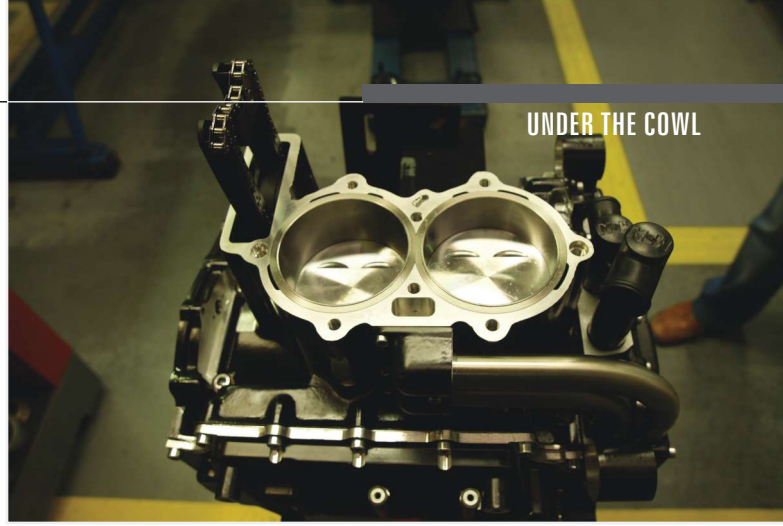
the prototype flew in nine days, I should have mine done next week.

A third airframe, a flyable replica, is going to be a multi-chapter project. As of now, folks from EAA Chapters 441, 54, 486, and 362 are—or will be—involved. Chuck Burtch (EAA 10213) of Phoenix, New York, has also had dreams of sitting in a TG-5 nose section. He and I are fellow staff members of the EAA Air Academy, and that's where we started comparing dreams and hatched this idea. The jigs and information being assembled for the restorations will be passed to the EAA project. Parts will be built by members across the country. Each year at Oshkosh, the assemblies will come together. At some point, the completed airframe will be covered and finished during an EAA AirVenture Oshkosh convention. Chapter 486 is a 501(c)(3) organization, so all donations can be gratefully acknowledged.

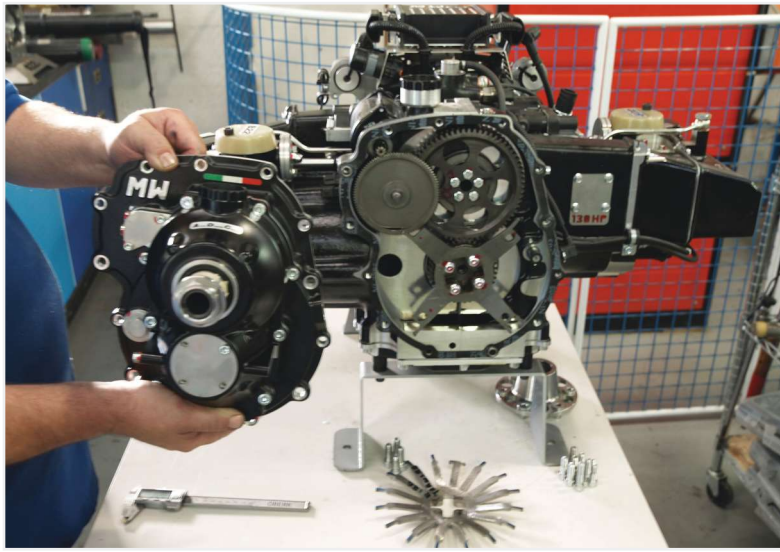
There are also some replica projects in the works in Ohio and Maryland, too. It's exciting to think about the possibility of a whole line of training gliders in the Warbirds area. They'll be the ones not belching blue smoke!

Editor's Note: The project members are looking for L-3 and TG-5 parts or tax-deductible donations. Contact Charles Burtch at cburtch@windstream.net. EAA





The newest engine in the MW Fly portfolio—the 150-hp flat four, the B25R.



The whole MW Fly engine lineup is adopting the second generation PSRU, which is suitable for fixed- and variable-pitch propellers. On the table is the new crank position/speed sensor; the old sensor is still installed on the engine.

The MW Fly Engine

A new Italian manufacturer comes to the U.S. market

BY MARINO BORIC

IN THE LAST DECADE, we have witnessed little new engine development in the ultralight/light-sport/experimental aircraft field for engines up to 110 hp that could possibly challenge the Rotax 912/914 engines. In the range from 100 to 150 hp, the situation was even worse. But that situation substantially changed in 2010 with the introduction of several new and interesting powerplants. The experimental aircraft builder now has a wide variety of options available, including ULPower, the D-Motor, and the Viking engine, just to mention a few.

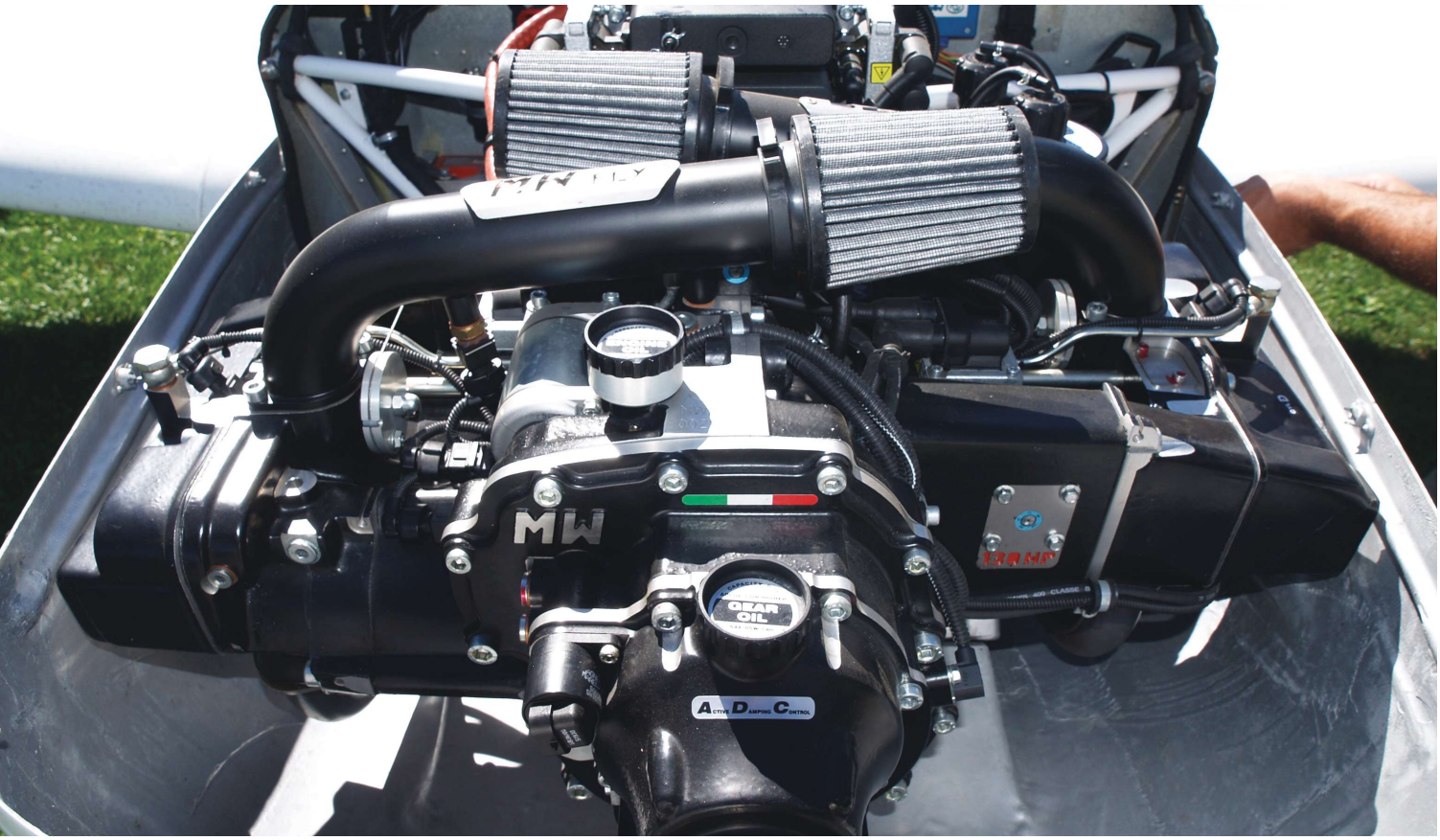
Now a new Italian engine manufacturer is dramatically widening the engine choices. In 2013, MW Fly introduced four Aeropower engines to the U.S. market in power ranges from 95 to 150 hp, and it is promising more engines soon.

This northern Italian company from Milan had been working secretly on a clean-sheet engine project for experimental and light aircraft since 2003. Fourteen years ago, two engineers from the Politecnico di Milano—Stefano Marella and Guido Fantini—started designing a new family of aviation engines. Marella and Fantini already owned an engineering company specializing in racing engine development and tuning. In 2004, the first two prototypes of the B22 engines were built, fired up, and dyno tested. A year later, three more engines swinging propellers were tested on an engine stand.

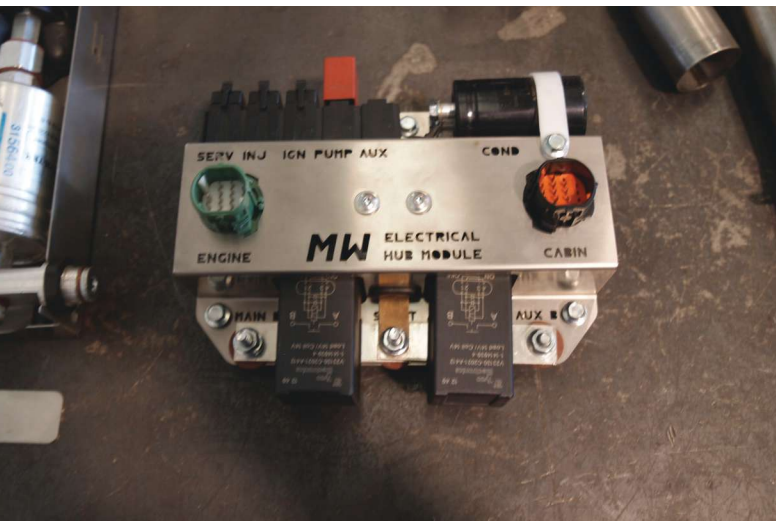
In 2006, the B22 engine was airborne on board a trike and flown in a pusher configuration. Two years later, the engine was installed and flown in an Italian ICP Amigo low-wing aircraft. By mid-2008, the project was still secret; but testing was getting difficult to hide and the first reports of the engine development were leaked.

In May 2011, the engine was finally introduced in Italy and then internationally during AERO Friedrichshafen 2012 in Germany. At the end of 2011, the serial assembly of the engines began within the structure of Officine Aeronautiche David (OAD) in Brescia, Italy. Since 1989, OAD has been a certified aviation engines overhaul and servicing company and is well known in Europe. OAD is handling engine maintenance for European engines and is a training center for MW Fly maintenance personnel.

Photography courtesy Marino Boric



Because of the length of the air intake manifolds, in flight the MAP is higher than the outside air pressure.



This "electric block" makes the engine installation easy.

In 2013, MW Fly introduced four Aeropower engines to the U.S. market in power ranges from 95 to 150 hp, and it is promising more engines soon.

AEROPOWER ENGINES: ONE BASE, FIVE VERSIONS

The MW Fly B22/25 engines are designed in a classic aeronautic spirit but using modern technologies. All Aeropower engines are aluminum made, have four cylinders, and are four-stroke with horizontally opposed cylinders. All engine versions/variants are liquid cooled, with two overhead camshafts (chains driven) and two valves per cylinder. The B22 engines' displacement is 2200 cc ("22" stands for 2200 cc), and the last developed engine, the B25, has a 2500-cc displacement (achieved by a bigger cylinder bore). The naturally aspirated B22 and B25 engines deliver from 95 to 150 hp.

The Aeropower engine variants are:

1. B22D, 95 hp at 3300 rpm, direct drive, 80 kilograms (176 pounds)
2. B22L, 115 hp at 3950 rpm, propeller speed reduction unit (PSRU), 84 kilograms (185 pounds), $16,900, TBO 2,200 hours
3. B22R, 130 hp at 4550 rpm, PSRU reduction gear, 84 kilograms (185 pounds), $18,900, TBO 1,800 hours
4. B22H, 130 hp at 4550 rpm, direct drive for helicopters, no reduction gear, 79 kilograms (174 pounds)
5. B25R, 150 hp at 4550 rpm, PSRU reduction gear, 84 kilograms (185 pounds), $21,900, TBO 1,500 hours.

Weight specs are for bolt-on engines less liquids, water

cooler/muffler, and electric fuel pumps. For pricing, contact the manufacturer or a local dealer. The above prices/data are those collected during EAA AirVenture Oshkosh 2013.

AEROPOWER 'BOLT-ON ENGINES'

The installation of an Aeropower engine is pretty simple, MW Fly said, as almost all necessary components are already attached to the engine. The manufacturer claims that all that is necessary for operation is to attach the throttle and the fuel lines and connect to the AC electrical installation. Four attach points are an integral part of the engine as is the complete oil and cooling system; the water cooler can be attached to the engine, but it is optional as is the muffler. (The installation differs from airplane to airplane.) The cooling thermostat and expansion tank are integrated in the engine as is a 350-watt alternator and the air intake manifolds with filter. Engine oil doesn't need a cooler and all oil lines are internal.

IGNITION AND FUEL INJECTION

The Aeropower engines are fuel-injected engines where two separate engine controllers (ECUs) fire two spark plugs per cylinder. The fuel is now injected via single injector per each cylinder head. The double fuel injector solution per cylinder side is in development and will be available in 2015.

As expected in a modern engine concept, the fuel-air mixture is calculated by two separate ECUs that are fitted with an emergency function. The ECU computes the amount of injected fuel based on parameters such as engine rpm, intake air pressure, motor oil temperature, air temperature, and absolute atmospheric air pressure. The ECU computer is mounted on the engine on its upper rear side and is connected to the proprietary health status annunciator module (HSA-M) in the cockpit via a CAN-bus line (can be used by Dynon or MGL devices). One fuel injector per cylinder pair is located directly behind the throttle valve in the middle of each cylinder head. This single injector may be duplicated; there are already holes for an extra pair of injection nozzles in the cylinder head.

ENGINE WEIGHT

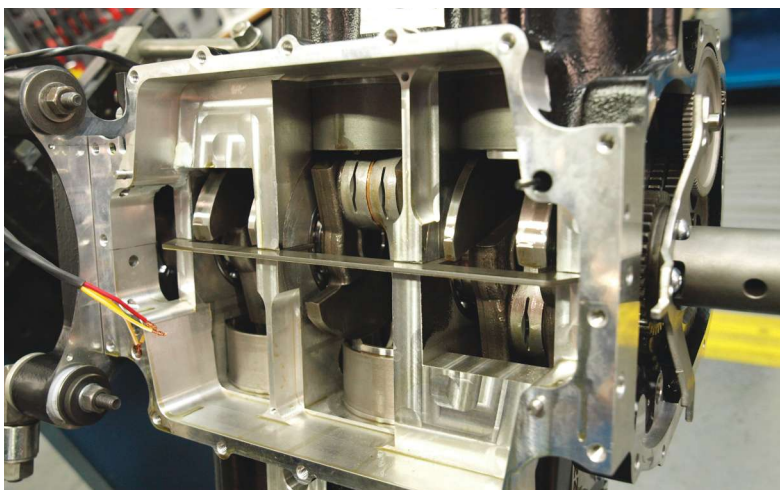
While looking sturdy and heavy, the Aeropower engine is only one inch wider than the Rotax 912 but is shorter and lower than it. In terms of weight, the Aeropower engines are some 20 pounds heavier than the Rotax engine, but the B22/25 engines deliver 130 to 150 hp, 30 to 50 hp more than Rotax 912. Taking this into consideration, you can see that the weight-to-power ratio becomes very appealing, indeed.

ENGINE DETAILS

The opposite-cylinder, flat-engine design principle, widely used in aviation, was chosen because of its low vibration level, the liquid cooling for reasons of durability and easy maintenance. Speaking about maintenance, I have not seen an aviation engine that has so many openings for engine

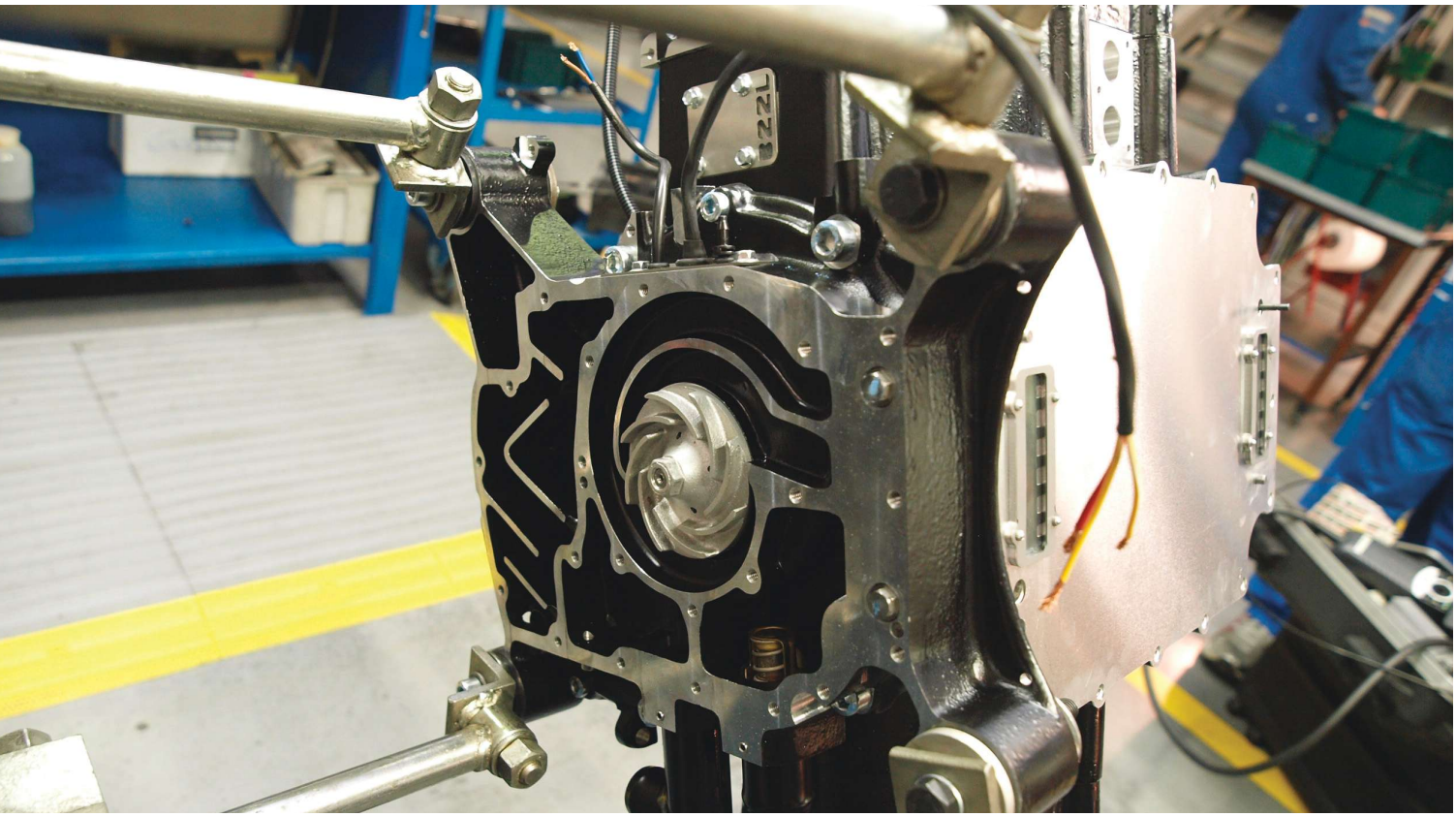
Probably the most unique feature of MW Fly engines is the numerous openings on the engine casing allowing the entire engine to be inspected with a boroscope.

The new single-engine controller casing hosts two separate engine controller units.

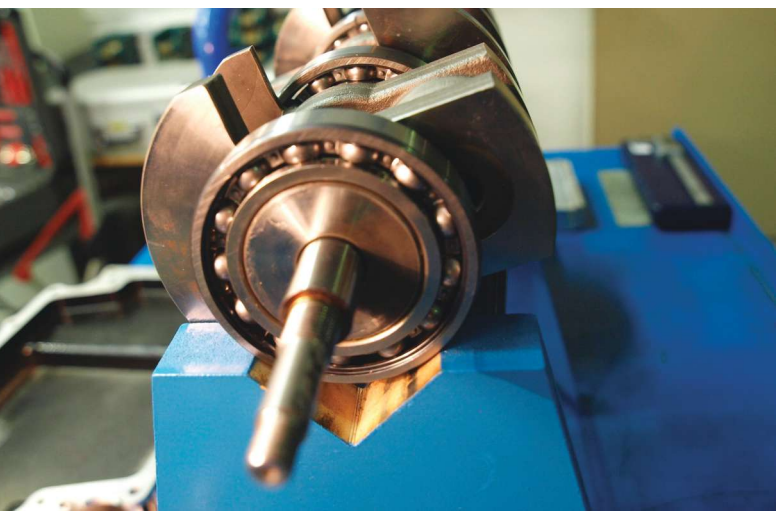


The MW Fly engine from below; the oil-pan is removed, giving us a great view of the crankshaft and the lower portion of piston rods.

Photography courtesy Marino Boric



This is the rear side of the engine. In the middle is the water pump and internal fluid ducts. On the engine outer perimeter are the four engine-mount points.



One of the unusual characteristics of all MW Fly engines: the crankshaft rotates in ball bearings.

inspection with a boroscope. Through these holes, located in cylinder heads and in the engine "basement," the engine can be inspected throughout. For inspection of the crankshaft and its bearings, the entire engine block, piston heads, and cylinders, little more than 20 minutes are needed, without a need to remove any engine component.

Usually, crankshafts and connecting rods are rotating on slide bearings in aircraft engines. Those bearings have higher friction and require higher oil pressure; that's why MW Fly decided to use ball/needle bearings instead of plain bearings. Therefore, the MW Fly oil pump produces a lower pressure and is less stressed.

In the case of the total loss of the mechanical oil pump, oil mist in the engine is already sufficient for adequate lubrication for a several hours of flight at reduced power. Even after completely losing oil, the engine will run for 15 minutes. The connecting rods are built monolithic, a contribution to greater robustness. The Aeropower engines are wet-sump engines, where the oil is contained in an oil sump located below the engine. So-called "gravity" valves are installed between the crankcase and the oil sump and let the oil flow from the crankcase to the oil sump, but they stop the flow in the opposite direction in case of an inverted flight. Aeropower engines have two overhead cams (OHCs) with two timing chains (one for each cylinder bank) that are driven by the secondary shaft and assisted by a chain tensioner.

REDUCTION GEAR

All Aeropower engines can be delivered with or without the reduction gear; the basic 95-hp B22D engine is an exception as this engine is produced only as a direct-drive engine.

So-called "gravity" valves are installed between the crankcase and the oil sump and let the oil flow from the crankcase to the oil sump, but they stop the flow in the opposite direction in case of an inverted flight.

Aeropower engines now feature a new and narrower propeller reduction unit that allows for much more streamlined engine cowlings. Props are rotating counterclockwise (clockwise on the 95-hp version), and the electrohydraulic prop governor is an option. In case that the market demands a geared engine with clockwise prop rotation (for twin-engine installation), MW Fly could satisfy that request in the future.

The B22/25 Aeropower engines feature a unique mechanical torque reduction system called ADC. According to MW Fly, this electrohydraulic system replaces the commonly used mechanical torque reduction that is a critical mechanical component and is subject to wear. The ADC system is lowering engine vibrations during the start procedure, during engine shutdown (it prevents the kickback), and on low engine rpm. What in theory sounds complicated can simply be explained like this: The engine computer is lowering the engine compression below 1,900 or 2,000 engine rpm, lifting the exhaust valve a bit so that the engine compression drops from the normal 1:10-to-1:5 ratio. The consequence is that the engine is firing much "smoother" than running with the "full compression. The ADC system doesn't need any maintenance and has been designed so that any failure of hydraulics or electronics does not compromise the flight safety as the engine can be continuously operated in that mode (with a 25 percent lower power output).

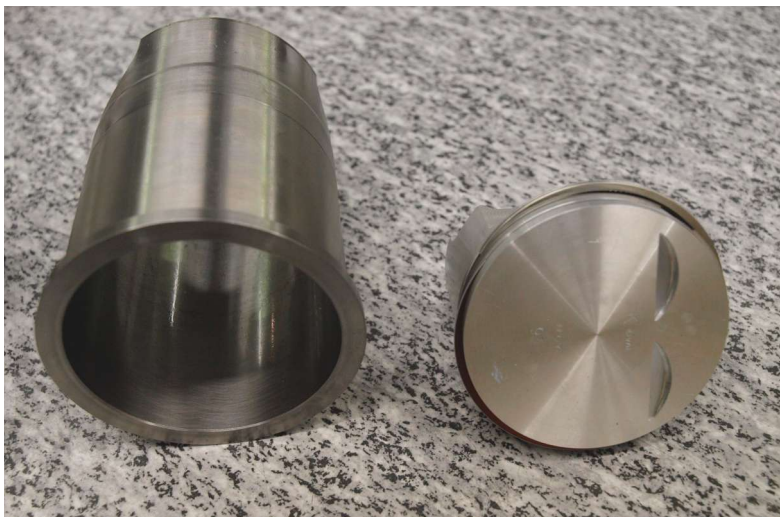
The MW Fly engines have been tested in fixed-wing aircraft, gyrocopters, trikes, and most recently a helicopter. After years of development, the company can confirm its original calculations and expectations now. Recently, the European Aviation Safety Agency (EASA) 50-hour test for certification was completed, so ASTM certification is expected soon. The MW Fly B22/25 engines have definitively enriched the engine choices for the experimental/light-sport aircraft builder.

For more information, visit *www.MWfly.it* and *www.David.it*. The North American distributor's address for these engines is Ottawa Aviation Services, 220 Hunt Club Road, Ottawa, Ontario, K1V 1C1, Canada. Visit *www.OttawaAviationServices.com*. EAA

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

Two of the four monolithic (one-piece) connecting rods on the MW Fly engines.

MW Fly owners Stefano Marella and Guido Fantini discuss the 150-hp engine details with the owner of Officine Aeronautiche David (OAD) in Brescia, Italy, where the engine is assembled.



The bigger bore cylinder liner and the piston for the 150-hp engine.

Photography courtesy Marino Boric

The new Garmin VIRB compact video camera can be controlled remotely and previewed on a Smartphone using the latest version of the Garmin Pilot app for iPhone and Android.

The Lure of Video

Enjoy our flights over and over

BY DAN GRUNLOH

WE ARE LUCKY TO be alive at a time when we have the freedom to fly for fun and when so many different kinds of aircraft are available. We are also lucky to be flying when it is so easy to document our experiences through video and share them with others. The ease with which we can shoot, edit, and quickly publish videos of flying has increased dramatically with the advent of the latest tiny video cameras. Video photography brings more fun to sport flying and is quickly becoming the primary way for newcomers to learn about flying. Video is everywhere and in all our devices, and aviation is perfect for the medium. Anyone who has explored videos on YouTube knows how much can be found there and how quickly one video leads to others. Video is the way to go if we want to attract youth to aviation.

EAA Vice President of AirVenture Features and Attractions Jim DiMatteo talked about the importance of video during a meeting with the EAA Ultralight & Light-Sport Aircraft Council in November 2013. A retired Top Gun aviator and organizer of international Red Bull Air Races knows what it takes to appeal to the youth. Jim said we are pilots, and we all tend to look at ultralights as an entry point into aviation. He figuratively "put on his Red Bull hat" for a second and looked at ultralights from the viewpoint of a young person. It looks like an extreme sport that could lead to aviation later, but for now the appeal to those interested in snowboarding or motocross is the fun of making videos with a GoPro and other small video cameras. The draw is not the desire to be a pilot. Instead it's the appeal of doing fun, cool things and making videos to share with friends. He thinks fun flying videos have an appeal to the youth that can attract major commercial sponsors. I have long felt that ultralights are a significant factor in attracting people to aviation. Ultralights can draw people into aviation who would otherwise not consider aviation accessible. They come for the ultralights, but they will learn more about all the other aspects of sport aviation and may try one of them.

MAKING AND EDITING LIGHT-SPORT VIDEOS

For video newcomers like me, a great place to start is with a set of three helpful videos by Richard DeHaven, the pilot of a StingSport light-sport aircraft (LSA) in Davis, California. His video "How to Make Videos From Small Aircraft" should be required viewing for anyone posting flying videos. He has advice on choosing and mounting helmet cams such as the well-known GoPro Hero or the newly released Garmin VIRB cameras. Please check out his nearly 40 videos of flying around scenic California for examples of his work...if only everyone followed his advice to keep it short and to add music or narration to the film. A long video with only the drone of the engine and the wind noise can be less than exciting for everyone except the original pilot. Even if you never plan to publish videos, it's wonderful to view and replay your own flights on those cold, dark winter nights when you can't fly. I should have started doing it sooner.

The great thing about these tiny cameras is how easy they are to mount almost anywhere on the airplane. In the distant past, I have mounted a full-size 35-millimeter camera off the wingtip of my trike. Landing and taxiing was a nervous situation. I recently watched a pilot attach a tiny helmet camera to the metal tail surface of a Sonex airplane with packing tape. He simply taped it on and went flying. It was so easy; it's amazing.

Flying videos are generally better if multiple views are shown. Alternate views are especially helpful in tractor airplanes to break up the constant intrusion of the curved prop image caused by digital shutter effects.

My trike offers the choice of mounting on the landing gear or the control bar of the wing. In turbulence, the wing mount gives me better results because the trike wing is quite damped in the roll axis whereas the undercarriage wiggles around more. In either case, turbulent conditions do not produce good videos. We want to show the fun of flying, not the uncomfortable bits. Trike pilot Barry Maggio garnered publicity when he became the first LSA trike pilot to fly up the Hudson River and around the Statue of Liberty. His "Flying Around New York Harbor" video was shot from the trike control bar, and Barry has been experimenting with a video camera mounted with a panning tripod head.

Browsing through the vast number of flying videos online will yield examples of some unusual mounting positions that produce striking results. Paraglider pilot and AirVenture ultralight volunteer John Vining suspended a small helmet camera from a line off the end of his paraglider wing. The camera is turned on and then laid out on the ground with the canopy for takeoff. As the chute comes up on takeoff, the camera is lifted and then guided by small fins; it follows him and documents the flight from a unique angle. He calls it his chase cam. Watch his delightful film "Oshkosh Ultralight Field 2012."

The possibilities for camera mountings are limited only by imagination. I'm surprised I haven't seen a GoPro or other tiny video camera mounted on a small pistol grip. I'd like to try having one mounted in a holster on my chest so I could whip it out quickly for opportunistic videos. Besides mounting a video camera on your powered parachute wing, a tripod pan head, or a pistol grip, there is one more possibility, the "camera on a stick" method. An exciting gyroplane video from Germany illustrates the possibilities of this configuration and at the same time begs for comment about the apparent lack of any safety line or tether on the equipment.

IMPORTANT SAFETY WARNINGS

Whenever the pilot in command is involved in taking pictures or videos, extra vigilance is required to maintain safety. It's easy to get absorbed into the picture-taking process and forget to fly the airplane. The desire to "get the shot" can tempt the pilot to take additional risks. Having a passenger operate the handheld camera should improve the safety and the photography. All handheld still and video cameras should be tethered. It's absolutely vital for open-cockpit pusher aircraft and can be as simple as a neck strap that actually goes around your neck. I can't count the number of times I have seen handheld cameras used in open cockpits without a safety line. Mine is tethered to the shoulder harness with a carabiner link. A dropped camera that encounters the prop will surely cause a

The shadow of a trike on a harvested soybean field from a NEX-6 camera mounted on left landing gear.

forced landing, and the wing or control system could be damaged by flying prop debris. Most of the time, a dropped object will fall clear of a pusher prop. However, if it bounces off the landing gear or wing strut, bad things could happen. Loose cameras in enclosed airplanes (even tractor types) should also be tethered because a camera dropped on the floor can foul control lines or rudder cables.

LURE OF THE VIEWFINDER

My recent attempt at making in-flight videos was with a conventional, compact camera. Most of the latest digital cameras have that capability. My Sony NEX-6 can take HD movies, but being heavier than the typical helmet cam, mounting options are fewer. It brings, however, a blessing (and a curse) in the form of the large LCD viewfinder. It is fabulous to have a live view and be able to adjust the zoom and exposure in real time, and it's great to be able to watch a replay immediately to see if it worked. However, flying the plane and looking at the viewfinder is a little like texting on your phone while driving in busy traffic. We humans don't multitask well; it was clear to me the video screen has incredible attractive power. It takes considerable discipline to avoid concentrating on the screen while shooting video. If you don't have a large viewfinder for your video photography, take consolation that you are probably safer without it.

MOVIE NIGHT AT EAA AIRVENTURE OSHKOSH 2014

Because of last year's successful event, we plan to have another open video screening at AirVenture 2014 in the Ultralight area. It will be an evening activity after the flying has ended, so watch for announcements. It was fun last year, but there were some technical difficulties with hardware and software compatibility. We will be asking filmmakers to submit their best short video or provide a web link to the video in advance. The video should show the fun of flying ultralights and light planes. The top films will get wider play perhaps at AirVenture and online. Wouldn't it be great if we could have a jumbo video screen to show our best videos in a continuous loop? Look for my first video efforts on my YouTube channel.

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.

Trim-Speed Band

How to find it for your airplane

BY ED KOLANO

HAVE YOU EVER BEEN frustrated with your airspeed control on final approach? How about taking several minutes to get your plane trimmed for that exact cruising speed? Well, it might not be your fault. It might just be your plane's trim-speed band that's causing your frustration.

The trim-speed band is the range of air speeds an airplane will maintain with no force exerted on the control stick. This phenomenon is usually caused by friction in the longitudinal control system that prevents the elevator from returning to its pre-deflected position. Held at its new deflection by friction, the elevator now commands a slightly different wing angle of attack, which results in a slightly different airspeed. Not all airplanes have a trim-speed band, but you won't know until you check for it.

If you've never been frustrated while trying to trim your airplane for an exact airspeed, your plane may not have a trim-speed band. If you have experienced difficulty nailing an exact speed or found after you thought your plane was trimmed for one speed that it seemed happy to fly a few knots faster or slower, there may be a trim-speed band. It's worth checking out. Here's how.

THE TEST PROCEDURE

Start by establishing a straight-and-level flight condition with the airplane trimmed for hands-off flight. It's not necessary to be absolutely level; a slight climb or descent is acceptable, but a steady airspeed is essential. Note your observed airspeed (what you read on your airspeed indicator). Let's say this "trim speed" is 120 knots.

Now slow down a couple of knots using only back-stick. Do not retrim or adjust the engine or propeller controls. Take your time to make sure you are stabilized at a steady speed. Let's say you've stabilized at 117 knots. You'll probably be climbing slightly, and that's okay. Slowly release your pull force on the stick while watching your airplane's nose and the horizon. If the airplane's nose drops when you release the back-stick force, you are outside the trim-speed band. If the plane's nose remains at the same place relative to the horizon, you are still inside the trim-speed band.

Do not rely on the artificial horizon, altimeter, vertical speed indicator (VSI), or the airspeed indicator for this test. The nose movement relative to the real horizon is a much finer gauge. If the nose moves down, it will occur immediately upon relaxation of the back-stick force, but it will probably not pitch nose-down quickly. You'll have to be meticulous to observe this sometimes subtle pitch change. Any head motion can give the appearance of the nose moving relative to the horizon, so make sure your head is perfectly still when you relax the back-stick. It's easy to become narrowly focused during this test, so don't forget your other pilot obligations, especially seeing and avoiding other aircraft.

If the airplane's nose did drop when you released your pull on the stick, you know that 117 knots is outside the trim-speed band. Again using only the control stick, stabilize at 118 or 119 knots and repeat the test. Let's say you stabilized at 118 knots, and the nose dropped again when you relaxed your pull. Repeat the test at 119 knots.

If the airplane's nose did not drop when you relaxed your pull at 117 knots, slow down a few more knots, and repeat the test. Repeat the test at progressively slower speeds until the nose drops. Let's say the nose did not drop at 117 knots, so you tested again at 112 knots where it did drop. You now know the slow end of the band is somewhere between 112 knots and 117 knots. You might try 115 knots next. If the nose drops here,

you'll know the slow end of the band is 116 knots. If it doesn't drop, the end of the band is somewhere between 112 knots and 115 knots. Continue this bracketing technique until you find the slow end of the trim-speed band.

Once you know the speed of the slow end of the trim-speed band, repeat the entire procedure at airspeeds faster than the original 120-knot trim speed. Using only the control stick, accelerate to a few knots faster than 120. Do not retrim or adjust the engine or propeller controls. Stabilize at the new, faster airspeed, and relax your push on the stick. If the nose rises, you're outside the band. If the nose does not move relative to the horizon, you are still inside the trim-speed band, so accelerate a few more knots and try again. Use the same bracketing technique and careful observation as you did for the slower airspeeds until you determine the fast end of the trim-speed band.

Let's say the fast end of the band was 124 knots and the slow end was 114 knots. This means your airplane has a 10-knot trim-speed band under this flight condition. It will maintain any airspeed within that 10 knots hands-free and without re-trimming. Knowing this can ease your future frustration when you're having difficulty trimming to an exact speed. One way to deal with a 10-knot trim-speed band during normal flying is to make those final tiny airspeed adjustments by nudging the stick forward or aft a tiny bit, and let the control system friction hold the elevator at its post-nudge deflection. This is often a lot easier than chasing an exact target airspeed by retrimming. An even easier solution is to just accept flying a couple of knots faster or slower than your target cruise speed.

We identified the 10-knot trim-speed band as 114 to 124 knots in our example, but the band will not always be a 6-knot-slow/4-knot-fast situation. It is a band, so it could lie anywhere around the 120-knot "trim" speed. The next time you establish a 120-knot cruise speed, the band could be 112 to 122 knots, 119 to 129 knots, or even 120 to 130 knots. You can never be sure where you are within the trim-speed band unless you test it. Naturally you are not going to perform this laborious test every time you level off, and it is not necessary. Just know that your airplane has a 10-knot trim-speed band during cruise flight around 120 knots.

You should repeat the entire test with your airplane set up for the landing pattern because the trim-speed band could be different than it is when cruising. Another important reason to perform this test for the landing condition is that we tend to fly much more precise airspeeds around the pattern, particularly on final approach. A large trim-speed band can mask any stick force cues to airspeed deviations, making it easier to drift off your desired final approach speed as more and more attention is directed outside the cockpit and less time is spent scanning your airspeed indicator.

Knowing you have a small trim-speed band allows you to trim for your final approach airspeed and concentrate on glideslope and line-up. Whenever you notice you're holding back- or forward-stick, you'll know you're flying slower or faster than the speed you trimmed for, assuming there's no change in configuration or power settings. All pilots use tactile cues like this whether they realize it or not, and this off-speed stick force cue is valuable feedback on final approach as progressively more of your attention is directed outside the cockpit. If your airplane has a large trim-speed band, you'll know that a diligent airspeed indicator scan is absolutely essential for tight airspeed control on final approach.

BY THE NUMBERS

1. Establish straight-and-level flight with the airplane trimmed for hands-off flight at a steady airspeed.
2. Decelerate a few knots using only the control stick. Do not retrim or adjust engine or propeller controls.
3. Stabilize at the new airspeed.
4. Note the relationship between your plane's nose (or canopy bow or some fixed airplane reference) and the real horizon.
5. Relax your pull on the stick while observing your plane's nose and the horizon.
6. If the nose does not drop relative to the horizon, you are inside the band.
7. Repeat the process, starting at Step 2.
8. If the nose drops relative to the horizon, you are outside the band.
9. Using only the control stick, establish a new steady airspeed between this speed and the last speed at which the nose did not drop. Do not retrim or adjust engine or propeller controls.
10. Repeat the process, starting at Step 3.
11. Continue this bracketing technique until the slow end of the trim-speed band is determined.
12. Using only forward stick, establish a steady airspeed a few knots faster than the original trim speed from Step 1. Do not retrim or adjust engine or propeller controls.
13. Repeat Steps 3 through 8, substituting the word "push" for "pull," "rise" for "drop," and "fast" for "slow."
14. After determining the slow and fast end speeds of the trim-speed band, subtract the smaller number from the larger number—the difference is the trim-speed band.

You don't have to rush out to test your airplane if you've never had a problem trimming your airplane or tightly controlling its airspeed. On the other hand, if you have experienced these symptoms, maybe it's not your fault. It's worth a check during your next $100 hamburger jaunt.

This month we explained how to determine your airplane's trim-speed band. We also discussed how the size of the trim-speed band can affect airspeed control, frustration, and safety on final approach. Now we're ready to delve into longitudinal static stability testing, and that will be next month's topic. EAA

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