Vol.3 No.8 I August 2014

EXPERIMENTER

The Spirit of Homebuilt Aviation I www.eaa.org

» **The Affordable Belite ProCub**
Lightweight wonder

» **Rotax Celebrates 25 Years**
Visiting the plant in Austria

Oshkosh Grand Champion

Rick Hansen's Plans-Built Hatz

The Best Oshkosh in Years

BY JACK J. PELTON

THIS WAS THE SECOND year that I have been directly involved in the preparation and operation of our annual convention and fly-in at Oshkosh, and I continue to marvel at what we accomplish. AirVenture is only possible because the EAA staff and member volunteers work tirelessly for weeks and months before the convention.

This year the number of volunteers actually grew, from about 5,000 last year to more than 5,400 this year.

The monetary value of each volunteer's efforts is enormous. But what I have learned is that our volunteers are irreplaceable at any price. Members from all over the country return to Oshkosh year after year donating their time and labor. But more importantly, they return with many years' worth of intimate knowledge of just how things work.

It was the same team effort that made this year's first AirVenture performance by the U.S. Air Force Thunderbirds possible. The Thunderbirds or the Navy Blue Angels have never flown their show at Oshkosh because the speed of their jets requires a larger aerobatic box that must be unoccupied around the runway during their performance. The size of that larger box includes businesses and residences on the east side of Wittman field.

But our airport neighbors graciously agreed to watch the performance from a slightly more distant location, making it possible for the Thunderbirds to perform. And the Thunderbirds were a hit. Attendance on both Saturday and Sunday was up more than 20 percent compared to previous years. And that was in spite of a downpour that soaked us all just before the Thunderbirds flew on Sunday afternoon.

Everywhere I went on the convention grounds during the week I heard overwhelmingly positive comments. Sure, the pleasant temperatures helped elevate everyone's mood, but it was more than that. There was a feeling—dare I say it—in the air that welcome change had arrived.

The entire week was dedicated to remembering and celebrating the life of our founder, Paul H. Poberezny. We began with a ceremony at the EAA Memorial Wall. Thousands signed their names to giant posters commemorating Paul's life and achievements. And a very special moment for me personally was presenting EAA's highest honor, the Freedom of Flight Award, to Audrey Poberezny, the woman who was absolutely as essential as Paul in creating and sustaining our association.

A part of Oshkosh that Paul would absolutely have loved was the One Week Wonder project to build a Zenith CH 750 kit airplane during the week. Thousands of people pitched in, and the airplane was completed, engine running, and signed off for flight before our convention closed. The project brought joy back to Oshkosh and demonstrated that it is within the reach of almost anyone to build his or her own airplane.

There were more airplanes on the grounds than we have hosted in many years. All available aircraft parking spots were filled at several points early in the week. We haven't seen that since 2007, the last year before the start of the global economic turndown.

There were also more people, though improvements we have made to the grounds helped spread us out and avoid huge areas of congestion. I heard good things about our revamped food offerings, and there was high praise for our greatly expanded evening entertainment programs on Boeing Plaza.

A huge reason people come to Oshkosh is to see what's new in all forms of personal aviation, and our exhibitors didn't disappoint. We had fewer total exhibitors this year because we reduced the number of non-aviation-related displays, but every visitor and every exhibitor I spoke with had a positive experience. In fact, several exhibitors told me that they had hosted more interested and qualified sales prospects at their display by Wednesday than they had the entire week last year.

There are, however, no statistics that summarize what everyone seemed to be feeling at Oshkosh. A corner has been turned. Most of us are now feeling more positive about the future and are investing again in our aviation activities. And EAA is on track to include all in celebrating the thrill of personal aviation. What a great year. EAA

On the cover: Rick Hansen's Plans-Built Hatz. (Photography by Jim Koepnick)

EAA PUBLICATIONS

Founder: Paul H. Poberezny
Publisher: Jack J. Pelton, EAA Chairman of the Board
Vice President of Communities and Member Programs: Rick Larsen
Editor-in-Chief: J. Mac McClellan
Homebuilding Community Manager: Charlie Becker
Editor: Mary Jones/EditEtc. LLC
Senior Graphic Designer: Chris Livieri
News Editor: Ric Reynolds
Copy Editor: Colleen Walsh
Multimedia Journalist: Brady Lane
Visual Properties Administrator: Jason Toney
Contributing Writers: Charlie Becker, Marino Boric, Budd Davisson, Mike Engel, Cy Galley, Dan Grunloh, Ed Kolano, Kurt Mehre

ADVERTISING

Display
Sue Anderson

Mailing Address:
P.O. Box 3086, Oshkosh, WI 54903-3086
Phone: 920-426-4800
Fax: 920-426-4828
E-mail: *experimenter@eaa.org*
Website: *www.EAA.org*

Need to change your address or have other membership questions? Call 800-564-6322 (800-JOIN EAA).

Features

12 Hatz Trick...
Third time is the charm!
BY BUDD DAVISSON

20 Belite Aviation and the New ProCub Lite
And other aviation products
BY DAN GRUNLOH

27 The New 'Touch' World of Avionics Suites
The Dynon SkyView Touch and Garmin G3X Touch
BY MARINO BORIC

Departments

02 Tower Frequency
BY JACK PELTON

04 Homebuilder's Corner
BY CHARLIE BECKER

32 Hints for Homebuilders
BY CY GALLEY

06 News from HQ
NEWS FROM EAA

08 Flightline
INDUSTRY NEWS

Columns

34 What Our Members Are Building
Paul Poberezny's *Mechanix Illustrated* Baby Ace Replica
BY KURT MEHRE

36 Under the Cowl
Rotax—25 Years, 50,000 Engines
BY MARINO BORIC

40 Ultralight World
Volunteers Create Their Own Fun
BY MIKE ENGEL

44 Flight Testing Techniques
First Flights...
BY ED KOLANO

The One Week Wonder team celebrates its success after the Zenith CH 750 Cruzer taxied for the first time.

Pure Magic!

The One Week Wonder lived up to its name

BY CHARLIE BECKER

"YES, EAA IS AN organization of doers—if it can be done, EAA will do it!"—Paul Poberezny, *EAA Sport Aviation*, September 1977

More than a year ago, I started planning the One Week Wonder project, where we would build a standard Zenith CH 750 Cruzer kit during the seven days of EAA AirVenture Oshkosh 2014. I had high hopes for this project because it was a way to put homebuilding in the spotlight in front of everyone who walked through the gates at Oshkosh 2014.

I know how big the "Oshkosh effect" can be. Twenty-one years ago, as a newly minted private pilot I thought the idea of building your own aircraft was, simply..."crazy"...until I made a trip to "Oshkosh." I knew from my own experience that if we could show people that homebuilding is actually a great way to get your own aircraft, we could win over thousands of people. One day walking the homebuilt flightline back in 1994 convinced me there was nothing crazy about those beautiful, high-quality "homebuilt" aircraft. From that day forward, I was a "homebuilder"; it was just a matter of time before I bought a kit.

As I sit here recovering from the most fun, challenging, and exhausting two weeks of my life, I still have to pinch myself that the One Week Wonder actually happened. I'm equally stunned by the fact that it was such a runaway success with the attendees and that the aircraft got completed. I've never played on a championship sports team, but my guess is teammates have a similar feeling to the one I experienced during the week. The big difference between the volunteers on the One Week Wonder project and a sports team is our teamwork *created an aircraft*. That is our trophy, and it will continue to promote homebuilding and aviation for many years to come.

We started on the CH 750 Cruzer Monday morning, July 28, as a mix of people, from young to old and from all over the globe. Most of us had never met one another, but we all came to Oshkosh because we love homebuilding and we wanted to be part of a team that would build a plane in a week. During those action-packed seven days we experienced the full range of emotions that most of us experience over the course of a project: enthusiasm, frustration, enjoyment, exhaustion, and ultimately, success.

During the week there was a never-ending interest in the progress of the build. Every time I looked up there were people watching the progress. The interest in the simple act of pulling a rivet on the aircraft was overwhelming. There was always a line to do it. Seeing a dad holding the rivet gun as his 2-year-old son pulled the trigger told me that we were winning people over to the idea of homebuilding.

One of the key things I learned from Paul Poberezny was that a core role of EAA is the promotion of homebuilding. That is why he wrote a three-part article about how to build the Baby Ace for *Mechanix Illustrated* magazine that catapulted EAA into an international organization. I can attest that the media loved the One Week Wonder story. They were stopping by all the time for an interview on the status. I hope to see coverage in both *Air & Space* and *Make* magazines, places where you don't normally see much on homebuilding an aircraft. I know in my heart that Paul is up there smiling.

It really hit home for me just how big a success we had on our hands when I was sitting at the Homebuilders Dinner on Thursday night, July 31, and Larry Zepp, EAA 81346, one of the One Week Wonder volunteer homebuilt ambassadors who engaged people on homebuilding and taught them how to pull a rivet, told me, "My first (EAA) convention was in 1978. I can absolutely say that being a homebuilt ambassador on the One Week Wonder project is the most fun I have ever had at Oshkosh!"

To hear this from a homebuilder, chapter leader, and 40-plus-year EAA member who had been coming to EAA conventions since Rockford was the ultimate compliment.

This project was a total team effort, and one that only EAA members would be able to pull off. My thanks to everyone involved, especially the team from Zenith Aircraft, for making it a success. EAA

Photography by Jason Toney

OFFER EXTENDED!

ONE WEEK ONE DVD

*Preorder your EAA AirVenture Oshkosh 2014 DVD and we'll ship it **FREE!****

Featuring the very best of EAA AirVenture Oshkosh 2014 including stunning footage not seen from the flightline. Relive the entire convention whenever you want with this DVD.

EAA
THE SPIRIT OF AVIATION

ShopEAA.com | 800.564.6322

Your EAA merchandise purchase supports EAA programs that help grow participation in aviation.

**Free shipping is valid on domestic orders only. International pre-orders are $3 shipping plus $1 for each additional DVD. After October 31, regular shipping rates apply.*

Dave Ross Receives EAA Tony Bingelis Award

DAVE ROSS, EAA Lifetime 98512, of Wakeman, Ohio, is the 2014 recipient of the EAA Tony Bingelis Award, recognizing his dedication as a volunteer EAA technical counselor, RV builder, and safety chairman for Chapter 50 of Sandusky, Ohio. A retired corporate pilot, Ross has been an active EAA member for 39 years, flew as captain of EAA's Ford Tri-Motor, and was a member of the International Aerobatic Club for 20 years.

Ross is an A&P mechanic and flight instructor and is known for his workmanship as an RV builder. According to those who nominated him, he offers up space in his personal workshop to anyone who wants guidance in building an aircraft. Ross provides on-site instruction and offers helpful suggestions throughout the building process.

Ross' passion for homebuilding has inspired others through his extensive knowledge and hard work. He displays his RV-4 at air shows throughout the country and has influenced many others to purchase and construct RVs.

Ross was slated to receive the Tony Bingelis Award during the EAA Homebuilders Dinner on Thursday, July 31, at EAA AirVenture Oshkosh.

The Tony Bingelis Award was created in 2002 to recognize an EAA member who has contributed to homebuilt projects and safety promotion while maintaining EAA values. The award honors the late Tony Bingelis, who was noted as a homebuilding authority, author of several homebuilding books, and a well-read *EAA Sport Aviation* columnist. A permanent display at the EAA AirVenture Museum commemorates the honorees.

Additional Pilot Program Review Continues

THE FAA RECENTLY CLOSED public comments on a new EAA-supported program designed to give homebuilders better access to safety and flexibility during Phase 1 flight testing. When approved, the Additional Pilot Program will be an option available to builders of kit planes that meet certain basic criteria that allows them to carry an additional pilot during Phase 1 flight testing.

EAA was deeply involved in the creation of this program, and the current proposal is the product of a yearlong collaboration between EAA and the FAA. It is based on successful pilot programs in recent years and is supported by a safety recommendation in the NTSB's 2012 study on amateur-built aircraft safety. The EAA team active in the project included members of EAA's Homebuilt Aircraft Council, Safety Committee, and staff.

Under the program, an experienced pilot who meets certain qualifications may be added during the first eight hours of Phase 1 testing and before the aircraft and builder complete a series of flight-test objectives to establish the fundamental airworthiness of the aircraft and the familiarity of the builder to the aircraft. Thereafter, the Additional Pilot standards relax to allow most current pilots to fly with the builder as an observer, provided there is a stated purpose for the observer's role in the flight (e.g. spotting traffic while systems are calibrated or monitoring engine information).

"By adding an appropriately qualified additional pilot during Phase 1 flight testing—particularly early in the process, we will mitigate the possibility of a loss of control, which is the dominant factor in fatal accidents during that time," said Sean Elliott, EAA vice president of Advocacy and Safety. "This optional program allows a homebuilt aircraft builder or owner to remain involved in the flight-test program with an additional layer of safety. We are very proud of the end product, because it is an excellent example of how to enhance safety while reducing regulatory barriers."

Any aircraft built from a kit listed on the FAA's Revised Listing of Amateur-Built Aircraft Kits with fully functioning dual controls and a powerplant "recommended, supported, or provided by the kit manufacturer" is eligible. The aircraft must also complete basic pre-first-flight tests, most notably fuel flow testing.

A builder or owner of an aircraft meeting the above criteria may request an operating limitation enabling the use of the Additional Pilot Program. The program itself is described in a draft FAA advisory circular, numbered AC 90-APP. The program may be used on any flight during Phase 1 flight testing, at the builder/owner's option.

FAA Clarifies Angle of Attack Indicator Installation Policy

IN FEBRUARY, THE FAA issued a press release announcing that angle of attack (AOA) indicators would be eligible for certification under industry consensus standards rather than traditional avionics certification rules. Shortly after the press release was issued, EAA wrote to the FAA requesting clarification on the installation of these safety devices and asking whether the FAA would permit AOA system installations as a minor alteration to spur widespread adoption of this technology.

In late June, the FAA's Small Airplane Directorate and Aircraft Maintenance Division responded. The FAA's policy is that AOA indicators are "non-required equipment that provide a safety benefit," and if they are manufactured to appropriate industry consensus standards, these devices "do not represent a major change to type design ... and do not require a supplemental type certificate for installation."

The policy also allows the Chicago Aircraft Certification Office to officially approve certain AOA system manufacturers' installation instructions, which allows the approved systems to be installed as a major alteration in standard category aircraft without any additional engineering data or supplemental type certificate. Review a copy of the letter here: ACE-100 Signed Letter.

Young Eagles Program Receives Spirit of Flight Award

THE NATIONAL AVIATION Hall of Fame has named EAA's Young Eagles program the recipient of its 2014 Milton Caniff Spirit of Flight Award, an honor given to groups or organizations that are "exemplary in improving and advancing aviation."

"The committee responsible for the 2014 selection process clearly believes that the positive impact the EAA Young Eagles program has had on fostering the growth of American general aviation is worthy of this recognition," said Enshrinement Director Ron Kaplan in his letter to EAA.

Since its creation in 1992, the EAA Young Eagles program has provided more than 1.8 million young people from ages 8 to 17 with free flights in GA aircraft. For many it was the start of their journey to becoming a pilot, aircraft mechanic, air traffic controller, and endless other career paths. More than 40,000 EAA members have volunteered over the years to make this experience possible.

Rewarding Flight

CENTERVILLE (OHIO) HIGH SCHOOL sophomore Alberta Dempsey received the gift of flight and the experience of a lifetime when she flew with EAA Young Eagles Chairman and renowned air show pilot Sean D. Tucker on June 25 in Dayton, Ohio. The flight was the grand prize of the Vectren Dayton Air Show Essay Contest.

The essay contest challenged youths ages 8 to 17 to imagine what first flight would be like and its significance. The 15-year-old Dempsey's winning entry, "Flying Away From Adversity," uses aviation as a metaphor for life.

"To me, flying means that adversity is overcome and your plane lifts off to bigger and better places," she wrote.

Dempsey's words won Tucker's heart. "Her essay humbled me because she captured me as a person and what my world is about," he said. "I can't wait to share this with other young people."

Tucker and Dempsey flew together for about 30 minutes in his two-seat Oracle Extra 300L in cooperation with the Vectren Dayton Air Show and the EAA Young Eagles program. In his role as Young Eagles chairman, Tucker aims to fly a Young Eagle and a Young Eagles volunteer at each air show during his 2014 tour. EAA

Photography by Mariano Rosales

SubSonex Personal Jet Model JSX-2 Makes First Flights

SONEX AIRCRAFT'S SubSonex Personal Jet model JSX-2 made its first flight on Thursday, July 10, and followed that with a week of successful series of initial flight tests. "Its flight characteristics can be summed up in two words—fast and smooth," said JSX-2 test pilot Bob Carlton,

The initial goal of the flight test program was to evaluate the systems, flight controls, gear and overall aircraft geometry, and handling through moderately high speeds. Following recommended FAA flight test protocols, the flight test team began earlier in the week with a slow taxi test and static engine runs progressing through high-speed taxi and finally the first flight.

The second flight of JSX-2 checked the function of the retractable landing gear and explored higher speed ranges. "With the gear retracted, the noise level is reduced significantly and it accelerates quickly to 150 mph," Carlton said. Thursday's third flight explored handling characteristics at moderate speeds, which proved to be very crisp, and the flight even included a few barrel rolls.

Some video excerpts of the third flight can be found at: http://youtu.be/lg64aN3SV6g.

Stalls were explored and were observed to be well-mannered and to present plenty of warning; in fact, the stall took considerable work to induce.

The SubSonex design team will be working to collect and analyze flight data in order to finalize published performance numbers for the new jet—the last step remaining before SubSonex kit reservation deposit holders are given their opportunity to place firm orders for 2014 kit production, after which time orders will be opened to the general public for deliveries in 2015. The SubSonex will be sold as a Quick Build Kit only, and will include almost everything required to fly with the exception of avionics and paint.

Available options for the SubSonex Personal Jet include cabin heat, oxygen, MGL iEFIS touch screen avionics, and more.

Like JSX-1, the new JSX-2 model is powered by the PBS TJ-100 engine, producing approximately 250 pounds of thrust in an advanced, fully integrated package. The new jet features a larger, more comfortable cockpit, a larger instrument panel, fully retractable landing gear, a BRS full-aircraft recovery parachute, higher fuel capacity in a rotationally molded cross-linked polyethylene fuel cell, easily removable wings, and a more sculpted and aesthetically pleasing nose section.

For more information, visit http://www.sonexaircraft.com/subsonex.

Zenair Blind Rivets Available Through Aircraft Spruce

ZENAIR BLIND RIVETS are now available through Aircraft Spruce & Specialty in 1/8-inch and 5/32-inch diameters.

What makes the Zenair rivet distinctive is that as the rivet is pulled, the rivet head is drawn into a dome-shaped top, which gives the finished rivet a low-profile, rounded top, enhancing the strength of the rivet while improving airflow over it.

Aircraft Spruce also carries the Zenair pneumatic riveter for $99.85 along with the Zenair manual riveter for $49.50, both of which feature the required domed head for pulling and forming the rivets. A package of 100 1/8-inch rivets (Part Number 12-03709) costs $11.65, and the rivets have a shear strength of 130 pounds. The 5/32-inch rivets (Part Number 12-03711) are $16.75 with a shear strength of 220 pounds.

For more information, visit AircraftSpruce.com. Zenith kit builders can purchase the same products directly from the Zenith Aircraft Company. See ZenithAir.com.

To watch a demonstration of pulling Zenair rivets, EAA has made a short video showing the process: http://bit.ly/1siNAE1.

New Titan Engine Company Focuses on Experimental and LSA Markets

DANBURY AEROSPACE HAS established a new business unit that has taken over all experimental and LSA engine assembly for ECi. The new Titan Engine Company has been in the works for the past few months, according to Kevin Eldridge, the head of Business Development for Titan Engines. He said the focus on the experimental market is a huge shift for the organization and has given them "tremendous freedom to bring new products and services to this market without the restrictions of the certified engine market." ECi will continue to provide parts and services for the certified market but will no longer be selling engine kits or completed engines through resellers for the experimental market.

Learn more at www.TitanEngine.com.

Beringer Adds 4-Inch Wheel and Brake

BERINGER WHEELS & BRAKES now offers a 4-inch main wheel and brake for light aircraft, up to 350 kilograms (roughly 330 to 770 pounds). Cut from solid aluminum billet on precision CNC machinery and carrying Beringer's signature bright red anodized finish, these new wheels and hydraulic brakes are reported to be the lightest available in their size, strength, and capability class. The wheel assembly, complete with bearings, hydraulic caliper, pads, and disc, weighs under 39 ounces. The choice of tire (not included) determines the ultimate installed weight.

The single-piston hydraulic caliper provides smooth, powerful braking on its floating disc. Maintenance is reduced through the incorporation of sealed ball bearings; and maintenance intervals are further extended, through Beringer's long-lasting sintered metallic pads, which generate more stopping power as they heat.

The new two-piece wheel saves weight through its CNC-machined construction and tubeless mounting, and accommodates several popular tire sizes (3.00-4; 4.00-4; 2.80/2.50-4; 10 x 3.50-4). Flange-mount aluminum axles are available to match various aircraft requirements.

Individual price is $459, FOB Chicago, and the new wheel assemblies are available now.

Contact us.sales@beringer-aero-usa.com or visit www.Beringer-Aero.com.

Sebring Expo Announces New Wednesday to Saturday Format

THE 11TH ANNUAL U.S. Sport Aviation Expo held at Sebring Regional Airport, Florida, will open one day earlier in 2015—from Wednesday, January 14, through Saturday, January 17, 2015.

"We've observed that attendance on Sunday traditionally has been lower than other exhibit days, and our survey results indicated our visitors from around the country like to fly home on Sunday," said Expo Director Jana Filip. "So, amending our dates seemed like the best way to offer a better event for both our exhibitors and our visitors...and it's good for our volunteers, too."

With about 20 additional exhibitor spaces available in 2015, Filip confirmed the Expo will again offer extra benefits to exhibitors who enter into partnership or sponsorship agreements with the Expo.

The Expo offers on-site overnight camping for homebuilts as well as special display parking space for owners to showcase their aircraft.

Learn more about the event at www.Sport-Aviation-Expo.com. EAA

FltPlan.com Now on Android

FLTPLAN.COM, THE LARGEST online and mobile device flight-planning service, has rolled out a new app for Android devices. The new Android app links seamlessly to www.FltPlan.com. You can go from a desktop to a mobile device in any order and not need to change anything or lose information.

As always, flight planning and flight information, including FAA certified and approved weather, are always free on FltPlan.com.

The company, founded and operated by pilots, introduced a new service in January called FltPlan Go. It is a streamlined version of the original FltPlan.com that offers even more features than the original legacy system. FltPlan.com will continue to support the legacy system so there is no need for pilots to change to Go if they don't want to.

Any pilot can register to use FltPlan.com for free at the website. More than 145,000 pilots use the service regularly, and a large majority of the non-airline flight plans are filed using FltPlan.com.

Combs Sets Another Record in Remos LSA

Daniel Routh (left) and Michael Combs.

MICHAEL COMBS, EAA 877079, unofficially earned a sixth aviation world record in his REMOS GX light-sport aircraft *Hope One* after completing a coast-to-coast flight on Saturday, June 7, as part of his Flight for the Human Spirit project.

If Combs' flight is verified by the National Aeronautic Association and ultimately the Fédération Aéronautique Internationale, it would establish a new point-to-point transcontinental speed record for this class of aircraft.

Between April 2010 and September 2012, Combs flew for the Flight for the Human Spirit project through all 50 states and British Columbia, Canada. On this latest flight, he departed Ontario International Airport in California at 5:27 a.m. on June 5 and landed at Charleston, South Carolina, 34 hours, 1 minute later.

The flight's final leg was the most emotionally charged for Combs, the REMOS team, and fans due to iffy weather. However, it cleared in time for Combs, who was accompanied by his son, Daniel Routh, to make his landing in Charleston.

"There are some landings that are more significant than others, and that one in Charleston will always be a fond part of my life," Combs said.

The mission has inspired aviation enthusiasts to want to learn to fly or return to flying, according to comments the team received during the coast-to-coast flight.

Learn more at www.ForTheHumanSpirit.com.

Lightspeed Introduces Zulu PFX

LIGHTSPEED AVIATION'S Zulu PFX (Personal Flying Experience), its new active noise reduction aviation headset, was launched in June. The company claims it is "the quietest aviation headset available" after thorough field testing by more than 50 pilots in dozens of aircraft and helicopters.

Technological advances deliver new levels of quiet by adapting ANR and audio responses to the user's ears, environment, and personal preferences. Acoustic response mapping uses sound waves and advanced signal processing to provide a custom audio response based on each pilot. Streaming quiet dynamic ANR uses external ambient microphones to continuously sample cockpit noise at a rate of 1 million times per second.

Pilots can also personalize preferences with FlightLink, Lightspeed's free app for the iPad and iPhone.

Learn more at www.LightspeedAviation.com. EAA

Photography by Jim Koepnick

Hatz Trick...

Third time is the charm!

BY BUDD DAVISSON

THREE OF ANYTHING engenders an overwhelming urge to engage in cliché wars. However, when talking about Rick Hansen of Fox Lake, Illinois, the cliché that definitely does *not* apply would be "If at first you don't succeed, try and try again." That cliché doesn't apply because Rick has created masterpieces with all three of the Hatz biplanes that he's built. Each has been better than the last, and each represents a given goal. Maybe the cliché should be "Practice makes perfect."

"This last Hatz was one I've been thinking about for a long time," Rick said. "I wanted to make it the lightest, best-performing Hatz I've ever built. In so doing, it would be light-sport aircraft compliant. However, beyond making it light, I had another, equally as important goal in mind. When I look back at when I first started building airplanes, I'm very aware of all the support I received from various sources along the way, going as far back as my mother. She supported my learning to fly and gloried in my building efforts. In fact, one of the high points of my homebuilding was when I flew my first Hatz to a family gathering and watched my relatives' reactions when my mother got out of the front cockpit and took her helmet off.

"And when it comes to the knowledge on how to build things, I look back on an endless line of people who freely passed along knowledge they had been accumulating over a lifetime. The first was George—I never knew his last name—who was rebuilding a Stearman not far from me. In the course of watching and listening, I not only learned how to do things, but I learned the true definition of craftsmanship. He set a standard, and today when I'm working, I can almost feel him looking over my shoulder. Glenn Courtright, who had B&F Aircraft for decades, is another one I feel watching me. I can't describe everything I learned from him, and he, too, set the bar for the way things should be done. So, when I got ready to do this last Hatz, I went into it determined to make it a learning experience for others by photographing everything I thought should be passed along. In effect, I'm passing down everything George, Glenn, and so many others gave me, and then sprinkled some of my own discoveries in the mix.

It's details like this that highlight the craftsmanship Rick Hansen puts into his aircraft.

Rick Hansen is all smiles after his Hatz was name Grand Champion Plans-Built Aircraft at EAA AirVenture Oshkosh 2014.

Photography by Jim Koepnick

Traditional round instruments maintain the "feel" of the Hatz as an antique homebuilt, with the GPS for modern-day peace of mind.

"I'm eventually going to assemble all of these photos, along with others, on my website, so the source of information will always be there. (For now, you can review Rick's project online on YouTube: Hatz: A Rick Hansen Journey).

One of the best aspects of being a scratchbuilder, which I fully realize is a different breed of builder, is that you're constantly figuring out new ways of doing things. The result is that you've either developed or adapted a thousand neat little tricks that make building an airplane much easier. So, thanks to digital technology, much of what I did in building this airplane is on the 'net. Eventually, I'd also like to do a blog where I pass along a lot of the stuff I've learned, much of it having to do with building safely."

In looking at the dozens and dozens of Rick's photos that will wind up on his website, it's hard not to gasp when his workshop is shown in the background: It would make most of us jealous because it is far too organized and well equipped, which is a glimpse into his background. His father was a cabinet maker who expanded to become a major cabinet manufacturer, and Rick just retired from that business; so organization, woodworking, paying attention to detail, and having the right tools are second nature to him. And it shows in his work. Even in his worktable.

He said, "Building a good worktable is super important. It lays the foundation for everything you do. For the Hatz, the table is 19 feet long and built like a box spar or hollow-core door. Three-quarter-inch sheets of melamine-faced particle board form the top and bottom skins but are spaced 6 inches apart by more particle board that is ripped perfectly straight into 6-inch strips. The 6-inch spacers form a perimeter, and 'ribs' run across inside the table. The top and bottom skins won't be long enough, so they have to be jointed to make the full length; those joints are staggered to one another so they don't line up. The result is a bench that is straight and super solid."

More of the prize-winning attention to detail evident throughout this aircraft.

Rick was more than experienced enough to tackle the woodworking aspects of the Hatz, but nothing in his back-

Rick's goal was to keep this Hatz sport-pilot compliant. Thus he chose the Continental O-200D light-sport engine, which saved 7.5 pounds over the usual O-200, plus it has an 8.5-to-1 compression for 5 percent more horsepower. Next he installed a B&C 200G lightweight 12-amp alternator. Then, rather than going with a metal prop, he saved a number of pounds by using a Ted Hendrickson wood prop with a brass leading edge that he had bought from Ted many years ago.

More attention to detail.

ground prepared him for the steel work required. He said, "As a welder, I was self-taught, and it started out as a very painful experience. I'd read all the articles and watched the DVDs, but when I'd test one of my welds and it would break, I'd get very discouraged. That went on for weeks. That's when my wife, Shahnaz, became my main support. She wouldn't let me stop and kept telling me that I'd get it. And she was right."

He had settled on using gas welding rather than tungsten inert gas (TIG) because the torches had other uses and because it was more forgiving in terms of joint preparation. Rick, of course, decided to go the average tubing layout one better. Even though the sides were laid up flat and then stood up and joined (as with most fuselages), when the tubing was cut (usually with a cutoff wheel in an angle head grinder and shaped with the same tool), rather than laying it flat on a table with locating blocks as most do, he used Formica sample chips as spacers to pick the pieces up so they centered on the longerons. Then sheet metal scraps were slid between the table and the joint to reduce scorching the tabletop.

As with so many others in sport aviation, Rick's interest in aviation was part of his life from the beginning, and as a kid, he was always craning his neck as the family drove past airports. Shortly after getting his private pilot certificate, he went to his first EAA Oshkosh convention. When asked what attracted him to the event, he said, "I'd heard good rumors. I flew up with a friend in his Luscombe, and I was absolutely overwhelmed by the aircraft and the people. It felt so good to be with so many who had the same interest as I did.

"Antiques really caught my eye and I loved taildraggers. Then an *EAA Sport Aviation* article came out on the Hatz, and that's what got me hooked on a Hatz. That was 1976, but I didn't get started on one until 1980. The Hatz was the perfect airplane for me because it was an affordable antique homebuilt. I finished it in 1986 and flew it for more than six years. I started the second one in '92, finished it in '97, and flew it for years. It had an O-200 for power."

Photography by Jim Koepnick

Although its lack of complexity makes a Hatz a dirt-simple airplane, it is nonetheless a big project. Even though all of the parts are simple, there are many more of them than in something like a Van's RV. That's just the way wire-braced biplanes are. So, by the time Rick had built two of them, he was well versed in the skills required. He had also spent a lot of time both in the air and in the shop with the design and had developed a definite idea of what the next one would be.

"I wanted a Hatz that was special in a number of ways and weight is the most important," he said. "Weight is everything in getting performance out of low horsepower, so I was going to build this airplane with ounces in mind. That's the way you have to think to save weight when building. You have to pay attention to every single little detail and be obsessed with saving every ounce you can. In so doing, eventually, you save pounds. At the same time, I wanted it to be the best-looking Hatz I had ever built."

In many ways, the concepts of cosmetics and light weight are contradictory. Many of the cosmetic touches that lift one airplane above another, in terms of appearance, add weight. In fact, most of them add weight. That's why Rick had to be so fastidious with every single detail; he knew he was going to have to include some cosmetic features that added weight, so he had to offset those by overdoing the weight-saving efforts in other areas.

"To save weight in this airplane, I did some things I hadn't done before," he said. "For instance, there is no wing walk on the right wing. Only on the left. And there is no plywood on the bottom of the wing under it, which is the usual arrangement. A wing walk is normally a box structure. Instead, I did some extra trussing of the ribs under the wing walk, so the load is spread between a number of ribs.

"I eliminated the use of birch everywhere. Instead, I used mahogany, which is lighter. And the fuel tank is 19 gallons rather than the 28 sometimes seen. The O-200 burns around 6 gallons per hour, so that's plenty of fuel."

Rick's wife, Shahnaz, is a big supporter of his aircraft habit and often helps on his project ... including rib stitching here.

Rick's shop is ... well ... enviable!

Many sport aviation parts suppliers have recognized that the success of the light-sport aircraft (LSA) category demands a different, lighter product line, and Rick took advantage of that in every way that he could.

"I installed a new Continental O-200D light-sport engine," he said. "This saved 7.5 pounds over the usual O-200, plus it had 8.5-to-1 compression for 5 percent more horsepower. Then I installed a B&C 200G lightweight 12-amp alternator. The engine came from Continental with a lightweight starter already installed. Then, rather than going with a metal prop, I saved a number of pounds by using a Ted Hendrickson wood prop with a brass leading edge that I had bought from Ted many years ago. It also looks much better. In my mind's eye, I see all biplanes with wood props."

In keeping with lightweight components, Rick used Grove LSA wheels and brakes, which have discs full of lightening holes.

"I spent some time designing a light, stainless-steel exhaust system and had it built by Daley Aviation," Rick said. "It's super simple, just two pipes, but it flows with the cowling.

"I carried the wood accent theme started with the prop over to other places in the airplane where I thought they fit. That's why I added solid mahogany 'stiffener' strips to the bottom of the center section fuel tank like WACOs have. They're unnecessary, but I think they add to the 'antique' look. That's also why I used mahogany for the instrument panels, flying-wire javelins, the elevator trim tabs, and the floorboards. It has a nice look and doesn't add much weight."

When instrumenting the airplane, Rick offset what he had to have in the back by putting nothing in the front.

"Since the airplane is soloed from the rear only, I simply eliminated everything from the front pit," he said. "It has stick, rudders, and throttle, but that's it. Truth is, this is such an honest airplane that you really don't need any instruments to fly it. Even so, to be legal, the rear panel has an airspeed indicator, altimeter, turn and bank (2 inches of vacuum provided by my antique brass venturi), a Horizon P-1000 electronic tachometer (eliminates the heavy 8-foot-long mechanical cable), a combination oil pressure/oil temperature gauge, cylinder head temperature gauge, and a Garmin 295 GPS that I panel mounted."

The panel space on little airplanes, and especially homebuilt biplanes, is limited, yet the ability to fly in much of America's airspace requires both radio and transponder. With no panel space left, Rick came up with a good solution.

He said, "My radio/electronics box mounts below the instrument panel. It contains my FS450 Fuel Scan by J.P. Instruments that monitors my fuel flow, fuel used, and fuel remaining. A lightweight Becker 2-¼-inch transponder, along with a Becker 2-¼-inch transceiver, takes care of comm requirements.

"I wanted to keep all the electronics in one area, so the box also mounts all circuit breakers, switches, headset jack receptacles, and has a map compartment. To make maintenance easier, the box has a 19-pin terminal/receptacle allowing for it to be easily removed should it ever require bench work. When it came to doing the radio/electronics work, Bernie Thalman came to my rescue. Bernie is a wonderful person and always anxious to help out a friend at Kenosha (Wisconsin) Airport."

The Hatz was the perfect airplane for me because it was an affordable antique homebuilt.

When it came time to cover and paint the airplane, Rick went with the Poly-Fiber system (3.1-ounce wasn't available) and got the gloss on the Poly-Tone on the fabric to match the Aerothane on the metal by buffing, not clear coating. Rick said, "I used a foam buffing pad (blue) with 3M polish, misting it constantly with water. The misting is important!"

DID ALL THE WEIGHT-SAVING EFFORTS WORK OUT?

"It came in at 829 pounds, which is at the LSA [takeoff] limit of 1,320 pounds, and still gives me a useful load of 491 pounds," said Rick. "That's more than enough to carry plenty of fuel and my wife or most of my friends."

Rick is quick to credit those who helped him, especially his wife, Shahnaz. He said she was inspirational in offering support and help when he needed it. It's also notable that she did all of the rib stitching on the plane. She learned the technique years earlier in a workshop at an EAA convention. Rick said, "One guy at the airport was so overwhelmed with Shahnaz's rib stitching that he asked if she had any sisters!

"I couldn't have finished this plane without the help of my good friend Pete Spear, whom I met when first starting the project. Pete would always make himself available when I needed his help. And I can't forget thanking Marie Spear, who helped me when hanging the engine; Danny Zelazo who helped me install the wings; and Tye Hammerie offered to help out on some projects and final inspection."

Summing up the experience, Rick said, "Through the building of this plane, many wonderful friendships were developed for which I will always be grateful."

Almost every homebuilder is indebted to others for their help, but few have been so determined to pay it forward in the manner Rick Hansen has done. Through his website and photos, future generations of builders will profit from his efforts and will owe him the thanks Rick has expressed for those before him.

And then there is the Hansen Hatz Number Four. He hasn't said anything official, but we'll be waiting for it. 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.

Get Hands-on.

The skills you need from the experts you trust.
For workshop dates, locations and costs,
visit **SportAir.org** or call 1-800-967-5746.

EAA SportAir Workshops

EAA SportAir Workshops are sponsored by Aircraft Spruce & Specialty Co. and Poly-Fiber Aircraft Coatings www.polyfiber.com

The characteristic gap in Junkers-style ailerons is quite visible on takeoff.

Photography by Dan Grunloh

Belite Aviation and the New ProCub Lite

And other aviation products

BY DAN GRUNLOH

BELITE AVIATION MANUFACTURES ready-to-fly and kit-built ultralights that use carbon fiber and good engineering to meet the weight and performance limits imposed by FAR Part 103...and still produce a safe and fun ultralight that has all the features you would expect in a "real" airplane.

That line sums up the philosophy and purpose of Belite Aviation. To understand the roots of Belite, we have to go back 30 years. When Dean Wilson displayed the Avid Flyer at EAA Oshkosh in 1983, and Dan Denny flew the first Kitfox in 1984, they introduced the concept of a folding-wing STOL airplane with Junkers-style flaperons. Suspended below the wing, the flaperons improved the airflow, the control authority, and the aircraft's performance at slow speeds. A geared Rotax two-cycle engine and those lift-producing flaperons could get two people in and out of the shortest ultralight airstrips and still cruise somewhere.

The radiator for the liquid-cooled, 36.5-hp, two-cycle Italian Polini proved to be much larger than actually needed.

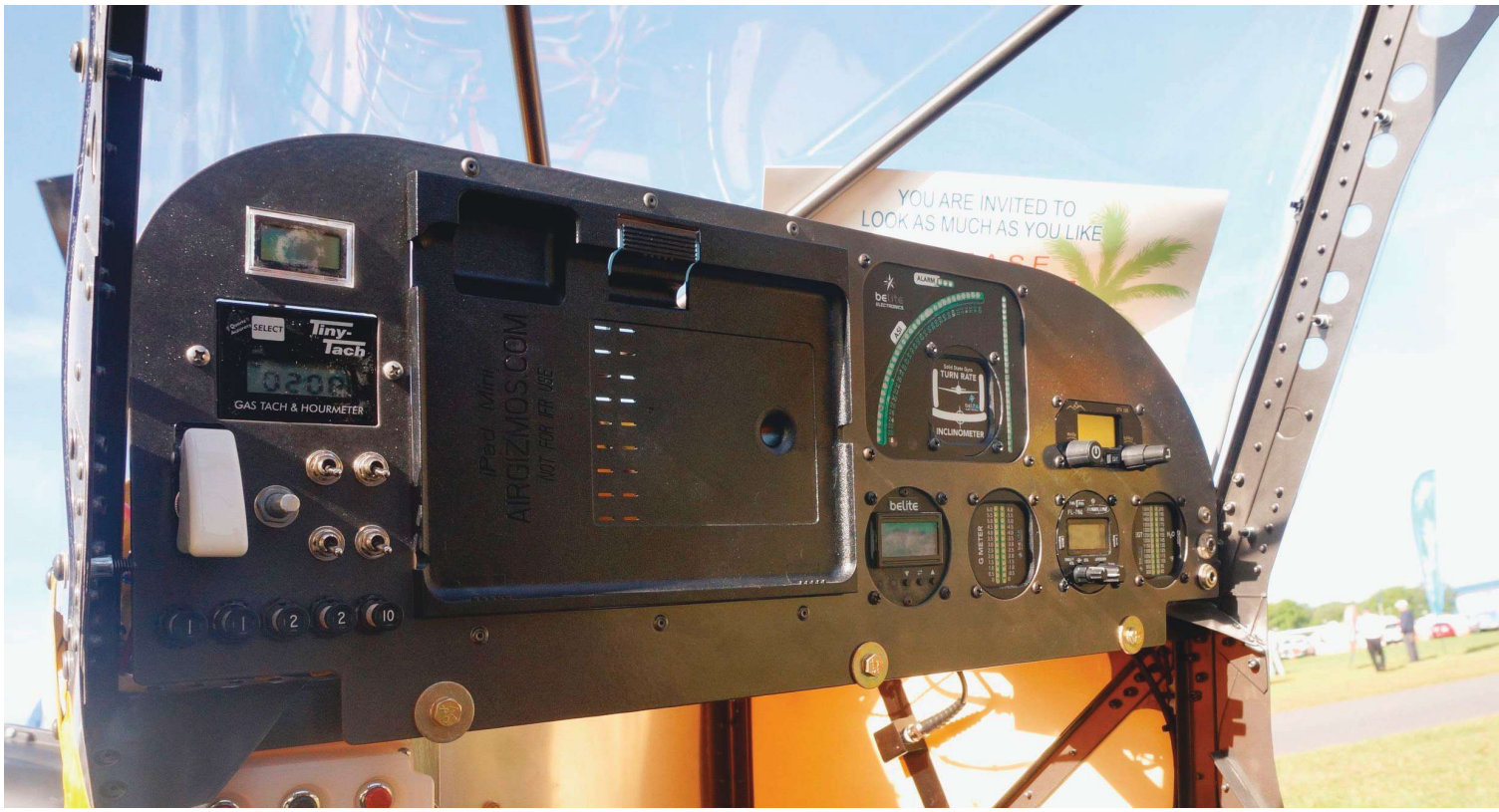
Wilson and Denny couldn't have known how many variants would be produced and how many other designers and manufacturers would be inspired. The genealogical tree of the Avid Flyer and Kitfox is quite complicated and branches out to include thousands of airplanes with names such as Skyraider, Ridge Runner, and new light-sport aircraft (LSA) from overseas. A single-seat version introduced in the year 2000, the Kitfox Lite by Skystar was rescued from obscurity by James and Kathy Wiebe in March of 2009 when they bought the rights, tooling, and leftover parts.

The Wiebes received very little documentation in the deal, so they purchased a privately owned Kitfox Lite to figure out how it was built. Coming from a time when there was less emphasis on adhering to the 254-pound weight limit, the acquired example weighed 294 pounds—40 pounds over the limit.

James kept the welded steel tube fuselage but changed the engine and redesigned the airframe to use carbon-fiber spars, lift struts, wing ribs, firewall, and seat. In July 2009, the new prototype—called the Belite 254—was flying at le-

This cabin photo shows the CNC-manufactured aluminum components of the cabin structure and the inside of the turtle deck.

Photography by Dan Grunloh and courtesy of Belite



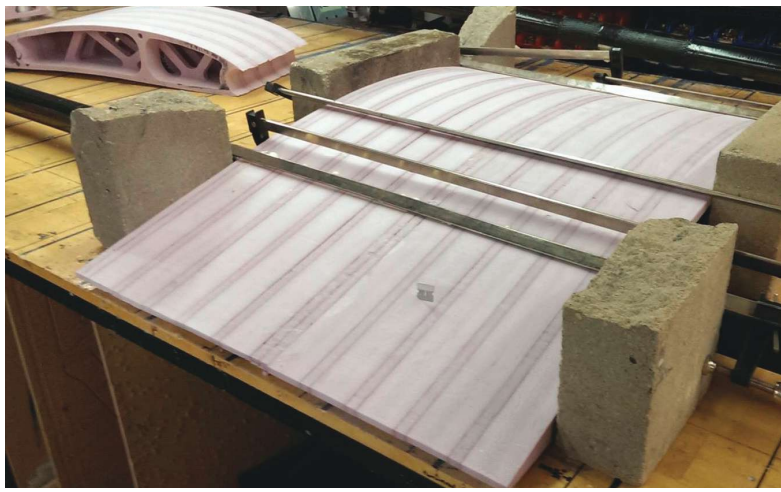
This is Belite's lightweight, simple panel dominated by an iPod dock that could make it very advanced and still ultralight-weight legal.

gal ultralight weight and was displayed at EAA AirVenture Oshkosh. That was just four months from loading parts and jigs into a truck to the flying and public debut of a redesigned airplane.

A little more history is required to get us to the new Belite ProCub introduced earlier this year. Some ultralight designs barely change at all in 30 years, but innovations come at a rapid pace at Belite Aviation, located in Wichita, Kansas. In 2010, Belite introduced a tricycle-gear version and a superlight airframe that could accommodate larger engines such as the 50-hp twin-cylinder Hirth F-23. A steady stream of new ideas flowed from the Belite shop, including aluminum-formed ribs to replace the wooden ribs, faired struts, spring landing gear, elevator trim, Hoerner wingtips, floats, and finally an aluminum fuselage and CNC-manufactured aluminum cabin as seen in the 2013 Belite UltraCub. The aluminum fuselage costs less, is easier to build, and saves weight, making it possible to accommodate heavier engines and pilots.

The Belite UltraCub took on the feel of the venerable J-3 Cub, thanks to a Casler ½ VW engine up front, and it garnered the Grand Champion Ultralight Award at Sun 'n Fun International Fly-In and Expo in 2013. There are 16 Belites flying and about 35 are currently under construction.

Along the way, James, an electronics engineer, developed a full line of very lightweight, solid-state LCD instruments that make it possible to have all the information you would expect in a type-certificated airplane but weighing grams instead of ounces or pounds. He recently introduced a sensor to detect water in fuel tanks, and a compact, low-profile fuel level sensor with no moving parts that works in any fuel tank. See it all at BeliteAircraftStore.com/avionics.

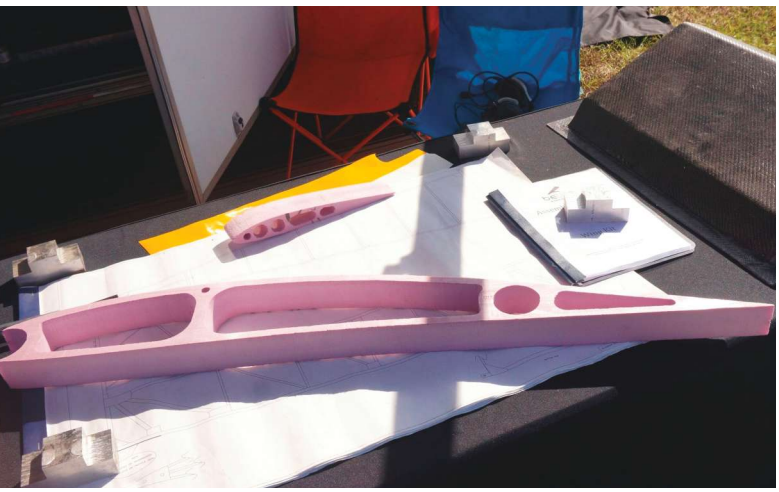


CNC-cut foam ribs are sandwiched together to form the wing of the ProCub.

THE PROCUB LITE IS SOMETHING COMPLETELY DIFFERENT

Anyone who thought that James had used up all his ideas in the first four years of the company's existence would

Hinges and gussets can be hidden under the fabric on the ProCub tail built with foam sheets and visible lightening holes.



A CNC router cuts the foam ribs to shape.

be wrong. His next airplane, the Belite ProCub Lite, took only three months from "idea to completion." It breaks new ground with a construction method never tried before and for which a patent has been applied. Its wing ribs are CNC cut from sheets of extruded polystyrene foam house insulation. The ribs are stacked on the main spar (like a shish kabob) and glued in place. The stacked foam ribs alternate with ribs that have trusses and special ribs with an aluminum plate. Gorilla Glue adhesive is used to lock it all together. The leading edge tube is added, and the trailing edge has a ¼-inch rod embedded in a fiberglass wrap. Foam wingtips are shaped by the builder, and their edges are fiberglassed. James said he realizes there are some questions that could come out of the construction method, but he points out that the main strength of the wing comes from a 4.5-pound carbon-fiber spar or 7-pound aluminum spar.

The point of the foam isn't to invent a new way to build a composite structure wing; it is simply a way to create a smooth shape and an easy-to-build wing. The ProCub is aptly named because the new method produces a very smooth, professional-looking airplane. The ProCub Lite can be a legal, under-254-pound ultralight using either aluminum or carbon-fiber spars. Carbon fiber is an option in all the Belite kits. Using more carbon fiber saves weight for other options but can add thousands of dollars to the cost.

James estimates an all-carbon ProCub Lite with small wheels, a Hirth F-33 engine, and minimal options could be built as light as 210 pounds. The aft fuselage components and tail of the ProCub Lite are also made from extruded foam sheets shaped with a CNC router. Aluminum or carbon-fiber tubes are inlaid into the foam structure for strength and to create attachment points. The overall appearance is very smooth with no protruding gussets or rivets to create drag. The Belite has now evolved quite a lot from its early Kitfox Lite roots. And it continues.

Photography by Dan Grunloh

FABRIC COVERING WITH NO PAINT

On Belite's aircraft, fabric covering begins with a conventional Dacron fabric using the Stewart system for fabric attachment. When shrinking the fabric tight, the iron is carefully adjusted and kept moving to avoid damaging the foam parts. At this point, the airplane could be finished with conventional paint if the temperature and humidity are acceptable and if you have the time, equipment, and inclination. Instead of using paint, Belite has been finishing all of its factory-built airplanes for the last two years with adhesive-backed Oracal vinyl sheeting. It goes directly on the unfinished Dacron fabric. The cost and weight are similar to those of painted fabric; but there are no solvents, spraying, or drying time, and it produces a perfect finish. It's quick and easy, and you can completely cover and finish a wing in two or three days. The 3-mil vinyl is intended for outdoor use, comes in a variety of colors, and already has a 7-year service history.

POLINI THOR ENGINE INTRODUCED

James really loves the ½ VW conversion engine on Belite's ultralight, and they also get good results with Hirth two-cycle engines. The first Belite flew with the 28-hp Hirth F-33 single-cylinder engine, but it's not recommended for heavy airplanes or heavy pilots. The 50-hp, twin-opposed Hirth F-23 and the 45-hp, air-cooled MZ201 have flown on Belites along with a few other engines. The Wiebes favorite builder for ½ VW conversions is Scott Casler at www.HummelEngines.com, but sometimes Scott has a long backlog of orders. Plans also are available for do-it-yourself VW engine conversions.

Always on the lookout for new possibilities, James came upon the Italian-built, 250-cc, single-cylinder, liquid-cooled, two-cycle Polini Thor engine. Polini is known for its smooth-running, internally balanced engines designed for powered paragliders. The new, liquid-cooled, 250-cc version is a different prospect with many advanced features

Tundra tires are shaved at considerable expense to save weight, hence their worn appearance…and an LED landing light for obvious reasons.

James Wiebe demonstrates that ultralights are lightweight and easy for one person to push off the runway after a flying session. While this photo shows James pushing the ProCub in at the Sun 'n Fun International Fly-In and Expo, this video highlights James' flight to EAA AirVenture Oshkosh 2014.

you might expect in a larger airplane. (There is that phrase again.) It has dual ignition, electric start, and a 2.8 gear reduction drive and centrifugal clutch in an oil bath. The engine produces 36.5 hp at 7,500 rpm with a theoretical compression ratio of 11.5, employing a reed intake valve in the crankcase. The engine without radiator and coolant but with electric starter is listed as 43 pounds. The full package, ready to run on the ProCub, was actually 54 pounds. James used a tiny lithium battery. If only we had such an engine 30 years ago!

Most Belite builders opt for the ½ VW conversion engine for that authentic, four-cycle sound and perceived reliability. For the air show or demonstration environment where a very good takeoff and climb are expected, James decided to use the Polini engine for the first ProCub Lite. A lightweight two-cycle can deliver when optimum short-field performance is desired. The Polini Thor is only 13 pounds heavier than the 28-hp Hirth F-33 but gives better performance for heavier pilots and airframes. It's also a lot quieter than the Hirth, likely due to the water jacket and a sophisticated intake air box and exhaust silencer. The Polini engine's cost is similar to that of the 50-hp Hirth F-23 or the 37-hp Casler ½ VW. Both are heavier than the Polini. The climb performance of the ProCub has been measured with electronic monitoring and calculated to be 650 fpm in standard conditions at sea level, with big tundra tires and with an oversize coolant radiator increasing the drag.

James admits that some of his builders don't care what the ultralight weighs, and they assume the FAA won't care, either. Nonetheless, the design gross weight limit of 550 pounds should be observed. Belites can be amateur-built N-numbered experimental aircraft, though kits have not been preapproved. An N-numbered Belite with a 200-pound pilot and 10 gallons of fuel would be at gross weight in a 285-pound airframe, not counting sandwiches and thermos. The yellow prototype ProCub Lite with Polini engine, tundra tires, and a built-in emergency parachute weighs 278 pounds.

CRASH-PROVEN CABIN ENCLOSURE STANDARD

A good airplane design should include a crashworthy pilot enclosure to protect the most important part of the package. Belite can now use the term "crash-proven" in its promotions. The seminal moment came when James received a phone call from a customer saying a friend had just stalled and spun his Belite named *Blue Goose* into the ground. A commercial pilot with 9,000 hours (in heavier aircraft) pulled the nose too high while climbing after takeoff, initiating a departure stall and spin. He recognized the problem and almost recovered in time. The Belite was extensively damaged, but the pilot escaped with minor scrapes. An examination of the bent but intact CNC-manufactured aluminum cabin enclosure verified the validity of the design. Everything bent where it should have, and no major design changes are indicated. From now on, all Belites will have this cabin as standard.

BELITE HOME RUN ON SOCIAL MEDIA

There is no doubt that Belite Aviation does a great job of getting the news about their airplanes out on the Internet. It starts with a good website, www.BeliteAircraft.com, with everything you might want to know plus one more jewel of interest to anyone interested in building for lightness—you can download an interactive Excel spreadsheet that gives the prices and the weight changes with each of the many options. The weight gain or loss, based on choice of wing construction, fuselage style, engine, brakes, wheels, and carbon-fiber options, is displayed along with the final empty weight. Carbon-fiber spars save 12.1 pounds, and carbon-fiber lift struts save another 2.5 pounds. Tricycle gear and drum brakes add 13 pounds. Foam and carbon flaperons save 5 pounds. But the 21-inch tundra tires add 18 pounds, and switching to a ½ VW engine adds 39 pounds. It's all there in the spreadsheet.

Belite offers two ultralights—the aluminum UltraCub and the foam ProCub—in either ready-to-fly or kit form. Basic kits less engine, coverings, wheels, brakes, and instruments start at $7,995. The basic minimalist-completed ultralight with the small Hirth F-33 is $16,995 with basic instruments but excluding cowl, brakes, spring gear, or turtle deck. A complete, ready-to-fly, one-of-a-kind show special ProCub Lite with all the carbon fiber and foam possible, all the great instruments, and those oversize tundra tires that had to be shaved down to reduce weight will set you back in excess of $50,000.

Belite Aviation has a content-rich Facebook page at www.Facebook.com/BeliteAircraft with regular updates on activities; 29,000-plus "likes" are clear evidence that James really loves to fly. He is also a practical engineer who proves his ideas with experiments and load test rigs, and he shares those details openly. The Belite YouTube Channel has 62 videos at this time. Many of them show the fun of flying ultralights. If you watch enough of these, you will want a Belite ultralight. The Belite image stream on Flikr at www.Flickr.com/photos/beliteaircraft includes 582 images, many of them beautiful scenic shots of the earth below the wheels of a Belite. And if that isn't enough, James also has his own blog at jameswiebe.wordpress.com.

In decades past, ultralight pundits and some manufacturers complained that it was not possible to build a legal, safe, fun ultralight with the characteristics you would expect in a type-certificated airplane. James Wiebe believed differently, and in a few short years his company has become one of the leading technology innovators in the field of ultralights. 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.

The New 'Touch' World of Avionics Suites

The Dynon SkyView Touch and Garmin G3X Touch

BY MARINO BORIC

DEVELOPMENT IN THE AVIONICS world is progressing at high speed. Sometimes that pace is so high that it is difficult to keep up with the latest news and products. Now that we have become accustomed to touch screens in our everyday life, avionics manufacturers recognized the market demand and presented new devices recently—at the Sun 'n Fun International Fly-In and Expo in the United States and at AERO Friedrichshafen in Germany. Dynon and Garmin debuted new avionics suites of which we would not have even dreamed a decade ago. And they look "airlinelike" but with the difference that they are affordable and easy to use, even in the tight cockpits of experimental and light-sport aircraft (LSA).

The Dynon SkyView Touch and Garmin G3X Touch are specially made for the experimental and LSA market. Both manufacturers have developed similar-looking devices, but they started from different base components, market positions, and assumptions. For Dynon, the SkyView Touch is a top-of-the-line product, while Garmin adapted—"downscaled"—its certified devices to meet the needs of the noncertified market.

Both manufacturers have created excellent products that allow us to navigate, monitor our engine and the aircraft, and dramatically increase our safety awareness. It was never so easy to have aircraft flight parameters, navigation data, surrounding terrain, weather, and traffic on only one screen. To describe these devices deeply would take almost all of the pages of our magazine, so here are the basic facts and pricing.

Until now I was reluctant to think about purchasing a glass cockpit because the development was so fast and the devices were difficult to use. Now the time is right for our experimental panel redesign using the newest "Touch" suites. They have matured to "serious" products that can appeal to an average builder, and their purchase won't require a second mortgage on our homes.

DYNON SKYVIEW TOUCH RETAINS MECHANICAL CONTROLS

Dynon Avionics, from its very beginning, primarily has been dedicated to the experimental and LSA avionics market. The company's flagship SkyView integrated avionics suite has been an experimental amateur builder's premium choice. Since the current avionics trend is toward touch-screen functionality, Dynon reworked its existing SkyView, creating the SkyView Touch. It has the "old" look of the well-known SkyView, but now it has a new user interface with touch functioning while retaining the traditional joystick knobs and buttons.

Dynon launched the new Touch device at Sun 'n Fun in the United States and at AERO in Germany, with company CEO Robert Hamilton on both continents untiringly promoting his new touch screen with great results.

"Touch when you want it. Turbulence when you don't," is Dynon's new slogan. What started as a grammatically challenged joke turned into the philosophy that Dynon used in developing the SkyView Touch. Although we daily use touch-controlled devices such as smartphones, tablets, and computers, turbulence can quickly render a touch interface to be almost impossible to use.

TOUCH IT 'RIGHT'

SkyView Touch solved this difficult equation—in the words of Hamilton—by using touch to augment and complement the physical buttons and joystick knobs rather than to replace them. "It's the best of both worlds," Hamilton said, so that pilots can focus on the flying, not on the technology. By the way, Dynon has not replaced or orphaned its previous SkyView displays; the SV-D700 and SV-D1000 units will continue to be sold and will be continuously updated.

SkyView Touch capacitive multi-touch technology allows natural actions, such as two-fingered pinch-to-zoom on the map; I could use the new SkyView touch screens with surprising ease. The inputs over the screen have cut the necessary time to a wanted display by half. Unlike most touch-based consumer phones and tablets, SkyView Touch preserves SkyView's sunlight-readable and glare-rejecting screen.

What is new on the SkyView Touch is an on-screen, six-pack flight instrument display. In my opinion, that's one of the smartest features, especially for older pilots or for those "downgrading" from IFR flight operations. This familiar round instrument layout can be displayed with a synthetic vision background or on a plain screen.

If you like dedicated controls, you are covered. The knob control panel assigns the items you adjust most to dedicated knobs, freeing up the multi-use SkyView joysticks and lowering pilot workload. The optional autopilot control panel removes the need to use the on-screen menus for autopilot mode changes.

DETAILS

Elements such as on-screen keyboards speed up entry of airport identifiers, and the map zooms and pans just like you've experienced on every tablet you've used. Touch an airport for more information, and airspace and the altitudes pop right up. Touch the altitude bar, and the closest knob assigns itself to adjusting your altitude bug. Touch the transponder, and the transponder menu pops up. The system retains Dynon's existing screens and anti-glare properties, so a flight on a bright,

Dynon President Robert Hamilton demonstrates the capabilities of the SkyView Touch at the Aero Friedrichshafen show.

Photography by Marino Boric and courtesy of Dynon Avionics

sunny day should not be a problem. And there is still the ability to automatically dim the screen enough at night.

When Dynon designed SkyView years ago, the goal was to create a platform that could be customized and expanded without requiring huge investments of time or money by individual owners. In the last three to four years, Dynon has added an autopilot, ADS-B, transponder, VP-X, and comm and radio, all without requiring any hardware upgrade to the main screen and network platform. The first SkyView was sold in 2009—just four years ago!—and it is still as up to date as those sold today. What gives me faith in the future is that Dynon is still selling and supporting my D10A that I purchased some 10 years ago.

NEW CONTROL CONSOLES

Together with the SkyView Touch, Dynon also introduced new knob and autopilot control consoles that integrate with the Touch display. The SV-KNOB-PANEL (vertical and horizontal) component contains dedicated control knobs for adjusting the most commonly used function modes, including altitude bug, barometric setting, and heading/track bug for $239. The autopilot control head drives all of the Dynon's integrated autopilot modes, including a dual-axis trim control that sells for $529. The autopilot can still be commanded from the SkyView screen, using touch or buttons. The SV-Intercom-2S sells for $285. The SV-COM-C25 comm radio—vertical and horizontal version—is priced at $1,239 and consists of a dedicated control panel and remote RF module (Sarasota Avionics pricing).

Dynon says that SkyView Touch was designed to complement SkyView's existing interface, not replace it. This allows you to rely on SkyView's complete set of buttons and joystick knobs when you need them most. This is critical for effective control in turbulence: While you usually hold a smartphone or tablet in your hands, your EFIS screen is at the end of your outstretched arm, and it's moving with the aircraft, not with you. These two things conspire to make touch control less than ideal when things get bumpy.

WHAT IS THE EXPENSE?

The SkyView Touch retains many of the same major features of those of the older SkyView but gets a software upgrade that enables more functionality. The single 10-inch display starts at

AIDING THE NEW CERTIFICATED AIRCRAFT GENERATION?

The German LSA manufacturer Flight Design recently made an unconventional step by selecting the Garmin G3X Touch for its C4 four-seat aircraft to make it less expensive, and thus, possibly more successful. This move could become "historic," because this is the first time that noncertified aircraft equipment will be used in a new certified aircraft.

Those noncertified Garmin G3X Touch screens will be installed parallel with the certified Garmin main stack of nav/comm products and will considerably lower the total cost of the airplane. This is likely to happen because FAR 23 is currently undergoing a rewrite, and Flight Design is closely working with the FAA in the United States and European Aviation Safety Agency (EASA) in Europe. Moneywise, this approach—using non-TSO equipment together with TSO equipment—means big savings. How big the savings will be is difficult to say as this rewrite is still in progress. But according to Flight Design, the panel shown at Sun 'n Fun will cost approximately $60,000 (45.000 euro) while the same panel built with only TSO-certified components would cost from $130,000 to $150,000 (100.000 to 120.000 euro). That's a big difference, especially if the aircraft costs just above $300,000 (250.000 euro) total. Actually, the Italian manufacturer Tecnam is the leader in certifying non-TSO equipment in a certified airplane. This was done in the P2008JC that is CS/VLA fully certified by EASA with the G3X.

This development is being closely monitored by Pipistrel, which is in the certification process for its sleek Panthera four-seater. With a rewrite of FAR 23, the costly regulations governing type-certificated airplanes could trigger a rush of new models and new innovations among larger-than-LSA aircraft. The hottest candidates that might pop up are LSA designs with two additional seats—let's call them LSA 4. Besides the already mentioned Flight Design C4 and Pipistrel Panther, Evektor's Cobra, Tecnam's P2010, and The Airplane Factory's Sling 4, along with a couple of other not yet officially announced airplanes are all aiming to meet the new guidelines. The future looks exciting for enthusiasts of larger aircraft.

$3,995 (MSRP) or $3,789 street price, which is $395 more than the non-touch device. Existing SV-D1000 SkyView customers can easily upgrade to the Touch version, sending the old unit to the manufacturer and investing an additional $795. The upgrade is a no-brainer (according to Dynon) as much of the existing Dynon wiring and remote components can be used with the Touch system. Software Version 10.0 for the SkyView Touch enables more functionality with third-party navigators, including Garmin's GNS and GTN-series navigators. This enables overlay of the navigator's course data on the SkyView map—a function that was lacking with the old software. SkyView Touch supports full electronic charting, including airport diagrams and geo-referenced procedure charts, for a mere $99 per year.

For more information, visit www.DynonAvionics.com.

GARMIN G3X TOUCH GOES EXPERIMENTAL

Also at Sun 'n Fun 2014 and a week later at AERO 2014, Garmin introduced its next-generation glass cockpit for experimental and LSA applications—the G3X Touch. The G3X T ("T" stands for "Touch"), which is available in up to a three-screen configuration in a single instrumental panel, has high resolution, 10.6-inch flight displays with split-screen functionality, plus advanced interface options.

The display bezel contains four dedicated buttons and two rotary knobs, giving users the option of using a combination of touch and traditional knobs and soft keys, all depending on a pilot's preference and habits plus weather conditions. One weak point in daily use of other flat-screen systems has been eliminated in this G3X T: Garmin's touch system does not work with capacitive sensors on the screen surface; instead it uses the location of the finger or a pen (or similar object) with infrared sensors located in the screen frame so it is possible to operate (to touch) the screen even with objects or gloves.

The G3X Touch has a split-screen mode with the option to view PFD, MFD, and engine information on a single display. Garmin's SVX (Synthetic Vision) is a standard feature on G3X Touch and provides a three-dimensional depiction of terrain, obstacles, water features, and the runway environment on a single display. The G3X Touch also displays VFR sectionals and IFR en-route charts. Synthetic Vision provides a three-dimensional forward view of terrain features on the PFD. Synthetic Vision imagery shows the pilot's view of relevant features in relation to the aircraft attitude, as well as the flight path pertaining to the active flight plan.

A version of G3X Touch also includes Sirius XM Aviation Weather and Radio capability, which displays NEXRAD, METARs, TAFs, TFRs, winds aloft, and other in-flight weather as well as entertainment. This function is now available only in the United States. The new GDL39R—a remote ADS-B receiver—is also compatible with G3X Touch.

The G3X T interfaces with the Garmin GMC305 autopilot, allowing access to all autopilot modes from the touch-screen display, including indicated airspeed hold, yaw-damper, flight director, and level modes. Touch-screen control functionality for the remote-mounted GTX 23 ES transponder is also provided on the display. Dedicated autopilot servos for the noncertified G3X T are already available and on sale.

A composite video connection (BNC) is included, which provides a way to connect to the VIRB, Garmin's HD action camera or other compatible camera, to show video in the PFD inset window or on the MFD. This feature is really interesting; it allows installing multiple VIRB cameras in and outside of the airplane and displays the image on the G3X. This feature has proved to be very useful for judging the height over a runway on landing. The only (small) drawback is that the G3X T can simultaneously display the

Photography courtesy of Garmin

image of only one camera, and another (aftermarket) camera switch in cockpit is needed for camera selection.

In addition to the flight instruments, the G3X T PFD also displays various supplemental information, including the outside air temperature, wind data, angle of attack (AOA), and vertical navigation (VNAV) indications.

VNAV settings create a three-dimensional profile from the present location and altitude to a final (target) altitude at a specified location.

One interesting feature is that you can monitor the AOA, but a dedicated probe is needed.

The G3X Touch EIS displays critical engine, electrical, and other system parameters. Among other options there are the "Lean Assist Mode" (it needs an EGT probe), fuel calculator, and crew-alerting system (CAS) messages which display warnings that need immediate crew attention.

COMM RADIO

The new comm radio is hidden away behind the G3X Touch display, so pilots can integrate the new GTR 20 remote comm for added functionality. The GTR 20 remote comm radio offers pilots a radio and intercom, which is controlled directly from the G3X Touch display. The 10-watt radio provides features such as 3D audio, stereo intercom, stereo music input, alert inputs, and standby frequency monitoring. Frequency identification is available on the display of G3X Touch. The Comm Frequency Box is composed of two fields—one active frequency on the left side and one standby frequency on the right.

REMOTE TRANSPONDER INTERFACE

The G3X Touch is capable of interfacing with several remote transponders providing Mode S interrogation and reply capabilities. The remote transponder can be controlled from the G3X display in a similar way as the comm.

FLIGHT PLANNING

Flight planning with the G3X is possible, and up to 50 flight plans with up to 300 waypoints each can be created and stored in memory. Flight planning on the G3X Touch consists of building a flight plan by entering waypoints one at a time and inserting approaches as needed.

ALARMS

The Alarms page allows the pilot to turn airspace alarms on or off and set an altitude buffer, arrival alarm, next waypoint alarm, proximity alarm, and fuel tank reminder alarm.

EASY TO INTEGRATE

According to Garmin, the new G3X Touch display, which starts at $5,499, can be easily interfaced with older G3X components without having to rewire the interface and the instrument looms. The G3X Touch with EIS interface module—a separate small box—starts at $6,099. The GTR 20 remote comm transceiver option is available for $995, and the GI 260 AOA indicator is $249.

Five light-sport aircraft manufacturers (13 aircraft models) have chosen the G3X Touch as their avionics option before its official presentation. These include Van's Aircraft, Cub Crafters, Flight Design, Pipistrel, and Tecnam.

For more information, visit www.Garmin.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.

A Necessary Hole

Venting the induction system

BY CY GALLEY

ONE OF THE HALLMARKS of homebuilding is good, precise craftsmanship—rivets aligned, no "smiles" on the heads, and all systems tight without any leaks. Unfortunately, in the induction system there needs to be a hole (leak) just before the fuel/air regulator, whether it is a carburetor or fuel injector. If you inspect any factory-built airplane, you will find such a hole.

At EAA AirVenture Oshkosh every year, a builder or two will come to us at Emergency Aircraft Repair and say, "I went to start my engine to leave for home; it fired once, then nothing. After more cranking, even with some priming, the engine refused to even pop. Can you help me?"

Although this is typically a problem with fuel-injected RVs, it has happened to other planes, even those with carburetors. Builders forgot to drill a hole in the lowest point of the air intake or covered it up during restoration.

Why the hole? For two reasons: 1) It is a drain for gas if you overprime; and 2) It lets water drain harmlessly out of the intake when the plane sits out in the rain. Fuel-injected RVs with the filter just in front of the left front cylinder are extremely susceptible to rainwater draining down into the fuel injector. The duct from the filter to the injector is like a big funnel. This never happens with planes when they are hangared back home; however, after sitting out in the rain for several days at AirVenture, it may happen.

Lycoming even has a port in the bottom of the injector body for a "snuffle valve drain." It automatically opens when the engine isn't running and closes at start-up. Many builders leave it off, as it costs about $70, and then they plug the port with a pipe plug.

When using the pipe plug, you need to drill a drain hole in the intake tube before the injector body. Many builders fail to

HINTS FOR HOMEBUILDERS VIDEOS

THE FOLLOWING HINTS ARE JUST A SMALL SAMPLE OF THE MORE THAN 400 HINTS FOR HOMEBUILDERS VIDEO CURRENTLY AVAILABLE FOR VIEWING ONLINE HERE.

Corrosion Protection
Sebastian Heintz and Roger Dubbert from Zenith Aircraft show how to brush Cortec Primer on an aluminum rib flange prior to riveting to aluminum skin. This small, optional step can help prevent corrosion between these surfaces.

Sealing Fuel Tank Fittings
Roger Dubbert also shows us a method to seal a fitting used in an aluminum fuel tank. Roger has found that 3-M Scotchweld Epoxy adhesive works very well to seal the threads and prevent leaks.

Band Saw Tabletop
Cutting very thin material on a band saw can be made easier and safer by incorporating this hint. Mark Forss, manager of the EAA SportAir Workshops, shows how to create a new table surface for your band saw.

Making a Fiberglass Layup
EAA Technical Counselor Mike Busch demonstrates how to apply two layers of fiberglass cloth over a foam core.

Photography courtesy of Cy Galley

do this as they think it will allow dust and dirt in and destroy their engine. Fortunately, the cross-section area of a 3/16-inch hole is very small compared to the relatively large intake tube, so little air and dirt enters.

NOW FOR THE FIX TO GET THE PLANE RUNNING

To get the engine running again, the intake tubes and injector body must be drained of all fuel and water. Fortunately, the plugged hole for the snuffle valve can be removed to drain the fuel and water by using a 3/16 Allen wrench. All the intake tubes running to the cylinders from the injector body must be drained.

A 3/16-inch hole should be drilled in a low spot just before the injector body. With a taildragger, the tail has to be lifted so the liquid will drain. Nosewheel planes are harder to drain because you can't lift the tail. At the Emergency Aircraft Repair, we have drained more than a quart of liquid out of a flooded intake system.

After draining, all the spark plugs have to be removed and cleaned of the jellied gas and water mix. The mix shorts out the plugs and must be removed before the engine will fire. Even after draining and cleaning, the engine might run rough until all the residual gunk heats up and is blown out or burned.

Draining water from a drenched airplane.

Taking on the completion of the MI Baby Ace brought new life to the Wausau EAA Chapter.

Paul Poberezny's *Mechanix Illustrated* Baby Ace Replica

Finishing Paul's last project

BY KURT MEHRE, EAA 170963

EAA FOUNDER PAUL POBEREZNY and several other early EAA members built the original *Mechanix Illustrated* (MI) Baby Ace and wrote a series of construction articles published in the May, June, and July 1955 issues of *Mechanix Illustrated* magazine. The articles included information about the EAA, which attracted a wide interest and brought a huge increase in membership to the then two-year-old organization. (Note: The original MI Baby Ace currently hangs in the Homebuilding Workshop display in the EAA AirVenture Museum.)

In January 2011, Paul began what would be his final aircraft project, a replica of the *Mechanix Illustrated* Baby Ace, with help from friends and volunteers. Paul wanted to build and fly the replica as a way to bring this focal point of EAA's history to life. Paul said, "This is the airplane that brought the whole homebuilt movement together. It launched the EAA from a local builders club to an international organization."

The *Mechanix Illustrated* Baby Ace replica project began at the Aeroplane Factory in Oshkosh—a workshop on the convention grounds. The project progressed over the next two years until Paul's passing in August 2013. Then the Poberezny family approached me to take over and see the project through to completion. I had volunteered on the MI Baby Ace project and other projects with Paul at The Aeroplane Factory for many years. I made a proposal to my local EAA Chapter 640 in Wausau, Wisconsin, to take on the project to honor Paul and in the spirit of the the Aeroplane Factory, and the group agreed. We then invited anyone with an interest in aviation or homebuilding to participate.

On November 2, 2013, EAA Chapter 640 President Bob Mohr and I arrived at the Aeroplane Factory to take the project back to Wausau to be completed. Since arriving at EAA Chapter 640, the project has sparked a new energy in the chapter. The project has attracted a number of new members and the interest of more than a few young adults volunteering on the MI Baby Ace. Many of the new members have little previous experience in homebuilding. Because of the success of the MI Baby Ace project, the chapter is considering another

Photography courtesy of Kurt Mehre

"This is the airplane that brought the whole homebuilt movement together. It launched the EAA from a local builders club to an international organization."

project following the completion of the Baby Ace. This aircraft would be a two-place project in which the volunteers could be given the opportunity to experience flight when completed.

The MI Baby Ace project met twice a week for "formal" work sessions—on Sundays from 2 p.m. to 5 p.m. and on Tuesday nights from 7 p.m. to 9 p.m. in Rick Coe's hangar at the Wausau Downtown Airport (KAUW). The project was chronicled at www.Facebook.com/MIBabyAce. The project was on display at EAA Oshkosh 2014, after making its first flight and completing Phase I flight testing just before AirVenture.

EAA Chapter 640 and the MI Baby Ace project would like to give a special thanks to Jon Goldenbaum of Poly-Fiber and Scott McPhillips of Hooker Harness for their donations to the project. EAA

Paul welding on the fuselage sides.

Kurt Mehre with the completed Mechanix Illustrated *Baby Ace replica.*

The Rotax factory in Gunskirchen, Austria.

Rotax—25 Years, 50,000 Engines

A four-stroke aviation engine celebration

BY MARINO BORIC

ON JUNE 5, 2014, ROTAX rolled out its 50,000th 9-series aircraft engine at its factory in Gunskirchen, Austria, and it celebrated the 25th anniversary of the four-stroke engine family with a fly-in at the nearby Wels Airport on June 5 to 7.

Rotax invited press representatives and its distributors from throughout the world to participate, and ultralight and light-sport aircraft (UL/LSA) manufacturers from around Europe flew in with 912iS Sport-powered aircraft for demos. Rotax combined its second fly-in event with an annual homecoming of Can-Am Spyder Roadster owners, whose engines are also manufactured in the Gunskirchen plant.

Activities at the Wels Airport allowed all interested media and fly-in attendees to take flights in 912iS Sport-powered aircraft and also rides on the company's Can-Am Roadster three-wheel motorcycles. I counted about 30 aircraft grouped around the luxurious Rotax party tent, all powered by the carbureted Rotax 912, 912S, and newest 912iS Sport engines.

From the very first four-stroke Rotax prototype engine that is still flying on a Falke motorglider to the latest 912iS Sport installed on a Pipistrel Virus, the whole of 912/914 engine history was displayed on the airfield. Most aircraft belonged to European UL/LSA manufacturers that used the occasion to visit the Gunskirchen plant and celebrate the production of the 50,000th four-stroke engine, which was a 912iS Sport destined for a South African flight school.

Rotax holds approximately an 80-percent market share among light aircraft engine producers. That translates into 170,000 aviation engines produced, of which 50,000

Photography by Marino Boric

are four-stroke units. These numbers are low compared to the 7 million (yes, 7 million) engines that Rotax has manufactured in total. All who attended the event were treated to factory tours and now have a much better idea of why Rotax is so successful. Francois Tremblay, director of BRP Rotax Propulsion Systems, who came from Canada for the event, said, "We want to give you an idea of what the company is all about, to see the manufacturing processes and the rigor behind our manufacturing so you can see why the customer pays the money they do for Rotax engines." The tour showed how Rotax is able to manufacture engines for any recreational product.

A LITTLE HISTORY

Thirty years ago, aircraft engines were spinoffs of snowmobile and industrial engines, which were heavy and based on Continental and VW engines. BRP Rotax decided to develop a new engine for aviation use because there was a market demand for a modern, reliable engine. In 1985, Rotax started the development of a two-cylinder flat engine especially for the aircraft market. Though the performance of this 65-hp engine was substantially higher than those of the competitors, BRP expected more. With the development of a four-cylinder flat engine, BRP wanted to reach the next level—the 80-hp engine's category.

The Rotax 912 development project was intended only for aviation use. For the very first time, all conditions needed on an aircraft engine were considered, such as security, reliability, and the appropriate (high) power-to-weight ratio. Rotax started the production of aircraft engines in 1973 with the first certified aircraft engine delivered in 1975. Its investment in four-stroke engine production was

Some of the Rotax-powered aircraft that joined Rotax's 25th anniversary celebration at Wels Airport.

BRP Rotax is also the producer of the popular Can Am Spyder, and Spyder owners joined in the celebration.

a smart one because, especially in the last decade, two-stroke engine sales declined rapidly. The 912's reliability, with an initial time between overhauls (TBO) of 600 hours, was twice as high as a two-stroke engine. The new Rotax 912 engine initiated the aircraft industry's shift from two-stroke engines to four-stroke engines—from the 40-hp engine used for single-seat ultralights to the new four-stroke engine with 80 hp that could be used for two-seat aircraft.

It was in 1989 to 1990 that the first Rotax 912 engine was delivered out of serial production. The target was JAR-22 certification; the airworthiness requirements for gliders and powered gliders for Austrian type certification were met within the first year following the production start.

Over the last 25 years, Rotax has manufactured 50,000 912 and 914 engines, which have logged some 40 million flying hours with a TBO successively increased to 2,000 hours. The latest milestone was the introduction of the fuel-injected 912iS engine two years ago, which was further improved this year as the 912iS Sport. The iS Sport has better torque, which mainly appeals to the U.S. market where constant-speed props aren't allowed on LSA. Rotax expects the 912 iS Sport to become the engine of preference in the U.S. light-sport segment.

With the newest member of the 912 family in serial production, the question of the day was: "What is coming next?" I asked that question to Rotax's leaders in Gunskirchen, and based on the answers I didn't get and the sweat on their faces, I'm convinced that Rotax is intensively thinking about a new engine with a power rating between 150 and 200 hp. Tremblay and Thomas Uhr, vice president of BRP-Powertrain and general manager of BRP-Powertrain GmbH & Co. KG, hinted that Rotax is "considering such an option," but they did not offer any details.

Evidently Rotax officials are closely monitoring the trend toward light, four-place aircraft certified under CS23 revisions, such as the new Flight Design C4, which needs an engine above the 912/914 power rating. I faced Rotax officials with the following question: "Rotax introduced the 912iS in 2012 and the 912iS Sport in 2014, so could we expect a fuel-injected 914 Turbo in 2016?" My question was neither confirmed nor denied. In confidence I was told by a well-informed insider to take a closer look at the 912iS Sport engine and its manual. That shows that all the needed sensors and the engine control unit (ECU) are easily reprogrammable to control even the turbocharger, so I would assume that pretty soon we could see a modernized and fuel-injected 914 delivering possibly 120 hp. By the

Photography by Marino Boric

way, during our factory tour I realized that Rotax engines on the dynos are often burning more fuel in a day than the entire Austrian light aviation fleet does.

Are we going to see a new Rotax 150- to 200-hp engine in the next five years? I really don't know; certainly demand is there right now and it will grow. But is Rotax going to invest $15 to $20 million to design a new engine? That is uncertain. Rotax has some definite advantages over Lycoming and Continental, mostly in terms of rapid prototyping, manufacturing capability, and flexibility. Rotax is able to develop and manufacture a certified engine in that power rating. (It has proven that with the V6 936 almost two decades ago. Do you remember it?) Rotax would face a soft market with original equipment manufacturers ordering some 200 engines a year, but wasn't the situation for the introduction of the 912 even worse? In its first production year, only 30 Rotax 912 engines were sold. It's kind of the chicken-and-the-egg situation: No egg, no chicken; no chicken, no egg. I've been told that EAA Founder Paul Poberezny often said, "You have to have the engine before you can build the airplane."

Considering that airframe manufacturers can only install what is already available on the market, I'm pretty confident that a new engine that burns all sorts of fuel and

Over the last 25 years, Rotax has manufactured 50,000 912 and 914 engines, which have logged some 40 million flying hours with a TBO successively increased to 2,000 hours.

that consumes 20 to 30 percent less fuel than those of the established competitors would simply sell well.

As a side note: It is remarkable that about 20 Rotax employees of the aircraft engine team are pilots. That puts them very close to their market and customers. In fact, Christian Mundigler, key account manager of Rotax Aircraft Engine Sales, recently became a Rotax test pilot.

Thanks, Rotax, for all your hard work and for a great party to celebrate 25 years of doing it well. 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.

A single-seat powered parachute comes in for a landing at Mark's Park.

Volunteers Create Their Own Fun

Meet the Wisconsin Powered Parachute Association

BY MIKE ENGEL

THE LONGEST RUNNING, volunteer-managed powered parachuting organization in the country, the Wisconsin Powered Parachute Association (WPPA), just wrapped up its 13th annual fly-in this past June. Although the weather allowed barely a solid afternoon of actual flying, the event was deemed yet another success.

But why would people travel great distances loaded down with camping gear, towing camping and powered parachute (PPC) trailers, to spend but a few hours in the air? It's the people, of course!

The humble beginnings of this tightly knit group date back to May 2001 when the idea of a PPC club was first considered at a basic flight instructor (BFI) refresher course sponsored by Floyd Funk in Hartford, Wisconsin. The 25 people in attendance expressed some interest in the idea, with seven people volunteering to be the initial officers and steering committee to facilitate getting the club organized.

On July 11, 2001, just two months later, the first officers meeting was held, and the Wisconsin Powered Parachute Association was brought into the world, bright-eyed and full of promise. In the following month, the first newsletter of the group was mailed to a database of about 130 known PPC fliers. That followed with a newsletter mailing on October 1 of the same year.

Having no previous such organization to foster the hobby, the club took off like a rocket ship. As the club grew in membership, the WPPA ventured forth with a small fly-in at Rockdale, Wisconsin, during that year. The response was very good.

Photography courtesy of Wisconsin Powered Parachute Association

In November 2001, the WPPA reached a milestone of sorts with membership increasing to 50. In March 2002, the WPPA facilitated a PPC breakout session at the annual Wisconsin Ultralight/Light Aviation Advisory Council Safety Seminar (WULAC), held in Wisconsin Rapids.

Two short months later, the WPPA co-sponsored with WULAC the first ever Powered Parachute Safety Clinic in the state of Wisconsin. The event was held in the lower level of the EAA AirVenture Museum in Oshkosh. Eighty-four people participated in the one-day safety clinic that included a free tour of the museum.

The membership then blossomed to more than 80 strong.

Feeling very confident, in June of that same year, the WPPA ventured into new territory, sponsoring a large PPC Fly-In at the now defunct Mark's Park and Airfield in New London—an 1,800-by-1,600-foot grass area, allowing takeoffs

Two-place powered parachutes allow for comprehensive training.

Some of the variety of powered parachutes available...and a powered paraglider pack.

and landings in any direction. Wind direction was not a factor, and the fly-in attracted PPCers, powered paragliders, and the public from town.

The next month, membership reached 100.

In March 2003, the WPPA held the second annual Powered Parachute Safety Clinic at the EAA AirVenture Museum. It was expanded to a full-day clinic and included speakers from Radical Audio Design, Rotax, and EAA. More than 100 people attended, with numerous powered parachutes on display. There was no stopping the WPPA now.

The second annual PPC Fly-In at Mark's Park took place in June 2003, with more than 20 birds assembled under the big white tent. On Friday night, the group did a flyover above downtown Fremont as part of the community's annual Fremont Days celebration. Then rain arrived and didn't end until Sunday, at which time the breezes kicked in.

But the unfavorable weather did not deter the group; discussions centered around new officer elections and the organization's website.

In August 2003, a new executive board emerged, armed with many ideas and untold enthusiasm. The new website also went live, hoping to spread the word and work of the WPPA—encompassing safety training and further education and introducing people to the fun sport of powered parachuting.

The organization continued to grow with leaps and bounds, bringing more and more people into the sport. The yearly clinics and fly-ins continued, gaining television and radio coverage for their efforts. The fly-in became so popular that in 2007, PPC manufacturer Powrachute held its national convention at the site, and a local WPPA member won the grand prize—a new, shiny, single-seat Rascal, the company's FAR 103 vehicle.

WPPA's success continued, and in 2011, the organization celebrated by having a grand celebration at Mark's Park, complete with fireworks and unique attractions, which brought in more than 100 PPC pilots with close to 300 attendees. It was an event to remember!

Today the organization continues, but coinciding with the introduction of the sport pilot/light-sport aircraft rule, the numbers of both PPC manufacturers and pilots themselves have been severely reduced.

Many things have changed. Mark's Park, the PPC airfield many called their second home, is no longer in operation. PPC manufacturers have dwindled to just a few. And the number of certificated flying instructors for the sport has been whittled down, at least in the Wisconsin area, to just three.

Photography courtesy of Wisconsin Powered Parachute Association

The organization continued to grow with leaps and bounds, bringing more and more people into the sport.

Even with these major changes, the WPPA continues to thrive, spurred on by the local FAA Safety Team (FAAST) to assist in educational opportunities, and by another local New London airstrip owner, Wayne Poppy of Poppy's Airfield, whose enthusiasm for aviation never seems to diminish. And what's most interesting about the very dedicated WPPA officers and board members is that not a single one of them takes a cent for their time and efforts. Strictly volunteer. And that includes long-time president Gary Morris, who commutes for meetings and events from a home near the Wisconsin-Illinois border! How's that for the love of aviation?

So, just what does the future hold for these people with a strong love for flight under the chute? At this point, as long as there are things to fly and like-minded friends to gather with, the end is nowhere in sight.

For more information about the WPPA, check out its website at www.WisconsinPPA.org. EAA

A powered paraglider touches down after an evening flight.

First Flights...

. . .and final thoughts

BY ED KOLANO

THIS IS MY FINAL ARTICLE for this "Flight Testing Techniques" column. My goal has been to intrigue, inspire, and even provoke you to think about why your airplane behaves the way it does and provide a few elementary flight testing techniques to help you explore your plane's characteristics. It's about aviation safety. Always has been; always will be. So I thought I'd end with some hangar-talk, first-flight considerations.

Let's assume you have a plan for accomplishing all of the following without rushing toward first flight. Your airplane is ready. An EAA technical counselor(s) looked over your work. The FAA has issued your experimental airworthiness certificate, and you've completed the EAA's Flight Advisor program. You're current and proficient, and ideally, you received some training in your airplane type.

While you're making provisions for—or accomplishing—the above, you should also be designing your first-flight test plan. The goal of your first flight is to get airborne and back down safely. While everything else is secondary to your goal, there is also a purpose to your first flight. You'll want to determine the airplane's flying characteristics and engine performance within a very small flight envelope. The primary reason for this first-flight exploration is for you to get familiar with your machine before returning to land. This limited purpose does not mean you should ignore everything else. Of course, you will identify any problems you notice, but you should not go looking for them during this flight. There will be plenty of opportunity for that on subsequent flights.

FIRST-FLIGHT PONDERINGS

Will you test or just fly around? What tests will you perform? What order will you fly these tests? Let's look at a few.

How about stalls? Some say you have to stall the airplane so you'll know what speed to fly on final approach. After all, your pitot-static system can only be calibrated in flight, and you haven't yet flown. So how do you know whether the airspeed indicator is reading correctly? You could fly your planned final approach speed at a safe altitude to check your plane's handling. Naturally, you would decelerate very slowly to this indicated airspeed, checking handling all the way. If your airplane behaves well at the predicted final approach speed, you might continue your deceleration to ensure safe handling down to 5 knots faster than the predicted stall speed. Safe handling in this regime should reduce your anxiety about handling problems during the landing flare.

If at any time during your deceleration you encounter a stall warning or too much reduction in flight control authority or you find the plane just doesn't feel right, don't fly any slower. Add a safety margin to that speed, use this safety speed for your final approach, and ensure you're on the ground before decelerating slower than the warning/control-reduction/feels-wrong speed.

How about configuration changes? Owners of airplanes with retractable landing gear and flaps must decide whether to raise the gear on the first flight. Some say they'd rather have the better glide capability should the engine quit. (Depending on the source, statistics indicate somewhere between 25 to 50 percent of new homebuilts will suffer some degree of power compromise—from rough running to complete seizure—during their first 10 flight hours.) Others say leave the gear down and provide for a forced landing by selecting an airport with plenty of gear-down-friendly, off-field options. Raising the gear runs the risk of not getting it down again, or worse, only getting some of it down.

If your airplane kit manufacturer recommends a no-flap take-off and a full-flap landing, what will you do? Flaps are nothing more than ailerons that move together. If only one flap lowers, then jams, you may not have enough aileron roll control to counter the rolling moment of the single extended flap. And it usually gets worse at slower, i.e. landing, speeds.

Runway and airport selection pros and cons can fuel a good hangar discussion, so here are a few items for debate. Bigger airports have longer/wider runways that are usually kept in good condition. They often have more than one runway. They might have crash and rescue services on the field. A cooperative control tower can provide assistance, such as notifying you of traffic, informing other traffic of your activity and whereabouts, and giving you a dedicated radio frequency for your test team and a hotline to the rescue folks, etc. An uncooperative airport can be inconvenient at best and a safety detriment in extreme cases. Residential and industrial communities surrounding bigger airports limit your emergency landing options.

You're pretty much on your own at an uncontrolled airport or private strip. You'll lose the amenities and facilities of the larger airport, but you probably won't have to deal with the traffic

congestion or constraints of flying in controlled airspace. You'll probably be limited to a single runway. What if the wind picks up and changes direction while you're airborne? Will you fly off grass or pavement? For some airplanes, you don't have a choice.

There are dozens more topics that fit into the first-flight philosophy question. The point is you should have one. Think it through, talk it over with everyone who's not already tired of hearing you talk about your airplane, and decide on your philosophy. It should be the one that best suits your airplane, its first-flight requirements, and your comfort level.

TEST PLAN

Your test plan provides a systematic approach for the safe, effective, efficient conduct of your flight test program. Every test flight should be covered in your test plan. The test plan shows, event by event, the airplane's initial condition, the details of the test to be performed, the data to be recorded, safety information, and anything else pertinent to that test event.

Test plans are living documents. A discovery on one test flight could warrant a change to the test plan for subsequent flights. Don't deviate from your test plan in the middle of a flight. If an event does not occur as anticipated, stop testing, land, review, and decide where to go from there. Rewrite the applicable portions of the test plan and fly the new tests.

The test plan is for planning and test program progress tracking. You won't take the test plan with you when flying. Test cards or data cards are for the pilot. These cards are written from the test plan but not in as much detail. The purpose of the cards is to provide the pilot only the information he feels is necessary. Test cards are tools; every test pilot has a different test card preference, and that's okay.

ADMINISTRATIVE PREPARATION

If you decide to fly from a controlled airport, coordinate your flight with the tower folks. Invite them to visit your hangar and see your airplane. A little friendliness and advance notice can go a long way toward a pleasant experience.

The same holds for the rescue crew. With the crewmen's permission, taxi your airplane to the firehouse and show them how to get you out of it, where the fuel cutoff is, where the master switch is, where the fuel lines run, the best lifting points if the airplane is upside down, etc. Don't forget to inform them of any medicine allergies or conditions you have. This little show-and-tell is likely to be a welcome break from their routine training. And don't forget to invite these folks to your first-flight postflight celebration.

Review your test plan and check your test cards. Make sure you and each member of your test team knows the details of the plan and your/his/her role and responsibilities. A mock first-flight run-through, including simulated emergencies, might be a good idea. It's better to do this for the first time by sitting around a table one evening rather than sorting out confusions during the flight.

As long as you're all there, why not brainstorm the what-ifs? What if we lose communication? What if the airspeed indicator quits working? It's an even better idea to keep a what-if journal as you build. Jot down every what-if that occurs to you when it occurs. Then use it as a checklist during your mock run-through to ensure every conceivable what-if has been answered and that everyone knows the answers.

WEATHER

Calm wind and unlimited visibility is ideal, but what will you accept? Make this decision well in advance of your first flight when there's no pressure to get into the air. Once you decide your limits, they should be inviolable. Get your test team's ownership in this decision. Everyone agrees that these minimums cannot be changed on test day.

GET YOUR HEAD IN THE GAME

Yes, there's an awful lot to think about when preparing for your first flight. There are dozens, if not hundreds, more considerations to ponder than are mentioned here. And there are no single correct solutions to these considerations. You must decide what's best for your situation. Still, there is some universal advice for your first flight and every test flight after:

- Always use buildup. Take baby steps as you explore your airplane. Don't try a full-stick-displacement aileron roll before examining your plane's behavior with lesser control displacements. Don't do power-on stalls before becoming comfortable with power-off stalls. You get the idea.
- Expand the flight envelope slowly. Start in the middle. Then work your way toward the edges in small increments of airspeed, control deflections, altitude, maneuvering aggressiveness, etc.
- Plan the flight and fly the plan. No exceptions. Your test plan should reflect buildup and proper envelope expansion. If changes to your plan are warranted, give them the same scrutiny you did for the original plan. And make those changes on the ground.
- When the unexpected happens, stop testing. Investigate the problem on the ground, devise an appropriate strategy, and proceed cautiously.
- Stay pragmatic. Qualitative tasks are more important than gathering numbers. Aviate, navigate, communicate, evaluate—in that order.

First-flight preparation can seem onerous. Some might say this level of detail is overkill. Have you ever been in a situation where you were not as prepared as you should have been? Did it shake your confidence? Did it take away from your fun? Take the time to thoroughly prepare for your first flight. You'll feel better about it. You'll enjoy it more. And it might even make the difference between a minor problem and an emergency situation. EAA

Ed Kolano, EAA 336809, is a former Marine who's been flying since 1975 and testing airplanes since 1985. He considers himself extremely fortunate to have performed flight tests in a variety of airplanes ranging from ultralights to 747s.