Vol.3 No.4 I April 2014

EXPERIMENTER

The Spirit of Homebuilt Aviation I www.eaa.org

Meet the BK Flier 1.3

The Homebuilt CC02 «
A fighter pilot's delight

Kids, Airplanes, and Drones «
Having fun with models

The New Rotax iS Sport Engine «
Debuts at Sun 'n Fun Fly-In

Jack and Rose Pelton

Thank You, EAA Volunteers

BY JACK PELTON

I HAVE BEEN VERY fortunate to win some awards and be honored by various groups over the years, but I can tell you that nothing has been more gratifying and meaningful for Rose and me than being named EAA Volunteers of the Year last summer at Oshkosh.

It was rewarding to us because we are part of such a large group. A group of volunteers so big and so dedicated that EAA, AirVenture, and the work our association does daily to support all types of personal flying would not be possible without them. Actually, I should say would not be possible without you, because so many EAA members volunteer in one way or another.

April is National Volunteer Month, and the week of April 6 is National Volunteer Week. These celebrations of volunteering date back to 1974 when then President Richard Nixon signed an executive order creating the spotlight on volunteering. Every president since then has acknowledged National Volunteer Week.

President George H.W. Bush was perhaps the greatest supporter of Americans volunteering for all manner of charitable efforts. Toward the end of his term President Bush helped to create the Points of Light Foundation to honor volunteers who go over and above in their efforts. I think of his promotion of volunteering when I'm in EAA's headquarters and see the photos of President Bush's visit to EAA and Oshkosh. He is, of course, a pilot, and his "thousand points of light" speeches were more than just the usual political rhetoric.

National Volunteer Month and Week are a means to give special thanks to all volunteers. Recognizing the endless good volunteers do in America is something we should do every week and every month, but that doesn't always happen. The reason is that so many volunteers do their work quietly, not drawing attention to themselves. That is certainly true here at EAA.

It would be impossible to host our big annual convention and fly-in at Oshkosh every summer without the many thousands of volunteers who pitch in. And I thank each of you. But volunteering is not just a one-week effort for EAA members. Volunteers perform essential tasks year-round.

For example, as signs of spring just begin to appear in Oshkosh, groups of volunteers arrive to begin the enormous task of preparing the grounds for the hundreds of thousands who will arrive in July. There is so much to be done to shake off winter wear and tear, and to improve our vast facilities.

EAA volunteers work with the staff to form organizations for specific tasks, select chairs and other group leaders, and identify what needs to be done and how best to do it. Volunteers bring valuable years' worth of experience to the job and knowledge of how EAA and Oshkosh operate that is irreplaceable.

We have subject experts such as our homebuilt technical advisors, medical council, and warbird and antique restoration experts who all volunteer to help keep EAA members and their aircraft flying. And we have volunteers who give their time and skills in non-aviation areas such as carpentry, electrical work, and so on that are essential to keep AirVenture and EAA functioning.

EAA has a volunteer opportunity for every member to use their experience and skills. Over the years many EAA chapters have focused on specific volunteer tasks and return year after year to get the job done. We need and appreciate each and every one of you who gives of time and talent.

Again, Rose and I want to thank you so much for the very special honor presented to us last year. And on behalf of your board of directors—who also volunteer so many hours to guide EAA through very difficult times in personal aviation—I say thank you, EAA volunteers. April is a time to show volunteer appreciation, but I want all of us at EAA to do that year-round. EAA

On the cover: Bruce King's BK Flier 1.3 poses in front of the historic Brown Arch. (Photography by Jim Raeder)

Photography by Jason Toney

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Departments

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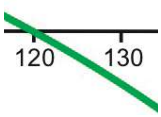

Paul and Charlie at the Aeroplane Factory.

Hallowed Ground

Paul's Aeroplane Factory rededicated to homebuilding workshops

BY CHARLIE BECKER

ONE HIDDEN LITTLE PLACE on the EAA grounds is the Aeroplane Factory. If you didn't know where to look, you had no chance of finding it. It is hidden in Camp Scholler behind, of all things, a port-a-potty staging area. It is part of a larger building that provides cold storage for EAA museum artifacts. For as long as I've worked at EAA, which is going on 14 years, it has been EAA Founder Paul Poberezny's workshop.

Paul always had a project going in the Aeroplane Factory. In fact, he was working on a Baby Ace right up until his passing last August. You would usually find more fuselages than wings because Paul liked to weld. Oftentimes, the completed fuselage would get sold off so another one could get started. Sometimes the aircraft would be built to completion.

Paul often spoke of the benefits of using your "hand and mind" to construct an aircraft. He understood how a person grew as an individual from homebuilding. Maybe it was because he wasn't particularly interested in school that he knew what homebuilding had to offer in the form of learning.

For me, the Aeroplane Factory is hallowed ground. This is where our "homebuilder in chief" spent many an hour building aircraft. Of course, since it was Paul's workshop, it has a homey feel with lots of photos on the wall of different aircraft and volunteers from over the years.

With Paul's passing, the question of what would become of the Aeroplane Factory arose. Would it be used for more museum storage?

Well, I'm thrilled to share with you that we will be rededicating the Aeroplane Factory as a facility for teaching homebuilding. Many of our members have enjoyed attending our SportAir Workshops that are dedicated to teaching members how to build aircraft. The Aeroplane Factory will become the new home for our SportAir Workshops. We will use one-third of it for housing our supplies, and the remainder will be a classroom and shop area for holding our workshops. We will preserve as much of the look and feel of Paul's shop as possible as a tribute to him and to let our students get a glimpse into his life. We will also rename it "Paul's Aeroplane Factory" in his honor.

The first workshops scheduled for our new SportAir home will be a "Van's RV Assembly" course on July 29 to 30 and an "Electrical Systems and Avionics" course on July 31 to August 1, both during EAA AirVenture Oshkosh 2014.

The dedication of this building to further the homebuilding education of our members is something of which we all should be proud. Although EAA serves all of sport aviation, this action demonstrates that homebuilding is still front and center. The fact that this also will keep Paul's workshop intact for future EAA members to enjoy makes it even better. EAA

ONE WEEK WONDER

THE CHALLENGE: *Build a Zenith CH 750 CRUZER in seven days at EAA AirVenture Oshkosh 2014. We're gonna need everyone's help. Oshkosh–you gotta be here!*

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You're Entering the Fun Fly Zone

WHEN ATTENDING EAA AirVenture Oshkosh 2014 this summer, head to the Ultralight area to visit Oshkosh's Fun Fly Zone! You'll experience hands-on learning, flight demonstrations of unique flying machines, and much more.

"This year is shaping up as one of the most action-packed, fun-filled conventions in many years," said EAA's Timm Bogenhagen, member programs specialist. "With the many improvements to the area made last year, it's easier to get there and move around to see all the action taking place."

Along with ultralights, the Fun Fly Zone is convention home to light planes, powered parachutes and trikes, hot-air balloons, homebuilt rotorcraft, and light-sport aircraft. The Fun Fly Zone is also the only place you'll be able to see regular flights of the emerging category of electric-powered aircraft.

Daily aircraft operations include morning and evening ultralight flying, homebuilt rotorcraft flights, as well as several scheduled special flight activities such as the Valdez STOL demonstrations on Friday evening, August 1. Balloon operators also will conduct tethered operations during the week, and on early Saturday morning you can see the full balloon launch.

EAA-Led Forums Slated for Sun 'n Fun

THIS YEAR MARKS the 40th anniversary of the Sun 'n Fun International Fly-In and Expo at Lakeland, Florida, which runs April 1 to 6 at Lakeland Linder Regional Airport. Sun 'n Fun is the traditional opening of the flying season, and EAAers will be there in force. EAA staffers and others will give presentations throughout the week. Here are the confirmed EAA-led forums:

Tuesday, April 1, 9 a.m., Room 3 – Flight-Testing Your Homebuilt – Charlie Becker, EAA Director of Communities & Homebuilt Community Manager

Tuesday, April 1, 12 p.m., Pilot Briefing Tent – Getting Started in Ultralights – Carla Larsh

Wednesday, April 2, 9 a.m., Pilot Briefing Tent – Registering Amateur-Built Aircraft – Charlie Becker

Wednesday, April 2, 10 a.m., Room 6 – Aircraft Insurance Solutions – Bob Mackey, Senior Vice President, Falcon Insurance Agency – EAA Aircraft Insurance Plan

Wednesday, April 2, 10 a.m. and 11 a.m., Room 9 – Protecting Your FAA Medical and Flying Safely – Gregory Pinnell, MD, Chairman, EAA Medical Advisory Council

Wednesday, April 2, 1 p.m., Room 3 – Get Started in Homebuilding! – Charlie Becker

Wednesday, April 2, 1:30 p.m., Pilot Briefing Tent – 10 Years of Sport Pilot Rule – Ron Wagner

Thursday, April 3, 9 a.m., Pilot Briefing Tent – LSA or Ultralight Flying? – Carla Larsh

Thursday, April 3, 10 a.m., Room 4 – Sheet Metal for Kit Aircraft – Mark Forss, EAA Workshop Programs Manager

Thursday, April 3, Noon, Room 4 – IAC Forum

Friday, April 4, 9 a.m., Pilot Briefing Tent – Tips for Low-Cost Flying – Dan Grunloh

Friday, April 4, 10 a.m., Room 3 – Rules and Regs of Homebuilding – Charlie Becker

Friday, April 4, 10 a.m., Room 9 – Are You and Your Airplane Insurable? – Bob Mackey

Friday, April 4, Noon, Room 4 – IAC Forum

Friday, April 4, Noon, Pilot Briefing Tent – 10 Years of the Sport Pilot Rule – Ron Wagner

Saturday, April 5, 11 a.m. and Noon, Room 4 – IAC Forum

Saturday, April 5, 12:15 p.m., Pilot Briefing Tent – LSA Documentation: What's in Your Logbook? – Mark Forss

Sunday, April 6, 11 a.m., Room 4 – IAC Forum

U.S. Senate Introduces GA Pilot Protection Act

THREE U.S. SENATORS recently introduced the General Aviation Pilot Protection Act as a companion bill to one unveiled in the House of Representatives in December, which includes a provision that would reform airman medical certificate standards while maintaining safety.

Sen. John Boozman (R-AR), Sen. Jerry Moran (R-KS), and Sen. Pat Roberts (R-KS) co-sponsored the bill that provides a solution to a long-standing hurdle of burdensome medical certificate standards for pilots who fly recreationally. In March 2012, EAA and AOPA requested an exemption that would ease third-class medical requirements for pilots flying certain types of aircraft, but the FAA has not to date taken action on that request despite more than 16,000 comments received in favor of the proposal.

"I urge the FAA to work with our pilots, respond to these reasonable petitions, and provide additional flexibility," Sen. Boozman said when introducing the legislation. "If the FAA continues to delay, this bill will start the discussion toward a legislative solution."

The proposed legislation would allow pilots to use a valid state driver's license in place of the traditional medical certificate if the flights are:

- Not for compensation
- Conducted in VFR operations only, at or below 14,000 feet MSL
- No faster than 250 knots
- In aircraft with no more than six seats and no more than 6,000 pounds gross takeoff weight.
- In addition to allowing pilots to operate common GA aircraft for personal and recreational flying without a third-class medical, the bill mandates that the FAA prepare and send a report to Congress detailing the impact of the bill's passage on general aviation safety within five years of the bill's enactment.

EAA has activated its Rally Congress website to make it easy for members to contact their elected officials and urge them to cosponsor this important legislation.

The House bill, H.R. 3708, was introduced in December by Rep. Todd Rokita (R-IN) and Rep. Sam Graves (R-MO). To date that bill has gained 52 co-sponsors and continues to gather support.

Please take a few moments and Rally Congress to support the General Aviation Protection Act!

AirVenture Workshop Areas to Be Upgraded for 2014

AS THE AIRVENTURE FLY-IN grounds continue to evolve, one area needing a little love is the long-standing workshop pavilions that have served the event for more than 25 years. That's happening in 2014!

Three spacious new workshop pavilions will be completed prior to the 2014 fly-in, each having the capability to be split into two separate working areas. That means six different workshops can be occurring at any time. A new Builders Education Center also will be constructed just west of those workshop pavilions, replacing the old building just across from Aces Bistro.

Another noticeable change will be the elimination of the old Central Exhibit Building along the flightline. That building was mostly unused at EAA AirVenture Oshkosh 2013, and at about 35 years old, was in need of extensive renovation if it was to be kept. A green space area will replace that building. Additional green space also will be created around the Federal Pavilion Building and in front of Aces Bistro.

The projects continue the effort to make the grounds more visitor-friendly and also establish the homebuilt, forums, and workshop areas as unique destinations at the event.

User Fees in White House Budget

THE WHITE HOUSE RELEASED its proposed budget for the upcoming fiscal year and once again included a $100 per flight user fee for many general aviation (GA) flights. The concept is almost exactly the same proposal that was rejected by Congress a year ago and for each of the two years before that.

EAA and other GA organizations maintain that such a proposal would be bad policy as it was in previous years. General aviation already pays into the Aviation Trust Fund through taxes assessed on every gallon of aviation fuel purchased throughout the year. This system ensures that everyone who flies pays into the fund, not just those who file flight plans or otherwise use ATC services. Fuel taxes are by far the most equitable and inexpensive means of administering revenue collection and do not require a large bureaucracy to invoice and collect.

EAA will continue to battle before Congress on behalf of its members and GA, as user fees would add expense and administrative burdens on those who fly without providing any advantage to those who use the airspace system or the agencies that maintain it. EAA

Dynon Avionics Announces the new SkyView™ Featuring SkyView Touch™

DYNON AVIONICS HAS unveiled the new SkyView™ integrated avionics system. This latest edition of Dynon's flagship product includes SkyView Touch™, two new control panels, and dozens of new features in SkyView 10.0 software. Michael Schofield, marketing manager at Dynon Avionics, said: "The New SkyView™ is the most intuitive and capable avionics system available. We've focused on creating an incredible pilot interface with SkyView Touch™ and new dedicated control panels. From the simplest light-sport aircraft to the most complex IFR aircraft, there's a SkyView for every panel."

Dynon's pilot-engineers designed SkyView to have a clean and intuitive interface so pilots can focus on the flying, not the technology.

SkyView Touch™ is priced at $3,995 (MSRP), only $395 above the non-touch, 10-inch display, and will be available this month. Dynon's commitment to supporting product platforms for years means that existing SkyView customers don't get left behind: every existing SkyView SV-D1000 display can be upgraded to touch for only $795.

Complementing SkyView displays are the new SV-KNOB-PANEL and SV-AP-PANEL Control Panels, designed to minimize workload and provide the pilot the most intuitive and direct interface. The Knob Control Panel has dedicated controls for the most-frequently adjusted items - altitude bug, altimeter setting (baro), and heading/track bug. The Autopilot Control Panel provides single button activation of all autopilot modes, including LEVEL mode and flight director. It has a built-in two-axis speed-sensitive trim controller. Both products are backlit, dimmed by SkyView, and available in horizontal and vertical versions.

The SV-KNOB-PANEL can be added to any SkyView system for $250 (MSRP). The SV-AP-PANEL can be added to any SkyView system for $550 (MSRP). Both will ship in April.

A new PDF brochure and more information about SkyView™ is available at *www.TheNewSkyView.com*.

For more information about Dynon products, call Dynon at 425.402.0433 or e-mail *info@DynonAvionics.com*, or at *www.DynonAvionics.com*.

Flight Schools: Win a New Rotax Engine

ROTAX HAS CREATED a global flight school locator web application. It's simple to use and free. Flight schools worldwide are encouraged to add their listings. For full details, visit the Rotax-Owner blog post. Rotax also will donate a brand-new 912 iS engine in exchange for the first 912 iS to reach 2,000 hours of flight time in a flight school. Full details are also available on the Rotax blog.

Rotax also will celebrate the 25th anniversary of the Rotax 912 engine family with a fly-in June 5 to 7 at Wels, Austria. For full details, visit the Rotax-Owner blog post.

Lastly, Rotax has released a new video that looks at three key differences in the new-style (2013 version) cylinder heads for the Rotax 912 and 914 series aircraft engines. Watch the video.

Photography courtesy of Dynon and Zenith Aircraft

Zenair Celebrates 40 Years; Zenith Ships 10,000th Kit

ZENITH AIRCRAFT COMPANY has now shipped 10,000 sets of plans to aircraft builders in more than 50 countries. Most sets of plans are sent with complete or partial aircraft kits, though some go to builders who prefer to scratchbuild the aircraft.

"We allow our customers to choose how to build their own airplane, whether as a scratchbuild project or from a complete kit or anywhere in between," Sebastien Heintz, president of Zenith Aircraft, said. "It's not uncommon to see people begin with basic materials and then upgrade to a quick-build kit; others might start with a quick-build rudder kit and then order basic materials for a scratch-build program because they enjoy the construction process. By far, however, most opt for the complete kits so they can get to the flightline faster."

With options for straight or amphibious floats, skis, and tundra tires, Zenith aircraft can be used for a wide range of mission profiles. Detailed plans for the two-seat Zenith Aircraft designs start at $425 a set. Richly illustrated, the sets contain step-by-step guides with all the information needed to build a complete airplane. Blueprints are professionally drafted using modern computer-aided design software.

Zenith Aircraft will host its first "Engine Day" at Sun 'n Fun on Friday, April 4, from 10 a.m. to 2 p.m. The event will be staged at the Zenith exhibit booth and is open to everyone.

Zenith has invited all major manufacturers of 65- to 150-hp engines to participate by putting their firewall-forward packages on display for Zenith kit customers and the public. Engine reps will be on hand to discuss the features of their powerplants.

Meanwhile Zenair Aircraft, Midland, Ontario, is celebrating its 40th anniversary this year. Over the past four decades, aeronautical engineer Chris Heintz, founder of Zenair Aircraft, has developed a dozen aircraft designs. Today, Zenith Aircraft Company markets kits for four of Chris Heintz's most popular and versatile concepts: the original STOL CH 701 Sky Jeep, the STOL CH 750, the CH 750 Cruzer, and the low-wing CH 650. Additional Heintz designs are built and sold by Zenith's sister company, Zenair Ltd. in Canada.

For more information about Zenith aircraft designs, visit *www.ZenithAir.com*.

Sam Aircraft Offers SolidWorks Files

SAM AIRCRAFT, HEADQUARTERED at Lachute Airport near Montreal, Quebec, is releasing complete read-only SolidWorks files to Sam customers. These files allow the builder to see exactly how every piece of the airframe is assembled.

Images can be rotated, flipped, zoomed, and manipulated visually to allow the builder to see the components and the part number, just as if he had an exemplary piece in his hands. And like having a professional builder helping, many models also have detailed tips and explanations.

Right on the drawing are tips such as "Start riveting the skin from the center outward." You don't want to read that *after* you've nailed down the perimeter!

Sam President Thierry Zibi said, "I know a few other manufacturers use SolidWorks, but I believe only Sam routinely releases these drawings to customers. As a builder myself, I know how much easier and better it is to see a proper example of the construction as building goes along. I also know that it's helpful for the occasional helper, who can study what's expected before he or she starts helping."

The drawings are released with each sub-kit (tail, fuselage, wing, etc.) and are free of charge to customers. "We just want the customer to have the best result, as easily as possible," Zibi said. "Our 3-D drawings [models] are a friendly visualization of the blueprints, with infinitely more perspectives and including every detail; it's like having the actual part to look at—without taking up the extra space." He laughed and added, "And you can't dent the drawings."

The Sam LS is a tandem, retro-look, metal aircraft powered by the 100-hp Rotax 912 S, and with a Sensenich ground-adjustable composite propeller. Conforming to Canadian advanced ultralight rules and to the U.S. light-sport aircraft standards, the Sam is available as a ready-to-fly special light-sport aircraft, as an experimental light-sport aircraft, or as an amateur-built experimental kit.

Learn more at *www.Sam-Aircraft.com*. EAA

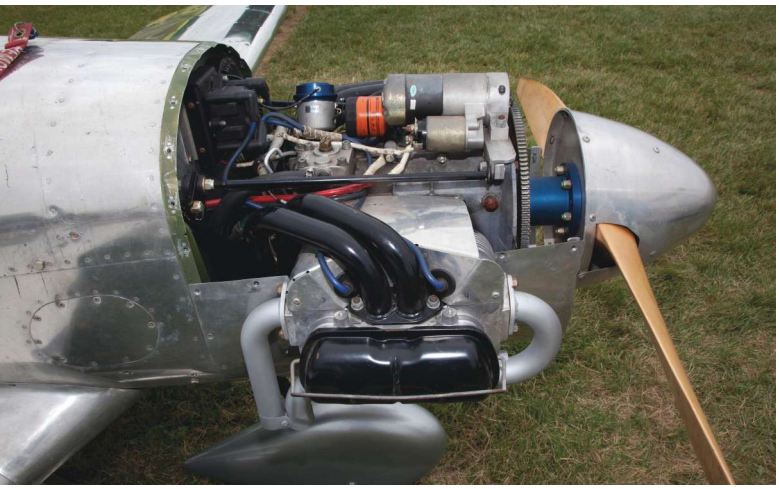
Bruce King's Brilliant BK Flier 1.3

His dream realized

BY SPARKY BARNES SARGENT

Photography by Jim Raeder

Though small in size, the BK1.3 can carry 30 pounds of baggage aft of the seat. It cruises at 130 mph while burning 3.5 gph, making it a usable cross-country machine.



The BK1.3 is powered by a VW conversion with a flywheel-mounted propeller hub. It has an 'integrated' 15-gallon fuel tank in the nose.

SUNLIGHT SPARKLED ALONG THE wings and fuselage of the BK Flier 1.3 N88BK during EAA AirVenture Oshkosh 2013. Tied down near the famed Brown Arch, this almost pocket-sized, sport pilot–eligible homebuilt aircraft gained numerous admirers and accolades.

Owner/designer/builder Bruce King has flown his self-designed homebuilts from San Antonio, Texas, to Oshkosh three times, as well as to Lakeland, Florida—a testament to the tiny planes' functional and comfortable design. In fact, his 2003 trip to Oshkosh in the prototype BK Flier 1 only cost $600, and he was able to carry 30 pounds of camping gear and clothing behind the seat.

Powered by a 65-hp VW engine, the BK 1.3 is truly a cross-country flier; it can easily cruise at 130 mph while burning 3.5 gph, with a 400-mile range (with reserve). Or if you really want to savor the scenery and save fuel, you can enjoy its economy cruise of 100 mph while burning 2.5 gph, with a 500-mile range (with reserve). The BK 1.3's tapered wings span 19 feet 4 inches and are gracefully faired into the fuselage. The fuselage measures 15 feet 4 inches from the tip of its spinner to its tail. Its relatively roomy cockpit is 26 inches wide by 40 inches tall, with 52 inches of horizontal legroom. Bruce designed the cockpit to hold a 250-pound, 6-foot 4-inch pilot (with size 14 feet). Combined with a full 15 gallons of fuel (90 pounds) in the nose's integral fuel tank, the BK 1.3 still has a 30-pound baggage allowance (behind the seat). The BK 1.3's gross weight is 850 pounds.

Bruce hails from an aviation background. His father worked as an air traffic controller and taught him to fly in a Cessna 150 in the late 1960s. His mother was employed during World War II as a "Rosie the Riveter" and later became a technical illustrator for U.S. Air Force flying manuals. Bruce built numerous radio-controlled airplanes, worked as an airframe and powerplant mechanic in an aircraft factory for nine years, was a technical writer for several years, and was a computer engineer in the healthcare industry from 1988 through 2003. From this varied background, perhaps it's no surprise that he catapulted himself into the flying, designing, and building of

aircraft—and taught himself how to use a computer-aided design (CAD) program to draw a comprehensive set of plans for the BK 1.3. But his strongest motivation comes from within.

"I got my pilot's license in 1969 when I was 19 years old and got checked out in a Piper Cub and an Aeronca when I was in college," Bruce said. "I logged 100 hours, and then I couldn't afford to fly for 25 years. In 1998 I was driving home and I saw a Cessna 150 flying. And I got this totally depressed feeling; here I was, nearly 50 years old, and I used to fly. Then a little voice came out of nowhere: 'Don't give up your dreams.' So I said to my wife, Marsha, 'I think I want to build an airplane. What do you think about that?' My wife and I are very close, and she said, 'I was wondering how long it'd be before you got to that!' I bought plans and spent a year and three months building a wooden ultralight. When I was ready to cover it, I just suddenly realized that wood and fabric is not for me."

Bruce ceased working on that project and purchased a set of Hummel Bird plans. But he soon realized that he wouldn't be able to fit inside it, so he began modifying the design. "I leaned a piece of plywood against the wall, and my son drew a line around me," he said. "That became the size of the bulkhead just behind the seat. I also stretched the fuselage so it would be big enough for me and finally got the airplane all finished. So after 27 years, I started flying again. I have 700 hours on it now [in 2013]. I flew that modified Hummel Bird from San Antonio to Oshkosh in 2003, making fuel stops every 200 miles," Bruce said. "I flew it during the Homebuilt Review, and I remember thinking, 'Wow, I went from 'don't give up your dreams' to flying down Show Center at Oshkosh!' I get excited now just thinking about it. The airplane only cost $6,000, including a new engine."

It wasn't just the flying bug that had bitten Bruce, though; it was also the building bug. He was soon at it again, this time combining the features of several different aircraft into the prototype BK 1. One factor that motivated Bruce to design his BK 1 arose from his own experience of modifying the Hummel Bird. "I learned the hard way that modifying another designer's plans was not the way to go and could be dangerous. The

The BK1.3 has electric start and a full complement of instruments for cross-country flying.

The fuselage and empennage are flush riveted, giving the BK Flier a neat and sleek appearance.

Photography by Sparky Barnes Sargent

stock Hummel Bird is a great flying aircraft," Bruce emphasized, "but I had built mine 100 pounds over gross weight and had installed a full four-cylinder VW engine (in place of the recommended, lighter-weight ½-VW engine), which made it nose heavy. So I decided it would be best to design my own aircraft—something that would safely carry the extra-large pilot, fuel, and baggage."

Bruce elaborated on that concept: "I used the cockpit and front end of the Hummel Bird and made it massively larger, and used a Piper Cherokee back end on it and a completely different wing and landing gear. I based the gear a little bit on the RV-8, in that the landing gear connects to the center section. I made the wing a whole lot bigger and tapered it in a way that it would have a real gentle stall characteristic. I spent eighteen months building that airplane, and I used paper templates and graph paper during the process."

Note the gracefully formed wing root fairing.

Bruce finished the project, which he named the BK 1, in November 2004 with $8,000 invested and was quite pleased with the results. It flew better than his highly modified Hummel Bird, was more comfortable, and had a 400-mile range. It had 15 gallons of fuel and a 65-hp VW conversion engine.

"I put the BK 1 into the CAD program in 2005 and started modifying and refining its design," Bruce said. "The resulting BK 1.3 is 1.1 times bigger than the BK 1. The cockpit is 2 inches wider, and the fuselage and wings are 2 inches longer. I used the basic cockpit dimensions from the RV-4 and made it just a little bit larger for more elbow and legroom. I could optimize my materials better by using CAD, so I had very little waste. In early 2006, I was posting build pictures on my website, and guys said, 'Look, we want to start our projects; can you send us the wing plans?' So I gave them the plans, and as soon as they finished the wings, I'd send them the fuselage plans. That way, they were giving me feedback on the plans. I built the BK 1.3 entirely from scratch in order to draw the plans accurately; I wouldn't make a piece until I had it in the computer and had a template printed out. Sometimes it took a dozen templates before I got one that was right. It took me seven years to complete the project, but

Bruce King in his BK Flier 1.3. His motto is "Don't give up your dreams."

I had a regular job at the time, plus kids in college. My wife is real supportive, which helps."

It was important to Bruce to make the airplane as safe as possible and easy to fly. To that end, he incorporated a wing airfoil similar to a Clark Y, but he modified it so that the wings are tapered yet flat on the bottom for ease of building. Bruce lengthened the ribs in the middle portion of the wing, and the airfoil at the wing root has a lower camber and stalls before the outboard portion of the wing, which has more camber. "This airplane does not have a stall break," Bruce said. "You can pull it up at a 45-degree angle, and as it runs out of airspeed, you can see the vibration of the stall going out the length of the wing. But the airplane just noses over a little; with power off, it does a little bit of a falling leaf, but you can pick it up with aileron because the wing won't stall at the tip. The spars have been analyzed by a structural engineer, who stated that they were 'grossly overbuilt.' It's built really strong, but we haven't approved it for aerobatics; we'd do a lot more testing and structural analysis before that."

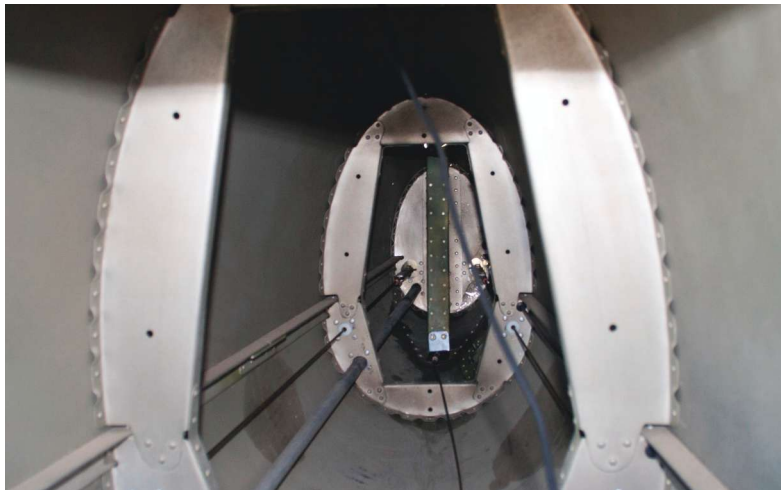
The BK 1.3 has a sleek, flush-riveted fuselage of monocoque construction with full-span flaperons, which simplify the building process (as opposed to having separate ailerons and flaps). Bruce said, "The ailerons go up twice as far as they go down, so you don't have to be on the rudders as much. You still have full aileron function with the first notch of 10 degrees; I use that for takeoff. The full 20 degrees steepens the approach to landing and decreases the airplane's tendency to float in ground effect."

It wasn't just the flying bug that had bitten Bruce, though; it was also the building bug.

Instead of using a separate fiberglass or aluminum fuel tank, Bruce decided to create "an integrated tank." He said, "The nose is sealed with Pro-Seal tank sealant, so I'm reinforcing the nose of the airplane even more, saving weight, and increasing the fuel capacity, while still providing gravity feed to the engine."

N88BK's powerplant is the Great Plains' Flywheel Drive Air-Cooled VW conversion engine, with a flywheel-mounted propeller hub and an Edward Sterba 52-by-44 wood propeller. "This engine weighs about 158 pounds and is less expensive and lighter weight than the other type with the accessory case," said Bruce. "Steve Bennett and I collaborated with Robert Hoover, and we worked with him until he passed away in 2012. So I had the two pre-eminent VW people working together on this installation. I'm really happy with it; it runs smoothly and has less vibration than the other VW engine, due to the way it's mounted. The mounts are underneath the engine, in front and in back."

Bruce fabricated the aluminum spring gear legs by first purchasing a 4-inch-wide-by-¾-inch-thick-by-4-foot-long aluminum bar. Then he used a Craftsman band saw with a fine-toothed plywood blade to make an approximately diagonal cut (a pattern is available) that created two gear legs. He rounded the corners with a router and round-over bit, then bolted them into the fuselage's center section. The end result was a set of stout aluminum spring gear legs for about one-fourth the price of ready-made legs. He used 500-by-5 wheels for the main gear and a 400-by-4 for the nose wheel.



Interior view of the all-metal monocoque fuselage.

The BK 1.3 can break ground in about 600 feet by accelerating at 40 mph indicated in ground effect, according to Bruce. Its stall speed is 48 mph (no flaps) and 44 mph (20 degrees of flaps), and 60 mph is the best climb speed, with 10 degrees of flap. The airplane climbs to altitude at 80 mph, and when set up for level flight at 3,200 rpm, it cruises happily along at 130 mph. Traffic pattern speed is around 80 mph, with 10 degrees of flaps added on base leg. Bruce said "Final approach is flown with full flaps at 50 mph over the fence. It rounds out and flares about 45 or 40 mph, and settles nicely onto the ground."

Bruce distributed 80 sets of early builder plans, and of those, about a dozen have turned into active projects. "That's about right for a plans-built airplane; usually one in ten ever reach completion," he said. "I've gone and seen several BK 1.3 projects, and they're looking good. Some experienced builders say they see it as a 1,500- to 2,000-hour project, making all the parts from scratch.

"I retired in November 2012, so I'm working full time with the BK Flier, which means that builders get phone and e-mail support. I want to help the builders get in the air because my real motive is to have other people be able to pull it off like I did. I don't think I'm all that great; I just went and did it. I joined EAA Chapter 35 in 1998, and Paul McReynolds was my technical adviser. I had a lot of support from my EAA chapter; I felt like I had joined the world of builders and fliers."

As far as completing the required FAA paperwork, Bruce recommended that builders visit the FAA website to view the FAA Advisory Circulars. "Download and read them,"

Photography by Sparky Barnes Sargent

he said. "Download the one on flight testing and read it. The circulars tell you everything the FAA rep or designated airworthiness representative is going to be looking for. Hopefully you've taken lots of photos of the process and have documented your building. You should be completely prepared for the airplane's inspection. Convince the inspector that you're honestly trying to comply with the rules and that you're not going to waste their time. Work *with* them, not against them, and develop a good relationship with your FSDO [flight standards district office]."

The BK Flier's website, *www.BKfliers.com*, provides a wealth of information: specifications, photographic builder's manual, parts catalog, videos, and even a section about his BK Flier cross-country trips. The tailwheel version (BK 1) is hand propped and weighs 60 pounds less than the BK 1.3, which has a nose wheel and an electric starter. Plans were released in 2013 and may be purchased for $375. A set of plans includes more than 320 pages of CAD drawings, full-size template of most parts, and checklists for preflight, inspection, and the flight-test program. The estimated build cost is $12,000 to $15,000 (including the Great Plains VW 1835-cc engine).

Bruce's enthusiasm for the BK Flier is contagious, and he readily welcomes questions about the airplane or building process. He also actively encourages others to achieve their dreams as well, and he was pleased to hear that a Canadian homebuilder recently applied to Transport Canada and gained approval to certify his nearly completed BK 1.

"Remember, I started building at 48 years old, and I was 52 before I flew my first homebuilt," said Bruce. "Now it's just like my life has been soaring; I've got three more projects on the drawing board, and they will be radically different from the BK 1.3. One will be a VTOL, and a future project is going to be a quick-build of a different design. I want to sell fuselages, wings, and other parts that are already built and hopefully get more people in the air. My mission is affordable flying, and safety and quality are part of that."

He summed up his experience: "Just 11 years ago, I was a guy who could not afford to fly. I never realized it was possible until I got the idea to build my own airplane. The goal of homebuilding is 'education and recreation,' and boy, you really get an education when you build an airplane!" EAA

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

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CC02
F-PSCK

The CC02 in flight 20 miles north of Paris.

The CC02

A French 'jet' with a piston heart

BY MARINO BORIC

THE CC02 IS ONE of the most unusual experimental projects we have seen recently in Europe. It is actually the dream of almost any experimental homebuilder. Claude Chudzik from France decided to stop dreaming and build the airplane of his desires. Here's the story of how one uncommon homebuilder made his dream become a reality.

Photography by Marino Boric

Do you remember your feelings watching military jets flying during an air show? We are talking of pre-sequester times in the United States, of course. I remember my emotions and my bumping heart after each low flyby of an F-15, F-16, or something of that caliber. I'm talking about that screaming, loud jet engine sound, about the airplane that flies like lightning down the runway. After such shows, I'd contemplate building something like that in my garage. Claude Chudzik has succeeded in doing that.

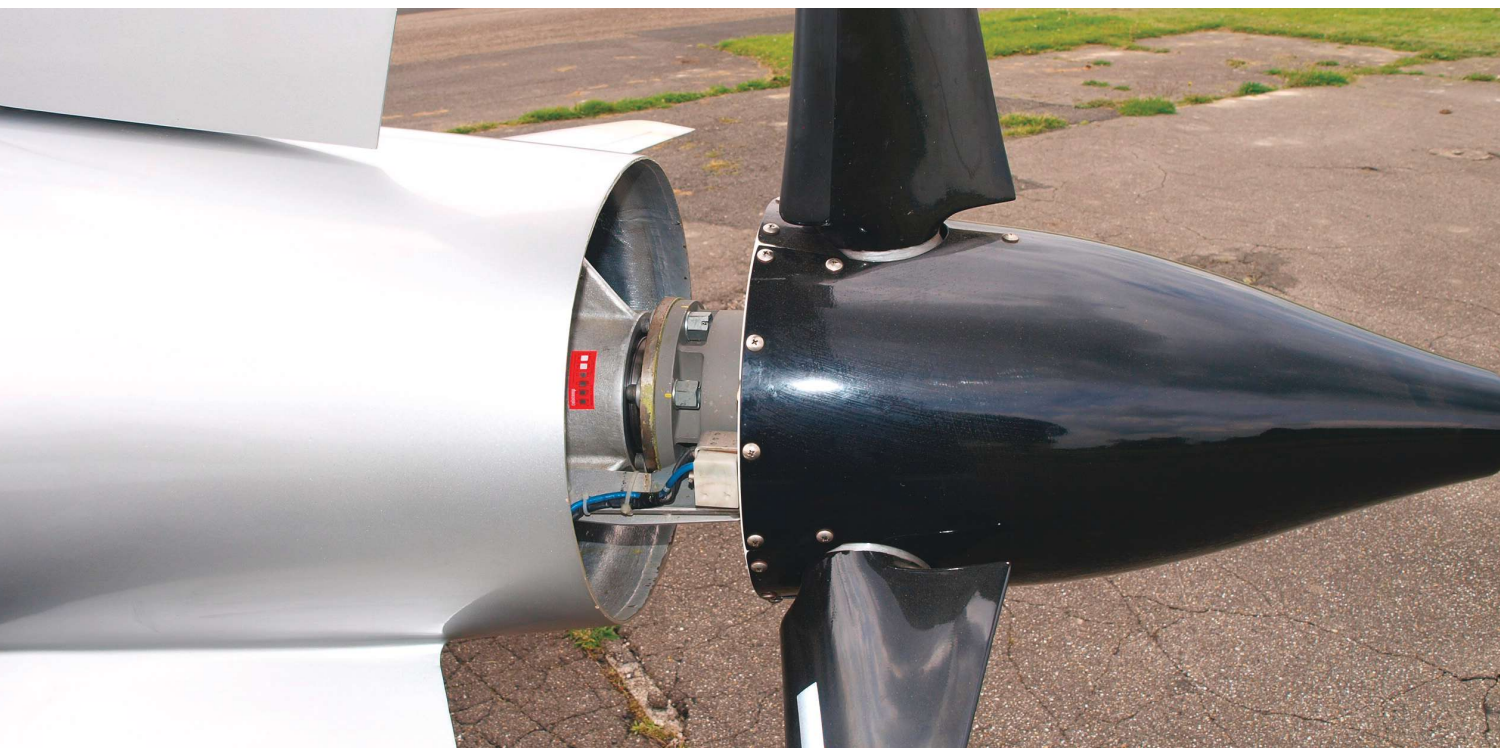
The maiden flight of the CC02 (CC02 stands for Claude Chudzik, second project; the first was the CC01) was made at Les Loges Airport (LFAI) near Nangis, France, just east of Paris on June 28, 2007. French certification of the aircraft was obtained on May 20, 2008. Getting to this first flight was a long journey. It began in 1987, when Claude won a prize given by the Paris Air Trophée for his CC01 canard airplane. That tiny single-seater, powered by a 25-hp, two-stroke engine, brought Claude several thousand francs (about $2,000 U.S.), which was enough for the purchase of foam, fiberglass cloth, and resin for another aircraft. Claude wanted something special; he was dreaming about a sleek, fast, fighter-looking aircraft. Normal sport aircraft with their straight wings did not look fast enough. Military jets looked much faster and had sharp, swept wings, so Claude had "no other choice" than to build a tandem aircraft with swept wings. Because nothing similar was on the kit market, he had to design his own airplane.

The front cockpit of the CC02. On the left side are the throttle and the prop pitch lever; just to the right of it, the rather complex flap selector lever.

The only choice was for Claude to design and build his own airplane. As an aeronautical engineer who works for a big aerospace company, he had good contacts in the aviation world.

The basic concept of the CC02 was developed in a period from 1987 to 1989. Claude's friend, Michel Barry, allowed Claude to prove the quality of his calculations in Michel's small wind tunnel. For that purpose, a 1:13 scale model was built and tested. Those tests allowed Claude to find out the best location of the lifting surfaces and to check the engine location and the overall airflow around the hull.

The initial specifications were to build an airplane capable of fast cruise with two persons on board and with one



It has an electrically variable pitch prop. The first prop was a fixed-pitch prop.

The CC02's fuselage features a clean belly and smooth lines. Note the closed main gear doors even while the gear is extended.

reconditioned engine that would fit into Claude's budget. An overhauled 200-hp Lycoming IO-360 fuel-injected engine was purchased, and around it the structure of the airplane was designed. Claude based his calculations on FAR 23 requirements, so the result was an airplane with a V_{NE} of 350 knots (650 kph) and operating limitations of +/-9*g* with a breaking load of +/-16*g*.

The pusher configuration was chosen because it promised the highest possible performance. Claude had an engine, construction materials, and a clear idea of the airplane's appearance and possible performance.

MORE DESIGN DETAILS

A swept wing with a negative dihedral was chosen for excellent maneuverability. Claude believed that would reduce the stabilizing effect of the main wings, which proved to be true later in flight testing. Stall resistance was solved with a dropped leading edge of the outboard portion of the wing. The airflow detaches from the wing in a gradual way from the fuselage toward the wingtips, resulting in the capability to maintain good yaw control.

Claude chose the canard layout because this configuration is less prone to stall. During wind tunnel tests, the size of the foremost wing was reduced for better stall recovery and for increased stability. The CC02 main wings are fitted with elevons—the combination of ailerons and flaps. The flaps deflect from -5 degrees to +16 degrees, and the differential aileron deflection is -22 degrees to +7 degrees. The forward lifting surfaces—forward wings/canard—are fitted with flaps that deflect when the (main) flaps are set. Geared electric motors on the canard and main wing extend flaps simultaneously on both wings with different angles; the forward flaps travel is approximately 50 percent of the main flaps travel with a deflection range from 0 degrees to 12 degrees. The result is a pretty flat landing angle of the airplane.

The rear cockpit is pretty spartan as the aircraft is primarily flown from the front seat.

All lifting surfaces are based on the NACA 65512 laminar flow airfoil. It was chosen for good performance and for the fact that it performs well, even in rain.

The CC02 has three lifting surfaces—a canard, the main wing, and a flying tail. Claude said this arrangement helped him solve the problem of the wide CG range.

The dropped wing leading edge offers low-speed wing efficiency.

WHY THREE LIFTING SURFACES?

This was the question I asked Claude. He explained his ideas in a short and clear way: "I wanted a sleek airplane, so I designed a tandem aircraft; that solution brought me the problem of the wide CG range that became even wider with the choice of the pusher configuration with the engine behind the rear seat. The use of the third lifting surface solved the problem of control of the wide CG range."

According to Claude, the T-tail adds stability to the aircraft. Classic canard airplanes have some problems; the elevators, whose deflection is -19 degrees/+16 degrees, are always in a clean airstream, even at high angles of attack. Besides that, the classic rudder adds considerably to the aircraft maneuverability.

On the very clean underside of the fuselage, two fixed fins should prevent a too-violent nose-pitch-up momentum in case of the loss of lift on the swept wing. Their position and size were carefully studied in the wind tunnel.

HOW WAS THE CC02 BUILT?

Claude first built the fuselage molds in which the two fuselage halves were manufactured using fiberglass mats, epoxy resin, plus 5- to 10-millimeter-thick Klegecell foam for building the sandwich structure. The fuselage halves were then bonded together.

The wings are detachable—that process takes approximately 20 minutes—and have a main spar that is carbon-fiber reinforced. The joint between the wing and the fuselage is not a straight line because the wing portion in front of the main spar, where it attaches to the fuselage, is used as a "wet-wing" fuel tank with the capacity of 19.7 gallons (75 liters) each. The detachable wing portions are 64 inches long, as measured on the main spar, and are fixed to the fuselage with screws and safety bolts. With the wings detached, the fuselage still stands on all three wheels. Its total width is 98.4 inches (2.5 meters), just below the maximum width allowed on public roads in France; thus, trailer transport is possible. The CC02 has a fuel range of 3 hours and 15 minutes (plus 30 minutes reserve). The two

fuel tanks are not interconnected, and the fuel selector is on the right side in the front cockpit. According to Claude, one nearly empty tank has little or no effect on the airplane stability.

THE ENGINE

The engine for the CC02 is a 200-hp, fuel-injected Lycoming IO-360. It is cooled by the air coming through two lateral openings located on each side of the fuselage that simulate jet engine intakes. Two NACA air intakes located on the underside of the airplane just in front of the engine bay provide engine-combustion air.

The jetlike air intakes have proved to be satisfactorily dimensioned for cooling of the Lycoming engine. For regular maintenance, there are few access openings in the fuselage. One is behind the rear seat backrest, three others are on the upper side of the fuselage for spark plug/injectors access, and there is a single inspection door for the oil check. The engine compartment is insulated with aluminum foil–coated ceramic fiber cloth. Two oil coolers are installed on both sides, behind the engine in the air-cooling flow.

Initially, the CC02 used a three-blade, fixed-pitch prop that recently was exchanged for an electric "constant-speed" MT propeller. Because of erroneous wiring of the variable pitch prop, the first flight after the prop swap almost ended in a disaster; the prop went to its max fine setting where it locked. To stay airborne for an emergency landing, the engine had to be spun at so high an rpm that an immediate overhaul was needed. According to Claude, "It was really scary. I was flying at a pre-stall speed all the time."

The engine is connected to the prop via an 18-inch (45-centimeter) shaft (4.3-inch or 110-millimeter diameter). The prop is attached to the connecting rod behind a self-designed and manufactured bearing that is attached to the rearmost part of the fuselage structure, which acts as the engine compartment air extractor. For further maintenance, there is a removable door on the airplane's belly between the main landing gear legs.

LANDING GEAR

The fully retractable, tricycle undercarriage was designed and manufactured by a shop local to Claude. The installation is similar to those used by Mooney airplanes. The hydraulically operated gear needs approximately 20 seconds for a complete cycle. A single lever in the front cockpit controls the process, which runs in a pretty complex pattern: First, the main gear doors open (they are closed when the gear is extended), the gear retracts, doors close the bay, then the front gear leg retracts (the door is open in the gear-down position), and nose gear door closes.

CABIN AND PANELS

The CC02 is designed to carry two people weighing 186 pounds (85 kilograms) each. A ladder is needed for access to the seats, which are suitable for up to 6-foot-tall (183-centimeter-tall) occupants not wearing a parachute. (To wear a parachute, you have to be 2 inches shorter.) Access to the cabin is possible only from the left side, as the one-piece canopy is hinged on the right side. Once seated, you believe you are in a real jet fighter. There are only 26.4 inches (67 centimeters) of shoulder width, but that feeling is just like being a Top Gun. You really have to try it! The space is limited, but I felt comfortable almost lying in the seat like in a glider airplane. The position is pretty comfortable, thanks to the left armrest. Ventilation is provided by two NACA intakes, active only in flight, as the prop is in the rear.

The instrument panels are classically equipped, mostly with traditional round analog instruments. The front panel is pretty complete while the rear has only basic instruments without a comm radio. In the front instrument panel, there is a Garmin 100 GPS and Becker nav and comm.

SPECIFICATIONS

Aircraft length: 19 feet 8 inches (6 meters)
Fuselage width: 26-3/8 inches (0.67 meters)
Wingspan: 18 feet 0.5 inch (5.5 meters)
Canard span: 6 feet 3 inches (1.9 meters)
Elevator span: 8 feet 8 inches (2.68 meters)
Canard surface: 5.5 square feet 0.511 meter^2
Wing area: 53.8 square feet (5 m^2)
Tail surface: 11.3 square feet (1.05 meters^2)
Empty weight: 1,220 pounds (560 kilograms)
Maximum weight: 1,850 pounds (824 kilograms)
Wing loading: 30.72 pounds/square foot (150 kilograms/m^2
V-rotation: 90 knots, flaps at 7 degrees
Economical cruise speed: 160 knots, 2,600 rpm (variable pitch prop)
V_{max}: 210 knots
Stall speed: 70 knots
Rate of climb: 1,200–1,500 fpm
Approach speed: 110 knots, flaps at 7 degrees
Engine: Lycoming IO-360, fuel-injected
Power: 200 hp
Tank capacity: 2 at 75 liters = 150 liters
Consumption: 10.5 gallons/hour (40 liters/hour)
Range: 3 hours 15 minutes + 30 minutes reserve
Load factor: +9/-9*g*

Photography by Marino Boric

The proud owner Claude Chudzik and his jewel; he said, "La vie est belle" (life is nice).

The French flag and registration number.

FLIGHT

Claude has logged almost 100 hours in the CC02 after its maiden flight in 2007. He said it performs exactly as he wanted. It has demonstrated good to excellent maneuverability and handling in all flight phases. The flaperons are functioning well, and tight turns are doable at speeds around 150 knots. There is no induced yaw and very little adverse yaw increasing at low speeds.

Claude is usually cruising at 150 knots, the exact cruise and maximum speed was currently unknown when I visited Claude because of the new constant-speed prop that is not yet properly tested. The CC02's empty weight is 1,220 pounds (560 kilograms), with a maximum takeoff weight of 1,850 pounds (842 kilograms). The CC02 is 19 feet, 8 inches (6 meters) long, and its wingspan is 18 feet (5.5 meters). Rotation speed at takeoff is 90 knots, and it climbs at 1,200 fpm (flaps at 7 degrees) and 1,500 fpm clean. Maximum horizontal speed with the variable pitch prop should reach 185 knots. Approach speed for landing is 110 knots.

CONCLUSION

This CC02 is a real eye-catcher. Before my first contact with it, I occasionally dreamed of being aboard a jet fighter; now I dream of flying my own kit-built CC02. I suggested that Claude should find a partner and start manufacturing a modern (carbon-fiber) version of the CC02 as an experimental aircraft. I would be one of his first customers. Surprisingly, his answer was not negative, so now I have a new dream. Thank you, Claude, for having built this flying dream! 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.

Photography by Marino Boric

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Spray Tube Extensions

BY CY GALLEY

SPRAY TUBES ARE a great addition to many aerosol-packaged lubricants, solvents, air, and even paint removers. They permit the application of the material right at the place necessary without getting the product all over the place. Tubes yield great control.

But the spray tube is not always a right length. You can cut it off if it is too long, but what do you do if it's too short? The electronics store has the answer—heat shrink tubing. It comes in 4-foot lengths in many different colors so one can cut it to length; I use color coding for different materials. Most nozzles are a universal size.

To lengthen the existing tube, add some heat-shrink tubing around it. You can shrink another tube at the exit. If the spray tubes are placed end to end without a gap, the result is very rigid. If you have nothing but shrink tubing between the two ends, it is very flexible.

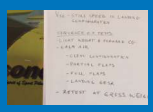
In the photo, there is a large gap between the two tubes. Safety wire has been used to provide some rigidity, plus it allows you to bend the assembly to curve it around an obstacle. If you want a long, straight assembly, tape a dowel alongside.

I save the tubes and nozzles from spent cans, but beware that some of the tubes may have a slightly different diameter. It doesn't make any difference when building an extension, but they might not fit into the nozzle. If one nozzle is too large, try another. If it's too small, you can see how the safety wire in the inset is wrapped around the nozzle onto the tube, holding the two together. Another solution is to superglue the tube in place. I did that when a tube was needed on a can of starting fluid and the pressure of the fluid kept "blowing" the tube out of the nozzle. EAA

HINTS FOR HOMEBUILDERS VIDEOS

HERE ARE SOME OF THE MOST RECENTLY ADDED VIDEOS FOR HOMEBUILDERS:

Deburring Aluminum
Sebastian Heintz and Roger Dubbert from Zenith Aircraft demonstrate how to deburr aluminum. Using various tools, they remove sharp edges to prevent stress risers and cracks from developing.



Determining V_{so} Speed
EAA Flight Advisor and Technical Counselor Joe Norris discusses V_{so} speed. This speed is required to be determined for experimental amateur-built aircraft during the Phase 1 flight testing process.

Blind Pulled Rivets
Sebastian Heintz and Roger Dubbert from Zenith Aircraft demonstrate how the flat headed, countersunk blind rivets used in the construction of Zenith aircraft are pulled and shaped into a low profile dome head rivet.

Layout Templates
Mark Forss, manager of EAA's SportAir Workshops, demonstrates a way to transfer layout holes using a see-through plastic template. This process allows matched-hole layout of wing skins or other large parts.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Robert's Prospector in flight.

Getting the Airplane I Wanted

My Prospector

BY ROBERT BOUNDS, EAA 234582

THIS AIRPLANE IS MY third homebuilt project that I've personally completed, and I've helped build a couple of others owned by friends. My first build was a Quickie powered by a Rotax 503 engine. That was a story in itself, but I'll just say that the airplane was a blast to fly. My second completion was a VariEze, which I still own and fly. It has about 800 hours on it now.

The story of my latest airplane started in 1989 at EAA Oshkosh. That year, Fred Keller won the grand champion homebuilt award with his Prospector bush plane. I saw it there and absolutely fell in love with it. I talked to Fred at Oshkosh and asked about plans, and he said there were none available and never would be. Rats!

I went home and ended up starting the VariEze with a kit of materials and plans that my brother-in-law had for years and never started. I completed it in 1996 and have happily flown it for years, even taking it to Alaska with my son, but I still recalled that Prospector once in a while. Then, while talking airplanes with a local friend, I mentioned the Prospector, and he said he had ridden in one. I was incredulous and envious, so I questioned him further about it. It turned out that Fred Keller had built a second Prospector for his friends, Tom and Betty Kuffel, and that was the one my friend had ridden in.

Of course, I immediately called Tom and Betty at their home in Montana to see if some plans had been developed or whatever. When I reached Tom on the phone, he said he had good news and bad news. The good news was that he did indeed have a Prospector. The bad news was that he and Betty had crashed it in the mountains of northern Idaho the previous month, totally destroying the plane, and they were both recovering from serious injuries. That was bad news on several levels.

Despite her initial "hesitation," Robert's wife, Deb, helped on the project.

Lots of foam to be carved and shaped.

Photography courtesy of Robert Bounder

Well, Tom and Betty are really nice people and we got to talking at length. Tom said that he possessed what was essentially a three-dimensional set of plans and that he thought a builder of my vast experience (careful, Bounds, this guy is smooth) should be able to reproduce the plane from scratch. And, nice guy that Tom was, he'd be willing to sell me this set of plans.

Not being that bright always, I thought this might just work. I told my wife, Deb (a lovely woman and a skilled but reluctant airplane fiberglasser) that maybe I would just cruise up to Montana (1,100 miles) and take a look at this wreckage, but I probably would not take on such a large undertaking... however, I hitched a flatbed trailer to my Jeep, just in case.

Off we went, my young son and I, on another adventure. We got to know Tom and Betty a little better and were infected by their enthusiasm for the plane. We went to look at the wreckage, and it was pretty well destroyed. But listening to my heart instead of my head, I convinced myself that it might be possible to make my own plans and build a new airplane. And besides, the landing gear was in good shape, so I already had a good start, right? The Kuffels and I came to an agreement on price, and I stretch-wrapped the mess onto the trailer and headed off for Nebraska. Boy, was my wife unhappy when I arrived home with my prize. She swore my next wife could help me build any planes after the VariEze, but saint that she is, she's still here; and I have photographic proof that she helped to build the new one.

It took a while to build up enough courage to start the project, but I finally got after the "plans" with a square, tape measure, sawzall, and notepad and started "planning." I made lots of changes (What builder doesn't?), including a completely different control system, canopy setup, vertical stabilizer, seating, etc. Lots of evenings were spent just trying to figure stuff out. Anybody who makes up a set of plans that others can successfully build a plane from has my utmost respect.

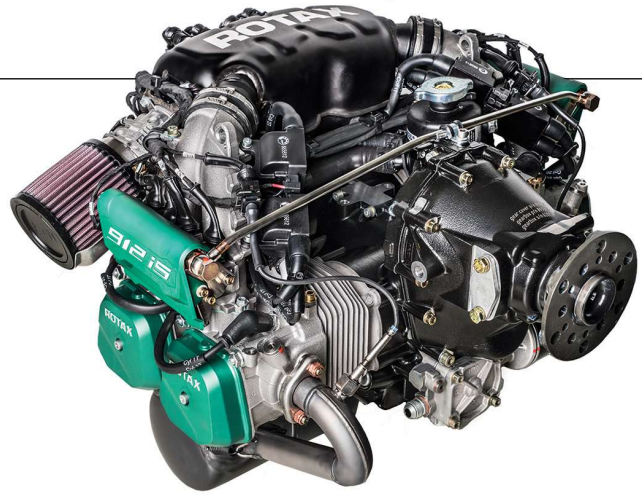
I worked pretty steadily on the project for seven years and had lots of help from Deb and friends. There were trials and triumphs and lots of learning. I had to stop building one summer and build a shop in the backyard because the airplane got so big that it outgrew the garage. We made a speedy trip to California to buy an engine that we hauled home in our Volvo wagon. But I (we) finally wore the thing down, and the "Bearcoupe" finally flew in June of 2013. What a rush! I was about to burst. Of course, there were a few teething problems, but I think I've fixed them all and the plane is flying really well. I've gotten lots of compliments on the plane and I love them all. I hate to admit it, but I'm pretty proud of my new bird. It's comfortable, has great visibility, and is the gentlest taildragger you'll ever fly. And no, there still aren't any plans available. It would take forever to make a set other people could use, and it is kind of a difficult design to build. I wouldn't do it again, but I'm sure glad I did it once.

How's that for a long-winded story? Homebuilding is a wonderful ride, isn't it? EAA

Robert forming the fuselage.

The engine coming home in our Volvo.

Leading edge details.



Meet the New Rotax 912 iS Sport Engine

The best ever Rotax 912 engine?

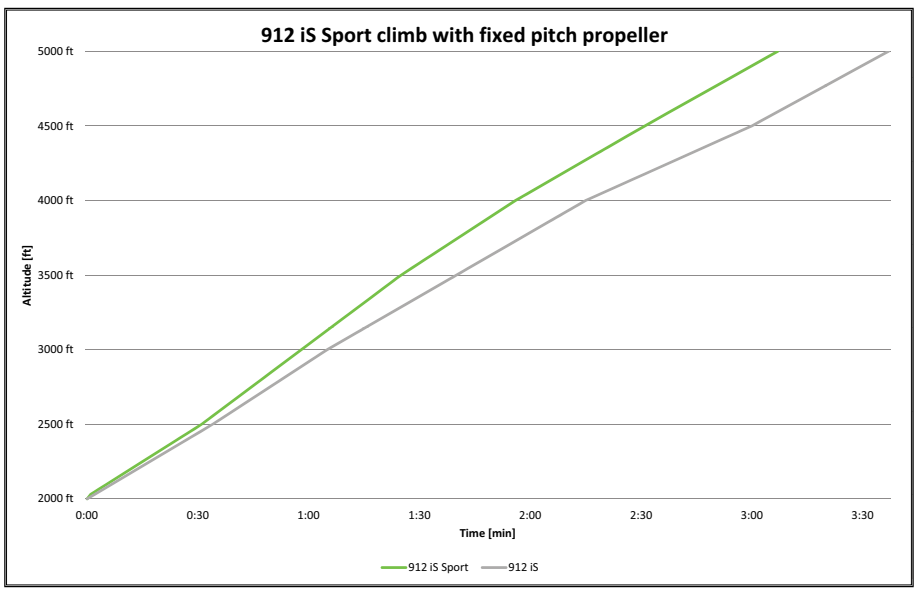
BY MARINO BORIC

THE LIGHT AVIATION ENGINE market has a new engine—the Rotax 912 iS Sport, which is being unveiled this week at the Sun 'n Fun Fly-In and Expo in Lakeland, Florida.

The Rotax 912 iS Sport is almost identical to the 912 iS fuel-injected engine presented two years ago. Some differences between the iS Sport and the iS are visible on the engine's upper side, while other changes are software-based. The 912 iS Sport engine is not a completely redesigned 912 iS, but rather is the result of fine-tuning and careful improvement. The basic engine is the same: same power rating and TBO, same concept, same displacement, same look. So, what has changed? A new, bigger aluminum airbox is 1.1 inches (27 mm) taller than the old one and offers a higher volume. Also new are longer engine intake runners and thus slightly repositioned ignition coils. The engine control units (ECU) are now driven by new software that has a different calibration. The result is that the new 912 iS Sport not only has better torque than the 912 iS but also is better than the carbureted 912 ULS engine.

When the 912 iS engine was introduced two years ago, aviation engine enthusiasts were thrilled to see a much more modern engine fitted with fuel injection for better mixture control, lower fuel consumption, and less pollution, but some were a bit disappointed because they expected a more powerful engine. The lower torque of the 912 iS engine—119 Nm at 5000 rpm versus 129 Nm for the 912 ULS—turned out to be a penalty, especially for heavier aircraft and hydroplanes. This disadvantage was perceptible at takeoff when hydroplanes not only had to lift a heavier load but also had to deal with the drag of the water.

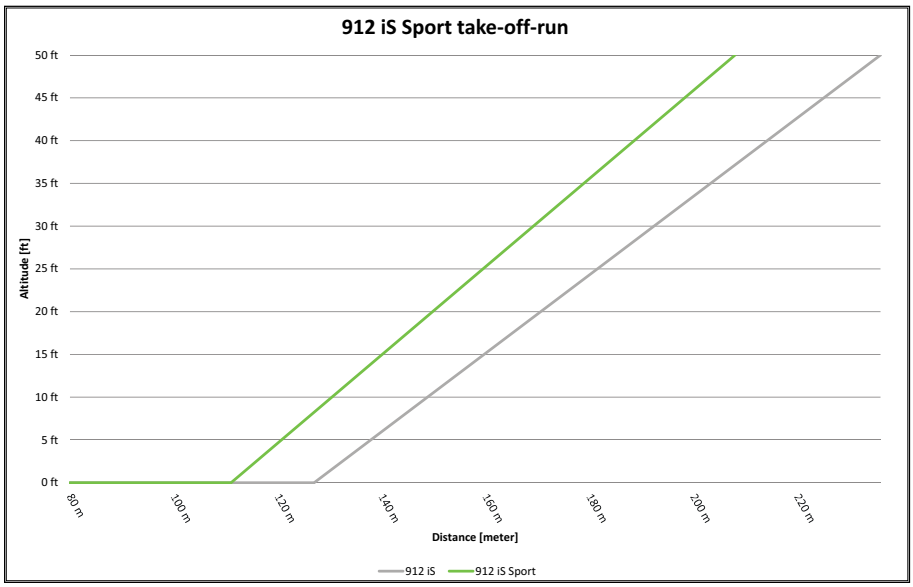
The all-new 912 iS Sport not only obliterates the drawbacks of the 912 iS but also will deliver much more torque than the 912 ULS. The same aircraft fitted with the 912 iS Sport (instead of 912 ULS or 912 iS) will take off sooner, climb better, and burn less fuel (see the attached graphs). The Rotax 912 iS Sport engine automatically improves its



fuel efficiency by switching to a lean ECO mode once the throttle is pulled back to a setting below 97 percent. All this can be monitored on the proprietary (or third-party) engine instrument in a cockpit.

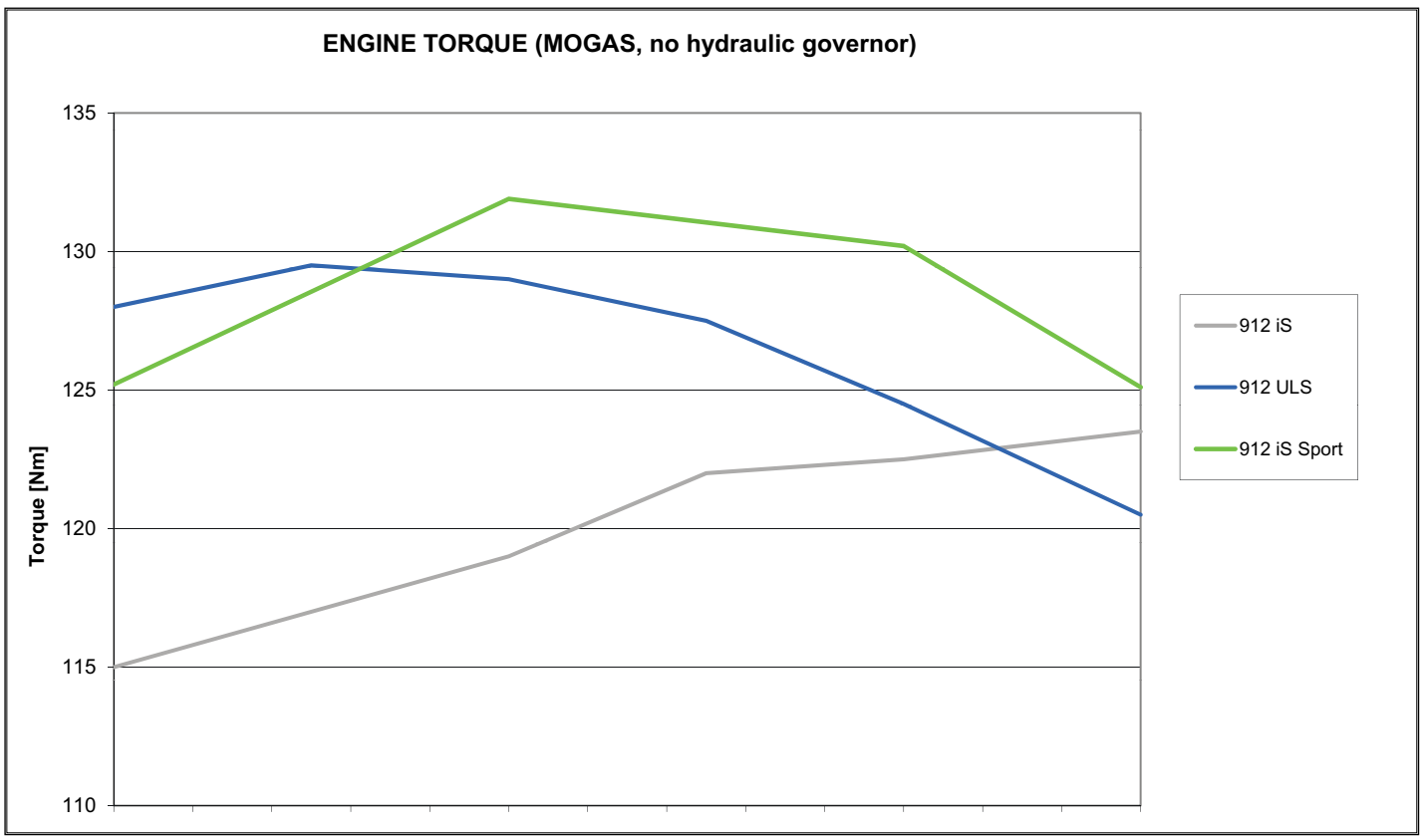
The biggest advantage of the 912 iS Sport versus 912 ULS is its lower fuel consumption. Real-life flight tests showed a fuel economy improvement of up to 36 percent as compared to the carbureted Rotax 912 ULS engine.

The new 912 iS Sport, according to Christian Mundigler, manager of Rotax Aircraft Engine Sales, is not going to supplant the 912 iS, but it is an easy guess that OEMs and other buyers will opt for the 912 iS Sport and the 912 iS will likely disappear.



According to Mundigler, all 912 iS engine owners who wish to upgrade to the 912 iS Sport will receive a retrofit kit for free until October 31, 2014, and only will be charged for labor costs. From November 2014 on, the retrofit kit will be an option, but the price is not yet determined. Rotax has retrofit kits on hold for all the 912 iS engines already sold (more than 500 units). The price of the 912 iS Sport will be held at the same price as the 912 iS until October 31, 2014. The certification and the TBO for the new 912 iS Sport are the same as for the 912 iS. 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.



Vendors along the south wall showcase the latest model products.

Kids, Airplanes, and Drones...

A look at model aviation

BY DAN GRUNLOH

WHEN THE FAA MODERNIZATION and Reform Act of 2012 became law two years ago, it included a special provision for model airplanes. Prior to that, model airplane operations were covered by Advisory Circular (AC) 91-57, published 1981. The rapidly changing technology of radio-controlled (RC) aircraft and the tremendous interest in domestic drones are pushing the FAA to deal with the difficult questions of who can fly dronelike aircraft and where. It was important that hobby model flying not be swept up into new regulations. The special provision for the first time recognizes there is a place for model aviation in our airspace system, provides a definition for model aircraft (including a weight limit of 55 pounds), and specifically prevents the FAA administrator from promulgating regulations covering aircraft models, if they meet the definition.

The new law includes language requiring model airplanes to be operated according to community-based standards and "within the program of a nationwide community-based organization." The FAA retains the ability to conduct enforcement actions against model fliers who do not adhere to the requirements of the law. This January, the FAA and the Academy of Model Aeronautics (AMA) signed an agreement, moving one step closer to formalizing the role of the AMA in establishing safety guidelines and overseeing the operation of recreational unmanned aircraft.

We have long recognized that the way to get youngsters interested in aviation is to provide them exposure to airplanes; in a time when airports are all protected by steel fences, that's not easy to do. The EAA Young Eagles program, giving millions of kids an airplane ride, has been going long enough to produce results as these Young Eagles reach college age and consider aviation as a career. However, the kids can't do much with real airplanes until they are 14 years of age, and that's where model aviation can help. EAA recognized the importance of models to bring youngsters into aviation when it signed a Memorandum of Understanding with the AMA in 2010.

The AMA is the world's largest model aviation association, with a membership of more than 164,000 and more than 2,400 model airplane clubs in the United States. The agreement included the provision that each new EAA Young Eagle would receive a youth membership in the AMA. Two years later, in 2012, the AMA exceeded 25,000 youth memberships with 10,000 of those coming from its partnership with EAA and the Civil Air Patrol. Sean Elliott, EAA vice president of Government and Industry Relations, is an avid aero modeling enthusiast. He

recorded a video in 2013 for the AMA that explains the importance of modeling. The AMA slogan "Fly a model – catch the bug" brings with it the added notion that some of those folks also will become interested in full-size airplanes.

Many of us current pilots started out flying models. New technologies providing ready-to-fly electric models for indoor and outdoor use make it easy for the youngest of kids to have a successful experience. It's not like the old days when we built the transmitter from a kit, spent more time fixing than flying, and struggled to start a balky glow-plug engine. Old-timers and kids alike will be amazed to see the progress that has been made. If you didn't try model aviation as a kid, now is the perfect time. There are more choices than ever before.

THE 'OSHKOSH' OF ELECTRIC RC FLYING

A great place to start would be somewhere like the 9th annual Hobbico E-Fest held February 15 to 16 in Champaign, Illinois. Described as the premier indoor RC event, it was a two-day smorgasbord of electric RC model flying with open flying periods, structured contests, demonstrations, and a strong focus on the youth. It all took place inside the Track and Field Armory Building at the University of Illinois. The 98-foot-high ceiling covers 80,000 square feet and was a marvel of its time when completed in 1914. Originally intended for military cadet training, the Armory now accommodates a variety of functions. The E-Fest event is like an "Oshkosh of RC flying" with tiny micro models flown on the east end, full-fledged 3-D aerobatics and helicopters on the west end, and everything else in between.

Activities included indoor scale, helium balloon chasing, obstacle course, combat (last one flying wins), and night flying with all the house lights turned off. In 2013 a prize was offered for those who could successfully land on a moving scale aircraft carrier driven around on the playing field.

Thanks to the amazing technology of digital transmitters, as many as 50 pilots can fly at the same time without anyone worrying about not being on his own unique frequency. It's all automatic. Commercial vendors of kits, planes, radios, and hobby supplies line the south wall. You can walk in, watch the RC airplanes flying, buy what you need on site, and take it home to begin your exploration into this fun side of aviation.

E-Fest is hosted by Hobbico, the world's largest mail order retailer and the largest U.S. manufacturer of hobby products, including RC airplanes, boats, and cars. The retail division, Tower Hobbies, was founded as a mail order business in 1971 by

Indoor aerobatic 3-D models easily hover and do vertical aileron rolls.

college students in one of the dormitory towers at the University of Illinois (hence the name). About that same time Great Planes Models was founded by Don Anderson. In 1985 the two companies merged to form Hobbico. Over the next 29 years, the company developed dozens of in-house brands and acquired other brand names to become the giant it is today.

THROWING CONFETTI INTO THE WIND

A big part of E-Fest is the programs designed for kids, and a lot of youngsters can be seen attending, brought there by their dads as the perfect way to introduce them to aviation. At the "Make It - Take It" booth, volunteers help young kids build their first rubber-powered model, and later in the day, a group of about forty kids are lined up for a simultaneous launch. After a controlled countdown, all the kids release their models to see which would travel the farthest and win a prize. From a distant vantage point at the end of the line, it looks a little like throwing confetti into the wind. Slightly older kids abound at the event and show impressive skills flying RC airplanes and helicopters with the improved ability that comes from starting early in life.

NCSU engineering students and their competition UAV.

WHAT IS A DRONE?

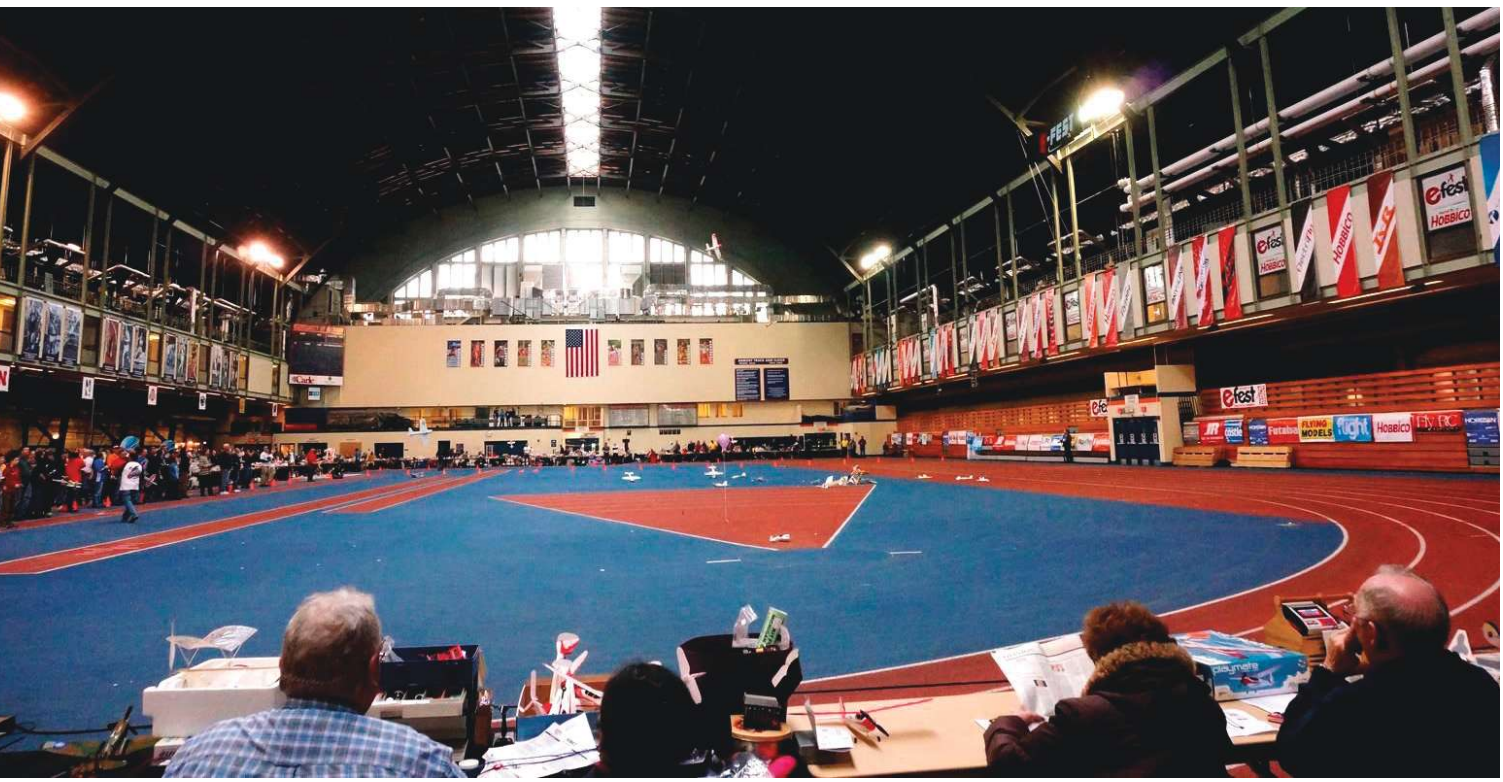
The schedule at the 2014 E-Fest included seminars covering subjects from model rockets to drones. The talk on drones by master RC pilot RJ Ritter of the North Carolina State Aerial Robotics Club was very informative. The people who design and build unmanned aerial vehicles (UAVs) are keen to ditch the term "drone" because of its negative connotations. The FAA rulings have come to differentiate between UAVs and RC models based on a few simple principles:

1) Sometimes you can't tell them apart by simply looking at the equipment.

2) UAVs usually have autopilots and can fly totally autonomous missions. Some have manual controls, but some do not.

3) UAVs have a payload such as imaging, communications, or emergency relief package.

4) Finally, UAVs are used for research, military, or commercial use. Hobby RC airplanes can carry a payload but absolutely cannot be used for commercial purposes. A fully autonomous



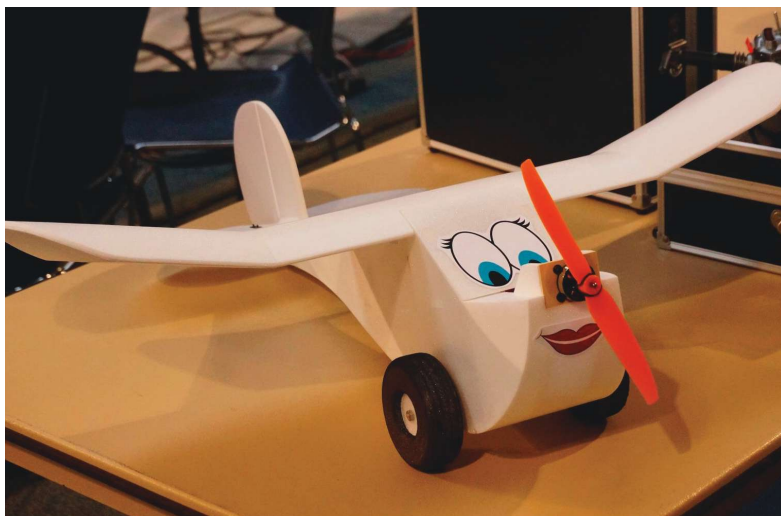
The cavernous Armory Building has a 98-foot-tall ceiling.

Kids build their first model with help from volunteers.

model airplane can be built and flown for hobby purposes, but the operator must maintain constant line of sight (LOS) with the model at all times.

Mechanical and aerospace engineering students at North Carolina State University (NCSU) have built a UAV airframe with a wingspan of 10 feet, empty weight of 19 pounds, and a maximum weight of 55 pounds. Endurance is 75 minutes, and loiter speed is 37 knots. It has an autopilot and laser altimeter. At the annual competition held in Webster Field, Maryland, it must autonomously take off, fly a search pattern up to 5 miles from the airport, find a lost hiker (dummy in a lawn chair), drop a water bottle, and return to the airport. Ground observers stationed along the route maintain constant LOS even though the UAV is operating autonomously. Participants operate under a certificate of authorization (COA) from the FAA because the controlling pilot does not have visual contact throughout the course. The NCSU club competed against 33 teams at the 2013 event and won second place. Here is the course description at the Student Unmanned Air Systems Contest. EAA issued this policy statement on UAVs in May of 2013. Commercial-use UAVs are distinct from hobby airplanes. They will require coordination and approval through the Unmanned Aircraft Systems Integration Office, AFS-80, which also monitors issues related to hobby aircraft operations.

EAA AirVenture Oshkosh typically includes model aviation activities sponsored by the AMA, and more is planned; but there is usually also some unofficial flying of small electric models and quad copters in the campground areas. The law signed in 2012 requires prior notification when flying within 5 miles of an airport, and flights such as this one in 2013 would likely be refused. If you're still not sold on model aviation, please try this YouTube search for E-Fest 2014 and "catch the bug."



This tiny foam model is reminiscent of the Sky Pup ultralight from 1983.

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

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

Photography courtesy of Dan Grunloh

Longitudinal Static Stability

A basic approach

BY ED KOLANO

LAST MONTH WE TALKED about your airplane's trim-speed band—that range of airspeeds the airplane can maintain without any force applied to the stick. Prior to that, we introduced non-maneuvering static longitudinal stability (static long-stab, for short), which is indicated by how much back- or forward-stick you must hold to fly slower or faster than the speed for which the airplane is trimmed. Now we'll explain a basic test technique for checking your airplane's static long-stab and show how it relates to the trim-speed band and control system friction.

First, you need to equip your stick with force and displacement sensors, then—just kidding. We're going to take a more simplistic and practical approach that identifies whether your airplane is stable, whether the friction in the control system is significant, and how these characteristics can affect the ease or difficulty of accomplishing flying tasks. No equations and no math. Woo-hoo!

Apparent longitudinal static stability is what it *appears* to be to the pilot while flying. That may sound like stating the obvious, but we're interested in the pilot's perception because that's what shapes the pilot's opinion. For instance, an airplane might be extremely sensitive to tiny changes in elevator deflection, but if that plane's longitudinal control system has a massive spring in it, the stick force needed to make that tiny deflection change could be high. To the pilot it might feel like a strongly stable situation because it takes so much stick force to move the airplane in pitch. So, we'll focus on what the plane *feels* like when flying off-trim and how that perception impacts your flying precision and workload.

Recall that last month's example started with the airplane trimmed for level flight at 120 knots. We stepped through the procedure and determined this plane had a trim-speed band between 114 and 124 knots, so we'll stick with that example here. After you determine the trim-speed band, you can assess the static stability at speeds slower and faster than the trim-speed band.

Using only back-stick, slow down a few knots to, say, 110 knots. Make sure the speed you choose is slower than the slow end of your trim-speed band. Do not retrim or adjust the engine or propeller controls. When you're stabilized at a steady 110 knots, note how much pull force it takes to hold that airspeed. There's no need to measure this force for our basic approach because you're just going to ensure that the stick force gets higher as your airspeed deviations get bigger. We'll explain how to deal with control system friction next month.

After you get a feel for how much pull force it takes to fly 110 knots, slow down to 100 knots. Stabilize there, and the pull force should be higher than it was at 110 knots. You can continue this process until you reach stall warning speed, but that's probably taking the test a little too far for the cruise-flight condition. For cruise flight, the idea is to learn how much control stick effort is needed to fly slower or faster than your trim speed. Operationally speaking, this would be a temporary situation because you'll eventually retrim for the new airspeed. The motivation for this testing under landing pattern conditions, however, is different. Here you want to assess your plane's stick-force cues for an airspeed change, so you can use this tactile feedback as another means of notifying you of an inadvertent airspeed deviation. It's a good idea to perform this test all the way down to stall warning airspeed—at a safe altitude, of course.

When you've mapped the range of speeds as slower than the slow-end speed of the trim-speed band, repeat the process for airspeeds

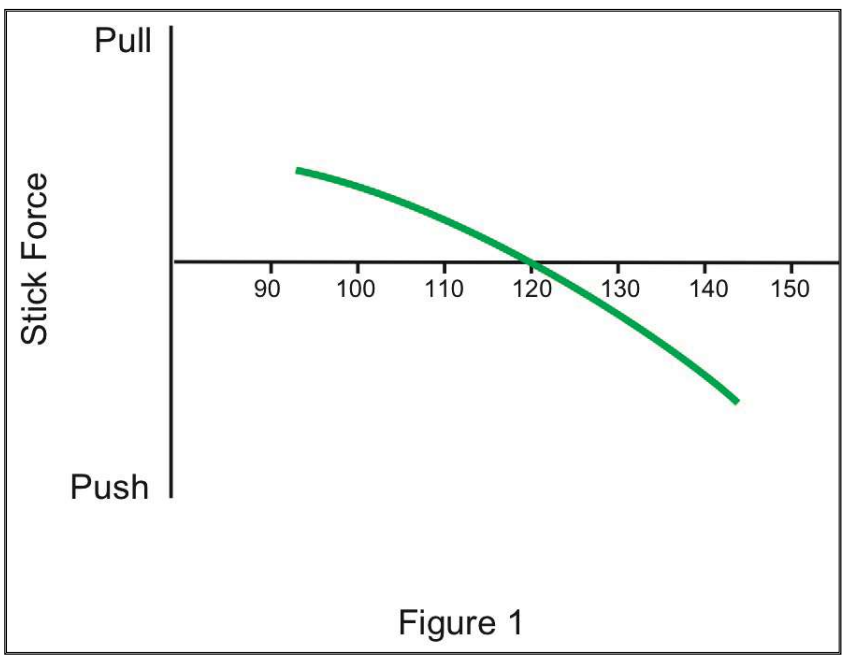


Figure 1

faster than the fast-end speed of the trim-speed band. Apply forward-stick to accelerate, but don't retrim or adjust the engine or propeller controls.

For our example airplane, you'd probably stabilize at 130 knots. Note how much push force it takes to maintain a steady 130 knots. Add a little more forward-stick, and stabilize at 140 knots. Repeat this until you map the airspeeds faster than the trim speed. Remember, you're not expanding your airplane's flight envelope during this test, so do not exceed VNE or any airspeed for which you have not already cleared the flight envelope. In the landing condition test, your fastest test airspeed should not exceed any speed limitation of extended landing gear or flaps.

Naturally, your altitude will change during this test, and that's okay within reason. If you find you're approaching 1,000 feet above or below the altitude where you initially trimmed for hands-off flight, simply climb or descend toward the original altitude and resume your testing. It's important not to retrim or adjust the engine and propeller controls during this repositioning maneuver.

Our example used 10-knot increments for target airspeeds, but stabilizing a couple of knots faster or slower than the target speed is okay. The idea is to get a feel for how the required stick-force changes when you fly off-trim airspeeds. Predictability is always a good thing, so the stick force should increase smoothly as the airspeed deviations increase. There should be enough stick-force change to be obvious to you that an airspeed deviation occurred, but not so much force that intentional off-speed flight is difficult.

Figure 1 shows a simplified static stability curve. Remember, the stick force corresponding to a particular airspeed is the force required to maintain that speed; it is not the force needed to change from another speed to that speed.

Admittedly, Figure 1 is admittedly overly simplistic, because it does not show the control system breakout forces, trim-speed band, or the effects of control system friction. Next time we'll explain how to check for control system friction and show how friction affects the static stability plot. We'll also bring the trim-speed band back into the discussion and discuss how all these ingredients in this long-stab stew feed into your overall impression of your airplane's handling qualities. 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 787s.

Dispelling Rumors...

Flight testing and two pilots in the airplane

BY RICK WEISS, EAA LIFETIME 214428

AS NOTED IN THIS MONTH'S Advocacy column in *EAA Sport Aviation* (page 10), the first few flight hours of a homebuilt aircraft are the most dangerous. Of all Phase 1 flight-testing accidents in 2011, 18 percent occurred on the first flight, and a full 65 percent occurred within the first eight hours. A large majority of the accidents, perhaps as high as two-thirds, were due to human factors, predominantly loss of control.

To address this problem, for the past nine months, EAA's Homebuilt Aircraft Council (HAC) and EAA's Government Advocacy team have been working closely with the FAA to develop an optional path for the flight testing of certain homebuilt aircraft, including experimental amateur-built (E-AB) aircraft and experimental light-sport aircraft (E-LSA). The purpose of this project is to improve the safety of Phase 1 flight testing by enhancing builder/owner pilot skills and lessening the risks associated with Phase 1 flight testing through the use of a qualified additional pilot. All of this is in response to the 2012 National Transportation Safety Board's (NTSB) accident study of experimental aircraft and the board's recommendations, particularly those regarding loss of control and engine failure issues.

Under this proposal, builders of kit aircraft meeting certain basic requirements may elect to fly with an appropriately qualified additional pilot during the early stages of Phase 1 flight testing, including the maiden flight. After the first ten hours and the completion of a simple package of testing for the aircraft and the builder, he or she may fly with an "observer pilot." The observer pilot would be useful for spotting traffic, monitoring systems, and other safety-related tasks during the latter stages of Phase 1, after the fundamental airworthiness of the aircraft is proven.

This "additional pilot" approach departs from traditional flight-testing philosophy, which stresses that only minimum required crew—in most cases the FAA views this as a solo pilot—should be carried aloft during flight testing. That philosophy assumes that mechanical defects are the most common causes of accidents. In homebuilt aircraft, particularly in well-proven kit aircraft, that is not true. Too often, builders lacking familiarity with the aircraft, currency, or knowledge of the flight-testing process make mistakes early in Phase 1.

This Hangar Debrief overview is meant to provide factual details about what's being discussed, realizing, of course, that everything can change as the proposal moves through the approval process. The FAA is currently preparing a new advisory circular (AC) to outline all of the requirements necessary for this option.

First and foremost, this new program will be purely optional. A homebuilder's right to test his aircraft within the current flight testing rules will remain. A builder may embrace the new program at his discretion, and may choose at any time to revert to the original flight-test program. This choice of programs maintains the freedoms we currently have. Briefly, here are some of the highlights and requirements for using this proposed option:

- The builder/owner must own some or all of the aircraft being tested and meet the pilot requirements for that particular category and class of aircraft, as well as all currency requirements.
- The aircraft must be built from a kit and be on FAA's Eligible Aircraft Kit List; here's a link for that list.
- The aircraft must have fully functioning dual controls.
- Only aircraft powered by powerplants that are recommended, supported, or provided by the kit manufacturer will be eligible. Certain third-party customized engines may be eligible. Turbine engines are not currently eligible. Powerplant testing, as found in AC 90-89, will be required as applicable. (These are tests builders should be doing, anyway.)
- With respect to the flight-test program, documentation for compliance will be via logbook entries, test plans, and photos or diagrams.
- The additional qualified pilot will be approved to assist the builder/pilot, to the extent desired and agreed to, during the initial flight testing of the aircraft. A flight-test plan will be required describing the required elements, both for the initial testing and also the required

maneuvers to be performed. The qualified pilot will have to self-certify competency for both pilot experience and the type of aircraft being flown by meeting certain requirement and experience levels via initial qualification and scoring matrices. A logbook entry will be required to complete the process.

- An additional observer pilot will be allowed to fly in the aircraft after the initial flight-test program has been completed. This pilot will be there to provide assistance to the builder/pilot to complete the flight-test program. This expertise will aid the builder/pilot in areas such as avionics use, as a safety pilot or in other capacities as necessary. The qualifications for this pilot will be determined by meeting certain requirement and experience criteria similar to—but to a different level from—the qualified pilot.

The question arises: Can a qualified pilot or observer pilot be paid? The answer is simple: Yes, if the airman certificate of the pilots supports compensation.

Numerous other issues must be considered before this option is exercised, including: a heart-to-heart discussion about who will be flying the aircraft at any given time, crew resource management, aeronautical decision-making issues, test card development, preflight briefings, how to ensure clear and unambiguous communications, and anything else related to the flight.

First and foremost, this new program will be purely optional. A homebuilder's right to test his aircraft within the current flight testing rules will remain.

Safety of flight is the goal of this project; in the end, we want to ensure that a safe, reliable aircraft enters the national airspace system and that a builder/pilot has gained the experience to fly his aircraft more safely.

We hope this article has given you a clearer insight into what is actually being discussed. Over the next few months, we'll try to elaborate on some of the details. If you have questions, please let us know and we'll do our best to address them in future articles. EAA

Rick Weiss is the chairman of the EAA Homebuilt Aircraft Council.