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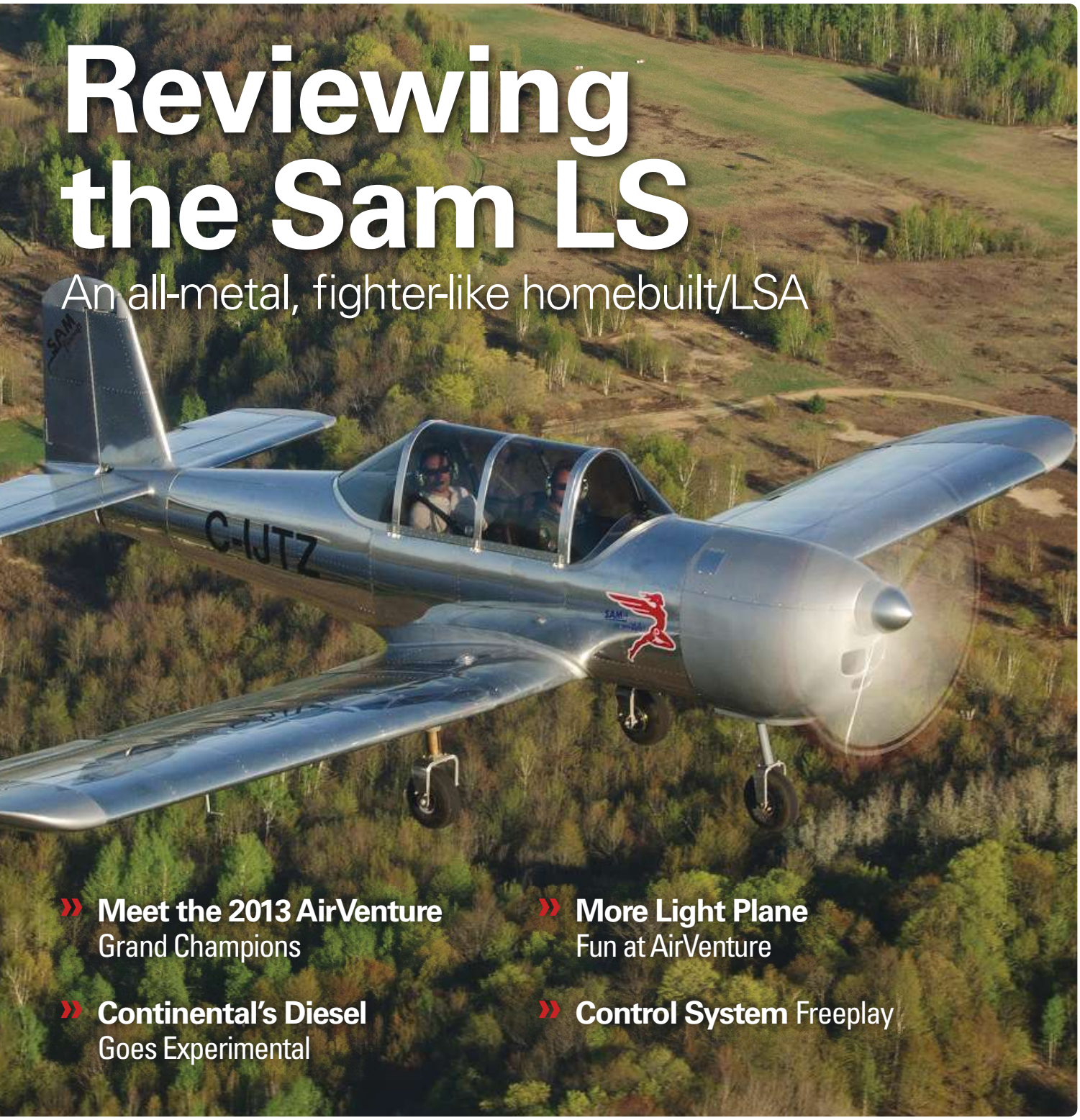
Reviewing the Sam LS

An all-metal, fighter-like homebuilt/LSA



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The Sam LS

From dream to reality

By Tim Kern

Author's Note: I have followed this project for years and—full disclosure—have written some press releases for the company, but I have refrained from making any qualitative judgments in this piece, restraining my writing to the information as presented by the company and the test pilot.

French pilot Thierry Zibi always loved the look of the Golden Age of Aviation military trainers. One day he started thinking, "What if they had the resources then that we have now?" In 2007, he decided to find out. Modern materials, engines, props, and avionics, he figured, would make a simple machine not only safe and fun to fly; they would yield a truly practical, comfortable, economical, and easy-to-build machine. So, why not give it a try?

A particularly appealing design of the era, the Ryan ST, was the practical inspiration for the overall look and proportion of Thierry's design. Modernizing this design for manufacture, making it accommodate modern-size pilots, and powering it with a modern engine would be Thierry and his engineers' task.

Interestingly, the tandem seating of the original ST created a huge and comfortable cockpit and allowed a streamlined and efficient fuselage. More on that later.

Thierry's plan included three configurations: a light-sport aircraft (LSA)-qualified model with a 28-foot, 6-inch wingspan; a cross-country (CC) model with a shorter (25.3-foot), higher-speed wing for speedier cross-country dashes; and

Photography by Jean-Pierre Bonin


SAM

a STOL version with a longer (31.8-foot) wing to allow slower flight and shorter takeoffs and landings. (The CC model is not LSA eligible because the clean stall speed will be a bit higher than authorized.)

Using Solidworks computer design software, Thierry and his team kept ease of construction, strength, weight, and cost in mind at each step. Thierry said, "We chose to design the aircraft on Solidworks for precision: Parts are CNC pre-drilled, and pre-bent with matched holes. It allows us precision repeatability and therefore offers ease of construction for the builder."

The framed, monocoque hybrid is built with 4130 chromoly tubing and aluminum (plus some composite materials for the cowl, tail cone, and fairings). Using common materials and building techniques, plus planning for maintenance, inspection, and repair, the Sam LS can be worked on at any shop.

Maintenance and inspection holes are built in throughout the aircraft. A comprehensive look at everything you usually need to see or adjust in the airframe requires very little disassembly. Portholes and inspection access, plus an easily removable tail cone, armrest, instrument panel, and floorboard, allow a thorough check or easy adjustment of virtually all the controls and main attachment points for the structure and controls.

Up front, the cowling is easy to remove, and the spinner is a balanced Sensenich unit that is matched to the two-blade composite prop and covers the pitch key access. That key allows auto-indexing of pitch changes in just moments, and without protractors or other special tools.

Well-known techniques, common tools, transferable skills, and no magic are required to build the Sam. As the plans took shape and Thierry focused on serving his market, he moved to Canada and set up his factory just west of Montreal.

Flying the Sam is the object, however. Thierry wanted to make this airplane very much a primary trainer, with predictable, mellow handling. A big rudder, linear controls, elevator and ailerons connected by push-pull tubes, and a steerable nose wheel (a tailwheel model is planned) are all designed to make handling in the air and on the ground as friendly as possible. A die-hard classic aviator can fly the Sam without the side-hinged and removable canopy, enjoying as much fresh air as he'd like.

The vintage look envelops all-modern technology. Electric flaps and trim, a 10-inch Dynon (plus an optional 7-inch unit in the rear cockpit—the primary pilot sits up front), Matco disc brakes, and a Rotax engine up front that turns a Sensenich auto-indexing composite ground-adjustable prop are all mated with 21st-century control balance and aerodynamics.

The flight envelope is LSA all the way: 1,320 pounds gross weight, 125-mph top cruise, with a 49-mph clean stall (42 with flaps), and a better-than-average 500-plus mile range courtesy of the 22-gallon fuel tank. With full fuel and configured as an LSA, there are still 358 pounds of useful load available.

The Ryan ST shown here was the inspiration for the Sam LS design, and it's named after Thierry's son, Sam.

Photography courtesy of Sam Aircraft

The structure of the Sam has been designed for a gross weight of 1,450 pounds, so homebuilders of any of the experimental versions can run full fuel and have 488 pounds left for fun.

Although the Sam LS is flying with the 100-hp Rotax 912S, it can accept engines from 80 to 130 hp, so a budget- or performance-minded builder of an experimental has a lot of engine choices. The options include the 80-hp Rotax 912 or turbocharged 914, the Jabiru four- or six-cylinder engines, the Continental O-200, VW, RevMaster, and UL Power four-cylinder engines; in fact, any proper horsepower unit up to 250 total installed pounds can work. Currently Sam Aircraft supports the Rotax installations and soon will support the ULPower line of engine as well.

Unlike some special light-sport aircraft (S-LSA) manufacturers, Thierry encourages the building of experimental amateur-built versions. The Sam is approved in Canada as an advanced ultralight in kit and ready-to-fly formats. For the pure experimental market, Thierry also offers several levels of kits, from 51 percent (including finished spars, weldments, and tested fuel tanks) to more basic kits that still include all the welded components.

Phased building is encouraged. "Save the engine and propeller until last," Thierry said, for convenience, logistics, and economics, and to keep pace with your increasing building skills. There is no price penalty for buying subkits; the only increase in cost might come from receiving multiple shipments.

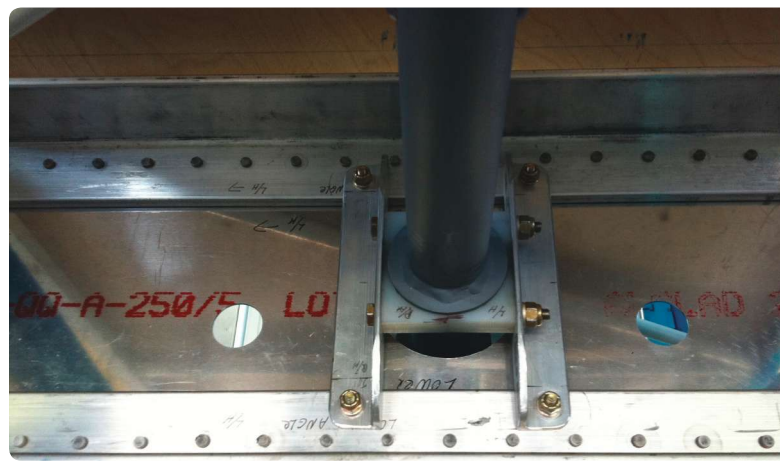
Proof in the Flying

The Sam's first flight on February 26, 2013, was a predictable event. "Everything was as we planned it," Thierry said. "Now we will go and examine the data."

The flight program was essentially complete by the beginning of May. Test pilot Rafael Langumier flew a series of 22 missions that encompassed 31 hours, expanded the flight envelope to the edges, and was able to confirm a level-flight top speed of 125 mph, a fully loaded climb rate of 900 fpm, and a gentle stall, with plenty of rudder authority all the way. Thierry said, "We did the spin testing at forward and mid CG, and we have done all the required test flights and received the approval by Transport Canada under the Advanced Ultralight (AULA) rule, which has a weight limit of 1,232 pounds in Canada."

After most of the flight envelope had been explored, Thierry flew with the canopy off. "It was my first open-cockpit experience," he said, "and it was exhilarating beyond my imagination!" All the Sam configurations can be flown without the canopy.

Digital and analog instruments provide primary and backup information in a neat arrangement on the panel.



The main control torque tube attachment.

The Sam is stressed + or -7.9*g* ultimate at the LSA gross weight of 1,320 pounds, and basic (positive-*g*) aerobatic maneuvers (chandelles, lazy eights, and banks of 60 degrees or less) are design-approved for both the LSA and CC models. In the experimental version, the Sam can gross up to 1,450 pounds.

Ease of build, inspection, repair, and ownership are designed in. The cowl comes off quickly for detailed inspection. Wheels and brakes are right out there in the airstream (and a parking brake is optional), and the master cylinders are right at hand in the cockpit. Control continuity is easy to check visually in addition to operationally where you move the controls and watch the panels.

The composite fuel tanks are tough and factory tested. It's easy to get under the floor; the canopy is a cinch to remove for access, or even for flight; and window panels are easily replaced.

Pilot and passenger comfort are enhanced by fixed rudder pedals and two movable seats, with enough travel to accommodate most pilots. On the LSA version, cabin heat is

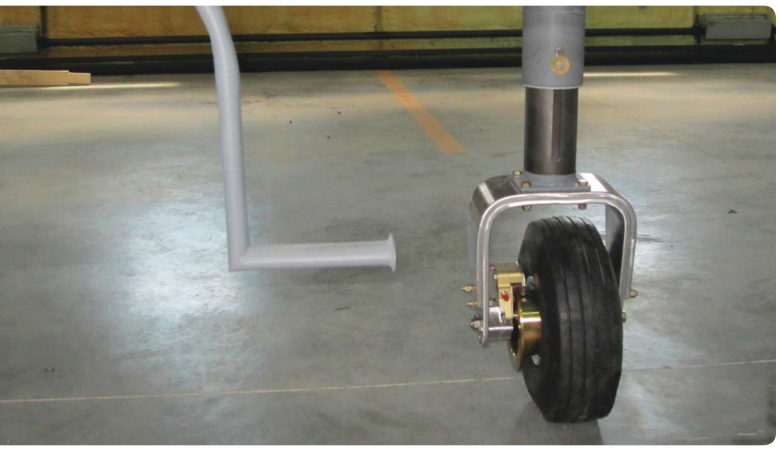
courtesy of a classic heat muff; it is possible (though not official) on experimental versions to use coolant or even oil heat courtesy of the Rotax engine.

About That Tandem Cockpit

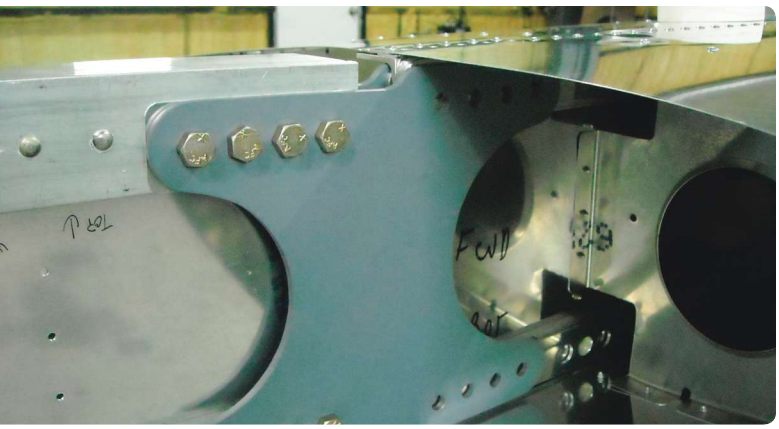
Everybody knows that most people want to sit side by side in an airplane, but the tandem cockpit has some advantages, particularly in comfort and efficiency.

First, efficiency: Not only does the cross section of a tandem cockpit allow a smaller fuselage frontal area, the added length of the fuselage can permit better ballistics and a proper taper to the tail. As for comfort, a relatively narrow fuselage is quite wide for a single person. (There is a minimum: The Rotax engine is 22.7 inches wide, after all; and it needs a little clearance.)

To have shoulder room equivalent to that in the Sam, a side-by-side cockpit would have to be 52 inches wide—about the same as the very large Diamond DA50 or Zenair STOL CH 850, all of which use big engines and carry at least twice as many people. (Note: A King Air 350's cabin—not cockpit—is 54 inches wide, including the aisle!)



The Sam's robust landing gear and step. The gear can be encased in wheel pants for a sleeker look and a bit more airspeed.



Construction of the Sam is simple and classic. Shown here are the wing attachment points. [Note: this was a fit-up only; washers are installed in actual assembly.]

The cockpit layout is classic: center stick; the throttle, choke, and "mags" are on the left; the right side provides the perch for the trim position indicator; and on the floor on the right is the fuel tank selector valve. Aircraft systems and power information and typical primary flight display information are displayed front and center, on the 10-inch Dynon screen. Standby instruments— airspeed, altimeter, vertical speed, and turn coordinator—flank the Dynon, with the radio just below it.

But ultimately for an airplane, it's about the flying, and for that, I rely on experts. Test pilot Rafael Langumier started his description of the walk-around (preflight) with this: "Starting from the cockpit, counterclockwise, the pilot can check everything easily. The hinges, rods, and connections are easy to check. The landing gear is very simple, and the fuel quantity can be checked visually and verified on the Dynon." Access to the engine oil reservoir also is easy, without the need to remove the upper engine cowling.

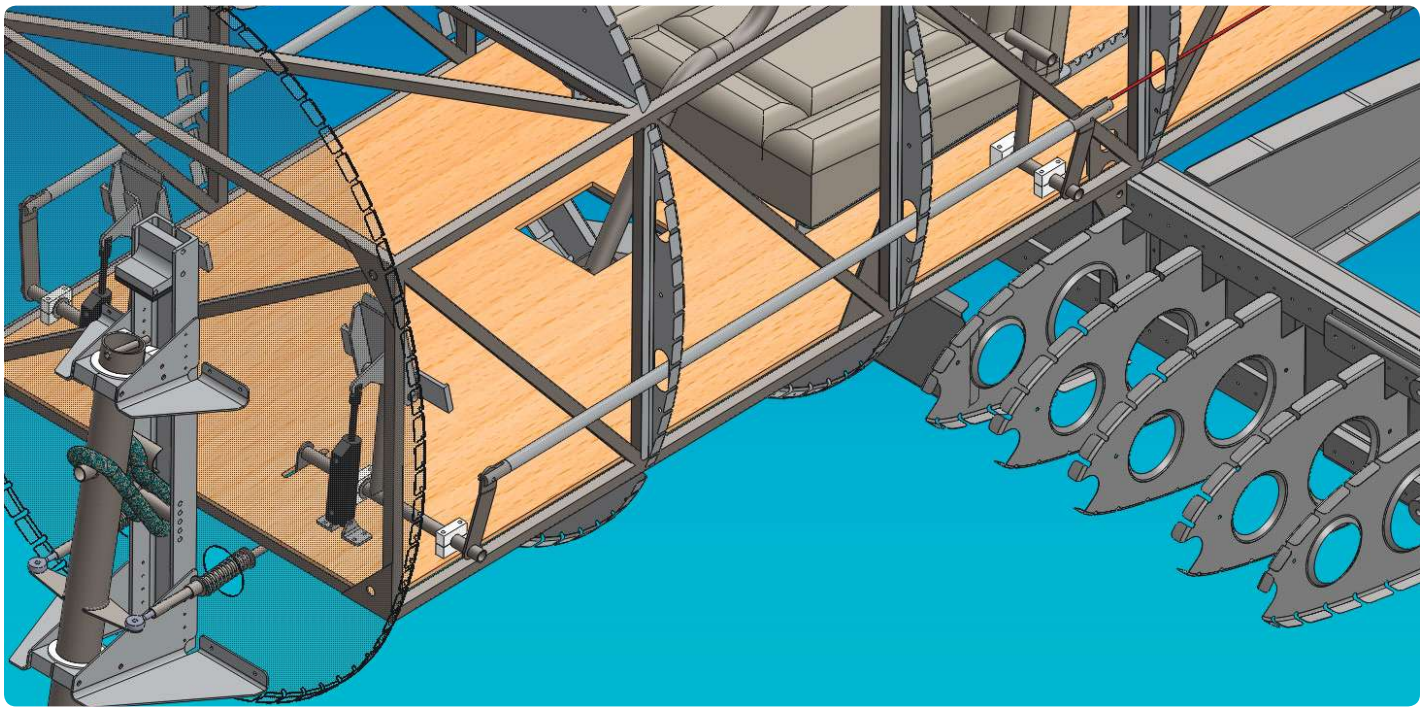
Rafael also likes "the easy access to the cockpit provided by a step in front of the left wing." He said, "With my chute and my helmet I can be seated without contortions. Every control falls to hand in a comfortable and natural position so that the pilot can keep his right hand on the yoke and play with the Dynon or switches with the left hand, even during critical phases of flight (like the approach)."

Rafael next went through the flight envelope, starting with normal phases of flight such as takeoff, climb, cruise, descent, approach, and landing. Takeoff on a cool windless day, without flaps, calls for rotation at 47 mph, and the Sam breaks ground at 53 mph; the takeoff run is under 400 feet. Rafael said, "I didn't find any difficulties in flying the Sam. The rudder needs a little pressure during the climb, but it disappears as speed increases, until in cruise, you don't need rudder pressure to keep the ball centered."

Stick forces, he said, are similar to what "we should find on certified aircraft. For example, controlling the Sam on the lateral axis requires two pounds of pressure. For the pitch control, about three to four pounds are necessary. This gives the Sam a good control on the roll; the pitch control gives the pilot the ability to maintain altitude easily, and the electric trim is helpful so that the pilot can fly hands-off." Roll rate is demonstrated at 18 degrees/second.

Rafael conducted stalls and steep turn stalls. He said, "The Sam stalls without buffet warning; but the nose drops when

Photography courtesy of Sam Aircraft



Thierry and his engineers used SolidWorks to design the entire aircraft. This image shows the forward fuselage.

the stall occurs, and the pilot can exit from the stall using conventional technique (by reducing angle of attack). No tendency was felt to roll or enter a spin, even when I did stalls in accelerated turns." Clean stall at LSA gross is right at 49 mph (and 45 mph at AULA weight); with the full 35 degrees of flaps, it is a slow 42 mph. (For reference, at a landing speed of 60 mph and with Rafael on the stick, landing distance was 350 feet.)

He performed some intentional "rookie mistakes," too, to see what the airplane would do. Rafael said, "I also tried to keep the stick full aft; the Sam's nose would drop, then oscillate above and below the horizon, regaining speed and stalling again without dangerous tendencies."

As for yaw, he said, "During a steady turn at 30 degrees of bank, the Sam had a tendency to stay established in the turn or to decrease the bank angle, which is known as 'divergent spiral stability.'"

Rafael took the flight envelope to VNE (155 mph) and said, "No flutter was felt." Overall, the tests showed "…longitudinal stability that results in a proportional stick displacement and force versus speed increase/decrease."

As for general accommodations, Rafael said, "The cabin comfort is good. Not so noisy, and the cabin heating system is very efficient. The knob installed on the right side of the panel opens the orifice on the floor, and hot air entered the cockpit quickly." Rafael also called the Sam "docile and versatile."

The manuals—pilot's operating handbook and the aircraft maintenance manual—are done.

The finished, fully loaded, ready-to-fly airplane is $131,000 (FOB Lachute); early orders get some nice options at no charge. The ultrafast-build kit is $33,440. The standard kits, which include everything but the engine, instrumentation, avionics, emergency locator transmitter, painting, and primer, come in at $23,200. Options, of course, can pick that number back up. Order the whole Sam airframe kit, or as many subkits as you like in 2013, and take a 20 percent discount. Delivery slots are still available for most subkits, for delivery in early 2014. (Complete kit orders—regularly $29,000—now are on special at $23,200, with priority delivery.)

Options include an additional (7-inch) Dynon panel for the rear cockpit, larger (6-inch) wheels, leather interior, wheelpants, stainless-steel exhaust, marker lights, parking brake, two-axis Dynon autopilot, and a BRS ballistic all-airframe parachute. The long-wing option will be available in 2014; the cross-country wing is scheduled for the following year.

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

Tim Kern is a private pilot and has written for more than 50 different aviation magazines. He was a key builder on two aircraft projects and has earned the title of Certified Aviation Manager from the NBAA.