

SPECIAL: 1998 HOMEBUILT SUPPLIER DIRECTORY

KITPLANES

FOR DESIGNERS, BUILDERS AND PILOTS OF EXPERIMENTAL AIRCRAFT

JUNE 1998

Vision of the Future:

All Composite, Built from Plans



**Building
A Champion**

**EAA's Test
Flight Class**

**This Gizmo
Really Flies**

\$3.99 CANADA \$4.99





PHOTOS: HOWARD LEVY

Realizing a Vision

Steve Rahm has a clear view of his ideal design.

By Howard Levy

Steve Rahm has discovered the key to success—start small. Rahm now owns his own company called American Affordable Aircraft, supplying the plans for an aircraft he calls the Vision. But Rahm didn't just spontaneously receive a vision of this design one day. He started with small steps, helping friends build and fly their own projects before he dared to create his own airplane—a synthesis of tried-and-true components.

Starting Small

Rahm, age 42, is the son of a prominent aerobatic airshow pilot. The 1300-hour private pilot learned to fly in a Citabria, Cessna 180 and his father's German aerobatic trainer, the Bücker Jungmann. After his father's

death during an airshow in 1976, Rahm purchased a used Cessna 172. At the same time, he began helping friends construct and test-fly their homebuilts. At the time, he was living in California and purchased a used Wittman W-8 that he reworked with advice from Northrop aeronautical engineering acquaintances.

He also became friends with then-student-pilot Lance Neibauer. When Neibauer flew his first design, the prototype Lancair 200, to Oshkosh in 1984, Rahm accompanied him. Rahm later worked with Wing Aircraft on the twin-engine Derringer, as well as with Jeanette Rand (of Rand-Robinson Engineering, Inc.) on the KR-2 and KR-1B motorgliders. He also helped restore antique aircraft and was a skydiving instructor.

Sean Ponsonby demonstrates the first customer-built Vision.

Vision designer Steve Rahm (left) and Sean Ponsonby compare notes on their pair of Visions.



Vision

continued

Sleek lines and high speed per dollar invested were among the objectives for Vision.



Been There, Done That

While flying and helping build a variety of homebuilt aircraft, Rahm developed his own opinions of what would be ideal configurations, sizes, materials and construction techniques for his own design. At one point, while flying a prototype with wings built with hot-wired styrene foam, turbulence set off a fuel leak, and the wing surface started to collapse, resulting in a quick but safe landing.

Rahm said, "That situation eliminated any thought of using styrene-based cores. It made me consider carrying fuel in the fuselage, having no protruding controls in front of the pilot and passenger, and giving crash protection major consideration."

Rahm realized that a kit aircraft was more expensive to build because of the cost of the kit, and he had seen more than one company go belly up. He leaned toward a conventional configuration, rather than canard, that could be built in stages. And having constructed numerous amateur-built aircraft, Rahm knew that he needed to make his drawings and manuals user-friendly.

He spent many hours at his computer developing the design and analyzing potential problems. One day, while he was at the computer, his wife said, "This must be your vision." And that's how the Vision got its name.

A Company is Born

Rahm's company, financially backed by Dennis Hynes, took root at Spruce Creek Airport in Daytona Beach, Florida. Rahm decided that the airplane would only be marketed using construction manuals—actually seven bound volumes—with approximately 400 pages of written descriptions that included close to 400 illustrations. Also, sales would not be made until an airplane was built and flown and a second aircraft was constructed using the manuals. In fact, during initial construction of the prototype, several people without prior building experience were employed as hands-on assistants to test if the manuals were easy to understand.

Rahm says he developed the Vision to fill a gap in the amateur-built market. The plane isn't too small and doesn't require a large powerplant, but it provides ample performance, he says. It is also the only known all-composite aircraft built from raw materials that employs the full sandwich open bay construction that is normally used in premolded kit aircraft. Major Vision parts are shaped over inexpensive plywood formers.

Construction began in October 1994, and Rahm first flew the airplane from Spruce Creek in October 1996. The flight lasted only a couple of minutes. Rahm said, "The engine started overheating in the pattern, and I immediately returned to the airport. After I enlarged and lengthened the under-nose cooling inlet, it proved just about trouble free. No other fixes have had to be made to the airplane's design." As of February 1998 the prototype had logged 65 hours.



The Vision prototype is powered by a 100-hp Subaru EA-81.

Mission Accomplished

A low 5.5:1 aspect ratio, one-piece wing is used for its high strength and stiffness, along with the potential of being of lighter-weight construction. The airfoil is a NACA 63A415 (similar to that on the Piper Cherokee 140), chosen because the "A" modification eliminates the trailing edge cusp, making it easier to build, and not as critical as a pure laminar flow airfoil. Rahm also incorporated a 1.5° twist in the wing that produces good aileron control throughout the stall. Each wing's inboard leading edge carries 11 gallons of fuel.

Electric flaps with 30° maximum deflection are cutouts of the basic wing. The flaps contain 27 solid E-glass foam ribs per side. The ailerons are pushrod activated. Each contains 29 sandwiched ribs. The wing is skinned in sandwiched E-glass, but the flaps and ailerons have sandwiched carbon fiber skins. Two people can remove the wing in about 1 hour and reinstall it in 2 hours without any damage to the finish. The aircraft is rated at +6/-4 G. A wing sample was tested to a 21.15 G destruction.

In fabricating the fuselage, the lower canoe-like half is made by bending Last-a-Foam—a urethane also used in all of the sandwiched parts—over plywood forms and wood stringers. After receiving the required number of E-glass layups, it is removed from the former and glassed on the inner side. Sandwiched bulkheads are the seatbacks, one aft of the baggage compartment, another in the turtledeck, and at the stabilizer. A rollover structure made of foam and eight layers of glass per side is located in the turtledeck, which had been fabricated like the lower fuselage section.

The only plywood (aircraft grade) in the airplane is the firewall that is sandwiched with synthetic asbestos. The prototype has a 40-inch-wide cockpit, but some builders are widening it to 44 inches. Canopy height is sized for a 6.3-foot pilot,

Vision

continued

The Rahm Vision features a VFR panel.

Ponsonby's cockpit adds gyro instruments.



but the turtledeck and canopy can be raised an additional 3 inches to accommodate taller passengers. The control stick is installed on a center console per Rahm's impact safety feature. Some builders are also cutting down the width of the console to provide roomier seating.

The seats contain a 12 G foam and glass crush structure to protect against spinal injury in a crash. The canopy is hinged to the right on the prototype, but some builders are opting for a fighter type, forward-hinged canopy for access from both sides. "The airplane has been designed for some personalization within certain parameters," Rahm said. An 18-cubic-foot baggage compartment is behind the seats, but weight and balance limits its use. With two aboard, only 15 pounds can be carried.

The fin and stabilizer are hollow structures with full sandwiched skins covering built-up sandwiched spars and ribs. Eight ribs are used in the stabilizer and four in the fin. The elevator and rudder have sandwiched carbon skins encasing a solid foam core. The elevator is pushrod controlled, and the rudder is controlled by cables. Elevator and aileron bellcranks and idlers are steel weldments with bearings installed. All control surfaces are mass and aerodynamically balanced.

Main landing gear plugs into the engine mount and has a 77-inch tread. The gear has Wittman-type round tapered rod legs fitted with streamlined fiberglass fairings and wheelpant. McCreary 5.00x5 tires are mounted on Cleveland wheels and disc brakes. The tailwheel is a steerable 6-inch Matco unit.

Rahm used a 100-hp Stratus converted Subaru EA-81 four-cylinder, four-stroke engine on the prototype. "I have no preference between aircraft or auto engines," he said, "but most people I spoke to seem to be interested in the auto types for their lower cost. I chose the Subaru because of the accolades by builders flying them on their various airplanes." The propeller is a 66-inch, 68-inch fixed-pitch wood Prince unit.

Weight and Performance

The Vision had a design weight of 800 pounds, but the prototype weighs 850 pounds. That weight rose again to 925

pounds with upholstery, paint and lead ballast to correct a tail-heavy situation. The prototype was a learning tool, and construction techniques and weight-saving simplifications have brought the empty weight back down to 825. The 21.8-foot span, 18-foot-long Subaru-powered airplane has a 1350-pound gross weight. Visions with larger engines will have a 1450-pound gross weight.

The never-exceed speed (V_{NE}) is 200 mph. The Subaru provides a 165-mph cruise and 6-gph fuel consumption at 90% power with pilot and full fuel. At 70% power, the cruise speed is 155 mph with a 5-gph fuel consumption. The takeoff roll over a 50-foot obstacle is 1500 feet, and the climb rate is 1600 fpm at 90 mph. With a standard 22 gallons of fuel, the range is 620 miles on 75% power. Approach is flown at 75-80 mph, and touchdown is at 54 mph with full flaps. It stalls at 53 mph with flaps and at 55 mph clean. With slight braking, it stops in 1200 feet, the company says.

Modifications

More recently, the prototype was modified with span increased 4 feet, incorporating tapered wingtip extensions that add 12 square feet, and there are 2-inch chord extensions on the elevator, plus two 14-inch strakes forward of the stabilizer to increase the area more. The airplane had not flown at the time of this writing, but the new configuration is expected to improve performance and handling in hot/high areas and for heavier pilots. It will also be more docile for less experienced pilots.

Retrofittable trigear has been devised by one builder. This gear employs a full-castering nosewheel, as used on the KIS, RV-6A and BD-4. The main gear will now be wing mounted. However, Rahm contends that the tricycle version should have the extended wing and tail modifications to offset the increased weight and drag. The touchdown speed is recommended to be kept under 60 mph.

Sold on It

The first customer-built Vision to be flown is the work of 29-year-old Sean Ponsonby. He was one of the so-called Beta Builders who built an airplane to test the construction manuals prior to their release to the public. Ponsonby had been looking for an airplane when he met Rahm who, at the time, was beginning to build the prototype fuselage. Rahm showed him concept

Vision

continued

To the airport! Sean Ponsonby's Vision nears completion.

A Lycoming 160-hp O-320 powers the airplane.

The "dirty" mode lowers flaps to 30°.



art of the proposed airplane, and Ponsonby liked what he saw.

Ponsonby, a carpenter, caught the aviation bug at age 15 in his homeland of Ireland when he flew with his cousin in a Cherokee. He immigrated to the U.S. 10 years ago, and before long, he had his private license, an instrument rating and an A&P certificate. He's working on his commercial license, as well as his bachelor's degree in aviation technology from Embry-Riddle.

Ponsonby's Vision is his first homebuilt, but he had some prior building experience helping friends construct their RV-6s and Lancairs, including the multi-award-winning Lancair IV-P built by Jim Rahm, Steve's uncle.

The idea of an inexpensive, pay-as-you-build airplane was intriguing, to him, so he obtained a set of Vision manuals. Getting help from his credit card, Ponsonby bought building materials in small amounts that could be paid off before he bought the next batch. He found this much easier than taking out a big loan.

First to Fly

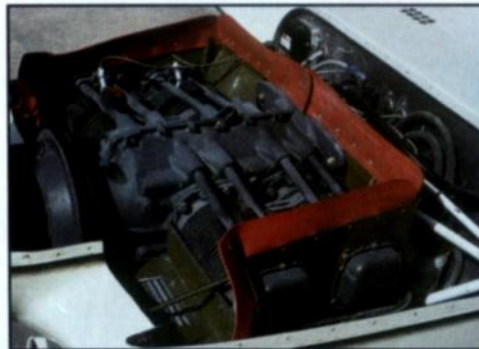
The airplane was fully assembled in Ponsonby's two-car garage. Work began in March 1995. The plane was rolled out in primer for photos in June 1997, then painted in the garage. In September, it was trailered (with the wings removed) to Spruce Creek for its first flight.

Ponsonby conducted some high-speed taxi tests but let friend Willie Carter make the first flight. Carter, who painted the wing for Ponsonby, is a high-time pilot and the local Pitts expert, having built 13 of them. The test flight lasted 40 minutes and included stalls, full-power high-speed runs at altitude, and stall speed checks.

Everything checked out OK on the flight, and to prove it, Carter did a high-speed buzz of the runway before landing. Carter had no complaints, and nothing had to be redone. Ponsonby planned to make the second test flight, but during a high-speed taxi run, a wind gust bounced him 8 feet into the air, so he just kept going. That hop lasted 30 minutes and was primarily pattern work.

Getting Personal

Since the Vision design lends itself to personalization, Ponsonby did just that. He used a 160-hp Lycoming O-320-D2A engine with a 68-inch ground-adjustable Ivo Magnum prop. He installed separate 8-gallon fuel tanks in both outboard wing areas, boosting fuel quantity to 38 gallons. Rahm is adamant that



the outboard fuel be burned off first. Ponsonby said, "I opted for the bigger engine and extra fuel to go faster and further, as well as for the better all-around performance they provide."

The engine required a reshaped cowling, so Ponsonby took a Grumman-American Cheetah nose bowl, split it to reduce the inlet area, and added fiberglass to shape the full cowling. He bonded on a Lancair 320 carburetor intake scoop, and for esthetic purposes, rounded the dorsal fin, and added electric trim to the elevator. The taildragger sits on Cleveland wheels and brakes, fitted with Goodyear 5.00x5 tires and a 6-inch Scott tailwheel.

Dual controls and brakes are installed. The instrument panel is a Terra IFR layout that includes a TX 760D com, a TN 200D nav with a Tri-Nav C indicator, and a TRT 250D transponder. A PS Engineering PM 2000 stereo intercom is also fitted. Seats incorporate the NASA-developed form-fitting Temper Foam, and the backs are canted 30° for comfort.

Ponsonby's wife, Mairead, also from Ireland, whom he met on the Colorado ski slopes, assisted in construction by stirring epoxy, mixing the micro (filler), and sanding the airframe. She also designed the interior and sewed and installed the upholstery. A forward-hinged canopy encloses the 40-inch-wide cockpit. Paint is an off-white Imron 4296U.

Perfect Performance

At the time of photography, Ponsonby was still restricted to an FAA test area, but his checkouts have included rolls, loops, hammerheads, lazy 8s, chandelles and constant 4-G turns. Rotation is at 50 mph after a 1000-foot ground roll. Initial climb rate is 2300 fpm at 120 mph, decreasing 100 fpm every 1000 feet. "I have to keep the climb angle from getting too steep because I lose too much outside vision, which is not a good thing in Spruce Creek's busy traffic pattern and the Daytona Class C area we are under," Ponsonby said.

The maximum cruise is 215 mph, and normal cruise is 209 mph TAS at 75% power at 8000 feet. Downwind is flown at 100 mph, slowing to 90 mph turning base, then dropping to 75

rollout. With 30° full flaps, the airplane stalls at 58 mph.

What does Ponsonby think of his Vision? "I love the way the airplane handles. It has exceeded all my expectations," he said. "All the hard work and expense—airframe \$7000, instrument panel \$11,000, engine and prop \$11,500—were well worth the results, and I look forward to having fun with it. Mine will be the first customer-built Vision at Sun 'n Fun and Oshkosh. Mairead and I will then fly to Utah for some white water rafting."

A Vision of the Future

Rahm reports that 46 construction manuals, (\$427 each) have been sold to date. Approximately 8 to 12 aircraft are under construction. Foreign manual buyers include four in Canada, two in Denmark, one in South Africa and two in Australia. Some engines to be used include eight 150-hp Subaru EJ-22 Legacys, five 170-hp Mazda rotaries, and a number of Lycoming 108-hp O-235s, 125-hp O-290s, and even a 160-hp O-320.

Although the Vision was developed as an affordable, raw-material-built aircraft, future builders will be able to purchase some prefabricated components from the company and from current builders producing multiple subassemblies.

Rahm's design philosophy was to provide a segment breakdown with each segment costing \$500 or less. A completed airframe would be \$6000-\$7000, excluding engine, prop, instruments, upholstery and paint. The prototype cost was \$17,090 complete. Customer aircraft build time is said to be 3000-3500 hours. Rahm is so confident that purchasers of the manuals will find them the most understandable on the market, he is offering a 30-day, money-back guarantee. So take a closer look. You and Steve Rahm may see eye to eye on his Vision. **KP**

The author wishes to thank Dick Russell for piloting his Beech T-34B for the air-to-air photography.