THE SONEX

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JIM KOEPNICK

A New Homebuilt Design That Can Be Built From Scratch

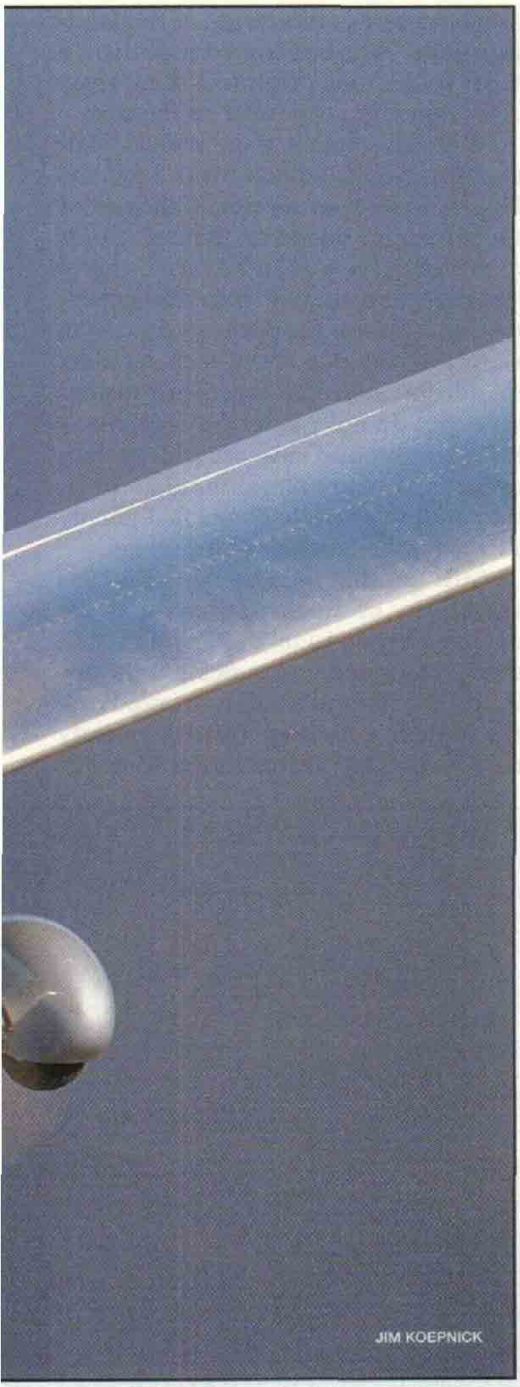
BY JACK COX

LEEANN ABRAMS

John Monnett

Homebuilts have certainly come a long way since the heydays of Heath Parasols and Pietenpol Air Campers. Historically, the trend has always been toward more and more sophistication, so that today the most advanced homebuilts are at the leading edge of structures, the use of new air foil sections, "different" configurations, etc. All of us admire the ingenuity being brought to bear on sportplane designs, but, regrettably, we also have to contend with the ever increasing cost that accompanies the growing sophistication. There's no way around it — it just costs more to design faster, higher flying and wider ranging aircraft, and it costs more to build, maintain and operate them. It comes as a pleasant surprise, then, when a company comes along in 1998 that is willing to buck the trend by trying to develop and market an airplane that is more attuned to the actual needs, lifestyles and wallets of the majority of people, rather than playing upon their egos and Walter Mitty dreams. It's a risky endeavor because we **like** having our egos stroked and we **like** to imagine we are fighter pilots saving the world for democracy, and appealing to those foibles continues to be a very successful marketing strategy. It is a worthy endeavor, nonetheless, because it's a hard fact of life that regardless of our hopes and dreams, the majority of us simply cannot afford an airplane that costs as much as a new house.

The company we're referring to is Sonex, Ltd. of Oshkosh, Wisconsin and



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the design philosophy has come from John Monnett and Pete Buck. You know John from his years with Monnett Aircraft and his development of the Sonerai series of sportplanes, his Moni powered sailplanes, etc., but you will not be as familiar with Pete. Just after high school, he was one of the early builders of a Sonerai and proved so capable that John hired him first as a part time and, later, as a full time employee at his original plant site in Elgin, Illinois. When John moved Monnett Aircraft to Oshkosh, Pete ventured instead to California to go to work for Lockheed's legendary Skunk Works™ . . . and to earn a bachelors and masters degree in aerospace engineering at night school. Today, Pete is the lead engineer on the Skunk Works™' military space plane project.

Remaining close friends over the years and retaining a shared first love for simple, economical sportplanes, John and Pete have been talking about an all-metal, two-place powered sailplane for some time, but have been too busy in their workaday lives to advance much beyond the talking stage. That situation changed recently, however, when John was approached by Italian business interests who wanted him to come up with a new version of the two-place Sonerai that would fit into that country's microlight category. In mulling that one over and, in particular, considering the ramifications of having to comply with a 40 mph stall speed requirement, John and Pete quickly came to realize that it would be about as simple to design a new airplane . . . and a lot more fun and intellectually challenging. Many of the design elements of the powered sailplane they had been discussing, which itself was in many ways an extrapolation of the earlier all-metal Moni and Monex designs, could be the starting point for such a new aircraft, they reasoned . . . and just that quickly the idea that would grow into the aircraft you see pictured here was born. They ultimately named it the Sonex.

From the beginning, the Sonex remained within the confines of the design philosophy that has guided John Monnett from the beginning of his involvement in aviation.

"The idea has always been to come up with an airplane that could be built for about the average price of an automobile. When I built the Sonerai I back in the early 1970s, it cost $1,200. That was less than the price of a new VW Beetle at the time, which was great because we just didn't have any more disposable income then. Today the average cost of a new car is about $20,000, so that gives us a lot of leeway. The Sonex was originally conceived to be powered with a VW engine, and even now we think the air-

(Below) A Sonex wing was tested to destruction on February 15, 1997. It easily withstood the design load of 3,150 pounds, and did not buckle until the 4,050 pound load (126%) pictured here was applied. Just after this picture was taken, the hydraulic pressure in the red jack at the far end of the wing was released and the wing buckled at the second rib out from the root.

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John Monnett provides perspective to show the massive spar carrythrough for one of the Sonex wings.

plane can be built for about $10,000. We're using the Jabiru engine now and it's more expensive than a VW, but builders can still come in under our 'price of a car' target. To me, it just doesn't make sense to spend a lot more for the kind of flying most people do, which is taking off and landing back at the same airport most of the time. How fast we go and how high we fly doesn't really matter a lot when we are just flying locally. We do want to have fun, and that's what we're trying to provide with the Sonex. It's faster than a 172, it's capable of recreational aerobatics, and it has nice, light handling characteristics . . . and it is affordable to build and operate. The wings come off easily and quickly so it can be kept at home if a builder wants to do that."

With that design philosophy to guide them, Pete and John moved on to the hardware, itself. The first decision was to design the airplane to FAA Part 23 certification standards, and that immediately presented them with their first dilemma. One of the toughest things a designer has to face is the FAA's landing gear drop test, and that is especially true if the aircraft in question is small and relatively low powered. The airframe weight needs to kept as low as possible in order to have good take-off and climb performance, but some pretty beefy structure is necessary make the landing gear and its attachment hardware strong enough to pass the drop test. At the same time, the gear should be resilient enough to provide a soft ride, low in aerodynamic drag, easy for the builder to construct and install and not all out of proportion in cost to the rest of the airframe. The rather novel solution Pete ultimately came up with - in part due to his experience with the material at the Skunk Works™ — was a couple of straight titanium rods for the main gear legs. It was Steve Wittman, of course, who invented and patented both the flat spring and rod type landing gears, but Steve's rod-type gear was made of steel and had to be machined to a taper to reduce the weight and achieve the desired degree of resiliency. Interestingly, the taper is not necessary when titanium is used. It is very light in weight and the bending characteristics of the material are such that a straight length of rod performs under load much as the tapered steel rod does. This means the builder simply buys a couple of rods cut to the proper length, drills two holes in each and installs them. Both taildragger and trigear versions of the Sonex were planned from the outset, and titanium rods were also selected for the nose gear struts and tailwheel springs.

Another design goal was to keep the airframe parts count as low as possible, and the titanium rod gears met that criterion perfectly. The rods, simple attach sockets and bolt-on axles are the major components of the landing gear. Not having to machine a taper in the rods or protect them from corrosion also cuts down on the cost.

With the solution to the critical landing gear problem determined, John and Pete were free to move on to the rest of the airframe. Based on their previous experience, it was to be an all-metal structure composed of 6061 flat and extruded aluminum, put together with stainless steel pop rivets with stainless mandrels. Stainless rivets are expensive, but do not rust if the airplane is left unpainted to save weight. A very clever spar cap extrusion, also 6061, was designed for the Sonex that greatly facilitates the building of the wings.

Still another design criterion was simplicity of construction, so as the airframe began to take shape on CAD, every component was designed to be built flat. As it ultimately worked out, the builder's tooling consists entirely of of two sawhorses and a 4' x 12'

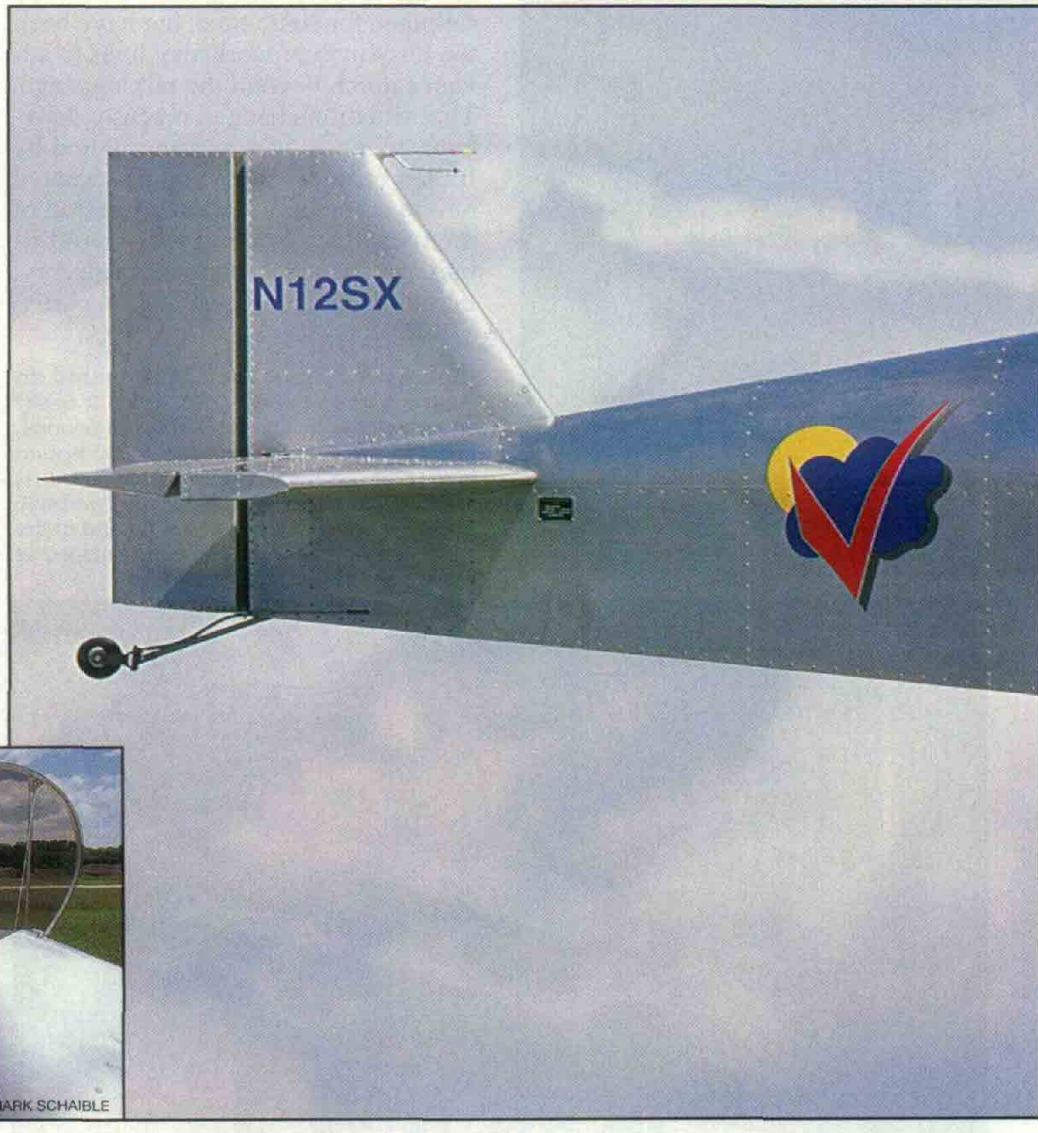

table. The tools needed, John says, are no more than what are available in his shop: a band saw, bending brake, an oxyacetylene welding rig, pop-riveting tools and common hand tools. One hundred 24" x 36" CAD generated drawings and a construction manual came out of the design process. As Sonex builders will find, the construction manual is very detailed - and sequential, so that when one is half way through the manual, he or she will also be half finished with the airframe. Check blocks occur throughout the manual so when a task is complete, it is checked off. If a project experiences a lengthy hold somewhere along the way, the builder will know where the work ceased. Likewise, if the project is sold before completion, the new builder will be able to determine what has already been accomplished.

Significantly, the cost of the plans includes a two-day workshop in which customers can learn all the basic building techniques needed to complete a Sonex. The workshops will be scheduled as needed at Sonex, Ltd.'s facility at Oshkosh and plans purchasers can attend as many times as they like. If they choose not to attend, there is no refund, however. A flight manual is also included in the plans purchase.

Virtually all the Sonex airframe can be built from the plans if the builder wants to do that much work . . . and save that much money. Many components will be available, however, including: the fiberglass cowling and wheel pants (the only fiberglass in the airplane); canopy; fuel tank; titanium legs for the landing gear; weldments (control system, mainly); motor mount; nose gear parts; the folded skins for the control surfaces; various channels and

John Monnett, left, and Pete Buck just after the first flight of the Sonex on February 28, 1998.

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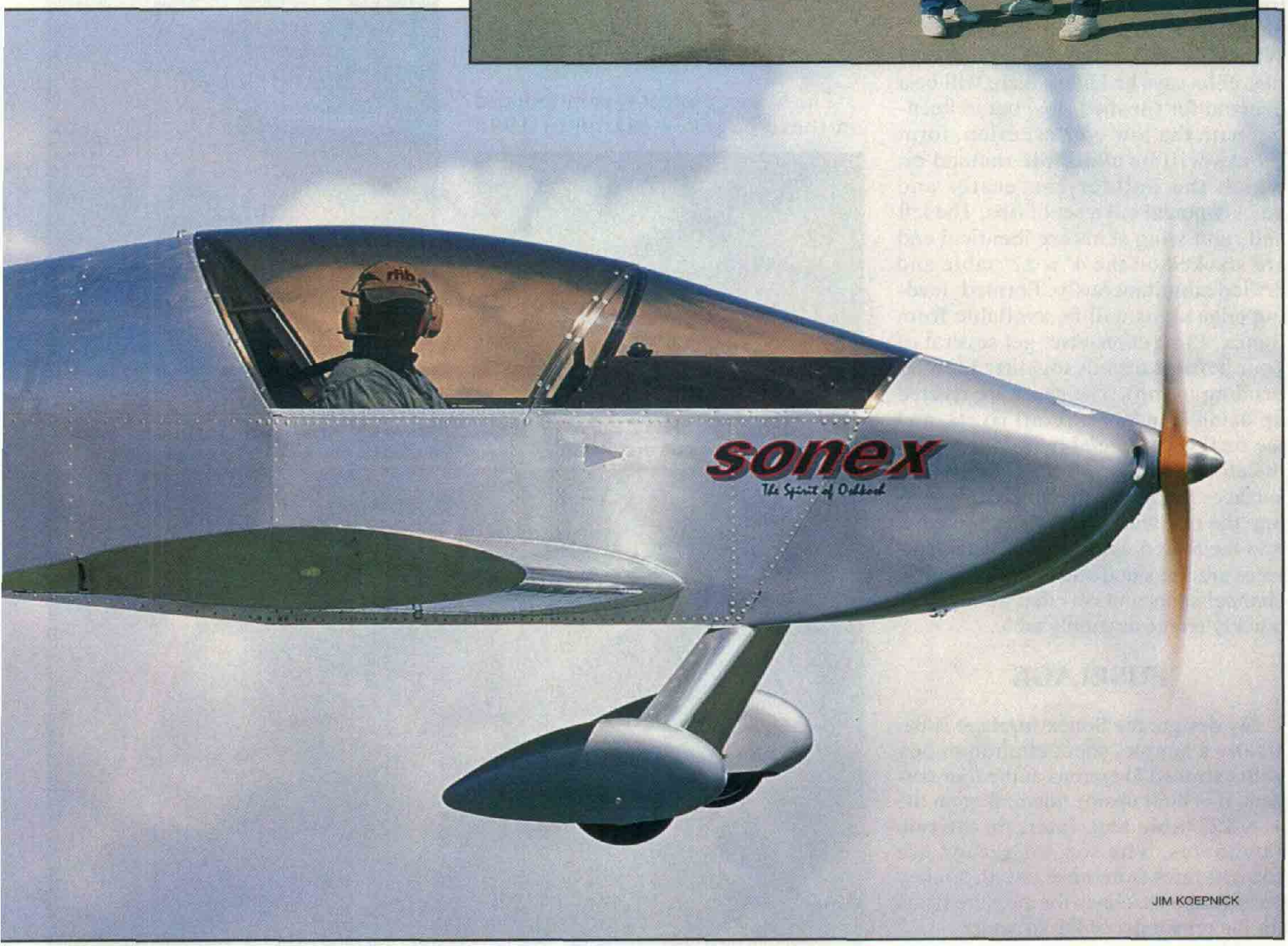

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fuselage bulkheads. There are no current plans for a 100% complete kit, however, because of the added cost of farming out items to subcontractors. Remember, the Sonex is intended to be as inexpensive as possible.

A breakdown of airframe component construction begins with the . . .

WINGS

The Sonex wing is built in two panels, with extensions of the spars left exposed to slide into slots in the fuselage and be pinned together . . . very much the way sailplane wings are attached. Pulling a few pip pins and disconnecting a few of the control link hookups are all that is necessary to remove the wings for trailering - a ten minute job at most.

Although the 6061 sheets of aluminum can be purchased at almost any metal supplier, the material for the Sonex spars will have to be purchased from Sonex, Ltd. This is to ensure the integrity of these critical components. What will **not** be supplied are finished ribs. John says he knows there will be a demand for finished ribs, but in keeping with the low cost criterion, form blocks will be available instead on which the builder can easily and quickly pound out a set of ribs. The left and right wing skins are identical and are stacked on the 4' x 12' table and drilled simultaneously. Formed leading edge skins will be available from Sonex, Ltd. (otherwise, get several of your heftiest friends together for a tin bending tromp). The spars are riveted up using standard aircraft rivets, and the final wing assembly is done flat on the aforementioned table. The control surfaces involve little more than riveting the ribs and leading edge channel into the folded-over skins. The tail surfaces are flat sided and consist of skins, channel spars and ribs that go together quickly on the assembly table.

FUSELAGE

By design, the Sonex fuselage is basically a simple, sheet aluminum box with extruded longerons at the four corners. It is built upside down, first on the 4' x 12' table and, later, on the two sawhorses. The top longerons are straight lines from nose to tail, so they serve as the baselines for measurements for the remainder of the structure.

"It's just simple framing," John says. "Everything's squared with carpenter squares and riveted together."

Once the fuselage sides are built, they are joined with intercostals bent up out of sheet aluminum. Then the structure is turned over and the rounded turtleback is installed. It consists of two-piece bulkheads made on form blocks in the same manner as the ribs, plus left and right side skins. Five prototypes have been built simultaneously in the Sonex facility at Oshkosh, and John installed all five turtle decks in a single morning's work.

To add sleekness to what would otherwise be a square box, the entire top of the fuselage is a continuous curve that extends from the point of the spinner to the vertical tail. This includes a very large windshield and canopy. The windshield is a flat wrap, but the canopy is a bubble blown by Sonex, Ltd. The two-piece fiberglass cowling creates a sleek, pointed nose for the airplane.

THE PROTOTYPE

The Sonex project was introduced on these pages in March of 1996 while it was still in the CAD drawing and model stage. Construction on five prototypes began later in the year: a taildragger and a trigear for Sonex, Ltd.; a trigear for the Italian company; and a taildragger each for Joe Gibson and George Rotter. Joe and George are retired Oshkosh area EAAers who are good friends of John Monnett and have volunteered their time and considerable building expertise from the beginning of the project. During the parts building stage, five of everything were constructed, plus parts for an additional wing for static load testing. With Pete Buck on hand from California to direct the loading,

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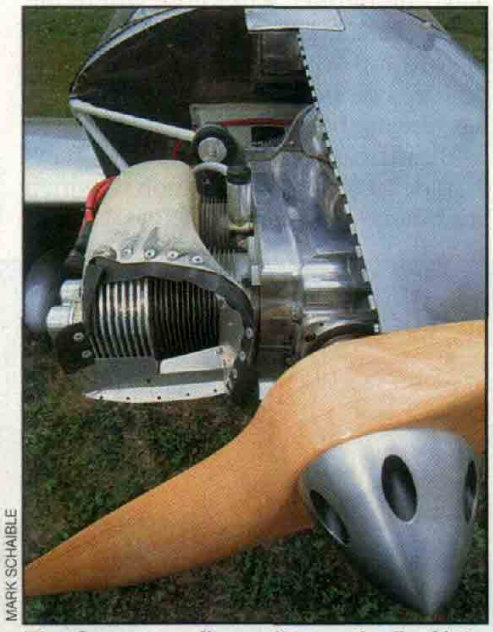
The Sonex has a direct steering tailwheel (no springs) like those Steve Wittman used on his Tailwinds and racers.



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The Sonex cowling splits vertically. Note the machined aluminum spinner. It looks good and allows visual inspection of the prop bolts.

(Below) The four cylinder Jabiru installed in the taildragger prototype.

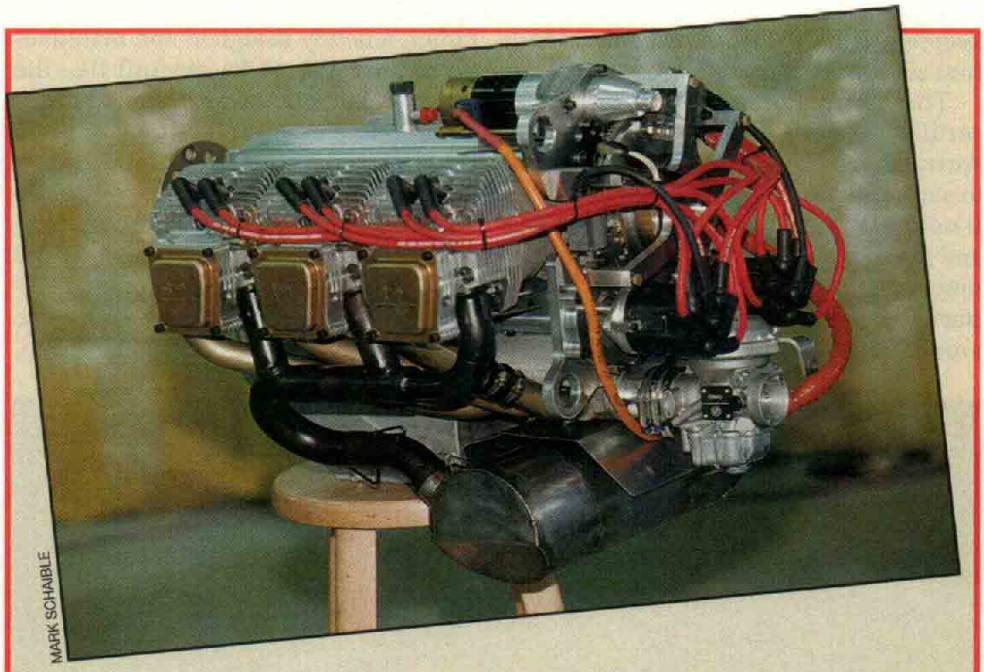
MARK SCHAIBLE

that wing was stressed to destruction on February 15, 1997. All involved were elated that it went to 126% of its design goal before it finally buckled about two feet out from the wing root. A report on that test appeared in our April 1997 issue.

Once the assembly stage was reached, all hands were turned to completing Sonex, Ltd.'s taildragger in time for display at Oshkosh '97 and to serve as the flight test airplane. By this time the decision had been made to power it with the compact little 80 h.p., four-stroke, air cooled Jabiru engine, and it was displayed with one of the Australian-built powerplants at Oshkosh '97 (see ***Sport Aviation***, October 1997). As reported in our April and May 1998 issues, Sonex N12SX was flown for the first time early on the morning of February 28, 1998. John Monnett came back all smiles and essentially trouble-free flight testing has continued through the spring and early summer of this year. The first of the trigear versions to be completed will be on display this month at EAA AirVenture Oshkosh '98 . . . and the availability of plans will be announced.

What has emerged from the design, prototype building and flight testing process is a slick looking little sport-plane-for-two with a span of 22 ft. and a length of 17 ft. 7 in. Empty weight with the Jabiru engine is 550 lbs. and gross weight is pegged at 1,050 lbs. With a wing area of 98 sq. ft., the wing loading is 10.71 pounds per square foot. The useful load is 500 lbs. of people, fuel and baggage. The airframe's limit load is a little over six Gs at 800 lbs. Max speed with 80 h.p. up front is 150 mph at sea level. 75% cruise at 8,000 msl is also 150 mph. The stall occurs at 40 mph. Fuel capacity is 12.5 gallons and range at 75% is about 320 miles.

The cowling originally designed for the Sonex had cheeks to accommodate the width of a VW conversion. The some six inch narrower Jabiru did not require them, so the prototype cowl is very compact and flows directly back into the fuselage without a break or joggle. The Sterba fixed wood prop is 54 inches long and has a 46 inch pitch. The spinner is actually the prop's thrust plate, machined out of a block of aluminum to a pointed shape. This is a clever solution to the problem of crack-prone conventional spinners and back plates and is in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SIX CYLINDER JABIRU

As this article was being written in late June, Sonex, Ltd. took delivery of one of the first six cylinder Jabiru engines to be produced. Rated at 120 h.p, it is essentially the four cylinder model with an extended case and two additional cylinders. It has a larger oil sump, but, otherwise, is little changed from the well-proven Jabiru flat four. The plan is to display the new six on the trigear Sonex at Oshkosh, then install it in the taildragger N12SX pictured here. It should be quite a performer with that much power.


MARK SCHAIBLE

keeping with the low parts count criterion set for the Sonex.

The Jabiru engine, which has been certified to European JAR standards in Australia, is CNC-machined from stem to stern and is a marvel of compactness. It comes with a stainless steel exhaust and muffler system, dual electronic ignition, a Bing carburetor, a lightweight starter and alternator. It is not a conversion of any existing engine, but is, rather, a newly designed and manufactured powerplant for aircraft like the Sonex. The Sonex was designed to accommodate essentially any engine in the 80 to 120 h.p. range, so long as their total installed weight is not over 200 pounds. VW conversions are certain to be popular for use in the Sonex because they are the least expensive of the readily available engines in the recommended power and weight range.

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Because the wings are removable, all the fuel is contained in a 12.5 gallon tank in the fuselage, just aft of the firewall.

The trigear version of the Sonex will have the simple, lightweight nosewheel steering mechanism John Monnett developed years ago for the Sonerai. A linkage off the rudder pedals, with a spring to absorb shock loads, it allows the use of a brake lever much like those on Piper Tri Pacers and the early Comanches. The same inexpensive Azusa cable-operated mechanical brakes John has used on his homebuilts for nearly 30 years are used on the Sonex, and the hand brake is used on both the taildragger and trigear versions. This is feasible on the taildragger because Steve Wittman's direct linkage tailwheel steering is standard. Once again, this fits the low parts count, ease of building and low cost criterion.

In the cockpit, a single, center-mounted stick is provided and a throttle can be mounted on both sides of the cabin. N12SX is set up to be flown from the left seat and has the throttle and hand brake lever on the left sidewall. The expansive swing-over canopy and long, sloping windshield allow a truly panoramic view in every useful direction. Particularly desirable is the view over the nose in the three-point attitude. The Sonex has a set of rather large flaps that are useful for lowering the nose on the landing approach and creating enough drag to allow the pilot to get the clean little airplane down where he or she intends to put it. A trim tab located on the left elevator and actuated by a lever in the cockpit completes the control system.

At this writing in late June, N12SX was nearing the completion of its flight test program. John is absolutely tickled pink with the performance, handling, quietness and economy of the airplane to date. We'll have a flight report in a future issue, but, meantime, more information on the Sonex is available from: Sonex, Ltd., 167 N. Oakwood Road, Oshkosh, WI 54904, phone/Fax: 920/231-8297. Web: http://www.vbe.com/~sonex

When the kits are in production, European sales will be through an Italian company headed by Rocco Bubbico. The address is: ARES SRL, Via Papiria 54/A, 00175 Roma, Number IVA 04604531006 ◆