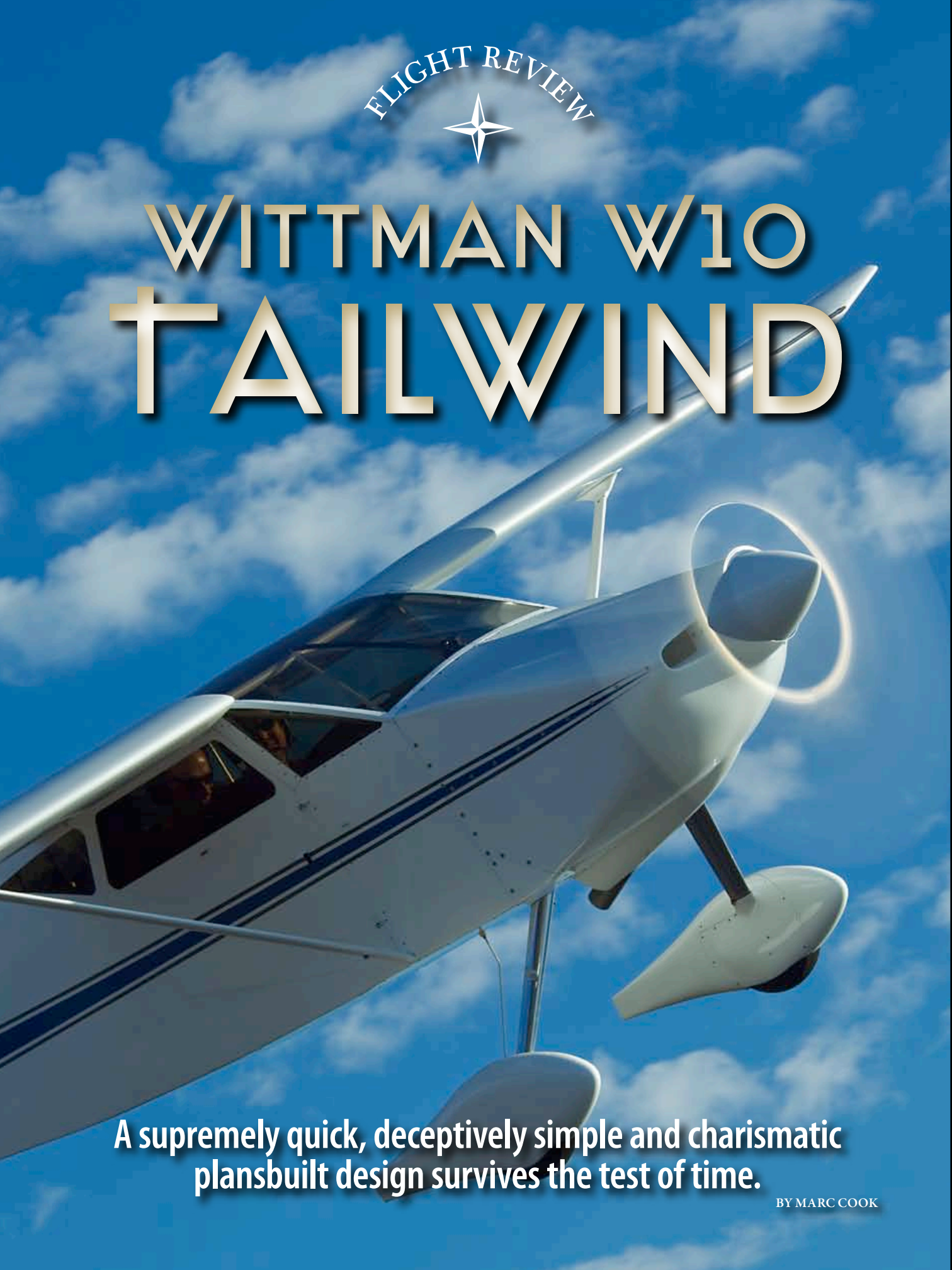
FLIGHT REVIEW

WITTMAN W10 TAILWIND



A supremely quick, deceptively simple and charismatic plansbuilt design survives the test of time.

BY MARC COOK

Builders joining the ranks in the last decade or two probably have a passing knowledge of Steve Wittman, recognize the name, but not much else. Most are aware of his contributions to landing-gear design—a slim tapered steel rod to replace the flat spring-steel or Cub-style designs popular in the infancy of homebuilding. Wittman divined that a carefully shaped metal rod could be light, strong and durable, and be easily slid into a mating socket inside the fuselage. Elegant, clean, superior. The Wittman gear is still among the most popular choice for fixed-gear homebuilts.

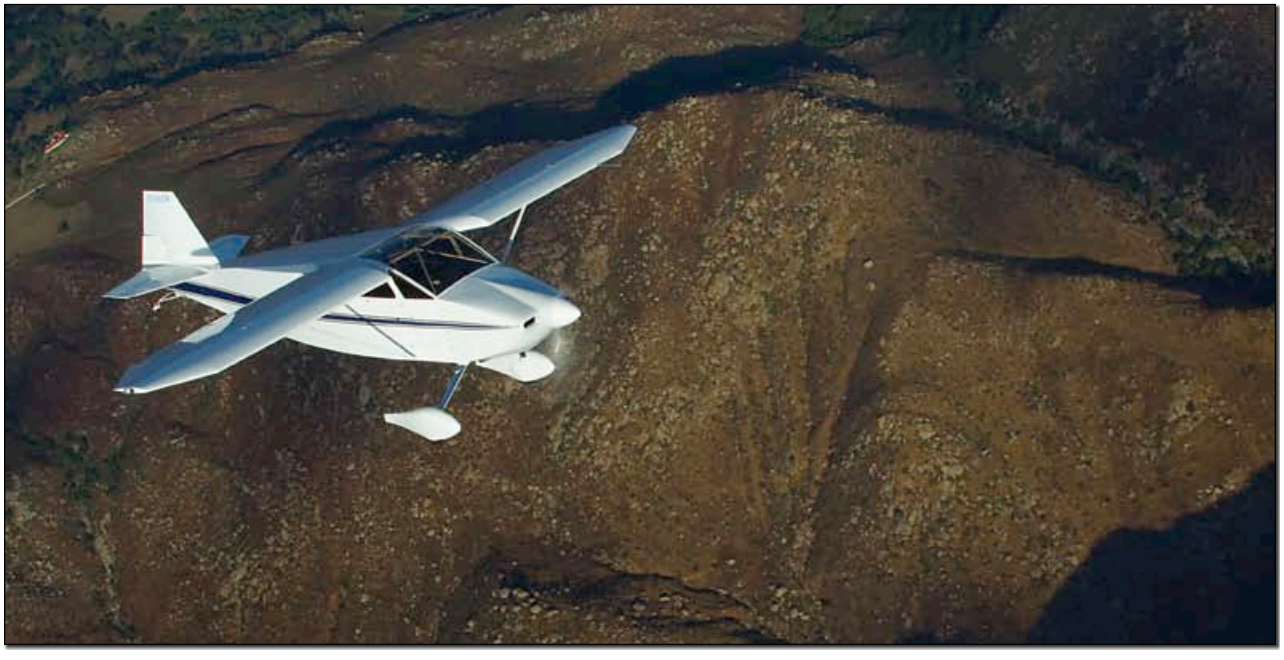
Tailwind builder Jim Rust.

Wittman was an eager air racer, that's true, but his accomplishments extend far beyond success in competition. The Tailwind design was a true pioneer in the Experimental/Amateur-Built field, and Wittman offered his airframe, body and expertise to prove the strength of the design and establish G-load limits for homebuilts. His was also the first aircraft to be approved to carry passengers (not for hire), a freedom we take for granted today. In 1953, when the Tailwind first flew, the sport that would eventually cater to 30,000 airplanes and many more pilots was still an oddity that followed the postwar boom and crash of the general-aviation market.

As the 1950s becomes a blurry image in the rearview mirror, Wittman's other accomplishments threaten to be consumed by time.

But not if builders like Jim Rust have anything to do with it. Among Wittman's many accomplishments are two standout homebuilt designs that set the bar for speed and simplicity, and that remain fairly popular aircraft for plans-builders today. They were created at a time before computer-controlled manufacturing allowed complicated shapes in aluminum, before fiberglass had taken hold, and while the production-aircraft manufacturers were still using steel-tube, wood and fabric.

Much of the Tailwind design derives from the materials chosen and the understanding that builders of the time wouldn't have access to much more than a hacksaw, welding set and a few basic airplane-building tools. Compound curves, the very thing so flaunted by the new-age plastic airplanes of the 1980s, are difficult to create in your garage, so the Tailwind has few of them. The slab-sided fuselage may look stodgy and un-aerodynamic, but that's not true. In fact, the sharp break at the corners helps reduce interference drag between the wing and the fuselage, and that's one of the big drag producers in light aircraft. A boxy shape also has inherently more structural



Photos: Kevin Wing, Courtesy Jim Rust

A popular modification is to substitute simple folded-sheet aluminum parts for the original fabric flaps and ailerons.

A cowling of Jim Rust's own design follows a propeller his company manufacturers. Doesn't this guy outsource anything?

rigidity, so the tubular members can be smaller, lighter and (important in the day, and today) less expensive.

"I've always been interested in Tailwinds," says Rust, whose Tailwind is such an amazing display of workmanship that the photos truly do it an injustice. "My dad started one but wasn't able to finish. It made me aware of Tailwinds, and I would always see them at airshows. It took several years before I was able to begin construction, and even then I spent a lot of time just gathering parts before I began what you would call building."

Performance Based

It wasn't just a sentimental bent that pushed Rust to build the Tailwind. "I really put a pencil to the performance numbers," he said, "and it comes out really well. For the power, there's really nothing that meets or exceeds the Tailwind's performance." Think about that. Fifty-eight years ago, the first Tailwind design was being developed, and today it's still competitive. Don't believe us? In 1994, the CAFE Foundation tested Jim Clement's 160-horsepower W10 and recorded a barograph-derived, super-stinkin'-accurate cruise speed of 188 knots on 9.6 gph at approximately 7000

So Much for Backstory: How's It Fly?

"If it isn't light, it isn't right!" That's the opinion of Jim Rust, owner of Whirlwind Propellers and builder of this immaculate Wittman Tailwind. He obviously followed his credo in building N316TW, which weighs in at 875 pounds basic weight. This is especially noteworthy because the Lycoming IO-320 engine and constant-speed propeller (one of his, naturally) weigh approximately 275 pounds. That leaves a scant 600 pounds for the airframe and avionics.

After waiting almost a week for the Southern California weather to clear, I was eager to fly this classic homebuilt. I expected a different experience and I certainly wasn't disappointed. Although I've flown aircraft covering the gamut from supersonic fighters to bombers to helicopters to light aircraft to the Goodyear blimp, this airplane was different from any I'd seen: excellent performance, good stability, but with, for lack of a better term, weird control characteristics.

My walk around the airplane gave me an impression of utility. Not glamorous, but functional. The wing intersection with the slab sides probably creates less interference drag than it would with a conventionally round fuselage. There's debate about whether the airfoil-shaped fuselage contributes any appreciable lift. The wings look small (24-foot span), but for an extremely light aircraft, they don't need all that much area.

Climbing into the austere cockpit wasn't difficult even for this 69-year-old, the unique shared control stick helping a lot. Just back up to the seat, sit down and swing your legs in. Once I was seated, all of the controls felt natural with no appreciable breakout force required. Full throw right aileron did push my leg a little (sitting in the right seat), but I could still get full deflection. The cockpit for two was surprisingly roomy given the size of this fuselage. Rust didn't add weight with soundproofing or a lavish stack of avionics or a plush interior. This airplane was designed for VFR fun and travel, and that's what he optimized it for. Functional. Admirably so.

During the build, you can see the Cessna-style baffling and metal boot cowl, along with the modifications to the engine mount to accommodate the Grove landing gear.

feet. Its best performance was 189 knots true at 8666 feet and 11.8 gph. Perspective check coming up: CAFE also tested a Lancair 320, which was in the 220-mph range (191 knots) at 8000 feet. Box versus Coke bottle. Fixed gear versus retractable. Elbowroom versus, well... not so much.

"The key to Tailwind performance," says Rust, "is that it's a small, light airframe with good aerodynamics." Indeed, his Tailwind weighs just 875 pounds empty, which is pretty good against the 1425-pound maximum gross weight. Externally, his is identical to the plans for the later W10, including

Engine start was typical for an IO-320. Nothing noteworthy there. The same held true for runup and operation throughout the flight.

Visibility was adequate during taxi, excellent out the sides, but restricted over the nose. It was possible to taxi without S-turns, however. Tailwheel steering with a spring cartridge was responsive, but needed assist from the brakes for entering or exiting sharp turns.

The 160-hp tied to the constant-speed propeller made for a spirited takeoff, even at max gross weight. We had 25 gallons of gas, plus two pilots, adding up to the 1450 max gross. By the time the tail came up, we were nearly ready for liftoff at 55 mph. No appreciable rotation is required, just a slight pull on the stick. It went so quickly, I didn't get a good estimate of the takeoff roll, but it was on

Old school, new school: Rust's Tailwind sports a Dynon SkyView EFIS backed up by a Trio autopilot, Becker com and transponder, and analog engine gauges.

the tapered, upswept wingtips—the original W8 had simple tips on the constant-chord wing—seemingly too-small airfoil-shaped lift strut, and the size and configuration of the tail section.

Mods & Ends

Not to say Rust's airplane is right off the pages of the plans. For starters, he built a set of integral wing fuel tanks. The normal way is to build a welded-aluminum tank slung beneath and ahead of the instrument panel. The capacity called out in the current plans is 35 gallons. Rust has access to high-tech composites, so he built what amount to structures within structures. A pair of carbon-fiber boxes hold the fuel and extend from one rib outboard of the attach points to three ribs shy of the tapered tip. Each "box" contains internal ribs that carry torsional loads. The tanks are bonded to the front and rear spars and carry small cap strips to locate

the order of 500 feet. Once airborne, we retracted the one notch of flaps and accelerated to 110 mph indicated (MIAS) for the climb. The aircraft exhibited almost neutral speed stability during the acceleration, requiring no trim; 110 IAS showed a 1500-fpm climb rate, which closely matches Rust's flight-test results. We cruise-climbed at 140 IAS and about 650 fpm. An aerospace engineer, Rust did exhaustive flight testing on the airplane. My independent spot checks on this flight closely agreed with his results.

We set economy cruise at 20 inches of manifold pressure and 2300 rpm when we leveled at 5500 feet MSL. Flying opposite headings to eliminate wind effects showed a ground speed of 150 knots or 170 mph. Excellent performance. Rust's exhaustive flight test yielded 201 mph at 11,000 feet, 20 inches of manifold pressure and 2400 rpm. Leaned to a 7.5-gph fuel burn pencils out to over 25 miles per gallon. That's much better than my SUV!

Along with this excellent performance, the aircraft exhibited good stability. Short period damping was deadbeat, there was no Dutch roll discernible, spiral stability was neutral, and the phugoid damping was positive with a period of approximately 30 seconds. It's possible to easily lift a wing with rudder, and steady heading sideslips confirmed that. The aircraft was slightly speed stable throughout the flight envelope. That said, it was extremely difficult to perform precise flight-test measurements because of the weird control characteristics the aircraft exhibited.

All three axes have light air loads and are sensitive. This gives the illusion of responsiveness, but the stable characteristics of the airplane counter that. For example, full aileron throw produced only about 100° per second roll rates. The pitch trim system is somewhat crude, but it really doesn't matter, as you don't have to trim much. It was literally impossible to attain a normal flight test trim shot of within 0.5 knot of speed, 10 feet in altitude, and 1° of heading from aim conditions and have it remain there hands-off for at least 5 seconds.

Some adverse yaw was obvious on turns and required proper rudder coordination, not trivial with my heavy feet. I tended to overcorrect in the yaw axis. The rudder had no centering characteristic; it was happy to trail either left or right of center. To keep

A modified door presents a wider portal for pilot and passenger comfort.

the plywood skin. Total capacity is 50 gallons, according to Rust, "and probably a doubling of the wing's torsional strength. Actually, the whole airplane is strong. I analyzed the structure—wingspars, strut and cage—and it easily meets the criteria for an airplane certified in the Utility category."

Removing the tank from the fuselage improves access to the panel and creates more room for goodies. But those tanks are not the most visible change you'll see in Rust's Tailwind. "I decided to use a set of Robby Grove's airfoil-shaped aluminum landing-gear legs," says Rust. "They're a really cool set, with a 6500-series airfoil shape and gun-drilled passages for the brake fluid. I created a new engine mount with pads to locate the gear; it's similar to what Grove sells for the Van's RV-8."

Tailwind watchers will also notice that Rust's W10 has the Clement door mod, which increases the size of the door opening by pushing the rearmost frame members aft at the top; this is a

the ball centered required feet on the pedals at all times, applying slight pressure. Rust has flown four Tailwinds to date and said he noted this problem with two of them. The reason I call these control characteristics weird is not just because they're so different, but because they just don't bother you. You adapt relatively quickly and enjoy flying the airplane even though you fly it differently. It's worth noting that Rust is planning to test a variety of airframe modifications to see if he can reduce or eliminate this characteristic.

Stalls were honest in the airplane. I performed one cruise and one approach configuration stall with 15 inches manifold pressure and 2300 rpm. I decelerated at about 1 mph per second. The aircraft felt solid in slow flight and the approach to stall. The warning, a slight burble, started at about 8 mph above the stall and increased to moderate intensity until the aircraft stalled at 48 mph IAS clean and 46 mph IAS dirty, an unmistakable warning that will serve owners well. The stall was an abrupt, clean break with slight right roll, easily controllable and recoverable. Reducing back pressure was enough to break the stall and recover with less than 100 feet of altitude loss.

I let the speed creep up on the descent back to the field, but traffic considerations kept me from completing any more test points. The air loads on the controls did not appreciably increase with speed, and the sensitivity appeared to remain about the same as noted previously. The KSEE traffic pattern was extremely busy, madhouse comes to mind, so we just flew a straight-in approach to 27L, 2738 feet long, plenty for this airplane.

Visibility throughout the flight, including the final approach and landing, was good. An approach speed of 85 mph IAS was comfortable down to the flare with about a 65 mph touchdown. The aircraft feels light on its feet initially, but retracting flaps allowed it to settle solidly to facilitate control on the ground.

Rust's "make it light" philosophy did have one drawback. The airplane is extremely noisy with the engine and air noise, making conversation and radio monitoring difficult. Still, a good set of noise-canceling headsets made the trade-off worthwhile.

Bottom line: The Tailwind offers a lot of bang for the buck and is an enjoyable airplane to fly.

—Paul Nafziger

common modification to improve access to the cabin and baggage area.

Rust's W10 uses the 150-hp IO-320 Lycoming, a common choice these days. The design has flown with many different engines, with Wittman preferring the six-cylinder Continental O-300/C-145, which was used in the Cessna 170s and early 172s. "But I know a lot of them are flying with Lycoming O-290s, which I think you could get for a few hundred bucks in the early days," Rust says. While many Tailwinds use a fixed-pitch prop, Rust uses one of his own Whirlwind constant-speed props. (You are surprised at this?)

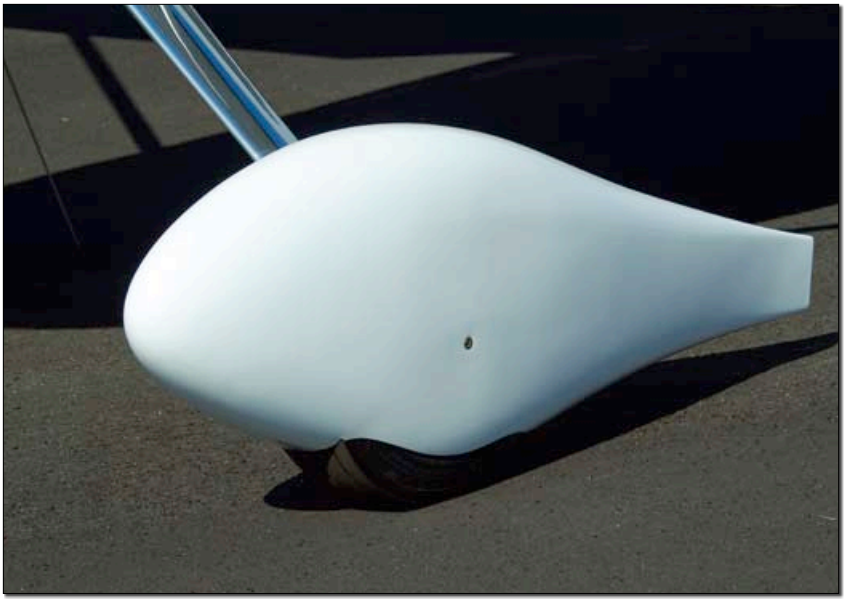
Building It

"Well, honestly," Rust says with a chuckle, "the plans are pretty terrible. But the good news is that there is a big support group around the airplane. Guys like Jim Clement [the builder whose airplane was tested by CAFE and provider of many prefabbed parts for the W10] are around to help, and there are enough flying that many of the difficult parts of the build have been figured out by someone else. There's a big fan club and a lot of enthusiastic builders out there." Getting peer support is not an issue.

"It's not an intimidating build," Rust

The Wittman control system uses a center stick with an overarching member to provide the feeling of a conventional stick with fewer parts and no need to sling a leg over.

Homemade wheelpants boost speed.



Specially modified Grove brakes are narrower than standard, allowing for a snug fairing.

Rust's personal touches include these large-capacity wing tanks, made from carbon-reinforced glass and fitted with internal ribs to increase torsional stiffness. He got 50 gallons and a bridge-strong wing.

continues. "A lot of guys get hung up on the welding. It's just not a big deal. You can have the fuselage welded and ready to go in 200 hours. I decided to TiG weld mine because I had the equipment and skill, but a lot of guys gas weld the fuselage and that's fine. It's not a complicated structure to make." The 4130-spec frame doesn't have a lot of complex joints, and it can be laid out without sophisticated jigging. "This is what I love about the Tailwind," says Rust. "It's an elegantly simple airplane that you can build with a hacksaw and a torch in your garage."

The wings are straightforward, too. "You can build one in 100 hours," says Rust. In all, the Tailwind can be finished in around 2000 to 2500 hours, so say those in the know, but that's assuming you don't go crazy with modifications and take it easy on the avionics suite. "It's interesting that the basic structure goes together easily, but you can spend a lot of time on the little things like fitting the glass [including windshield that wraps up and over into the roof] and getting the seats the way you want them. Plus, you might get to make your own cowling. I used my design, but there are sources for prefabbed cowlings." Back when the design was new, builders were left on their own. "It didn't really say what to use," Rust continues. "That's why you'll see some with Piper stamped nose bowls, and some made totally from scratch. Until recently, Tailwinds all looked quite different because this part was left to the builder, but they're starting to look more alike now."

The control system is very simple, with pushrods and torque tubes for pitch, roll and flaps. Here, the center of the concentric shafts feeds the ailerons, while the outer moves the plain flaps.

Half a rudder and still powerful: The Wittman's truncated rudder gets the job done, though Rust's example still has a bit of surface float; it's not an uncommon Tailwind trait.

In all ways that matter, the construction methods used in the Tailwind are conventional, at least by 1950s standards. Wood wing, steel-tube fuselage, fabric covering on the fuselage and tail group—all materials and practices familiar to anyone who has restored a Cub or repaired a Maule. And time keeps improving the case: The aluminum wing control surface on Rust's airplane is a popular modification—replacing the steel-tube/fabric arrangement used originally—to reduce weight, cut costs and further simplify the design.

Still Uncommon

It's more a commentary on modern building practices favoring a high level of prefabrication that there aren't more Tailwind projects being completed. Four years ago, in our 2007 Plansbuilt Buyer's Guide, 375 W10 Tailwinds were said to have flown. That number is up by just two in our most recent survey of plansbuilt designs—though we have to wonder if the accounting or reporting is a little suspect.

Strength may come in numbers—even as it's fair to say that Tailwind enthusiasts are as vocal as any larger, equally partisan group—but for Steve

The pronounced "kick" in the leading edge helps put the wing where it needs to be for weight and balance without sacrificing (as much) forward vision.

Rust's W10 displays the "composite" nature of the design: fiberglass, aluminum, fabric, wood and steel tube. Probably a kitchen sink in there, too.

Wittman's enduring design there is the cachet of having created a machine from "scratch," and having done so for a fraction of the cost the prefabbed machines exact. It's not uncommon to spend less than $30,000 for a very nice example with reasonable equipment. If that isn't a lot of airplane for the cash, we don't know what is. ✢

To order Tailwind plans, call 800/861-3192 or visit www.aircraftspruce.com. Find a direct link at www.kitplanes.com.

WITTMAN W10 TAILWIND

Price (basic plans)	$195
Estimated completed price	$12,000 - $40,000
Estimated build time	2500 hours
Number flying (at press time)	377
Powerplant	Lycoming IO-320, 160 hp @ 2700 rpm
Propeller	three-blade Whirlwind constant-speed
Powerplant options	Lycoming O-290, Continental O-300

AIRFRAME

Wingspan	24 ft
Wing loading	15.49 lb/sq ft
Fuel capacity	35 gal
Maximum gross weight	1425 lb
Typical empty weight	880 lb
Typical useful load	545 lb
Full-fuel payload	340 lb
Seating capacity	2
Cabin width	40 in
Baggage capacity	80 lb

PERFORMANCE

Cruise speed	180 mph (156 kt) TAS
	7500 ft @ 75% of max-continuous, 9.0 gph
Maximum rate of climb	1200 fpm
Stall speed (landing configuration)	45 mph (39 kt) IAS
Stall speed (clean)	49 mph (43 kt) IAS
Takeoff distance	750 ft
Landing distance	650 ft

Specifications are manufacturer's estimates.