DOUBLE PUSHIN'

Glass Speedster

IS THERE A VELOCITY TWIN IN YOUR FUTURE?

BY BUDD DAVISSON

WHEN WAS THE LAST time that the homebuilding market had a twin-engine airplane added to the menu of neat things we can build? If you don't count the AirCam (not usually thought of as a high-speed cross-country machine), the Rutan Defiant is the only one that comes to mind. It first flew in 1978; unfortunately, plans were reportedly discontinued five years later. However, that was then, this is now, and the Velocity Twin is very definitely "now" in every sense of the word.

As homebuilt aircraft go, the V-Twin is about as sophisticated as homebuilt airplanes can get and still be more or less "normal." And

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the only reason it comes even close to "normal" is because the homebuilt aircraft market stopped seeing futuristic canard shapes as being abnormal nearly two decades ago. Since Rutan surprised us with the VariEze, we've revised our definition of "normal." Step outside of sport aviation, however, and the V-Twin would still be judged as being wildly exotic and abnormal.

In talking about the concept of a homebuilt twin, we're not even going to bother to get into the is-a-twin-actually-safer controversy because that'll always be a hot topic with no ironclad answer: Decisions made one way or the other are usually based on personal preference and opinion. There will always be the contingent that says a twin isn't actually safer because, if you lose an engine on takeoff, there's a chance you'll lose control of the airplane and maybe spin it.

Wait a minute! Yes, we will get into that controversy because, when it comes to single-engine control, Duane Swing, EAA 71724, engineer and co-owner of Velocity, designed the possibility of spinning out of the V-Twin. In fact, the company refers to the V-Twin as the No-Spin-Twin. So, how'd it do that? With some clever engineering, that's how.

Basically, the V-Twin is a slightly modified version of its well-proven XL line of single-engine Velocitys. The XL and XL-5 are both traditional, canard-type aircraft but have cabins much larger than other four-place kit aircraft, and with six-cylinder engines, they offer speeds in the 200-knot range.

Virtually all canard aircraft produced in modern times pay homage to Burt Rutan's revolutionary Eze designs of the 1970s. Canards aren't new (remember the Wright brothers?), and a number were experimented with during World War II (Curtiss XP-55, etc.), but it was

SPECIFICATIONS

Engines: IO-320 (160 hp)
Propellers (full-feathering): M-T three-bladed
Empty weight (standard): 2,000 pounds
Gross weight (standard): 3,200 pounds
Wing loading at gross: 21.0 pounds per square foot
Useful load: 1,200 pounds
Fuel capacity: 100 gallons
Payload with full fuel: 600 pounds
Seating: four or five

The XL cockpit/door dimensions, which are larger than many "normal" twins, were retained on the V-Twin.

The 160-hp, fuel-injected Lycomings are burning 6 gallons each at 175 ktas, or 8 gallons at 185 ktas.

Rutan who brought pre-existing ideas like canards and winglets out of cobweb-covered corners and into the technological daylight and put them to use. In the Ezes he proved the worth not only of canards, pushers, and winglets, but also revolutionized much of aviation by making composite construction both understandable and acceptable. By the 1980s, his concepts had spawned an almost endless line of similar butt-first designs, the Velocity being one of them.

Originally designed and produced by Danny Maher in Sebastian, Florida, one of the first kits was sold to the father and son building team of Duane (the engineer father) and Scott (the MBA son) Swing of Dayton, Ohio. They built several Velocitys, and in the process, designed and built a retractable gear system that could be adapted to existing Velocity kits. In so doing, they had to set up limited production of the required parts. So, when the Velocity business came up for sale, they stepped up to the bar, purchased it, and moved their families to Florida. This was in 1992, and one of the more obvious trademarks of the company has been the constant

Co-owner and engineer Duane Swing designed the V-Twin to give twin-engine economy, performance, and safety not found elsewhere.

PHOTOGRAPHY BY **CHET WEHE**

improvement of its kits (going to pre-molded components, for instance) and introducing new, improved versions of the basic Velocity. The V-Twin, however, was a leap of faith in a very different direction.

Where the Velocitys were aimed specifically at the high-performance, four- (and then five-) place, cross-country market, the V-Twin is venturing into a new market niche that has one foot in homebuilding and the other in the general aviation light twin market.

In recent years, the general aviation light twin market has had severe insurance pressure placed on it. Underwriters are reacting to accident statistics that say owner-flown light twins have a higher percentage of accidents. This is because of the aforementioned problems when an engine is lost at the wrong time, e.g., on takeoff. This problem is in direct contradiction to the supposed safety of having two engines, versus one, in the event of a failure.

Duane has been a longtime owner of Twin Comanches (five in all), so he's very familiar with the engine-out problems that are possible. He knows that the asymmetric thrust of one engine combined with degrading airspeed clearly defines a single engine minimum control speed (V_{MC}), below which the pilot can no longer control the yaw and the airplane will roll toward the dead engine at a speed well above actual stall speeds. Worse yet, if the airplane approaches a stall, the yaw guarantees a spin.

Duane was also totally aware of the risks of flying single engines at night or in hard IFR conditions. The loss of an engine in those situations was likely to be fatal unless the pilot was extremely lucky, something that cannot be depended upon. This is why many companies won't allow their employees to fly at night or IFR in single-engine airplanes.

Those two factors, the possible loss of control when losing an engine in a twin and the probable negative outcomes of losing an engine in a single, seem to present something of a conundrum. Duane's recognition of both of those factors was combined with one more factor that gave him a real push toward designing a better, safer twin: His wife wouldn't fly with him in a single-engine airplane. So, the die was cast: a Velocity Twin was definitely in his future. And it would be designed specifically to avoid the stall/spin possibilities of power failure on takeoff.

In the case of the Velocity Twin, the canard has a 3.5 degree higher angle of incidence than the wing, and they are the same airfoil. This is an important detail because, with that setup, the canard will stall well ahead of the wing and the nose will automatically go down, always keeping the wing below the critical angle of attack. In other words, the pilot can't actually cause the wing to stall, and without a stall, the airplane isn't going to spin. Both yaw and critical angle of attack are necessary for a spin to develop.

To control the yaw, the larger canard angle is combined with a single, large, centrally mounted vertical stabilizer and rudder, which eliminates both the winglets and the not-very-effective "rudders" that most canard aircraft have mounted on the winglets. These are radical departures for a Rutan-based design. Also, because there is very little fuselage between the engines (160/180 hp IO-320/360 Lycomings) they can be mounted much closer together than on conventional twins. This greatly cuts down on the effects of asymmetric, single-engine thrust because the moment arm is much shorter. The combination of all of these factors results in a twin-engine airplane

Engine controls are traditional.

Winglets were replace by a large central fin and rudder to give sufficient control with one engine out and the other at full power.

The engines are mounted closer than normal to centerline, which reduces asymmetric thrust with a dead engine.

that basically has no single-engine, minimum controllable speed. Flight tests have shown that even with the stick all the way back in what should be a stalled condition, there is enough rudder authority available to cancel out yaw at any speed and power.

An argument could be made that you can buy a really good Twin Comanche that, while it won't give all of the performance of the V-Twin, would be cheaper and you wouldn't have to build it (the kit is $110,000 plus engines, etc.). However, the T-Comanche and virtually every other light twin in the same performance category will have the same traditional slow-speed, engine-out characteristics that Duane worked so hard to eliminate in the V-Twin.

Although based on the XL, the V-Twin wing has a slightly broader chord and gained 2 feet per side giving a total span of 34 feet 10 inches. Also, the center section, firewall to firewall, is gusseted to the integral fuel tanks. Other than that, the center section was so stiff to begin with that it needed no other beefing up. Also, the vertical tail, which is a separate component, is designed to provide total, single-engine yaw control for up to 230/240 hp per side.

When powered by the 160-hp fuel-injected Lycomings with electronic ignition, at 8,000 feet it is cruising at 175 knots, which may sound a little slow for a twin, but not when you consider it's burning only 6 gph per side. If you're willing to push that up to 8 gph per engine (75 percent), you'd be looking at 185 knots, which is very respectable. At that kind of fuel burn, the airplane has a range of 1,250 nm.

PERFORMANCE

Rate of climb at gross (two engines): 2,000+ fpm
Rate of climb at gross (one engine): 350+ fpm
Cruise speed: 75 percent power, 185 knots
Fuel consumption: 75 percent power, 16 gph
Absolute range: 75 percent power, 1,250 nautical miles
Endurance: 75 percent power, 6.25 hours
Cruise speed at economy cruise power: 175 knots
Fuel consumption economy cruise power: 12 gph
Absolute range at economy cruise power: 1,400 nautical miles
Endurance at economy cruise power: 8+ hours

Glass airplanes should have glass panels, right? The spacious panel can accommodate any combination of displays, digital or otherwise.

If you come back to 6 gph you'd have eight hours of endurance for 1,400 nautical miles. Better yet, the single engine climb at 8,000 feet is still 360 fpm at gross, and it'll hold altitude on one engine at 12,500 feet.

The V-Twin is only available as a quick-build kit because, as their sales people at Oshkosh said, "Most people who buy an airplane like this are fliers, not builders. They want a fast, totally safe design that offers a much larger cabin than is available anywhere else in the market, and they don't want to spend 10 years building it."

He's referring to the nearly 4-foot width of the cabin, which is huge by any standards. To help impatient builders, the quick-build fuselage comes pre-molded in top and bottom halves with the tail molded separately. The factory says the basic airframe can be assembled in a little more than 1,000 hours plus the paint, interior, and avionics. However, to knock even more time off, the factory has an FAA-approved 51 percent builder assist program at its plant in Sebastian.

It's difficult, if not impossible, to make a blanket statement about how EAA homebuilders look at multiengine airplanes. Or at serious cross-country airplanes for that matter. Still, no matter how the membership is analyzed, there's very definitely a sizable go-fast, A-to-B crowd, as the number of Glasair IIIs, Legacys, and such show. How many of them want to fly at night is another question, but certainly a good number because not all cross-countries begin at sunup and finish before sundown. And no one can totally predict when they'll find themselves talking to ATC, while on the gauges plowing through some unforeseen heavy weather. The real question is how many of the latter are totally comfortable doing such things on one engine. If questions about the safety of such endeavors give any of them sweaty palms, Velocity Aircraft just might have the answers. EAA

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