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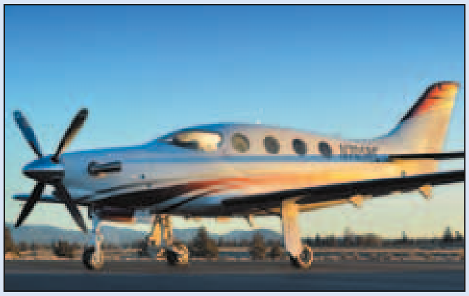

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Epic E1000: Big Power and Speed

Starting with a successful kit-built hotrod, Epic Aviation seeks to certificate a 1200-HP personal traveling machine with jet-like performance.

by Rick Durden

CHECKLIST

- (+) 1200 HP gives a 4000-FPM initial climb and a margin of takeoff safety.
- (+) Experience with years of kit versions gives Epic a leg up on certification.
- (~) Meeting Part 23 requirements is rough; nothing is guaranteed.

To date, the single-engine turboprop market has been a classic economic model of independent niches—the players don't compete directly. The Pilatus PC-12, Daher-Socata TBMs, Cessna Caravans, Quest Kodiak and Piper Meridian target different mission and load needs; there's not much to encourage price competition, although the TBMs are so fast they do go head to head with some jets.

This could change in 18 months—when Epic Aviation hopes to finish certification and start delivery of its 1200-HP E1000 to compete directly with the new TBM 900. Epic offers an amazingly slippery-looking, hell-for-stout carbon-fiber machine with a larger cabin, more payload, max cruise speed within measurement error and slightly shorter legs than the TBM.

With an initial $2.75 million price tag for the E1000—we wonder if Socata will drop its $3.4 million-equipped price to compete. To make it more interesting, the FAR Part 23 certificated airplane Epic is developing started life as an Experimental category, kitbuilt aircraft.

HISTORY

In 2004, Epic Aircraft began selling the LT, a 320-knot, composite, single-engine turboprop, as a kit. Buyers would spend several weeks at Epic's facility, working under supervision, as they complied with the 51 percent owner-built rules for the basic airplane. Once past that hurdle, they were free to contract with Epic for the company to build the rest of the airplane and add on various options.

In 2009, a combination of management shenanigans forced Epic Aircraft into bankruptcy. It was sold at auction in 2010. The new owners started selling kits again. In 2012, the company was again sold, this time to Engineering, L.L.C., a Russian company. It appears to be well-financed and has announced its determination to build a certificated airplane based on the LT—the E1000. Putting skin in the game, the new Epic Aircraft also purchased the old Lancair Columbia/Cessna Corvalis factory on the Bend, Oregon, airport. During our visit to the 200,000 square-foot facility, we saw the last few LT kit-built airplanes being finished up in one building while work was going forward on the molds to build conforming parts for the E1000 in another.

Epic has forecast FAA Part 23 certification of the E1000 in 2015; given all that goes into that process and its requirement for the regular infusion of cubic money—we think there's a pretty good chance it will happen if world sanctions imposed on Russia for its behavior in the Crimea don't shut off the tap. Epic has been hiring engineers and has built and tested some parts of what are to be the conforming prototype airplanes (two are planned and are to be completed this year).

NO CHANGES

We were told that Epic management decreed that the E1000 would simply be a production version of the LT—there were to be minimal changes to the airplane. While that approach sounds good and is intended to keep costs down, the reality is never that simple. Although, having what might be considered to be over 50 "proof of concept" airplanes providing feedback from the field doesn't hurt.

Nevertheless, there will have to be some expensive changes. For example: The seats will have to meet crashworthiness requirements—that's a million bucks just getting the first ones designed and built. Max stall speed under Part 23 is 61 knots, the LT we flew stalled at 63, even with its long, double-slotted flaps. A stall speed above 61 knots generates changes in crashworthiness requirements that can be prohibitively expensive and heavy. We were told VGs are being considered to reduce stall speed and that a stick pusher system may be installed as well.

Because no production-conforming prototype E1000 exists, we flew two different Epic LTs, one only recently completed and one from the middle of serial number range. We were satisfied from our meeting with chief pilot Rich Finley and VP of marketing, Mike Schrader, that the production airplane will have handling and performance at least on a par with the LT. Because handling, stability and control for the LT are close to what will be required for certification, one we flew had weights installed for flight tests for aft CG handling.

AIRFRAME

The LT is, and the E1000 will be, constructed of carbon fiber—at the high end of the spectrum of strength-to-weight ratios of composites. The wing is a one-piece unit that has been tested to over 10G, as has, we were told, the conforming ailerons. On one hand, building to such a load factor means the structure is too heavy, especially given the very conservative FARs on composite structure strength. However, it also gives a great deal of room for the airplane to grow.

The fit and finish of the LTs we looked at was first rate—one of the benefits of composites. The absolutely smooth, clean skin is formed into a number of compound curves that help with both high- and low-speed performance and would be unreasonably expensive to attempt on a metal airplane. The windshield appears to simply be a transparent section of the overall airframe, so smoothly is it faired. The wing leading edge has an unusual curved taper—we learned it was purely for esthetics, not performance. We were a little surprised at the modest size and shape of the winglets and can't help but wonder if they will be tweaked in the future as Pilatus has now done a few times on the PC-12.

POWER

The engine is a Pratt & Whitney PT-6-67A with a 1825-ESHP thermodynamic limit, derated to 1200 SHP. TBO is 3500 hours. It swings a four-blade prop; we couldn't help but wonder if a five-blade isn't somewhere on the drawing board, although with a 4000-FPM initial rate of climb, the extra weight may not be worth any incremental performance gain.

The dual buss electrical system is powered by a starter/generator and backup alternator—outputs to be defined. There will be two batteries, mounted on the firewall. The hydraulic landing gear has an emergency nitrogen blow-down backup. A total of 288 gallons of fuel can be carried in the two tanks—

Long span, double-slotted flaps have maximum travel of 40 degrees, above. Main landing gear is trailing-beam design, right.

a maximum of 400 pounds of fuel imbalance is acceptable. It is anticipated that a device to automatically switch tanks will be installed—the LT requires that it be done manually. Max pressurization differential is 6.5 PSI.

De-icing will be provided by leading edge boots. Known icing certification will probably require some form of windshield anti- or de-icing. We were told that the windscreen is so highly raked that simply using defrost has been adequate per owners in the field. Schrader and Finley said that bleed air will probably be used.

WEIGHT

Gross weight is to be 7500 pounds, with an empty weight of 4400 pounds targeted—Epic wants a full-fuel payload of over 1100 pounds so it can be a fill the seats and fill the tanks machine, besting the TBM by more than 300 pounds. The reality of certification usually means empty weight creep; we'll be watching to see how effective Epic's engineers fight that battle.

INSIDE

The cabin door is aft of the wing, just ahead of the rear seats. There are two seats in the cockpit, and four in the cabin. There is space for baggage behind the rear seats. Currently 500 pounds is allowed.

THE IMPOSSIBLE TURN

No matter how low the risk of an engine failure is for a turboprop engine, the fact that there's only one attached to the airframe invariably raises "What do I do if...?" We have not been able to find any positive correlation between phase of flight or power changes with engine failures on turboprop engines—so the smart money says it's most likely to happen in cruise because that's where the engine spends most of its time.

With a 17.5-to-1 glide ratio and 700-800 FPM rate of descent, the Epic LT and upcoming E1000 have quite a radius of action should something go wrong at FL280—as well as a fair amount of time to troubleshoot and see if usable power is available.

However, power loss in cruise just isn't what elevates a pilot's pulse rate—it's the loud silence just after takeoff and the question of whether to land straight ahead or attempt "the impossible turn" back to the airport. After flying the Epic, we think that the sheer power and acceleration of this airplane modifies the dynamics of the engine failure on takeoff decision equation. Simply put, the airplane has so much energy within 30 seconds of breaking ground that there's a good chance of making a safe landing following a power loss on takeoff.

To start with, 1200 HP on a clean, 7500-pound airplane means fast acceleration. The book says it will get out and over a 50-foot obstacle in under 2000 feet.

Takeoff procedure is to lift the nosewheel at 80 knots, retract the gear as soon as the airplane begins to climb and raise the flaps when the gear hits the wells while accelerating to 160 knots. On our flights, that speed was reached in less than 30 seconds after breaking ground and the rate of climb was going through 3000 FPM.

Epic Aviation's Chief Pilot Rich Finley demonstrated to us that once 160 knots is achieved, the airplane has plenty of energy to return to the departure runway should the engine fail. The procedure is pull the power lever to idle, the prop to feather and enter a modified Lazy-8: the nose is already high, but pitch is increased and then a turn is initiated. Max pitch, about 25 degrees up, is reached at 45 degrees of turn and the nose starts down—it will get down to the horizon at 90 degrees of turn. Bank is increased through the first 90 degrees of turn, targeting 45-60 degrees.

At 90 degrees of turn, the speed is about 110 knots and the first notch of flaps is selected. The airplane has gained about 500-700 feet since the engine quit. Bank is maintained and the nose drops as needed to hold 110 knots. There's plenty of altitude and energy to get the airplane turned back (a runway return requires more than a simple 180-degree turnaround). The gear is extended and flaps used as needed.

We tried Finley's turn at altitude—it worked. The combination of enough power to generate a lot of altitude in a short time and the low-drag airframe provides a post-takeoff safety margin we've never experienced in a single. The turn will have to be practiced; a pilot who hasn't done Lazy-8s and experienced the constantly changing control forces and complex pitch/bank relationship will need dual.

Finley has also developed what we think is an effective one-size-fits-all procedure for engine power loss in the Epic. It is simply: power to idle, prop feathered and turn toward the nearest airport. We worked through a power loss flow chart he created—up high you have time to troubleshoot, down low you land—and found that it works.

While an engine failure when ATC has you at 4000 feet 30 miles out over Lake Michigan means getting wet, we think the power of the Epic reduces the risk of a bad result during the critical time after takeoff.

Getting into the cockpit seats was pleasantly easy compared to a number of airplanes of this size—there is no console to step over. Visibility is generally good, although the low "eyebrow" of the windshield caused us to think that it was going to be difficult to see into turns—that did not prove to be the case.

The production airplane will have either a Garmin G1000 or G950 panel—the final decision has not been made. An LT will be going to Garmin shortly for the work leading to the integrated glass panel that will appear on the E1000.

FLYING IT

Taxiing is sure-footed and solid. The nosewheel will unlock and castor, allowing the airplane to pivot on one wheel—unexpected and welcome for maneuvering a 43-foot wingspan on tight ramps.

At the risk of getting carried away and waxing rhapsodic, acceleration on takeoff goes beyond "oh wow" and well into the "addictive" arc on one's personal "holy smokes" indicator. 1200 HP pulling 7500 pounds of clean airplane results in a scorchingly short takeoff run (1700 feet over a 50-foot obstacle). The rudder trim (coolie hat on the yoke) is set at full right prior to launch, so the rudder input needed is low. The rudder is nicely sensitive, and we suspect that experience would erase the weaving we demonstrated on takeoff.

The downside to all that power is setting it on takeoff. The 80-knot rotation speed comes up in seconds—trying to get the power lever to the proper torque while keeping the airplane straight is challenging, especially on a narrow runway. Too much torque, and you risk damaging the engine; too little and you don't clear the obstructions. With the computerization available today, having to set power on takeoff on a turboprop is not acceptable. On a hot, single-pilot airplane, automation should keep the workload as low as possible—in our opinion, setting power for takeoff ought to be as it is on a jet; just push it up to where it clicks.

At 80 knots, raising the nose five degrees quickly results in a positive rate of climb; which means it's time to suck the gear up (max retraction speed is currently 135 knots) and then retract the flaps and transition

Composite structure allows exceptionally clean lines and compound curves for maximum cabin size and minimum drag, top. Cabin door is cut from the finished cabin after molding, giving a tight fit, middle. Current mockup of E1000 panel with angle-of-attack indicators up high, bottom.

to a 160-knot climb while watching the rate of climb notch up over 4000 FPM. Additionally, 160 knots is the magic number after takeoff as it gives enough energy to allow a return to a runway behind you if the engine takes the day off.

Time to climb to FL340, max certificated altitude for the E1000, is currently published at 15 minutes. We suspect that is going to prove accurate as we saw over 3000 FPM during climbs through the teens.

CRUISE

A max cruise speed of 325 knots at FL 280, burning 62 GPH, with a VFR range of 1385 NM is forecast for the E1000—it should be easily obtainable as the LT will do that now and Epic is reworking the engine air intake to make it more efficient. Slowing to a cruise speed of 260 knots, fuel flow is forecast to be 40 GPH, which will give a range, with VFR reserves, of 1650 NM. We did not go above 17,500 on our flights—there, at high cruise, we saw 312 KTAS, at a fuel-sucking 82 GPH.

We flew the LT through its full speed range from stall (some warning buffet, a minor bobble marked the break) to Vne (280 KIAS). Controls are moderately heavy, as one expects in a turbine, and remained responsive at all speeds. As might be expected with the kind of power up front, any speed or power change requires retrimming the rudder. It's not a big deal, just something to keep in mind.

Handling in the pattern was solid, although the LT is akin to a jet in that speed changes are not felt—you have to pay attention to speed on approach as there's no sensory indication. 120 knots is used on an instrument approach, with 10 degrees (first detent) of flaps. Close in, slow to 95 KIAS with full flaps and about 15 percent torque to generate a three-degree glideslope. The combination of long-span, double-slotted flaps and the ability to use the prop as a speed brake allows fine-tuning an approach and getting in and stopped easily in under 2000 feet.

Finley advised that thus far, testing of the LT is showing a demonstrated crosswind velocity of 37 knots. With the control authority we observed at low speed, we're not surprised.

PERFORMANCE

Epic advertises the performance of a Cessna Citation 500 on less than half the fuel burn—that's probably about right. The idea is to make the prospective owner pilot think twice about buying a jet.

Another advantage to the turboprop is that the new owner doesn't have to spend two weeks getting a type rating and then a week to 10 days renewing it. Epic's initial training program for the LT, and probably for the E1000, is targeted at 10 hours in the airplane over the course of four to five days—training to proficiency. Recurrent training includes five hours in the airplane and usually takes place over two days—a distinct value for the person who has to take time off from making the money to afford an airplane for training.

CONCLUSION

As a kit-built hotrod, the Epic LT has enjoyed success. We are the first to recognize that it's a huge step to go from experimental to certificated airplane—some companies that have tried have hemorrhaged money until admitting defeat. If Epic's reports of adequate funding are correct, we think Epic has a good chance of pulling off Part 23 certification.

Epic has a potentially powerful alternative to the TBM 900. We'll certainly be watching the competition with interest.