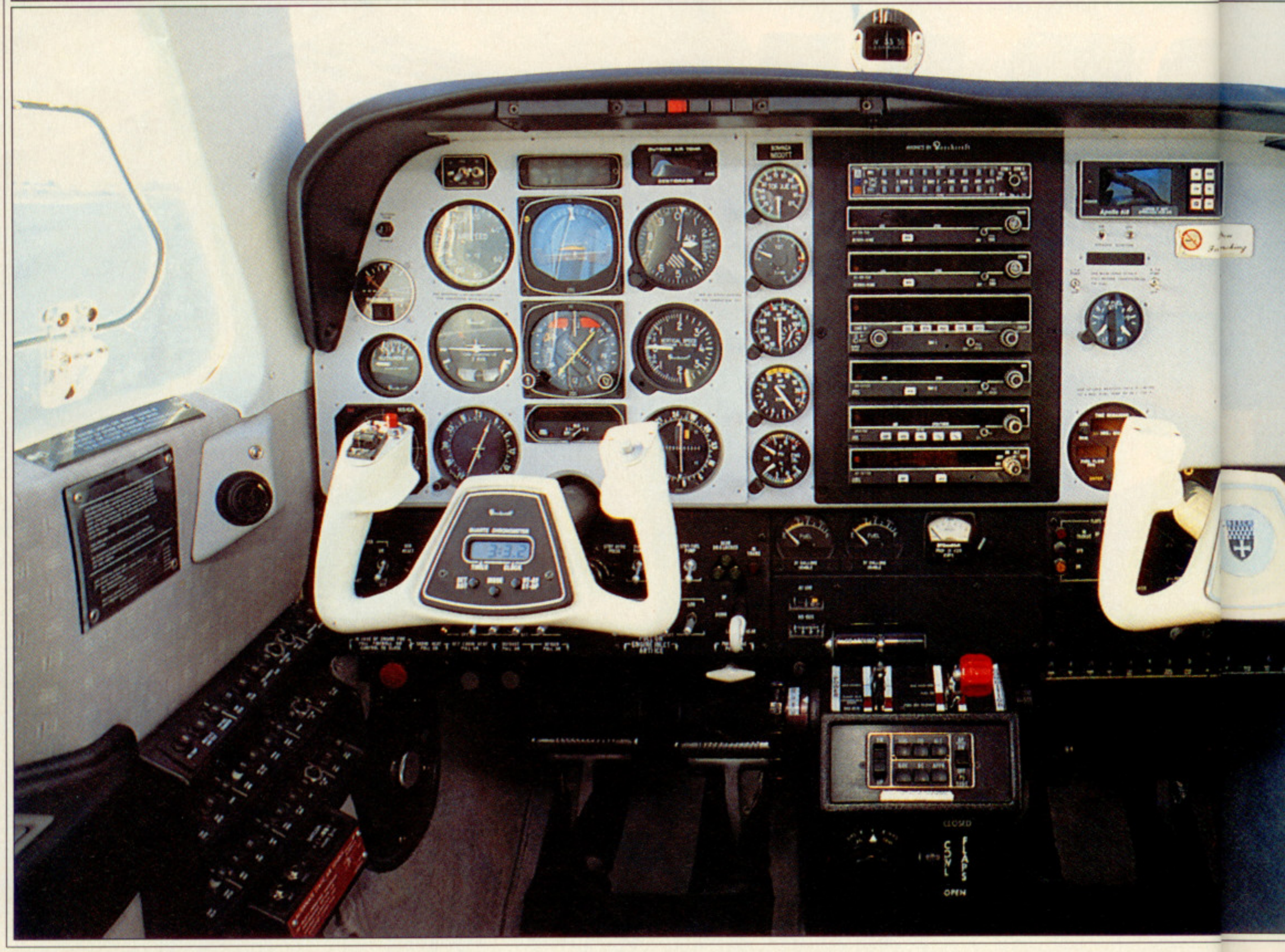
POWER TOOL

Tradewind Turbines A36: A bigger, bolder Bonanza.

BY MARK R. TWOMBLY

One way to increase an airplane's performance is to give it more guts. Wilbur and Orville had that figured out in 1904 when they built the *Flyer II* with a 15-horsepower engine, a 25-percent boost in power over the original *Flyer.* As the saying goes, there is no substitute for horsepower. ■ Well, maybe one: shaft horsepower. It's the power delivered by a turbine engine to a gearbox that turns a shaft to which a propeller (or in the case of a helicopter, a rotor) has been attached. Shaft horsepower is no different than horsepower; it's just that, pound for pound, a turbine engine makes more of it.

PHOTOGRAPHY BY MIKE FIZER



The Tradewind Turbines Bonanza conversion is proof.

Tradewind Turbines in Amarillo, Texas, is swapping the A36 Bonanza's 300-hp Continental for a 450-shp Allison turbine engine. To be precise, it's an Allison 250-B17F/2, from the same family of turbine engines that powers every version of the Bell JetRanger and McDonnell Douglas (Hughes) 500 helicopters along with a variety of fixed-wing airplanes. The 250-series engine has been in production for more than a quarter-century and, thanks to those thousands of helicopters, has logged a few hours—about 50 million, according to Allison, a division of General Motors.

The Allison is small, light, and packs a punch. Its size and power are ideal to bridge the gap between the largest piston engines from Continental and Lycoming and the smallest turbines from Pratt & Whitney and Garrett.

The Prop-Jet Bonanza, as it was originally called, was developed and in 1986 certified by Soloy Corporation in Olympia, Washington, in conjunction with Allison. Soloy also engineered Allison turbine conversions for Hiller and Bell helicopters and the Cessna 206 and 207. In October 1989, Tradewind Turbines Corporation purchased the Prop-Jet Bonanza supplemental type certificate and set up shop at Tradewind Airport in Amarillo. Tradewind Turbines is a partnership between Joe Boyd, who had been a Prop-Jet Bonanza dealer at DuPage Airport west of Chicago, and Jim Whittenburg of Amarillo, owner of Tradewind Airport, former Beech dealer, and one of the first buyers of a Prop-Jet Bonanza.

Soloy certified the Prop-Jet Bonanza with a 250-B17C engine rated at 420 shp for five minutes, 369 shp maximum continuous power. Tradewind has upgraded the conversion to the B17F/2, which is rated at 450 shp (also a five-minute limitation; maximum continuous power is 369 shp). The C engine delivers its best true airspeed, about 200 knots, at around 12,000 feet; critical altitude for the F/2 is 15,000 to 17,000 feet, where it propels the Bonanza to 210 to 215 KTAS.

The conversion is restricted to 1979 and newer A36s because they have 28-volt electrical systems. But it's best suited to Bonanzas built since 1984. That's the year Beech redesigned the instrument panel and dropped the vernier throttle in favor of a throttle quadrant. The newer panel has dual yokes and King Air–style engine gauges, so the turbine gauges for the Allison engine are right at home. The conversion requires very few changes to the excellent updated A36 panel.

Because the Allison is lighter than the Continental it replaces, a new nosecone is added that moves the propeller 21 inches farther forward, preserving the airplane's center of gravity. That in turn opens up space ahead of the firewall for a 4.5-cubic-foot baggage area. The nose baggage bin is a welcome addition to the A36, which is tight on baggage area to begin with.

The conversion also includes wing-tip fuel tanks, each of which holds 20 gallons usable fuel. Total usable capacity with the tip tanks is 114 gallons. Two small toggle switches on the panel activate pumps that transfer fuel from the tip tanks to the wing tanks, which must be half-empty before the transfer takes place. The weight of the extra fuel reduces payload only about 80 pounds because maximum gross weight of the airplane increases 186 pounds, to 3,849 pounds, with the conversion. All of the extra weight must go into the tip tanks. Full-fuel payload for an Allison-powered Bonanza not equipped with radar or air conditioning would be about 640 pounds.

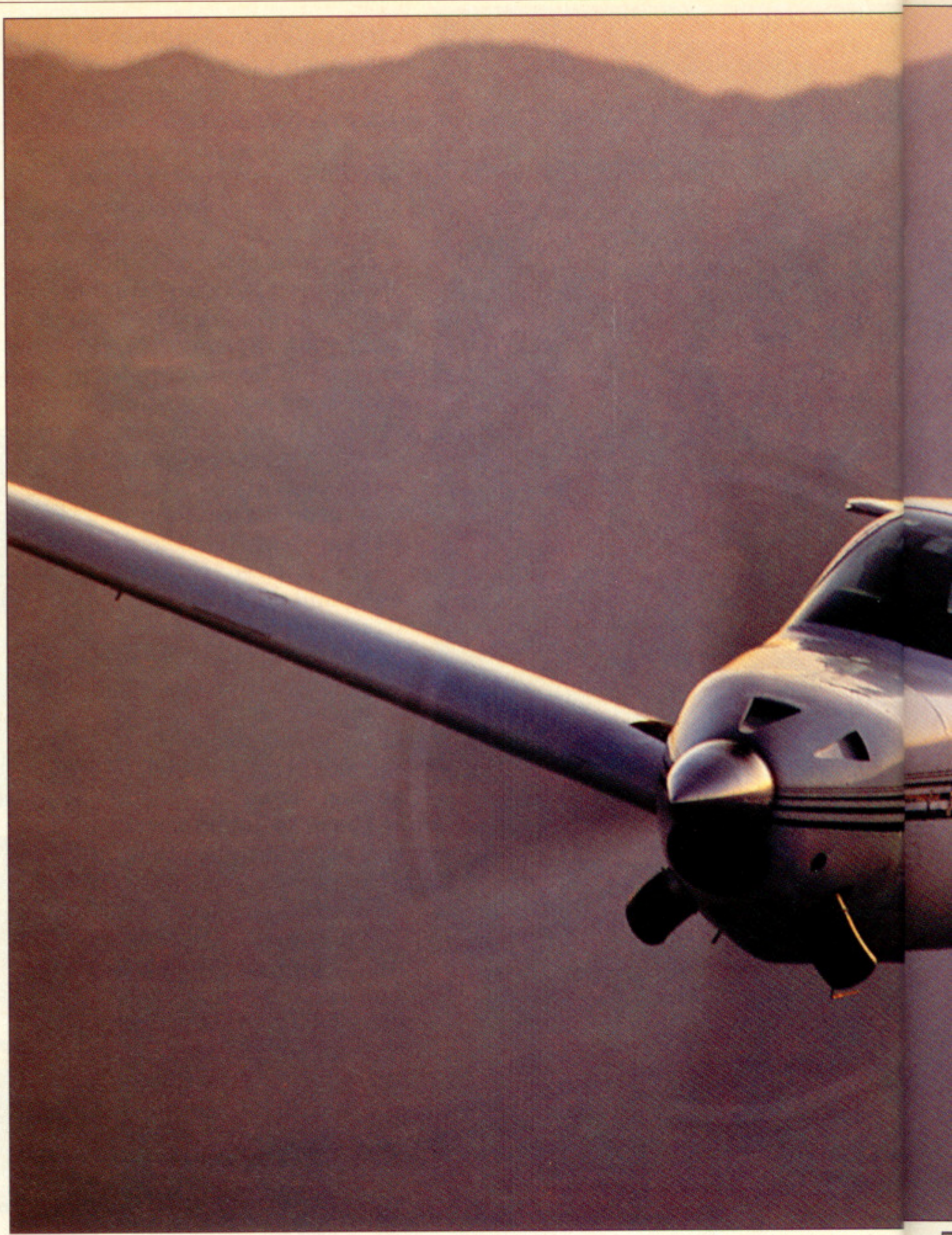
The long, pointed nose and wingletted tip tanks change the appearance of the A36 rather dramatically. It's a big, handsome airplane, with performance to match. It doesn't take much imagination to contemplate the effects of a 50-percent increase in power on a stock A36's takeoff roll, climb rate, cruise speed, and operating altitude; they're shorter, quicker, faster, and higher.

Presented with the opportunity to fly a Tradewind Turbines Bonanza, it's hard not to flex the airplane's muscle with a round of maximum performance flying. So here goes:

I'm with Boyd in N600TT, his beautifully painted and leather-upholstered demonstrator, in position for takeoff with the brake pedals depressed and the power coming up. When the brakes no longer will hold the airplane in check, I release them and advance the power until the needle on the torque gauge reaches 107 percent, maximum rated power. (On a warmer day or at a higher altitude, the engine would have reached maximum allowable turbine outlet temperature first.) The engine spools up quickly; a sensitive touch is needed on the power lever to avoid bounding past the torque or temp limits.

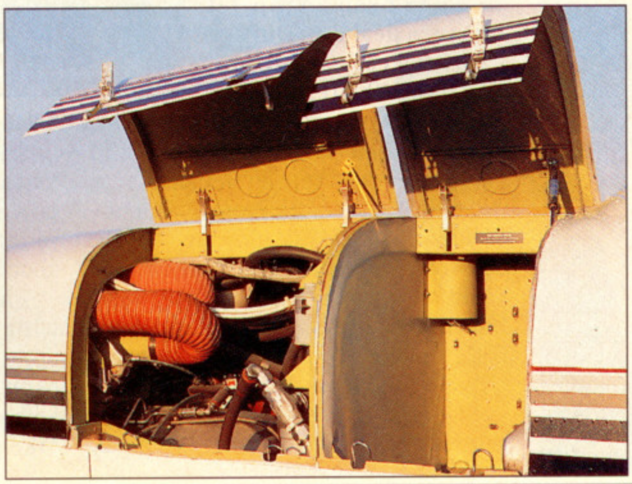
Acceleration is brisk, but it's easy to keep the nose tracking the centerline. At 70 knots, I rotate, wait a few seconds, then stow the gear. Boyd has suggested an 85- or 90-knot climb-out, so I haul back on the yoke to chase down the advancing airspeed. It takes 15 degrees nose up to hold 90 knots. The VSI points to a 2,500-foot-per-minute ascent.

A minute later, we level off to stay below the floor of some controlled-access airspace. The torque has to be brought back to about 55 percent to avoid busting the airspeed redline.



Farther south in unregulated airspace, we climb to 4,500 feet to sample slow flight and stalls. The turbine engine and Osborne tip tanks have negligible effect on the Bonanza's handling at the bottom end of the envelope. The airplane behaves as it does with piston power, even when applying power to recover from a stall.

Time to descend. Because there are no cylinders to shock cool, a turbine engine is unaffected by gross power reductions. Pulling the power lever back to Flight Idle is like deploying a small drag chute from the tailcone. When the airspeed bleeds off to below 154 knots, I extend the gear, then push the nose over—way over—to maintain 140 knots. Check that VSI again, Joe: We are heading earthward at 3,000 fpm.



Back at the airport, we make a normal full-flap approach. Speeds and procedure are the same as in an avgas A36, the only difference being the sensitivity of the power. On short final, I decide to execute a missed approach and cob the power—gingerly. Despite nose-up trim and all that power, the abort is routine.

The next circuit is to a full and forceful stop. When the mains touch, I pull the power lever up and back past Flight Idle and Ground Idle and into Reverse. The propeller blades rotate to a negative pitch, and the engine spools up with a *whoosh,* directing thrust forward. It's very effective

stopping power—ABS without the brakes. In little more than the length of a football field, better than 1.5 tons of Bonanza is brought to a halt.

Stretching the turbine Bonanza to its limits is not the stuff of everyday flying, but it serves to demonstrate that the airplane is easy to manage even under extreme conditions. It's also instructive to sample the kind of performance you can call on if and when it's needed.

Until getting to know the Allison-powered Bonanza, you might consider it an expensive indulgence, good for astounding friends and spectators with zoom climbs, kamikaze descents, and arresting-hook landings but of no real practical use. After all, the A36 is not pressurized, which means you have to breathe oxygen to take full advantage of the engine's ability to deliver high true airspeeds. If not, if instead you choose to fly low and breathe free, you'll have to do so at partial power.

The turbine engine imposes an airspeed restriction on the A36. The redline on the airspeed indicator is reduced from 205 knots on the stock airframe to 167 knots. In other words, the yellow caution range is gone. Top of the green is as fast as the turbine Bonanza can legally fly.

The airspeed restriction is not unique to the A36. All piston-to-turbine conversions are subject to the "top of the green becomes red" rule. That's because airspeed indicators in turbine-powered aircraft do not have yellow arcs. So why not extend the green arc to the existing redline instead of reducing the redline?

The reason is the power of the Allison compared to the piston engine it replaces. At lower altitudes and full power, the turbine Bonanza could fly perilously close to and perhaps even beyond the stock A36's 205-knot V_{NE}. That's a long way from the 141-knot maneuvering speed. The Federal Aviation Administration takes the conservative approach with turbine conversions by reducing never-exceed speed. It makes sense.

Given the lack of pressurization and the airspeed restriction, how practical can it be to spend lots of money hanging a turbine engine on a perfectly good Continental-powered A36? And it is lots of money—$381,000 for the conversion minus about $30,000 credit for the piston engine if it's new, less if there's time on it. But spend a day bisecting the continent with Boyd in 600TT, and you'll come to appreciate the transportation benefits of a kerosene-burning Bonanza.

We departed North Las Vegas Air Terminal early in the morning and, following a brief ATC-mandated wait at 11,000 feet, were cleared to 17,000, an optimum altitude for the Allison. The Bonanza averaged about 1,000 fpm in the climb, and the optional Aero-Trim electric rudder trim saved my right leg from fatigue on the way up.

Ambient temperature has a big effect on a turbine engine's ability to make power. It was warm over the Rockies at 17,000, so the Allison was only putting out about 69-percent power—about 290 shp—at 24 gallons per hour. That's the same power and fuel flow you'll get from a piston-engine A36 early in a climb. But there we were, looking down at snow-brushed mountain peaks, indicating 160 knots for a true airspeed of about 214 knots. We landed in Amarillo 3 hours 11 minutes and 79 gallons after taking off from North Las Vegas. The tanks were full when we departed, so we shut down with 30 minutes of cruise fuel remaining on top of an hour's reserve.

After lunching in the cozy airport café, Boyd gave me a tour of the Tradewind facility. Several A36s were undergoing conversion, including a couple of brand-new Bonanzas. The ability to match a new airframe with the Allison engine is a big selling point. Boyd is talking to representatives from two foreign countries about the purchase and conversion of 55 new Bonanzas. One country would use the airplanes as military transports, the other for training pilots for the national airline.

Boyd's wife, Dorothy, joined us for the flight to Chicago. Back again at 17,000 feet, with the day drawing to a close, Joe snoozed while Dorothy, breathing from her own bottle of oxygen, busied herself with work at the foldout table in the club cabin. Thanks to a little push, we were scooting over the heartland at better than 250 knots.

The weather deteriorated as we advanced northward. For the first time since leaving Vegas, we encountered clouds. I flipped the switch activating the anti-ice system, which includes engine ignition and electrically heated engine inlet lip, stator vanes, pitot tube, and propeller blades. The cowl flap, which controls airflow through the oil cooler, must be opened when anti-ice is turned on.

We climbed to try to top the weather, first to 19,000 and then 21,000. The airplane still was climbing at about 800 fpm when we reached Flight Level 210 and clear air. With anti-ice off, the airspeed settled on 147 KIAS, 210 knots true, at 21.5 gph.

Before landing at DuPage, I wanted to sample cruise flight at a non-oxygen altitude, so we descended. As expected, I had to pull off some power to avoid exceeding V_{MO} in level cruise at 9,000. True airspeed worked out to 193 knots at just under 26 gph.

The conclusion of the flight couldn't have been more of a contrast to the serenity of the day: a night, low-IFR approach to DuPage in some very turbulent air. The Allison's power and response allowed for precise speed control in the difficult conditions, and using Reverse after touchdown eased concern about the potential for hydroplaning on the wet runway.

The trip was over. I had eaten eggs for breakfast in Vegas, chicken-fried steak for lunch in Texas, and airport pizza for dinner in Chicago. In 6 hours 41 minutes of flying, we had covered more than 1,600 nautical miles and used 165 gallons of gas. That's an average of about 240 knots and 24.5 gph. The same trip in a Continental-powered Bonanza would have taken 8 hours and 128 gallons, but that's assuming the winds down low would have been equally as helpful, and that's rarely the case.

If you're reaching for a calculator to figure out how much more it costs in fuel to fly the turbine Bonanza, you're probably not going to be comfortable spending more than a third of a million bucks on getting the turbine engine in the first place. Those who can sign the check without flinching will be buying a very special airplane. It's a Bonanza, only better.

I caught a bus to Chicago-O'Hare for a commercial flight back to Washington, D.C. The drive to the airport took an hour, then I and my fellow passengers cooled our heels in the terminal for several hours while the flight crew waited for a first officer to show up. I finally arrived in Washington in the wee hours of the morning, facing another hour's cab ride before crawling into bed. If only I could have caught the Tradewind. . . . □