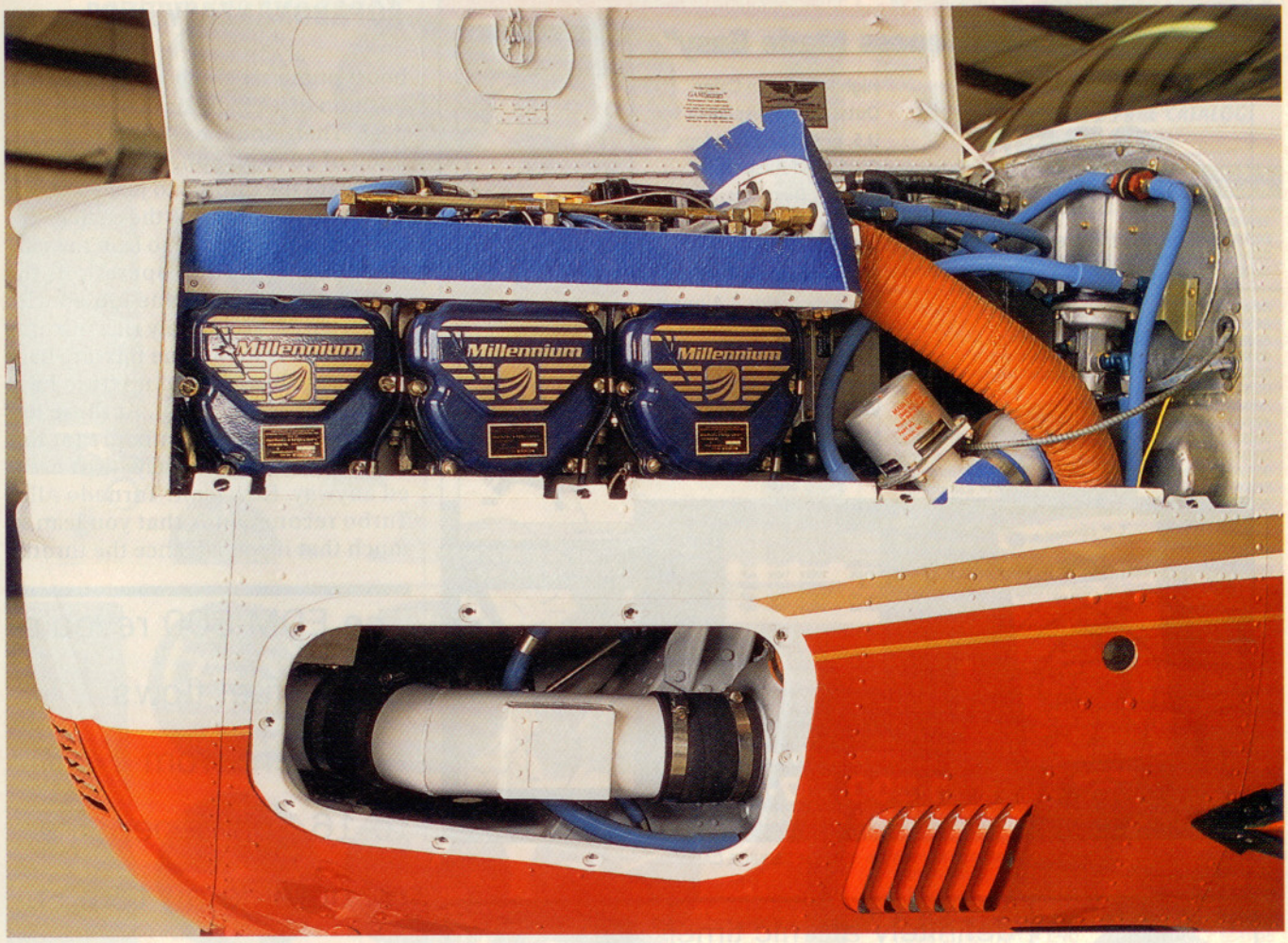

AOPA'S 2001 BONANZA SWEEPSTAKES

Turbo on the go

How to get to 200 knots

BY THOMAS A. HORNE

I just checked my logbook and discovered that I'd spent a total of 25.3 hours behind the yoke of N2001B, the V35 Beech Bonanza that will go to some lucky winner come late January or early February 2002. That makes me the high-time pilot in this particular airplane, and the experience has been both educational and fun. Every few weeks I'm off to fly N2001B from one refurbishment site to another, all over the nation. If this isn't a dream job, what is?

One thing's for sure: That lucky winner will need some time to get accustomed to N2001B's engine operating procedures and peculiarities. The 300-horsepower Superior Air Parts Millennium IO-550 engine, together with its Tornado Alley Turbo turbonormalizer, make a powerful and—for most—unusual match. Factor in the recommended lean-of-peak TIT (turbine inlet temperature) operating procedures and you've got several learning curves to climb.

Can I quickly sum up how you fly this V-tail's engine? Yes. You fly with one eye glued to the J.P. Instruments EDM-800 engine analyzer and a hand on the mixture control. Now that's an overstatement, but for the transitioning pilot that perception will definitely come through.

Starting the engine is fairly conventional. Battery switch on, throttle firewalled, mixture full rich, auxiliary fuel

PHOTOGRAPHY BY MIKE FIZER

boost pump toggle switch to the High position, then look for the fuel flow to peak. That should be in the neighborhood of 20 to 25 gph. Then it's pump off, retard the throttle to just above the idle position, and crank the engine.

Once alive, it's time to lean the mixture. During ground operations the spark plugs can become fouled with lead from an excessively rich mixture, so the drill is to dial the mixture back (both the throttle and mixture have vernier-type controls). At these low power settings a rich mixture for this engine—any engine, really—isn't needed anyway. How lean? Tornado Alley Turbo recommends that you lean so much that if you advance the throttle

The EDM-800 reveals cruise fuel flows anywhere from 14.5 to 16 gph depending on outside air temps.

from a typical 1,000-rpm idle, the engine will stumble.

Takeoffs are also conventional. Throttle, propeller, and mixture controls full forward, and off you go. At takeoff power the EDM-800 should show a TIT of no more than 1,200 degrees Fahrenheit. For short-field or high-density-altitude takeoffs the mixture can be leaned to 1,310 to 1,380 degrees for more power. Full-rich takeoff power is richer than necessary and robs a little horsepower—a tradeoff for cooling the big IO-550 with fuel.

Should you use the three-position (High, Off, and Low) auxiliary boost pump for takeoff? Probably, and here's why. So far, vapor has been forming in the fuel lines, causing a few anxiety-producing power fluctuations during climbs (and cruise, too, for that matter). Then again, all of my time in the sweepstakes Bonanza has been spent in warm—sometimes hot—weather, which is conducive to vapor formation. The record for hottest ambient temperature during a takeoff goes to Texas' Houston-Southwest Airport, where the

At 44 degrees Fahrenheit above standard and 12,500 feet, the Bonanza turns in 196 KTAS at a 2,500-rpm, 16.7-gph, 60-degree-lean-of-peak high power setting (top). Economy cruise at 2,200 rpm (above) yielded 183 KTAS. At this setting you could fly halfway across the country, thanks to the airplane's 114-gallon maximum fuel capacity.

mercury hit 106 degrees. That's when I definitely set the boost pump at the Low position. (The High position is intended for use only if the engine-driven boost pump fails, and it moves a higher flow of fuel.)

There have also been fuel-flow fluctuations in cruise. So I typically end up running the boost pump on Low pretty much all the time. After all, low boost is intended for vapor suppression.

I've heard two main explanations for the vapor problem. The first has to do with high fuel temperatures. Let the Bonanza sit out on a 100-degree ramp for a few hours and the fuel in its tanks gets very hot indeed. Ergo, *vaporama*, especially at high power settings—at least until a few hours at cruise altitudes, when the fuel temperature drops. The other explanation holds that the fuel-line diameters are too narrow and won't allow enough fuel to pass through. Believers of this theory emphasize that this V35's fuel lines are the same diameter used in earlier Bonanzas, those with smaller engines that sucked less fuel.

While climbing, you leave the throttle wide open. Tornado Alley says it's important to lean to a target TIT during climbs. From sea level to 10,000 feet, for example, you shoot for 1,280 to 1,300 degrees F.

What I like to do is set up the EDM-800 to show TIT and cylinder head temperature (CHT) during climbs. This way I can tell if any CHTs are heading for the 380-degree threshold that Tornado Alley would like you to stay below (CHT redline is 460 degrees). If CHTs get too hot, enrichen the mixture and climb at a higher airspeed.

Once you've reached your cruise altitude, level off and let things stabilize for a few minutes. I've been cruising between 9,000 and 12,000 feet, but it's possible to fly as high as 18,000 feet, using the nasal cannulas in N2001B's Mountain High portable oxygen system. A mask is provided for flying at higher altitudes.

Anyway, what I do then is reduce rpm to 2,500 (though you can use settings as low as 2,200 or 2,300—but who wants to go slower?), close the cowl flaps, and start leaning. Once again, you have to eyeball the EDM-800 very closely, because you're aiming to lean the engine to 50 to 100 degrees Fahrenheit lean of peak TIT. Tornado Alley's George Braly makes this process relatively easy by recommending that you simply (and slowly, from three to five seconds) pull back on the mixture knob until you reach a fuel flow of 15 gph or so. This quickly puts you on the lean side of peak.

Now it's time to watch the EDM-800's TIT display. From the lean side of peak, enrichen the mixture and watch the digital TIT readout's numbers climb. They should peak anywhere from 1,540 to 1,640 degrees; exact peak TIT varies from engine to engine. Now that you've identified peak TIT, the Tornado Alley-recommended procedure is to dial the mixture back until you see TITs drop by 50 to 100 degrees. Now you're ready to cruise.

Mind you, you're operating at a lean-of-peak mixture setting, and cooling the engine with air. Rich of peak, the traditional way of setting mixture, cools

At far left, the J.P. Instruments EDM-800 engine monitor is set up to show compressor discharge temperature (CDT)–the temperature of the air leaving the intercooler. At left, TIT and fuel flow are displayed.

the engine with fuel. You can lean N2001B with precision because its cylinders are equipped with turbo GAMIjectors—finely tuned fuel injectors that meter fuel so that each cylinder receives the same fuel-air mixture. The EDM-800 lets you fine-tune TITs to a fare-thee-well, because it reads in increments of one degree!

Throttle? It stays at the wide-open throttle (WOT) position. At WOT, the wastegate of Tornado Alley's turbocharger is set to reach a maximum of 27 to 30 inches of manifold pressure, not 32 or 36 or even 41 inches, like the turbochargers on some other airplanes. That's why the sweepstakes Bonanza's turbo system is called a turbonormalizer. This lets the airplane maintain sea-level manifold pressures at altitudes as high as 18,000 feet—and often higher.

A glance at the EDM-800 will reveal cruise fuel flows anywhere from 14.5 to 18.5 gph, depending on the outside air temperature, altitude, and propeller rpm. The warmer the air, the less fuel you'll use.

AOPA BONANZA SWEEPS

A word about the EDM-800 is in order. This fantastic instrument can be set up to show any number of engine and other variables. I mean, there's almost nothing that it doesn't show! It's all there: bus voltage, outside air temperature, induction air temperature (the temperature of the air coming out of the induction system's intercooler), compressor discharge temperature (the air temperature going into the intercooler), the difference between hottest and coldest cylinders' EGTs, all cylinders' EGTs and CHTs, TIT, oil temperature, and a feature that warns of cylinder shock cooling. On top of all this, the instrument maintains a 20-hour history of most of these variables. You can download them and make graphs and spreadsheets, showing trends and letting you identify trouble spots. N2001B's engine data were plotted out, and we learned that the engine is working like a top in all departments (though high OATs have kept oil temperatures a tad high)—and all cylinders peak at the same EGT, a great testament to the

CONTRIBUTORS

AOPA would like to thank the following companies that are donating or discounting their products and services to refurbish AOPA's 2001 Bonanza Sweepstakes project or are otherwise assisting with the project.

Upgrade and modifications installation
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Post Office Box 27966
Golden Valley, Minnesota 55427
800/328-4629 or 763/535-0505
fax 763/535-3759
www.beryldshannon.com
Therese and Doug Kelly
Route 2, Box R45, Military Highway
Mercedes, Texas 78570
888/787-0689

Precision matched fuel-injection nozzles
General Aviation Modifications Inc.
2800 Airport Road, Hangar A
Ada, Oklahoma 74820
888/359-4264 or 580/436-4833
fax 580/436-6622
www.gami.com

Engine monitor
J.P. Instruments Inc.
3185-B Airway Avenue
Costa Mesa, California 92626
800/345-4574 or 714/557-3805
fax 714/557-9840
www.jpinstruments.com

Four-place oxygen system with Electronic Delivery System (EDS)
Mountain High E & S Company

625 Southeast Salmon Avenue
Redmond, Oregon 97756-8696
800/468-8185 or 541/923-4100
fax 541/923-4141
www.mhoxygen.com

Audio landing gear and overspeed (V_{NE}) warning system
P2 Inc.
Post Office Box 26
Mound, Minnesota 55364-0026
888/921-8359 or 952/472-2577
fax 952/472-7071
www.p2inc.com

Engine
Superior Air Parts Inc.
14280 Gillis Road
Dallas, Texas 75244
972/233-4433
fax 972/233-8809
www.superair.com

Turbonormalizer system and annual inspection
Tornado Alley Turbo Inc.
300 Airport Road
Ada, Oklahoma 74820
877/359-8284 or 580/332-3510
fax 580/332-4577
www.taturbo.com

Engine build up and test
Western Skyways Inc.
1865 Launa Drive
Montrose, Colorado 81401
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fax 970/249-4155
www.westernsky.com

effectiveness of the turboGAMIjectors.

So what kind of speed can the owner of our Bonanza expect? You can get an idea from the flight from Oshkosh to Batavia, Ohio's Clermont County Airport. This was a delivery flight to Air Mod, the company that will fit the Bonanza out with a new interior. Here are the numbers:

- 9,500 feet pressure altitude
- 30 inches manifold pressure
- 2,500 rpm
- 16.1 gph (50 degrees F lean of peak TIT)
- 22 degrees Celsius OAT
- 1,501 degrees F TIT
- 1,410 to 1,420 F EGTs
- 344 to 380 degrees F CHTs (the number-six cylinder is the hottest)
- 153 KIAS
- 186 KTAS

Tornado Alley claims that true airspeeds can be as high as 220 kt in the 25,000 to-30,000-foot range. At those altitudes, you can more or less count on 200-kt-plus true airspeeds, Tornado Alley says. Even without a tailwind, you're in King Air country. The fastest groundspeed I've seen has been 230 kt. It's a traveling machine, all right, and all the

more so with full tip tanks. This raises the airplane's total fuel capacity to 114 gallons.

Descents are performed by reducing propeller rpm, then adjusting the mixture to keep TIT and EGTs from plunging and shock cooling the engine. Manifold pressure can be reduced to keep your airspeed under control. You have to watch your airspeed in slam-dunk descents

A gentle voice says "overspeed, overspeed." Not that I've heard it, of course.

because the Bonanza is slippery and will build energy fast once you head downhill. Approach redline and the P2 Inc. audio landing gear and overspeed warning system kicks in. A woman's voice comes over your headphones with a gentle "overspeed, overspeed" reminder of your impending violation. Not that I've ever heard it, of course.

You get to come off full throttle when nearing the airport. Then a 15- to 20-inch manifold pressure setting is a good ballpark value. On final, things return to normal in that you adjust power to stay on the target airspeed and a proper glide path, and move the propeller and mixture controls full forward. Cross the threshold decelerating from the 70-kt, full-flap approach speed, enjoy the aileron responsiveness afforded by the Beryl D'Shannon vortex generators as you battle any crosswinds, and grease it on with minimal fuss. Like all Bonanzas, ours/yours yields face-saving landings time after time. But with cruise speeds 30 or more kt faster than the rest of the breed, this Bonanza is quite unlike any other.

i See AOPA Online (www.aopa.org/pilot/bonanza/) for weekly updates on the AOPA Sweepstakes Bonanza.

It just may be the fastest Bonanza ever, bar none. AOPA

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