TURBO BONANZA

Flying high and fast, there's plenty to think about, and the B36TC gives you plenty of time in the air to think.

BY MARK M. LACAGNINA

When Beech Aircraft introduced the first turbosupercharged Bonanza—the V35TC—in 1966, success proved elusive. The airplane offered good performance, but Bonanza buffs kept on buying normally aspirated butterflies. Sales of the turbo model were disappointing, to say the least. Some believe the general aviation market was not ready for a turbocharged single, even a turbocharged Bonanza. Others point to problems, such as turbine housings that cracked and bearings that gummed up and jammed when lubricating oil was scorched into coke by excessive heat. One experienced V35TC pilot remembers that his airplane seemed to be in the shop more than in the air. Another recalls the maintenance costs for the turbocharger matched those for the rest of the airplane.

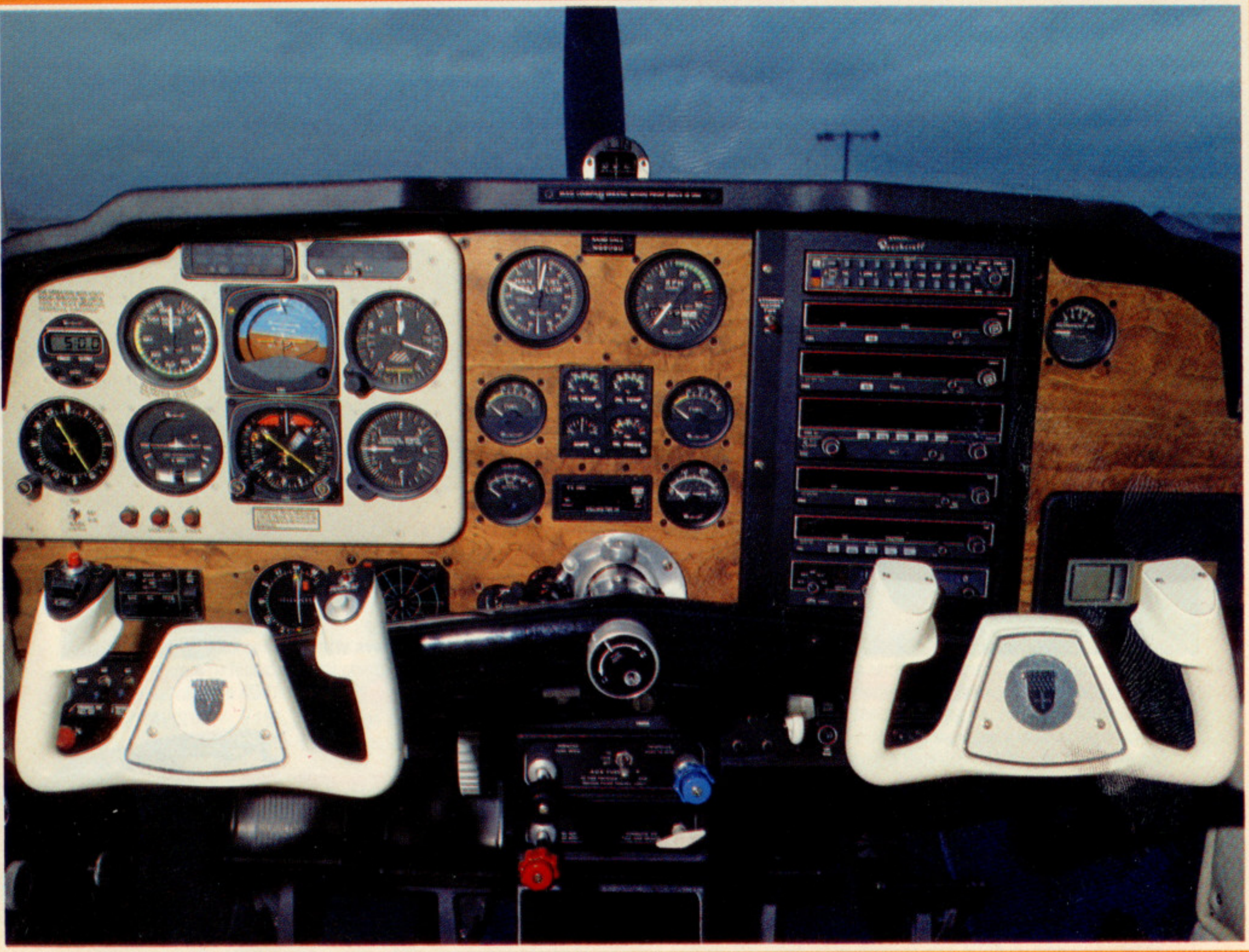
In 1970, after producing only 132 turbo Bonanzas, Beech called time-out. For the next nine years, the company watched as other manufacturers, especially Cessna Aircraft, doggedly pursued solutions to the problems of turbosupercharging light singles. During the hiatus, Beech engineers learned a lot about turbocharger installation and operation—and particularly about heat management.

When Beech introduced the A36TC Bonanza in 1979, success was within its grasp. The turbocharger installation in this airplane is as impressive as the V35TC's was problematical. According to Federal Aviation Administration records for the past 62 months, problems with turbochargers and related systems were involved in 71 general aviation accidents and inflight incidents. Neither the A36TC nor the newer B36TC is on that list. In addition, the FAA received a whopping 1,280 service difficulty reports on turbocharger installations in general aviation airplanes. The total includes only five Bonanzas—all A36TCs—and involves cracked turbine inlets.

The A36TC Bonanza sold well, but there was one consistent gripe. The airplane has usable fuel capacities of 44 gallons standard and 74 gallons optional. Even with the optional fuel system, the A36TC has a maximum endurance of only 3.8 hours with a 45-minute fuel reserve at 75-percent power and 20,000 feet. Although the airplane can cover a lot of ground in less than four hours, many owners and potential owners beseeched Beech for even longer legs. . . .

. . . that is, longer wings. Beech heeded the call and introduced the B36TC Bonanza last year. Installation of Baron wing tips increased the turbo Bonanza's wingspan by 52 inches. The wing assembly was strengthened by the incorporation of the Model 58 Baron's main wing spar and fuselage carry-through structure, resulting in a gross weight increase from 3,650 pounds to 3,850 pounds and a useful load increase from 1,397 to 1,528 pounds. All this, of course, was means to an end: increased fuel capacity. Each of the B36TC's leading edges houses two interconnected fuel bladders. One holds 40 gallons of fuel; the other, 14 gallons. Total usable fuel capacity is 102 gallons (30 gallons more than an

PHOTOGRAPHY BY ART DAVIS



continued

A36TC with optional tanks). At 75-percent power and 20,000 feet, the new turbo Bonanza can stay in the air for 5.25 hours and still have a 45-minute fuel reserve. It is also a bit faster than the A model, but not much—a knot or two at altitude. At Flight Level 250, the certificated maximum operating altitude, the B36TC's cruise speeds range from 200 knots at 79-percent power (maximum cruise power) to 162 knots at about 54-percent power (economy cruise). Fuel consumption is about 16.6 gph and 11.2 gph, respectively.

The increased endurance of the Beech B36TC did not come easily, however. As reported earlier by editor Edward G. Tripp ("Beech B36TC Bonanza," June 1982, p. 116), one thing did, indeed, lead to another. That other thing is the wedge-shaped device that protrudes from the outboard leading edge of each wing. The device, a dual vortex generator, resulted from Beech's efforts to improve the airplane's spin characteristics.

During initial tests, the company found that the B36TC, with its long and heavy wings, would enter a rapid, nose-high spin to the right when loaded to aft-CG. The airplane originally did not meet certification standards that require an airplane to be able to recover aileron effectiveness within one turn after a one-turn spin. The task confronting Beech engineers was to tame the airplane's stall characteristics without a major structural modification.

First, they tried conventional antispin modifications. Rudder travel was reduced from 25 degrees to 20 degrees. Elevator-down travel was increased from 20 to 25 degrees. These changes helped a lot and eventually were retained. But the airplane still required a little more than one turn to recover from a one-turn spin in certain load configurations.

Beech then experimented with a variety of strakes (small fins) mounted below and in front of the tail, in front of the wing roots and on the nose. Although one configuration did allow the airplane to meet spin certification standards, it created the potential for other problems, such as aft-CG shifts and possible ground strikes on the ventral tail strake.

The company proceeded by tapping into the considerable spin research that has been performed by the National Aeronautics and Space Administration. In tests of a Grumman Yankee equipped with a dropped leading edge, NASA found that at high angles of attack, a strong vortex would originate at the edge of the droop and effectively block the progress of the stall from the wing root. In effect, the vortex generator allowed the outboard portion of the wing to continue flying after the inboard portion had stalled fully.

Beech conducted numerous tests of single and dual vortex generators of various sizes at different locations on the leading edge before deciding on a final configuration that exceeds the spin certification standards without creating other problems. (More information on the B36TC's dual vortex generators is contained in a technical paper, "Development of Wing Leading Edge Vortex Generators for a Single

Engine General Aviation Airplane," by Dennis Crider, Beech Aircraft Corporation. The paper, publication number 830770, is available from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, Pennsylvania 15096. Cost is $2.25 for SAE members, $3.50 for nonmembers.)

We did not sample the spin characteristics of our evaluation aircraft, N6508U. Spins, after all, are prohibited. Stalls produced mixed results. One *Pilot* staffer, using rudder to keep the ball centered, found stalls to be straightforward and gentle, with little tendency by the airplane to drop a wing. Another, seeking to simulate the circumstances that attend unintentional stalls and using the time-honored technique of using the rudder to keep the wings level, found 08U would roll off onto its right wing sharply during power-off stalls. Our results cannot be called conclusive, since we suspect that our evaluation airplane was a bit out of rig.

Both the A and B models have a simple Off, Left, Right fuel selector mounted face-up to the left of the pilot's seat. Fuel management was simplified further in the B36TC by the elimination of one auxiliary fuel switch. The A36TC has two of them. One is used to prime the engine for starting and to maintain fuel flow if the engine-driven fuel pump fails. The other switch has three positions: Off, Low and, depending on when the airplane was built, either Hi/Low or Auto. This one is used to purge fuel vapor from the system during normal operations and to maintain recommended fuel flow, if necessary, during takeoff on a hot day. According to the A36TC's pilot's operating handbook, the Low position should be selected if fuel flow drops below 32.5 gph on takeoff. If this does not do the trick, the Hi/Low (Auto) position should be selected and the mixture leaned to keep fuel flow below 34.2 gph. . . .

Confusing, eh? Beech apparently thought so too. The B36TC has only one auxiliary fuel pump switch. With three positions—Off, Low and Hi—it is used either to prime the engine, purge vapor or cover for a failed engine-driven pump. To preclude potential hot-day takeoff fuel-flow problems, Beech switched from three-eighths to one-half-inch fuel lines.

The B36TC, which made its debut only last March, has not been subject to any airworthiness directives to date. There was one AD issued on the A36TC, requiring a fuel drain to be installed around the idle fuel adjustment screw. The AD was issued after an accident occurred when an adjustment screw backed out and allowed fuel to leak and ignite on contact with the turbocharger.

A one-day training program for owners and operators of turbo Bonanzas is offered at Beech headquarters in Wichita. The morning is spent viewing and reviewing audiovisual presentations on systems, normal and emergency operating procedures, and physiological factors of high-altitude flight. In addition, Beech has a variety of tapes on avionics equipment. There is always an instructor available to answer questions. After the "student" is satisfied that he has exhausted the resources of the A/V room, a familiarization flight is conducted. This includes the standard checkride routine of slow flight, steep turns, stalls, landings and takeoffs, plus a demonstration of engine restart procedures at altitude and a no-flaps landing. I found the training program to be quite valuable, even though I already had undergone a thorough check-out in Teterboro, New Jersey, by an instructor for Beechcraft East, which maintains N6508U on a leaseback arrangement, and had logged a dozen hours in the airplane.

The B36TC Bonanza is a complex and sophisticated airplane. For the newcomer, there is much to learn and much to think about. For a pilot used

BONANZA

continued

to flying low and slow, high-altitude flight is a brand-new ball game with myriad considerations. Above 16,000 feet, for example, some of the B36TC's airspeed limitations change: Vne, never-exceed, decreases four knots for each 1,000-foot gain in altitude; similarly, Vno, maximum structural cruising, decreases three knots per 1,000 feet. The fledgling turbo Bonanza pilot also learns, or should learn, that any ham-handedness with either the throttle or the mixture control could be rewarded with an engine-out. Activate the starter in the thin air above FL200 and you may be setting yourself up for magneto problems later on. Carbon tracking is the culprit here.

The list goes on and on, but you get the point: There *is* much to learn. But then, once you have learned what you need to know, you will find that flying the B36TC is relatively easy. There are no cowl flaps. The fuel system is simple. The turbocharger on the big Teledyne Continental engine incorporates a variable absolute pressure controller. The pilot merely sets the desired manifold pressure with the throttle, and the pressure controller adjusts the turbocharger wastegate to maintain that setting. If adjusted properly, the pressure controller automatically compensates for changes in ambient pressure and temperature.

Preflight preparation is fairly routine. The airplane can hold a lot of fuel and a lot of people, so weight and balance calculations both for takeoff and for landing are in order. Baggage space is relatively limited. When the A model Bonanzas were introduced, Beech did install a 70-pound-capacity baggage compartment in the rear of the cabin. There is enough room—10 cubic feet to be precise—for a couple of big suitcases and, maybe, a few small ones—but that is about all. With the optional club seating arrangement, there is quite a bit of space for baggage between the front and second rows of seats.

Both sides of the upper engine cowling can be raised to get a good look at the plumbing. It is a good idea before each flight to check for freedom of movement of the overboost pressure-relief valve and to ensure that the flexible internal baffles, which direct the flow of cooling air onto the engine, are in the proper positions. (During the Beech ground school, my instructor,

FLIGHT NOTES

Pilot staffers flew a B36TC on a variety of missions and in weather conditions ranging from severe clear to severe. We would be less than candid if we were not to say that we simply love the airplane. (The biggest problem I had with N6508U was the agony of returning it to its rightful owner.) Our notebooks contain several observations, flattering and otherwise, that are worthy of note:

• If you are buying a B36TC, take your time on the customer-acceptance flight and make sure everything is working properly. The compass-slaving system in our evaluation aircraft went on the fritz several times—and, seemingly, at the worst possible times. Once, while our concentration was diverted to working out an amended clearance, a controller politely inquired as to our destination. It was Washington, D.C., but the autopilot quietly was taking us to Toronto. The static-discharge system also was not up to snuff. On one flight, static build-up treated us to a light show and played havoc with the radios. Make sure the static-discharge wicks are grounded properly (metal-to-metal) with the airframe.

• The windshield defrosting system is very effective but very noisy.

• The arrangement and variety of cockpit lighting systems is superb. However, the airplane needs a better glareshield because at night, a lot of interior light is reflected by the windows.

• The airplane has adjustable rudder pedals. The author found a seating position just right for his Hobbit-size frame. Another staffer, who could play guard for the Lakers, was not so fortunate. The airplane could use a longer seat track for tall pilots.

• The B36TC was designed to be flown regularly and at high altitude. There is no way to avoid occasional, unintentional encounters with ice. On one particular flight, ATC had us muck about overlong at an altitude we certainly did not desire or plan for. With a quarter inch of rime ice on the wings, the airplane lost 20 knots, and the oil and cylinder-head temperatures began to climb. After one-half inch had accumulated and 35 knots were lost, ATC finally granted an altitude change. The heated prop functioned properly throughout this episode, thank goodness. The point is that without cowl flaps, the pilot's choices are limited in an icing encounter. To keep engine temperatures below the red arcs, you may have to reduce power. Then, there is only one direction in which to go: down.

• In warm-weather ground operations, the optional cabin ventilation blower will be worth its $915 list price. *—MML*

Steve Bryant, found one baffle that was bent the wrong way in our evaluation aircraft.)

When flying any turbocharged airplane, it is important to make sure the oil has been warmed to recommended temperature before attempting to take off. Cold oil could cause a momentary overboost. The B36TC handbook calls for takeoff (maximum continuous) power, 36 inches and 2,700 rpm, to be set before brake release. This may have been necessary for the A model, with its complicated takeoff fuel-management procedures, but is questionable for the B36TC—unnecessarily hard on the brakes and on the propeller. If there is enough runway, it is better to stabilize manifold pressure at about 25 inches, release the brakes and then feed in the rest of the throttle during the roll. The engine instruments and indicators are grouped in the middle of the panel. They can be monitored easily without a lot of head-twisting.

Rotation speeds are 67 knots with 15 degrees of flap and 70 knots without flaps. Recommended climb speed at maximum continuous power is 112 knots, and the airplane can maintain maximum power up to its critical pressure altitude of 19,000 feet. If you are not racing the space shuttle, however, try cruise climb power, 34 inches and 2,600 rpm, and 120 knots. Plenty of upward mobility, and you can see over the airplane's nose.

The airplane can be equipped with oxygen systems of either 49- or 76-cubic-feet capacities. The latter will provide more than two hours of oxygen for six people at 20,000 feet.

During cruise and descent, the mixture can be leaned to peak turbine inlet temperature or to a maximum of 1,650°F, whichever comes first. However, if you are going to operate the airplane regularly at peak turbine inlet temperature (TIT), better make sure that the indicator is not lying to you. The recommended time between major overhauls (TBO) of the engine and turbocharger is 1,600 hours—only 100 hours less than the normally aspirated A36 Bonanza. Get the turbo too hot, and you are going to be facing a lot of big repair bills right now. Beech recommends calibration of the TIT probe every 100 hours. For owners who want to run at redline, this is a must.

The B36TC can mix well with traffic in just about any airport environment. The landing gear and approach flaps can be extended at 154 knots, indicated, which enables the pilot to come in fast and slow down quickly, if it becomes necessary.

During my initial checkride in N6508U, the instructor noticed that I seemed to be working harder than necessary during one particular landing. He suggested that I just let go of everything for a moment. I did. It was weird. Nothing happened. The airplane seemed to be telling me, "Stop fidgeting. I'm trimmed properly, in the right configuration and at the proper airspeed. Thank you for that; now I can make it to the runway quite nicely on my own."

Indeed, the Bonanza is a graceful, stable and forgiving airplane. The controls are light, responsive and well-balanced. Flying involves an ounce of pressure here, an ounce there and a few twists yonder. However, the delightful handling qualities of the B36TC are spoiled by a tendency to Dutch roll in even mild turbulence.

As mentioned earlier, the B36TC gives you plenty of time to think about what you are doing and what soon will need to be done. The nonstandard location of gear and flap controls in the Bonanza and Baron has been widely criticized. The concern is that pilots unfamiliar with the airplanes can—and often do—grab the wrong control at the right time. There certainly is merit to this concern, but I cannot help but think that any B36TC pilot who finds himself in a situation prompting him to grab things without thinking is already in serious trouble.

Recommended landing approach speeds are 84 knots with flaps up and 81 knots with flaps down. In some circumstances landing the long-winged airplane in a strong crosswind is a bit of a challenge. The yoke is low-slung, really only inches above the pilot's legs, and the padded armrest is wide and long. The combination actually is quite comfortable during most operations; but if you need full left aileron to counter a strong left crosswind, you have to take your elbow off the armrest and tuck it against your side. Otherwise, there is no way to get full control deflection. This is a bit annoying at first, but you get used to it after a few touch and goes.

After landing, the engine should be run at idle for four minutes (to preclude potential heat-soaking, two or three minutes will suffice on especially hot days) to give the turbocharger a chance to spool down. Taxi time can *continued*

be included, as long as there are no bursts of power.

Our evaluation airplane is a typically equipped Beech B36TC with a full stack of King Silver Crown avionics, a King KFC 200 autopilot, a 76-cubic-foot oxygen system, a WX-10 Ryan Stormscope (which did not work properly) and an electrothermal propeller deicing system. There are two things we would add to turn the full house into a royal flush: a yaw damper and a stand-by generator system. We also feel that rudder trim, which currently is not available, should be added to the B36TC's options list.

There is only one major modification available for the B36TC. For $13,000, Smith Speed Conversions of Johnson City, Kansas, can make the quick airplane go about 15 to 17 knots faster. The modification involves an extensive aerodynamic clean-up of the airplane, ranging from the installation of aileron and flap gap seals to removal of the tall-mounted rotating beacon.

All in all, it is not difficult to understand why the turbo Bonanza currently is Beech's best seller. Flying a high-performance airplane at altitude is a thinking man's game. The B36TC is a thinking man's airplane. □

BONANZA

Beech B36TC Bonanza

Base price $161,500

• Price as tested $230,000 (est)

AOPA Pilot Operations/Equipment Category*:

IFR $225,000 to $280,000

Specifications

Powerplant	Teledyne Continental TSIO-520-UB, 300 hp @ 2,700 rpm/36 in Hg
Recommended TBO	1,600 hr
Propeller	McCauley 3-blade, constant speed, 78 in
Length	27 ft 6 in
Height	8 ft 5 in
Wingspan	37 ft 10 in
Wing area	188.1/sq ft
Wing loading	20.55 lb/sq ft
Power loading	12.88 lb/hp
Seats	6
Cabin length	12 ft 7 in
Cabin width	3 ft 6 in
Cabin height	4 ft 2 in
Empty weight	2,338 lb
Empty weight, as tested	2,577 lb
Max ramp weight	3,866 lb
Useful load	1,528 lb
Useful load, as tested	1,289 lb
Payload w/full fuel	916 lb
Payload w/full fuel, as tested	677 lb
Max takeoff weight	3,850 lb
Max landing weight	3,850 lb
Fuel capacity, std	648 lb (612 lb usable) 108 gal (102 gal usable)
Oil capacity	12 qt
Baggage capacity	70 lb, 10 cu ft

Performance

Takeoff distance, ground roll	1,180 ft
Takeoff distance over 50-ft obst	2,350 ft
Max demonstrated crosswind component	17 kt
Rate of climb, sea level	1,050 fpm
Cruise speed/Range w/45-min rsv, std fuel (fuel consumption)	
@ 79% power, best economy	
10,000 ft	178 kt/868 nm (108.6 pph/18.1 gph)
20,000 ft	193 kt/931 nm (104.4 pph/17.4 gph)
@ 69% power, best economy	
10,000 ft	167 kt/962 nm (91.2 pph/15.2 gph)
20,000 ft	182 kt/1,010 nm (88.8 pph/14.8 gph)
@ 54% power, best economy	
10,000 ft	146 kt/1,116 nm (67.8 pph/11.3 gph)
20,000 ft	158 kt/1,130 nm (67.8 pph/11.3 gph)
Max operating altitude	25,000 ft
Landing distance (over 50-ft obst)	1,700 ft
Landing distance (ground roll)	950 ft

Limiting and Recommended Airspeeds

Vx (Best angle of climb)	77 KIAS
Vy (Best rate of climb)	100 KIAS
Va (Design maneuvering)	141 KIAS
Vfe (Max flap extended)	
Approach—15°	154 KIAS
Full—30°	125 KIAS
Vle (Max gear extended)	154 KIAS
Vlo (Max gear operating)	
Extend	154 KIAS
Retract	154 KIAS
Vno (Max structural cruising)	168 KIAS
Vne (Never exceed)	206 KIAS
Vr (Rotation)	70 KIAS
Vs1 (Stall Clean)	66 KIAS
Vso (Stall in landing configuration)	57 KIAS

*All specifications are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, at sea level and gross weight, unless otherwise noted. *Operations/Equipment Category is defined on p. 97 of this issue. The prices reflect the costs for equipment recommended to operate in the listed categories.*