SPEEDY BEECH

Less drag equals more knots for the Bonanza

BY J. JEFFERSON MILLER

Michael D. (Mike) Smith will consider almost any means of making the Beech Bonanza faster. Over time, he has tried and discarded a number of changes aimed at making the Bonanza aerodynamically more efficient. Mounting the airplane's antennas internally, for example, yielded a four-knot speed increase, but some owners complained of poor radio reception. Smith now replaces the antennas with types that have less frontal area, thereby gaining about one knot in speed. Removing the airplane's tiedown rings eked out another fraction of a knot. However, without tiedown rings, pilots found it was impossible to secure the aircraft to the ground. This early modification has been discontinued.

What has survived the trial-and-error process is a speed conversion package consisting of a number of drag-reducing modifications. Some of these modifications are major, such as changing the wing's angle of incidence, and many are relatively minor, such as the removal of four raised emblems from the fuselage. The cumulative effect of all the modifications is an average 17-knot increase in cruise speed, according to Smith. The modification package is available for all Bonanza models, although certain modifications may not be applicable to certain models. The price of the total modification package is $18,280. To date, Smith has modified about 300 Bonanzas.

His own Bonanza, a 1966 V-35, picked up almost 22 knots after the conversion. Smith has flown the V-35 to two victories in the CAFE 400 race, in 1981 and in 1983. (CAFE is the acronym Competition in Aircraft Fuel Efficiency.) In the 1983 race, Smith achieved a fuel efficiency of 14.49 mpg at an average speed of 165 knots. Smith also has won the Dulles 400 efficiency race in his modified Bonanza.

Other advantages of the speed conversion, according to Smith, include about 10-percent greater range, improved fuel efficiency by about 1 mpg at 75-percent power, improved climb performance (by 200 to 400 fpm), quicker roll rate (120 degrees per second), lower stall speed (from 56 to 46 knots), higher service ceiling (from 16,600 to 22,000 feet) and shorter takeoffs and landings.

The addition of flap and aileron gap seals largely is responsible for the changes in rate of climb, roll rate, stall speed, service ceiling and takeoff and landing distances. The seals eliminate interference drag between the wing and the flaps and ailerons. Smith offers the seals as a separate kit for $1,400, installed.

The most costly single item in the total modification package, at $5,280, is the "RamAire Nose Conversion." Smith's brochures refer to the RamAire nose as a separate kit. All other elements of the modification package are referred to as the "Smith Speed Conversion," which costs $13,000. The RamAire nose conversion is available only for Bonanzas built after 1963, since those are equipped with the 285-hp Continental IO-520 engine.

The installation of the RamAire nose reduces cooling-air inlet size from 105 to 48 square inches, substantially cutting down the amount of drag caused by cooling air flow. smaller inlet size also cuts down the volume of air available to cool the engine. To achieve adequate cooling with the smaller air inlets, Smith developed baffles and seals for the engine compartment. These baffles and seals direct incoming air down through the cylinder heads.

Smith said that the RamAire door—an engine intake-air inlet that bypasses the air filter—raises the maximum altitude at which 75-percent power can be maintained from 6,500 to 9,000 feet. Opening the RamAire door in flight provides an extra three-quarters of an inch of manifold pressure. The door is opened with a vernier control located just below the prop control.

The door should not be opened in smog, blowing dust or icing conditions. But it can be opened to provide a needed boost on takeoff when density altitude is very high, if the strip is not covered with dust or debris that might be ingested by the engine. According to Smith, the RamAire nose adds about five knots to the Bonanza's speed when the door is open and about three knots when it is closed.

The rest of the elements in the modification package, those included in the Smith Speed Conversion, add about another 12 knots to the Bonanza's cruise speed. Most of the drag-reducing measures in the package individually account for a half-knot to a knot increase. Briefly, they consist of:

- A change in the wing's angle of incidence to reduce drag at high speed cruise. The maximum speed gain is four knots (the exact amount of change in the angle was proprietary information, Smith said);
- Rerigging of ailerons and flaps for more precise alignment, less drag;
- Installation of new flap and aileron gap seals;
- Installation of aluminum seals to close the gaps between the propeller blades and the spinner;
- Removal of cowling door handles;
- Redirection of the exhaust stacks: They now extend straight back instead of out at 45-degree angles;

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- Stiffening of the nose-gear door to ensure a tight seal;
- Tightening of the main-gear door rigging. Addition of aluminum door extensions and foam seals for a snug fit in the frame;
- Removal of roof-mounted antennas. Installation of two whip antennas on the belly for communications radios and a two-part blade antenna on the tail for navigation radios;
- Replacement of the ADF antenna with a smaller unit;
- Placement of the ELT antenna in the tail fairing of the vertical fin;
- Removal of four raised emblems;
- Replacement of about 230 round-head screws with countersunk screws;
- Replacement of the outside air temperature probe with an electronic temperature probe in the nose;
- Addition of a fiberglass tailcone to reduce "intersection drag" between the elevators and the original tailcone;
- Removal of the step;
- Removal of the rotating beacon; and
- Narrowing of the wingwalk.

It takes 350 to 400 man-hours to perform all these modifications. A Bonanza must be left at Mike Smith Aero for two weeks in order to complete all of the modifications, including the installation of the RamAire nose.

The airplane shown on these pages, N18367, recently received the full Smith modification package. Ferrying the airplane to Mike Smith Aero in Johnson City, Kansas, and back to Frederick, Maryland, after the conversion had been completed provided me with an opportunity to compare performance figures.

On the return legs, the Bonanza's true airspeed averaged 16 knots faster than on the way to Johnson City. All speed readings were taken at the same gross weight and with the same load distribution, but altitudes and atmospheric conditions differed slightly. Comparisons were made between speed readings taken at the same power settings. Smith calculated an 18-knot increase for 18367 in his own speed tests.

The highest speed I recorded in the converted aircraft was 192 knots true airspeed. Power was set at 75 percent

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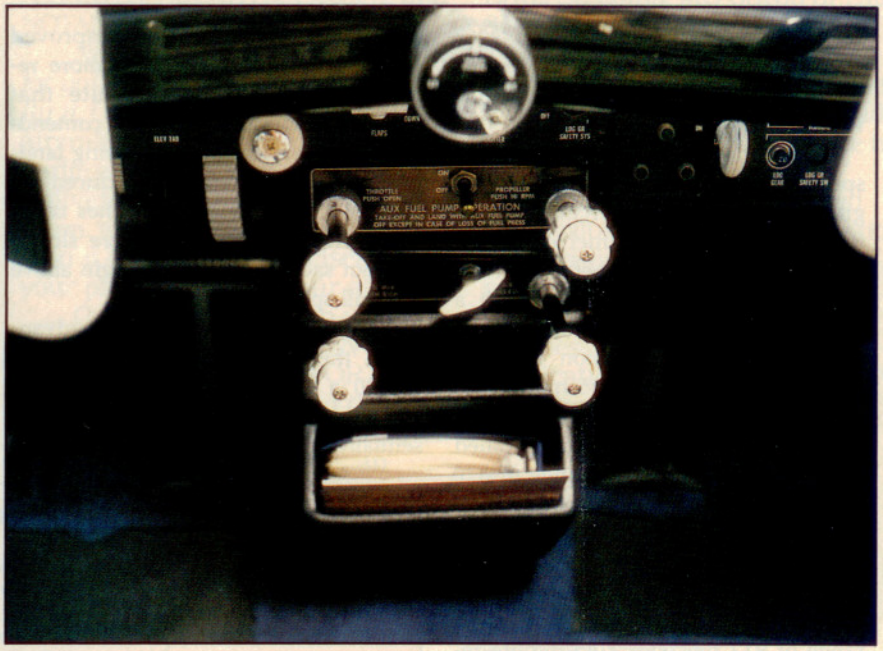
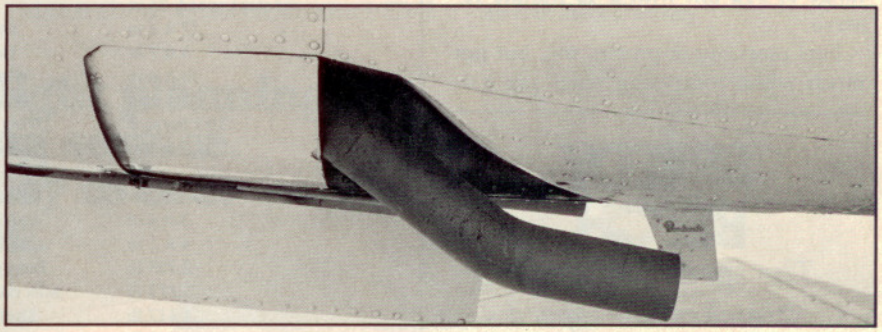
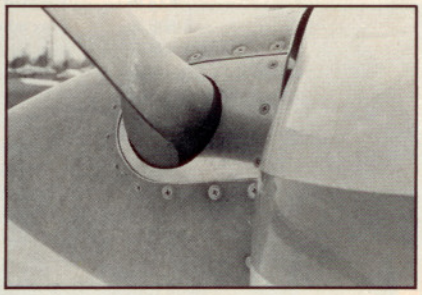
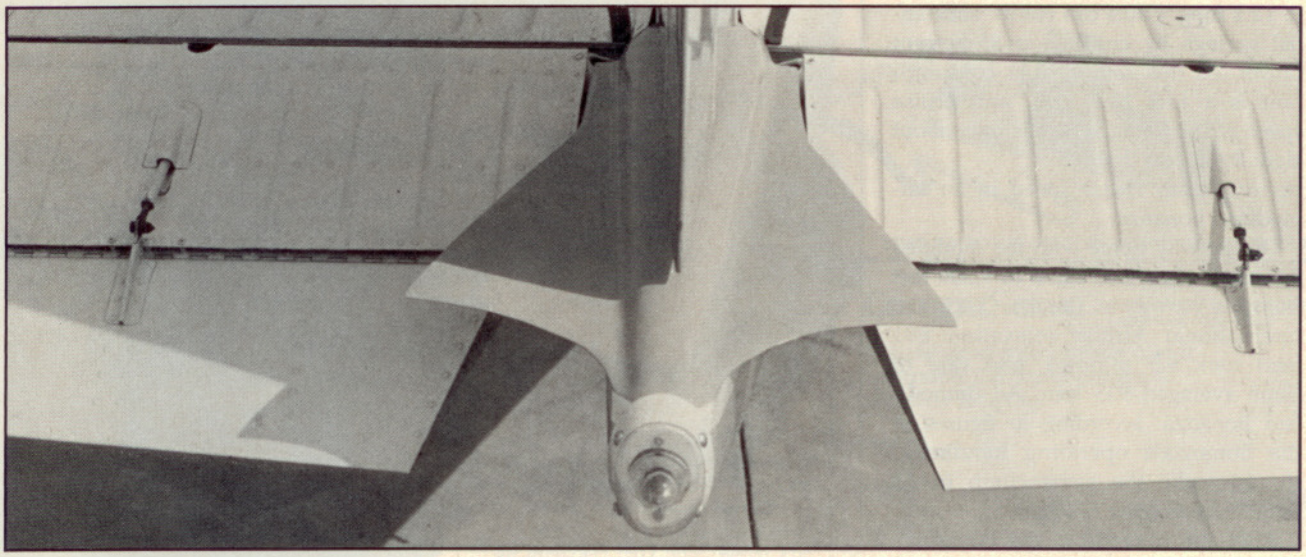
The Smith Bonanza's most distinguishing feature—its "Ram Aire" nose—adds about 5 knots.







The modified Bonanza has four vernier controls that all look alike: The bottom right control opens and closes RamAire door. Other modifications include: turned back exhaust stacks (they used to extend outward at 45 degree angles); spinner seals around the propeller; and a fiberglass tailcone to reduce "intersection drag" between the elevators and the original tailcone.



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at 7,500 feet. Temperature was 4°C. The aircraft was 700 pounds below maximum gross weight and had a forward center of gravity.

With a 16-knot gain in cruising speed, the A-36 also gains 9.5 percent greater range at 75-percent power. Burning 15.2 gph (the fuel consumption at 75 percent), the before-conversion Bonanza can fly 692 nm with a 45-minute reserve. At the same power setting, the after-conversion Bonanza can fly 758 nm with a 45-minute reserve, an increase of 66 nm.

At 55-percent power, the unmodified Bonanza has a maximum range of 820 nm with a 45-minute reserve. The airplane can cruise for 5.7 hours at 144 knots, burning 11.5 gph. After the conversion, the Bonanza can cruise at 160 knots at 55-percent power, achieving a range of 912 nm with a 45-minute reserve.

Fuel economy improves, too, but not much when comparing miles per gallon at a given power setting. For example, the Bonanza's before-conversion mileage at 75-percent power is 11 mpg. After the conversion, the mileage rises to 12.1 mpg. Pilots can realize substantial savings by cruising at 55-percent power. At this setting, fuel consumption is a low 11.5 gph, and cruise speed is 160 knots, which is only about eight knots less than 75-percent-power cruise speed in an unmodified Bonanza.

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The speed conversion stretches the speed envelope—10 knot lower stall speed and about 16 more knots at the top.

On the way home with the modified Bonanza, a best-rate climb to 9,500 feet from the runway at Greater Cincinnati International Airport (elevation 891 feet) took 9.5 minutes, and rate of climb averaged 935 fpm. An unmodified Bonanza, according to figures in the Bonanza's operating handbook, should make the same climb in 13 minutes, averaging 670 fpm.

After the conversion, the Bonanza's slow-speed handling was improved noticeably. The airplane was more responsive in roll, an attribute that seemed most valuable when contending with gusty crosswinds during landing. Rotation speed was reduced by about 10 knots, and approaches could be flown about 10 knots more slowly without sacrificing a safe margin above the stall speed.

Despite its several practical advantages, the speed conversion, at about $1,000 a knot, may seem excessively expensive to some. After all, it is, essentially, a luxury item for an already fast single. However, compared with the cost of trading in a Bonanza for a faster airplane (for example, a Beech Baron), the modifications could be considered a bargain in terms of the cost of operation.

There is, however, no great economic incentive for buying the speed conversion, although it will pay for itself in fuel savings over a number of years. The best reason to buy the speed conversion simply is for the personal satisfaction of going faster. And for many Bonanza owners, that is reason enough. □

Beech A36 Bonanza	Model	Beech A36 Bonanza with full Smith speed mods
	Specifications	
Continental IO-520-BB 285 hp @ 2,700 rpm	Powerplant	Continental IO-520-BB 285 hp @ 2,700 rpm
McCauley, two-blade, constant-speed, 84 in	Propeller	McCauley, two-blade, constant-speed, 84 in
27 ft 6 in	Length	27 ft 6 in
8 ft 7 in	Height	8 ft 7 in
33 ft 6 in	Wingspan	33 ft 6 in
181 sq ft	Wing area	181 sq ft
19.9 lb/sq ft	Wing loading	19.9 lb/sq ft
12.6 lb/hp	Power loading	12.6 lb/hp
4-6	Seats	4-6
12 ft 7 in	Cabin length	12 ft 7 in
3 ft 6 in	Cabin width	3 ft 6 in
4 ft 2 in	Cabin height	4 ft 2 in
2,195 lb	Empty weight	2,195 lb
3,612 lb	Max ramp weight	3,612 lb
1,417 lb	Useful load	1,417 lb
973 lb	Payload w/full full	973 lb
3,600 lb	Max takeoff weight	3,600 lb
3,600 lb	Max landing weight	3,600 lb
480 lb (444 lb usable) 80 gal (74 gal usable)	Fuel capacity	480 lb (444 lb usable) 80 gal (74 gal usable)
12 qt	Oil capacity	12 qt
400 lb, 48.7 cu ft	Baggage capacity	400 lb, 48.7 cu ft
	Performance	
1,140 ft	Takeoff distance, ground roll	850 ft
2,040 ft	Takeoff distance over 50-ft obst	1,820 ft
1,030 fpm	Rate of climb, sea level	1,400 fpm
179 kt	Max level speed, sea level	195 kt
168 kt	Cruise speed @75% power @6,000 ft	
697 nm	Range @75% power w/ 45-min rsv @6,000 ft	
	Cruise speed @75% power @9,000 ft	188 kt
	Range @75% power w/ 45-min rsv @9,000 ft	770 nm
16,600 ft	Service ceiling	22,000 ft
1,450 ft	Landing distance over 50-ft obst	1,110 ft
840 ft	Landing distance, ground roll	590 ft
	Limiting and Recommended Airspeeds	
62 kt	Vs1 (Stall clean)	53 kt
52 kt	Vso (Stall in landing configuration)	43 kt

All specifications are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, at sea level and gross weight. Mike Smith Aero, Incorporated's address: Stanton County Airport, Box 340, Johnson City, Kansas, 67855. Telephone: 316/492-6840.