

N99RL: A UNIQUE 35B FULL-FLAP V-TAIL

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I was fortunate enough to quite recently buy a 1970 Bonanza with a rather unusual, possibly unique, combination of major modifications. In October 1977 the Robertson STOL conversion was installed, which replaced the ailerons with spoilers, extended the flaps to full span, removed the spring interconnect between the rudder and aileron, increased the nose-up trim range and reduced the bob weight in the pitch circuit.

In N99RL, the spoilers are positioned behind the rear spar and are similar in length to the old ailerons, and are therefore long in span but quite narrow chord, each being a total of about 3 square feet. When down, they cover the area where the leading edge of the extended flap retracts up into the wing. The flaps increase in area by almost 15 square feet, and go to nearly 32 ft in span. The flap control is modified to provide only two positions, 15 and 30 degrees.

With the flaps up, the spoilers provide crisp roll control just by lift reduction through the spoiler lifting on one or the other wing. However, with flaps extended, the spoiler on the upgoing wing, instead of just staying flat, now goes down—more like the differential action of normal ailerons. This partly closes the gap (created by the flap extension) between the leading edge of the flap and the trailing edge of the wing, thereby accelerating the airflow over the flap and providing more lift.

This combination of lift reduction on one wing and lift increase on the other gives very positive roll control at low speeds, especially at flaps 30, compared to ailerons. There is little to no yaw from the spoiler activation, flaps up or down, hence disconnection of the rudder interlink.

STOL Bonanza pilots can have even lazier feet than normal. Spoiler actuation is done via the existing aileron control cables linked to cams, which act on pushrods to the spoilers.

There is also a mechanical linkage between the flap and the spoiler pushrods to provide the differential spoiler movement when the flaps are out.

This mechanical wizardry is all visible through new access hatches underneath each wing. In some respects, the mechanical geometry involved is like the ruddervator mixer for the V-tail. The kit adds about 19 lbs.

I have no idea how many Bonanzas were modified, but you certainly don't seem to see many. Fortunately, 99RL is extremely well-documented, and I have the installation drawings for this modification, as well as the rigging instructions.

To help confirm the rigging I also had a set of rigging tools made. I would be happy to share this information with any ABS member with this modification who needs it.

In February 1980 D'Shannon tip tanks were added, providing an additional 15 gallons of fuel each side, although in fact they appear to hold about 17. There was no STC for increased gross weight, as D'Shannon has never applied for this in combination with the STOL kit. The tip tanks, as usual, move the certification to Normal from Utility, so the Va drops significantly because of the lower g limit in the Normal category.

In April 1997 the engine was turbonormalized, and in 1998 carried over to a new TCM IO-520BB. In November 2000 this installation was enhanced with the latest Tornado Alley modifications, including the larger intercooler, expanded air intake around a recessed landing light, and the various cooling improvements. The motor now has about 250 hours in this latest configuration.

It also has all the more common changes, such as three-blade prop, replacement windows, fancy avionics and so forth.

Important handling differences

The combination of modifications provides a very attractive blend of speed, climb performance, STOL and long legs,

but the STOL modification brings some important handling differences. Most notable are the larger trim changes with flap extension, needing full nose-up trim, now 21 degrees, for landing at forward CGs with full flaps* the slow flight regime, where 65 KIAS is very comfortable with crisp roll control with Flaps 15; and takeoff with up to 9 degrees of nose-up trim with Flaps 15.

*Editor's Note: This is not unusual for turbonormalized Bonanzas with or without the STOL kit.

Take off with insufficient nose-up trim takes a big pull on the yoke to get down to the speeds needed for good climb performance, and at too high a speed climb, performance with these large flaps deteriorates markedly. V_x with Flaps 15 is 68 KIAS, V_y 78 KIAS (according to Robertson data), numbers that are not much different from those in the old POHs before they stopped giving such data.

V_{so} is reported as 53 KIAS at Flap 30s, again not much different from the standard airframe. Full-flap full-power stalls appear to take place somewhere well below 50 KIAS (position error gets quite large at the angle of attack involved), and the spoilers retain full roll control into the stall without any adverse effects. While this is not part of the flight regime you use much, the STOL behavior is much friendlier than the standard airplane.

All the above speeds are at maximum gross takeoff weight of 3,400 lbs.

Conversion research

Before buying this aircraft, I did some research on the STOL conversion. Barry Schiff wrote a review in the September 1977 *AOPA Magazine*, flying a prototype installation. He did not attempt to validate a claim by Robertson of 40 percent reduction in takeoff and landing roll, but he spoke highly of the improved roll control and full-power stall.

I talked with one other owner of a Bonanza with both the STOL kit and latest TN conversion (including the IO-550), but no tip tanks. He also referenced improved slow-speed handling, excellent soft-field performance using the big flaps, and the ability to fly approaches very slowly, with power, well on the back of the drag curve and then using a little more power in the flare to arrest the descent and stop in very short distances.

There does not appear to be any downside to the conversion other than its rarity.

I have no absolute performance data other than that provided by Robertson, and the numbers comparison above is not very informative. I did fly some comparisons with my previous V35B, also turbonormalized (albeit with the older system without the induction improvements), but without tip tanks and with a two-blade prop.



My initial reaction was that there was not much difference in takeoff performance, but, with more experience and gaining confidence with lower liftoff and initial climb speeds, it is clear the takeoff and initial climb performance of 99RL is significantly better, both clean and with Flaps 15. How much is from the three-blade prop, how much is the upgraded TN system, how much is tip tanks (which certainly appear to provide some lift) and how much is from the slower speeds from the STOL, I cannot judge.

I would not depart my home field (2,500 ft) on a hot day at gross weight in my old airplane, but in this one, operating out of 2,000 ft at my normal weights would give me no concern. In their POH supplement Robertson claims 770 ft ground roll and 1,240 to 50 ft with Flaps 15 at max gross weight.

My Beech POH does not have data for takeoff with flaps, but John Eckalbar's book suggests that this is not much different from Flaps 20 performance in the standard plane.

It also initially appeared slower in cruise than my previous Bonanza, but this was mostly resolved when I checked the fuel-flow calibration on the EDM700 and found it was over-reading, so 15 gph indicated was not 15 gph actual. Gph is, of course, a direct analog of HP when running LOP, so you can fairly easily check cruise speed comparisons between planes at the same power by running at the same fuel flows.

It also has an SDI (Hoskins) digital display, running off the same flow meter, which over-reads about 7 percent, and I don't know how to adjust the K factor (ideas anyone?). I don't think the STOL kit should have any significant influence on cruise speed, and the other owner I spoke with does not think so either. It might be still a few knots slower in cruise, probably due to a combination of tip tanks and the three-blade prop cruise efficiency. It does not have the latest "scimitar" style prop.

General handling in cruise is very similar to the standard version, with perhaps a slight dead band with wings level. But with the flaps out, it is completely different—so different, in fact, that at 70 kts with full flaps, you really only need to lean on the yoke a little to keep the wings level. The normal large yoke movements at slow speed in turbulence are not needed; using them would probably snap the airplane onto its side, or more...

There is a tendency to over-control for the first few landings, but after that, it is easy. You must also adapt to the large trim change with flap.

I can easily land and stop at midweights with little braking in about 1,200 ft from 50 ft over the threshold in no wind at the 2500 ft field where 99RL is based, using 60 to 65 KIAS on short final. This is one case where the published data is different, with Beech showing 1,300 ft to stop from 50 ft at 3400 lbs and 70 KIAS on short final, while Robertson shows 914 ft at the same weights.

Would I do it again?

- **Would I buy the STOL conversion today?** Probably not, as I don't have a real need for STOL performance, although it is nice to be a lot higher over the end of the runway out of my urban home field on a hot day. I don't even know if the conversion is still available. I believe it cost around \$8,000 in 1977. Bonanzas with IO-550 conversions almost certainly have even better takeoff performance, as well as improved climb and cruise, although the big flaps would help with very soft fields.

- **Would I put on tip tanks?** Maybe: the longer legs are occasionally useful, and the ability to tanker cheap fuel saves a few dollars. In SE Michigan I can easily save 70 or 80 cents a gallon for the sake of flying half an hour from my base. If I load 80 or 90 gallons, then it is worthwhile.

I have never flown a Bonanza with tip tanks before this one, but I can imagine that roll control is ponderous with them full, and there would also be some roll/yaw coupling; the STOL kit certainly minimizes this. One of the enduring pleasures of Bonanza flying is the handling, so the STOL/tip tank combination is probably better than just tip tanks from that perspective.

- **Would I put on the TN conversion?**

Aside from the high cost, this is without question for me the best upgrade to a Bonanza, especially combined with the change to the 550 motor. I have more than 1100 hours flight time in TN-converted Bonanzas. In terms of fuel efficiency, cruise speed and altitude capability, this transforms the airplane with no reliability

or maintenance cost concerns (at least in my experience). I would not pay to convert a 30-year-old plane, but I can easily understand why owners of newer Bonanzas would do so. I believe there is also a gross weight increase available, at least for some versions.

Buying already-converted older airplanes in excellent condition, if you can find them, is a good arrangement, and I have done it twice. There is also a small ancillary benefit in that the additional weight ahead of the datum (also helped by the three-blade prop) helps the aft CG issue a lot. In fact, it is possible in 99RL to be out of the front of the envelope with two largish adults in the front, full fuel (tips and mains), no rear seat passengers and no baggage.

The STOL modification moves the forward CG limit aft from 77 to 78 up to 3,000 lbs but leaves the other limits unchanged. I can, however, put four 180-pound adults inside with no baggage and 60 gallons of fuel in the main tanks and be just inside (and stay inside with fuel burn) the aft edge of the envelope. Or I can put my wife and daughter inside, 100 pounds of baggage, fill the mains and tips, and be comfortably inside the

envelope (and fly for a lot longer than their bladder capacity).

Cruising at 190 KTAS or more in the mid-teens on 15.5 gph, at wide open throttle and lean of peak, with all the CHTs cool, and the engine humming smoothly is always a delight and is wonderfully efficient.

99RL has modern avionics (at least by my standards), with the GX60 IFR GPS, SL30 nav/com, KN53 Nav, KT76A, PS6000 audio and the excellent MX20 MFD, including the ability to show weather and approach plates. It has the recording EDM700, Century 2000 coupled AP, KCS55 HSI and electric backup AI, as well as low air pressure, voltage, starter engaged and gear up warning lights (and horn) as well as repeaters for the three greens directly below the HSI.

About the only thing lacking is a standby alternator, but I am waiting for GAMI to certify theirs, and then for me she will be the complete solution for both long trips and short fields.

I take no credit for 99RL. I bought her in the present state from ABS member Ray Lockhart. No one owner decided on the combination of upgrades; I think three different owners did the three major mods, and I am just fortunate to be the current owner of this very unusual Bonanza.

ABS member Nigel Thompson has around 2,000 hours of flight time, of which about 1,600 or so are in his present or past Bonanzas: a 1966 C33, a 1973 V35B and this 1970 V35B. (V35Bs with the TN conversion).

WHAT'S WRONG?

By Adrian Eicchorn, Alexandria, Virginia

Assuming the gust lock is in place, how well would this airplane withstand strong winds?
See page 90?? for the answer.

