Turbo-Normal Test Case

by John Foose, *Contributing Editor*

Last spring I was contacted by WBS to see if I was interested in having a TurboNormalizer installed on my one year new Millenium IO-520BB by Western Skyways.

After some consideration involving finances, timing, etc., I agreed to this great improvement, as it allows the engine to keep full sea-level manifold pressure right up to 21,000 feet. This is accomplished by having a turbine that is spun by the exhaust gases, compressing the incoming ambient air pressure to a preset manifold pressure controlled by an automatic mechanism called a wastegate.

The condition was that I had to be the Beta installation – I would be the guinea pig. I contacted Al Head, the president of Western Skyways (see ad on page 10), to work out the details. In exchange for letting them have the plane for 3 months, I would get a nice new installation at a price that was unbelievable, and I would also be the recipient of any future improvements at no cost. For example, it might mean an improved intercooler (think of a radiator for air that lowers the temperature of the aircoming from the compressor going into the engine). The original factory turbocharged installations did not have an intercooler, causing hotter exhaust and cylinder head temperatures, when producing the same power as the turbo-normalized (TN) systems. Also, since this is a TN system and not a turbo-charged system, it did not involve any modifications to the internal workings of the engine. By way of comparison, the engine on the factory turbo system, the IO 520 D, has lower compression ratio pistons, running at 8/1 instead of the IO 520 BB at 8.5/1. The TN system has an automatic waste-gate that keeps the manifold pressure at a maximum of about 30" of mercury, while the factory system is set at about 34". This is just a quick overview of the turbo system.

John Deakin, in his column in AvWeb called *Pelican's Perch*, has written extensively on the turbo systems in a series called, *"Those Fire Breathing Turbos"*. The articles will tell you everything you want to know about turbos, in easy-to-understand language with really nice pictures. You can check it out at www.AvWeb.com; go to "columns" to locate the articles.

After all the details had been worked out, we agreed to deliver our plane in April, with the understanding that we would get it back near the end of June, or early in July. Also, since our plane would be out of annual by the end of May, Western Skyways agreed to do the annual as part of the contract - I agreed to pay for any needed parts and they would supply the labor at no charge. On top of that, Al delivered us back to Seattle from Montrose, Colorado, in his Cessna P210. How do you beat a deal like that?

A fly in the ointment was discovered after work had begun – the STC did not cover two-bladed propellers. Western Skyways said that since this was their oversight, they would supply an overhauled 3 bladed propeller at no cost to me, including replacing the electric de-ice boots. I felt a little guilty about this and said I would pay for the overhaul, still a very good deal for me. Their willingness to "make it right" reflects their customer-oriented service.

Al Head kept me informed all through the process, with updates every couple days, letting me know how the project was going. Since he made some engineering changes to the original STC, there was paperwork involved – a lot of it – mostly involving the hiring of a DER (an FAA Designated Engineering Representative), a person with the power of an FAA employee, but in private practice. As the old adage goes "the job's not complete until the paperwork is done," and the paperwork became the delaying factor in this conversion, although they missed their delivery date by only a week. Not too bad for an original installation, I didn't think, as they sometimes take twice as long as the estimates.

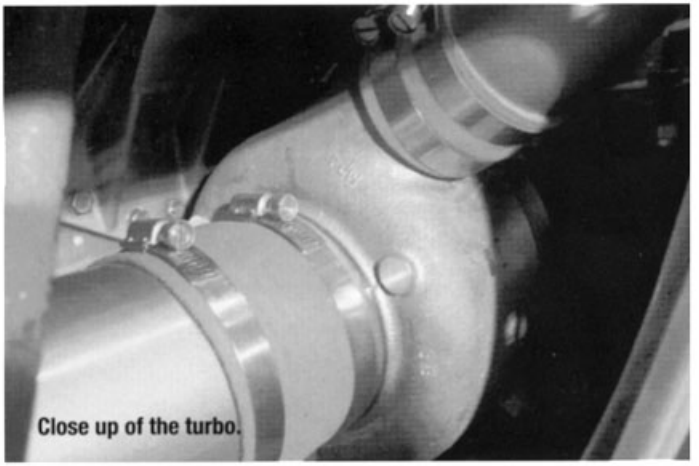
When we took delivery of the plane, I was unhappy with the spinner, as my old one was chromed and the new one was not, plus it was scratched and wouldn't polish out. Al said to find one I liked and he would pay for it, which he did. Another example of great service.

The Performance.

I can now cruise along at13,500 feet, running lean of peak EGT, (thanks to my GAMI Injectors), burning about 15 GPH, with a True Air Speed of 178 knots, all while keeping my hottest Cylinder Head Temperature well below 380°F. In case you've been living in a cave for a while, GAMI (General Aviation Modifications Inc.) of Ada, Oklahoma, has been selling their "tuned" fuel injectors for several years (see ad on page 33). They distribute the fuel to the cylinders in a predetermined volume, making for a smoother running engine; one that runs cooler while operating Lean of Peak EGT. This is a boon to Bonanza flyers, as it enables us to get the same power by increasing the Manifold pressure (no, you don't have to own a turbo to get the benefits) and using less fuel. As their advertisements say, they pay for themselves.

Living in the Seattle area where every trip involves going over mountains unless I am flying to Hawaii, the turbo has surely changed my flying habits. I can fly high over the weather while generating enough power to continue to climb up into the flight levels if need be. It is great to be in clouds, picking up a little ice and have the option to go up as well as down to get out of it. When center says the tops are at 17,000 feet, I can file for 18,000. Plus, up there the True Air Speeds are higher, which is another benefit, along with having the airspace to yourself. The airliners are at 35,000, and the other GA folks are down at 10,000.

There is good news for those of you with the IO 550's. Western Skyways plans to start flight testing by the end summer and hopes to have approval soon after. If anyone wants more information, please feel free to call me at 425-868-7003 or email me at foosejl@cablespeed.com. –

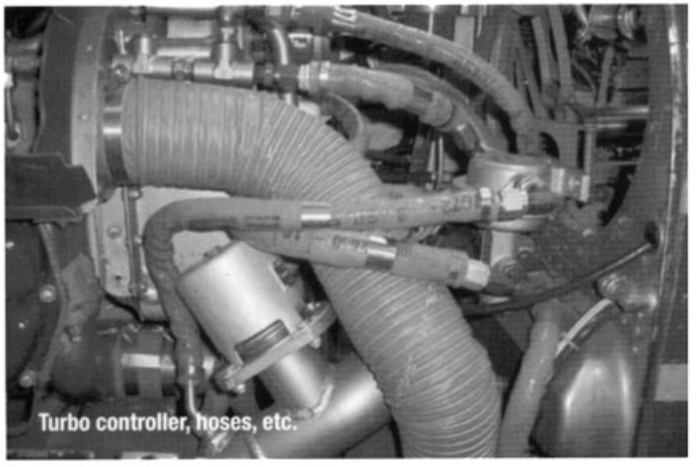


Close up of the turbo.

Cross over hoses from the intercooler.

The muffler/heat exchanger.

Filter for the pressurized air for the magnetos.



Turbo controller, hoses, etc.

The intercooler.