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FLYING

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Tests Examine Effect of Tuned Exhaust

I'm not a test pilot but Robin Thomas of Power Flow Systems invited me to fly a Cessna 172 fitted with his tuned exhaust system and then, as a comparison to fly the same airplane with the standard factory exhaust system. Even I could tell there was a difference. It was that obvious.

As Thomas explained to me before the two flights, the idea behind a tuned exhaust system is to optimize the exhaust pipes—by altering their length and diameter—so there is an efficient flow of exhaust gases from the engine. According to Thomas, the exhaust is not continuous but comes out as short "puffs" traveling at 300 feet per second, or 200 mph. When the exhaust valve in a cylinder closes, it creates a vacuum behind the puff. By altering the length and/or the diameter of the exhaust pipe it's possible to control the system so the vacuum stays in the pipe long enough for the next "puff" to jump in and get pulled along. Tuning the exhaust system also helps eliminate the pulse of back pressure that can be driven back upstream into the other cylinders. That's the theory. Determining the proper length is the first problem, the second is figuring out how to fit it in the cowling; in the Cessna 172 the ideal length of the exhaust pipes is something like 80 inches.

During the test flights I was monitoring the climb speeds to see that they were held as close to the same as possible and noting the times at each 500-foot interval as we climbed to 7,500 feet. Obviously, to get a reliably accurate indication of the differences, it would have been necessary to try to replicate atmospheric conditions and do a number of flights to get an average. We didn't have that opportunity. By the time we finished the first flight, switched from the tuned exhaust to the standard exhaust and made the second flight, conditions had changed.

Nevertheless, the difference was obvious by comparing our height as we flew over the windsock during the two takeoffs. With the tuned exhaust we reached 1,000 feet in 1:39 compared to 2:12 with the standard system. The times to 1,500 feet were 2:32 versus 3:27 and the Cessna 172, fitted with the tuned system, reached 4,000 feet almost two minutes faster (7:31 compared to 9:28) than with the standard system; and 7,500 feet almost three and a half minutes quicker (15:50 compared to 19:15). It was obvious from the erratic bumps—and rate of climb—that by flying later in the day the standard system benefited from thermal lift. Close to the ground and again after we had climbed above the haze layer, the tuned system proved to me it provides increased climb performance.

Results of test cell runs conducted by Lycon, Visalia, California, and provided by Thomas are probably more accurate and indicative of the effects of tuning the exhaust system than my efforts at flight testing. According to those tests, an O-320-A1A engine with a standard Cessna exhaust system, at full power turned 2,563 rpm and generated 133.8 horsepower. Under identical conditions, the same engine fitted with Power Flow's tuned exhaust system was able to turn at 2,665 rpm and generate 157.1 horsepower. (With a "neutral" exhaust system—no back pressure or vacuum—the engine was capable of developing 159 horsepower.) At full power, with the Cessna system the oil temperature was more than 14 degrees hotter (149.0 compared to 163.5 degrees). When both engines were throttled back to 2,500 rpm, the engine with the Cessna system in the test stand was burning 94.7 pounds of fuel per hour; the engine with the tuned system burned 73.2 pounds, a difference of some 2.5 gallons per hour.

In addition to the increased power or reduced fuel consumption, another advantage claimed for the tuned exhaust system is that the exhaust tubes are 40 percent thicker than the original and that there are no welds in the cabin heat section, essentially eliminating the possibility of carbon monoxide seeping into the heating system.Installation of the system, which weighs two to three pounds more than the original, takes about 30 minutes. The system includes four headers, cabin heat, carb heat (carburated models only), tail pipe and muffler; hardware, support rod and gaskets, and is priced at $3,425. The STC currently covers all Cessna 172s fitted with 150- or 160-hp Lycoming O-320 engines produced between 1967 and 1986. But Thomas said he's working now on approvals for Lycoming's 110-, 180- and 200-hp four-cylinder engines and would then target the six-cylinder engine in the Cessna 182. "There's more tubing to squeeze into the same place," he says, "but I'd expect to be able to get an additional 30 horsepower, since the engine starts with a 31-horsepower detriment."

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The only changs made were updating the contact information and price, everything else is identical, 12-11