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Saving $4,000 in fuel

Thirty-one years ago this month I first flew an airplane by myself. Little did I know then that I had launched a lifelong learning journey. While I'm not sure I can articulate some tidbit of learning picked up after every flight, I know that I do learn something not just every time I climb into an airplane, but also in just thinking about aviating. By contrast, I also have been driving for 31 years and I most assuredly can say that I haven't learned much about driving since those first few years—except to realize that as I get older I get more conservative in my driving.

Editor in Chief Thomas B. Haines flies his A36 Bonanza from Frederick Municipal Airport (FDK).

One means of continuing to learn throughout life is a willingness to question and re-examine steadfast beliefs—perhaps reconfirming that you were correct in the first place, or, in other situations, maybe deciding that what you once believed to be true is not and never was—or maybe it was once true, but no longer is. As enlightened as that might sound, let's face it that seldom on our own—without outside motivation—do we actually re-evaluate what we believe to be true.

The recent dramatic spike in avgas prices is the current motivator for me to re-examine the way I have operated aircraft engines for the last three decades. A previous owner replaced the stock Continental IO-520 in my 1972 Beechcraft Bonanza A36 with a Continental IO-550 and swapped the two-blade prop for a three-blade. The –520 is rated at 285 horsepower continuous whereas the –550 can output 300 horsepower continuously. When I first bought the airplane in 1999 I operated the engine as I had in other Bonanzas that I had flown, running it about 75-percent power and 50 degrees rich of peak (ROP) exhaust gas temperature. Within a few hundred hours the engine experienced top-end lubrication problems, resulting in cam lobe and tappet spawling, necessitating an overhaul. Now, I paid for that engine when I bought the airplane, but it just seemed like part of the purchase price. When I had to shell out tens of thousands of dollars separately to overhaul it, the cost seemed so much more tangible. So I vowed to baby that engine even more—even though I have no indication that the way I flew it previously had anything to do with the problems that it experienced.

Since the overhaul I have flown it consistently at 65- to 70-percent power and 100-degrees ROP, accepting fuel flows about one to two gallons per hour higher while going slower than before in the name of protecting my investment. What I had learned was that 50 degrees ROP was just about the worst possible power setting in regard to engine wear and tear. In fact, according to George Braly of General Aviation Modifications, Inc., any power setting between about 50 degrees lean of peak (LOP) and 125 degrees ROP results in higher than desired internal combustion pressures. Outside of that range, the pressures drop off markedly. I had accepted that 100 degrees ROP or thereabouts was a compromise between the top of the optimum window and a somewhat reasonable fuel burn. Braly's company makes balanced fuel injectors that allow properly instrumented engines to be flown significantly LOP, resulting in lower fuel burns and, he says, longer engine life. Key to the success of such operations is a properly trained pilot and good instrumentation.

Motivated learning

While I had read all about LOP operations and had many a lecture from Braly over the years, I had resisted operating my engine that way—even though I had a set of Braly's balanced injectors on the engine and a JP Instruments EDM 800 multi-probe engine analyzer onboard. It went against the training I had received as a new pilot and against the "conventional wisdom" of many pilots. But along came a motivator to help me re-evaluate my thinking: $6 a gallon fuel prices!

During a recent visit to JP Instruments in Huntington Beach, California, I asked proprietor Joe Polizzotto to show me on a demo unit how his EDM 800 engine analyzer switched into LOP mode. As it turns out, it's only a button push away. With that, the unit displays the exhaust gas and cylinder head temperatures for each cylinder from the top of the display downward—in "icicle" format, as opposed to the usual bottom up. In that mode, it's easy to watch each cylin-

The dots above the 4 and 2 on the JPI EDM 800 indicate the first and last cylinders to go lean of peak. Each bar represents about 5 degrees. Cylinder 2 is 6 degrees beyond peak (bottom left). Fuel flow is 7.6 gph. The 76 at top is 76 percent horsepower.

der go lean of peak as you lean the mixture. The system places a small dot above the first and last cylinder to go over lean all the while showing fuel flow in gallons per hour. Encouraged by Polizzotto and his vice president, Larry Elbert, and their experience in various airplanes, I vowed to give it a try in my Bonanza.

On a flight shortly thereafter I leveled at cruise altitude, switched the EDM 800 over to LOP mode, and grabbed the mixture knob (Braly calls it the "money lever") for what Braly calls "the big pull." Over just a few seconds I dialed the mixture back from 17 gph, about 100 degrees ROP, to about 12.5 gph while watching the EDM 800. Cylinder number two was first to peak; number five was last. At 12.5 gph, the engine was running about 50 degrees LOP. As I passed through peak, I could feel the engine give a little sigh as power dropped off slightly, but it soldiered on without even a shudder. I could feel a slight change in the usual vibration—not more, just different.

The EGTs climbed from the mid-1,300s to the mid 1,400s while CHTs remained about the same. Many LOP advocates claim they see lower CHTs, but I've not experienced that so far. But my airplane always runs hot, which suggests that I have some more work to do on baffling, cowl flap positions, and louvers.

The day-to-day result is that I now am cruising on about 12.5 gph, saving about 4.5 gph while giving up 4 to 5 knots of true airspeed. At 150 hours a year and with fuel at $6, I will save more than $4,000 a year in fuel—almost enough to pay my hangar rent. At least as important, my endurance has also increased, meaning fewer fuel stops—which also increase fuel burn during the climb and cause wear and tear on the engine and airframe. Plus, most accidents happen in the terminal area so I've reduced my exposure to risk as a result of fewer takeoffs and landings. For example, on a recent flight the EDM 800 showed I could fly four hours ROP with reserves. A minute later, LOP, the endurance had jumped to 5.17 hours with reserves.

A couple of things to keep in mind: In general, Continental engines seem to run better LOP than Lycoming engines. Braly claims many Lycoming engines will do fine LOP, but it may be more challenging to set them up properly. Lycoming, in general, does not recommend LOP operations. Also, LOP requires good instrumentation to help the pilot know what is happening with the engine. A multiprobe engine analyzer is a requirement.

More challenges

Braly isn't finished shooting holes in my engine operating techniques. Now he's challenging my methods of power setting. I typically run the engine at about 21 inches of manifold pressure and 2,500 rpm.

"Would you purposely fly your airplane with a dirty air filter?" he asks. "With anything less than wide-open throttle, you might as well be." Any time you retard the throttle, you are sending the engine less than optimal combustion airflow, he says. Run wide-open throttle (WOT, in Braly parlance) and use rpm and mixture to manage horsepower, he suggests.

I'll give it a try. I've long ago accepted that there is almost nothing that I know everything about. AOPA

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