Efficient Cross Country Flying

Who else, but Klaus Savier, could make an 8:30 AM forum interesting enough to keep me awake without coffee.

Klaus pointed out, "Fuel efficiency boils down to miles per gallon of fuel while time efficiency boils down to miles per hour. On a typical flight, the longer one remains flying (fewer fuel stops with wasted ground time) the sooner he will get to the destination." That sounds pretty obvious but frequently flying at a slower speed with lower power setting will actually take less time than using a faster speed but having to make a fuel stop.

Klaus cited several cases where he had reduced power/speed to prolong fuel supply and had actually arrived before other airplanes that flew at high speed and power settings: "Today's technology makes it pretty simple to do. Note your GPS destination ETA and adjust power setting/fuel flow on your fuel computer until you can arrive at the destination with your required reserve. It's that simple. I was reminded of the hour hold over Ripon entering OSH. I just throttled down to loiter speed, which burns as little as 1.2 GPH_s and let the auto pilot fly a 5 mile diam circle in smooth cool air while the rest of the traffic was battling it out at 1800'. I had PLENTY of time with no fuel concerns and was in a perfect position the minute the airport opened up. Meanwhile, others were headed for alternate airports to refuel and join the OSH parade again. I suspect some stayed at the alternate airports and never did fly into Whitman field."

Electronic ignition reduces fuel flow at the same power setting, gives smoother power and provides lower EGTs than conventional mags. I have heard that and saw it on my airplane but didn't know how it could be. I thought: more power means more heat and that equals higher CHT and EGT.

Klaus explained how the principle of refrigeration applies here. Roughly, the principle states temperature will drop as the gas gets less dense or is expanded. If we look at the power stroke of a piston engine we see the piston moving downward and the combustion chamber volume increasing. This increasing volume lowers density and drops the temperature. In a conventionally timed magneto ignition the fuel burn occurs so far after top dead center that the burn is taking place as the piston moves down and expanding the combustion chamber volume. The normal expansion cooling (refrigeration) is not as effective because the late ignition timing has "built a fire in your refrigerator". That doesn't seem very efficient and it isn't either.

A similar event happens if you run one mag and one electronic ignition but turn off the mag as recently proposed by a high profile builder. The electronic ignition will fire with the proper advance but the flame front in the combustion chamber can not travel to all parts of the charge in the limited time before the downward moving piston expands the volume rapidly. The result is more "fire in the refrigerator". One of Klaus's statements put it all in perspective, "A single ignition source actually damages your engine because the slower burning raises EGT 100-200 degrees".

Higher compression ratios will increase efficiency, too. The diesel is noted for its superior efficiency because of its very high compression ratios. Klaus suggested, "If you have a low compression ration engine like the O-235-C's 6.5 to 1 consider upgrading to the 8.5 to 1 pistons". I did and have more power for the same fuel burn.

Klaus explained how one can measure their actual compression ration. "Compression ratio is the total volume above the piston when it is at its lowest point, BDC, compared to the volume above it when it is at TDC. This volume in the combustion chamber with the piston at TDC is called compressed vol., cv. The volume above the piston at BDC is a combination of the compressed volume and the swept volume, sv. Swept volume is the displacement of the cylinder. Thus: CR = sv+ cv:cv. I take the engine's displacement, 0-200 :4 to get cylinder displacement or sv and only measure the cv. You may measure your engine's cv by the following procedure: fill a burette with 10 wt motor oil. That oil is thick enough to not run around the ring end gap yet thin enough to be handled easily. Position the piston on TDC with the top spark plug removed. Rock the crankshaft to be SURE you are on TDC. Add oil to the cylinder until it appears in the top spark plug hole at a particular thread of your choosing. Record the volume of oil used which is the cv. Remember to let the oil volume in the burette stand for 3-5 minutes before reading so all oil runs down off the glass sides."

Different cylinders may have slightly different size combustion chambers. That is why some engine performance builders "cc their engines". The engine smoothness will be enhanced if all combustion chambers are exactly the same. Of course anything that effects cylinder combustion can affect perceived smoothness. With respect to smoothness, Klaus indicated it takes a significant ignition timing change to get a noticeable change in power or perceived smoothness.

The speed-efficiency guru indicated ceramic coatings of engine parts is wrong for our type engines as the ceramic material holds heat on the surface and may cause pre-ignition. You end up having to retard timing to prevent pre-ignition and lose power by doing that.

Klaus' final comment was vindication for some and fighting words for others. "Water cooled engines burn more fuel than air cooled."

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