OXFORD FLYING CLUB

OXC

DEDICATED TO SAFE, AFFORDABLE FLYING

Leaning

N735GC

Francis Pullaro

Leaning for Cruise

Cessna 182Q POH

Cruise performance data in this handbook and on the power computer is based on a recommended lean mixture setting which may be established as follows:

(1) Lean the mixture until the engine becomes rough.
(2) Enrichen the mixture to obtain smooth engine operation; then further enrichen an equal amount.

For best fuel economy at 65% power or less, the engine may be operated at the leanest mixture that results in smooth engine operation. This will result in approximately 5% greater range than shown in this handbook accompanied by approximately 3 knots decrease in speed.

Leaning for Cruise

Cessna 182Q POH

LEANING WITH A CESSNA ECONOMY MIXTURE INDICATOR (EGT)

Exhaust gas temperature (EGT) as shown on the optional Cessna Economy Mixture Indicator may be used as an aid for mixture leaning in cruising flight at 75% power or less. To adjust the mixture, using this indicator, lean to establish the peak EGT as a reference point and then enrichen the mixture by a desired increment based on figures in the table below.

Continuous operation at peak EGT is authorized only at 65% power or less. This best economy mixture setting results in approximately 5% greater range than shown in this handbook accompanied by approximately 3 knots decrease in speed.

NOTE

Operation on the lean side of peak EGT is not approved.

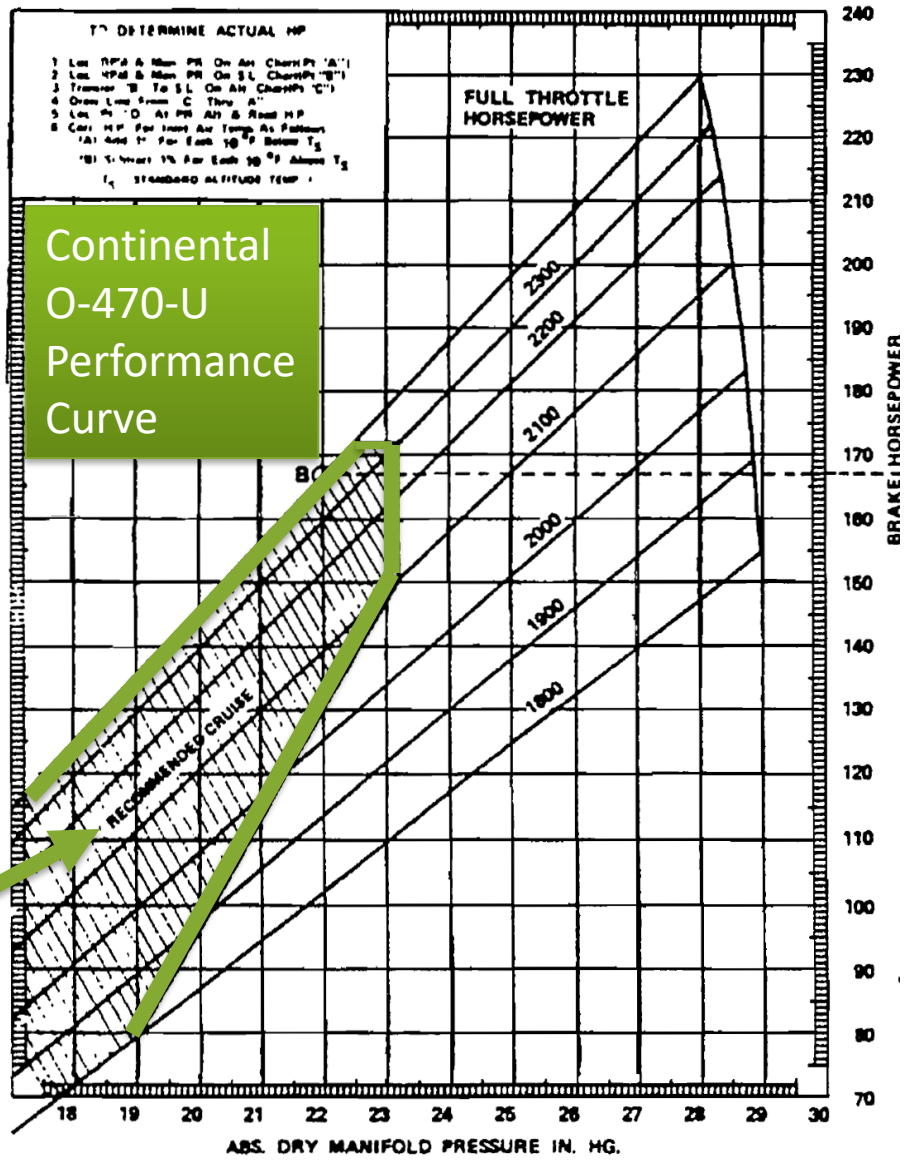
When leaning the mixture under some conditions, engine roughness may occur before peak EGT is reached. In this case, use the EGT corresponding to the onset of roughness as the reference point instead of peak EGT.

Leaning for Cruise

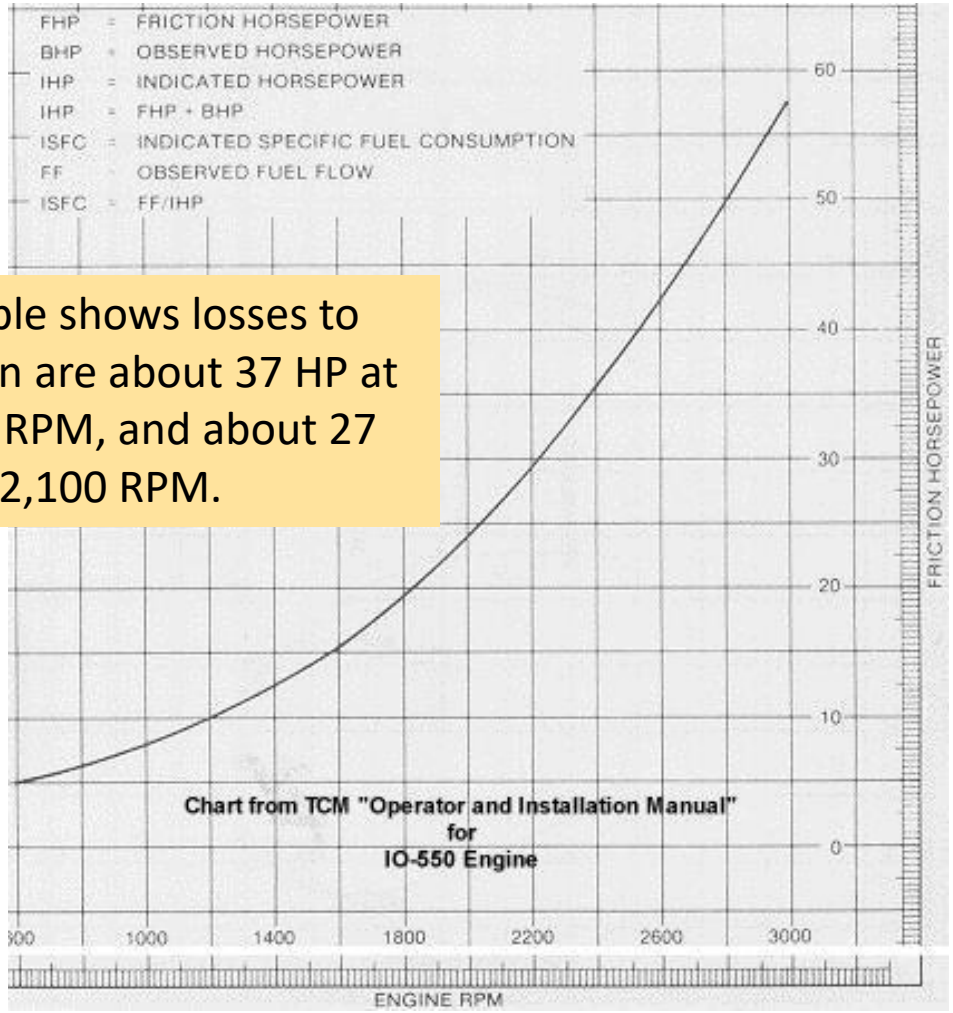
Despite the POH's prohibition on running "lean of peak" (LOP), this presentation will show how the POH's guidance to lean to roughness essentially sets to LOP operation and will maximize fuel economy and ensure low cylinder head temperatures.

O-470-U Operating Range

Continental O-470 Operator's Manual



Operating Over-square



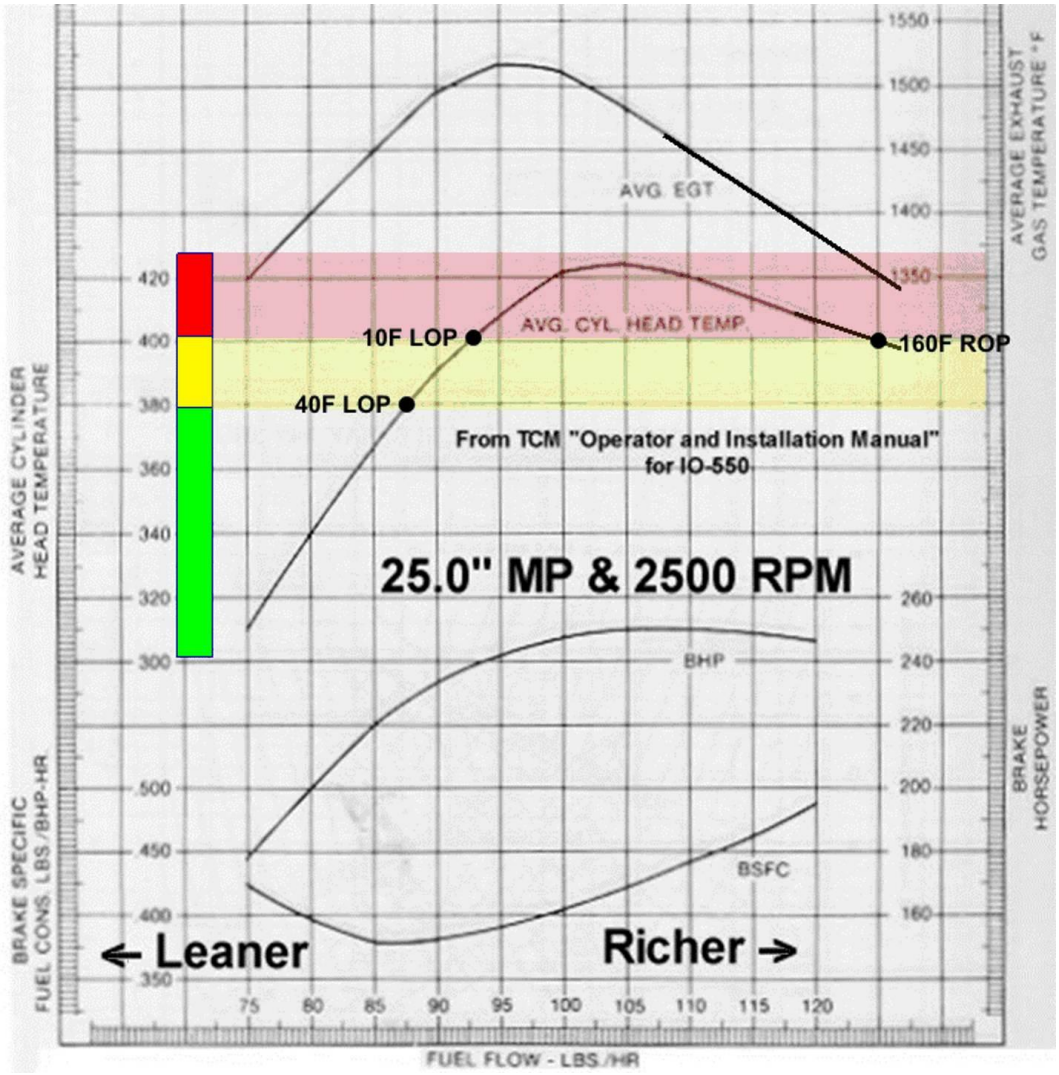
Example shows losses to friction are about 37 HP at 2,500 RPM, and about 27 HP at 2,100 RPM.

For low power and maximum-efficiency, run leaner mixtures and the lowest possible RPM allowable for the MP.

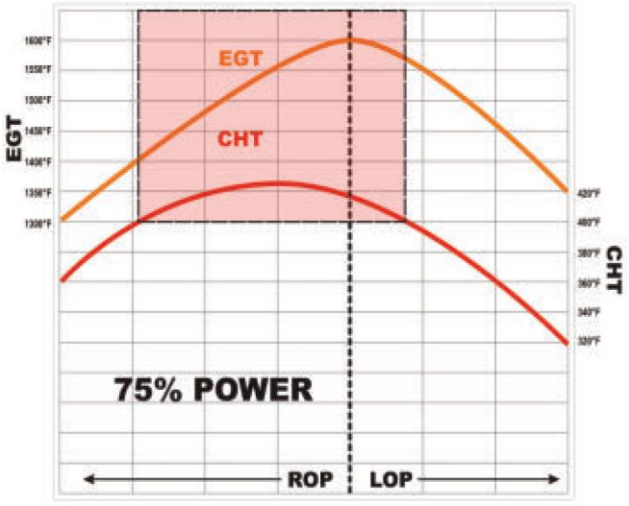
A slower turning engine does not work as hard and has more time to complete the combustion process.* And it's quieter!

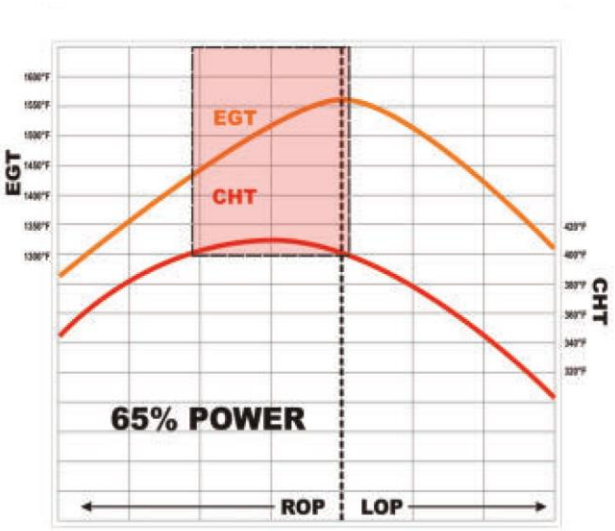
* See Mike Busch's Hip to Be (Over)Square (2018)

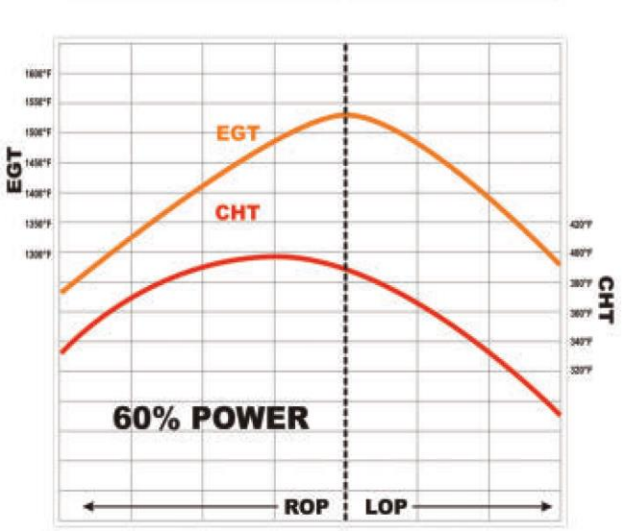
Avoid the Red Zone



Avoid the Red Zone

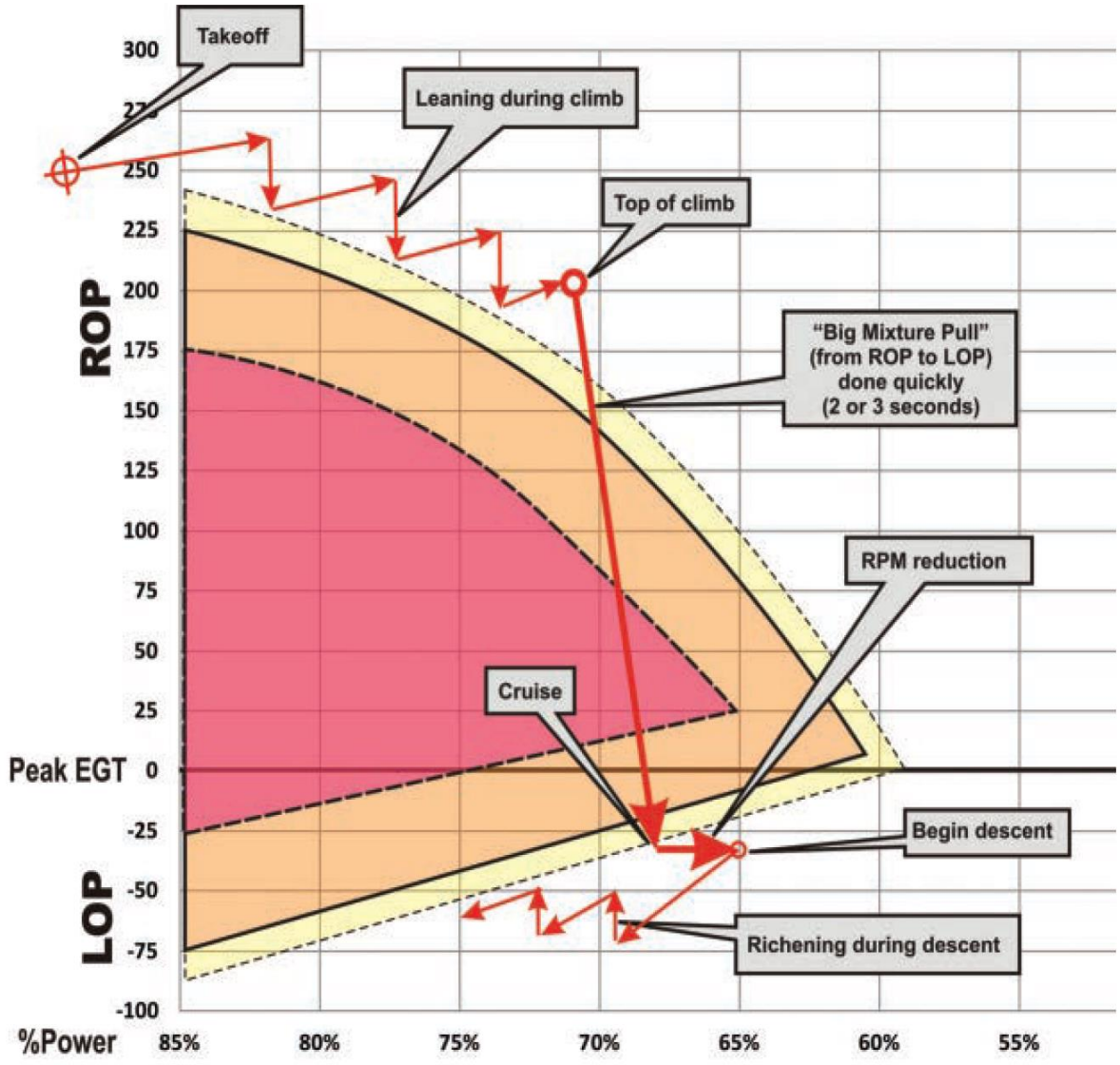




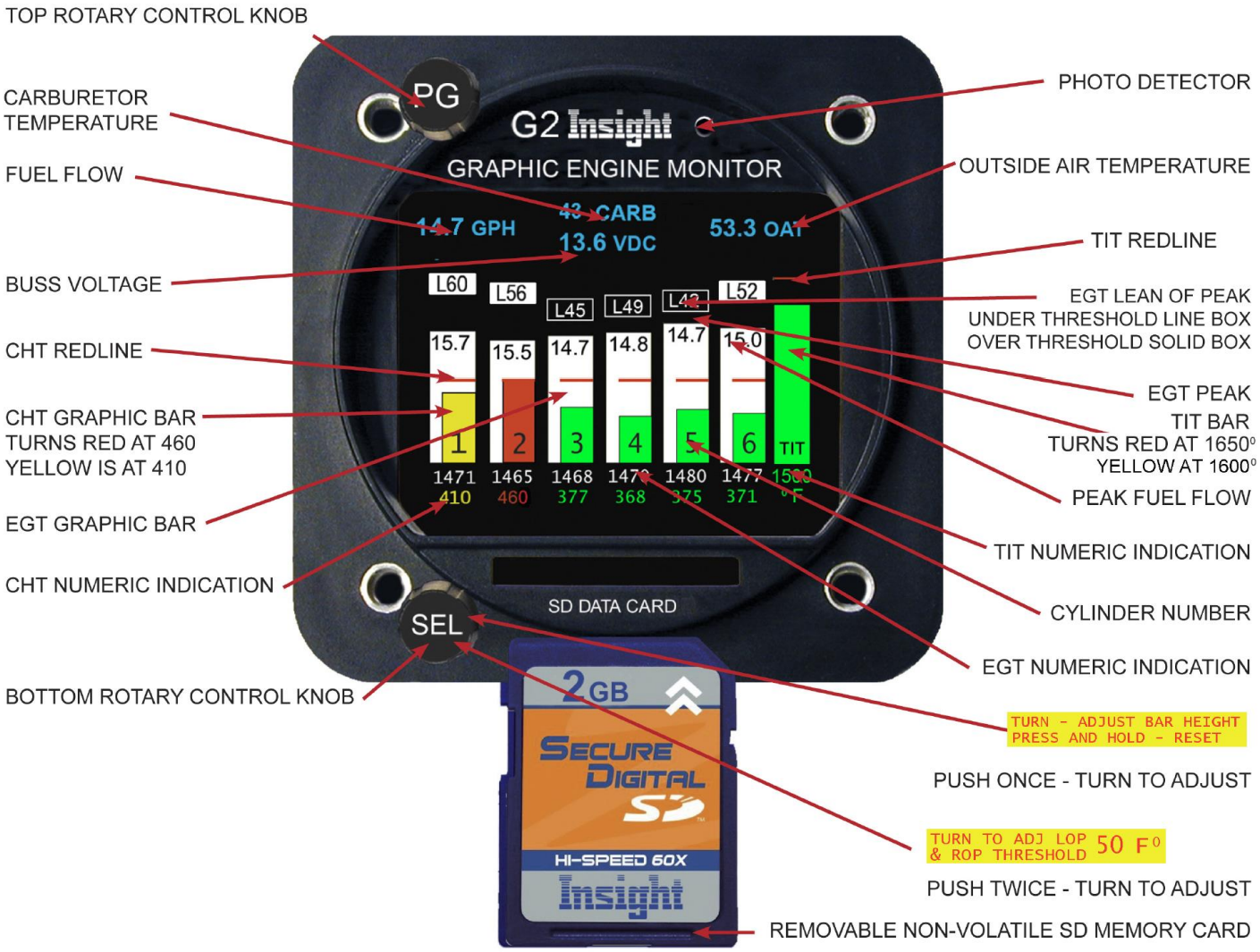


The lower the power, the narrower the red box becomes. Somewhere between 60 percent and 65 percent for most engines, it disappears completely.

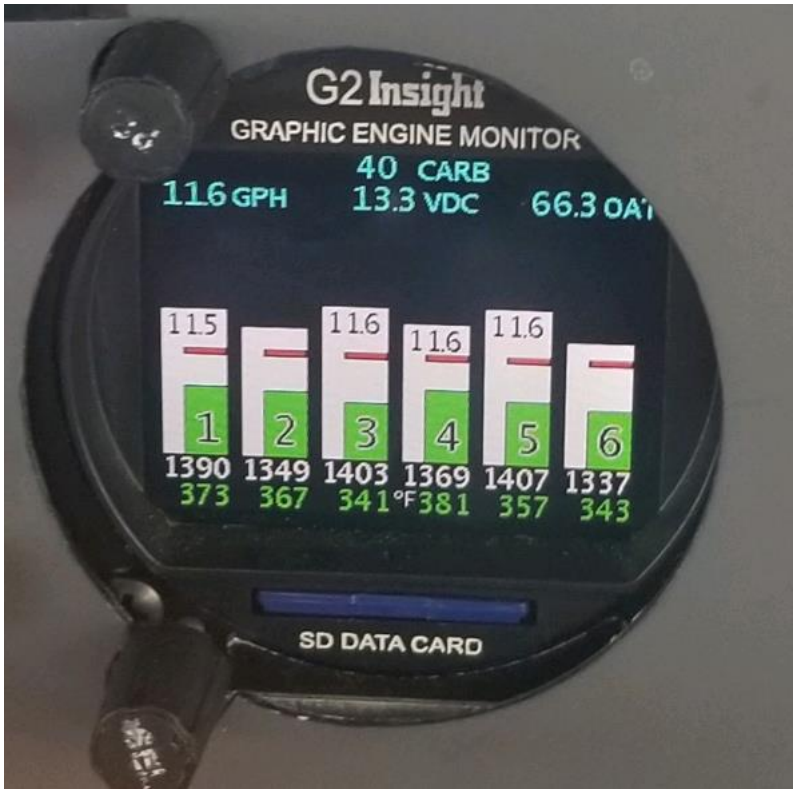
The Leaning Process



Insight G2 Engine Monitor



Leaning with Insight



- At cruise, quickly perform a coarse leaning of the engine until the fuel flow is a couple of GPH more than the normal cruise indication.
- Pause briefly to allow the engine to stabilize and cylinder head temperature to return to normal. Make final trim adjustments to the airplane, reset cowl flaps, etc.

* The Insight manual recommends a 2-minute pause. Busch recommends the "Big Mixture Pull" to avoid any time in the red or orange zones.

Leaning with Insight

Set the lean threshold by pushing SEL button. Then **slowly lean the mixture until one of the EGT <u>lean boxes</u> appears at the top of the EGT bars**. This final leaning should take about five seconds. The first lean box to appear on top of the EGT bars column of bars identifies the leanest cylinder (the first to reach peak EGT).

Leaning with Insight

Continue leaning until the lean boxes appear on all cylinders. To operate lean of peak, move the mixture control in the lean direction until the boxes show solid white with an 'L' number inside in black.*

* Experience shows engine likely reaches roughness before all boxes turn white. That happened here but all cylinders are still 30 to 60 degrees LOP.

Do Not Lean to POH's GPH Numbers

Leaning to POH's GPH figures could result in higher fuel burn and CHTs with cylinder 4 eventually exceeding 380F or even 400F

POH

CRUISE PERFORMANCE

PRESSURE ALTITUDE 2000 FEET

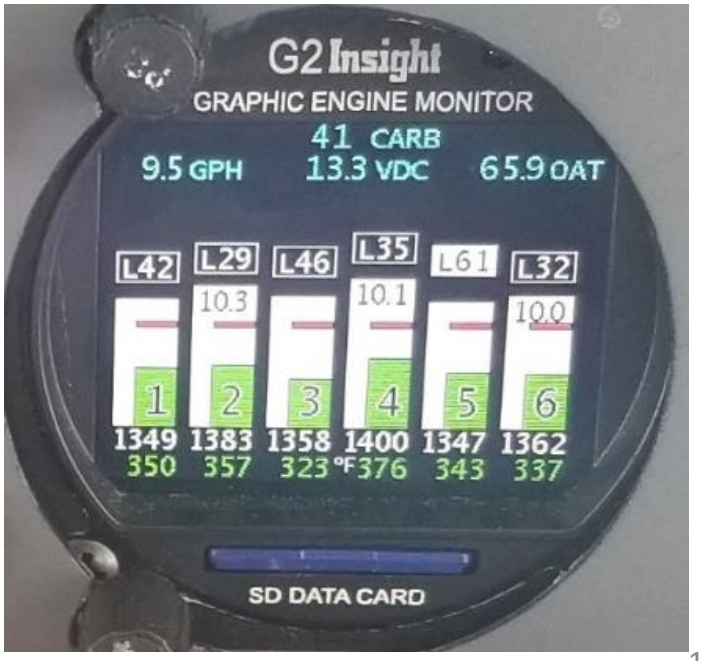
CONDITIONS:
2950 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE
For best fuel economy at 65% power or less, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -9°C			STANDARD TEMPERATURE 11°C			20°C ABOVE STANDARD TEMP 31°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2400	22	77	134	13.1	74	135	12.6	71	136	12.2
	21	72	131	12.3	69	132	11.8	67	133	11.4
	20	67	128	11.5	65	128	11.1	63	129	10.7
	19	62	124	10.7	60	124	10.3	58	125	10.0
2300	23	78	135	13.3	75	136	12.8	72	137	12.4
	22	73	132	12.5	70	133	12.0	68	133	11.6
	21	68	128	11.7	66	129	11.3	64	130	10.9
	20	64	125	10.9	62	125	10.5	60	126	10.2
2200	23	73	132	12.5	70	133	12.0	68	133	11.6
	22	69	129	11.7	66	129	11.3	64	130	10.9
	21	64	125	11.0	62	126	10.6	60	126	10.2
	20	60	121	10.2	58	122	9.9	56	122	9.6
2100	23	68	128	11.6	66	129	11.2	64	130	10.8
	22	64	125	10.9	62	126	10.5	60	126	10.2
	21	60	121	10.2	58	122	9.9	56	122	9.6
	20	56	118	9.6	54	118	9.3	52	118	9.0
	19	52	113	9.0	50	114	8.7	48	113	8.5
	18	47	109	8.4	46	109	8.1	44	108	7.9

Actual Leanest Mixture & Smooth Engine

18C OAT, 2650 lbs, 3000' @ 29.89" Hg
Cowl flaps closed
23" x 2100 rpm (~65% power)



Leaning Experiments

The 182's O-470 engine is notorious for its poor mixture distribution. These techniques* might improve mixture distribution of the carbureted engine and enable it to be leaned more aggressively before it starts to run rough:

- A touch of carb heat during cruise (particularly in low OATs).
- Avoid full-throttle operation, backing off the throttle to a slightest drop in MP.

The warm induction air and the slightly cocked throttle plate both improve fuel atomization and mixture distribution in your engine. It might enable you to lean more aggressively before the engine starts running rough.

*These techniques are discussed in Mike Busch The Savvy Aviator #59 (2008), Richard Coffey's Skylane Pilot's Companion (1996) pages 140-141 and John Deakin's the Pelican's Perch #18: Mixture Magic (1999)

Conclusion

735GC can be operated LOP without creating uncomfortable engine roughness.

It will save our club money through less wear on the engine and lower fuel costs.