Pelican’s Perch #63: Where Should I Run My Engine? (Part 1)

*In his many columns about how to lean, whether to use full power after takeoff, oversquare operation and so on, AVweb's John Deakin has left many of the details up to the pilot/owner. Yet many readers would just as soon have him tell them exactly how to set up and run an engine. In this month's column he does just that, with a step-by-step guide to smarter engine operation. Fair warning: his advice may not always agree with the POH.*

John Deakin

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First, a shameless plug, and a disclaimer, so that you know where I’m coming from. I am one of three partners in the new “Advanced Pilot Seminars, Inc.” a company formed for the purpose of educating pilots in engine management. The other partners are George Braly and Walter Atkinson. We have now completed two seminars, one in September and one in November, with two more scheduled, one in January 2003, the other in March 2003. See the [web site](http://www.advancedpilot.com/) for further details.

It has been a very rewarding experience to teach this course, and to see the light dawn in the eyes of the attendees, as they watch (and listen to) all the parameters of a live engine running on the most sophisticated test stand in the world. We are seriously considering taking the show on the road, perhaps one in California, and another in Florida.

In that seminar, we feed the group Friday night, do some introductions, explain what we’re going to do, and we fire up the engine on the test stand (currently the big TIO-540J2DB) to give them a taste of what’s coming. We also assign a small amount of homework, asking them to read a couple pages of the wonderful “Basic Theory of Operation, Turbo Compound Engine,” (see my [book list](https://www.avweb.com/features/avweb-classics/pelicans-perch/pelicans-perch-63where-should-i-run-my-engine-part-1/182192-1.html)) published by the Curtiss-Wright Corporation, much of it written by American Airlines when they were running that superb engine in the DC-7. At that point, we put a couple of large easels up front with big pads of paper, and ask, “OK, what questions did you bring to this course? What don’t you know, what’s bugging you? What do you want to take away with you, when you leave?” We write every question on the big sketch pads, and we pin them up around the room.

Each time, this has sparked a very lively discussion, and we get about 40 excellent questions or so, which we promise to address during the seminar. As we cover them, we cross them off, and then we usually have about 10 left over that we clean up at the end.

One of the most common requests we get is something like, “What power settings should I use?”

We don’t like that question. To answer it would take a book (which we’re working on). We prefer the much simpler answer, where ***not*** to run your engine.

Mostly, we want to ***educate***, so that pilots can make their own selections, but in an intelligent manner, using science, rather than the mumbo-jumbo found in the dreadful POHs published in the last 40 years. We don’t like the “cookbook” approach, we’re afraid folks will pick one setting, focus on that one single setting, and feel they don’t have to learn anything else. This was the genesis of the old “23 inches of manifold pressure, 2,300 RPM, and that’s about 65%,” very much an OWT (Old Wives’ Tale). Mixture settings were pretty mysterious, from “Don’t touch the red knob,” to “Aw, pull it out about an inch, and leave it there.”

All too often, where ***not*** to run is precisely where many POHs say ***to*** run them. With some, we run power settings on the test stand just like the factory suggests, and the results are appalling. With the big TIO-540J2DB (a 350 HP monster found in the Piper Chieftain), we show that the engine may be running in light detonation under some conditions otherwise considered to be “normal”! This is a magnificent, well-designed, rugged engine, which should happily run to TBO and beyond. In large part due to the POH mixture-setting instructions, it often doesn’t. It has a reputation in some circles as “the most difficult” engine in the GA fleet. Properly operated, the test stand shows these are excellent engines.

One attendee at our last course runs several of these big engines, and when he saw the results of running as suggested by the POH, picked up his cell phone and called during the next break to tell his pilots not to do that, with orders on new procedures!

But we still get that pesky question, so I thought I’d take a stab at an answer in this column. We did this in the last course (by request), and it seemed to be a hit. In this column, I’d like to suggest an SOP (Standard Operating Procedure) for a normally aspirated engine like the IO-550. This advice will apply to all the normally aspirated (in other words, non-turbo) engines of four and six cylinders with fuel injection. The ***principles*** also apply to carbureted engines, but they usually do not have the precision in fuel distribution to use some of these techniques.

(Some readers may want to read some of my old [engine columns](https://www.avweb.com/features/avweb-classics/pelicans-perch/pelicans-perch-63where-should-i-run-my-engine-part-1/#engine).)

Finally, the more I get into this stuff, and the more problems I see, the more strongly I become convinced of the sheer folly of running any of these high-performance engines without an all-cylinder engine monitor. I know of nothing else in the aviation industry that will pay for itself so quickly, add so much to safety, and give greater peace of mind. JPI, Insight, and Electronics International make the leading devices in this field, all of them are good, and there may be others I don’t know about. I run the JPI EDM-800 myself, and I like it the most, perhaps because I am most familiar with it. The features I consider important, in no particular order:

* EGT and CHT for ***all*** cylinders, graphical and digital displays
* Owner-programmable exceedence settings for all parameters
* All data easily downloadable, and “graphable”
* Exceedence warnings, visual and aural
* Fuel flow and GPS inputs/outputs
* Single-digit resolution (for spotting trends sooner)
* Data recording and downloading, all parameters
* Other parameters: Oil pressure and temperature, Compressor Discharge Temperature, Induction Air Temperature, Turbine Inlet Temperature, Battery Voltage & Amperage, OAT, manifold pressure, and RPM

I hate government regulations. We have far too many of them. Too many of them are really silly ones, and it has become utterly impossible to avoid breaking some of them on ANY flight, no matter how religious you are about following them. But, that’s for another column. One regulation that would make sense to me is a requirement to have such an engine monitor on all engines used in commercial passenger service. I am utterly convinced that the Whyalla crash (which I discussed in [June](https://www.avweb.com/features/avweb-classics/pelicans-perch/pelicans-perch-63where-should-i-run-my-engine-part-1/182152-1.html) and [July](https://www.avweb.com/features/avweb-classics/pelicans-perch/pelicans-perch-63where-should-i-run-my-engine-part-1/182153-1.html)) would have never even come close to happening, if the airplane had been equipped with any of the engine monitors, and the pilot had modest training in their use. The stage for the accident was set ***two months*** before it happened, and a monitor would have prevented that, too (mis-set timing). With the information that pilot had available to him, I believe he acted with reasonable prudence. But if he’d had any engine monitor, and understood what it was trying to tell him, he would have known it was insane to continue that flight, and the causal chain of events could have been interrupted two months earlier. He simply didn’t have the information he needed so badly, and eight people died.

So, let’s run through a normal flight with a normally aspirated IO-550, almost certainly equipped with GAMIjectors, a good engine monitor, and an accurate fuel flow indicating system.

***Carbureted Engine?***

*I’m sorry, I have very little help or advice for those with carbureted engines. I’ve flown one Cessna 182 with such poor fuel distribution that leaning was hopeless at any altitude. One old trick is to operate high enough to use full throttle for cruise, but then back the throttle out just barely enough to detect the smallest possible drop in manifold pressure. That may cock the throttle plate just enough to induce a more turbulent flow, or a vortex where the fuel and air mix, and that may give better fuel distribution, allowing a bit more leaning.*

Starting

I doubt that anyone has trouble with cold starts. If there is a problem, there is something wrong with the engine. Crack the throttle, mixture rich, hit the boost for a few seconds, and go.

Hot starts come in several religious varieties, and everyone has a favorite. Some of them even work, some of the time or even most of the time. The only method I know for the big-bore TCM engines that works on real science is to run the electric boost pump for 60 to 90 seconds with the mixture off, then proceed with a normal cold start. That requires an engine with a “vapor vent return line,” as found on most of the TCM “big bore” engines. For the others, I cuss along with everyone else. Try hot-starting a big Merlin, sometime!

Taxiing

All pilots should be familiar with ground leaning, because not all airports are at sea level. Even with a perfectly set idle mixture at sea level, operations at higher elevations will really need leaning. Many engines are not even set properly at sea level, and for these, ground leaning is a really good idea, all the time.

(No, contrary to some advice, you cannot cause detonation by ground leaning, and you cannot hurt the engine at even twice or three times the normal power used for taxiing.)

How do you know if you need to lean on the ground? The classic idle mixture test is done after flying, so the engine is fully and evenly warmed. The book usually calls for a low idle RPM for this test, about 600, or so. That’s fine, but I prefer to set the idle mixture while running about 1,000 RPM, which is where I usually operate on the ground for taxi, and while waiting. Whatever RPM you prefer, lean the mixture slowly until you see a rise in RPM, then lean very slowly, looking for peak RPM. On most engines, this takes a LOT of mixture travel, and it happens just before the mixture shuts the engine down.

What are we doing, here? We are leaning to “best power mixture” (which really means we are leaning until the engine develops the maximum horsepower for the given throttle position), which will be reflected by an RPM rise, since the prop is not up to governing speed. Watching for an RPM rise won’t work in flight, because the constant-speed prop will maintain the RPM by twisting the blades as needed. Essentially, at any RPM below the prop-governing range, you have a fixed-pitch prop.

If you see no rise at all during this test at a sea level airport, and the engine just shuts down, the idle mixture is either absolutely perfect, or too lean, but there is no way to tell which. This is the reason we want to see a slight rise. That rise indicates you started out slightly rich, and leaning did cause a reaction. While a small rise is not perfect, it’s “good enough.” You can probably operate that way on the ground (at sea level), and never have a fouled plug.

If you see a rise of more than about 50 RPM, then a drop as the mixture goes “too lean,” your idle mixture setting may be too rich. You then have a choice of irritating your mechanic by asking for a minor tweak, or just ground leaning it yourself.

If you get the idle mixture setting too lean, it will make the engine a bit harder to start when cold, at sea level. This is the reason many manuals call for something like a 100-RPM rise on this test.

If you operate in very cold weather, move!

Seriously, you may want the richer mixture described in the manual for better starts in cold weather, and then just manually lean for all operations as the engine warms. Another factor that may come into your decision-making is whether you start your engine in cold weather without preheat. I won’t start my engine if the engine is below 40F, and I use preheat religiously below that.

Even if you have your idle mixture setting adjusted perfectly at sea level, when you operate out of an airport above sea level, your engine will idle too rich if not manually leaned, and the higher the airport, the richer it will be. At very high airports (Leadville, at nearly 10,000 feet), your engine may not even start or run with a full-rich mixture setting. If you don’t lean at high-elevation airports, then roughness and plug fouling are inevitable.

So here is one of many choices you make as a pilot. If you operate almost entirely out of warm, sea level airports, it’s probably worthwhile to bug your mechanic to diddle with the idle mixture setting, then you won’t have to ground lean at all. This may be as simple as reaching through a hole to set the screw, all the way to removal of an entire cowling to make this trivial adjustment.

If you operate out of one high elevation airport exclusively, the same advice applies, but be aware that a foray to lower elevations may mean a hard-to-start engine from a mixture that is much too lean at sea level. Extra prime, or boost pump operation, may be required.

For an airplane that operates at a variety of elevations, it’s best to set it properly at sea level. Or you can do like most of us, and just forget diddling around with it, and just ground lean all the time. My RPM rise is about 200, the last time I checked it, and I don’t care, because I lean right after the start as a habit.

For renters, be grateful the engine starts and runs at all, and if the mixture lever actually works, use it as needed to keep it running.

If you choose to manually lean your engine on the ground, I strongly suggest you lean it brutally, to the point where you can’t even get up to runup RPM, in order to prevent you from taking off partially leaned. I don’t care how good you are, or how thoroughly you run your checklists, you ***will***, one day, try to take off with your mixture leaned. If it’s super-lean when you try that, the engine will simply wheeze, run out of air, and die as you push the throttle in. Doesn’t hurt a thing, and it’s an excellent reminder to “push the mixture in, dummy!”

Runup

Most modern manuals say that if the engine will take runup RPM without “faltering,” it’s good to go. I wince a little at that, but that’s probably due to my radial engine experience, where 40C (100F) is minimum before exceeding 1,000 or 1,200 RPM. Different engines and different oils, so I compromise and won’t run my engine above about 1,200 RPM until I show 90F on the JPI “OIL.”

If you did lean, either push the mixture fully in for runup, or enrich it just enough to get runup RPM. A mag check with a leaned mixture is much more diagnostic than the normal runup at full rich, so if I do a mag check at all, I’ll do it leaned.

I think most people overdo runups. Many go to ridiculous lengths to set exactly the RPM specified in the POH, and they prolong the agony far too long. From the hangar, I hear these folks on the runup pad at high RPM for agonizingly long periods. Folks, this is quick functional check only, and if the POH says “1,700” for runup, anything between about 1,200 and 2,000 will do just fine for the purpose of the functional check. Higher RPM makes a lot of unnecessary noise, heats the engine up too much if prolonged, and blows dust all over the place, not to mention picking up dust, dirt, and gravel, and chipping your prop and paint job. So run it up to around 1500 to 1700, don’t worry about the exact setting, and ***get on with it.***

One short cycle of the prop with a 100 or 200 RPM drop is sufficient to indicate proper functioning, and further (or deeper) cycling accomplishes nothing, unless it’s very cold outside, and the prop is sluggish. All these oil-operated props on GA aircraft have passages that assure a continuous flow of warm engine oil to the prop internals. Some of the old radials get a bit sluggish and stiff in very cold weather, and a few more cycles on both the props and the feathering systems are often a good thing with them. (For those with external lines from the feather pump to the prop, several feathering cycles may be needed, and don’t expect them to feather quickly in cold conditions, either!)

Mag Check

I could write a book on mag checks! This can range from skipping it entirely, to a ***real*** mag check, rarely done. The usual quick mag check at 1700 or so is not a good test of the ignition system, but it’s not a bad idea, just to make sure someone didn’t remove a mag when you weren’t looking.

If you know the airplane, and you performed an ***inflight, high-power, lean-of-peak*** mag check before the last landing (I’ll cover that later), then you might skip it entirely on the runup, or at most, quickly go from BOTH to LEFT, RIGHT, and back (at any RPM), just to make sure something didn’t quit or come loose while parked. You can even do this while taxiing out, with no other airplanes around, if you’re very comfortable with the airplane and “multi-tasking.”

Note there ***must*** be ***some*** drop in RPM (on the ground) when running on one mag. A failure to show a drop is a dead giveaway to a bad mag switch, or a broken wire to the mag, which leaves it “hot” all the time. You, or someone else, might get a nasty surprise the next time you move the prop to put a towbar on.

Some make a ***big*** issue of which mag to check first and last, with some cockamamie theory that one way leads to leaving the mag switch in some position other than BOTH when done. I’ve looked at this, discussed it (many times), argued about it, and I simply cannot see any human-factors issues at all. I’m no more (or less) likely to miss returning that switch to BOTH from either position, so I don’t care which one you check first. To my knowledge, I’ve never failed to go back to BOTH, and I’ve done a fair number of mag checks.

If you want to do a ***real*** mag check, then get the engine up to some significant power setting (hard on the engine, airplane, and prop), perhaps 2000 RPM, lean the mixture until the RPM rises a bit, then falls on the lean side, and check each mag for 10 seconds or more, while watching the EGT bars on your engine monitor. ***All*** EGTs should ***rise*** on one mag, and fall back to the starting point on BOTH, and the engine should run smoothly (assuming very good fuel distribution).

No, Virginia, contrary to popular opinion, running on one mag is ***not*** harmful to the engine, and will ***not*** foul the non-operating plugs, and above all, it will ***not*** cause detonation! In fact, if detonation is in progress at any time, switching to one mag will probably kill the detonation, instantly. We demonstrate this on the test stand.

This hard-on-the-engine test (hard because of the high power on the ground with no cooling) should be done very rarely, perhaps only after maintenance on the ignition system when flight is not practical. The engine will be quite hot when done, and should probably be allowed to cool off at 1,000 RPM for a minute or three, before shutdown, or even before takeoff. (The CHT after takeoff is directly related to the CHT before takeoff.)

If you do this mag check while LOP, then you should ignore the magnitude of the mag drop, for it will be huge, two to six times as great as the usual 1700 RPM full-rich check shown in the POH. During the check, you should be looking at the graphical EGT bars on the engine monitor (in “Normalize” mode, if available). All EGT values should rise smartly when you switch to one mag, then fall back to the original position on BOTH. This is a very demanding check of the entire ignition system, and will often reveal a problem with even a brand-new spark plug. By some reports, as many as one in 20 new plugs are defective out of the box or suffer infant mortality in the first 50 hours, so don’t be surprised if this test shows one that does not show up on the “bomb” test, or on a POH-style runup.

This is also a good time to mention that if you drop any spark plug, even a few inches to the table, throw it away. They are very easily damaged by a sudden shock, and the damage usually does not show with a visual inspection, or by the usual test under 80 PSI air pressure. You risk more than a simple inoperative spark plug, because a cracked ceramic core can cause preignition, that most deadly of all malfunctions in the combustion chamber. Handle with care, please!

The Takeoff

Idle mixture adjustments have no connection with the mixture you get at higher power settings. That is set with other adjustments, and fine-tuned by the pilot with the mixture knob and boost pump.

*IT IS ABSOLUTELY CRUCIAL THAT YOU ATTAIN THE FULL REDLINE FUEL FLOW AT TAKEOFF, AT SEA LEVEL!*

If you take nothing else from this column, pay attention to that statement. That fuel flow is ***vital*** for cooling, and that redline is a ***minimum***, not a maximum. The ***vast majority*** of all these engines are set ***too lean*** by the manufacturer’s recommendation! Almost all mechanics will resist this idea, and they seem to think that if the book specifies a fuel flow redline, then a little less than redline is somehow “better.” If you cannot get your mechanic to set this up properly, ***find a mechanic who will***. If your full-power fuel flow is a bit over redline, so much the better! You can always manually lean it back to redline if you wish, but you can’t do much with a fuel flow that is less than redline. Even half a gallon per hour can make a large difference in CHTs right after takeoff, and during climb. Normal climb CHT in a well-baffled normally aspirated engine is around 330F at full power and sea level, at any decent climb airspeed. CHT might be higher if you insist on low climb airspeeds. If you see higher CHTs on your engine monitor, ***your fuel flow is too low***. A lot of these fuel flow indicators are not very accurate at all, and most are not even true fuel flow gauges at all. They’re pressure gauges, marked in flow. We really like digital fuel flow systems that have been calibrated by actual tests for this reason. If your redline is 27.0 GPH, and you get only 26.5, ***have it set higher***.

With ***all*** aircraft engines, use full available rated takeoff horsepower for ***all*** takeoffs. I cannot think of a single exception. You are usually ***not*** being kind to your engine when you use less, and you may very well be mistreating it when you do so. I see warbird operators using a lot less power all the time, and I think they’re wrong. You can tell ’em, but you can’t tell ’em much. If the engine manufacturer has published data for an alternate power setting for takeoff, that’s fine, too. Otherwise, stick to the full rated power. That means full throttle (for normally aspirated engines), full redline RPM, and mixture full rich at sea level, or leaned appropriately for altitude.

While I’m grumbling, get your tachometer checked, too, many are not accurate. You ***want*** full redline RPM for takeoff, no more, and ***no less***. It’s important.

Somewhere in pilot training, lip service may be paid to higher elevation takeoffs, and leaning for those takeoffs may be mentioned casually by a newbie CFI who has never been to anything but a sea level airport. It usually takes attendance at a mountain-flying course to get the training for that, unless the pilot just happens to take his training at a high elevation in the first place. I learned to fly in Florida, so my first high-elevation takeoff was a harsh lesson.

Somewhere above about 3,000 to 5,000 feet, leaning for takeoff starts to take on significant importance, and even more so with shorter runways, hot days, deep canyons, poor runways, long grass, and other performance-inhibiting conditions. Above those altitudes, the full-rich mixture setting is much too rich, and will cause a major loss of available power. Since the altitude has already reduced your power (less air), you’re not making as much heat, and you don’t need the excess fuel for cooling.

The books are full of various techniques for this, but I find the simplest and most effective is just add full throttle, full RPM, then grab the mixture knob and move it aggressively from full rich to whatever feels like “more power” on the takeoff roll. You ***can’t hurt the engine*** with momentary mixture settings like this on normally aspirated engines! Saw that mixture knob back and forth, and ***feel*** the power change in the seat of your pants! At some point as you pull the mixture out from full rich, you’ll ***feel*** the power first increase, then for a large part of the movement you’ll feel no power change at all, because the “best power” mixture setting is very flat in that area. (In other words, “best power” occurs over a fairly wide range of rich settings, but not at full rich.) Go ahead, pull it a bit too far, and you’ll ***feel*** the power drop off from being not rich enough. Push it back in to the point where you first felt the best power, and forget it. It’s quick, simple, and very effective, and pinpoint accuracy is not necessary.

The time to experiment with this is ***not*** your first takeoff from a muddy, short, dogleg runway with obstacles deep in a canyon, with a strange airplane when it is 110F in the shade! Work with it a little at a very high-elevation airport with lots of hard-surface runway to get the idea. It’s not hard, but it does take a couple practice runs to feel good about it. (***Don’t*** use this technique in a turbo!)

The Climb

If your POH has a ***limitation*** on takeoff power (usually two to five minutes where present), then follow it. Don’t be in a hurry to get the power back, but don’t run over the limit, either. This particular limitation usually comes from real engineers, decades ago, and there’s generally a good reason for it.

Note the emphasis on “Limitation,” above. I mean that literally, a limitation in the “limitations” section of the manual that prohibits the continued use of full-rated takeoff power beyond some short time limit.

***Any other*** suggestion in the POH to reduce power for the climb should be viewed with extreme suspicion. I am tempted to say it should be universally ignored as bad advice, but that may be too strong. In any event, the normally aspirated engines are almost always rated for continuous full-power operation. Use it. On all these engines (again, normally-aspirated), the first observable reduction in MP from the fully open position will ***also*** lean the mixture. That’s something you don’t want to do. It is counter-productive because it can actually increase the peak internal cylinder pressure, and it moves the peak pressure too close to top dead center. You will usually see the CHTs rise if you do that.

I can hear it now, “There’s that nut Deakin, suggesting we ignore the POH.”

Let’s address that issue.


This is the crucial TCM chart that is soimportant to understand. It shows a “mixture sweep,”from rich to lean, left to right. Attendees at our seminars areable to draw this chart from memory when they leave – in theirsleep! (Click chart for larger version.)

Generally speaking, the hard data in the engine manuals, produced decades ago, is accurate and correct, conforming to good engineering practices. A TCM chart like that is the centerpiece of our seminars, and is emblazoned on the backs of our t-shirts (handouts for really excellent questions). That data may not even be put into the POH (written by the ***aircraft*** manufacturer), so the only way you can find it is to buy the installation and overhaul manuals from TCM and Lycoming.

More and more, we’re finding that the text in the POHs and other recent publications is very poorly written from an engineering standpoint, and often directly contradicts the hard data from the same manual. The modern (since the late 1960’s) POHs seem to be written by the marketing departments, and then proofed by non-flying lawyers for CYA, with little or no regard for the engineering data, and more concern for maximizing speed and range numbers than for the proper operation of the engine. In some cases, the difference can lead to premature engine failure. To that extent, it is a factor in safe flight – as well as economical flight. I’m less interested in CYA for the manufacturers, or marketing hype, and more concerned with protecting my own A, thank you very much.

You follow some POHs at your own peril. For example, the POH for the Chieftain suggests a climb fuel flow of 27 to 30 GPH, with a limit TIT of 1,500F. We demonstrate that on the test stand (briefly), and the accelerated burn time of the not-rich-enough mixture will usually cause light detonation. Even if it doesn’t on any given day, it always causes very high internal pressures and CHTs, even higher than a full power, full rich setting. Over time, that abuse can cause worse results than mere light detonation. Can you spell “Whyalla VH-MZK”?

For another example, Lycoming writes about the “oversquare” issue, citing the source of the confusion as the techniques used with the old radials, and they get it exactly backwards! Operators of the old radials were prohibited from ***undersquare*** operations! The manifold pressure was generally required to be ***more*** than the RPM times 100! (Except for final approach and landing.)

It would be laughable, if it were not so tragic. In my opinion, that really bad advice in the Chieftain manual (leaning to 27-30 GPH in the climb), in conjunction with some other factors, formed an essential part of the causal chain that resulted in the Whyalla Airlines crash in Australia on May 31, 2000, killing 8 people. (See my previous columns on that accident: [**The Whyalla Report – Junk Science?**](https://www.avweb.com/features/avweb-classics/pelicans-perch/pelicans-perch-63where-should-i-run-my-engine-part-1/182152-1.html) and [**FLYING’s Report on Whyalla**](https://www.avweb.com/features/avweb-classics/pelicans-perch/pelicans-perch-63where-should-i-run-my-engine-part-1/182153-1.html). I note with some sad satisfaction that the Australian Transport Safety Board has now – after months of intense scrutiny – decided to re-open the investigation into Whyalla VH-MZK. That is a good first step.)

There is the issue of noise, one of the greatest enemies of general aviation worldwide. If you take off full-bore with any of the big flat sixes, the full RPM from most of them will make a lot of prop noise. If this is a consideration, reducing RPM by 100 or 200 RPM will make a big difference in noise output, and will not harm your engine in any way, ***provided*** you have the fuel flow set to redline, or more. It’s not “optimal” for the engine to reduce the RPM, but in my opinion, it’s a decent trade-off. Your mileage may vary. ***Do not*** reduce the RPM if your fuel flow is below redline at sea level, in any of these engines!

By the time you get to 3,000 feet agl or so, the power will have been automatically reduced by the altitude, the mixture will have become richer on its own, and the slightly reduced RPM at that point will be fine, if you prefer to use it for the rest of the climb. Using reduced RPM after takeoff for this sort of noise abatement only makes the engine a bit unhappy for about the first 2000 feet of climb, until the manifold pressure drops by itself. Note the throttle remains fully open, and the “mixture-enhancement” feature remains fully rich, as does the mixture knob.

In fact, on a properly conducted flight, the throttle will go fully open on takeoff, and remain there for the entire flight regardless of the cruise altitude, until somewhere in the descent when the airplane picks up too much speed. There is ***no*** functional difference between a partially closed throttle and a dirty air filter, and few would willingly fly with a dirty air filter.

Leaning in the Climb …

… is for next month. Meanwhile, let me leave you with a question, and a thought:

Do you ever note your CHT and EGT after takeoff, before reaching about 1,000 feet AGL? You really should.

Be careful up there!