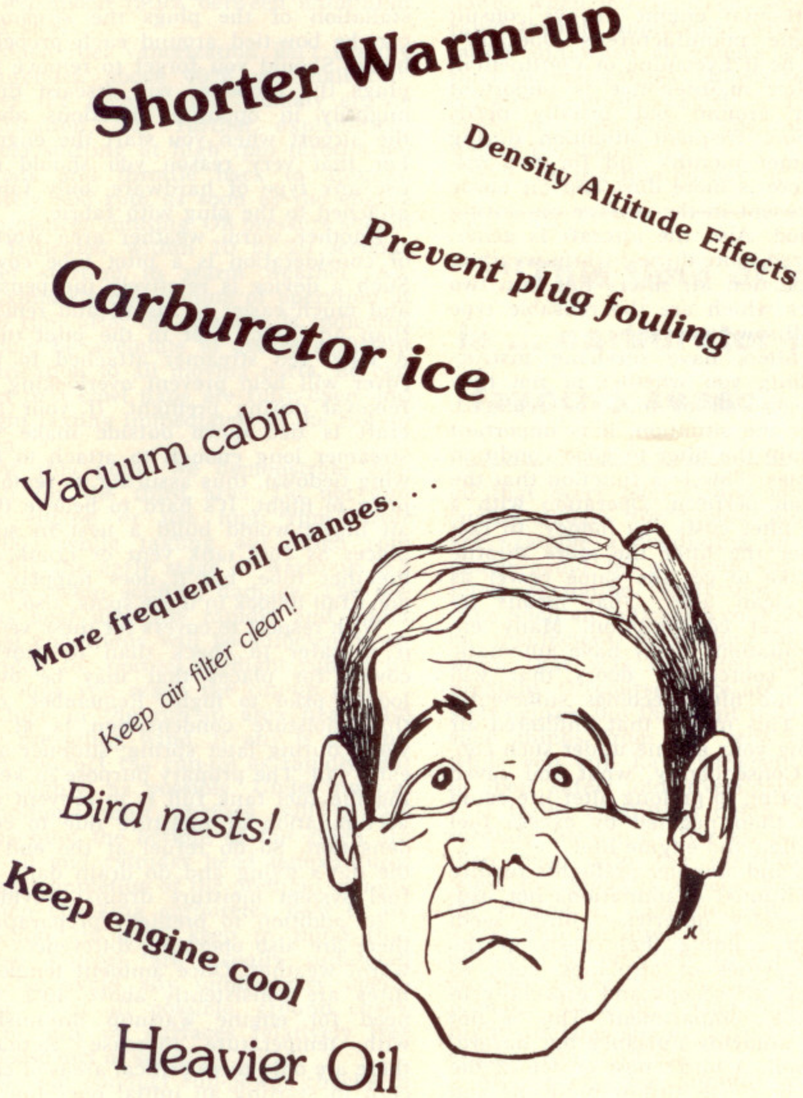
■■ Ah! Summer again. No more bone-chilling preflights, oil so stiff you can chin yourself on the prop and no more snow and ice. Now there will be pleasant early morning and evening flights, gliding to a landing on some bucolic grass field; just you and that wonderful airplane. If only it were that easy, but there is work involved as well, so let's get to it.

The first order of work should be a good spring housecleaning, and this can be more important to your pocketbook than you may realize. A thorough vacuuming out of the cabin and baggage compartment should be the first order of business. Be certain to do the sidewalls and upholstery as well as all floor carpets. This practice will help increase the useful life of your gyro filters. As will not smoking in the airplane.

The vacuum-driven gyros have filters (or a filter system) to prevent dust and dirt from entering the inside of the gyros and fouling their mechanisms. This filter system is located inside the cabin, usually behind the instrument panel.

Dirty gyro filters reduce gyro performance and increase rate of preces-

Warm Weather Operations



How to keep the airplane — and the pilot — out of trouble in the summertime

by KEN GARDNER / AOPA 132319

sion. As a rule these filters cannot be cleaned and subsequently have to be replaced. Replacement, like everything else on an airplane, is expensive. Thus, keeping the interior clean also helps prolong the service life of your gyro filters.

Once the ambient temperatures are consistently above 40°F (approximately 5°C) you should consider changing to the proper grade of lubricating oil for warm weather operation. Usually two grades of lubricating oil are specified: SAE 50 for the larger engines and SAE 40 for smaller ones. Incidentally, those numbers can be confusing, for there are three different ways to specify the same approximate viscosity number. For example:

SAE 50 = Grade 100 = Military designation 1100

SAE 40 = Grade 80 = Military designation 1080

In the Teledyne Continental Motors family of engines, all those with 300 cubic inch displacement (CID) and less are recommended for operation with SAE 40 or grade 80 oil in warm weather (40°F and above). Beginning with the IO-346 and all engines of greater CID, the correct grade of lubricating oil will be grade 100 or SAE 50.

Some owners choose to operate such engines all year with grade 40. Nowhere in the manufacturer's operating literature does such a recommendation appear. Therefore this practice is not specified and thus can hardly be considered in the best interest of your engine's operation. Do change to the correct grade of engine lubricating oil, and do not use oil additive compounds. A quality, name brand lubricating oil contains sufficient additives to meet your engine's needs; more than that it cannot use.

Warm, especially hot, weather is rough on engine oil, so change as often as recommended and more often in extremely hot (90°F or higher) and dusty conditions. No one ever wore out an engine by changing the oil too often, but the opposite has certainly been true. The preceding information is quite similar for Lycoming engines as well; however, for the exact information for

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your particular engine always consult the engine manufacturer's Operator's Manual, be it Lycoming or Continental.

Air filter maintenance is important the year around but usually needs much more frequent attention during the summer months and for two reasons. There is more dust and air borne debris present in the surface air during this period. Also the aircraft is generally utilized more during warm weather. Most induction air filters fall into two categories which are the reusable type and the throw-away type.

Most filters have servicing instructions telling you whether or not they can be serviced or must be replaced. Whatever the situation, it is important to maintain the filter in good condition at all times. This is a function that the owner can perform. Operation with a dirty air filter costs you money. In fact the dirtier the filter the more throttle it will take to get the same power as with a clean filter. That means increased fuel consumption. Many engine installations today have automatic alternate source air doors that will open if the filter becomes sufficiently clogged. This means that unfiltered air is entering your engine under such conditions. Consequently, what you saved in attempting to prolong filter life could be more than negated by excess fuel consumption and engine life.

Spring and summer preflights require some additional examinations not usually necessary otherwise. Birds seem intent on building their nests in the various cavities of airplanes, such as tail cones, air scoops and especially in the engine compartment. This is not only an annoying nuisance but hazardous as well. A bird's nest on top of the engine can cause airflow problems and subsequent overheating of that immediate area. It also constitutes a fire hazard.

On some airplanes it is possible to remove a nest from on top of the cylinders without actually having to remove the top cowling, but not always.

Two large pieces of two-inch-thick foam rubber cut slightly larger than the air inlet openings will satisfactorily plug these openings and effectively prevent birds from nesting.

To preclude taking off with the inlet plugs in place, firmly attach two large, red streamers to each plug. During installation of the plugs the streamers can be bow-tied around each propeller blade. Should you forget to remove the plugs the propeller will discard them mightily in opposite directions about the airport when you start the engine. For that very reason you should not use any type of hardware, only fabric attached to the plug with fabric.

Another warm weather area worthy of consideration is a pitot tube cover. Such a device is relatively inexpensive and much easier to install and remove than an insect nest in the pitot tube. A long, red streamer attached to the cover will help prevent overlooking its removal during preflight. If your aircraft is tied down outside make the streamer long enough to attach to the wing tiedown, thus assuring its removal prior to flight. It's hard to believe that an insect would build a nest in such places as fuel tank vent or crankcase breather tube, but it does happen, so don't fail to look in those spots, also.

With respect to covers for these vents, it is safer to check than to provide covers for places that may be overlooked prior to flight. Remember, too, that moisture condensation is at its worst during later spring, summer and early fall. The primary purpose in keeping the fuel tank full is to prevent the accumulation of moisture due to condensation. So do refuel at the end of the day's flying and do drain daily all fuel system moisture drains provided.

In addition to preflight preparation, there are also operating differences for warm weather. Once ambient temperatures are consistently above 40°F the need for engine warmup diminishes with temperature increase. Actually there are only three critical areas of concern in starting an initial operation of a naturally aspirated engine. The first area is fuel vaporization, and above 40°F that ceases to be a problem. The second area is engine lubrication; perhaps most critical of all is cylinder wall lubrication since the walls are more susceptible to drain-off when the engine is at rest. Add to this the oil-scraping action of the piston rings and the delay until lubricating oils reach the cylinder walls and one can see the need to be careful immediately after start up. The third critical area is excessive piston-to-cylinder-wall clearance present in cold engines due to the difference in expansion ratios between aluminum and steel.

Since fuel vaporization isn't usually a problem above 40°F we shall consider the second area, namely engine lubrication, for further explanation. Avoid starting at high rpm throttle positions and throttle back to approximately 800 rpm as soon as the engine commences running. Oil pressure should be indicated within 10 to 20 seconds after start-up in warm weather. Approximately one minute of operation at 800 rpm after oil pressure is indicated should be adequate to assure sufficient lubrication to all moving parts. Be certain that cowl flaps are fully open and begin taxiing immediately to the run-up area.

At this point we demonstrate concern for the third area. Do not gun the engine or use high rpm (over 2,000) while taxiing out. High rpm during the early stage of warm-up can cause piston scuffing damage. The pistons heat up quite rapidly and under most conditions will be sufficiently expanded for normal preflight run-up by the time you reach the run-up area.

Once in the run-up area head into the prevailing wind, if any is present, and conduct the run-up as rapidly, but thoroughly, as possible. Under normal conditions most engines will be approaching the bottom of the green arc on oil and cylinder head temperatures upon completion of the preflight run-up. When checking carburetor heat or induction air heat, keep in mind that these sources are usually unfiltered air, so avoid any unnecessary operation. If at all possible, ground check them only on surfaces relatively free of loose dirt or sand.

Do not conduct full-power checks in the run-up area. Under such circumstances the propeller vortex can cause loose debris to be picked up by the propeller with subsequent blade damage. By the same token the propeller will hurl such debris into the polished forward area of the nose strut causing damage to it and subsequently to its inner oil seal. Such practice can also damage extended wing flaps on low-wing aircraft.

Once preflight run-up is completed the takeoff should be commenced as soon as possible. As a general rule the engine will be ready to accept takeoff power when it can accept smooth and rapid throttle application without hesitation and when all gauges are within their normal ranges. Unless very short runway conditions exist, a full-power check is made during the initial portion of the takeoff roll.

It is during this portion of the takeoff that every pilot should monitor all engine gauges for proper indications. For example a fluctuating oil pressure gauge could be an indicator that oil pump cavitation (starvation) is occurring. Such an indication could be caused by insufficient lubricating oil in the sump that was neglected during the preflight. Of course there are other possible causes, but the point is to discover such things from the very beginning while you still have sufficient runway to abort safely and investigate.

"This time of year is ... carburetor ice's favorite season ..."

If traffic conditions detain your immediate departure after engine run-up, then head into the prevailing wind (even five knots is a help) and operate the engine at approximately 1,000 to 1,200 rpm for direct-drive engines and 600 to 800 propeller rpm for geared engines. Slower engine speeds tend to promote spark plug lead fouling, and higher engine speeds accelerate rising engine temperatures.

After every five minutes of ground operation, accelerate the engine to 1,800 rpm for five seconds or so to clear the spark plugs; then return to the suggested running speeds. If engine temperatures approach their respective red line limits and you expect continued delays, it would be better to taxi back and shut down to permit the engine a cooling off period than to attempt a takeoff with engine temperatures near the red line. During such long delays pre-lead fouling conditions are continually in progress; however, the actual or detrimental form of lead fouling occurs with rapid throttle application during the hurried departures following long delays.

When such circumstances prevail, much of the lead fouling can be prevented by taxiing into position, holding the brakes and slowly opening the throttle until at least 2,000 rpm is obtained. This procedure will provide the combustion chamber conditions necessary to expel most of the lead and subsequently reduce such fouling. If your density altitude is in excess of 5,000 feet, lean the mixture for smooth operation at the holding rpm you have selected. Be certain you return to full rich for the takeoff leaning procedure prior to departure.

After takeoff, climb out at an airspeed that provides satisfactory engine cooling. A good general rule to follow here is "the higher the ambient temperatures, the higher the climb airspeed." My own personal practice is to add at least 10 mph to the climb speed for every 10 degrees above 80°F ambient temperatures. Admittedly you cannot do this with every type of aircraft, but where you can it helps keep engine temperatures in line.

All cooling devices should be fully open for the takeoff and climb. I have often observed pilots close the cowl flaps shortly after takeoff so that better performance could be obtained during the climbout. They go strictly by the cylinder head temperature (CHT) gauge and as long as it indicates within the green arc all is thought to be well. But is it?

What about the temperatures in the accessory section where all of those expensive accessories like magnetos, generators or alternators and vacuum pumps are located. Are they cooling properly? Remember that the now hot engine-cooling air passes over the accessory section before it goes overboard and that the red-hot exhaust system is nearly always located in or near the accessory compartment.

There is a lot of expensive equipment in that accessory section, and, while you may feel that engine temperatures according to the CHT gauge are satisfactory, you could very well be overheating the accessory section with a subsequent reduction in the service life of the equipment located there. If you have been guilty of this practice, ask your mechanic to carefully examine the rubber engine mounts and hoses at the next inspection for evidence of heat damage.

While we're on this subject consider cowl flap procedure. Climbing with the cowl flaps closed could be reducing rather than improving performance. Some aircraft are equipped with cowl flaps that can be set in "trail position." That means the cowl flaps are, in effect, disconnected from their controls and are allowed to assume their own position. Naturally this will be the position of lowest drag, and it almost never is fully closed or fully open. The position changes with airspeed but usually ends up somewhere in mid-range.

In hot weather the cowl flaps could be set full-open throughout the climb to cruising altitude unless ambient conditions or the operator's manual directs otherwise. I have never seen any damage from climbing with the cowl flaps open, but I certainly have with them closed—especially with a tightly cowled, turbocharged engine.

Upon reaching cruise altitude, if ambient temperatures are still in excess of 60°F allow the cowl flaps to remain open while you establish cruise power, perform cockpit chores and set up headings. This will allow engine temperatures to stabilize and permit the aircraft to reach its approximate cruise speed. The last two chores should be mixture trimming and adjusting cowl flaps as necessary to maintain the desired CHT. The full ram-air effect of cruising speed should be attained before the mixture is precisely leaned and the cowl flaps adjusted for cruise. Only under these conditions will the end result be the way the engine runs best.

This time of the year is also carburetor ice's favorite season. I have encountered many a pilot who believes that this is primarily a wintertime phenomenon, but it isn't. It's presence is quite subtle in the beginning but could easily be fatal in the end. However, a few numbers can help you detect it before it even gets a chance at you. If atmospheric humidity is 60% or higher, watch for carburetor ice. You can usually obtain this information from FAA Flight Service Stations along your route.

Most airplanes have an outside air temperature (OAT) gauge, and if yours does not it will be worth your while to have one installed to help ascertain when conditions are ripe for carburetor ice. Next you should be familiar with the type of fuel metering equipment on your particular engine. If it is equipped with a float-type carburetor, you can expect air temperature in the carburetor to be 60°F less than ambient air at cruise speeds; if equipped with a pressure carburetor a temperature differential of 30°F less than ambient will exist; and, if fuel injected there will be approximately no change.

Now let's suppose you are flying cross-country in a Piper Cherokee 140 or a Cessna 170B. The ambient humidity is 80% with an OAT of 80°F. Both aircraft have float carburetors, so you subtract 60° from the ambient 80°F and get a carburetor throat temperature of 20°F, or 12° below freezing. An 80% humidity content means there is enough moisture in the air to freeze upon contact with the cold metal parts in the carburetor throat. Thus ice is a strong possibility.

Consequently, keep a sharp eye on any loss of airspeed, rpm or a manifold pressure. Should such losses appear, apply full carburetor heat immediately and lean the mixture to compensate for the increased density altitude effect caused by heating the incoming air (in effect, "thinning" the air). You could maintain this configuration indefinitely, or, if you have a carb air temperature gauge, make adjustments by reference to it. Without such a gauge, Lycoming recommends full carb heat or none, no in-between. Continental's position is somewhat similar.

These suggestions do not address the procedure for impact or cooled-water icing, which is an altogether different situation. With fuel injection there is little danger from carburetor icing because the throat temperature will usually be at the ambient or near-ambient temperature. Nevertheless, this system is equally vulnerable to impact icing. However, impact icing usually involves IFR flight into known moisture regions with ambient temperatures below 32°F.

When either carburetor heat or alternate air is employed, the mixture should be leaned to smooth the engine operation and restore the power loss caused by overly rich conditions resulting from the heated air source. If heat is applied after ice is already present, do not attempt leaning until the ice is completely gone.

Another area of concern in warm weather is the density altitude effect. Unless otherwise specified in the aircraft or engine operator's handbook, all performance figures are usually predicated under ISA conditions (60°F, 29.92 inches Hg). Consequently, operating conditions will not be the same when ambient temperatures or barometric pressures are other than standard. For example, an engine developing 75% power at 24 inches Hg and 2,350 rpm at ISA conditions will develop less power if the ambient temperature is 70°F. A general rule is 1% loss of power for each 10° above 60°F and a 3.5% loss for each 1,000 feet above sea level. This has a considerable effect on required runway and climbout performance.

The aircraft and, especially, the naturally aspirated engine are quite sensitive to density altitude, thus it becomes quite important to know what the density altitude actually is anytime there is a question about runway length, climb performance and leaning for takeoff. There are times when it may be necessary to lean for a warm weather takeoff from a field actually below 5,000 feet msl. It's not at all uncommon in hot weather to encounter field elevations 3,000 feet higher than their normal msl elevation due to the hot weather density altitude effect.

There is an old saying in this business. "When all else fails, read the owner's manual." Ironically, a lot of problems would not even have begun had the owners taken the time to read the performance sections of their owner's manuals. □