Cumulative problems sneak up on the pilot and may cause permanent, sometimes catastrophic, damage before they are recognized. Here the culprit is not gross overheating of the engine once or twice, but rather the cumulative result of continuous use of improper procedures over a long period of time—each occurrence adding to the problem until there is a major malfunction. The end result is a shorter TBO by as much as half the expected life, scored pistons and cylinders, and broken or stuck piston rings.

Taxi and runups are critical periods of heat dissipation, and simple preventive measures often are ignored by pilots and mechanics. Always face the airplane into the wind when stationary, especially during engine runup. A nonmoving aircraft has a difficult time getting sufficient airflow through the cowling for cooling, so any help from the wind is beneficial. Avoid unnecessary or long runups; they generate excessive heat that is difficult to dissipate. Similarly, minimize static high-power time.

Never run up an engine under high power with the cowling removed! Frequently practiced by mechanics, this procedure leads to shortened cylinder and piston life because the cowling directs airflow to the lower and back sides of all cylinders and is primarily responsible for getting airflow to the aft cylinders.

Takeoff and climb also are critical periods for engine cooling. An engine should be operated in these phases at full-rich mixture unless the ambient conditions require leaning; the excess, unburned fuel that results from the rich mixture serves as an additional coolant. It is also imperative to long engine life that the pilot adhere to the climb speed designated in the POH. The specified speed is designed to provide the best rate of climb with consideration given to engine cooling. Lower speeds will require higher angles of attack, which translates into reduced cooling airflow and decreased TBO. A common problem associated with trainer aircraft, or any aircraft used by numerous low-experience pilots, is that the aft cylinders tend to burn out early, often significantly below TBO, because of poor climbout technique. It is very important to get a reliable mechanic to check the engine for such premature wear before purchasing a used aircraft.

Generally, cruise and descent are not considered to be cooling problems. However, one thing to watch out for is cooling the engine too rapidly during descent, particularly in larger aircraft. Shifting quickly from cruise to idle power while in a descent can lead to thermal shock, the uneven cooling of the engine, and possible engine failure. The best technique is to plan ahead and begin descending far enough away from your destination to permit a power-on descent.

Engines requiring more precise temperature control are equipped with cowl flaps. The pilot monitors the CHT and opens or closes these flaps as necessary to assure proper engine cooling. Generally, cowl flaps are open during engine start, runup, taxi, takeoff, and initial climb. They are closed after level off and remain so during cruise, enroute climbs, descents, and landing. If the ambient temperature is particularly hot, the CHT may reflect the need for partial opening of cowl flaps during enroute climb or cruise.

Pilots transitioning from less complex aircraft may be dismayed to discover that cowl flaps are yet another thing to remember. When executing a missed approach, cowl flaps need to be opened after initiating the climb because of increased power and