Make Your Own Engine Heater

How to bring down the cost — and the problems — of cold-weather starts

by DONALD T. WAGNER / AOPA 508312

■■ An engine pre-heat is an essential bit of tender care your airplane deserves unless you limit your flying to warm weather.

After several hours at single digit temperatures, starting a lightplane is chancy at best. Oil thickens to glue consistency, battery output is less than half, heavy priming washes away the protective oil film that keeps those expensive metals from scraping against each other. That first 30 seconds running time after a cold start can cause more wear than several hours in the air.

Any amount of heat will improve starting conditions. Applying a propane torch directly to the engine is

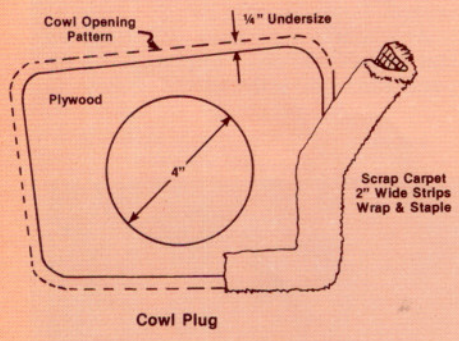
extremely dangerous. If you don't set fire to your pride and joy, the uneven temperatures cause movement of metal parts by expansion that can create damaging stresses.

If you're in a closed hangar away from the wind, a light bulb or small electric heater of 200 to 300 watts may be placed in the bottom of the cowl where convection will raise the oil temperature a few degrees. The light must be positioned with care so that the bulb does not touch fuel or electrical lines because the bulb surface is hot enough to melt insulation or to vaporize fuel. The protective cage of a trouble light usually can prevent this. There is also the danger, though, that drops of oil, fuel or water might land directly on the bulb and cause it to shatter.

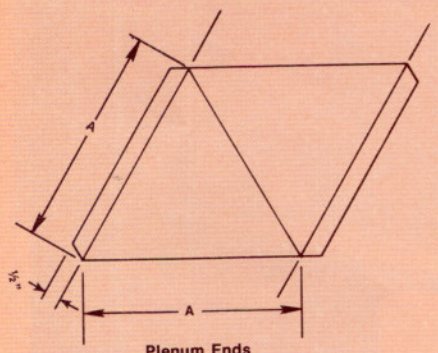
One popular, inexpensive heater is the type that focuses two infra-red bulbs on the front cylinders. This applies a safe temperature with the heaters well away from stray fluids. Remember, the infra-red heats only what it can see. The oil is then heated by conduction through cylinders and crankcase. The effect is almost nil. Having the front two cylinders warm may allow them to fire quickly and bring the rest to life, but high wear conditions are still present for the rest of the engine.

The best situation, then, is a heater that circulates warmed air around the engine to raise the temperature uniformly. Several good commercial units are available that do this safely. The most powerful use a propane or kerosene pressure burner and usually carry the products of combustion in the heated airstream. A considerable quantity of water vapor is also introduced that condenses on the engine, but leaving the heat on long enough to raise the temperature above the condensation point will dry it out again. I, personally, feel uncomfortable leaving a heater with an open flame in the airstream unattended for even a few minutes, so this type of heater should be used only for the quick warmup on the ramp before a trip.

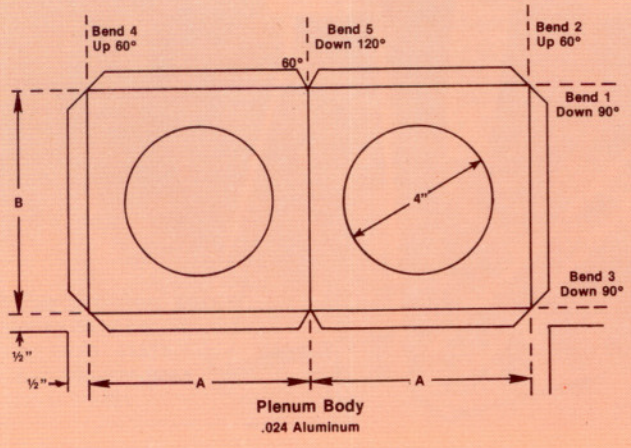
You can build a simple, electric forced-air heater, that will do a good job, yourself, for about one-third the cost of commercial units. The heart of my unit is a 1,500-watt electric heater, sold as a milk house heater through farm supply stores. The de-



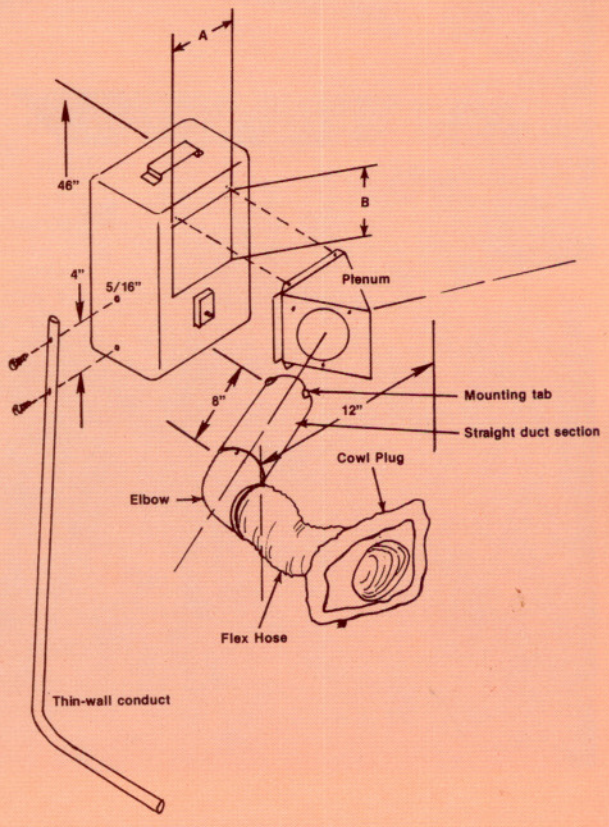
Cowl Plug



Plenum Ends



Plenum Body
.024 Aluminum



sign may be adapted to any small heater of this type. With a small heater such as this it is important to put all of its output in and around the engine. Remember to keep a close fit of warm air ducts to the cowl openings and short duct runs.

The first job is to get a few measurements from the plane. Cut and fit a piece of cardboard to the cowl openings. Measure the height of prop centerline above ground, distance between cowl openings and distance from cowl openings to a position clear of the prop. The dimensions shown on the sketches were developed to fit a Beech Musketeer with the heater sitting just below the prop spinner. Slight changes will adapt this unit to most single-engine cowls.

Next, buy your heater. The unit I used was less than $20, had a dual range and a built-in thermostat. (The thermostat serves no function on the completed heater.) Other materials needed, besides the 110-volt, 1,500-watt heater, are a 13- by 15-inch aluminum sheet; one length of 4-inch-diameter vent pipe; two 4-inch-diameter, 90° elbows; 60 inches of dryer flex hose with clamps; 10 feet of ½-inch thin-wall conduit; four each ¼-inch diameter, 1-inch-long, round head machine screws with nuts and flat washers; 20, ⅛-inch pop rivets; and, scrap plywood and carpeting.

Tools needed for the job are tin snips, hand drill, saw, pop riveter and a stapler. A circle cutting bit would make it easier to cut accurate openings in the plenum and cowl plugs.

Measure the width (A) and height (B) of your heater output grill and substitute these dimensions in the layout sketch. Transfer the layout, full-size to a sheet of light-gauge aluminum. The aluminum sheet sold in most hardware stores is usually .024-inch-thick, dead soft material that is very easy to cut and form. Cut out the plenum body and ends and dress the edges lightly with a file or sanding block to remove the sharp edges.

The bends can be easily formed by hand or with a light mallet over the edge of a block of wood. Three pop rivets on each end will be sufficient if your bends have been made with care. The joints should fit closely enough to prevent losing any of that precious heated air.

Cut straight duct sections to length before snapping the seams together. Cut mounting tabs by snipping ½-inch deep lengthwise ¾-inch apart at three points around each tube circumference. The appearance is neater if the tabs are formed out after slipping the tube through the 4-inch hole in the plenum. Rivet each tab. After assembling and aligning the elbows, pop two rivets in each joint to keep them secure.

Remove any obstructing grill guards from the face of the heater. Now the plenum and duct assembly can be riveted to the heater. Be sure to clean any drilling chips out of the heater interior; they could possibly cause a short circuit in the heater coils or electrical switch connections. The thin-wall conduit can be formed to provide legs that will support the unit at the proper height. (Heater frames are usually very light sheet steel so washers should be used inside the frame to spread the load of the quarter-inch bolts used to attach the legs.)

Trace your cardboard pattern of the cowl opening on some scrap plywood at least ¼-inch thick. Hand mark a cutting line a quarter-inch inside the outline. Locate and mark a 4-inch-diameter hole in the center of the plug. After cutting out the plug, staple or tack a 2-inch-wide strip of carpeting folded over the edge along the full perimeter. This carpeting not only provides a tight seal to force the warm air around the engine, but protects against scratching the cowling.

The flexible dryer vent line is a vinyl tube supported by a 4-inch-diameter wire coil. It is sold in 60-inch sections with two tube clamps and is rated for continuous duty at 190°F. A length of only 12 inches on each side would have been sufficient for my installation but I decided to use the full 30 inches on each side, which may make this unit usable on other planes without modification. Draw the flex tube through the holes in the cowl plug and staple it to the opposite side, catching at least one turn of the wire. Clamp the other end to the duct elbows and the unit is complete. Be sure your extension cord can handle 10 amps.

This entire heater is safe and quite effective. It's safe to leave operating unattended since the warm air enters the cowling at approximately 150° maximum. I usually turn it on about an hour before flight time and find the engine cranks well and starts easily. It has been effective at −10°F with as little as 30 minutes heating time. □