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### Why Your Engine Needs Heat

## PILOT REPORT

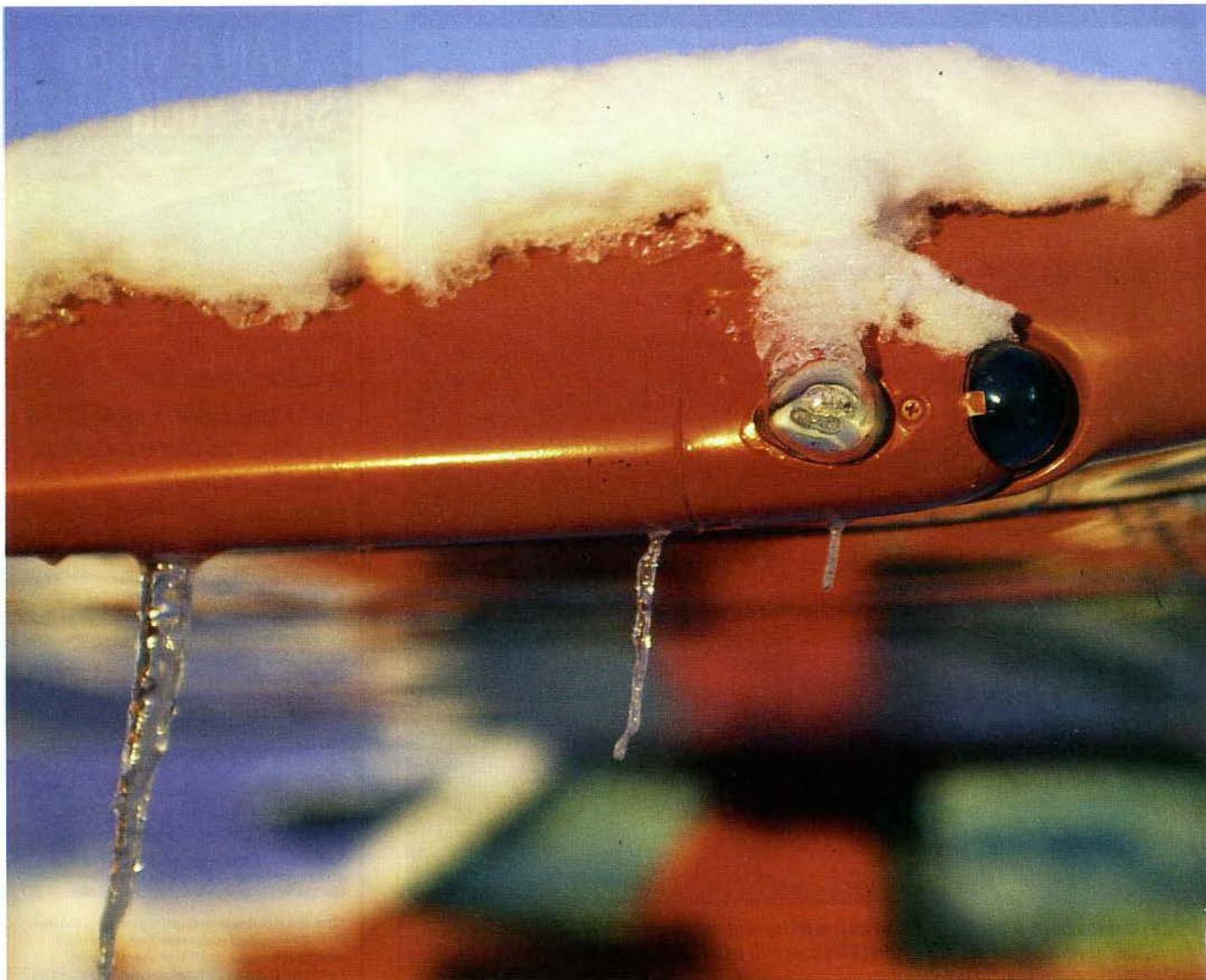
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## Pilots need to stay warm during the winter months. Your airplane deserves the same consideration. • By Buddy Ferguson

**Y**our engine needs preheat. Starting a cold engine can give it the equivalent of 500 hours of cruise wear and tear, according to engine authorities. Assuming no other potentially catastrophic damage occurs, this single event easily could raise the hamburger price to a healthy four-digit value.

So, when do you preheat? Here's a simple rule of thumb: Whenever water can freeze, your airplane needs preheat. How much and what kind of preheating is necessary? The preheating process varies because of a number of factors, including aircraft type, temperature, the level of self-sufficiency required and even pilot preferences. Regardless of whether the tug pulls your aircraft from a heated hangar or homemade devices are employed

in the backcountry, the goal is to deliver heat to your engine, battery and cockpit, and take the necessary steps to preserve it. Let's first consider the whys for each of these components.

Aluminum is an amazing alloy that has given engineers the ability to design all-metal aircraft structures, their engines and components without the power loading requirements of the space shuttle. The metallurgical properties of this material provide the basis for the preheating argument. It's important to understand that aluminum responds more rapidly and to a greater degree to thermal change than most other engine metals. Under cold conditions, the operating tolerances between these dissimilar metals are compromised, possibly to the point of being

nil. This will have significant consequences during startup. The closer we can move toward normal operating temperatures prior to start for both the metals and the proper grade of lubricating oil, the more likely an engine will make TBO.

Aircraft operation without electrical power, although not impossible, can increase the overall degree of flight difficulty. Starters, instruments and avionics all require electron enthusiasm to be motivated. A fully charged wet battery may be immune from freezing to a temperature of minus-95 degrees F, but once depleted to 25%, it will freeze at approximately 10 degrees F. Because a cold storage battery's chemical reactions are slowed, the situation becomes equivalent to using a battery of lower capacity. Although volt-



# Aircraft And Engine Preheat Is A Big Deal

age may be normal, you may not have enough amperage for multiple engine starts. Keep in mind that a cold battery, especially one not placed on the firewall, may take hours to fully charge in flight.

When the thermometer dips, cockpit knobs, selectors, displays, switches, mechanical instruments and housed cables are all subject to condensation buildup and changes in tolerance. Freezing temperatures may seize mechanical actions or short delicate circuits. Lubricants will become more viscous, creating undesirable resistance. At some point, electronic components may refuse to power up.

The cost of admission to winter flying doesn't have to be great, but an investment in some basic items is essential. This dollar figure will vary based on your  
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established minimum operating temperature. An insulated engine blanket designed for the aircraft should be your first imperative. Even when an aircraft has been in a heated hangar, Mother Nature quickly will rob whatever heat was absorbed by the aircraft once it's moved outside. In this situation, a short ground run to generate some additional heat may be a good idea before fitting the engine blanket. As the temperature approaches Fahrenheit teens, a propeller will become like a giant radiator rapidly dissipating internal engine heat. Under these conditions, insulated prop and spinner covers should be added to your list. Power will be required to operate heating equipment, so one or more extension cords will be needed. Do not go cheap here. Buy industrial-grade

extension cords designed for cold weather. A 100-foot cord that won't coil can be quite frustrating to get back into the airplane.

So how do we deliver heat to the aircraft without risking a total meltdown caused by a portable barbecue grill undergoing thermal runaway? The choices are either heat by combustion or resistance. FBOs that provide preheating services often have industrial-sized, kerosene-fired heaters that can simultaneously pump hot air through flexible hose ducts into your engine cowl and cabin. These units can get the job done on a small single-engine airplane in about the time it takes you to run to Starbucks. Portable units in this genre vary in performance and generally will require a 12-volt power source and propane, which vaporizes poorly at subzero temperatures. Devices on the order of a camp stove and pipe, while certainly far superior to nothing at all, may lack the output to get you thawed from a deep freeze.

Resistance heat is measured in watts and offers some advantages in terms of simplicity. Engine preheating systems from manufacturers like Tanis and Reiff, which incidentally cost less than one replacement cylinder, are easy installations and require only a reliable AC power source. If grid electricity isn't available, these systems can be operated by a portable generator, like the lightweight Honda EU1000i rated for 900 continuous watts. A small, remove-before-flight, interior car warmer or ceramic heater carefully placed and secured can be quite effective underneath an insulated cowl, especially if plugged in while the engine is still warm. While not able to bring the cockpit to a balmy level, these small units will be more than sufficient to warm your gyros and prevent their premature seizure. Those with fans will, of course, have a greater current draw, which may be a consideration if you're using portable power.

And don't forget—aircraft preheating should be recognized as only one of several necessary phases of the winter preflight. There are many other maintenance-related steps that should be undertaken before the mercury heads south. These considerations are beyond the scope of this discussion, but essential to the safe operation of an aircraft in colder ambient temperatures. Aircraft and engine operating manuals, service bulletins, trained mechanics and experienced pilots should all be consulted. A strategy for dealing with airframe contamination also is of paramount importance.

So once again, here's what you should do before flying your plane in cold air:

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- Preheat when the temperature drops below 32 degrees F.
- The time required will depend on your methods, but expect the duration to increase exponentially as the temperature inches downward.
- Warm engine oil is not a true indicator of a thorough preheat. Touch the

cylinders, case and crankshaft (behind the propeller flange) to check these metals for heat absorption.

- Keep your battery fully charged.
- Be mindful of the placement of any heating source, especially those that deal with live flame. Fuel sumps or strainer leaks, engine oil and some fabrics might

## Fire It Up

Looking to buy an engine preheat system, but don't know where to begin searching? The following is a list of manufacturers that offer a variety of engine preheaters for each individual's needs. They range from industrial-strength preheaters to portable equipment that you can use anywhere, even in the backcountry. Some companies even offer accessories that help you reduce the time it takes to preheat an engine so you can enjoy valuable winter flying time.

### Aerotech Herman Nelson International Inc.

Although catering to mostly the "big boys" like the airlines, military and petrochemical oil field and pipeline industries, Aerotech Herman Nelson offers several engine preheaters for general-aviation pilots. Its **12-volt D.C. Engine Preheaters (LT 2-12 MH-300 and LT 2-12 MH-200)** are ideal for remote locations where electrical outlets are not available. Weighing only 16 pounds, they feature a push-button ignition, a safety shutoff valve and adjustable regulator. They also come in **115-volt versions (LT 2-12 MH-310 and LT 2-12 MH-210)**, perfect in a hangar, garage and machine shop or anywhere electrical outlets are available. But if you use them in conjunction with the company's **Heat Wand De-Icer**, your engine heating job may get a whole lot easier.

For more information, contact Aerotech Herman Nelson International Inc. at (800) 486-4328 or log on to [www.aerotech-herman-nelson.com](http://www.aerotech-herman-nelson.com).

### AeroTherm

Working on the principle that the best way to heat an airplane engine is in a heated hangar, the company has developed its own **AeroTherm Aircraft Engine Heater System**. It recirculates heat into the engine compartment continuously, warming up the engine and its cylinders evenly as well as the oil. The AeroTherm engine heater system comes with a heater box and heater hoses weighing 10 pounds



**AeroTherm**

overall, making it one of the lightest and portable heaters around. It comes in 500-, 1,000- and 1,500-watt settings, has hoses that are rated from minus-60 degrees F to 260 degrees F and has a thermostat to shut off air at the desired temperature. All you need to do is attach the nylon suspension band to the prop and you're ready to go.

For more information, contact AeroTherm at (605) 645-0824 or log on to <http://aerothermheaters.com>.

### E-Z Heat Inc.

**E-Z Heat's Aircraft Engine Preheater System** comes in six models and is available for Lycoming, Continental, Pratt & Whitney, Garrett and Franklin



**E-Z Heat**

engines. It consists of a flexible synthetic pad that conforms to the contours of the oil pan and heats 12 quarts of oil from minus-40 degrees F to 60 degrees F. The heaters are thermostat-controlled, and all 100-volt preheaters include a Lite Brite power cord that gives owners an instant visual to see whether or not they remembered to plug in the preheater.

For more information, contact E-Z

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react with some enthusiasm.

• Don't be intimidated by the season. Dress for the diligence and safety that winter flight ops demand.

Now, go enjoy how the winter light illuminates the landscape. Did I mention the benefits cold, dense air has on aircraft performance? P&P

Heat Inc. at (800) 468-4459 or log on to <http://e-zheat.com>.

### Flame Engineering

What began as a propane torch business for burning weeds and brush on a small Kansas farm has evolved into a lucrative



*Flame Engineering 115-Volt A.C. Preheater*



*Flame Engineering 12-Volt D.C. Preheater*



*Flame Engineering Self-Contained Preheater*

business that sells the Red Dragon product line of aircraft engine preheaters. Originally developed for Alaskan bush pilots, the preheaters are available in **12-volt D.C. or 115-volt A.C. models**, have a push-button ignition and take only 15 minutes at zero degrees F to preheat the engine.

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The advertisement features a background image of a small aircraft flying at night. The text is arranged in a hierarchy from top to bottom: 'Change Your Approach', 'PreciseLite HID AVIATION LIGHTS', 'Light Up Your Landings', a list of five bullet points, the Precision Flight logo, the website 'www.preciseflight.com', the phone number '1-800-547-2558', and 'CALL TODAY TO GET YOUR FREE 22-PAGE CATALOG'. A small image of the catalog is shown in the bottom right corner.

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