

Guidance on Aircraft Engine Pre-Heat during Cold Weather OPS

The electric engine preheaters installed on CAP planes are a very effective means to protect our valuable aircraft assets from excessive wear and potential damage during cold weather flying. This excerpt from an AVWeb.com article on cold starts has some “chilling” facts: *“In less than a minute, a single cold start without proper preheating can produce more wear on your piston aircraft engine than 500 hours of normal cruise operation. If it's cold enough, a single cold start can cause the catastrophic destruction of an engine shortly after takeoff.”* Read the entire article here:

<http://www.avweb.com/news/maint/182846-1.html?redirected=1#howcold>

CAP aircraft are equipped with electric pre-heaters to combat the hazards of cold starts and it's important for CAP pilots to understand how to use it properly to achieve maximum protection during cold weather OPS.

Here are some things pilots of CAP planes with installed electric pre-heaters should consider:

- Electric aircraft engine pre-heaters only work over time, we're talking hours. Standard Reiff and Tanis preheater systems, the usual types installed on CAP aircraft, use a total of between 250 to 540 watts of heating elements in their various models and work on the "slow and steady wins the race" principle. These heaters must be plugged in for hours to warm a cold-soaked engine. Imagine how long it might take to warm up a 250-450 pound engine using a hair dryer, then triple or quadruple that! (Typical hair dryers are about 1200W.) Don't expect a plug-in aircraft heater to take an engine from stone cold to starting condition within an hour, or even several hours, after being plugged in! And the colder the engine, the longer it'll take an electric preheater to warm it.
- The best strategy for electric engine pre-heater use is to plug it in when the aircraft is parked and leave it on all the time when the ambient temperature is expected to be less than 50°F. Thermostatic switches are available to conserve electricity if that's a concern. These plug into the electrical outlet and switch the juice on and off when temps drop below ~40°F and rise above ~50°F respectively. They're available for < \$20 at builders supply stores; look for them in the plumbing section where they're used to switch on/off heating elements to keep pipes from freezing. Make certain any switch used is rated for the appropriate current capacity.
- Make certain electricity is getting to the pre-heater. Sounds silly, but many times outlets in hangars are not functional for any number of reasons. An extension cord with a built-in indicator light at the female plug end is a real convenience in this regard. If that's not available, plug in any handy electrical appliance to verify



whether or not there's juice at the end of the cord you'll attach to the plane's pre-heater plug. (Neon night lights are available for less than a buck at your local discount store and make great indicators.)

- Get the aircraft out of the wind. Think about how wind chill effects you! Any wind block can help (i.e. downwind of a building) and an unheated hangar can make a big difference in this regard.
- Close off engine air inlets and insulate the cowling to keep the heat in the engine compartment!
 - Electric aircraft pre-heater manufacturers sell fancy fitted insulating blankets that wrap the cowling and prop to keep the heat where it needs to be. They're great, but EXPENSIVE! Consider the following inexpensive (i.e. cheap) and easy ways to maximize plug-in engine heaters' effectiveness:
 - Put in the cowl plugs; they're usually made of something that has insulating properties and they block BIG air holes and prevent heat from escaping! (If your CAP plane is missing cowl plugs call your LGM.)
 - Close the cowl flaps (if equipped) for the same reason.
 - Throw an old blanket, moving pad or sleeping bag over the cowling to insulate the heated area; this keeps a lot of heat from escaping through gaps and minimizes radiant loss through the un-insulated metal or fiberglass cowling
 - Take care to keep the blanket (etc.) away from oily spots on the cowling.
 - Use bungee cords to secure it around the cowling (essential if outside where it can blow off)
 - Insulating material cannot be water absorbent if outside and exposed to the elements
 - Take care to prevent metals grommets or zippers from scratching paint.
 - Label anything you use to insulate the cowling "REMOVE BEFORE FLIGHT"; it may seem obvious, but hey...we're all about safety!
 - Consider carrying the insulators and extension cord in the plane if you'll land somewhere and expect the plane to sit out in the cold for several hours. Ask the FBO if you can plug it in; any FBO who values its customer will gladly comply. If they protest about the use of electricity tell them it only uses a couple KW hours a day. A KWh costs about a dime where I buy electricity. Discuss the potential hazards of a cold start with them and I'll bet you can convince them to help CAP protect its mission assets by plugging in! If necessary, offer to pay a few bucks for a few hours' electricity.
 - Consider adding the following to your go/no go decision list: *When the temperature is below the starting range recommended in the POH and/or Engine Manual, **NO pre-heat = NO GO!***

- **CHECK TO MAKE CERTAIN THE PLUG-IN PRE-HEATER WORKED!**
During cold weather OPS make this your first preflight action: Pull one cowl plug and feel a cylinder or the engine block; it should be warm to the touch if the pre-heater is working. Don't forget to replace that cowl plug to keep that heat in the engine during the rest of your pre-flight activities!
- If the plane is not pre-heated appropriately and it must fly to meet the mission requirements, you must request authorization to "purchase" an FBO engine pre-heat from the FRO, DO or IC. These typically run around \$30 for the half-hour preheat usually required for our type engines; however, I've seen it run as much as \$75 at some FBOs! (Chances are you'll be denied that request and the FRO, DO, IC will find another plane & pilot that's got a warm engine to fly the mission. There's an incentive to make certain pre-heaters are plugged in and working!)
- Finally, air-cooled engines are designed to dissipate heat *FAST!* Leave the plane's pre-heater plugged in, cowl plugs and insulators in place as long as possible up to the time of engine start. BE SURE TO HEED THE "REMOVE BEFORE FLIGHT" warnings on all those items before cranking the engine! Once cowl plugs and insulators are removed, get that engine running before the benefit of the pre-heat literally vanishes into cold air!

There's a lot of great information about aircraft engine electric pre-heaters available on the internet. Here are links to two manufacturers' web sites:

<http://www.reiffpreheat.com/FAQ.htm>

<http://www.tanisaircraft.com/TechData.aspx>

Protecting our aircraft engines from the hazards of cold starts is an important duty of the CAP pilot. As with all mission flying, training, knowledge and situational awareness are the key to doing things right and being ready to respond to whatever challenges the mission presents.

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