

T-CRAFT MAINTENANCE

COLD WEATHER OPERATIONS

It is that time of the year when it is important to again share information about a variety of cold weather considerations. Many of the items included here come from various articles and the compiled knowledge of several experienced pilots and mechanics.

The basic idea is aimed at helping with cold weather starting. I have included tips and information on preflight, starting, in-flight safety, and engine operational considerations. In no way is this article all-inclusive.

In all cold weather operations the general health of the engine is very important. Our regular maintenance program insures the proper functioning of all systems. I am confident that T-Craft engines are well maintained and in excellent operating condition. Parking inside helps eliminate most situations, however if you park outside things can happen.

Most of the time we think of starting an engine as a very simple process. Just engage the starter and listen for the engine to start purring. Unfortunately, when the weather turns cold it is not always that simple. When dealing with a reciprocating aircraft engine, it may be essential to get a start on the first try in order to avoid icing over the spark plugs and making an immediate start impossible.

So where do we begin? T-Craft has the means to **pre-heat** the engine block and oil. We use oil pan heat plus a small heater w/blower to help keep the engine block warm. These heaters are thermostatically controlled and have been set where we want them so please DONOT attempt to adjust the controls. In addition to hard starting, failure to preheat the entire engine and oil supply system may result in minor amounts of abnormal wear to internal engine parts, and eventually to reduced engine performance and shortened TBO time.

Preflight – (Thoroughness of a preflight inspection is important every time). Water is one of the most likely contaminants of aviation gasoline. We all know that the engine will not run on water, dah, and although we may get away with small amounts of moisture in the fuel during warm weather, flight into freezing temperatures makes any amount of moisture in the fuel system very critical. Even a tiny bubble of moisture may freeze in the fuel line and totally cut off the flow of fuel (opportunity to practice power off landings). During cold weather we want to keep gas tanks full to prevent condensation (375 being the exception because of weight considerations). Make sure the tank cap is on tight and properly. Look for contamination before every flight by religiously draining fuel tanks and sumps. Preflight inspection should include checking the engine breather tube for any obstruction so that any freezing of moisture at the end of the breather will not result in a loss of engine oil. If the breather freezes shut, pressure can build up in the crankcase and the crankcase nose seal will rupture. Ouch! Check the fuel selector valve for freedom of movement. It may be frozen fast and you'd better find it out while still on the ground. Moisture may get on an aircraft from cracks in our hanger roof (steps are being taken to minimize these cracks). Check aircraft surfaces for ice and freedom of movement.

Starting – Remember that the battery is handicapped by cold weather and will have a slightly reduced output at lower temperatures. The battery with a full charge survives nicely, but one that is discharged could freeze. Should the battery be run down during an attempt to start, DONOT leave it; get it charged immediately. And finally, be absolutely certain that the Master Switch is always OFF while the aircraft is parked between flights. If left on, the battery will discharge and possibly freeze. These rather minor mistakes can become an inconvenience to you and quite expensive to the club.

Probably the most important factor in starting an engine is achieving a fuel/air mixture that is satisfactory for combustion. Many pilots are unaware of or ignore the change of starting procedure needed to successfully start under varying temperature conditions. As temperatures go down it becomes more and more important that we have a plan for priming that will achieve the correct fuel/air mixture. As the air becomes colder and denser, the amount of prime used must be increased, but the number of strokes to be used should be planned as a result of some trial and error experimentation for each aircraft a pilot flies. There is a tendency to over prime that results in washed-down cylinder walls and a possible scouring of the walls. This also results in poor compression and, consequently, harder starting. The fuel part of the fuel/air mixture may be the part we have the most control over during the engine start, but keep in mind that the amount of throttle opening does have an effect on the air that is pumped through the engine. Just as we compensate for cold/dense air by adding more fuel for start, it may also be appropriate to reduce the air part of the mixture when the temperature is very cold. For example, if the throttle is normally set open one half inch for warm weather starting, it may be helpful to reduce this to one-quarter inch in cold weather. Again, it will require some experimentation to determine what is needed to achieve the correct fuel/air mixture for any particular aircraft at any temperature range. The pilot's operating handbook (POH) will specify the steps in starting a specific model engine. However, some of the POHs may not explain why certain procedures are used in the starting process. Priming can best be accomplished with an engine priming system, as opposed to use of the throttle. Excessive throttle priming can cause flooding of the carburetor and air box, resulting in a fire in the induction system or on the outside where the fuel drains overboard. This would give you the opportunity to practice emergency egress.

When an engine does not start easily, it can be frustrating. Of course this can occur at any time of the year and it is very tempting to just keep grinding away with the starter in an attempt to get it going. Should this happen to you, **RELAX, TAKE A DEEP BREATH**. Perhaps seek help from another member if available and/or from Aero Services if during workday. Take care of that starter or it may fail. The general rule for starters is that they should only be operated for short periods, and then allowed to cool. If engine start has not occurred after three, 10-second periods of operation with a pause between each, a five-minute cooling off period is required. Without this time limit for operation and an adequate cooling off period, the starter will overheat and is likely to be damaged or to fail completely. What a bummer and expense.

Engine Operation - Ok we now have the engine running. Check for an indication of oil pressure. Learn the characteristics relative to response of oil pressure indications of the aircraft/engine combination. On T-Craft aircraft an almost immediate response should be noted. Avoid rapid acceleration after any cold start-up and make every effort to maintain a constant speed of about 1000 RPM during initial warm-up period for several minutes. Do not idle engine below 1000 RPM. It's not good practice to idle engines below 1000 RPM at any time to prevent lead fouling of spark plugs. Oil temperature indications should register on the aircraft gauge

before takeoff is attempted so that problems associated with unusually high oil pressure will be minimized. Although carburetor ice is not necessarily a wintertime phenomena, a check of carburetor heat should be made during the engine run-up. Extend your warm-up period in cold weather. The engine is usually warm enough for pre-flight ground check in above freezing temperatures after 2 to 3 minutes running at 1000 RPM. Below freezing temperatures, the warm-up period should be longer. Let the engine temp get into the green before running her up.

In Flight - Prior to take off be sure that all temperatures are up and in normal operating ranges, and thereby prevent a temporary power loss during a critical part of the takeoff. Cold or heavy oil can and quite often does affect normal operation of the hydraulic lifters. Aviation lubricants require a little more time in warm-up to obtain normal flow in order to function properly throughout the air-cooled aircraft engine. We use multiviscosity oil in our birds, which is ok during cold weather.

During flight in very low temperatures, exercise constant speed props about every 30 minutes to help prevent congealing of oil in the prop dome.

Keeping the oil temperature above the minimum recommended temperature is a factor in engine longevity. Low operating temperatures do not vaporize the moisture that collects in the oil as the engine breathes damp air for normal combustion.

Power-off let downs should be avoided. This is especially applicable to cold weather operations when shock cooling of the cylinder heads is likely. It is recommended that cylinder head temperature change not exceed 50 degrees F., per minute. Plan ahead, reduce power gradually and maintain some power throughout the descent. Also keep the fuel/air mixture leaned out during the descent. We want to insure the greatest possible engine heat for the power setting selected.

Exposure to snow, frost and cold weather while flying requires the consideration of many factors, both airframe and engine related. While there are other issues, this discussion has mainly dealt with issues relating to the engine. Safer flying and longer engine life could result from your careful consideration of the material addressed.

Enjoy your winter flying. It is a great time of the year to fly. Make sure you have added warm clothing to your survival kit.

Thank you for taking your time to read all this.

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