Winter Flying Tips (P-8740-24)

Introduction

Winter flying in most parts of the United States can adversely affect flight operations. Poor weather conditions with fast moving fronts, strong and gusty winds, blowing and drifting snow, and icing conditions are just part of the conditions that require careful planning in order to minimize their effects. Operation in this environment requires special winter operating procedures.

These pages are designed to refresh the pilot's memory in cold weather operations. Pilots should assure themselves that they have obtained adequate cold weather knowledge appropriate to the aircraft used and the geographical and weather environment. Winter flying is not particularly hazardous if the pilot will use a little extra caution and exercise good judgment in analyzing weather situations.

The material presented here has been taken from many discussions of winter flying techniques with highly qualified pilots in various parts of the United States. The experience gained in accident investigations has also been included in this guide.

This guide contains ideas and possible courses of action for the pilots to keep in mind while operating aircraft during winter months. It is produced in connection with the Federal Aviation Administration, General Aviation Accident Prevention Program, as a reference for pilots desiring information on winter flying.

About Winter Flying

Most pilots are familiar with winter conditions in their particular area; however, often a distance of a few miles may change the environment enough to present new problems to an inexperienced pilot. There are certain precautions that are significant to winter flying. Flight planning during winter months will require special knowledge in order to protect the aircraft as well as the pilot. Extra precautions should be used. Often roads that are well traveled during the summer months will be abandoned in the winter. To be forced down far from civilization may create a serious problem of survival. With today's extensive highway system, following a highway would not extend most flights in small aircraft by more than a few minutes. Even the vehicles on the road can give valuable information. You may see cars and trucks coming toward you with fresh snow adhering to the front of the vehicles. In most cases, you may as well start making a 180-degree turn due to reduced visibility ahead.

File a flight plan. A flight plan, in conjunction with an ELT, and a little knowledge on winter survival may save your life. Experience has shown that the advice of operators who are located in the area where the operation is contemplated is invaluable, since they are in a position to judge requirements and limitations for operation in their particular area.

When flying to a business appointment, always give yourself an out by informing your contact that you intend to fly and will arrive at a certain time, unless the weather conditions are unfavorable. ***You, the pilot, have complete responsibility for the GO or NO GO decision based on the best information available.*** Do not let compulsion take the place of good judgment.

Aircraft Preparation

If your home base is located in a warm climate area, you may not have familiarized yourself with the aircraft manufacturer's recommendations for winterizing your aircraft. Most mechanical equipment, including aircraft and their components, are designed by manufacturers to operate within certain temperature extremes. Manufacturers generally can predict their product's performance in temperature extremes and outline precautions to be taken to prevent premature failures.

Baffling and Winter Covers

Baffles are recommended by some manufacturers to be used in augmented tubes. Winter fronts and oil cooler covers are also added to some engine installations. FAA approval is required for installation of these unless the aircraft manufacturer has provided the approval. When baffles are installed on aircraft, a cylinder head temperature gauge is recommended, particularly if wide temperature differences are to be encountered.

Engine Oil

The oil is extremely important in low temperatures. Check your aircraft manual for proper weight oil to be used in low temperature ranges.

Oil Breather

The crankcase breather deserves special consideration in cold weather preparation. A number of engine failures have resulted from a frozen crankcase breather line which caused pressure to build up, sometimes blowing the oil filler cap off or rupturing a case seal, which caused the loss of the oil supply. The water, which causes the breather line freezing, is a natural byproduct of heating and cooling of engine parts. When the crankcase vapor cools, it condenses in the breather line subsequently freezing it closed. Special care is recommended during the preflight to assure that the breather system is free of ice. If a modification of the system is necessary, be certain that it is an approved change so as to eliminate a possible fire hazard.

Hoses

An important phase of cold weather preparation is inspection of all hose lines, flexible tubing, and seals for deterioration. After replacing all doubtful components, be certain that all clamps and fittings are properly torqued to the manufacturer's specifications for cold weather.

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Cabin Heat

Many aircraft are equipped with cabin heater shrouds, which enclose the muffler or portions of the exhaust system. It is imperative that a thorough inspection of the heater system be made to eliminate the possibility of carbon monoxide entering the cockpit or cabin area. Each year accident investigations have revealed that carbon monoxide has been a probable cause in accidents that have occurred in cold weather operations.

Control Cables

Because of contraction and expansion caused by temperature changes, control cables should be properly adjusted to compensate for the temperature changes encountered.

Propellers

Propeller control difficulties can be encountered due to congealed oil. The installation of a recirculating oil system for the propeller and feathering system has proved helpful in the extremely cold climates. Caution should be taken when intentionally feathering propellers for training purposes to assure that the propeller is unfeathered before the oil in the system becomes congealed.

Batteries

Wet cell batteries require some special consideration during cold weather. It is recommended that they be kept fully charged or removed from the aircraft when parked outside to prevent loss of power caused by cold temperatures and the possibility of freezing.

Wheel Wells and Wheel Pants

During thawing conditions, mud and slush can be thrown into wheel wells during taxiing and takeoff. If frozen during flight, this mud and slush could create landing gear problems. The practice of recycling the gear after a takeoff in this condition should be used as an emergency procedure only. The safest method is to avoid these conditions with retractable gear aircraft. It is recommended that wheel pants installed on fixed gear aircraft be removed to prevent the possibility of frozen substances locking the wheels or brakes.

Operation of Aircraft

A thorough preflight inspection is important in temperature extremes. It is natural to hurry over the preflight of the aircraft and equipment, particularly when the aircraft is outside in the cold. However, this is the time you should do your *best* preflight inspection.

Fuel Contamination

Fuel contamination is always a possibility in cold climates. Modern fuel pumping facilities are generally equipped with good filtration equipment, and the oil companies attempt to deliver pure fuel to your aircraft. However, even with the best of fuel and precautions, if your aircraft has been warm and then is parked with half empty tanks in the cold, the possibility of condensation of water in the tanks exists.

Fueling Facilities

Another hazard in cold climates is the danger of fueling from makeshift fueling facilities. Fuel drums or "case gas," even if refinery sealed, can contain rust and somehow contaminants can find their way into the fuel. Cases are on record of fuel being delivered from unidentified containers which was not aviation fuel. As a precaution, we suggest:

Where possible, fuel from modern fueling facilities; fill your tanks as soon as possible after landing, and drain fuel sumps to remove any water which may have been introduced.
Be sure the fuel being delivered is, in fact, aviation fuel and is the correct grade (octane) for your engine.
If you are not using modern fueling facilities, be sure to filter the fuel as it goes into your tanks. *NOTE: A funnel with a dirty worn out chamois skin is not a filter, nor will a new, clean chamois filter out water after the chamois is saturated with water. Many filters are available which are more effective than the old chamois. Most imitation chamois will not filter water.*
Special precautions and filtering are necessary with kerosene and other turbine fuels. Manufacturers can supply full details on handling these fuels.

Fuel Filters and Sumps

Fuel filters and sumps (including each tank sump) should be equipped with quick drains. Sufficient fuel should be drawn off into a transparent container to see if the fuel is free of contaminants. Experienced operators place the aircraft in level flight position, and the fuel is allowed to settle before sumps and filters are drained. All fuel sumps on the aircraft are drained including individual tank sumps. Extra care should be taken during changes in temperature, particularly when it nears the freezing level. Ice may be in the tanks which may turn to water when the temperature rises, and may filter down into the carburetor causing engine failure. During freeze-up in the fall, water can freeze in lines and filters causing stoppage. If fuel does not drain freely from sumps, this would indicate a line or sump is obstructed by sediment or ice. There are approved anti-ice additives that may be used. Where aircraft fuel tanks do not have quick drains installed, it is advisable to drain a substantial amount (1 quart or more) of fuel from the gascolator; then change the selector valve and allow the fuel to drain from the other tank. Advisory Circular (AC) 2O-43C, *Aircraft Fuel Control,* *(http://www.airweb.faa.gov/Regulatory_and. . .89790036862569C3004BA88B?OpenDocument)* contains excellent information on fuel contamination. Paragraphs 10 and 11 are especially pertinent to many light aircraft and include a recommendation for periodic flushing of the carburetor bowl.

Aircraft Preheat

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Low temperatures can change the viscosity of engine oil, batteries can lose a high percentage of their effectiveness, instruments can stick, and warning lights, when "pushed to test," can stick in the pushed position. Because of the above, preheat of engines as well as cockpit before starting is considered advisable in low temperatures. *Use extreme caution in the preheat process to avoid fire. The following precautions are recommended:*

Preheat the aircraft by storing in a heated hangar, if possible.
Use only heaters that are in good condition and do not fuel the heater while it is running.
During the heating process, do not leave the aircraft unattended. Keep a fire extinguisher handy for the attendant.
Do not place heat ducting so it will blow hot air directly on parts of the aircraft; such as, upholstery, canvas engine covers, flexible fuel, oil and hydraulic lines or other items that may cause fires.
Be sure to follow the manufacturer's procedures.

Engine Starts

In moderately cold weather, engines are sometimes started without preheat. Particular care is recommended during this type of start. Oil is partially congealed and turning the engines is difficult for the starter or by hand.
There is a tendency to overprime, which results in washed-down cylinder walls and possible scouring of the walls. This also results in poor compression and, consequently, harder starting. Sometimes aircraft fires have been started by overprime, when the engine fires and the exhaust system contains raw fuel. Other fires are caused by backfires through the carburetor. It is good practice to have a fireguard handy during these starts.
Another cold start problem that plagues an unpreheated engine is icing over the spark plug electrodes. This happens when an engine only fires a few revolutions and then quits. There has been sufficient combustion to cause some water in the cylinders but insufficient combustion to heat them up. This little bit of water condenses on the spark plug electrodes, freezes to ice, and shorts them out. The only remedy is heat. When no large heat source is available, the plugs are removed from the engine and heated to the point where no more moisture is present.
Engines can quit during prolonged idling because sufficient heat is not produced to keep the plugs from fouling out. Engines which quit under these circumstances are frequently found to have iced-over plugs.
After the engine starts, use of carburetor heat may assist in fuel vaporization until the engine obtains sufficient heat.

Radios

Radios should not be tuned prior to starting. Radios should be turned on after the aircraft electrical power is stabilized, be allowed to warm up for a few minutes, and then be tuned to the desired frequency.

Ice, Snow, and Frost

A common winter accident is trying to take off with frost on the wing surface. It is recommended that all frost, snow, and ice be removed before attempting flight. It is best to place the aircraft in a heated hangar. If so, make sure the water does not run into the control surface hinges or crevices and freeze when the aircraft is taken outside. Don't count on the snow blowing off on the takeoff roll. There is often frost adhering to the wing surface below the snow. Alcohol or one of the ice removal compounds can be used. Caution should be used if an aircraft is taken from a heated hangar and allowed to sit outside for an extended length of time when it is snowing. The falling snow may melt on contact with the aircraft surfaces and then refreeze. It may look like freshly fallen snow but it usually will not blow away when the aircraft takes off.
If an aircraft is parked in an area of blowing snow, special attention should be given to openings in the aircraft where snow can enter, freeze solid, and obstruct operation. These openings should be free of snow and ice before flight. Some of these areas are as follows:

Pitot tubes
Heater intakes
Carburetor intakes
Anti-torque and elevator controls
Main wheel and tail wheel wells, where snow can freeze around elevator and rudder controls.

Fuel Vents

Fuel tank vents should be checked before each flight. A vent plugged by ice or snow can cause engine stoppage, collapse of the tank, and possibly very expensive damage.

Taxi

Braking action on ice or snow is generally poor. Short turns and quick stops should be avoided. Do not taxi through small snowdrifts or snow banks along the edge of the runway. Often there is solid ice under the snow. If you are operating on skis, avoid sharp turns, as this puts torque on the landing gear in excess of that for which it was designed. Also for ski operation, make sure safety cables and shock cords on the front of the skis are carefully inspected. If these cables or shock cords should break on takeoff, the nose of the ski can fall down to a near vertical position which seriously affects the aerodynamics efficiency of the aircraft and creates a landing hazard. If it is necessary to taxi downwind with either wheels or skis and the wind is strong, get help or don't go. Remember, when you are operating on skis, you have no brakes and no traction in a crosswind. On a hard-packed or icy surface, the aircraft will slide sideways in a crosswind and directional control is minimal particularly during taxiing and landing roll when the control surfaces are ineffective.

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Takeoff

Takeoffs in cold weather offer some distinct advantages, but they also offer some special problems. A few points to remember are as follows:

Do not overboost supercharged engines. This is easy to do because at very low density altitude, the engine "thinks" it is operating as much as 8,000 feet below sea level in certain situations. Care should be exercised in operating normally aspirated engines. Power output increases at about 1% for each ten degrees of temperature below that of standard air. At -40 degree F, an engine will develop 10 percent more than rated power even though RPM and MP limits are not exceeded.
If the temperature rises, do not expect the same performance from your aircraft as when it was operated at the lower density altitudes of cold weather.
Use carburetor heat as required. In some cases, it is necessary to use heat to vaporize the fuel. Gasoline does not vaporize readily at very cold temperatures. Do not use carburetor heat in such a manner that it raises the mixture temperature barely to freezing or just a little below. In such cases, it may be inducing carburetor icing. An accurate mixture temperature gauge is a good investment for cold weather operation. It may be best to use carburetor heat on takeoff in very cold weather in extreme cases.

If your aircraft is equipped with a heated pitot tube, turn it on prior to takeoff. It is wise to anticipate the loss of an airspeed indicator or most any other instrument during a cold weather takeoff -- especially if the cabin section has not been preheated.
During climbout, keep a close watch on head temperature gauges. Due to restrictions (baffles) to cooling air flow installed for cold weather operation and the possibility of extreme temperature inversions, it is possible to overheat the engine at normal climb speeds. If the head temperature nears the critical stage, increase the airspeed or open the cowl flaps or both.

En Route

Weather

Weather conditions vary considerably in cold climates. In the more remote sections of the world weather reporting stations are generally few and far between and reliance must be placed on pilot reports. However, don't be lured into adverse weather by a good pilot report. Winter weather is often very changeable; one pilot may give a good report and five or ten minutes later VFR may not be possible.
Remember, mountain flying and bad weather don't mix. Set personal limits and stick to them.
Snow showers are, of course, quite prevalent in colder climates. When penetration is made of a snow shower, the pilot may suddenly find himself without visibility and in IFR conditions. Snow showers will often start with light snow and build.
Another hazard which has claimed as its victims some very competent pilots is the "whiteout." This condition is one where within the pilot's visibility range there are no contrasting ground features. Obviously the smaller the visibility range the more chance there is of a whiteout; however, whiteout can occur in good visibility conditions. A whiteout condition calls for an immediate shift to instrument flight. The pilot should be prepared for this both from the standpoint of training and aircraft equipment.

Carburetor Ice

Three categories of carburetor ice are:

Impact ice - Formed by impact of moist air at temperatures between 15 and 32 degrees F on airscoops, throttle plates, heat valves, etc. Usually forms when visible moisture such as rain, snow, sleet, or clouds are present. Most rapid accumulation can be anticipated at 25 degrees F.
Fuel ice - Forms at and downstream of the point where fuel is introduced, and occurs when the moisture content of the air freezes as a result of the cooling caused by vaporization. It generally occurs between 40 and 80 degrees F, but may occur at even higher temperatures. It can occur whenever the relative humidity is more than 50 percent.
Throttle ice - Forms at or near a partly closed throttle valve. The water vapor in the induction air condenses and freezes due to the venturi effect cooling as the air passes the throttle valve. Since the temperature drop is usually around 5 degrees F, the best temperatures for forming throttle ice would be 32 to 37 degrees F although a combination of fuel and throttle ice could occur at higher ambient temperatures.

In general, carburetor ice will form in temperatures between 32 and 50 degrees F when the relative humidity is 50 percent or more. If visible moisture is present, it will form at temperatures between 15 and 32 degrees F. A carburetor air temperature (CAT) gauge is extremely helpful to keep the temperatures within the carburetor in the proper range. Partial carburetor heat is not recommended if a CAT gauge is not installed. Partial throttle (cruise or letdown) is the most critical time for carburetor ice. The recommended practice is to apply carburetor heat before reducing power and to use partial power during letdown to prevent icing and overcooling the engine.
To prevent carb ice:

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Use carb heat ground check
Use heat in the icing range
Use heat on approach and descent

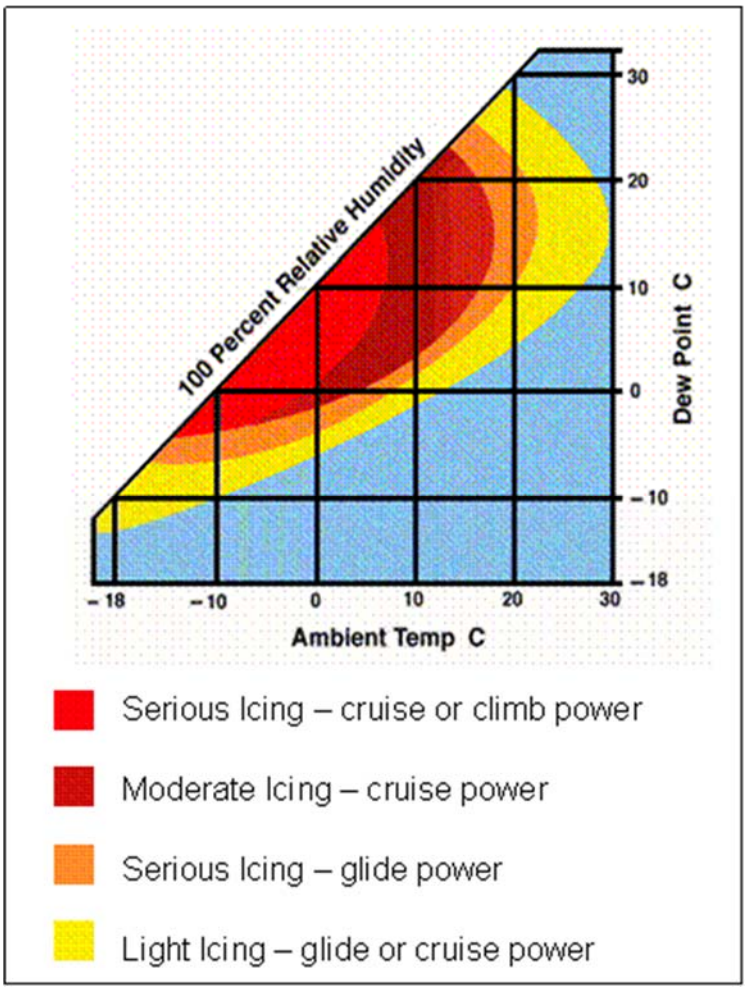
Warning signs of carb ice include:

Loss of rpm (fixed pitch)
Drop in manifold pressure (constant speed); rough running

Pilot response to warning signs should be:

Apply full carb heat immediately (may run rough initially for short time while ice melts)

In the chart below, the curves encompass conditions known to be favorable for carburetor icing. The severity of this problem varies with different types, but these curves are a guide for the typical light aircraft. Light icing over a prolonged period may become serious. When you receive a weather briefing, note the temperature and dewpoint and consult this chart.



Carbon Monoxide Poisoning

Don't count on symptoms of carbon monoxide to warn you: It's colorless, odorless, and tasteless, although it is usually found with exhaust gases and fumes. If you smell fumes or feel any of the following symptoms, you should assume that carbon monoxide is present.
Initial symptoms include feelings of sluggishness, warmth, and tightness across forehead, followed by headache, throbbing, pressure at the temples and ringing in the ears. Severe headache, nausea, dizziness, and dimming of vision may follow. If any of the above conditions exist, take the following precautions:

Shut off the cabin heater or any other opening to the engine compartment.
Open a fresh air source immediately.
Don't smoke.

Use 100 percent oxygen if available.
Land as soon as possible.
Be sure the source of the contamination is corrected before further flight.

Spatial disorientation can also be expected any time the pilot continues VFR flight into adverse weather conditions. Flying low over an open body of water during low visibility and a ragged ceiling is another ideal situation for disorientation.

Letdown

Engine Operation

During letdown, there may be a problem of keeping the engine warm enough for high power operation, if needed. It may be desirable to use more power than normal, which may require extension of landing gear or flaps to keep the airspeed within limits. Carburetor heat may also be necessary to help vaporize fuel and enrich the mixture.

Blowing Snow and Ice Fog

Blowing snow can be a hazard on landing, and a close check should be maintained throughout the flight as to the weather at destination. If the weather pattern indicates rising winds, then blowing snow may be expected which may necessitate an alternate course of action.

Ice fog is a condition opposite to blowing snow and can be expected in calm conditions about -30 degrees F and below. It is found close to populated areas, since a necessary element in its formation is hydrocarbon nuclei such as found in automobile exhaust gas or the gas from smokestacks.

Both of the conditions described above can form very rapidly and are only a few feet thick (usually no more than 50 feet) and may be associated with clear en route weather. Pilots should always make a careful check of the current and forecast weather, as well as make a preflight plan for alternate courses of action.

Landing

A landing surface can be very treacherous in cold weather operations. In addition, caution is advised regarding other hazards such as snow banks on the sides of the runways and poorly marked runways. Advance information about the current conditions of the runway surface should be obtained. If it is not readily available, take the time to circle the field before landing to look for drifts or other obstacles. Be aware that tracks in the snow on a runway do not ensure safe landing conditions. Often snowmobiles will use runway areas and give a pilot the illusion that aircraft have used the airport and the snow is not deep.

Ski wheel combinations are popular and very convenient; however, forgetting to use the landing gear appropriate to the runway surface can be embarrassing.

In level flight, due to their relatively "dirty" profile, skis will cut cruising speed to some extent. In addition to some loss of aerodynamic efficiency, skis have other disadvantages. They require more care in operating because bare spots must be avoided to keep from wearing the bottom coating of the skis, although the bottom coating must be renewed on some skis periodically. There is now an anti-friction tape that is very useful for this purpose. Skis equipped with the anti-friction coating do not freeze to the surface like those that expose bare metal to the snow. Another method of keeping skis from freezing to the snow is to taxi the aircraft up onto poles placed across and under the skis. This prevents them from touching the snow for most of their length.

Extra care in use of skis during takeoff and landing is also recommended. Rutted snow and ice can cause loss of ground control, even failure of skis or landing gear parts. Deep powder snow can adversely affect ski operation. Prolonged takeoff runs in deep powder are expected and it may be deep enough that no takeoff is possible under existing conditions. In this case, experienced operators pack a takeoff path with snowshoes, or taxi back and forth until an adequately packed runway is available.

Post-Flight

The following are items to consider before leaving the aircraft after the flight:

As soon as possible fill the tanks with the proper grade of c-lean aviation fuel, even if the aircraft is going into a heated hangar.
If the aircraft is to be left outside, put on engine covers and pitot covers.
If the weather forecast is for snow or clear and colder, put on rotor, or wing covers and save yourself from a snow or frost removal job in the morning.
Control locks or tied controls are suggested if the aircraft is left outside, and there is a chance of high wind conditions. Tiedowns are also suggested in high winds.

If the aircraft is equipped with an oil dilution system, consider the advisability of dilution of the engine oil. If it is decided to dilute, manufacturer's recommendations should be carefully followed commensurate with the temperature expected.
During engine shutdown, a good practice is to turn off the fuel and run the carburetor dry. This diminishes the hazard of a fire during preheat the next morning.

Survival

After a crash landing, it is best to leave the aircraft as soon as possible. Take time to analyze the situation and help others. Take care of any injuries first. Stay away from the aircraft until all gasoline fumes are gone. Sit down and think. Keep in mind that survival is 80 percent mental, 10 percent equipment, and 10 percent skills. Since mental factors are the number one problem, establish a goal to conquer regardless of the consequences. Don't have "give-up-itis" or a "do-nothing attitude." Don't run off without taking time to think out each problem. Don't imagine things that are not there. There are basic fears in each of us. They are:

Fear of the unknown
Fear of darkness
Fear of discomfort
Fear of being alone
Fear of animals
Fear of death
Fear of punishment
Fear of personal guilt

Points to remember:

Your MIND is the best tool for survival. USE IT!
The number one enemy is yourself.
The number two enemy is injuries.
The number three enemy is temperature.
The number four enemy is disease.

Whether to stay with the aircraft or start out on foot may be a major decision. Did you file a flight plan? If you did, it may be best to let them find you. Is your emergency locator transmitter operating? Do you have a survival kit? Don't fight a storm. Stay put and find shelter. Most storms are of short duration. What do you have in the aircraft that can be used to aid in survival? Other tips:

The compass will keep you going in one direction.
Gasoline will help make a fire.
Oil can be used for smoke signals.
Seat upholstery may be used to wrap around feet or hands.
Wiring may be used for tie strings.
The battery may be used to ignite fuel.
Use whatever is available to protect the body from the loss of heat; don't waste body heat by eating snow.
Make a fire and heat water before drinking.
You can conserve energy to last three weeks if you have water and stay dry -- body heat can escape 240 times faster from wet clothing than from dry clothing.
It is best to eat small amounts of sugary foods to replace the energy lost through body heat.

A good survival kit is well worth its weight. The following would be a useful kit; however, you can assemble an inexpensive survival kit of your own.
First you need a metal container with a lid. This container can be used to heat water, make tea, use as a digging tool or polished as a signal mirror. In addition, you need:

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Boy Scout knife.
Small candle.
Box of matches (wrapped in plastic).
Leaf bag (pull over head, cut hole for face).
Garbage bag (step in, pull up and tuck in pants or tie around waist). You now have body protection from heat loss.
Sugar cubes (wrap in plastic, 6 to 12 cubes).
Plastic tape. The list above is only a sample of what can be done. Use your own innovation and remember that survival depends upon you.