C-172R Cold Weather Operations

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Introduction

This supplement references FAA Advisory Circular (AC) 91-13C Cold Weather Operation of Aircraft, AC 20-113 (prevention of icing in fuel and induction systems in reciprocating-engine aircraft), aircraft manufacturer recommendations, and Operating Instructions for the Red Dragon Engine Pre-heater. The supplement provides guidance to management, flight crews, Dispatch, and Maintenance personnel for operations conducted during cold weather to include aircraft preparation, starting, ground operations, flight, and flight crew survival. CWO applies to all operations conducted in Bridgewater State College aircraft, and includes:

- Guidance for initial and recurrent ground training and testing of all flight crewmembers, Dispatcher, and other personnel (as appropriate) determined by the Chief Flight Instructor.
- CWO procedures and responsibilities, pre-takeoff check procedures, operational use of de-icing/heating equipment, and pre-takeoff contamination check procedures.
- Specific procedures for each type of aircraft flown by Bridgewater State College.

CAUTION

Adherence to all policies and procedures noted in this supplement is mandatory.
BSC flight crews and affected personnel shall review applicable items and ensure compliance.

Initial and Recurrent Training

Initial and recurrent training for the Bridgewater State College CWO program is required for all affected personnel [flight crews, maintenance personnel, fuelers, dispatchers, Bridgewater State College employees and Bridgewater State College contract personnel (if applicable)] and includes the duties, responsibilities, procedures and practices associated with all equipment used in the program. Both initial and then recurrent training (if applicable) is required prior to conduct of any de-icing procedures or use of de-icing equipment.

Initial training:

- Duties and Responsibilities
- Equipment procedures
- Aircraft-specific requirements

Personnel conducting de-icing procedures will receive instruction including demonstration and performance training:

- Definitions
- Equipment familiarization / operation
- Aircraft de-icing and pre-heating procedures
- Aircraft checks and communication

Recurrent training occurs not less than annually and includes a review of the segments presented during initial training, and any employee-specific changes to the CWO program occurring since the initial or previous training period.

Aircraft, Personnel, and Equipment

Aircraft de-icing / cold weather procedures are designed to clean the aircraft of exterior contaminants that could affect flight, and "warm up" the aircraft for flight. The PIC is responsible for ensuring this occurs via de-icing by heating and other appropriate means. De-icing fluids are not yet approved for use with Bridgewater State College aircraft and therefore may not be used. Ground personnel (Fuelers/MX) and/or other flight crewmembers can assist the PIC by advising of any observation of contamination on any aircraft surface.

The section of the supplement regarding survival is intended to serve as a guide, and not as a replacement for proper pre-flight planning. Flight crews are expected to plan accordingly for cold weather flying and should always consider the possibility of an off-airport landing. The New England region can be especially inhospitable during winter months, and flight crews should prepare for the need to execute survival measures if necessary.

Abbreviations and Definitions

"BSC" means Bridgewater State College.

"C" or "F" means temperature in degrees Centigrade or Fahrenheit, respectively.

"CWO" means cold weather operations.

Cold Soaked Fuel Frost (CSFF): Ice or frost that forms on the wing surface when cold fuel in full or nearly full fuel tanks causes the temperature of the aircraft wing surface to be at or below 0^{o}C (32^{o}F) in conditions of high humidity, light rain, drizzle, fog, etc. CSFF can occur in temperatures well above freezing.

Critical Aircraft Surface(s): Aircraft surface(s) that must be clear of contaminants before take-off: Propeller, windscreen, wings, vertical and horizontal flight controls and trim tabs, flaps, wheel & brake assemblies.

De-Icing: Removal of frost, ice or snow from the aircraft using mechanical devices (e.g. brooms) and/or by heating the aircraft.

Freezing Precipitation: Snow/sleet/frzg rain/drizzle or hail that could adhere to A/C surfaces.

Frost: A crystallized deposit, formed from water vapor on surfaces at or below 0^{o}C (32^{o}F). Frost is likely if the dew point is within 3^{o}C (5^{o}F) of OAT.

Fuel Ice: Occurs when suspended water freezes in cold fuel, or when water vapor is present in solution and freezes as fuel passes through a venture. Fuel-injected systems deposit fuel directly to cylinder chambers, and the fuel distribution point often sits atop a warm engine block, which reduces the risk of fuel ice in these systems.

Ice Pellets / Snow Pellets / Snow Grains: Frozen water droplets that may have sufficient mass to accumulate on aircraft surfaces.

Impact Ice: As the moisture-laden air strikes and freezes on elements of the induction system which are at temperatures of 32" F. or below, ice may build up air scoops, heat or alternate air valves, intake screens, and any protrusions in a carburetor. Use caution during flight in snow, sleet, rain, or clouds, especially if ice begins forming on windscreens or wing leading edges. The FAA recommends preventive use of alternate air rather than as a de-icer.

Induction Icing: May be characterized as impact ice, throttle ice, or fuel (vaporization) ice. A single type or any combination of the three can lead to significant power loss resulting from improper fuel/air ratio. Most important is that induction icing is preventable by the pilot.

"OAT" means Outside Air Temperature

Post De-Icing Check: Inspection performed immediately after de-icing operations to ensure that all contaminants have been removed from the aircraft. All BSC flight crews shall conduct this check as a physical hands-on inspection.

Pre-Takeoff Check: Check of the aircraft wings or representative aircraft surfaces for frost/ice/snow conducted after de-icing and prior to takeoff.

Pre-Takeoff Contamination Check: Check of aircraft wings, control surfaces/other critical surfaces to verify clear of frost, ice and snow: Conducted not more than 5 minutes before takeoff.

Red Dragon: An electrically powered propane heating blower unit used to pre-heat the engine and engine compartment and de-ice critical aircraft surfaces prior to cold weather flight.

Representative Aircraft Surfaces – Aircraft surfaces that flight crewmembers can readily observe during day and night operations to determine whether or ice/snow is adhering to that and likely to other aircraft surfaces.

Slush – Partially melted snow/ice that can be splashed on the fuselage or landing gear by aircraft wheels during taxi, takeoff, and/or landing.

"SLD" means super-cooled water droplets that form ice deposits on contact with objects (e.g. aircraft surfaces).

Throttle Ice: Typically formed at or near a partially closed throttle (e.g. cruise power setting). Water vapor in the air condenses and freezes as a result of the cooling that occurs downstream from a partially opened throttle valve (butterfly valve).

Cold Temperature Error Table

Table 7-2-3 below, derived from the FAR/AIM and ICAO formulas, indicates how much altimeter error can exist when flying in extremely cold temperatures. BSC flight crews are frequently operating under these conditions during day and night VFR and IFR flights. To use the table, find the reported temperature in the left column, then read across the top row to locate the height above the airport/reporting station (i.e., subtract the airport/ reporting elevation from the intended flight altitude). The intersection of the column and row is how many feet *lower* than indicated the aircraft may actually be as a result of the possible cold temperature induced error.

The possible result of the above example is obvious, especially if the aircraft is operating at a minimum altitude and/or when conducting an instrument approach. When operating in extreme cold temperatures, pilots should strongly consider compensating for the reduction in terrain clearance by adding a cold temperature correction.

ICAO Cold Temperature Error Table

Reported Temp °C	Height Above Airport in Feet													
	200	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1000**	**1500**	**2000**	**3000**	**4000**	**5000**
+10	10	10	10	10	20	20	20	20	20	30	40	60	80	90
0	20	20	30	30	40	40	50	50	60	90	120	170	230	280
-10	20	30	40	50	60	70	80	90	100	150	200	290	390	490
-20	30	50	60	70	90	100	120	130	140	210	280	420	570	710
-30	40	60	80	100	120	140	150	170	190	280	380	570	760	950
-40	50	80	100	120	150	170	190	220	240	360	480	720	970	1210
-50	60	90	120	150	180	210	240	270	300	450	590	890	1190	1500

WARNING

BSC aircraft are PROHIBITED from taking off with any frost or contaminants still adhering to the wings, flight controls, or other critical aircraft surfaces.

Duties and Responsibilities

The following section lists individual personnel functions in the CWO program.

Chief Flight Instructor

- Overall responsibility for CWO program.
- Develops and manages the CWO program, including proper training of all personnel with duties and responsibilities related to CWO.
- Ensures proper execution of the CWO program by all participating personnel.
- Advises the Associate Dean, School of Business of necessary CWO program changes.

Dispatcher

- Monitors weather conditions at airports affecting Bridgewater State College flight training operations.
- Initiates aircraft preparation procedures in anticipation of inclement weather by alerting the evening and morning flight crews, arranging for hangar space (when available) for aircraft to be used for the following morning's first flight, and arranges for early arrival of personnel to assist with morning aircraft preparation.
- Coordinates refuel of Red Dragon propane tank and battery recharge with Sandpiper Air, Inc.
- Maintains knowledge and proficiency with CWO program to ensure safe and effective flights.

Bridgewater State College Flight Crews

- Regardless of landing location or flight type (dual/solo), the Pilot-In-Command is retains responsibility for ensuring that the aircraft is de-iced / pre-heated (if necessary) and is safe for flight.

Flight Instructor

- Maintains knowledge and proficiency with the CWO program to ensure and conduct safe and effective training flights.

Pilot-In-Command

- Determines if the aircraft is safe for flight.
- Arrives within enough time to determine and then execute pre-heating and de-icing procedures before scheduled departure.
- Requests aircraft de-icing as conditions require.
- Demonstrates knowledge and proficiency with engine pre-heating / aircraft de-icing procedures and practices.

- Demonstrates knowledge of aircraft critical areas and required precautions for avoiding aircraft damage to components and surfaces.
- Performs a proper pre-flight inspection.
- Demonstrates knowledge of adverse effects of surface roughness or contamination on aircraft performance and flight characteristics.
- Demonstrates knowledge of the effects and hazards of blowing snow, slush, etc. on critical aircraft components and surfaces.
- Performs a pre-takeoff check before each takeoff when de-icing has been conducted.
- Conveys and ensures compliance with Bridgewater State College approved de-icing procedures when in a location without approved qualified operating personnel.

Cold Weather Pre-Departure Inspections

BSC flight crews shall conduct the following inspections when operating BSC aircraft within the appropriate weather conditions:

Preflight: Normal walk-around preflight inspection conducted by the flight crew, with special attention paid to any aircraft surface contamination. Initiates the required de-icing / pre-heating procedures, if appropriate.

CAUTION

The pre-flight inspection is one of the most critical components of safe cold weather operations. Flight crews must avoid the urge to hurry the inspection due to the cold weather conditions.

Post De-Icing: Performed immediately after de-icing to ensure that all contaminants have been removed from the aircraft. Includes wings, control surfaces, engine inlets, or other critical surfaces. Ensures all critical surfaces are free of frost, ice and snow before engine start.

Pre-Takeoff: Performed by flight crews immediately prior to takeoff, and conducted from inside the cabin. Check wings, struts (if applicable) and tail surfaces for contamination. During night flights, use available wing lighting or flashlights to conduct the check.

WARNING

If in any doubt regarding the condition of the wings or flight control surfaces, the flight crew shall DISCONTINUE THE TAKEOFF and return to the ramp area for inspection and, if necessary, further de-icing.

WARNING

Flight into expected or known icing conditions is PROHIBITED for all BSC aircraft.

Snow Removal, De-Icing and Engine Pre-Heating

BSC flight crews shall adhere to the following de-icing and engine pre-heating procedures.

Snow Removal

Shovels shall only be used to remove snow from the area near landing gear and in front of the aircraft in order to permit taxiing. Approved brooms / brushes may be used to remove large accumulations of snow from the aircraft. The underlying layer of snow/ice will then be removed using heating. This equipment is located in AvOps Room 111.

CAUTION

Bridgewater State College Aviation Operations has purchased specific brooms and brushes to be used ONLY for snow removal from aircraft. This equipment must be free of all debris, and not frozen before use, as any stiff object (frozen broom bristles) can damage aircraft surfaces.

CAUTION

Flight crews are PROHIBITED from using ANY hard or sharp tool to remove ice from the aircraft surfaces, or attempt to "break" ice from the aircraft; This will likely cause damage to the aircraft in the form of dents, scratches, or punctures.

Blowing snow creates a special hazard in that the snow can enter ports, gaps, and openings and freeze. During pre-flight inspection and again after snow removal, BSC flight crews shall focus special attention on the following aircraft areas to ensure contaminants have been removed/have not re-frozen:

- Flight controls including hinges and counter-balances
- Static ports
- Pitot intakes and vents
- Fuel vents
- Stall warning vanes/vents
- Cowl and heater intakes

Aircraft Pre-Heating Procedures
At OAT temperatures at or below below 32^0 F/0^0 C it will likely be necessary to pre-heat the aircraft engine. The following procedures shall be used for engine pre-heating.

WARNING

ONLY properly trained and certified BSC personnel may operate pre-heating equipment. Students are PROHIBITED from using pre-heating equipment.

Night Aircraft Preparation
Prior to Training Center evening closure, and earlier in the afternoon when possible, Dispatch shall select the aircraft to be used for first flight(s) the following day. Dispatch will receive assistance from available flight crews or call for additional assistance as necessary.

- Aircraft selected for hangar space shall be taxied to Sandpiper Air, Inc. for placement in the hangar. The CFI of the next day's flight crew(s) (Solo or Dual) shall be contacted and informed that his/her assigned aircraft is located at the Sandpiper hangar.
- Aircraft not selected for hangar space will be de-iced and pre-heated as necessary using the Red Dragon engine pre-heater. Dispatch shall verify that the Red Dragon battery is fully charged, sufficient propane is available for a minimum three (3) aircraft pre-heat/de-ice cycles (approximately ½ gallon of fuel per 1 hour of heating), and that the unit is secured in Training Center Room 111. Dispatch shall alert Sandpiper, as necessary, of the possible need for assistance in refueling/charging the Red Dragon, or in obtaining additional propane.
- CFI(s) for the non-hangar aircraft (Solo or Dual) shall be contacted and informed of the non-hangar status of his/her assigned aircraft. The CFI is therefore alerted of the need to arrive well in advance of his/her scheduled event departure the following morning.
- Dispatch shall ensure that all snow removal equipment (brooms/shovels, Red Dragon) is clean, free of debris, secured, and ready for use the following morning.

Morning Aircraft Preparation
Any non-hangar aircraft shall be readied for flight as follows:

- CFIs for the first flight shall arrive in time to conduct pre-heating and (if necessary) de-icing prior to scheduled departure. *CFIs should allow not less than 45 minutes prior to lesson start time for full engine pre-heat / aircraft de-icing*, and arrive at the Training Center accordingly. Crews will require the use of a step ladder, broom, and the Red Dragon heating unit.
- All equipment is to be stowed in Room 111 between use(s).
- Dispatch and assigned flight crews shall coordinate efforts to utilize the BSC Red Dragon and request assistance from Sandpiper for an additional Red Dragon unit, if necessary.

Red Dragon Operating Procedures

WARNING

The Red Dragon Engine Pre-heater shall be used in accordance with the published Operating Instructions.

Safety Checks

1. Obtain the Red Dragon from storage Room 111.
2. Check fuel quantity (LP gas cylinder): Approximately ½ gal. is required per hour of heating operation. To determine fuel quantity, estimate approx. weight of cylinder, and subtract tare weight (T.W.) as stamped on cylinder collar from estimated total weight.
3. Divide the result by 4.24 (propane) or 4.81 (butane). The resultant figure is the number of gallons of remaining fuel in the cylinder.
4. Ensure hose is properly connected at heating/blower unit junction. Request assistance if the hose is loose or has come disconnected.
5. Verify battery terminals are free of corrosion, connectors are properly secured, and battery box cap is secured in place.

Red Dragon Start-Up

1. Do not attempt Start-up indoors.
2. Ensure fire extinguisher is charged and on hand during use of Red Dragon.
3. Depress safety valve button. Adjust regulator until a small amount of gas is escaping, then release button. Gas should stop immediately.
4. Depress fan switch to engage fan motor. Ensure fan blower is operating.
5. Depress safety valve button and hold down.
6. Press igniter plunger and repeat gently until ignition occurs, then hold red safety valve button down for 15 seconds. At this time release the button, and the burner should continue to function. If the burner goes out, re-attempt the start again from Step 4.
7. Gently adjust regulator (red knob) to obtain the desired amount of heat.
    a. **For engine pre-heat,** set maximum 10 – 12 psig.
    b. **For wing de-icing,** set maximum 15-20 psig.
8. NEVER exceed 25 psig. operating pressure. **NOTE:** Turning the regulator knob to the right increases the flow.
9. NEVER use the Red Dragon to melt snow/ice from Plexiglas components (i.e. windscreen, windows, etc.)

CAUTION

Avoid prolonged contact of heating hose with synthetic material (e.g. clothing such as jackets, gloves) when operating at higher heat settings, as the Red Dragon will generate sufficient heat to melt such material.

CAUTION

If the fan stops or the unit overheats, immediately shut off the fuel at the fuel cylinder.

CAUTION

At NO time is the Red Dragon to be left unattended while it is running.

Red Dragon Shut-Down

1. Reduce regulator press. so that only a low roar can be heard from the pre-heater (10 – 20 psi).
2. Turn propane tank valve OFF and let the remaining gas burn out of the hose.
3. Turn Regulator pressure down for storage.
4. Replace the Red Dragon unit in Room 111. Keep the heating hose from dragging on the ground to avoid damage and extend service life.
5. Always store fuel cylinders in their proper upright position.

Troubleshooting

For any problems associated with proper operation of the Red Dragon unit, consult the Operating Instructions and Parts Manual pp. 4 -5.

Tips

- To improve heater efficiency and save fuel use the shortest run of ducting and avoid bends as much as possible. The 12' hose reaches the entire upper wing surface of the QMA-11E.
- For engine pre-heating, place the heater hose end into the cowling space on the underside of the fuselage, between the exhaust pipes. Avoid the breather lines that protrude from the cowling, and position the hose directly beneath the engine block. Apply pre-heat for a minimum of 15 min.
- Do NOT place heating hose so that it blows hot air directly on combustible aircraft components (e.g. upholstery, or flexible fuel, oil, and hydraulic lines).
- For wing and control surface de-icing, apply only enough heat to wing and flight control surfaces to gradually and steadily melt any snow/ice contamination. Ensure liquid contaminants do not re-freeze at hinge joints or inside flight control surfaces.

WARNING

During Red Dragon operations, qualified Bridgewater State College personnel shall ensure that a fire extinguisher is in the vicinity at all times.

Starting Aircraft

Pre-heat procedures are required for all Bridgewater State College aircraft when the outside air temperature is below 32° F (0°C). Normal engine starting procedures shall be used until temperatures fall below 20° F (-7°C) with and without pre-heating.

- Aircraft flown within the previous hour do not require pre-heating.
- Starting engines without pre-heat below 32° F (0°C) or beyond the one-hour between-flight interval requires prior authorization from the Chief Flight Instructor or his/her designee.
- All cold-weather starts are to be conducted in the following manner:
    - Master Switch OFF
    - Magnetos OFF
    - Ignition Key OUT of Ignition and visible to crew member outside the aircraft.
    - Parking Brake engaged.
    - Qualified flight crew member at aircraft controls.
    - After pre-heating period, propeller pulled clockwise (as viewed from cockpit) through 2-3 full cycles by qualified flight crew member or Maintenance personnel.
    - Red Dragon shut down and secured, and moved away from propeller area.
    - Attempt engine start using appropriate checklist.

CAUTION

Flight crews shall avoid over-priming the engine, as this washes down cylinder walls, makes engine starts more difficult, and increases the risk of fire during engine start.

Starting Engine Below 20° F (-7°C)

CAUTION

Flight crews shall not attempt more than two (2) engine starts without assistance from Maintenance, the Chief Flight Instructor, or his/her designee.

C-172R (With or Without Pre-Heating)

C/R ENGINE START (With or Without Pre-Heating)

External Lights ..... **AS REQUIRED**
Battery Master ..... **ON**
Fuel Shutoff Valve ..... **ON**
Fuel Selector ..... **BOTH**
Throttle ..... **OPEN ¼ INCH**
Aux. Fuel Pump ..... **ON**
Mixture ..... **RIC?H, Then CUT OFF**
Aux. Fuel Pump ..... **OFF**
Propeller Area ..... **VERIFY L/C/R CLEAR**
Starter ..... **ENGAGE**
Mixture ..... **RICH**
Throttle ..... **SET 800 – 1000 RPM**
Oil Pressure ..... **CHECK**
Mixture ..... **AS REQUIRED**
Engine Start Checklist ..... **COMPLETE**

If engine does not start, repeat the start sequence.

WARNING

Do not attempt flight if voltage output shows outside of IFR requirement.

Standing Water, Ice, Slush and Snow

In the New England flying environment, flight crews are likely to encounter standing water, slush, ice, snow or a combination of these on the runway and/or taxiways at their home or other airport. BSC CFI's must use good judgment and common sense in dealing with this operational concern.

- Note performance reductions expected of the aircraft. Refer to appropriate performance data as necessary. Know what to expect.
- Prior to engine start, ensure that all runway lighting systems are available (e.g. HIRL, REIL).
- Verify that all aircraft covers, pitot covers and tie-downs are removed and properly stowed.
- Tires can freeze to the ramp surface. If the aircraft cannot be moved under normal power, do not apply more power to dislodge the tires. The aircraft may break free, but is likely doing so onto an equally frozen surface where it will then move rapidly forward and endanger other aircraft and personnel.
- Increase taxi spacing/distance behind other aircraft when ramps and taxiways are contaminated, to allow greater time to bring the aircraft to a stop. If taxiing behind turbine aircraft, keep in mind that their exhaust can cause dry snow to melt and freeze on aircraft surfaces, and may cause ice and sand to be blown onto trailing aircraft.
- Verify that flight controls have full freedom of movement prior to takeoff.
- Change altitude immediately if severe ice is encountered.
- Select an altitude above the clouds or at least one that reduces icing exposure. Question returning crews, if available, and/or ATC about any icing encounter or potential for same.
- Radio static may occur in cumulus clouds at OATs between 0°C and -15ºC. A change in airspeed or altitude may help alleviate the problem. Notify ATC of the situation if communications are adversely affected.
- During descent, super cooled clouds at low altitude can increase the potential for icing. The probability of increased exposure time in holding patterns can make matters worse. If assigned a holding pattern in areas where icing is possible, maintain vigilance for icing build-up, and request an immediate deviation from ATC as necessary to exit the icing conditions.
- If landing on an iced runway, touch down firmly at the aiming point, without allowing the aircraft to float. Land at the minimum safe speed. Avoid the temptation to "grease it on."
- On ice-covered ramps the aircraft will likely creep forward even with chocks installed. Avoid heavy use of brakes while taxiing on ice, as they are likely to lock rapidly and render the aircraft un-steerable. Taxi s-l-o-w-l-y.
- Ensure that the parking brake is released to prevent frozen brakes on the next departure.

Survival in Cold Weather

Although much of the area over which BSC training flights occur is generally well populated, the terrain is heavily wooded, rocky, and contains numerous large ponds and other water hazards. Longer cross-country flights are conducted over inhospitable mountainous terrain. Flight crews should always consider the unlikely event of a forced landing during all training operations.

In cold weather, survival depends on several important factors:

- The *will* to survive: Perhaps the most important element of survival. Numerous stories highlight the power of the human spirit and will to overcome seemingly insurmountable odds and obstacles (e.g. Shackleton's voyage on *Endurance,* 1914-1916*,* or members of the Uruguayan rugby team's survival of an airline crash in the Andes mountain range, 1972).
- Proper gear: Survival gear varies with individual needs, temperature, and route. There are numerous survival kits on the market, or one can be developed using basic resources and planning. Basic kits include water container, magnetic compass, water-proof matches, cutting tool or multi-tool, string or rope, visual signaling device (flashlight), audible signaling device (whistle), small assortment of first-aid supplies, possibly a survival blanket.
- Proper clothing: *Likely the most important piece of gear.* Survival clothing only works if it is being worn. Flight crews should wear their gear (preferred) or have it immediately available in the event of a forced landing. Wearing the clothing removes the need to remember to retrieve it in the event of a post-landing fire. All Bridgewater State College CFIs are issued a reversible flight jacket that provides both insulation and, when reversed, a bright orange covering that can be more easily seen from air or land rescue personnel.
- Physical status, i.e. level of injury: A non-injured person's likelihood of survival is good, under the right conditions. Under any conditions, the survival rate for a severely injured person (broken bones, lacerations, internal organ damage, severe burns, etc.) drops dramatically. Such injuries decrease mobility, physical stamina, and can weaken the psychological state of a downed airman. For an injured person, it is imperative then that rescue assistance be obtained as soon as possible.
- Effective use of communications (squawk 7700 and IDENT well prior to landing, contact ATC or others on 121.5 Emergency frequency, personal cell phone, handheld transceiver).
- Proper use of ELT: Remember that the ELT can be removed, and should be activated before landing if possible. ELTs are designed to activate automatically in the event of a hard landing similar to the type expected in an off-airport scenario.