

Table of Contents

17.0 Boats, Canoes and Inflatables

17.1 Risks and Hazards

17.2 Responsibilities (Due Diligence) Regarding Boats, Canoes and Inflatables

17.3 Safe Operating Guidelines for Boats, Canoes and Inflatables

17.4 Safe Loading Guidelines

17.5 Equipment – Required and Recommended

17.5.1 Required Equipment

17.5.2 Recommended Equipment

17.5.3 Information about Specific Equipment

17.6 Communications Guidelines for Boats, Canoes and Inflatables

17.7 Guidelines for Motors and Fuel Handling

17.7.1 Motors

17.7.2 Fuelling Procedures

17.8 Maintenance and Inspection Guidelines

17.9 Training

17.10 Safe Boat Handling Guidelines and Techniques

17.11 Recognition of Boating Risks and Hazards

17.12 Water Survival

17.12.1 Risks and Hazards

17.12.2 Prevention and Preparation

17.12.3 Cold Water Immersion Hypothermia

17.13 Resources

17.0 Boats, Canoes and Inflatables

Introduction

When boats are used for exploration work, it is important to select the appropriate boat and motor for the type of waters where they will be used; use the largest, safest boat available for the job. For large bodies of water, coastal areas and on cold lakes, use large boats or rigid inflatable boats (RIBs) with keels, if possible. These have much greater stability than small boats or canoes. Canoes and dugouts should be avoided. However, if required, they should only be used on small lakes and streams.

Operators should be thoroughly familiar with the characteristics and limitations of their boat and motor; they should know their personal boating capabilities and not exceed them. When working on boats in unfamiliar or hazardous waters or where navigation is difficult, a company should consider hiring certified pilots or experienced locals who are familiar with the risks and hazards of the project area.

Due to the possibility of capsizing and falling overboard, everyone who uses boats should know how to swim. Training in boat recovery and rescue skills, cardiopulmonary resuscitation (CPR) and other resuscitation skills is essential. If you work in cold water areas, be prepared to deal with cold water immersion hypothermia at all times and wear a personal flotation device (PFD) with appropriate thermal insulating properties.

Transport Canada sets minimum requirements and standards for the operation of pleasure craft, non-pleasure craft, and commercial vessels. These requirements are found on government websites and, where relevant, are listed within the chapter and in the resources section to enable the reader to find additional information about boating safety.

Acronyms

CPR – Cardiopulmonary Resuscitation

CPSS – Canadian Power and Sail Squadrons

CSA – Canadian Standards Association

DSC – Digital Selective Calling

EPIRB – Emergency Position Indicating Radio Beacon

ERP – Emergency Response Plan

GPS – Global Positioning System

MMSI# – Maritime Mobile Service Identity Number

PCOC – Pleasure Craft Operator Card

PFD – Personal Flotation Device

PPE – Personal Protective Equipment

RIB – Rigid Inflatable Boat

ROC-M – Restricted Radiotelephone Operators Certificate

SOP – Safe Operating Procedure

VHF – Very High Frequency

17.1 Risks and Hazards

Some of the risks and hazards related to boating include:

Death due to drowning may be caused by:

- Not wearing a PFD (after capsizing, falling overboard)
- Trying to swim to shore without wearing a PFD after capsizing, swamping or falling overboard

Capsizing may be caused by:

- Using the wrong boat for the body of water
- Lack of training, lack of piloting skills
- Rogue waves and/or swamping
- Weather: Sudden storms or winds

Injuries may be caused by:

- Exposure to bad weather or sun caused by inadequate clothing (e.g., hypothermia, sunburn)
- Slips and falls on deck or while boarding the boat
- Fire and/or explosion due to improper fuelling procedures

Stranding may be caused by:

- Engine breakdown, lack of spare parts
- Lack of training to read charts, lack of navigation skills
- Lack of navigation and/or communication equipment
- Lack of required safety equipment (paddle, communication, signalling)
- Adverse weather
- Changing tides

17.2 Responsibilities (Due Diligence) Regarding Boats, Canoes and Inflatables

As presented in section 1.2 Due Diligence, companies should be able to demonstrate due diligence with regard to their employees' who use boats and work in, on or near water. Requirements to demonstrate this aspect of due diligence include but are not limited to the following measures:

Exploration Companies

- Develop written safe operating procedures (SOPs) and site specific SOPs (as needed) for the use of boats, motors and for employees who work near water.
- Develop written emergency response plans (ERPs) that address potential emergencies related to the use of boats, motors and for employees who work on or near water.

BOATS, CANOES AND INFLATABLES

- Make sure supervisors are trained so they are competent; provide training and education for employees regarding SOPs, ERPs and hazards related to working on water and with boats.
- Carry out inspections and maintenance of boats and motors, docks etc.
- Monitor the use of boats and implement consequences when SOPs etc., are not followed.
- Documentation: Keep records of all training, accidents, incidents and corrective actions, mitigation of hazards, inspections, maintenance, infractions etc., that apply to boats and their use.
- Provide required personal protective equipment (PPE).
- Carry adequate insurance.

Project Supervisors

- Implement company SOPs and those in the manufacturers' operator manuals for boats and motors.
- Develop site specific SOPs that address hazards associated with boats and working on water, as required.
- Advise, instruct, and monitor employees and contractors regarding company SOPs, health and safety regulations etc., and potential hazards of using boats and motors.

Operators

- Follow company SOPs and training regarding boats provided by the employer.
- Be familiar with any warning decals on boats and associated equipment.
- Use PPE and safety equipment as directed.
- Report hazards, dangers and defective boats and equipment to a supervisor.

17.3 Safe Operating Guidelines for Boats, Canoes and Inflatables

Operators are expected to know the regulations that apply to the waters in the country where they work. It is the responsibility of the owner or operator (person entrusted by the owner) to make sure that all required equipment is on board and in good working condition.

1. Comply with the manufacturer's operator manual regarding safe operating procedures for the boat and/or motor. Most manufacturers supply comprehensive operations and maintenance procedures.
2. Be familiar with the *Canadian Safe Boating Guide* or equivalent. Refer to the following website: <http://www.tc.gc.ca/marinesafety/tp/tp511/menu.htm>.
Be familiar with the *Small Commercial Vessel Safety Guide* if the boat is of this class, or equivalent. Refer to the following website:
<http://www.tc.gc.ca/publications/EN/TP14070/PDF/HR/TP14070E.PDF>
3. Comply with the Canada Shipping Act, 2001 regarding registration and/or licence requirements for company owned boats. Refer to the following website:
<http://www.tc.gc.ca/marinesafety/TP/TP13813/booklet/menu.htm>

BOATS, CANOES AND INFLATABLES

4. In Canada, as of September 15, 2009 all operators of pleasure craft are required to possess a Pleasure Craft Operator Card (PCOC). Pleasure craft include power boats, personal watercraft and motorized sailing craft. The basic knowledge required to pass the test is fundamentally important. An operator will receive a fine of \$250 if found operating a motor boat without it.
5. Wear an approved personal flotation device (PFD) or lifejacket suitable to your body size. Employees should be required to wear a PFD whenever they travel in small watercraft on company business. Wear a PFD when sampling or working on steep shorelines that border cold water bodies and wear a full body harness and lanyard if the situation requires it. Wearing a PFD should be mandatory whenever employees use small boats, even if they are not technically on “company business”.
6. Know and adhere to recommended ratings for load, number of occupants and horsepower on the boat. Make sure the safety compliance notice, the capacity label and/or licence number is displayed, as required.
7. Use boats and motors that are fully equipped, safe and appropriate for the bodies of waters where you work. Do not use defective equipment.
8. Employees who use boats should be adequately trained and should be checked out by trained personnel before proceeding with work. More than one person on board should be able to operate the boat and motor in case of emergency.
9. Inspect the boat and motor before heading out. Make sure all required equipment, emergency supplies and adequate fuel for the journey are on board. Plan for 1/3 fuel outbound, 1/3 fuel inbound, and 1/3 fuel in reserve.
10. Have an emergency response plan (ERP) in place. Develop procedures for dealing with emergencies, including breakdowns, capsizing, a missing or overdue boat, and cold water immersion. “Cold water” is defined as that below 21°C (70°F). Therefore almost all bodies of water in Canada (except southern lakes during summer months) are classified as “cold water”.
11. Establish a communication schedule with routine check-in times. Employees using boats should adhere to the check-in schedule and inform their base camp, person in charge or expeditor etc., if plans are changed while en route.
12. Tracking system: File your daily trip plan (boating route) with the project or camp manager, the expeditor or whoever is in charge of the tracking system. That person should be familiar with the ERP and know what to do if the boat does not arrive or return as planned, and what to do if you do not check in as scheduled.
13. Travel at a safe speed appropriate for the water conditions and maintain control of the boat at all times.
14. Be aware of the existing navigational conditions, taking into account factors such as tides, currents, ice, rapids, and potential obstructions. Have appropriate navigational charts and maps and tide tables.
15. Do not boat during inclement weather. Head for shore if bad weather threatens. Do not take chances.
16. Do not operate a boat at night except with appropriate navigation lights and in familiar waters.
17. Travel as close to shore as safely possible in case problems develop.
18. Refrain from smoking on any boat powered by an outboard motor.
19. Do not operate a boat if you have consumed alcohol or if you have taken medication or drugs that might affect your ability to operate the boat.

20. Contract a competent, experienced, licensed pilot for large boats and wherever there are difficult navigational hazards or other local hazards (weather, tides) beyond the skill level of the employees using boats.
21. Prior to beginning a trip, operators should instruct passengers where basic equipment is located – life ring, boat hooks, fire extinguisher, lines, first aid kit etc., in case they are asked to retrieve them in an emergency.
22. It is best to operate a boat with at least one crew member. If it is necessary to work alone, follow the guidelines in section 2.1.1 Working Alone vs. the “Buddy System”. It is advisable to carry a satellite phone, which is the most dependable means of communication, especially in a remote area.

17.4 Safe Loading Guidelines

A safe load depends upon many factors: the type of boat, weather conditions, water conditions (waves), the size and weight of gear and cargo, the number and placement of passengers in the boat, and the experience of the operator and passengers. The maximum allowable load may not be a safe load. Boats capsize or swamp more readily if they ride too high, too low, or list (lean to one side). Allow extra freeboard for safety in case weather conditions change for the worse.

- Know and do not exceed the maximum load and allowable number of passengers for the class of boat. The permissible gross load capacity includes the weight of the engine, fuel, gear and all passengers. Make an extra trip, if necessary.
- Distribute the passengers and load so that the boat is “trim”. Keep loads centred and as low as possible. This is especially important for canoes and dugouts. Place heavier items on the bottom and lighter ones on top. Passengers should sit on the bottom of canoes and dugouts.
- When travelling with a group of boats, distribute the food, equipment and survival kits as equally as possible between them. This reduces the chance of placing the entire field party at risk with the loss of a single boat.
- Secure all large items with strong ropes and cover them with heavy tarpaulins to prevent shifting or loss if the boat capsizes. Passengers must not get trapped with cargo should the boat capsize.
- Load inflatable boats so no sharp or pointed objects can pierce or damage the inflatable hull.
- Never load or unload a boat unless it is securely moored to a dock or is properly beached.
- If loading in calm water, allow enough freeboard for rougher water conditions.
- If travelling in rough water, make sure the boat has enough ballast for stability.
- Transport important cargo items in waterproof packs or several layers of plastic bags to keep them dry. Tie them to the boat. Keep essentials in your pockets (e.g., waterproof matches, whistle, knife, keys, identification papers and licences).
- Follow Transport Canada regulations for the transportation of dangerous goods. Information is available on the following website: <http://www.tc.gc.ca/tdg/who.htm>

17.5 Equipment – Required and Recommended

Exploration companies use a variety of boats. The type and size of boat chosen used should be determined according to the size and nature of the body of water where it will operate. While transporting boats by aircraft limits the size of boat utilized, the boat should still be as large and stable as possible to increase the safety factor.

Transport Canada prescribes the minimum required safety equipment for boats, which depends on their length and use.

- If the boat is classed as a pleasure craft, refer to the following website for the specific equipment requirements for boats of various lengths if they differ from those described in section 17.5.1 Required Equipment:
<http://www.tc.gc.ca/marinesafety/debs/obs/equipment/size/menu.htm>
- If the boat is classed as a small commercial vessel, equipment requirements can be found at the following website:
<http://www.tc.gc.ca/publications/EN/TP14070/PDF/HR/TP14070E.PDF>

17.5.1 Required Equipment

Required equipment for powered pleasure craft less than 6 metres in length

Below is the list of required equipment for powered boats less than 6 m (19 ft 8 in) in length. This includes canoes that use outboard motors. The list is taken from the “*Safe Boating Guide*”, which is also available on the following Transport Canada website:

<http://www.tc.gc.ca/marinesafety/debs/obs/equipment/size/less6m.htm>

Personal protection equipment

1. One (1) Canadian-approved personal flotation device or lifejacket of appropriate size for each person on board
2. One (1) buoyant heaving line no less than 15 m (49 ft 3 in) in length

Boat safety equipment

3. One (1) manual propelling device (paddle or set of oars)
or
An anchor with no less than 15 m (49 ft 3 in) of cable, rope, or chain in any combination
4. One (1) Class 5-BC fire extinguisher, if the pleasure craft is equipped with an inboard engine, a fixed fuel tank of any size, or a fuel-burning cooking, heating or refrigerating appliance.
5. One (1) bailer
or
One (1) manual water pump fitted with or accompanied by sufficient hose to enable a person using the pump to discharge water from the bilge over the side of the vessel

Distress equipment

6. A watertight flashlight
or
Three (3) Canadian-approved flares of Type A, B, or C

Navigation equipment

7. Sound signalling device or sound signalling appliance
8. Navigation lights that meet the applicable standards set out in the Collision Regulations if the vessel is operated after sunset and before sunrise, or in periods of restricted visibility

Required equipment for canoes and rowboats less than 6 metres in length

Below is the list of required equipment for boats less than 6 m (19 ft 8 in) in length that operate without a motor. The list is taken from the "Safe Boating Guide", which is also available on the following Transport Canada website:

<http://www.tc.gc.ca/marinesafety/debs/obs/equipment/size/canoes.htm>

Personal protection equipment

1. One (1) Canadian-approved personal flotation device or lifejacket of appropriate size for each person on board
2. One (1) buoyant heaving line no less than 15 m (49 ft 3 in) in length

Boat safety equipment

3. One (1) manual propelling device (paddle or set of oars)
or
An anchor with no less than 15 m (49 ft 3 in) of cable, rope, or chain in any combination
4. One (1) bailer
or
One (1) manual water pump fitted with or accompanied by sufficient hose to enable a person using the pump to discharge water from the bilge over the side of the vessel

Navigation equipment

5. Sound signalling device (whistle) or sound signalling appliance
6. Navigation lights that meet the applicable standards set out in the Collision Regulations if the vessel is operated after sunset and before sunrise, or in periods of restricted visibility

Required equipment for boats greater than 6 m in length

Below is the list of required equipment for boats greater than 6 m (19 ft 8 in) but less than 8 m (26 ft 3 in) in length. The list is taken from the "Safe Boating Guide", which is also available on the following Transport Canada website:

<http://www.tc.gc.ca/marinesafety/debs/obs/equipment/size/greater6m.htm>

Personal protection equipment

1. One (1) Canadian-approved PFD or lifejacket of appropriate size for each person on board
2. One (1) buoyant heaving line no less than 15 m (49 ft 3 in)
or
One (1) approved lifebuoy with an outside diameter 610 mm or 762 mm that is attached to a buoyant line at least 15 m (49 ft 3 in)

3. A reboarding device if the freeboard is greater than 0.5 m (1 ft 8 in)

Boat safety equipment

4. One (1) manual propelling device (paddle or set of oars)
or
An anchor with no less than 15 m (49 ft 3 in) of cable, rope, or chain in any combination
5. One (1) bailer
or
One (1) manual water pump fitted with or accompanied by sufficient hose to enable a person using the pump to discharge water from the bilge over the side of the vessel
6. One (1) Class 5-BC fire extinguisher, if it is a power-driven vessel, plus another class 5-BC fire extinguisher if the craft is equipped with a fuel-burning cooking, heating or refrigerating appliance

Distress equipment

7. Watertight flashlight
8. Six (6) Canadian-approved flares of Type A B or C

Navigation equipment

9. Sound-signalling device or sound-signalling appliance
10. Navigation lights that meet the applicable standards set out in the Collision Regulations if the vessel is operated after sunset and before sunrise, or in periods of restricted visibility
11. Radar reflectors may be required under certain conditions. Vessels less than 20 m (65 ft 7 in) in length or that are constructed primarily of non-metal materials must have radar reflectors, unless they are not essential to the safety of the vessel, or the small size of the vessel or its operation away from radar navigation makes compliance impractical. If properly positioned, they help larger, less manoeuvrable vessels detect your presence on their radar screens. They should be located above all superstructures and at least 4 m (13 ft 1 in) above the water (if possible). Additional information is available on the following website:
http://www.tc.gc.ca/marinesafety/tp/tp511/equipment.htm#navigation_equipment

17.5.2 Recommended Equipment

Recommended equipment will depend on the time of year, length of the trip, and expected weather. The items in bold should be considered essential in addition to those required by Transport Canada.

- First aid kit, size appropriate for size of crew and region**
- Radio, satellite telephone, as appropriate for region**
- Location equipment – GPS unit, compass, up-to-date charts**
- Emergency Position Indicating Radio Beacon (EPIRB), as required**
- Signal flares, signal mirror**
- Water**
- Survival kit, size appropriate for size of crew and region**

- Axe
- Bow saw (if portages are expected)
- Food
- Additional clothing
- Additional Class BC Fire extinguisher(s) – a 5-BC is very small

Additional recommended equipment for boats that operate with motors

- Patch kit (inflatable boats)
- Air foot pump, pressure gauge (inflatable boats)
- Manufacturer's operator manual for motor
- Tool kit
- Rope of appropriate length to manually wind around the flywheel

Tool Kit – Suggested Contents

- Extra spark plugs
- Extra cotter and shear pins
- Funnel and filter
- Electrical tape
- Duct tape
- Tools: knife, screwdrivers, pliers, gap gauge, wire, adjustable wrench, spark plug wrench
- Extra propeller (if size is convenient to carry), extra cotter pins

NOTE: Store the tool kit, maps and charts in waterproof containers

Abandon Ship Bag (Ditch Bag)

Contents will depend on size of boat and crew

- Survival kit
- First aid kit
- Compass, GPS and extra batteries
- Signal flares
- Signal mirror
- EPIRB
- Portable radio

Tips about Equipment

- Fire extinguishers: A fire at sea is the most dangerous situation a mariner can be faced with. Therefore, it is a good idea to at least double the required number of extinguishers as a 5-BC has an effective range of about 1.5 m (5 ft) and a blast lasts less than a minute. Mount fire extinguishers near the engine, galley and berths.
- Keep extra paddles and emergency equipment readily available – not stowed under your gear.

- Lines and ropes and motors do not “mix” – be vigilant and keep lines from falling overboard. Never allow lines to drag in the water as they may foul the propeller. Carry 30 metres of rope so that you can “line” a boat through shallow water. Use a heavier natural fibre rope for towing. Do not use nylon rope for towing as it will stretch; if it breaks it will whip back. While polypropylene line that floats is best for docking, it may stretch, break and whip back if used for towing. The force of a parted rope can sever limbs or kill people.
- Bailing device: To make a simple one, cut the bottom out of a plastic bottle with a handle. Glue the bottle cap on and tie this device to the boat so it does not blow overboard.
- Abandon Ship Bag – also known as a “ditch bag” or “grab bag”: It is recommended that the boat’s emergency equipment be stored in an abandon ship bag. In an emergency situation you will generally not have time to collect the boat’s emergency equipment. The bag should be waterproof to protect its contents and have sufficient excess volume to float, even when fully loaded. The bag should be attached to the boat with a few feet of lanyard and a secure snap clip or carabineer at the end to allow a person to quickly attach it to their PFD harness so the bag does not go missing in the chaos that often accompanies the abandonment of a boat. The contents of the bag should reflect the size of the boat and number of occupants. If a number of boats travel together, each boat should have a bag with appropriate contents.

17.5.3 Information about Specific Equipment

Lifejackets and PFDs

In Canada, one properly fitting lifejacket and/or PFD, approved by Transport Canada, Fisheries and Oceans Canada or the Canadian Coast Guard, is required equipment for each person on board any boat. The definition of “PFD” differs between Canada and the USA. In Canada, lifejackets and PFDs are two separate classes of buoyancy aids. In the USA, the term PFD is a general term applied to lifejackets and several other classes of buoyancy aids. The Canadian definition of PFD is used in these Guidelines.

- Lifejackets are designed for use in an emergency, primarily for use in open and rough waters. They are designed to (1) keep your head out of water and (2) turn you onto your back should you be unable to do so. They are more buoyant than PFDs and are only available in high visibility colours – red, yellow or orange. Lifejackets are required on commercial vessels.
- PFDs are less buoyant than lifejackets although some may look very similar. They have a limited capacity to turn the wearer over in the water and come in a variety of colours. Most people choose a PFD because they are more comfortable and easier to wear than a lifejacket. Many PFDs are designed to be worn while working around or on water and some varieties have good insulating properties for working in cold water environments. Choose a bright colour to enhance your safety.
- Lifejackets and PFDs are available in different sizes to suit different body shapes; to comply with Transport Canada regulations, any lifejacket or PFD must fit the wearer properly. Choose a style that fits comfortably, allows freedom of movement and fits over both bulky and lightweight clothing. PFDs should be brightly coloured for increased visibility should you fall overboard. If a PFD does not fit correctly, the user should not wear it and should find one that fits properly.
- PFDs should be destroyed if they are faded, worn, scuffed, shredded or compromised in any way, as it is illegal to have them on board any boat in this condition, even as spares.

BOATS, CANOES AND INFLATABLES

- Lifejackets and PFDs should be fitted with both a sound signalling device (i.e., whistle) and a light (ideally a waterproof strobe light).
- Some PFDs contain several plastic air sacs or compartments filled with buoyant material inside the cloth cover. A hole in the plastic may ruin the jacket so it will be unable to protect your life as it is designed to do. Treat your PFD with care; do not use it as a cushion, step on it, or use it for a boat fender etc.
- If you work on cold water or on ice, a flotation jacket or an immersion survival suit may be essential. A variety of styles provide insulation and wearing one will reduce the risk of hypothermia should you fall in. Compared to an ordinary PFD, a convertible flotation jacket with a crotch flap and hood offers you a 50% to 75% increase in predicted survival time in the event of cold water immersion. Under some conditions, it is advisable to wear an immersion survival suit plus a flotation jacket.
- Inflatable PFDs are available and have a variety of features:
 - Vest types are not inherently buoyant. They may be orally inflated, manually inflated, or automatically inflated.
 - Automatic inflating vest PFDs require replacement cartridges so they can be used more than once. If choosing this type, it is very important to carry extra CO₂ cartridges. Automatic inflating PFDs may also be orally inflated if the CO₂ mechanism fails.
 - Inflatable PFDs are more comfortable to wear than other varieties; they may be a good choice when performing some types of work. Check the legal restrictions for wearing inflatable PFDs, as they are not acceptable for all situations.
 - Inflatable PFDs require frequent inspection and maintenance. Follow the manufacturer's guidelines for storage.
- Care of PFDs:
 - Clean with mild soap and running water – never with strong detergents, by dry cleaning or with gasoline to remove spots.
 - Do not dry them close to a direct heat source or in continuous direct sunlight.
 - Do not store them in a closed heated space, a damp space or in direct sunlight.
- Wear your PFD whenever you work on or near water, as directed in section 17.3 Safe Operating Guidelines for Boats, Canoes and Inflatables.
- Valuable information is available on the following websites:
 - The Cook-Rees Memorial Fund For Water Search And Safety provides extensive information to increase awareness regarding why and how to choose, fit, and maintain a lifejacket and PFD: <http://www.wearalifejacket.com/perfchoice01.html>.
 - Comparison chart of various types of lifejackets and PFDs: http://www.redcross.ca/cmslib/general/lifejacket_chart.pdf.
 - Transport Canada: <http://www.tc.gc.ca/marinesafety/debs/obs/equipment/lifejackets/menu.htm>.

Rigid Inflatable Boats (RIBs)

- Correct assembly is important. Follow the manufacturer's assembly instructions to place the floorboards correctly.

BOATS, CANOES AND INFLATABLES

- Proper inflation of RIBs is very important. Be sure to fully inflate the boat. If inflated on land, the internal pressure will drop when the boat is launched into water, as the water temperature will cool the air in the chambers. Check all chambers and inflate each one to the correct pressure after a short time in water.
- Carry a foot pump and appropriate spare parts for the inflatable.
- For stability, it is important to use the appropriate size of motor.
- Load inflatable boats so that no sharp or pointed objects can pierce or damage the inflatable hull.
- Keep speed under control. Inflatables can flip backwards – bow over stern – in high winds and turbulent water.
- Lift (never drag) the inflatable to avoid wear on the fabric. Do not moor them where sharp rocks may puncture the hull.
- Clean sand out of RIBs as it gets stuck in the inflation valves and can be abrasive to the fabric.
- Maintain RIBs by washing it and regularly checking for small tears and rips. Repair them with the correct patch kit materials. Large rips or tears should be repaired by professionals.
- Apply patches to an inflatable boat only when it is completely dry. Only use the material provided in the manufacturer's patch kit as it is specific to the fabric of the boat. Never use silicone products as they prevent the patch material from adhering to the boat fabric.
- To increase stability, tow an inflatable using a bridle so that the tow line forms a V or a Y shape when attached to the two (2) lateral D rings, rather than a single line attached to the bow handle.
- Use the correct procedures outlined in the operator's manual to haul an inflatable on a trailer.
- Pack an inflatable boat away carefully for storage to avoid damage. The boat must be dry prior to storage to prevent the growth of mildew.

Flares

Transport Canada provides information about available types and the safe use of flares on the following website:

<http://www.tc.gc.ca/marinesafety/debs/obs/equipment/rescue/menu.htm#DistressFlares>

The following information is available on the website.

- Flares are meant to be used during times of true distress.
- Flares must be approved by Transport Canada. They have a shelf life of 4 years from the date of manufacture, which is stamped on each flare. For the proper way to dispose of out-of-date flares, contact a local law enforcement agency, a fire department or Transport Canada Centre.
- Store flares vertically in a cool, dry place. A waterproof container is best. They should be kept in an easily accessible location in case of an emergency. Do not store flares near combustible liquids such as gasoline or oil.
- Follow firing directions carefully. Do not rely on one flare to be seen. Launch several flares at one minute intervals.

- There are four (4) types of pyrotechnical distress flares:
 1. Type A: Parachute – a single red star that reaches 300 m (984 ft) and falls slowly with the aid a parachute. They are easily observed and burn for 40 seconds.
 2. Type B: Multi-star – two or more stars that reach 100 m (328 ft). Each star burns 4 or 5 seconds and are observed easily from the surface or air.
 3. Type C: Hand-held – a red torch flame with limited surface visibility. They burn for at least one minute and are best for pinpointing location during an air search.
 4. Type D: Smoke (buoyant or hand-held) – produce dense orange smoke for three minutes. Use for daylight signalling. Position the smoke downwind and follow the directions for use carefully.

Charts and Tide Tables

Charts contain important information regarding true directions, water depths, land masses, dangers, currents, etc., which maps do not show. Navigation can be challenging depending on the waterways, underwater hazards, tides, ice, etc. Small boats should steer clear of potential dangers such as rapids, currents and commercial shipping channels. Operators should know how to:

- Use a compass along with marine charts
- Plot a course
- Find their position by several methods
- Use electronic navigation equipment
- Use navigational references such as tide tables, the Canadian buoyage system, navigation lights and signals.

Information about paper and digital charts, which are available from the Canadian Hydrographic Service, can be found at the following website: <http://www.charts.gc.ca/charts-cartes/index-eng.asp>.

Amendments to charts and publications are published monthly by the Canadian Coast Guard and are available at the following website: http://www.chs.gc.ca/pub/en/products/canc_charts.asp

17.6 Communications Guidelines for Boats, Canoes and Inflatables

Good communication equipment and check-in routines are essential. The communication requirements for boats depend to some degree on where they operate. Each crew needs communication equipment that fulfills the following requirements:

- Always to be able to report emergencies to obtain help
- Allow operators to respond to emergencies from other boaters
- Keep in touch with the base camp, office and/or expediter
- Keep informed about weather forecasts and warnings (if available in the area where working). This requires a marine receiver or marine radio.

Equipment

As crews require effective two-way communication equipment that operates in their field area, they need a reliable mobile/cell phone, satellite telephone, or a VHF (Very High Frequency) radiotelephone, or combination of these. It is advisable for boats to carry a marine VHF radiotelephone with the DSC (Digital Selective Calling) feature wherever there is VHF coverage. Maintain communication equipment in good working order.

A VHF operator should have a Restricted Radiotelephone Operator's Certificate (ROC-M). In addition to a ROC-M, boats working in US waters are required to have a VHF Station Licence. The Canadian Power and Sail Squadrons (CPSS) offer classes to obtain radio operator training and information can be found by following the link to courses & training on their website: <http://www.cps-ecp.ca/public/>

Vessels over 8 m in length and ships carrying more than six passengers are required to carry a VHF-DSC Radio. (VHF) Digital Selective Calling (DSC) radios are based on satellite and digital technology. Each has a unique number – a Maritime Mobile Service Identity Number (MMSI#). With this radiotelephone, an automatic digital emergency MAYDAY call can be sent by pushing a "distress" button. The boat's identity and position are transmitted and any DSC radio in the area will be alerted to the distress signal and be able to identify the boat and its location coordinates. These radios may be portable or built into a boat. An ROC-M is required to transmit on a VHF radio.

Information is available regarding radio communications and radio navigational aids services in Canada provided by Fisheries and Oceans Canada and other government agencies that contribute to the safety of boats in Canadian waters. Follow the appropriate links at this website: http://www.ccg-qcc.gc.ca/eng/CCG/MCTS_Radio_Aids. A simplified list of VHF channels is available at the following website: <http://boating.ncf.ca/vhfchannels.html>

Emergency Communications

Learn to use your communication equipment proficiently so that you can use it automatically in the event of an emergency. Follow instructions in the operator's manual. Seek advice or assistance early when problems begin to develop rather than waiting until they have multiplied and you face a much more serious situation.

- A marine VHF-DSC radio connected to a GPS receiver provides reliable emergency communications for coastal Canada and the Great Lakes. Use channel 16 for emergency calling purposes. Use channel 70 for emergency DSC (digital) communications.
- Satellite telephones provide good communication but do not alert other vessels that you are in distress or provide a signal for search and rescue to follow in the event of an emergency. Be trained to use a sat phone correctly as they require special procedures. Post instructions onboard and keep them with the sat phone.
- Mobile/cell phones may be useful if they work in the field area. They are not always reliable and they won't work if they get wet or damaged. You can contact Rescue Coordination Centres by dialling *16 – *if* it is available from your wireless provider. A mobile/cell phone will not alert other vessels that you are in distress or provide a signal for search and rescue to follow in the event of an emergency.
- Emergency Position Indicating Radio Beacon (EPIRB): These are buoyant radio distress beacons that can be manually activated or they can float free from a sinking or overturned vessel. They transmit for hours. EPIRBs must be registered with the Canadian Beacon Registry at 1-877-406-7671 or at <http://www.canadianbeaconregistry.forces.gc.ca/>. (Refer to Chapter 19. Communications.)

- Emergency use of VHF channels:
 - VHF radio channel 16 is used for emergency and calling purposes only. Once you call another boat on channel 16, take your conversation to a working frequency to continue.
 - Keep the radio tuned to channel 16 so you are aware of emergency calls.
 - VHF channel 70 should be used only for DSC (digital) communication and not for voice communications.
- Urgent messages: When a situation requires immediate urgent action (e.g., a mechanical breakdown), but is not a life-threatening distress situation, you may interrupt another transmission as soon as possible by announcing PAN-PAN, PAN-PAN, PAN-PAN. Proceed with your message when communication traffic clears. An urgent message has priority over all other messages except distress calls. Examples of urgent situations are loss of power or loss of steering and you need a tow.
- Distress messages: Use channel 16 in Canadian waters. When you are threatened by grave and life-threatening danger requiring immediate assistance, announce MAYDAY, MAYDAY, MAYDAY. Never use MAYDAY unless the emergency is imminently life-threatening. Examples of distress situations are a sinking boat, a fire or a cardiac arrest on board.
- Give this information when you send an urgent or distress message:
 - Give the name of your vessel; repeat it three times.
 - Give the call sign.
 - State the position of the vessel.
 - Describe the nature of the emergency.
 - State type of assistance required.
 - State how many people are on board.

The following Transport Canada website provides additional information about emergency communications:

<http://www.tc.gc.ca/marinesafety/debs/obs/equipment/rescue/menu.htm#EmergencyCommunications>

17.7 Guidelines for Motors and Fuel Handling

17.7.1 Motors

- Read the manufacturer's operator manual carefully and follow the safe operating procedures.
- Use a motor appropriate for the job required of the boat. For example, an inflatable that must handle heavy surf requires a long shaft motor, but a short shaft motor would be preferable on navigable rivers. Do not use a motor that is too powerful for the size of the boat. Do not twin motors on a boat unless the motors and boat are designed for this purpose.

- Secure the motor and tie it to the boat; the motor mounting clamps may loosen due to vibration.
- Sit or squat while starting an outboard motor. Do not stand.
- Know the fuel consumption of the boat and motor combination. Check the fuel level before departure and check frequently during the trip. Use a dipstick; don't depend on a gauge. Reserve more than half the fuel for your return trip. A good plan is to count 1/3rd fuel for the outbound trip, 1/3rd fuel for the return trip, 1/3rd fuel for emergency consumption.
- Carry more fuel than required for the worst conditions or in case of an emergency. For example, boats consume more fuel when the water is rough. If necessary, carry extra fuel and oil, mixed to the correct ratio, in CSA approved containers. Label the contents correctly (e.g., mixed boat gas 50:1).
- To avoid damage, do not use the motor in shallow water. When in doubt about the depth of water, reduce your speed and post a lookout at the bow, if possible, to watch for underwater hazards. Lift the motor and paddle the boat. In swampy areas, check that the propeller does not become fouled with vegetation and that there is a proper discharge stream of cooling water. If you need to clean weeds from the propeller, make sure the motor is stopped – not just in neutral.
- Unhook the fuel hose and hoist the motor when you beach a boat for more than 15 minutes.
- Repair outboard motors on land rather than on water, whenever possible.
- Do not wear loose clothing that might get caught in motors. Never operate an outboard with the shroud removed as loose clothing can easily get caught in the flywheel.
- Check for the following common problems if the motor stops while underway:
 - Fuel supply
 - That the fuel hose is not kinked or otherwise obstructed
 - Rough water may cause dirt in the fuel tank to be stirred up and get into the fuel filter and fuel lines.
 - The plugs and points are clean and not worn.
 - The ignition system is free of water.
 - The tank vent is open and clear.
 - The water intake/discharge is blocked.
 - The water pump has overheated.
- Consider travelling with a second boat and/or carry a back up motor that uses the same hose linkage as the main motor. Otherwise a separate tank of fuel is required for the back up motor.

17.7.2 Fuelling Procedures

Fuelling should be carried out on shore. Should a fire or explosion occur, then the crew will be safely on land.

- Secure the boat to a dock or on shore.
- All passengers are required to be on shore if they are not helping with fuelling.

- Fuel only when the motor is shut off; fuel in a well-ventilated place.
- Remove portable fuel tanks to shore to fill them.
- When fuelling inboard motorboats with non-removable fuel tanks, it is essential to prevent fumes from entering the boat and accumulating inside the cabin or in the bilges. If fumes are present in such places, a spark may cause an explosion. Complete the following practices before fuelling begins:
 1. Shut off all electrical switches and all motors on board, including portable radios.
 2. Extinguish all open flames including any pilot lights.
 3. Close all hatches, doors and windows on boats with cabins.
- Do not smoke. Do not allow open flames or sparks in a fuelling area.
- Use the correct fuel and ground the nozzle against the filler pipe. Allow fuel to flow into the fill-pipe only as fast as the pipe can handle. Do not overfill the tank. Close the tank cap securely when fuelling is done.
- Clean up any fuel spills completely with spill kit materials. Dispose of contaminated materials in appropriately marked containers.
- Restart an outboard motor after all spills are completely cleaned up.
- Inboard motorboats with non-removable fuel tanks: Open up an inboard motorboat with non-removable fuel tanks and ventilate it. Do not restart a gasoline engine until the engine and fuel tank compartments have been ventilated for at least 4 minutes using the blower and underway ventilation system, or for as long as stated in the operator's manual.
- Portable containers: Use CSA approved containers for fuel. When filling them, always place portable containers on the ground so the containers are properly grounded (earthed). Do not fill containers placed on vinyl bed liners of pickup trucks as that kind of bed liner prevents proper grounding. If the container is not grounded, fuel flowing into a container can create static electricity and generate a spark that will cause fuel vapors to explode. Only fill the containers to 95% capacity, as fuel expands as it warms. (Mark the containers with a "full" line.) If possible, store fuel containers in a cool location out of direct sunlight.

17.8 Maintenance and Inspection Guidelines

Inspections

Inspect and test boats and motors before each field season. Report defects in writing to the supervisor, employer or owner and have the defects fixed that affect the safe operation of the vessel before further use. Carry out an inspection before heading out on each trip.

Verify the following before leaving the dock:

- Weather forecast known, trip plan filed
- Maps and charts on board
- Inspect the hull and gear for seaworthiness
- Inspect the motor: Check the hoses and lines, oil and water filters, battery is charged, clean spark plugs. Check for fuel leaks. Check the clamps, cotter pins, belts, and that the

throttle operates smoothly. Tools and spare parts are present. Check the fuel and oil levels. Take reserves, as needed.

- All required safety equipment is present and in good order, survival and first aid kits, and sufficient food, water and clothing
- Communication equipment (VHF radio, mobile/cell phone, sat phone) is present and working and extra batteries are stowed on board
- Boat is correctly loaded
- Everyone should be wearing a PFD.
- Passengers know their responsibilities in the event of an emergency.

Maintenance

Regular motor maintenance reduces the likelihood of mechanical failure.

- Regularly check that the motor is securely mounted. There should always be a safety cable joined to the linchpin. Check this while en route – every trip, every day.
- Learn to make emergency repairs to the boat and motor. Learn to use the appropriate tools correctly.
- Perform periodic maintenance on the motor, as recommended in the manufacturer's operator manual.
- If working in salt water, keep the propeller and bottom of the boat clear of marine growth.
- Many boat fires are a result of poor fuel system maintenance. Always use marine engine parts when replacing engine parts, as they are ignition protected to reduce the likelihood of explosion due to lingering fuel vapors. Car parts are not ignition protected and must never be used as replacement parts in a marine engine. Additional information about this safety issue is available at the following website:
<http://www.tc.gc.ca/MarineSafety/bulletins/2006/03-eng.htm>

17.9 Training

Without training, many boat operators do not realize the limitations of their boating knowledge, skills and experience and may find themselves in situations that exceed their abilities. Crews should be made aware of predictable risks and hazards, and the precautions to take to avoid incidents and injuries while operating boats. Ideally, training regarding boats should be provided by certified instructors. The following lists some of the formal training that is available.

- A minimum of level of knowledge for everyone working on boats is the Power Craft Operator Certificate (PCOC), which can be obtained on an individual basis or in class settings throughout Canada. Information is available from:
 - Transport Canada has a course provider database website:
<http://www.tc.gc.ca/marinesafety/debs/obs/courses/pcoc/menu.htm>
 - Canadian Power and Sail Squadrons (CPSS) offer PCOC classes. Follow the link to Boating Licence at the following website:
<http://www.cps-ecp.ca/>
- Anyone working on boats in excess of 6-7 metres should learn navigation and safe boating skills in classes taught by professionals.

BOATS, CANOES AND INFLATABLES

- The CPSS provides excellent classes in boating, navigation and seamanship at beginning through advanced levels. Website: <http://www.cps-ecp.ca/> path: Course Descriptions.
- A list of advanced level classes for small vessels and the class locations is available at the Transport Canada website: <http://www.tc.gc.ca/MarineSafety/TP/TP10655/menu.htm>
- If the transportation of dangerous goods is required, refer to the following Transport Canada websites to determine if training is required and where training classes are located. Websites: <http://www.tc.gc.ca/tdg/publications/CLAdvisory/ADVOL1Enew.htm>
<http://wwwapps.tc.gc.ca/saf-sec-sur/3/train-form/search-eng.aspx>

All on-board training should be done in a safe location. Employees should know general boat-handling techniques and procedures appropriate for the type of boat and bodies of water where they will operate. If additional site specific training is necessary, try to obtain it from competent employees or people who are very familiar with the local risks and hazards. Employees should be checked out by a supervisor before receiving permission to proceed with work that requires the use of boats. General boat-handling skills should include:

- General boating safety awareness
- Maintenance of equipment and trouble shooting for mechanical problems
- Load management skills
- Shore and dock landings and departures under a variety of circumstances
- Anchoring and securing methods
- Boat-handling techniques for tides and currents, rough weather conditions and ice conditions (as relevant)
- Rescue practice
- Crew responsibilities in the event of an emergency
- Learn the capabilities of your boat. These include speed, fuel consumption, handling abilities under various sea conditions. Know the bottom clearance of the boat.

17.10 Safe Boat Handling Guidelines and Techniques

General safe guidelines include:

Tracking system: File daily trip plans with the field supervisor, designated camp manager, expeditor or a responsible person who will know what to do if you do not check in on schedule. Post the plan in the camp or with the responsible person. Always notify them of changes to plans. For longer trips, file the general planned routes including time estimations and stopping points.

- On one way trips, inform someone at both the point of origin and the destination of any schedule changes and your safe arrival.
- Leave the following details as a minimum:
 - Date and time of departure
 - Date and estimated time of arrival
 - Names of persons on board

- Point of origin
- Destination
- Proposed route (and all known stop points for a longer trip)
- Leave a photo, diagram or full description of the boat so it can be easily identified in an emergency.
- Post the communication schedule and adhere to check-in times. Communicate all changes in plans to the appropriate contacts.

General safe boat-handling techniques include:

- Avoid steering a course that permits waves to hit the boat broadside. Try to steer a course so the bow heads or angles into the waves. Avoid travelling too close to a lee shore.
- If you turn or stop a boat too quickly, the wake may swamp the boat. Negotiate stops and turns slowly. Do not create a wake that damages the shoreline.
- Look out for floating or semi-submerged logs, debris, rocks and shoals etc.
- One of the most common causes of breakdown is a fouled propeller caused by dangling lines or weeds. Use polypropylene bow and stern lines that float and use caution in shallow water.
- Use caution when coming ashore. Do not run aground and damage a propeller or the body of an inflatable boat.
- Do not jump from a boat onto a dock. If you cannot step off, make another approach. If you fall overboard, you may be crushed between the dock and the boat.
- When approaching a dock, instruct passengers to keep their hands in the boat.
- Keep your weight low. Do not stand up in a canoe, a dugout or small boat. If necessary, paddle while sitting on the bottom to increase the stability of a canoe or dugout. Passengers should not sit on the gunwales of a boat while underway.
- Loosen the laces if wearing heavy field boots before you start a journey in a canoe, inflatable or small boat. If you capsize, you can discard them quickly. Consider wearing light weight boots or shoes while in a boat.
- Learn the appropriate knots to use around boats. They save effort.
- Hire an experienced pilot or guide when faced with hazardous work (in Canada or elsewhere).
 - Seek a person who is thoroughly competent and licensed where required by law and who has experience with the type of boat being used.
 - If hiring a boat and pilot in another country, adhere to Canadian safety standards, including required equipment, maintenance and inspections.
- Learn how to avoid wildlife hazards associated with water, if present (e.g., crocodiles, hippos).

17.11 Recognition of Boating Risks and Hazards

The interaction of weather conditions, water and landforms may create unique problems on the water. Learn the signs that indicate hazards, such as obstructions or wave patterns that change around headlands, shoals and entrances of bays. Learn what hazards to expect in different localities. Typical problems one may encounter on open water are quite different from those one may experience in rivers or on small lakes.

Weather

- Monitor weather reports for several days before a planned departure to be fully aware of current and projected weather forecasts. Watch the barometer for rapid pressure changes. If weather is forecast to deteriorate, be prepared to postpone the trip. Don't take chances. The following websites provide information on marine weather and channels:
 - Environment Canada and the Canadian Coast Guard provide weather information:
http://www.weatheroffice.gc.ca/marine/index_e.html
http://www.ccg-gcc.gc.ca/eng/CCG/MCTS_Radio_Aids
 - The USA provides the National Oceanic and Atmospheric Administration (NOAA) Weather Radio marine coverage information:
<http://www.nws.noaa.gov/om/marine/marsame.htm>
- Learn to recognize the signs that indicate changing weather that may create problems. Some examples are: the sudden appearance of dark clouds, increasing winds, building waves, distant lightning and heavy static on an AM radio, which may indicate a nearby thunderstorm.
- Always head for shore and safety when bad weather threatens. Don't be caught out in a storm. Winds can quickly whip up waves that can swamp a small boat.
- Know the areas where the terrain and wind can combine to cause hazards. For example, afternoon storms frequently develop with little warning on lakes in mountainous areas.
- If you are caught out in heavy weather, do the following:
 - Close all portholes and hatches.
 - Make sure that everyone is wearing their PFD. Passengers should sit on the floor near the centre line of the boat.
 - Switch to a full fuel tank.
 - Secure any loose gear that might shift and cause damage.
 - Head the boat so the bow encounters the waves at an angle of 45°; this effectively increases the distance between wave crests, which will reduce the impact of waves. If necessary, reduce speed.
 - Keep water bailed or pumped out of the boat to keep it stable.
 - Steep following seas are particularly dangerous, as they may break over the stern of the boat and swamp it. Maintain power so the boat rides the back of a wave, if possible.
 - In an extreme emergency where the vessel is at risk of sinking, be prepared to lighten the vessel by discarding cargo.
- Lightning: Get off the water immediately when threatened by a lightning storm. If this is not possible put on a PFD, expect rough seas, crouch low in the boat below deck if

possible. Stay away from the mast or antenna, any attached wiring and rigging, and any metal.

- Fog: Do not set out if fog is present; postpone your trip. If it develops while underway, reduce speed, post a lookout, sound the fog signal, turn on any navigation lights and raise a radar reflector to make your presence known. Remain in sight of shore during foggy weather. You should be able to stop the boat within half the distance you can see.
- Apply sunscreen frequently and use good quality polarizing sunglasses when you work on water.
- The Beaufort Wind Scale Table is a useful tool for estimating wind speed when a boat is not equipped with an anemometer. Website: http://www.msc-smc.ec.gc.ca/weather/marine/beaufort_e.html
- Marine weather forecasts are issued several times a day and updated as required. Post the times when new forecasts are issued so you do not forget to check.
 - Understand terminology used in marine weather forecasts: one knot equals one nautical mile per hour, which is equivalent to 1.85 km/h or 1.1 mph.

Table 17.1: Wind Descriptions

Wind Description	Wind Speed
Light winds	1-10 knots
Moderate winds	11-19 knots
Strong winds	20-33 knots
Gale force winds	34-47 knots
Storm force winds	48-63 knots
Hurricane force winds	64 knots or more

- Marine Warning Criteria: Warnings are issued 12 to 24 hours in advance for predicted, sustained winds and for other weather-related phenomena that may affect boats (Freezing Spray Warning, Storm Surge, Ice).
- Strong wind warnings (formerly small craft warnings or advisories) are issued when sustained winds and frequent gusts are forecast between 20-33 knots. While there is no legal definition of “small craft”, any boat that might be negatively affected by the warning should heed “Strong winds warnings”.

Table 17.2 Wind Warnings

Wind Warnings	Wind Speed
Strong wind warning	If winds of 20-33 knots are forecast
Gale warning	If winds of 34-47 knots are forecast
Storm warning	If winds of 48-63 knots are forecast

Hurricane force wind warning

If winds of 64 knots or greater are forecast
--

Shallow Water

- Navigate cautiously. Watch out for protruding objects such as rocks, semi-submerged objects and shoals. Hint – a flock of birds in the middle of a lake usually means a shoal.
- Use up-to-date charts and mark safe navigation channels on them.
- Weeds, often associated with shallows, cause problems by fouling the propeller and the motor's water intake. Listen for changes in the sound of the engine and watch the cooling water discharge.

Open Water, Coastlines or Ocean Shores

- Make use of local knowledge to answer questions about tides, hazards and safe boating operations in the field area. If planning a journey on water, plan the route to provide a safe harbour in case the weather changes.
- Carry a GPS unit, a good compass and up-to-date charts that indicate the water depth. Mark safe navigation channels on your charts. Always travel with local tide tables or charts in tidal regions and learn to use them correctly.
- Remain in sight of shore during foggy weather or postpone your trip. Remember that fog can last two or three days so be prepared with adequate provisions for this possibility if a planned trip will last more than a day.
- Stay close to shore, but in rough conditions, keep well clear of the shore breakers.
- The presence of numerous islands, inlets and/or channels can be very challenging to navigate. Carry a GPS unit as a backup navigation system.
- When you haul boats out of the water, make sure they are above high tide. Secure boats carefully and thoroughly.
- Avoid camping on islands subject to high tides. In some areas, islands may become submerged (Bay of Fundy, Ungava Bay).
- Watch out for larger than usual waves.
- The safest time to travel through narrows or a tidal bore is at slack water. Consult tide tables.
- In areas with ice, make sure the wind is low before you set out. Beware that the movement of ice could block your return passage.
- The safest time to explore unfamiliar waters and inlets is at low tide so there is a margin of safety if you are grounded.

Lakes

- Make use of local knowledge whenever you work on lakes. Learn about local weather patterns and local hazards.
- Plan the routes so you have protection from winds. Stay as close to shore as reasonably possible. However, unexpected winds and waves sometimes occur near leeward shores (shoreline effect). Be vigilant.

BOATS, CANOES AND INFLATABLES

- Keep a close watch on the wind and developing weather, as squalls can develop very quickly, especially on small lakes.
- On large lakes, winds often build during the course of the day and die down in the evening. Cross large bodies of water when weather conditions are the best and most stable. This may be in the early morning or in the evening.
- Never cross lakes during high winds or if a thunderstorm threatens. Postpone your trip until winds and the threat of lightning diminishes.
- Wave action may vary considerably on a lake. Waves will build if the wind direction has been consistent over a long stretch of water. Remember to head into waves at a 45° angle.

Rivers

- Use sequenced aerial photos to predict where you might encounter hazards such as rapids, waterfalls, fallen trees (sweepers) or logjams. Use the photos to keep track of your progress. Whenever possible, fly over the traverse route along rivers to check out these hazards. Remember that water conditions appear less dangerous when seen from above.
- Carry a GPS unit whenever there are navigation hazards such as numerous islands and channels, smoke from jungle-clearing fires etc.
- If you have any doubt about the conditions ahead, get out and scout out the situation from shore.
- Do not run rapids. Always be prepared to transport the boat and supplies on foot rather than risk your safety. "Line" the boats through from shore with lines attached to the bow and stern.
- Avoid fallen trees and logjams. These are major hazards. The current flowing through these can pull you under. If you are drawn into one, make every effort to jump or hoist yourself up onto it. If you are drawn underwater, it may be impossible to free yourself or for others to rescue you.
- Control speed of a power boat, especially in rivers with heavy local traffic and when approaching blind bends.
- When operating downriver from a dam, be prepared for an unexpected release of water. When operating upriver from a dam, stay a safe distance back from the spillway.
- Contract to use experienced local pilots, especially in areas with navigational or local hazards.
 - To avoid cuts and scratches, wear adequate clothing and safety glasses when travelling by dugout or canoe along narrow rivers or streams, especially in jungles.



Figure 17.1: Wear PFDs and line boats through rapids. © Iain Mitchell

17.12 Water Survival

When working on water, unless you are well prepared and lucky, capsizing or falling into cold water far from shore in a remote area most likely means death by drowning or hypothermia – even if one is wearing a PFD. By planning ahead and paying attention to the risks, one can greatly reduce the chances of unexpected immersions. It is essential to have a project communication check-in schedules and emergency response plans that are appropriate for the working conditions.

17.12.1 Risks and Hazards

- Drowning caused by not wearing a PFD, trying to swim to shore rather than staying with the boat
- Capsizing caused by:
 - Using the wrong boat for the water
 - Lack of piloting skills
 - Overloading, incorrect loading, or shifting cargo
 - Weather – unexpected winds or sudden storms, rogue waves
- Hypothermia or cold water immersion hypothermia caused by
 - Wearing inadequate clothing

- Lack of survival equipment
- Serious survival situation caused by:
 - Not following safe operating procedures
 - Loss of supplies (gear, survival equipment, food and water, the boat)
 - Lack of check-in procedures and project emergency response plans
 - Loss of communication equipment
 - Hypothermic victims unable to help themselves

17.12.2 Prevention and Preparation

To diminish the risks associated with cold water immersion:

- Operate the boat at all times to prevent capsizing and falling into cold water. Knowledge, training and prudence all help to prevent a potential disaster.
- Wear your lifejacket or PFD. If you capsize or fall overboard and are not wearing a PFD, your chances of survival are greatly diminished. The surprise, combined with the gasp reflex and cold shock, plus the swim failure reaction to immersion, can easily overcome even the best of swimmers. It is very difficult to put on a PFD while in the water, IF you can even locate one. Your PFD should be appropriate for your work conditions and fit when used in combination with additional clothing.
- Include cardio pulmonary resuscitation (CPR) and other resuscitation skills in your first aid training (e.g., Heimlich manoeuvre).
- Anyone who works on boats should try to become a competent swimmer. Good swimmers do not panic as easily when faced with an emergency situation in water. Inform co-workers if you are a non swimmer or a poor swimmer and use extreme caution when you work with boats. Wear your PFD at all times.
- Practice recoveries from capsize situations if using canoes or rafts. Your party will know better what to expect, how to react and what to do in an emergency situation.
- Use an automatic shut-off device (stop engine switch) on the motor. If you fall overboard, the motor will automatically stop and you will have a better chance to regain the boat.
- Consider installing a small rope ladder at the side when using a boat that is difficult to climb into from the water. A reboarding device is required equipment on any boat with freeboard exceeding 0.5 m (19.5 in).
- Always carry waterproof matches and a knife in your pocket so you can build a fire to dry out and warm up.
- Know how to prevent, recognize and treat cold water immersion hypothermia.

17.12.3 Cold Water Immersion Hypothermia

Information in this section is compiled primarily from the following sources. They contain excellent and important updated information about cold water immersion and hypothermia.

- *Hypothermia Frostbite and other Cold Injuries: Prevention, Survival, Rescue, and Treatment* by Gordon G. Giesbrecht Ph.D., and James A. Wilkerson M.D.

- *Survival in Cold Waters* by Dr. C. J. Brooks, available on this Transport Canada website: <http://www.tc.gc.ca/marinesafety/TP/Tp13822/menu.htm> .
- The Cook-Rees Memorial Fund For Water Search And Safety website provides general references and information to increase awareness of cold water immersion and links to recent research on the subject: <http://www.wearalifejacket.com/protcoldshock01.html>
- *Cold Water Boot Camp* is a project with a website that demonstrates the realities of falling into cold water using nine volunteers. It contains excellent information with downloadable video clips that demonstrate “cold shock”, “swim failure” and how long it actually takes to develop hypothermia. It is an excellent teaching tool that clearly demonstrates the importance of wearing a life jacket to survive more than a very short time if you fall into cold water. Website: <http://www.coldwaterbootcamp.com/>

How your body reacts when you fall into cold water:

If you fall into water, your most important defence against cold water immersion hypothermia is to be wearing an appropriate PFD. Falling into cold water (<21°C or 70°F) is a serious emergency. Death from cold water immersion may occur at any of time during the following stages.

First stage: *Cold Shock*: You will immediately suffer cold shock and be unable to breathe well. You may drown almost immediately if you gulp in water or cannot keep your head above water.

Second stage: *Cold Incapacitation* develops during the next 10 to 30 minutes. Your extremities cool quickly and your limbs and hands become numb so you lose the ability to grasp and swim. You have about 10 minutes to perform self rescue tasks. As time passes victims cannot maintain a horizontal swimming posture, which is known as “swim failure”, so they often drown during this stage.

Third stage: *Hypothermia*: It takes about 30 minutes for your core body temperature to drop so that true hypothermia sets in. Your body loses heat 25 times faster in cold water than when exposed to cold air. Shivering intensifies and you lose good judgment quickly, yet you probably will not become unconscious for one hour. Hypothermia advances at a faster rate as the water temperature decreases.

Fourth stage: *Circumrescue Collapse*: Death may occur due to post rescue collapse (cardiac arrest) during rescue or within hours of rescue.

Dr. Gordon Giesbrecht promotes this principle to help remember what will happen and what to do should you fall into cold water:

“One Minute — Ten Minutes — One Hour”

One Minute

You will suffer “cold shock”. Do not panic. The gasping and hyperventilation lasts about one minute. Work to regain control of your breathing – if you inhale water you may drown almost immediately. Wearing a lifejacket will keep your head above water so you can breathe.

Ten Minutes

Once you can breathe more easily, immediately work at self-rescue. Climb out of the water and into the boat. Signal for help. As ten minutes pass, your fingers, hands and limbs will become progressively incapacitated from the cold; you will be able to accomplish less and less. If you cannot get out, stop struggling to preserve body heat and assume the HELP position (below). You must keep your head above water until rescue arrives, which is why wearing a lifejacket is so important.

One Hour

If you cannot get out of the water within about 15 minutes, chances are you will be unable to do so. However, you will not be truly hypothermic for about an hour. Wearing a life jacket increases your chances of rescue even if you are hypothermic, as it keeps your head up and allows you to continue breathing.

Follow these guidelines if you capsize or fall overboard into cold water:

- Do not panic. Keep your head above water and regain control of your breathing.
- Do any necessary jobs requiring your hands once you can breathe more easily. Retrieve your whistle and flare gun and signal for help. Climb back into the boat – or onto it – if it is overturned and you cannot right it. Work at tasks before you succumb to cold incapacitation.
- Stay with the boat. Get as much of your body as possible out of the water. Try to climb back into the boat and bail water out. Crouch low to stay out of the wind as you paddle to shore. If you cannot get back into the boat, climb up onto the overturned boat and tie yourself to your partner with a belt or rope. This will delay the onset of hypothermia.
- If you cannot get out of the water: Remain still. Do not swim or tread water, as moving water conducts heat away from your body 35% faster than still water. Due to diminished swimming abilities, heavy clothing and “swim failure”, you can only swim one-tenth to one-fourth the distance you can normally swim in warm water. Do not overestimate your ability to swim. It is usually much safer to drift to shore with the boat.
- If you decide to swim for shore, do it *only* if the shoreline is *very* close. Check the wind direction to be sure it will not blow you offshore. Most victims drown within a few metres of safety.
- Consider swimming for shore only:
 1. If there is no chance of rescue at all
 2. If you are wearing a lifejacket *and* you are very close to shore.
 3. Be very careful as people always *underestimate* the distance to shore and *overestimate* the distance they can swim.

In addition:

- Do not discard clothing or light weight shoes; they help retain body heat while you are in the water. Get rid of boots only if they are *very* heavy. Button up clothing and cover your head to help preserve body heat. In cold water, up to 50% of heat loss can be from your head and neck area.
- Eat any available food in your pockets to supply energy to combat hypothermia (candy bars etc.).
- **Once on shore**, build a fire immediately using the contents of your survival kit (distributed in your clothing). Concentrate on warming your head and trunk area. Put on dry clothing. If none is available, remove clothing one item at a time, wring it out to reduce the water content and put it back on.
- NOTE: It is important to treat all people rescued from cold water immersion as hypothermia or shock victims. Treat victims *very* gently and whenever possible, lift them from the water in a horizontal position rather than with a vertical lift to prevent cold blood

pooling in the legs. Transport them horizontally to a medical centre. Treat victims gently and as directed in section 9.9.3 Hypothermia.

Heat Escape Lessening Posture (HELP)

If you cannot get out of the water, assume the HELP position. This position preserves body heat in the chest, sides and groin areas. HELP is an acronym for the **H**eat **E**scape **L**essening **P**osture.



If you are alone



Huddle if you capsize with a group

Figure 17.2: Heat Escape Lessening Posture (HELP)

If you are alone, this position minimizes heat loss from the torso area. You must be wearing a PFD. Try to wear a hat to minimize heat loss from your head.

1. Cross your arms tightly across your chest.
2. Draw your knees up close to your chest.
3. Stay still. Do not expend energy by moving around.

If you capsize with a group, huddle together to minimize heat loss. Remember that you must all be wearing PFDs.

1. Form a circle facing inward so that your chests are close.
2. Place your arms around the back of each person next to you.
3. Intertwine your legs.

17.13 Resources

The Prospectors & Developers Association of Canada (PDAC) thanks the following for granting permission to include material from their publications.

Dr. Gordon G. Giesbrecht
Transport Canada

Their permission does not imply that they endorse the PDAC Health and Safety Guidelines. The PDAC is solely responsible for the content of these Health and Safety Guidelines.

Books

Getchell, David R. Sr. ed. (1994) *Outboard Boater's Handbook: Advanced Seamanship and Practical Skills*. International Marine.

Giesbrecht, Gordon G. Ph.D., Wilkerson, James. A. M.D. (2006) *Hypothermia Frostbite and Other Cold Injuries: Prevention, Survival, Rescue, and Treatment*. 2nd ed. The Mountaineers Books.

Health and Safety Committee. (2006) *Safety Guidelines for Mineral Exploration in Western Canada*. Fourth edition. Association for Mineral Exploration British Columbia. Also available at this website: <http://www.amebc.ca/documents/resources-and-publications/publications/current/safety%20guidelines-web.pdf>. Accessed November 5, 2009.

Kesselheim, Alan. (2001) *The Wilderness Paddler's Handbook*: McClelland and Stewart.

McKown, Doug. (1992) *Canoeing Safety and Rescue*: Rocky Mountain Books.

Internet Resources

Brooks, C. J. Dr. August 24, 2001. *Survival in Cold Waters*. Transport Canada, TP 13822 E. 2007. <http://www.tc.gc.ca/marinesafety/TP/TP13822/menu.htm>. Accessed November 5, 2009.

Canadian Coast Guard. Fisheries and Oceans Canada. *Radio Aids to Marine Navigation 2008*. http://www.ccg-gcc.gc.ca/eng/CCG/MCTS_Radio_Aids. Accessed November 5, 2009.

Canadian Hydrographic Service. Fisheries and Oceans Canada. *CHS Replaced and Withdrawn Charts*. http://www.chs.gc.ca/pub/en/products/canc_charts.asp. Accessed November 5, 2009.

Canadian Hydrographic Service. Fisheries and Oceans Canada. *Nautical Chart Products*. <http://www.charts.gc.ca/charts-cartes/index-eng.asp>. Accessed November 5, 2009.

Canadian Power and Sail Squadrons (CPSS). <http://www.cps-ecp.ca/>. Accessed November 5, 2009.

Canadian Red Cross. *Lifejacket Comparison Chart*. http://www.redcross.ca/cmslib/general/lifejacket_chart.pdf. Accessed November 5, 2009.

Cold Water Boot Camp. <http://www.coldwaterbootcamp.com/>. Accessed November 5, 2009.

Environment Canada. *Marine Weather for Canada*. http://www.weatheroffice.gc.ca/marine/index_e.html. Accessed November 5, 2009.

Environment Canada. Marine Weather Services. *Beaufort Wind Scale Table*. http://www.msc-smc.ec.gc.ca/weather/marine/beaufort_e.html. Accessed November 7, 2009.

National Oceanic and Atmospheric Administration. National Weather Service. *NOAA Weather Radio Marine Coverage*. <http://www.nws.noaa.gov/om/marine/marsame.htm>. Accessed November 5, 2009.

National Search and Rescue Secretariat. *Beacon Registration*. <http://www.canadianbeaconregistry.forces.gc.ca/>. Accessed November 5, 2009.

Pat's Boating in Canada. *VHF Marine Radio Working Channels*.
<http://boating.ncf.ca/vhfchannels.html>. Accessed November 5, 2008.

The Cook-Rees Memorial Fund For Water Search And Safety. *Performance*.
<http://www.wearalifejacket.com/perfchoice01.html>. Accessed November 5, 2009.

The Cook-Rees Memorial Fund For Water Search And Safety. *Protection: Cold Shock*.
<http://www.wearalifejacket.com/protcoldshock01.html>. Accessed November 5, 2009.

The Cook-Rees Memorial Fund For Water Search And Safety. *Research*.
<http://www.wearalifejacket.com/rescoldwater01.html>. Accessed November 5, 2009.

Transport Canada. *Approved Training Courses*. TP 10655 E.
<http://www.tc.gc.ca/MarineSafety/TP/TP10655/menu.htm>. Accessed November 5, 2009.

Transport Canada. *Canada Shipping Act 2001- 2007 Entry into Force: What you should know –*.
TP 13813. <http://www.tc.gc.ca/marinesafety/TP/TP13813/booklet/menu.htm>. Accessed November
5, 2009.

Transport Canada. Office of Boating Safety. *Equipment*.
<http://www.tc.gc.ca/marinesafety/debs/obs/equipment/menu.htm>. Accessed November 5, 2009.

Transport Canada. Office of Boating Safety. *Lifejackets & PFDs*.
<http://www.tc.gc.ca/marinesafety/debs/obs/equipment/lifejackets/menu.htm>. Accessed November
5, 2009.

Transport Canada. Office of Boating Safety. *PCOC Courses & Testing Course Providers
Database*. <http://www.tc.gc.ca/marinesafety/debs/obs/courses/pcoc/menu.htm>. Accessed
November 5, 2009.

Transport Canada. Office of Boating Safety. *Required by Size & Type*.
<http://www.tc.gc.ca/marinesafety/debs/obs/equipment/size/menu.htm>. Accessed November 5,
2009.

Transport Canada. Office of Boating Safety. *Rescue / Distress*.
<http://www.tc.gc.ca/marinesafety/debs/obs/equipment/rescue/menu.htm#DistressFlares>.
Accessed November 5, 2009.

Transport Canada. Office of Boating Safety. *Safe Boating Guide - TP 511*.
<http://www.tc.gc.ca/marinesafety/tp/tp511/menu.htm>. Accessed November 5, 2009.

Transport Canada Ship Safety Bulletins. *Subject: Automotive Parts Dangerous in a Marine
Environment*. <http://www.tc.gc.ca/MarineSafety/bulletins/2006/03-eng.htm>. Accessed November
5, 2009.

Transport Canada. *Small Commercial Vessel Safety Guide* TP 14070 E.
<http://www.tc.gc.ca/publications/EN/TP14070/PDF/HR/TP14070E.PDF>. Accessed November 5,
2009.

Transport Canada. Transportation of Dangerous Goods. *Guidelines for Training Criteria*.
<http://www.tc.gc.ca/tdg/publications/CLAdvisory/ADVOL1Enew.htm>. Accessed November 5,
2009.

Transport Canada. Transportation of Dangerous Goods. *Organizations Providing Dangerous Goods Training*. <http://wwwapps.tc.gc.ca/saf-sec-sur/3/train-form/search-eng.aspx>. Accessed November 5, 2009.

Transport Canada. Transportation of Dangerous Goods. *The Transportation of Dangerous Goods Directorate: Who we are*. <http://www.tc.gc.ca/tdg/who.htm>. Accessed November 5, 2009.