

**U.S. Department of the Interior**  
**Non-Motorized Moving Water**  
**Operator Orientation Course**  
Version (v2012-02-24)



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DAY 1 – CLASSROOM

## **NON-MOTORIZED MOVING WATER MODULE**

### ***1. Background***

The Non-Motorized Moving Water Module outline is designed to enhance the current Department of Interior (DOI) Boating Safety Program. This program consists primarily of the Motorboat Operators Certification Course (MOCC), MOCC for Instructors (MOICC), Airboat Operation Module, Open Water Module and the River Module.

The DOI Watercraft Safety Group recognizes the significant amount of non-motorized watercraft use occurring and supports the adoption of this non-motorized boating module for use by all DOI bureaus. The goal of this module is to provide introductory guidance and orientation to field staff on the appropriate use and hazards involved in using non-motorized watercraft (rafts, IK's, kayaks, canoes, drift boats etc.) primarily in moving water situations.

### ***2. Course overview***

The non-motorized module is divided into 4 hours of classroom instruction and 8 hours in the field with a maximum of 6 students per instructor. Optimally, this will be instructed over a two day period.

This course is not intended to be a substitute for a certified Swift Water Rescue course or the need to develop additional skills for running rivers. This course will teach you how to recognize and, with practice, skillfully avoid boating hazards.

Any suggestions for improving the course are welcome. Please contact Jake Schlapfer BLM- Anchorage District Office-Alaska, 4700 BLM Road, Anchorage, Alaska 99507. (907-267-1281) ([Jake\\_Schlapfer@blm.gov](mailto:Jake_Schlapfer@blm.gov)).

### ***3. Objectives:***

- a. Understand watercraft reactions to various forces of flowing water.
- b. Comprehend general rules for running rivers.
- c. Determine if a section of moving water is safe to run.
- d. Determine the best watercraft type, application and maintenance requirements.
- e. Execute common maneuvers in watercraft on moving water.
- f. Avoid common problems and identify hazardous situations.

#### **4. What this course is:**

An introductory-level course on safe operation and maintenance of non-motorized boats.

#### **5. What this course is not:**

It's not a course about running whitewater, although there is some information on whitewater included. It's not a course about river rescue, although some basic information on this topic is covered. Using non-motorized watercraft may be an important component of your job. If so, additional training may be necessary to perform your job safely such as a swift water rescue course and advanced levels of first aid training.

For more information regarding available watercraft training and general watercraft safety contact your state watercraft safety specialist. Information is available through the DOI safety net website at:

<http://www.doi.gov/safetynet/index.html>

#### **6. Moving Water**

- a. **Moving Water** – Refers to rivers, creeks, deltas, streams, tailraces, bayous, canals, etc. In short, it is any water that has current. However, for simplicity the terms “river” and “moving water” are often used interchangeably.
- b. **Water flow** – Commonly measured in cubic feet-per-second (cfs). It is the volume of water running through a channel. Water velocity is the speed the water is traveling.

#### **7. River Channel Characteristics**

- a. **General channel** – Deepest part of river bed, also generally defines thalweg.
- b. **Thalweg** – The deepest part of the channel, generally in the middle of the waterway.
- c. **Straight** – There is an even depth across the entire channel. Thalweg is often difficult to distinguish.
- d. **Meandering** – A winding waterway. Fastest & deepest on the outside of a turn
- e. **Braided** – Many similar sized channels. Difficult to choose best route
- f. **Entrenched** – Confined channel often containing rapids
- g. **Width** – How wide the channel is. Greater width decreases power but often adds complexity

- h. **Gradient** – Amount of drop in river elevation. Steeper gradient increases velocity thus increases power.

### 8. River Features and Hazard Definitions

- a. **Laminar Flow** – Main direction and energy of the current flow.
- b. **Helical Flow** – Flow that is disturbed by substrate (bottom) or banks of river. Flow is slowed down and tends to churn in a helical fashion downstream.
- c. **Current Vector** – Determined by direction of the laminar flow. It does not always correlate with the river banks. This is critical to understand when figuring out ferry angles.
- d. **Pools** – Slow, flat surface, deep. Difficult to detect submerged hazards.
- e. **Runs (glides)** – Mild elevation change, intermediate velocity, smooth surface, even depth, or gradual decrease.
- f. **Riffles** – Associated with elevation change, higher velocity, rough but consistent surface, rough but consistent depth, some air entrainment.
- g. **Rapids** – Increased elevation change, high velocity, rough and inconsistent surface and depth, considerable air entrainment. Usually contains large rocks.
- h. **Tongues** – The V-shaped (downstream V) segment of river that occurs between two constricting objects. Usually indicates deepest, cleanest route through a section. The upstream “v” indicates an obstruction under the water.
- i. **Eddies** – Eddies occur where water is forced to go around an object rather than over it. In order to fill the low pressure void located directly behind the object, water is drawn upstream. Depending upon size they can offer places to stop, scout, rest, or perform a rescue.
- j. **Eddy fences** – This is the demarcation line between the laminar flow and the eddy. It is easy to see and can present a hazard if large enough. It can be higher than the eddy itself, making it difficult to cross.



- k. **Hydraulics** – Also known as a “keeper”, “stopper” or “Maytag”. A result of water pouring over an object whether natural (rock) or manmade (low head dam) where a depression in the water level exists. This water is then filled by surrounding water higher than the level of the depression. This action can trap debris, boats and victims. This water can become very aerated, making escape difficult.
- l. **Standing waves** – Large, usually symmetrical waves in deep water caused by a major constriction in the river channel.
- m. **Pillows or cushions** – Lifting water found on the upstream side of obstacles, like a rock. Can be strong enough to ward debris and even watercraft from impact.
- n. **Undercut banks** – Current is usually strong and deep, be aware that debris may be lodged at angles.
- o. **Strainers** – A fallen tree or debris in water (major part under water) that lets water pass through it but not a solid object.
- p. **Sweepers** – A tree, log or other obstruction extending out over the water, likely partially submerged, which can catch the boat or knock a passenger out.

## ***9. Moving Water Classifications***

The combination of all these features, including flow and gradient, determines the difficulty of a river. The scale used to determine river difficulty is called the International Scale of River Difficulty.

### **International Scale of River Difficulty**

***Class I*** Moving water up to small waves, passages clear, no serious obstacles.

***Class II*** Medium sized regular waves, passages clear, some maneuvering may be required.

***Class III*** Waves numerous and irregular, rocks, eddies, narrow passages, scouting and maneuvering required.

***Class IV*** Powerful, irregular waves, boiling eddies, dangerous rocks, congested passages; precise maneuvering required, scouting mandatory.

***Class V*** Exceedingly difficult, violent rapids, often following each other without interruption, big drops, and violent current, scouting mandatory but often difficult.

***Class VI*** Limit of navigability, generally considered impossible to run.

Be aware that there can be inconsistencies in classification. The perceived difficulty of a rapid or river varies among individuals. Some boaters base classification on the potential risk of a swim while others base classification on the difficulty of navigability. Perception of difficulty also varies geographically. Classification of rivers in some areas may be higher due to the coldness of the water, the changes in flows, as well remoteness. A rapid could be a class II in low water or a class IV in high water and changes may occur daily due to rain events, etc.

## **10. Trip Planning:**

### **Prior to any float trip:**

- a. File a float plan (see Appendix A-2)
- b. Consult your "Checklist" (see Appendix A-3)
- c. Identify trip leader – This person has final say- and each boat has a captain
- d. Explain crew expectations/requirements/limitations/special concerns (medical)
- e. Explain safety equipment and emergency procedures. Provide examples. Describe what you are going to scout, how, where, and when.
- f. Check the weather forecast and water levels
- g. Communications – Why, When, and Where
- h. Shuttles – agree upon shuttle logistics prior to launch.

### **Consult the following sources:**

- a. Maps, charts and brochures - These are available for some of the larger, frequently used waterways. Contact the local managing agency to see if detailed river maps are available.
- b. Books/river guides – These are often available for commonly used waters.
- c. Experienced people - In this day and age, if a river can be run, it has been. Arrange to have an experienced person go with you or your party on your first trip down a new stretch of water.
- d. USGS stream gages - Know the river characteristics at certain stages or flow rates. Current flow data can be found at: <http://waterdata.usgs.gov/nwis/>

## **Trailer/Unloading**

- a. Before using a trailer to haul a boat, you must be comfortable with trailer backing and towing. Be aware that the length of a trailer affects maneuverability (turning radius and pivot sensitivity).
- b. If you are hauling a raft/canoe(s) on a trailer, make sure trailer is well maintained.
- c. Check rear view mirrors constantly while in transit.
- d. Know your trailer (how much to submerge). Sealed wheel bearings are best if you need to go in as far as the trailer hubs. Do not use a trailer that floats.
- e. Boat and gear should be tied down and stored, but before final backing release the boat.
- f. Always use a spotter when backing.
- g. Angle trailer into water with the stern downstream if possible (this will allow boat to slide off trailer smoothly without twisting or pinching).
- h. When loading and unloading, vehicle windows should be down to facilitate communication with the spotter, trailer wiring unplugged, and seat belt off.
- i. Always have a spotter when backing.
- j. Have your boat set up and ready to go before backing onto the ramp.
- k. Do not block the ramp with a boat not ready to go. When loading, finish securing the boat away from ramp.
- l. Communicate with other people waiting to launch, help them if appropriate. Be Patient!

## **12. River Navigation:**

- a. **Reading the water** – Navigation based on what you see while you are floating is a skill that takes time, training and experience to watch for changes in water color and texture indicators. Polarized glasses are helpful.
- b. **Map Reading** – A good river map is critical in trip planning and preparing for obstacles.
- c. **Memorizing routes** – You will become familiar with a river's characteristics once you have run the stretch using maps and reading the water. This method is common, quick and easy, but has limitations. For example: Water clarity and flows can change, making the route you memorized unidentifiable. Rockslides, logjams, and other obstructions may be in the river that were not there the last time you floated this particular stretch of river.

### 13. On the Water Techniques:

- a. **Approaching and leaving shore** – Consider boat construction type (can you drag it without damage?), weight and size, amount of gear, water depth, substrate type, load distribution and current speed. All of these factors affect the ease of landing and takeoff and the wear and tear on the boat.



- b. **Ferrying** – Point upstream portion (stern) of boat 45 degrees toward the shore. This same theory applies to a swimmer, head towards where you want to go and the current will help you get there.

- c. **Avoiding Obstacles** – Point the bow of the boat to the shore or object you wish to avoid and pull away (back stroke) with paddle or oar strokes. You are much stronger at pulling the oars than pushing them. In short, face your danger and pull away from it when maneuvering your boat.

- d. **Eddies** – Use for resting, scouting, etc. Eddies represent different laminar flows. The velocity is slower or can cause reverse flow compared to the main laminar flow. Eddies can help you to rest or even pull ashore, but also may cause differences in oar strokes, especially if one oar is in the main current and the other is in the eddy. Anticipate the often opposing forces, such as the eddy fence.

- e. **Waves** – Weight distribution is critical to negotiating larger waves. Typically, it is best to have the most weight on the downstream side of the watercraft.

- f. **High siding** – When the watercraft is at risk of flipping, such as broad siding a boulder, everyone in the boat needs to shift to the side of the boat which is rising (the high side).

- g. **Scouting difficult sections** – Before entering rapids or a potentially dangerous situation, it is critical to stop in a safe location or eddy above the hazard to scout it out. In some cases, it may be difficult to find a place to pull over or eddy out. When in doubt, scout it out!



- h. **Use navigation markers** – Some of the larger waters have navigation markers (e.g., the Columbia and Snake rivers in the Pacific Northwest). Although primarily designed for power boats, all navigation markers should be recognized. Special attention should be given to markers on non-motorized streams. These often indicate hazards that are about to be

encountered. They are not common in typical white water rivers, and are used more often for large boats with a deep draft in deep channel situations.

- i. **Sketch tricky routes** – Keep a notepad on board, and sketch a route after successfully running it. Note river flow/levels. Some rivers have guide books, however, be aware of their limitations (generally associated with flows). Also, be aware that obstacles can change after major storm events, including rock slides, debris flows, etc.

#### **14. Rules for Running and Reading Rivers**

**Note: There are exceptions to all of the following rules!**

- a. **Center** – channel rule: In the absence of clues, the center channel is usually the safest place to be. Exceptions to this may be large rivers that make the center channel difficult to exit.
- b. **Outside** – bend rule: The outside of a bend is normally deeper than the inside of a bend. Keep in mind that this will also contain the largest volume of fast moving water, potentially producing powerful water close to the river bank.
- c. **Chop (wave) rule** – The larger (taller) the chop or waves, the deeper the water.
- d. **The bubble line rule** – In slow rivers, bubbles and foam will often follow the deepest part of the channel (thalweg).
- e. **Tongue rule** – Look and aim for a “V” shape on the water surface (with the point of the “V” pointing downstream). This gives you an indication where most of the water is flowing. It can usually be found at the top of a rapid. On the other hand, stay clear of a “V” that points upstream. This can indicate some sort of obstruction under the surface.
- f. **Standing-wave rule** – If the distance between large wave crests is about the same as the length of your boat, don’t go there. The risk here is that the boat could potentially flip. Must be prepared to high-side.
- g. **Shoreline rule** – Pay attention to the shoreline characteristics as it will likely reflect what is under the water. For example, if you see large boulders or bedrock outcrops strewn inconsistently across the shoreline, expect the same underwater.
- h. **Dam rule** – Don’t assume the river bottom will be normal around dams, bridges, pump houses, or any other human made structures near a river. There may be man-made obstructions just below the surface such as rebar or wire.
- i. **Escape rule** – Always plan an escape route. Ask yourself questions like, “what would I do if the boat flips and I lose gear and passengers, etc.. Always have a backup plan.
- j. **Green rule** – The safest route is usually where you see the greenest water. This indicates the deepest part of the channel with often the least amount of obstructions.

- k. **Right-of-way rule** – Non-motorized boats have the right-of-way, but boat captains should allow room for a motorized craft when you hear one coming, especially those traveling downstream where their maneuverability is limited. Remember: You can hear a motor boat coming but they cannot hear you.
- l. **SAFE rule** – Scout, Analyze, Formulate, and Execute. Use these four steps before running any whitewater rapid. Once you make a decision on which way to run the rapid, do not change your mind once you are into it.

### **15. Environmental & Personal Considerations**

- a. Flow levels (both regulated and unregulated rivers) – Check flows regularly as they can change drastically in a short time. High water may be very pushy with lots of debris while lower water may expose hazards you have never seen. Again, keep track of flow levels during your trips.
- b. Day length and light – Keep in mind, your ability to read water will diminish well before dark. Know when the sunrise and sunset will be to better plan your day. Low sun angles (winter) can cause poor visibility.
- c. Weather/water conditions:
  - i. Multiple day trips – Have clothing for all possible weather conditions.
  - ii. Temperature - Changes will make proportional changes in air pressure for inflatable boats.
  - iii. Fog - Remember that fog can often be denser over moving water
  - iv. Snow – Snow can limit visibility, and adds weight
  - v. Debris – Debris can be damaging and dangerous especially when partially submerged.
  - vi. Turbidity - Extremely turbid water can make the river hard to read.
- d. Personal Considerations:
  - i. Sunglasses (preferably polarized) - Glare from the water or boat parts can be blinding and polarized glasses can remove most of that glare.
  - ii. Brimmed Hat – Brimmed hats help with glare and protect the skin from UV rays and other weather conditions such as rain and snow.
  - iii. Fatigue - Be keenly aware of fatigue near the end of a long day. You may lose a powerful oar stroke when you need it most. Many accidents are attributed to fatigue.
  - iv. General Health – Make sure you are physically fit and in good health. You do not want to become a burden for someone else.

## 16. Boat Operation

**Remember:** Make safe and sensible decisions and know your own limitations

- a. **Running rapids** – Whether you can safely run a rapid or negotiate a hazard safely is based on the following:
  - i. Water depth/velocity
  - ii. Air entrainment
  - iii. Technical difficulty (Class level)
  - iv. Boat size/type
  - v. Boat load (be aware of additional water you may take on in a non self-bailing boats in a white water situation)
  - vi. Skill
  - vii. Water/air temperature
  
- b. **On-water interactions** – In many areas, there is a conflict between rafters and motorized watercraft users. This is partially because some people don't understand what the characteristics or hazards each watercraft has to consider. For example, a jet boat may expect a raft to be more maneuverable than it is and should be able to move out of the jet boat's way. They may also be long standing cultural or historical use patterns on certain stretches of rivers. Be aware of these uses and the sentiment attached to them.
  
- c. **Weight and Distribution Considerations:**
  - i. Know the weight capacity of your boat.
  - ii. Keep the center of gravity low.
  - iii. Keep the boat balance characteristics.
  - iv. Leave room for passengers.
  - v. Store and organize gear.
  - vi. Protect boat and passengers from loose gear.

## 17. Reasons Why Bad Things Happen On A River

- a. **Inexperience** – Attempting sections above your skill level.
  
- b. **Complacency** – Losing sight of the risks involved.
  
- c. **Accidents** – They do happen.
  
- d. **Fooling around** – Use good judgment.
  
- e. **Fatigue** – Know when it's time to quit for the day.



- f. **Poor communication** – Make sure everyone knows their responsibilities.
- g. **Lack of preparation** – Make sure you are prepared knowledge of the water.
- h. **Poor or inadequate equipment** – Carefully examine your equipment before the trip and replace damaged equipment before you go.
- i. **Mother Nature** – Know the weather forecast and predicted water level changes.

### **18. If You Go Overboard:**

- a. **Defensive swimming** - Keep your feet up and in front of you pointed downstream. Use the current (ferry angle) and backstroke to eddy out or get to shore.
- b. **Aggressive swimming** – Actively swimming, usually toward an eddy, raft, throw line, or other form of safety. If the water is deep enough, rolling over onto your stomach will allow a stronger stroke. Swimming pointed upstream allows you to ferry just as a boat would.
- c. **Hypothermia** – This is a lowering of the body core temperature. This can happen whenever a swimmer is immersed in cold water for any length of time or when cool air or spray hinder your ability to stay warm. Hypothermia can affect a person’s judgment and is life threatening in advanced stages. Signs of hypothermia are shivering vigorously, pale skin, confusion, clumsiness, and slurred speech. If a person has become hypothermic, remove wet clothes and get them into dry clothes, hat, and mittens immediately. Gently warm with a heat source such as a campfire, heat packs, or containerized warm water. If the victim is able, give warm, sweet, non-caffeinated liquids, snacks, and get the person moving. If the victim’s core temperature continues to drop they may become unconscious and possibly suffer cardiac arrest. At this stage, it is essential that the victim is evacuated and hospitalized as soon as possible.

***Note: it is no longer recommended to get the hypothermic individual into a sleeping bag with another person. This adds an element of danger to the rescuer as they too may lose their own body heat.***

### **19. Ten Absolutes of River Rescue:**

1. Always wear a PFD.
2. The priorities at the scene are always self-rescue first, the rescue and security of fellow teammates second, and the equipment last.
3. Always have a backup plan that is well understood by everyone.



4. Always deploy upstream spotters above the location of the rescue operation to warn or stop other boaters - ideally on both sides of the river.
5. Always have multiple downstream backups.
6. Always use the appropriate equipment for the job.
7. Never count on victims to help in their own rescue.
8. Never tie a rope around a rescuer and always use a downstream back-up.
9. Once the victim is contacted, never let go unless your own safety is at risk.
10. Never put your feet down if swept away and swimming. Always crawl out of the river.

**20. General List of Emergency Equipment:**

**Gear**

- a. Bail bucket/hand bilge pump(s)
- b. Repair kit – Have a dedicated repair box for each boat that is maintained complete with replacement parts, glue, and material as needed.
- c. Extra paddle/oar
- d. Air pump for inflatable boats
- e. Ropes to include: Bow and Stern lines, Flip lines, Throw bags
- f. Rescue rope/kit – Specifically for rescue. Obtain training on proper use.

**Safety**

- a. First Aid Kit – small kit on each boat and large kit on trip leaders boat
- b. Cell/satellite phone – Cell phones do not work in many remote locations.

***See Appendix A-3 for additional Emergency Equipment and Gear List suggestions***

## DAY 2 - IN THE FIELD

### BOAT ORIENTATION

1. **Fill out a float plan (See Appendix A-2)**
2. **Gear Packing (work as a team to set up boat, See Appendix A-3 for sample packing list)**
3. **First Aid List (See Appendix A-4 and verify as a team)**
4. **Boat Types (shore side discussion)**

**Inflatables** – Most inflatables are made of durable materials such as hypalon, neoprene, nitrulon, PVC, or other synthetics.

- a. **Rafts** – There are 2 types of set ups for rafts:

Paddle Raft: These rafts have no frame to support oars. They are propelled by a crew of several people (usually 4 to 8) paddling under the direction of a designated captain.

Oar Rafts: These rafts are set up with a frame that sits on top of the tubes. Oar rafts can carry more gear than non-frame rafts. The frame supports oarlocks for the oars, typically 9 to 14 feet long (depending on raft size). The frame also supports a variety of gear such as coolers and extra seats.

Standard floors or bucket boats are an option when white water is not a factor. Self-bailing floors are a better choice in white water as they allow water coming into the boat to drain.

- b. **Catarrafts** – These boats are built with two separate pontoons joined by a frame. They are designed for performance, agility and stability, whether transporting passengers and gear or sport boating. Catarrafts have less drag than a raft giving it better maneuverability and are also easier to get unstuck in sand and gravel bar situations. Catarrafts are a bit more affected by the wind because they ride higher in the water and have less surface contact with the water than a conventional raft. A frame is needed to unify the boat. Frames are built without a floor. Floors made from plywood or cargo mesh are available if desired. Consult your dealer.



- c. **Kayaks/Canoes** – From whitewater to sea kayaking, inflatable kayaks have become much better at their intended purpose, rivaling hardshell boats in performance. Some whitewater boats have become serious play boats while others are best suited for running big waters.



*Inflatable kayaks:* These boats offer more stability than hard shell kayaks and can fold down to fit in a small plane or helicopter. These boats are a bit easier for forgiving in white water than a hard shell kayak.

*Inflatable canoes:* Like the inflatable kayak, the inflatable canoe is durable and stable but can carry a larger load than the kayak. It can also fold down to fit in a small plane or helicopter.

*Note:* As a safety measure, most inflatable watercraft include a multiple chamber tube system. This system provides sustained, balanced flotation during emergency deflation situations where one or more chambers are damaged.

*Pack Rafts:* These small, portable inflatable boats are designed for a variety of water conditions including technical [whitewater](#) and ocean bays and fjords. A packraft is designed to be light enough to be carried for extended distances. It is typically used with collapsible paddles or lightweight oars. Most pack rafts weigh less than nine pounds (4 kg) and usually carry a single passenger. Most often they are paddled from a sitting position, although kneeling can be advantageous in some situations.



## Hard Shells

- a. **Kayaks/Canoes** – These take more experience to operate than their inflatable counterparts, especially in moving water. While not as stable as most inflatables, they are more sensitive to maneuvers and can generally turn and move much faster through the water. Typically, a double bladed paddle is used to propel these crafts.

### **Kayaks come in a number of sizes and types:**

- A whitewater kayak is usually short, anywhere from 8 to 12 feet, and does not have a noticeable keel.
- A creek boat is a kayak designed for descending steep, narrow and obstruction ridden creeks. Creek boats are shorter and have rounded up ends to reduce the chance of pinning and increase maneuverability.
- Play boats are designed to surf and spin on waves. Some make repeated rotations in a hole easier. The hull shape along with the



bow and stern are modified with surfing in mind.

- A sea kayak is a kayak designed for 1 or 2 people. These boats generally have a keel and a rudder to help stabilize and steer the boat.

Hard shell canoes take more experience to operate than inflatable canoes, especially in moving water. They are not as stable as most inflatables, are more sensitive to maneuvers and can generally move much faster. A canoe paddle is single bladed.

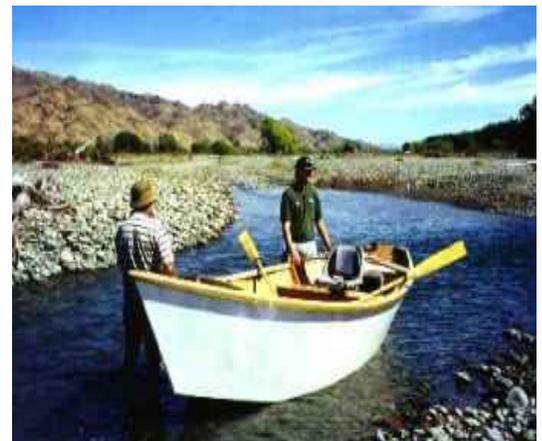


**There are also a variety of canoes:**

- C1 (1 person closed canoe): This boat is similar to a kayak. It is a closed boat with a cockpit in the middle. The difference is that the paddler kneels rather than sits, and uses a single bladed paddle rather than a double.
- C2 (2 person closed canoe): This boat has the same features as a C1 for 2 people. It is a closed craft with a gear storage cockpit in the middle. The paddlers kneel and use single bladed paddles. Coordination is necessary between the two paddlers for effective movement.
- OC1 (1 person open canoe): This is an open canoe that seats one person near the middle of the boat. The extra space in an open whitewater canoe is often filled with inflatable flotation bags that keep water from filling up the boat.
- OC2 (2 person open canoe): This boat is often called a tandem canoe and seats two people. A whitewater OC2 will also use flotation bags and may use thigh straps. Close coordination with your canoeing partner is key to the success of this watercraft.

Foldable Kayaks and canoes deserve mention as they have excellent application in the right environment. These are made of canvas or other flexible skins over a skeleton frame. The boats break down to fit into bags which are designed for easy transport. Durability is excellent, but care must be taken when handling the frames and many components of the system.

- b. **McKenzie Style Drift Boats**—The design of this boat utilizes the shape and style of the old wooden flat bottom boats used in the western states to float rivers and the whaler boats used on oceans (dories). The unique shape of the drift boat gives the rower more control of the boat's forward motion and the ability to slow it down if needed.



The boat is designed to generally accommodate groups up to 4, but some large (20ft.) drift boats can accommodate up to 6 people for the day. Due to the wide beam at the center of the boat, these boats are very stable and resist flipping. Boat lengths are commonly 14 to 17 feet. Some Drift boats have self bailing decks and are used in big waters such as the Colorado River.

- c. **Frames** –Raft frames hold the oars in place and provide stability for the raft. They also provide the oarsman with a place to sit, and a place to tie down gear. The type of frame you choose will depend on how you plan to use the raft. Most frames are adjustable to accommodate changing needs. Frames for both the cataraft and raft come in many different sizes to accommodate different uses. Larger frames carry more gear such as coolers and dry boxes and can allow additional seats to be mounted. Other components may include motor mounts or an anchor system. Frames can break down into pieces that will fit into a small plane or helicopter.

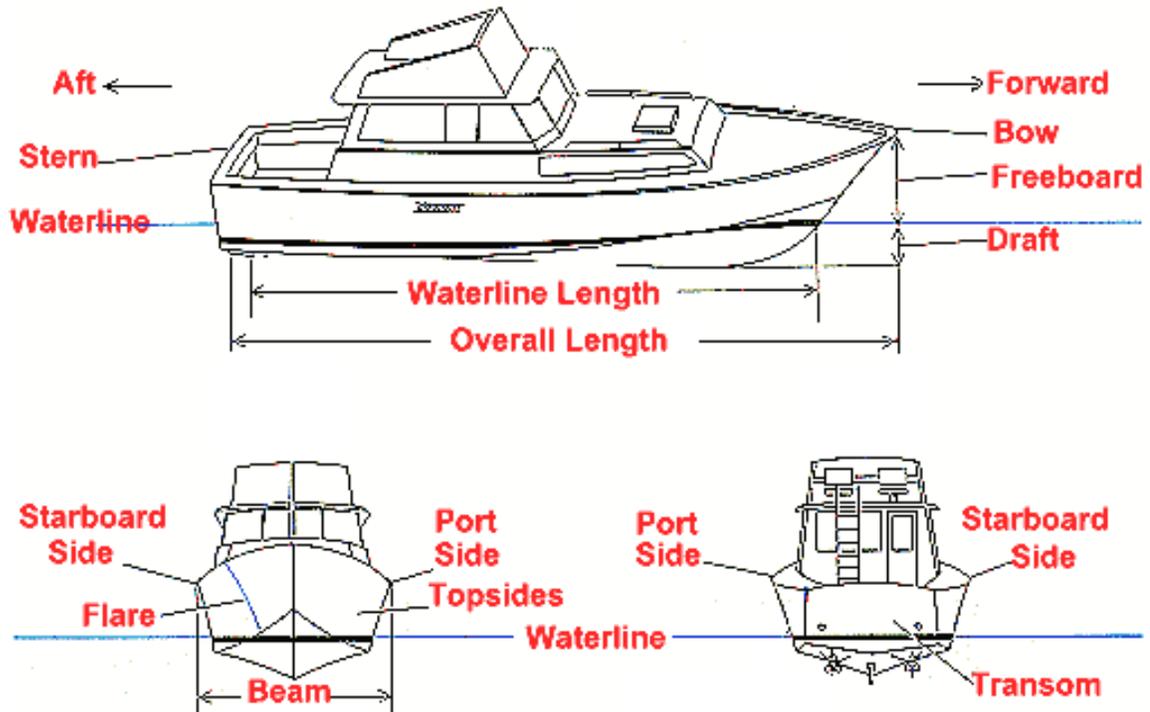


- d. **Oars and Paddles** – Either paddles or oars can power non-motorized watercraft. A paddle raft requires a team of paddlers, while an oared craft has one person powering the craft. Oar rigs require a frame. The type of power you choose depends on the type of trip you take and the type of water you will run. Oar lengths and attachment points vary with the size of the craft and personal preference. However, for general reference, a frame width of 54” would use an oar length of about 7.5 feet. A frame width of 72” would use an oar length of about 10’. Oars can also be purchased with shafts that break down into a number of pieces, which is good for transporting. Paddles can have one blade and a shaft as you would use with a canoe or can have two blades and a shaft like what you would typically use while kayaking.



## 5. Boat Orientation

Boats terminology is generally the same for all types of watercraft. Although different boats have specific parts most all watercraft have the same general components. Be sure to have a good understanding among all crew regarding the specific boat parts on your watercraft. This can be especially important during a rescue situation.



## 6. Boat Accessories

### Inflatables:

- Bow and stern lines – for tying your boat to shore
- Flip lines – give extra leverage to right a flipped boat usually 10' long – tied daisy chain or in a stuff bag.
- D-rings – gives you more options to tie and secure gear.
- Foot cups – for foot placement in big waves.
- Cargo nets – throw it over your gear to secure it while you float
- Cargo Floor – an option for a floor in your cataraft. Keeps your gear above the water level.

- g. Thigh strap – thigh straps for an inflatable kayak.
- h. Pumps – Hand, foot, electric, and bilge.
- i. Dry bags – keeps dry items such as clothing, camera's, etc.
- j. Carabineer – great for clipping in water bottles, dry bags, sandals, or other small essentials.

**Hard Shell (Canoe/Kayak):**

- a. Spray skirt
- b. Pads – seat, thigh, hip, heel
- c. Deck bag – straps to your kayak for extra storage
- d. Back band – used for additional back support
- e. Canoe floats – used for white water canoeing
- f. Canoe thigh straps

**Oars/Paddles:**

- a. Oar grips
- b. Shaft extenders
- c. Blade protectors
- d. Spare oar keeper
- e. Oar Locks, Rights, and Sleeves.
- f. Oar Pin and Clip set. A variation of securing the oar in place
- g. Oar Mounts
- h. Paddle drip ring. Prevents water from running down your paddle shaft.
- i. Counter balance weights

**7. Maintenance and Care** – Maintenance on all non-motorized boats can be classified into 5 different areas. In order of importance they are:

1. Transportation
2. Rigging

3. De-rigging
4. Storage
5. River Use

**Transportation:**

- a. When transporting an inflatable, make sure that it is free of mud and sand. If necessary pad potential wear spots with soft objects to minimize wear problems.
- b. It is a good idea to protect the inflatable tubes in a bag or big tarp.. Clear plastic sheeting, 6 millimeters thick (available at hardware and lumber stores) is excellent material for protecting boats from abrasion, but not from puncture.
- c. If trailering the boat, leave only as much gear on the boat as you can easily move the boat. If there are others waiting to use the boat ramp, do not tie your boat down while on the boat ramp. Move the vehicle and boat to a safe location off the boat ramp and tie down all equipment. Heavy equipment, such as coolers, can be stored on a watercraft while on the trailer (if you're using one).

**Rigging:**

- a. Inspect frame parts for any sharp metal, fiberglass, rough surfaces on the frame that can quickly rub a hole in a raft.
- b. When inflating air chambers. Inflate each chamber a little at a time. A rule of thumb when gauging proper pressure is to be able to push down a half inch with your thumb. This will indicate approx. 2.5 psi. Be aware that direct sunlight will increase psi of your boat (particularly boats made of hypalon material and dark colored craft).
- c. Avoid walking on tubes before they are inflated. This can cause rocks or other rough materials to wear holes in the tubes.
- d. When rigging hard shell watercraft be sure of your tie down points and pay attention to weight and balance including your passengers.

**Derigging:**

- a. Keep your group of boats together and to one side of the boat ramp if possible.
- b. De-rig (take gear apart) as quickly as possible to allow other boats the same opportunity.
- c. Make sure all gear is tied down securely before transporting. Wash as much of the mud and sand off boat as possible. Dirt can get into tube valves and damage them. Scan the area for sharp vegetation like goat head thorns and cactus. Cracks can develop on inflatable tubes that are rolled too tightly.

### **Storage:**

- a. When storing a boat, wash it off with soap and water to remove any trace of food particles or oils that may be left from the summer's use. Hungry rodents will eat flavored PVC and plastics.
- b. Allow boat to dry completely.
- c. Consider using an anti UV protectant prior to storage and re-rigging. These products act like sun screen for your boat. NEVER USE ARMORALL OR A SILICONE BASE PROTECTANT.
- d. Keep boats covered to protect them from the UV rays. Store inflatable boats partially inflated if possible. Warm up boats before inflating if the temperatures are below freezing.

### **River use:**

- a. During use, avoid parking watercraft in places where wave action against rocks and other hard objects could damage your tube or hull. Be aware of water level changes due to dam fluctuations or precipitation. Inspect the area where you are parked before pushing off to avoid damage from sharp rocks and sticks. It is advisable to pull a boat up on shore to minimize the wear.

## **8. Steering/Maneuvering**

### **Oarsman**

- a. Back Rowing
- b. Front Rowing (Portegee)
- c. Single Oar Turns
- d. Double Oar Turns
- e. Pulling into eddys
- f. Pulling out of eddys
- g. Tucking behind rocks
- h. Obstacle Assisted Turns
- i. Shipping (Tucking the blades against the side of the bow or stern when going through narrow or rocky channels or around obstacles).



## Paddlers

- a. Forward Stroke
- b. Back Stroke
- c. Sweep Stroke
- d. Draw Stroke/Pry Stroke
- e. Low Brace/High Brace



**Paddle Captain** – This person is in charge of keeping the raft on course by communicating with the paddlers and executing rudder strokes to keep the raft moving along a safe course and to change the ferry angle if necessary. (see above photo, Yellow Helmet). Utilizes all paddle strokes especially the turning strokes. It is essential that all paddlers work together. It is important to follow the stroke of the front paddler. This avoids hitting paddles and provides more power.

### Captain commands may include:

- a. Forward Paddle
- b. Back Paddle
- c. Left Turn
- d. Right Turn
- e. Stop (Drift)
- f. Dig in (paddle hard)
- g. Hold on
- h. will also indicate which side of the boat to initiate the stroke

**9. Throw bags** – A throw bag is a standard river rescue component that contains a length of rope stuffed loosely into a bag so it can pay out through the top when the bag is thrown to a swimmer. They need to be readily accessible and contain at least 75 feet of line. Throw bag rope is generally made of polypropylene so it floats and is highly visible to the swimmer and rescue team. The key to successful use of the throw bag is practice practice practice!



**10. Flip lines** – Flip lines are designed to aid in re-flipping an overturned raft. This activity is inherently dangerous and should only be performed by experienced or well-trained individuals. This training is available in a swift water rescue course.

## **11. Trip Leader Responsibilities:**

### **Before the trip:**

- a. Send out a gear list for overnight trips to participants ahead of time to make sure people will have the appropriate gear for the weather. See appendices A3.
- b. Suggest people who use prescription drugs have duplicate medication located in another waterproof location than their personal bag in case it gets wet.

### **Before launching on the river:**

- a. **ALWAYS**, always have a safety talk prior to launching on the river, especially if you have novices on the trip, or people who you have not boated with before as they may not use the same signals etc.
- b. Discuss and determine where all the rescue gear is located.
- c. Go over on-the-water signals.
- d. Determine who has Swift Water Rescue training, first aid training, etc.
- e. Determine if anyone on the trip has a medical condition. Know how to treat it if a situation arrives. Know where their medication is and how to administer it if this becomes necessary.
- f. Always put your most experienced boater in the lead, the second most experienced boater in the rear or sweep position. Locate your least experienced boaters somewhere in the middle. Kayaks and canoes move faster in the water than rafts, but may be useful in rescue situations. Smaller boats should be in the middle of the rafts, depending on experience.
- g. Discuss the objectives for the day so everyone knows the daily plan. Discussion can include: upcoming rapids and scouting options, interesting stopping locations such as archeological sites, possible lunch spots, possible camp spots, approximate float time before first stop, etc. These conversations will enhance group dynamics.

### **While on the River**

- a. Always keep the boat in the front of you and boat behind you in sight. Eddy out and wait for people if the group becomes separated.
- b. On a braided stream, let your most experienced boater lead. Stay close enough to be able to follow the lead boat. Always follow the braid that the lead boat takes. If the lead boater is not doing a good job reading the river, switch leaders.

## 12. Signals

**Whistles** – It is often impossible to hear people in other boats over the sounds of the river, particularly near rapids. Whistles can often overcome these peripheral sounds. It is best to keep whistles to a minimum.



- a. A single burst means: “look this way”
- b. A continuous or 3 burst whistle means: “someone is in serious trouble”.

**Hand Signals.** Go over hand signals with your group prior to launching boats so everyone is using the same signals. Hand signals may vary, but here are a few standards:

- a. **Point positive:** Always point in the direction you want to go, not to the obstacle
- b. **Eddy Out:** With upraised finger make circles in a level plane: Eddy out.
- c. **Stop:** Hand up, palm toward receiver in halt position-- alternating with pointing toward best stopping place: Stop where indicated.
- d. **Scout:** Flat, horizontal hand at brow, sometimes with slight forward and back motion: Scout. Usually combined with a stop signal and an indication of which bank on which to stop.
- e. **Are You OK?** With arm forming an O, repeatedly lift and tap finger tips on top to head or helmet: yell are you OK?
- f. **I’m OK:** Form an O with one arm with fingers touching top of head or helmet.



Appendix A-1

**RIVER MANEUVERS (Oarsman)**

Date: \_\_\_\_\_ Student: \_\_\_\_\_ Instructor: \_\_\_\_\_

River/Location: \_\_\_\_\_ Boat: \_\_\_\_\_

<b>Completed</b> 	<b>Maneuvers</b>	<b>Notes</b>
	In-current holding (keeping the boat parallel to shore)	
	180 turn In-current (left and right)	
	Ferrying slow/fast	
	Ferry into eddy	
	180 turn into eddy (left and right)	
	Eddy Turns and Peel Outs	
	Person retrieval	
	Return to shore	
	Towing	
	Trailing	

**RIVER MANEUVERS (Paddling)**

Date: \_\_\_\_\_ Student: \_\_\_\_\_ Instructor: \_\_\_\_\_

River/Location: \_\_\_\_\_ Boat: \_\_\_\_\_

<b>Completed</b> 	<b>Maneuvers</b>	<b>Notes</b>
	Back/Forward Stroke	
	Draw Stroke	
	Pry Stroke	
	In-current holding	
	180 turn In-current (left and right)	
	Ferrying slow/fast	
	Ferry into eddy	
	180 turn into eddy (left and right)	
	Eddy Turns and Peel Outs	
	Person retrieval	
	Return to shore	
	Towing	
	Trailing	

Appendix A-2

**Float Plan (Sample)**

1. KEY CONTACT (name) \_\_\_\_\_ (phone) \_\_\_\_\_

2. DESCRIPTION OF BOAT. TYPE \_\_\_\_\_ COLOR \_\_\_\_\_

TRIM COLOR \_\_\_\_\_ REGISTRATION NO. \_\_\_\_\_

LENGTH \_\_\_\_\_ NAME \_\_\_\_\_ MAKE \_\_\_\_\_

OTHER INFO. \_\_\_\_\_

3. NAME, AGE, ADDRESS & TELE. NO. OF ALL PEOPLE

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. TRIP EXPECTATIONS: LEAVE AT \_\_\_\_\_ (DATE/TIME)

FROM \_\_\_\_\_ GOING TO \_\_\_\_\_

RETURN BY \_\_\_\_\_ (TIME) AND IN NO EVENT LATER THAN \_\_\_\_\_

ANY OTHER PERTINENT INFO. \_\_\_\_\_

5. VEHICLE INFORMATION:

AUTOMOBILE LICENSE # \_\_\_\_\_ MAKE/TYPE \_\_\_\_\_

TRAILER LICENSE # \_\_\_\_\_ MAKE/TYPE \_\_\_\_\_

PARKED AT \_\_\_\_\_

6. IF NOT RETURNED BY \_\_\_\_\_ (TIME)

CALL THE COAST GUARD, TELEPHONE NUMBER \_\_\_\_\_

OR (LOCAL AUTHORITY) TELEPHONE NUMBER \_\_\_\_\_

## Appendix A-3

**RIVER TRIP GEAR PACKING LIST** – Your packing list may vary greatly depending on the circumstances you expect to encounter. The following list is only an example of items that you may consider. Consult an experienced person familiar with the river or environment you are likely to encounter to best outfit yourself.

### General

- Fill out a float plan, let person know that they are a trip follower
- Has a vehicle shuttle been set up?
- Prepare truck for trip: Oil, tire pressure, spare tire, tire jack, lug wrench, Fuel tank is full, washer fluid, remove trash, first aid.
- Trip objectives and maps for each person
- Firearm and ammunition
- Food (check office fridge and freezer)
- Camera
- Batteries
- Maps/ river guide book
- Working pencils pens and several permanent markers to give to miners
- Paperwork file with sufficient copies of all necessary forms.
- Radio, cell phone or SAT phone with extra batteries, frequency/channel list. (check to make sure it works).
- Copy of last year's trip report for the river section.
- Field Notebooks (one for each person)
- Bear Spray
- GPS Unit
- Matches (wind proof, in several different waterproof bags/containers, propane lighters.)
- Toilet paper in a bag with U-dig spade
- Human waste carry out system.
- Flashlight, headlamp

### Cooking Gear

- Cook Kit (Large and small pot. Coffee pot, handle, lids for each & Wok)
- Cook Stove (gas or Propane)
- Propane Tank (**Filled 100%**) and appropriate connections
- Cook stove, grill
- Spatula and utensils
- Water Filter (make sure to test)
- Aluminum Foil
- Scrubby, Dish Soap, Hand Sterilization
- Containers for leftovers
- Paper towels
- Cooler
- Fill Plastic Potable Water Cubes with water and Refreeze
- Screen for dish water

## **Boats**

- Rafts and frames (check to make sure frame parts are the right ones and tight with spare everything)
- Dry box
- Patch kits (open and look inside, is glue dried out? sand paper, instructions, spare valves)
- Paddles or oars (1 extra per boat, extra oarlock)
- Bilge pumps (1 per boat)
- Foot pumps (1 per raft)
- Throw bag (1 per boat)
- PFDs (1 Life Jacket for everyone)
- Straps (enough for strapping gear for trailering and for strapping in equipment/rowing frame)
- Cargo Nets

## **Other**

- Tarp, Bungee and Cord
- Garbage bags
- \_\_\_\_\_

## **Personal Items**

- Bandana/hankie
- book
- camera & film
- eating utensils (plate, cup, silverware)
- hat/visor
- jacket - wool/pile
- knife

- long underwear
- pants - minimum 2 pair (fleece)
- personal water bottle
- raingear - High quality - waterproof)
- rubber footwear
- shirts (long sleeve, short sleeve, T-shirts)
- shorts – quick dry
- Pants (1 warm, 1 quick dry)
- socks – wool
- sun block
- sunglasses
- sweater – wool
- tennis shoes
- sandals
- toiletries (toothbrush, soap, shampoo ...)
- towel
- underwear
- water container (6 gal)
- waterproof Bag
- sleeping pad/sleeping bag
- ice chest
- tent
- insect repellent
- work gloves
- binoculars (optional)

Appendix A-4

**First Aid Kits** – Different river adventures require different safety equipment. It is critical, also, that you are comfortable with all equipment and safety tools and first aid supplies you plan to carry with you. A Wilderness First Aid Course is the minimum recommended training. The following first aid kit is an example that contains items you may consider in your own kit.

<b>Kit Contents</b>			
<b>Qty</b>	<b>Medical Information</b>	<b>Qty</b>	<b>Essential Equipment</b>
1	Comprehensive Guide	1	CPR Microshield or one way valve kit
1	Life-Threatening Emergencies info	1	SAM® Splint
	<b>Wound Management Items</b>	1	Sawyer Extractor
1	20cc. Irrigation Syringe	1	Hypo. Thermometer 86F.-100F.
2	Povidone Iodine Sol.	1	Hyper. Thermometer 96F.-107F.
10	Wound Closure Strips	1	Shears/scissors
3	Tincture of Benzoin	1	Splinter Picker Forceps
6	Double Antibiotic Ointment		<b>Infectious Control Items</b>
6	Antiseptic Towelettes	4	Examination Gloves
	<b>Blister Items</b>	1	Antimicrobial Hand Wipes
1	Moleskin	1	Infectious Control Bag
1	Molefoam		<b>Medications</b>
	<b>Bandage Materials</b>	1	Aloe Vera Gel
16	4x4 or 3x3 or 2x2's	2	Oral Rehydration Salts
2	Eye Pad	12	Extra Strength Tylenol
2	Non-Adherent Sterile Dressing	12	Motrin
2	8x10 and/or 5x9 Trauma Pads	6	Antihistamine
1	Triangular Bandage	8	Mylanta
2	Conforming Gauze Bandage(2"or3")	8	Diamode (Immodium)
1	Elastic Bandage w/ Velcro (2"or3")	1	Glutose Paste
1	Adhesive Tape 10 yards	4	Cortisone Cream 1%
20	Strip & Knuckle Bandages	3	Sting Relief Pads
4	Cotton Tipped Applicators	3	Tinactin Anti-fungal Cream