

# A

## Common Sense Approach To Understanding Sea Kayak Design

### I. The Basics

- You are supporting an object in a liquid medium.
- You want to move this object along the dividing line between two mediums, one 800 times denser than the other.
- You want this object to be able to maintain its orientation with the plane dividing the two mediums.
- You want to move this object with the greatest possible efficiency and at times, with specific speed requirements.

### II. There are limits to how far you can go with each of these dimensional changes.

- Length adds skin friction
- Beam adds skin friction, wave making resistance and form drag.
- Adding free board adds windage.

*Thus every kayak design is based upon compromise*

The basic elements of sea kayak design.

- Size
- Length
- Fore and aft volume distribution
- Lateral volume distribution
- Fore and aft weight distributions
- Topsides shape
- Deck characteristics
- Cockpit
- Features

## Size

- Bigger boats carry more gear
- Smaller boats offer less resistance to wind and waves
- The choice may be between comfort on the water or comfort ashore and your preference between the pleasure in getting there and the pleasure in being there.

## Weight

- “The only place weight belongs is in a steam roller.”
- “If I can carry it I don’t want it in my boat”
- However, the decision as to whether it’s worth \$1000.00 to save ten pounds with Kevlar or other exotics is a good one that has no clear answer.
- Essentially, heavy is slow – light is fast and anything involved with moving mass consumes energy. Conservation of energy should be the concern of every sea kayaker – it extends the distance you can paddle and it increases your ability to handle rough conditions.

## Length

- Generally, longer boats are faster boats
- Shorter boats are slower boats

## V. Fore and aft volume distribution

- The fore and aft distribution is described by “prismatic coefficient”
- Boats with higher prismatics (volume carried toward the ends) have a higher potential speed, but require more horsepower to make that speed.
- You look for the boat that is most efficient at the speed you want to maintain as allowed by our available horsepower.

## VI. Lateral volume distribution

- General, wide boats are more stable, narrow boats are less stable.
- The important concern is the stability curve that illustrates how the “initial stability” compares with the “secondary stability.”
- Width at the gunnel enhances the ultimate stability and width at the waterline increases the initial stability.
- The paddler who is more proficient will want a boat that can be leaned with control.
- The boat that has low initial stability a high secondary stability may be the best compromise as it allows the boat to respond well to leans and still offers stability when it is most needed.
- Narrow boats allow for advance paddling techniques such as static braces and easier execution of advance rolling - (the Greenland types).

## VII. Fore & aft weight distribution

- While you may have difficulty determining how the manufacturer has distributed the weight in the boat- light ends provide a faster ride in waves, reduce paddling effort in waves and provide a drier ride in waves. You will have more to do with this by how you pack the boat - placing the lighter gear in the ends and the heavier gear near the middle - but it is an important factor in boat performance.

## VIII. Topsides shape

- Low topsides and a low bow in particular, lead to a wet boat.
- Flare foreword and /or a higher bow will keep water off the boat.
- Flare amidships will provide greater secondary stability.

## IX. Deck characteristics

- Crown to the deck will help shed water
- A low after deck will facilitate a layback roll and other advanced paddling techniques.

## X. Cockpit

- Small cockpits are favored by those who paddle in heavy conditions
- Small cockpits facilitate bracing & rolling
- Large cockpits are better suited to flat waters and are favored by beginners, large people, and paddlers who have launch site considerations. Getting into a boat from a pier and other odd launch sites is easier.

## XI. Features

### A. Rudders

1. Aren't intended to steer the boat – just control directional stability.
2. Cause a loss of speed when used through increased drag.
3. Tend to slow paddling skill development
4. Seldom provide solid foot braces
5. Are vulnerable to damage. A paddler who has not developed paddling skills while using a rudder can be in real trouble if the rudder fails in difficult condition.
6. Are the choice of flat water paddlers and paddlers who are less interested in skill development?

### B. Retractable skegs

1. Retain solid foot braces
2. Give a boat a multiple personality – maneuverable when desired and directionally stable when used.
3. Can be fine tuned to virtually eliminate the need for corrective strokes.
4. When retracted, skegs are all but invulnerable.

- C. There are boats that perform well without either but good paddling skills are needed to compensate, particularly in extreme conditions.
- D. Deck lines are a major safety feature for any conditions in which you may find yourself out of your boat.
- E. Bulkheads are virtually a must for anything other than the most benign condition paddling.
- F. Built in pumps are another major safety feature, but they should be properly installed with a strum box and should have good volume unless expected to simply recover minor amounts of water. Compare the GPM figures.
- G. The value of a built in compass is obvious.

## XII. An overview

- A. It isn't impractical to think of sea kayaks as you do automobiles.
  - How do we want it to perform?
  - How rugged must it be?
  - What is or will be our proficiency level?
  - Will we be paddling light or with a lot of gear?
  - And, how often? Don't buy a boat based on what we will do once or twice. How will we use it most of the time?
  - Think about it the way - do you want:
    - A sports car
    - A family sedan
    - A pickup truck
    - A touring machine
    - A Queen Mary
- B. Finally, you should always ask ourselves, "How will I look in this boat?" "Does it suit my self-image?" "Does it please my eye?" These questions may seem irrelevant, but you should like out boat and its appearance - that's important to being satisfied.

## Boat Factors

Wide beam at Gunnel - increased ultimate stability if waterline beam

*narrow*

Wide beam at water line - increases initial stability

Hard chine hull - generally increased stability

Low center of gravity - increased stability

High freeboard - increased secondary stability, reduced initial stability

Narrow beam - decreased stability

Semi - circular cross section - decrease initial stability

### *Directional Stability*

Narrow hull - increase

“V” ed cross section - increase

Deep Hull - generally an increase

Straight keel line - increase

Skeg - increase/decrease

Weight in ends - increase

Wide beam - decrease

Flat floor - decrease

Shallow hull - decrease

Swede form - decrease

Rockered profile - generally a decrease

Weight in middle - decrease

### *Speed & Efficiency*

Longer waterline length - increased speed potential

Semi-circular cross-section - increase in both

Straight keel line - increased speed

Narrow beam - increase in both

Fine bow - increases in both

Low weight - increase in both

Weight near center - increase

Short water line - increase in both

Wide, flat hull - decrease in both

Rockered hull - generally a decrease in speed, may aid in efficiency

Blunt bow - decrease in both

Blunt, rounded stern – decrease in both  
Weight in ends - decrease in both  
Rudders – decrease in speed, may be more efficient for the poor  
paddler.

## **XIV. SAFETY INFORMATION**

You now have christened your boat and found that it is seaworthy. Your thoughts turn to taking your first real trip. This is always a very exciting time. You plan the where your going, how many meals you'll need, the length of time and what kind of gear will be needed. A least half the fun is planning and preparing for a trip. I would like to welcome you to sea kayaking with a word of caution. Sea kayaking can be a safe and rewarding activity if common sense prevails and certain precautions are taken. Read up on a few sea-kayaking books about trip preparation before you go. Think about taking a class or two to improve your skills and to meet new sea kayaking friends. Always think about the safety of yourself and your partners. Below is a list of recommended items that will come in handy for each trip you go on? So before you put in for a day's paddle, check that you have the following items.

- ◆ Be prepared to solve your own problems. For example, pack the necessary supplies to make emergency boat repairs and have extra food in case your paddling schedule is delayed by poor weather.
- ◆ Whether paddling solo or in a group, have your techniques for self - and assisted rescues so well learned that you can do them under any conditions. The Eskimo roll is great for a quick recovery but should not be counted on. Be sure to practice alternative exit and re - entry techniques.
- ◆ Enhance your boating skills by taking courses by traveling with more experienced boaters who can share their knowledge.
- ◆ Do not paddle alone unless you are experienced and have your act week in hand regarding skill, physical condition, and mental preparedness. If you are traveling solo, leave yourself a wide margin of safety.
- ◆ The greatest single danger to sea kayakers is hypothermia. Like cotton, cold water kills. Dress appropriately and educate yourself about hypothermia.
- ◆ Get a marine weather forecast each day *before* you head out on the water.
- ◆ The United States Coast Guards and the Canadian Coast Guards recommends that all boaters file a float plan with someone. That person

should know where you are going and when you are due in port. If you make major changes to your plans during the trip, update you contact party.

- ◆ Always carry a compass when paddling and know how to use it. A deck-mounted compass will help you keep your bearing over long distances.
- ◆ Carry a VHF (Very High Frequency) radio aboard is a good idea but will not eliminate the need of any of the above. Keep in mind: electronics do not fare well in small open boats and may fail when you need them most. Small hand-held VHF radios (including weather radios) have a very limited range and work on line of sight. Do not expect to have pick up VHF channels (either sending or receiving) while on shore, because the land mass on which you are standing on by be blocking the signal. To reach a VHF channel, you may have to paddle a quarter mile offshore. The same limitations apply when traveling up a steep-sided inlet; you may have to completely leave the inlet to use your VHF radio.
- ◆ Always tie you boat when you go ashore even when it has been pulled well above the high tide line. A sudden squall can toss a lightweight boat right back into the water. As for beaching your boat “for just a minuet,” you may not realize how fast the tide rises until you turn to see your pride and joy drifting off to sea.
- ◆ Always carry a first aid kit. Know exactly what it contains and how to use it. Make sure that others in your group know where to find it. A full equipment checklist can be found at the back of the book.
- ◆ Do not try to keep to a tight schedule because going so may tempt you to take unnecessary chances. Relax and adjust your schedule to fit the weather and other circumstances. Better to hole up short of a goal than to risk your life and those of your companions.

Remember: Safety travel involves having not only the appropriate knowledge, also a healthy respect for the sea and an ability to expect the unexpected. These skills are gained through time on water (TOW) experience and by living according to the rules of the sea.



## V. SEA KAYAK EQUIPMENT CHECKLIST

- *Day Trip*

- Sea kayak -with deck lines, bowlines & grab toggles
- Paddle
- Spare Paddle
- Spray skirt
- Paddle leash
- Buoyancy bags for both ends (Optional if boat has bulkheads)
- PFD with whistle, knife and nose clip
- Capsize recovery gear (Paddle float, stirrup sling etc.)
- Bilge pump
- Sponge
- Compressed-air horn
- Deck compass
- Tide and current table, if needed
- Distress kit (see attached)
- Lunch and reserve food supply
- Hand bearing compass
- First aid Kit
- VHF radio transceiver (or at least weather band radio with instructions)
- Day Bag (in cockpit) (see attached)
- Larger dry bag (fleece top and pants, wind jacket, wind pants, socks, warm hat & gloves)
- Dry suit or wet suit
- Paddle jacket plus spare
- Wading footgear with liners
- Paddle gloves
- Waterproof watch
- Sun Hat
- Sunglasses
- Change of shoes with sandals (if extensive stay at destination anticipated)
- Water bottles
- Binoculars preferably waterproof
- Basic emergency shelter or hypothermia treatment-small tarp or light sleeping bag

- *night*

- Food, condiments and spices
- Repair Kit
- Epoxy putty
- Soft annealed wire
- Ground pad
- Toilet paper
- Towel
- Extra clothing (see attached)
- Day pack (for hiking)
- Water containers (size depending on water availability & climate min. 1 quart day)
- Fry pan
- Eating utensils (bowl, cup, knife, fork, & spoons.)
- Small thermos
- Fuel

- Fishing gear, license, filet knife, needle nose pliers.
- Log book and pen
- Permits
- Money
- Cockpit cover
- Tent with inside plastic liner
- Toilet articles (tooth brush, paste, hair brush, nail clippers, biodegradable soap, shampoo, hand lotion, razor, shave cream, Vaseline, deodorant, small shovel, toiler paper, small zip lock bags)
- First aid kit
- Miscellaneous gear bag (see attached)
- Hatchet and take apart buck saw
- Water filter
- Cook set strainer, windshield, pot lifter, spatula, large spoon, and whiskers.

• *Overnight/Extended Trip*

- Matches (plastic jar)
- Tarp and ties lines
- Clothes pins
- Weekend-level first-aid kit
- Stove
- Grill
- Headlamp
- Camp chair
- Clean clothes for return trip
- Leave float plan with responsible persons
- Dish scrubber & biodegradable soap (salt & fresh water kind)

• *Extended Trip*

- Global Position Satellite
- Shore survival kit for wilderness coasts (basic shelter, fire, food, and signaling items in compact case to be carried on your person)
- Repair kit for extensive boat damage
  - Fiberglass
- Resin and catalyst
- Cloth or mat
- Disposable rubber gloves
- Small vice-grip pliers with cutters
- Drill bits
- Duct tape
- Plastic wrap
- Tin foil
- Wooden Popsicle stick
  - General
- Sandpaper (50 grit & 200 grit wet /dry)
- Piece of hacksaw blade
- Silicon lubricant (avoid contact with fiberglass)
- Small vice-grip pliers with cutters
- Sealant for cloth seams
- Spare fastenings (bolts, nuts, & cotter pins as needed)

- ❑ Class B EPIRB for remote coasts where VHF coverage is poor
- ❑ Extended first-aid kit
- ❑ Sea anchor
- ❑ Barometer
- ❑ Extra alkaline battery pack for radio
- ❑ Leave float plan with responsible person
- ❑ Extended antenna for VHF radio
- ❑ Shower components
- ❑ Biodegradable soap (sea soap for salt water)
- ❑ Camp chair
- ❑ Clean clothes for return trip

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- *Extreme Cold Conditions*

- ❑ Dry suit
- ❑ Neoprene hood
- ❑ Warm footwear
- Pogies or neoprene gloves

- **Day Bag (in Cockpit)**

- |   |  |
|---|--|
| <input type="checkbox"/> Leatherman tool  | matches, handy wipes, caladryl,                |
| <input type="checkbox"/> Mini-mag flashlight with red lens  | water purification tablets &                   |
| <input type="checkbox"/> Sunscreen  | quarters)                                      |
| <input type="checkbox"/> Insect repellent   | <input type="checkbox"/> Waterproof flashlight |
| <input type="checkbox"/> Parachute cord   | <input type="checkbox"/> Spare Glasses & strap |
| <input type="checkbox"/> Mini first aid kit (aspirin,<br>Tylenol, space blanket, Band-<br>Aids, adhesive tape, waterproof | <input type="checkbox"/> Lip cream             |
|   | <input type="checkbox"/> Pack towel            |
|   | <input type="checkbox"/> Strobe light          |

- **Distress Kit (in cockpit)**

*Water bottle containing:*

- |  |  |
|--|--|
| <input type="checkbox"/> Duct tape     | <input type="checkbox"/> Water proof matches |
| <input type="checkbox"/> Fire starter  | <input type="checkbox"/> Flares              |
| <input type="checkbox"/> Light sticks  | <input type="checkbox"/> Smoke signal        |
| <input type="checkbox"/> Signal mirror | <input type="checkbox"/> Butane lighter      |

- ***Miscellaneous Gear Bag***

- |   |   |
|---|---|
| <input type="checkbox"/> Vinyl repair kit       | <input type="checkbox"/> Extra matches                          |
| <input type="checkbox"/> Spare candles          | <input type="checkbox"/> Thermometer                            |
| <input type="checkbox"/> Cockpit cover          | <input type="checkbox"/> Honing oil                             |
| <input type="checkbox"/> Hammock                | <input type="checkbox"/> Parachute cord                         |
| <input type="checkbox"/> Sewing kit             | <input type="checkbox"/> Candle lantern                         |
| <input type="checkbox"/> Soft Arkansas stove    | <input type="checkbox"/> Extra batteries (check size &<br>type) |
| <input type="checkbox"/> Extra insect repellent | <input type="checkbox"/> Hiking compass                         |
| <input type="checkbox"/> Spare light bulbs      | <input type="checkbox"/> Extra plastic bags                     |
| <input type="checkbox"/> Small camp shovel      |   |
| <input type="checkbox"/> Fire starter           |   |

- ***Extra Clothing***

- |   |  |
|---|--|
| <input type="checkbox"/> Underwear (two pairs)                | <input type="checkbox"/> Handkerchiefs |
| <input type="checkbox"/> T - Shirt                            | <input type="checkbox"/> Short (1)     |
| <input type="checkbox"/> Long sleeve shirt                    | <input type="checkbox"/> Swimsuit      |
| <input type="checkbox"/> Belt                                 |  |
| <input type="checkbox"/> Camp shoes                           |  |
| <input type="checkbox"/> Long underwear (no cotton 2<br>pair) |  |
| <input type="checkbox"/> Wool or polypro socks (2)            |  |