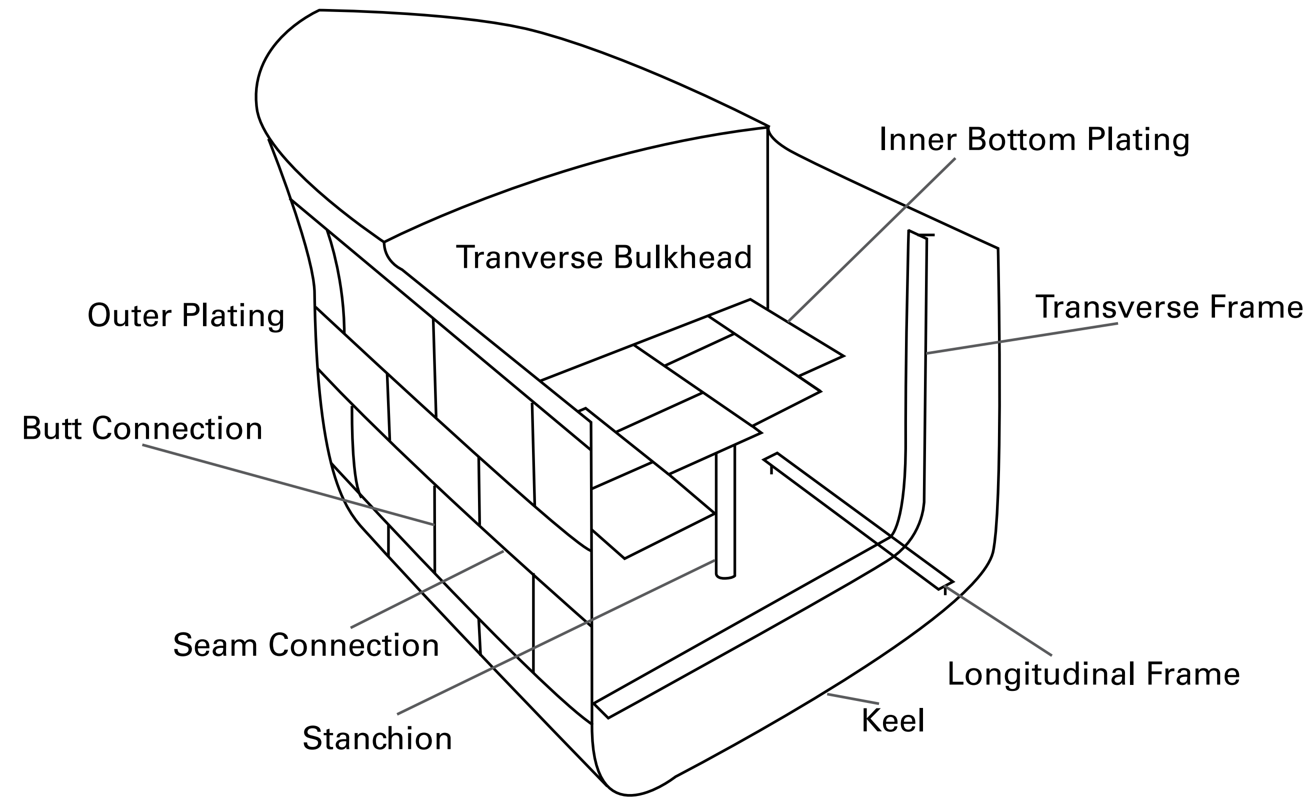
ConfidentCaptain oceanpros

DECK GENERAL

THE VESSEL

CONSTRUCTION OF A VESSEL

- "Skin": outermost boundary, includes
  - The Shell Plating: the outermost surface of the hull
  - Deck Plating: Planking



CONSTRUCTION OF A VESSEL

- Keel: "backbone" of the vessel
  - Draft is the lowest point of the keel.

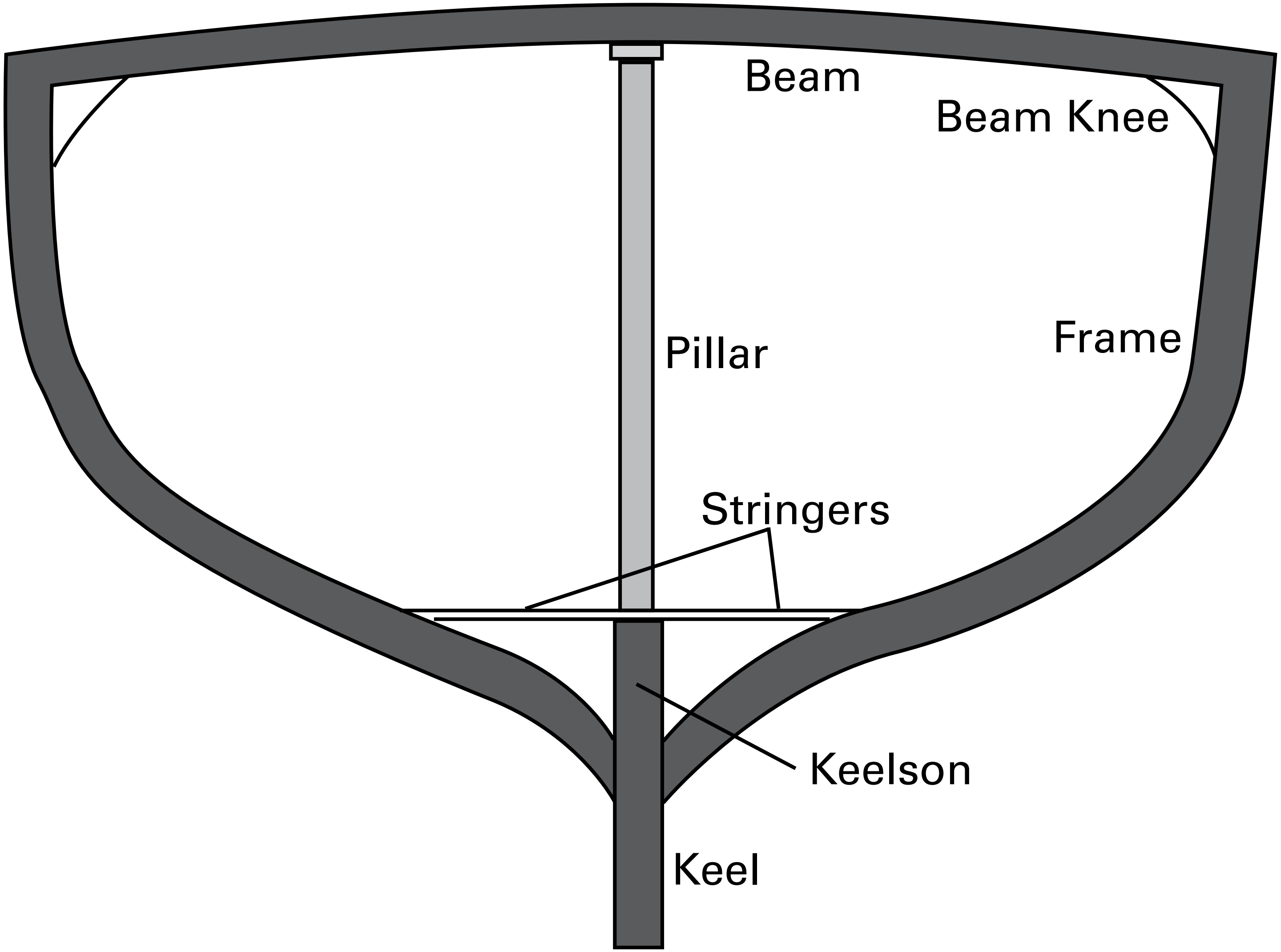
CONSTRUCTION OF A VESSEL

-Transverse Frames: “ribs” of the vessel

-These are attached to the keel and run horizontal up the vessel providing support and shape.

- Futtocks: curved parts of transverse frames attached from floor to top timbers

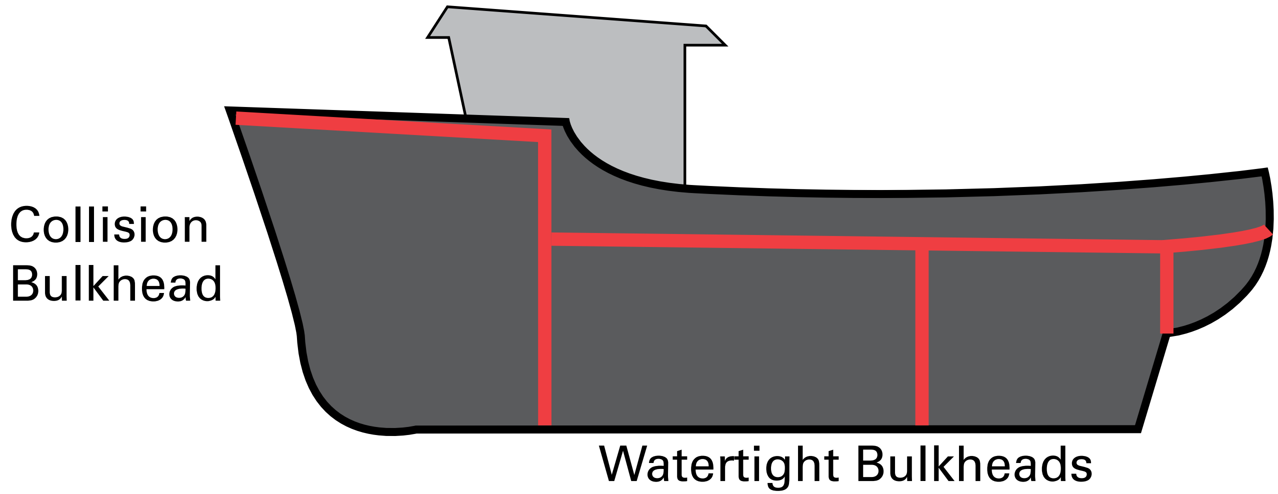
DECK GENERAL



BELOW THE DECK

- Bulkheads: a watertight wall, breaking the vessel into compartments

- Collision Bulkhead: must have a collision bulkhead to receive a certificate of inspection.



DECK GENERAL

BELOW THE DECK

- Double Bottom: two layers of watertight hull surface in the bottom of the vessel.

- Floors: The I-beams below the deck plates Sole: floor of boat in an enclosed portion

PROPELLER

- Stern Bearing: the support for the propeller shaft

- Stuffing Box: a watertight box in which the propeller shaft passes through

BELOW THE DECK

- Butt Joint: where two plates or planks meet vertically

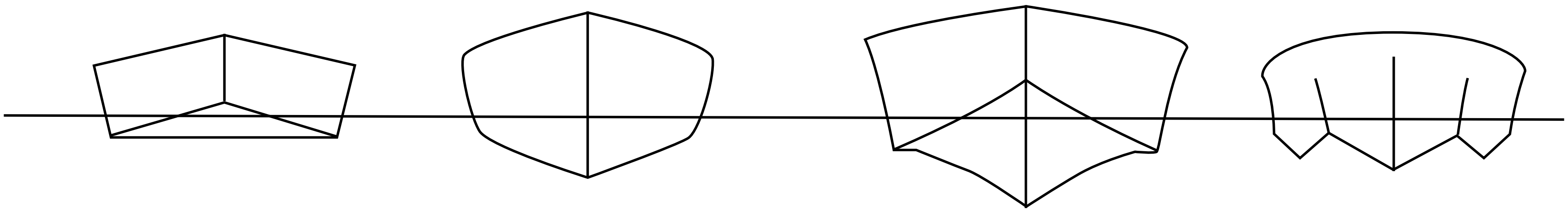
- Seam: where two plates or planks meet horizontally

FRAMING METHODS

- Transverse: usually used on shorter vessels
- Longitudinal: usually used on larger vessels; more stable

THE HULL

- Hull: The main body of the ship
  - Shapes include:
    - Flat Bottom
    - Round Bottom
    - Deep V Hull
    - Cathedral Hull



THE DECK

- Camber: slightly arched in order for water to easily drain

- Sheer: curvature of the deck from fore to aft.

- An upward curve is positive and downward is negative.

HULL TERMINOLOGY

- A complete list of terms can be found on page 150.

Give special attention to the following...

- Hawsepipe: the hole in bow for anchor chain to pass through
- Sagged: when the center of the vessel curves downward.
- Hogged: when stress is put on the keel causing the center of the vessel to curve upward.
- Stringers: usually lighter longitudinal strength beam used for reinforcement.

LOAD LINES AND PLIMSOLL MARK

- Plimsoll mark: safe-load mark

- Markings to label max. mean legal draft for voyage
    - Basically, they tell you when to stop loading.

LOAD LINES AND PLIMSOLL MARK

- Loadline symbols vary because different waters have different densities depending on salinity/temp.

- Warm water is less dense than cold water

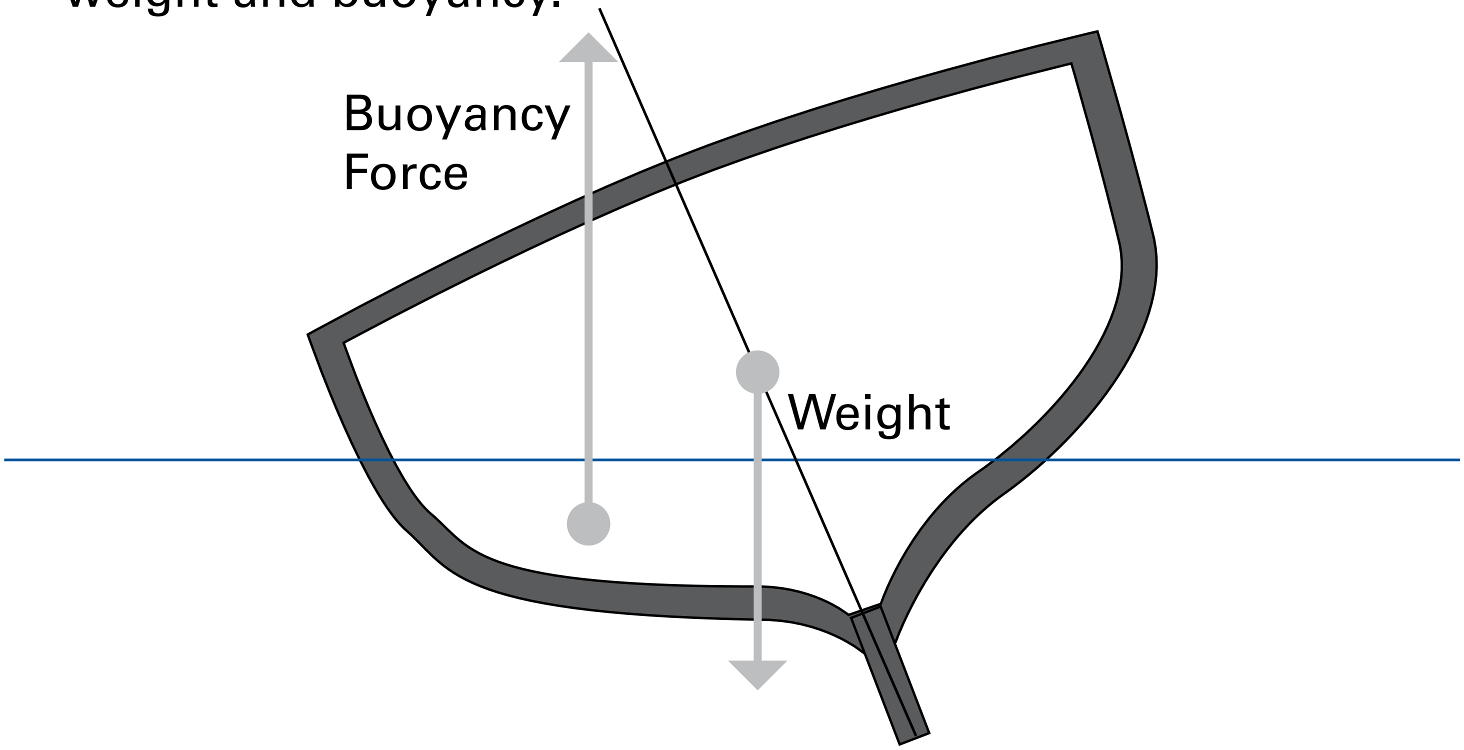
- Fresh water is less dense than

TF	Tropical Freshwater
F	Freshwater
T	Tropical
S	Summer
W	Winter
WNA	Winter North-Atlantic
AB	American Bureau of Ships

STABILITY OF THE VESSEL

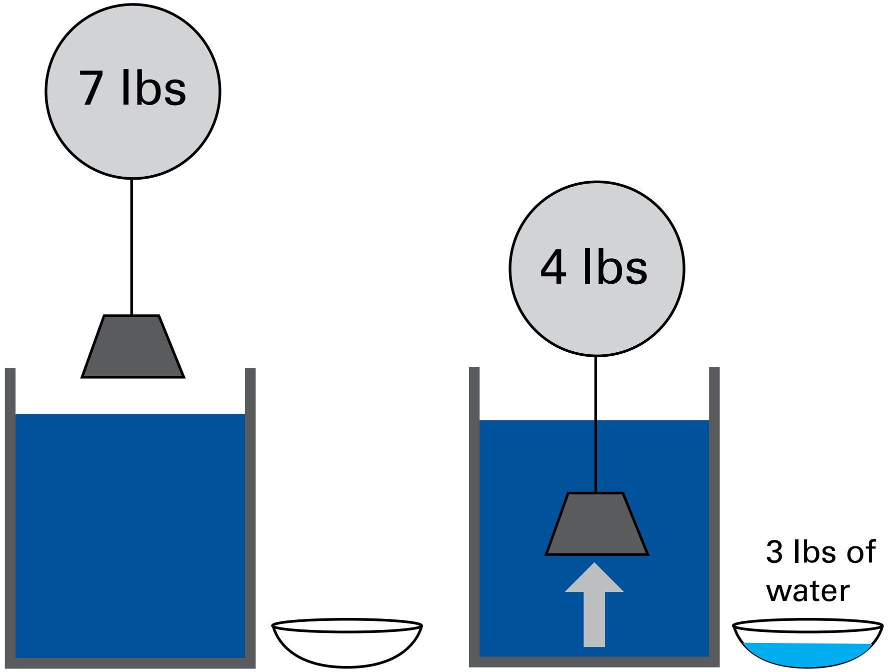
- The stability of a vessels refers to its ability to float upright.

- Stability is determined through an understanding of weight and buoyancy.



ARCHIMEDES PRINCIPLE

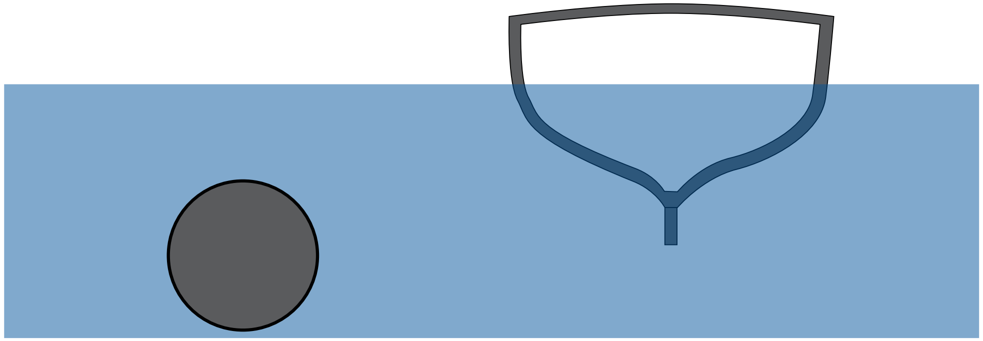
The bouyant force is equal to weight of the displaced water.



ARCHIMEDES PRINCIPLE

Ball: displaced water weighs less than ball, so the ball sinks

Hull: displaced water weight = hull weight, so the hull floats

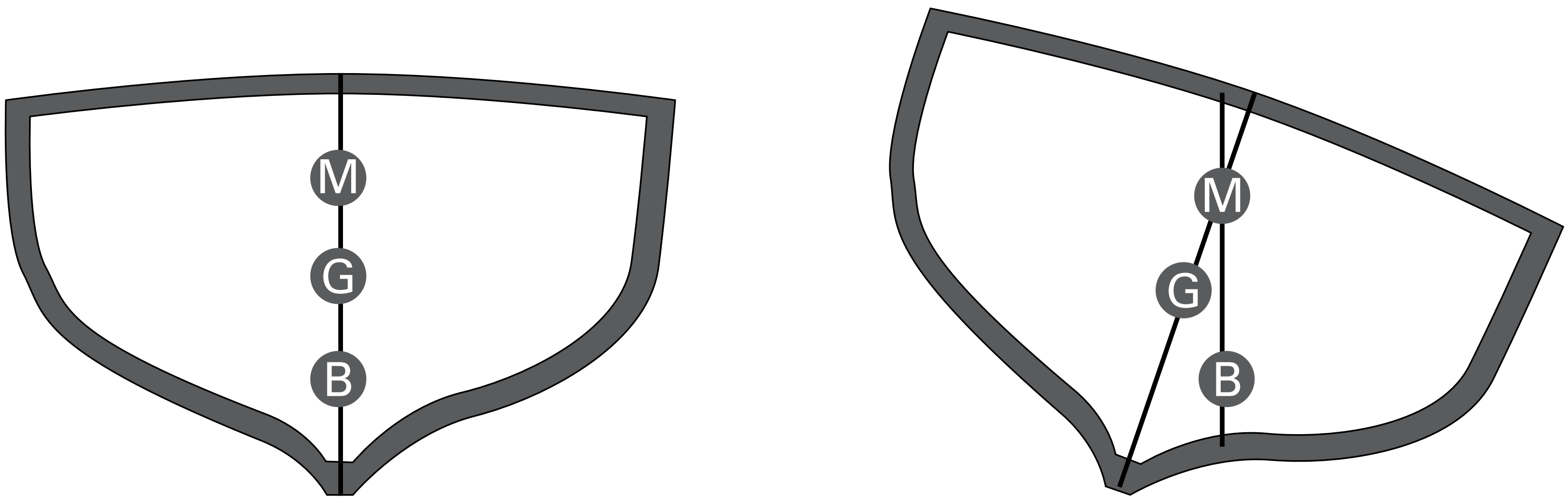


ARCHIMEDES PRINCIPLE

- An objected immersed in fluid is buoyed up by a force equal to the weight of the fluid displaced by the object.
- This means a vessel displaces a weight of water equal to its own weight.
- As water density changes, floating ability will also change.

CENTER OF BOUYANCY

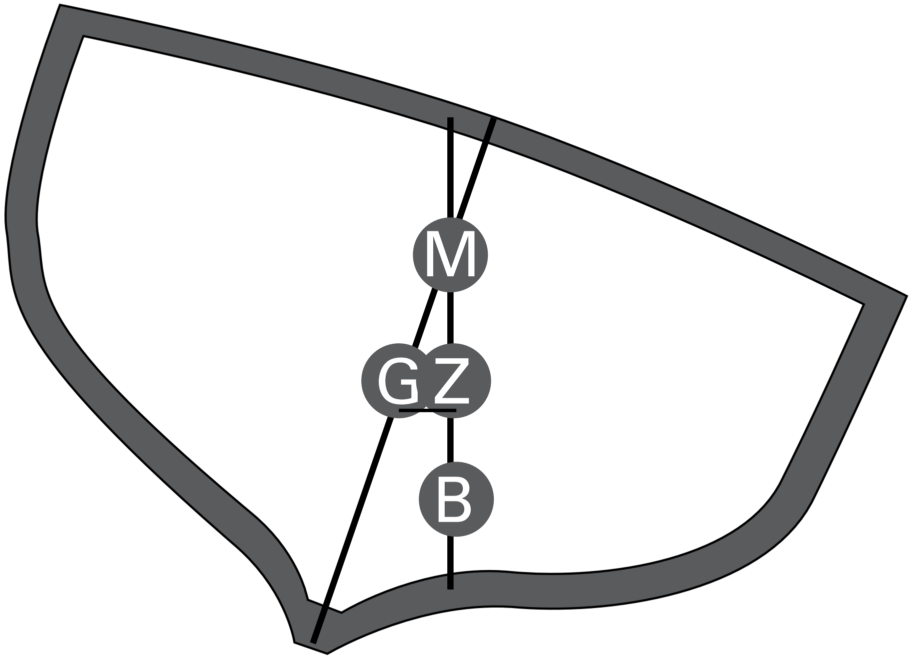
- Buoyancy is the upward force of the water displaced by the hull, and what keeps the vessel afloat.



Ship Stability diagram showing centre of gravity (G), centre of buoyancy (B), and metacenter (M) with ship upright and heeled over to one side. Note that for small angles, G and M are fixed, while B moves as the ship heels, while for big angles both B and M are moving.

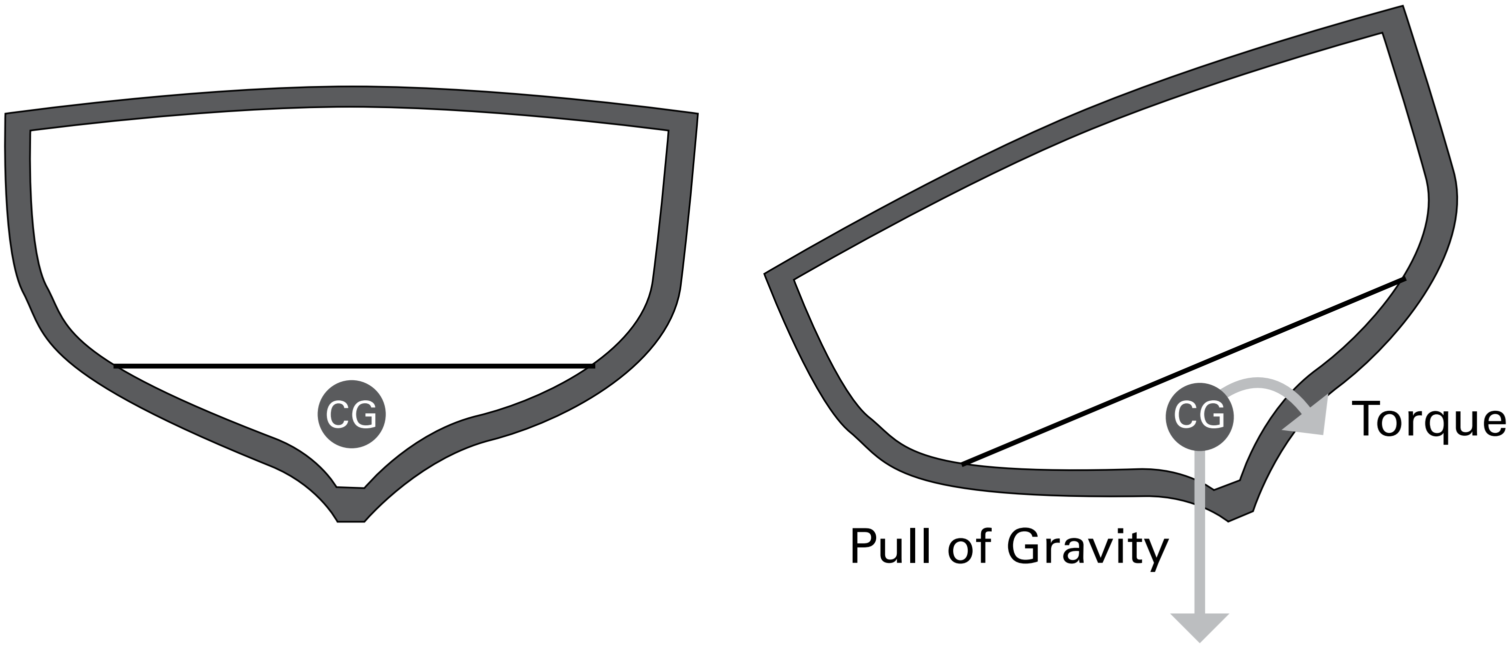
CENTER OF BOUYANCY

-The center of buoyancy for a vessel is the center of the submerged portion of the vessel where all upward force is applied.



CENTER OF GRAVITY

- Where all the mass of the vessel would be located if it had to concentrate itself to a single point.
- Typically the lower center of gravity is, the more stable the vessel is.



STABILITY

- A vessel is at equilibrium when center of buoyancy is directly below the center of gravity.

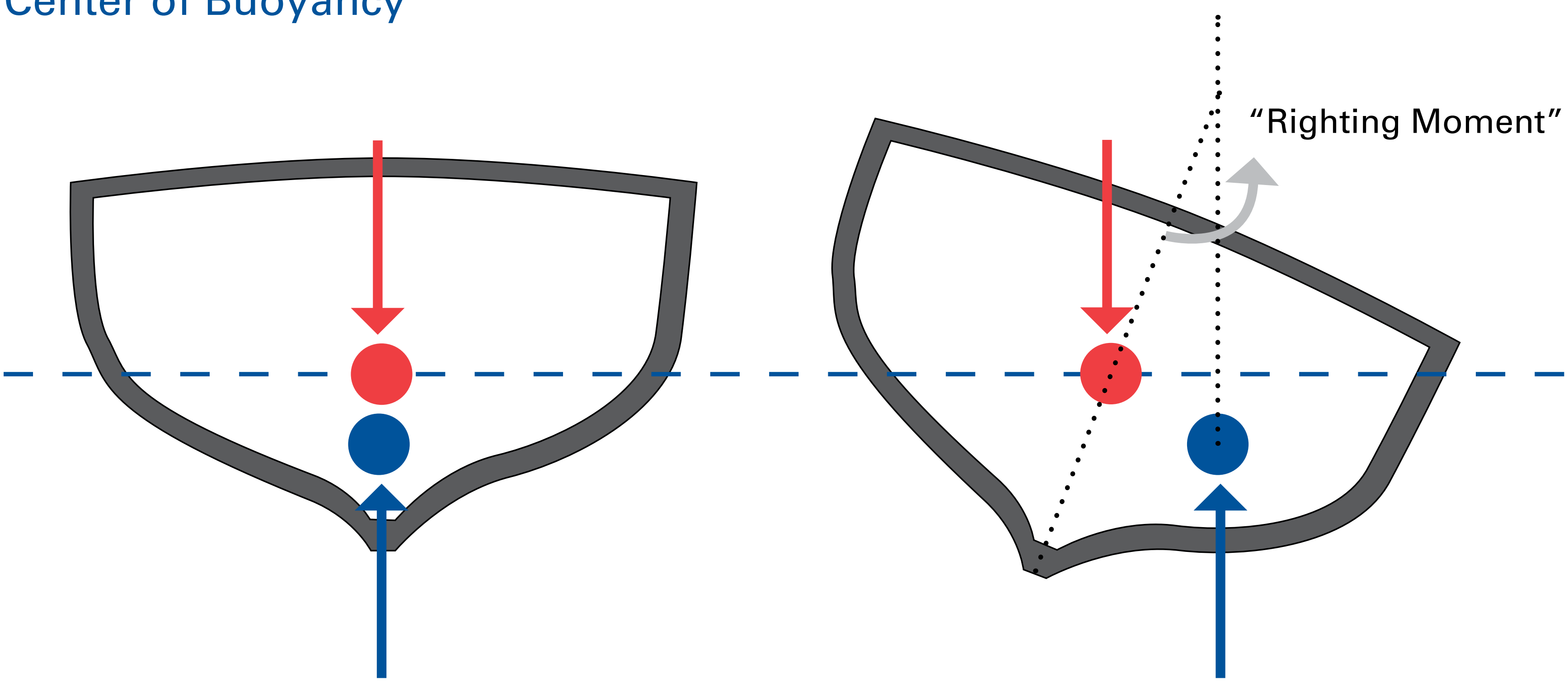
- Equilibrium is affected by anything that changes the center of gravity or buoyancy

- This includes dynamic forces such as winds and waves that cause the vessel to roll and heel.

- Static forces caused by weight placement.

STABILITY

Center of Gravity
Center of Buoyancy



STABILITY TERMINOLOGY

A complete list of terms can be found on page 152.

Give special consideration to the following...

- Compartment Standard: Number of compartments able to flood to margin line without sinking the vessel.
- Free Surface: refers to when a compartment is only partially filled with liquid, allowing the liquid to move freely, resulting in virtual rise in the center of gravity.
- Heel: The temporary leaning of a vessel due to an unbalance, usually caused by external forces.
- List: A more permanent condition in which the vessel is unbalanced, usually due to internal forces.

STABILITY TERMINOLOGY

- Metacenter: The intersection of the vertical line through the center of buoyancy and the vertical centerline.

- Metacentric Height (GM): The distance between the center of gravity and the metacenter.

STABILITY CALCULATIONS

- To calculate metacentric height (GM)

  $$GM = (0.44 \times \text{Beam} / \text{Time of Roll})^2$$

  - Beam in feet
  - Roll period of vessel in seconds
  - Time between successive peak roll angles on the same side of a vessel (average several rolls)

STABILITY CALCULATIONS - EXAMPLE

- To calculate metacentric height
  GM: $(0.44 \times 18\text{ft} / 6 \text{ secs})^2$
  $= 1.74$

  - This vessel would be rather tender
  - For small vessels the minimum GM should be 3:
    - Over 4 : is preferred

STABILITY CALCULATIONS

- To calculate the reduction of metacentric height due to free surface:

  $$L \times B^3 / 420\,(D + W)$$

- D = Displacement

- W = Weight of Liquid

STABILITY CALCULATIONS - EXAMPLE

-Your vessel displaces 869 tons and measures 136′L × 33′B. You ship a large wave on the after deck. What is the reduction to the GM due to free surface before the water drains overboard, if the deck measures 52′L × 33′B and the weight of the water is 52.8 tons?

1. L × B3 420 (D + W)

2. 52 × 333 420 (869 + 52.8)

3. 4.83ft.

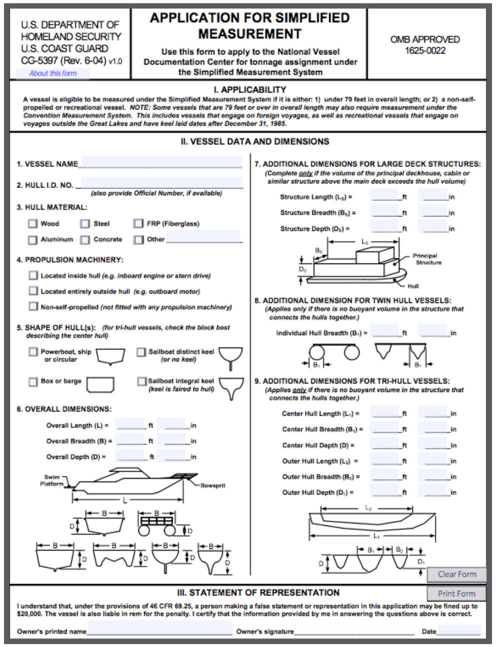
DISPLACEMENT

- Displacement can be considered a measure of a vessel's weight.

- This is because according the Archimedes Principle, objects immersed in fluid is buoyed up by a force equal to the weight of the fluid displaced by the object.

TONNAGE

- Tonnage is a measure of carrying capacity, specifically the volume of interior spaces.
- 1 ton = 100 cubic feet of interior space
- Tonnage does NOT refer to weight
- http://www.uscg.mil/hq/msc/docs/CG-5397.pdf



U.S. DEPARTMENT OF HOMELAND SECURITY
U.S. COAST GUARD
CG-5397 (Rev. 6-04) v1.0
About this form

APPLICATION FOR SIMPLIFIED MEASUREMENT

Use this form to apply to the National Vessel Documentation Center for tonnage assignment under the Simplified Measurement System

OMB APPROVED 1625-0022

I. APPLICABILITY

A vessel is eligible to be measured under the Simplified Measurement System if it is either: 1) under 79 feet in overall length; or 2) a non-self-propelled or recreational vessel. *NOTE: Some vessels that are 79 feet or over in overall length may also require measurement under the Convention Measurement System. This includes vessels that engage on foreign voyages, as well as recreational vessels that engage on voyages outside the Great Lakes and have keel laid dates after December 31, 1985.*

II. VESSEL DATA AND DIMENSIONS

1. VESSEL NAME ____
2. HULL I.D. NO. ____ *(also provide Official Number, if available)*
3. HULL MATERIAL: ☐ Wood ☐ Steel ☐ FRP (Fiberglass) ☐ Aluminum ☐ Concrete ☐ Other ____
4. PROPULSION MACHINERY:
   - ☐ Located inside hull *(e.g. inboard engine or stern drive)*
   - ☐ Located entirely outside hull *(e.g. outboard motor)*
   - ☐ Non-self-propelled *(not fitted with any propulsion machinery)*
5. SHAPE OF HULL(s): *(for tri-hull vessels, check the block best describing the center hull)*
   - ☐ Powerboat, ship or circular
   - ☐ Sailboat distinct keel *(or no keel)*
   - ☐ Box or barge
   - ☐ Sailboat integral keel *(keel is faired to hull)*
6. OVERALL DIMENSIONS:
   - Overall Length (L) = ____ ft ____ in
   - Overall Breadth (B) = ____ ft ____ in
   - Overall Depth (D) = ____ ft ____ in

   Swim Platform, Bowsprit, L, B, D

7. ADDITIONAL DIMENSIONS FOR LARGE DECK STRUCTURES: *(Complete only if the volume of the principal deckhouse, cabin or similar structure above the main deck exceeds the hull volume)*
   - Structure Length (L_S) = ____ ft ____ in
   - Structure Breadth (B_S) = ____ ft ____ in
   - Structure Depth (D_S) = ____ ft ____ in

   L_S, B_S, D_S, Principal Structure, Hull

8. ADDITIONAL DIMENSION FOR TWIN HULL VESSELS: *(Applies only if there is no buoyant volume in the structure that connects the hulls together.)*
   - Individual Hull Breadth (B_1) = ____ ft ____ in
9. ADDITIONAL DIMENSIONS FOR TRI-HULL VESSELS: *(Applies only if there is no buoyant volume in the structure that connects the hulls together.)*
   - Center Hull Length (L_1) = ____ ft ____ in
   - Center Hull Breadth (B_1) = ____ ft ____ in
   - Center Hull Depth (D) = ____ ft ____ in
   - Outer Hull Length (L_2) = ____ ft ____ in
   - Outer Hull Breadth (B_2) = ____ ft ____ in
   - Outer Hull Depth (D_1) = ____ ft ____ in

Clear Form

III. STATEMENT OF REPRESENTATION

Print Form

I understand that, under the provisions of 46 CFR 69.25, a person making a false statement or representation in this application may be fined up to $20,000. The vessel is also liable in rem for the penalty. I certify that the information provided by me in answering the questions above is correct.

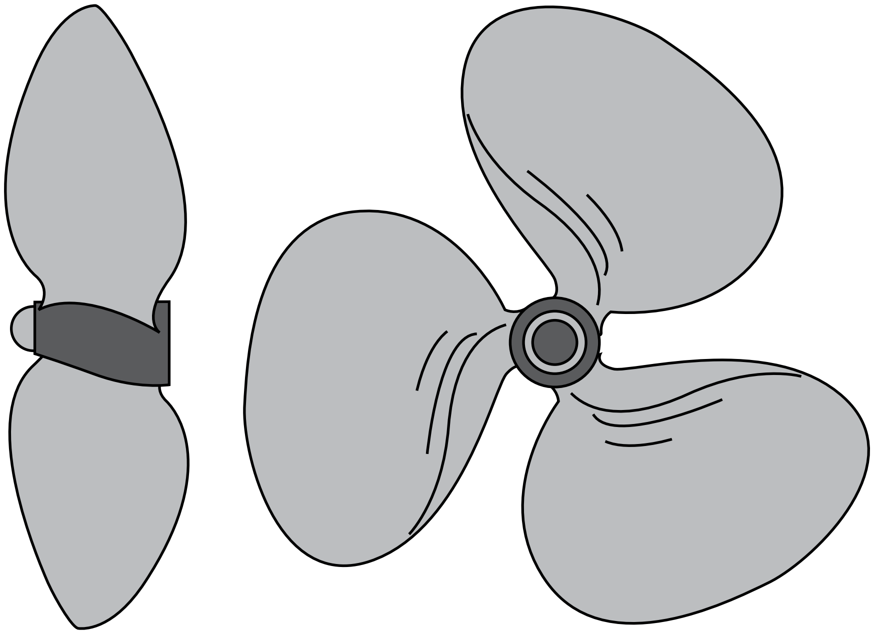
Owner's printed name ____ Owner's signature ____ Date ____

OPERATING A VESSEL

BASIC BOAT HANDLING

PROPELLORS

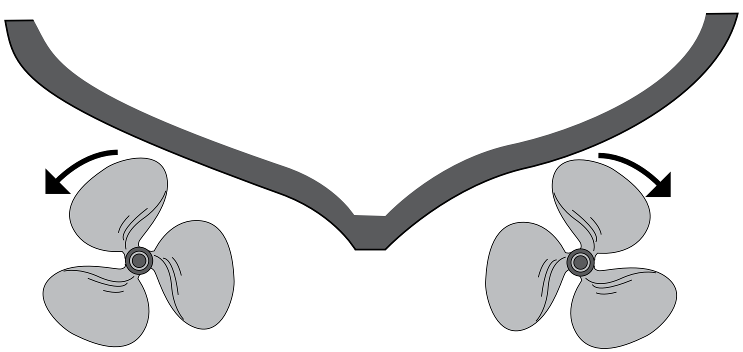
- The rotation of the prop sucks water through it, creating a suction screw current, while simultaneously expelling water, creating a stronger discharge screw current.



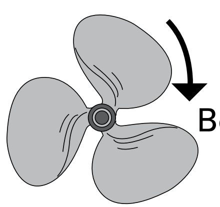
PROP WALK

- Occurs when torque builds from the blade of the prop striking the suction screw current at an angle.

- When moving astern with a right handed prop, the torque pushes the stern port.

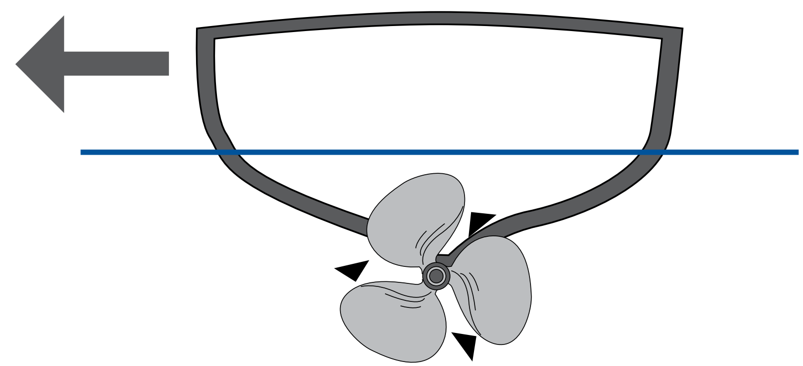


Twin-screw rotation viewed from stern



Bottom blades walk

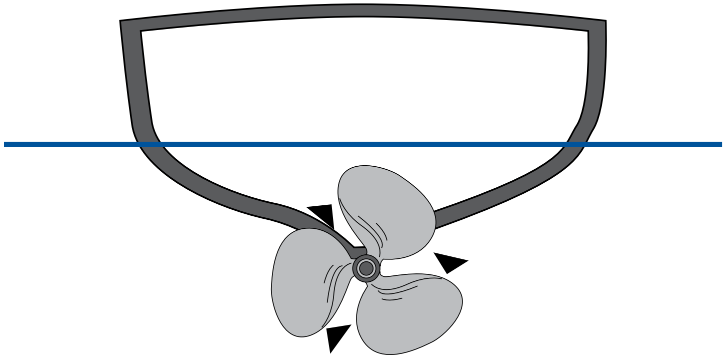
Right-hand prop walking viewed from stern



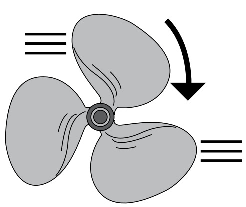
Direction of yaw of right-handed propeller going astern

PROP WALK SINGLE SCREW

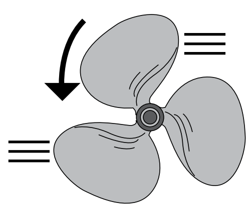
Propeller Walk for a Single Propeller



Blades in shallow water provide less propulsion force.
Blades in deeper water provide more propulsion force.



Right-Oriented
Moving forward: Easier to turn left when turning left.
Moving Backward:Easier to turn right when turning right.

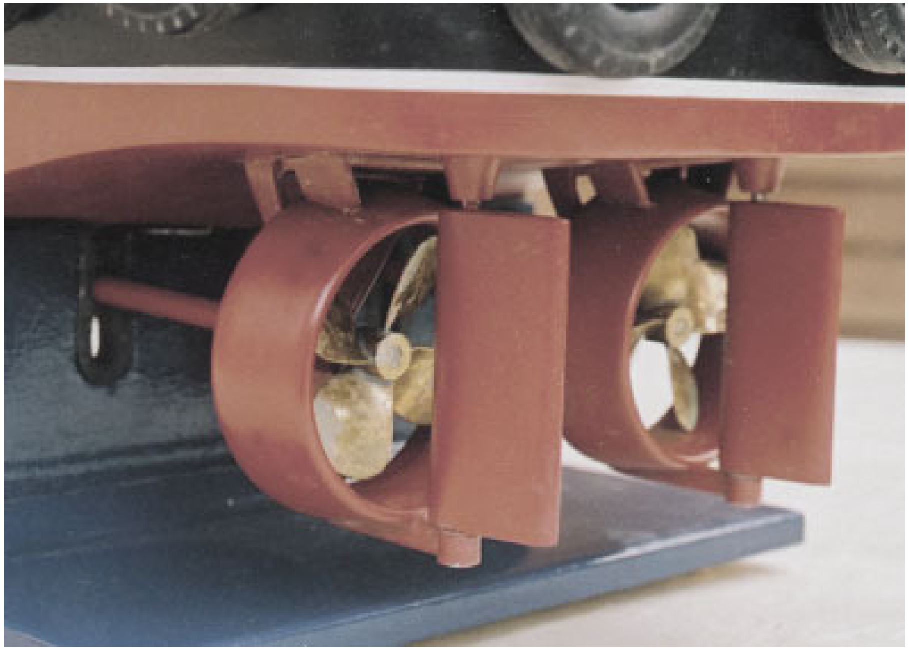


Left-Oriented
Moving forward: Easier to turn right when turning right.
Moving Backward:Easier to turn left when turning left.

Note: this effect is more pronounced when the boat is moving in reverse.

TYPES OF PROPELLORS

- Kort Nozzle: a cylindrical shroud surrounding the propeller that increases efficiency at lower speeds when going ahead, but less efficient when going astern.



TYPES OF PROPELLORS

- Inboard/Outboard: achieving directional control by changing the direction of prop thrust. (no rudder)

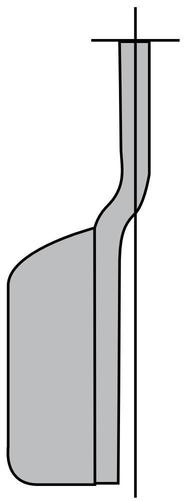
- Bow Thrusters: provides lateral control of the bow at slow speeds.

RUDDER

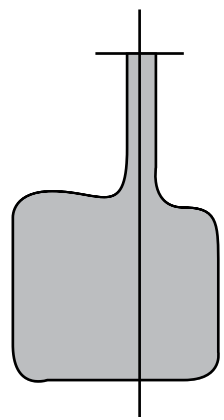
- Vertical blade located at the stern
- Spins on a vertical axis
- Attached to a rudderpost

RUDDER

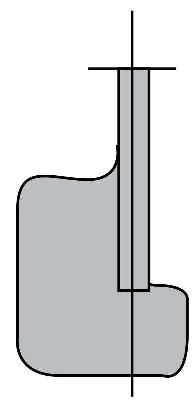
- Unbalanced



- Balanced



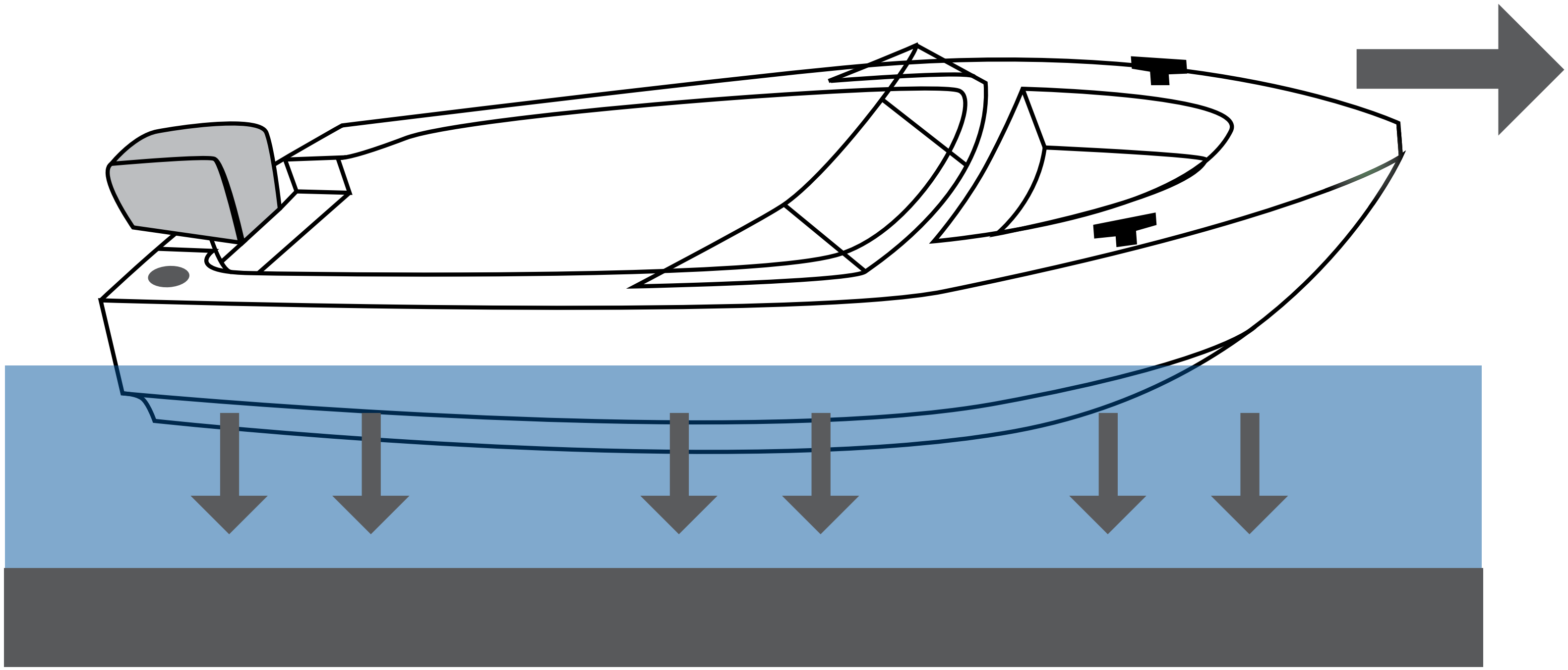
- Semi- balanced



SQUAT EFFECT

- When in shallow water…rudder control can be sluggish.

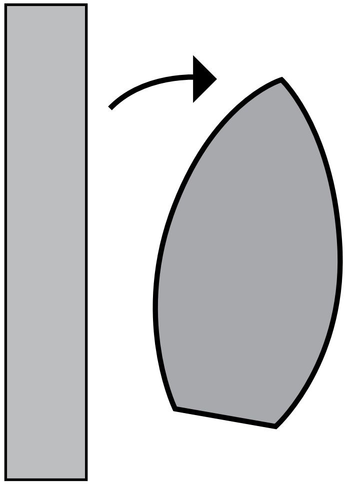
Squat Effect: when a vessel moves through shallow water an area of low pressure is created under the stern of the vessel causing the vessel to sink lower in the water.



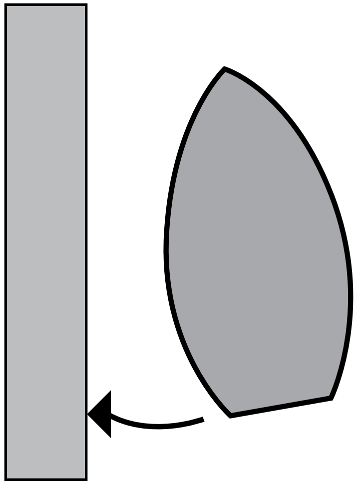
BANK EFFECT

-When near shorelines or other vessels...

- Bank Cushion: The vessel's bow wave causes water to pile up between the bow of the boat and the shoreline or embankment. This build up of water will force the bow away from the bank.



- Bank Suction: The opposite happens to the stern, which is then pulled toward the bank because of the Bernoulli Effect and the suction of the propellers.



TERMS TO KNOW

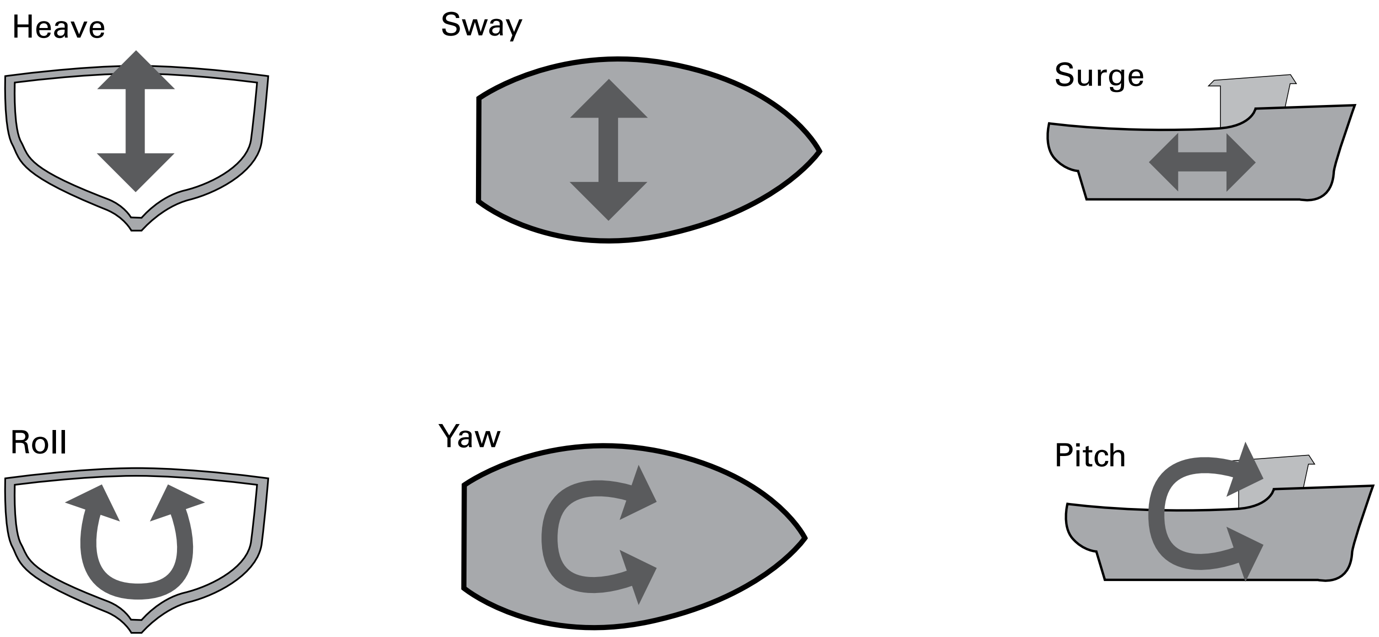
- Head Reach: the distance traveled from the time of full astern to dead in the water.
- Turning Circle: Path followed by the pivot point of vessel.
- Advance: distance gained in the original travel direction when you are turning
- Transfer: distance gained at right angles to vessel's original course after turning through 90 degrees.

MEASURING WATER DEPTH

- Fathometers: measure water depth
- 6 feet in a fathom
- Technology can fail – prudent mariners should carry a lead line

VESSEL MOTION

- Six simultaneous motions



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DECK GENERAL

VESSEL MOTION

Sway - a side-to-side motion

Roll - sideways rotational motion as a result of rough water

Heave - up and down motion

Pitch - vertical rotational motion as the bow rises and falls

Surge-fore and aft motion

Yaw-when a vessel runs off course to either side

Broaching - vessel is horizontal to the waves and can lead to a vessel capsizing