



How do you build a cardboard boat?



**Griffin-Spalding County United Way
2015/2016 Campaign Kick-Off
8th Annual Cardboard Boat Race
Saturday, September 12, 2015
Dundee Lake Park**



Boat Construction Rules

The entire boat must be built of cardboard, duct tape, and one-part polyurethane.

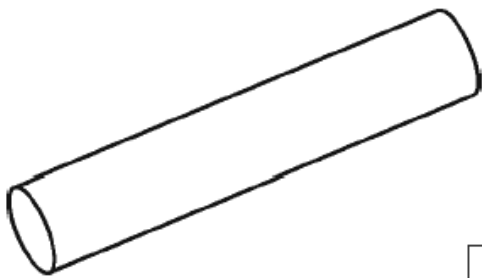
- Only exceptions are the paddles & decorations
- Use Cardboard boxes, “blocks”, carpet tubes
- No pre-treated cardboard allowed
- No Sona-Tubes, waxed or ‘treated’ cardboard
- No wood, plastic or fiberglass
- No caulking compounds or two-part/mixed adhesives
- No wrapping in duct tape, plastic or fiberglass
- Duct tape may be used to reinforce seams
- Waterproof the boat with Varnish, Paint or Polyurethane (one part, paint-like substance)
- Decorations are encouraged, as long as they don’t effect structural strength or buoyancy
- The crew compartment can not be enclosed so as to interfere with escape
- Every crewmember must wear a personal floatation devise, PDF



Boat Construction Materials

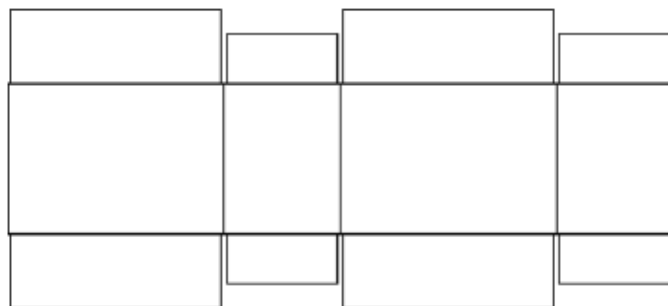
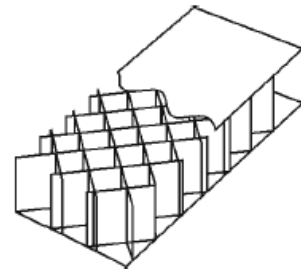
Permissible Materials	Materials Not Allowed
<ul style="list-style-type: none"> • Corrugated Cardboard Appliance or grocery stores • Cardboard “blocks” Furniture stores • Cardboard Tubes Carpet/linoleum stores • Fastening material Duct or masking tape Liquid nails adhesive Latex Paint, Varnish 	<ul style="list-style-type: none"> • Wood, Styrofoam • Plastic sheathing • Fiberglass • Sona-Tubes, coated cardboard • Silicon, Wax, Tar • Caulking compounds • Metal • Staples, clamps, screws * Judges decide on the interpretation of the rules

Boat Construction Materials (examples)



Carpet Tube
(about 4 ½” dia.)

Cardboard
Block
(2-3” thick)



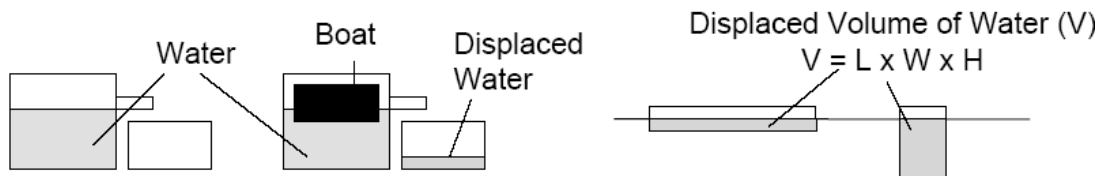
Cardboard Box - cut open

Cardboard Boat Design

- Consider size - building & transporting
 - Big enough to hold crew, small enough to carry
 - Wider is better, but still be able to paddle
 - No surfboard style designs are allowed
 - Rafts are allowed
 - Consider total weight of all materials when wet
 - Everything must be removed from the lake
- Boat decorations and crew costumes are encouraged
 - Use your imagination and be creative!

Cardboard Boat 'Physics'

- "How much will you sink?" - Displacement



Weight of Water =
62.4 pounds/cubic-foot

$$\text{Water Displaced (ft}^3\text{)} = \frac{\text{Weight-of-boat-}\&\text{-people-lbs}}{62.4 \text{ lbs/ft}^3\text{-H}_2\text{O}}$$

$$\text{Depth(ft) boat sinks} = \frac{\text{Water Displaced (ft}^3\text{)}}{\text{Length X Width of boat (ft}^2\text{)}}$$

Example:

Box boat, 3 ft X 6 ft, 1ft tall (high)

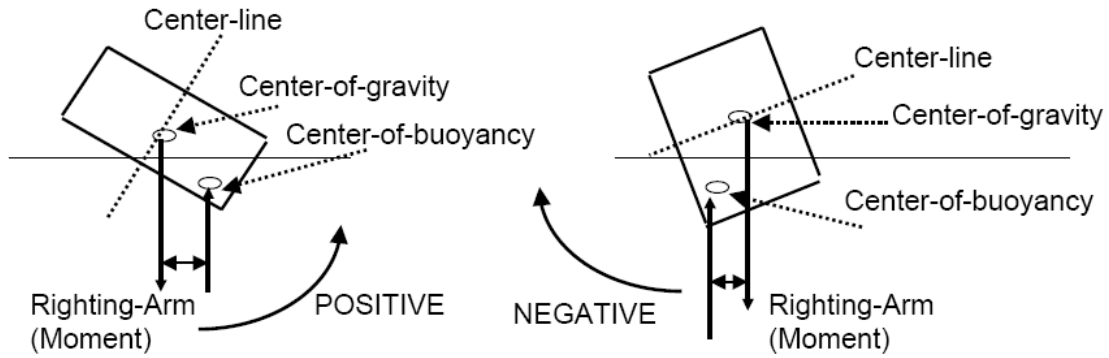
Boat volume = 3' X 6' X 1' = 18 ft³

Boat displacement = 18 ft³ X 62.4 lbs/ft³ = 1123.2 lbs

Which equates to 93.6 lbs per inch of boat height

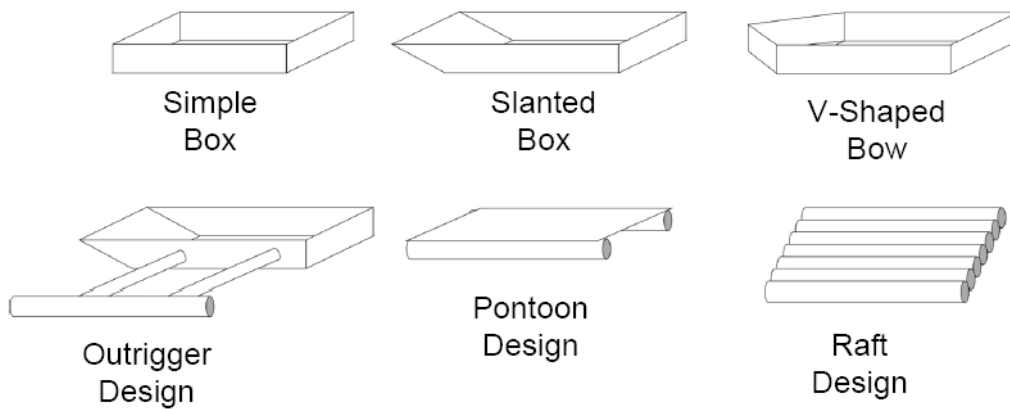
More Cardboard Boat 'Physics'

"Wider is Better" - Center of Buoyancy



Even More Cardboard Boat 'Physics'

Movement Through the Water



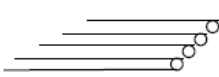
Cardboard Boat Design Suggestions

- Set the Design Goal: Fun, Speed, and Appearance
- Sketch out your design
 - Build a scale model from manila paper:
 - Estimate materials or plan how to use what you have
 - Plan out what construction techniques will be used
- 1'x1'x3' box: will float 187 lbs.
 - If it'll hold you, it's big enough to float
- Flat bottom, sit-to-paddle & canoe styles - are the best/easiest
- Rudders help keep you straight but make turning difficult and adds complexity to your design
- Long boats go fast - but are harder to turn
- Short boats (<8') - are difficult to keep straight
- Best Length: 8-12 feet
- Best Height: 18 inches
 - This allows room to sit/kneel & still paddle over the edge
- Best Width:
 - 18"- 30"(max) for 1 person
 - 48" wide for 2 people side by side
- Kneeling is a "power" position but sitting is more comfortable

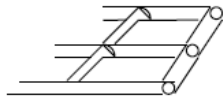
Construction Tips & Techniques I

- Cover all edges of cardboard - acts like siphon
- Cardboard Tubes make great frames
 - Cut for joining & bending
 - Fasten tubes together
- Cardboard Hull
 - 1-2 layers, fasten & cover the seams
 - With 2 layers, overlap the seams & polyurethane in between
 - Decorate, paint & varnish
- Reinforce the area where you sit, kneel or stand
- Carpenter's glue and liquid nails work well
 - Hot-melt glues will melt in the heat and sun
- Duct tape only non-painted surfaces (tubes or frame that will be covered)
 - Duct tape shrinks when painted
 - Duct tape should be covered with masking tape if you need to paint it
 - Clear tape melts when painted
 - Masking tape works well on glued edges & seams
 - Kraft paper with spray adhesive may also be used

More Construction Tips & Techniques



Solid Tube
Frame

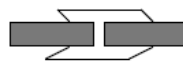


Center/Cross
Beam
Frame

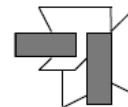
FRAMES

CONNECTING TUBES

Cardboard
Wrapper for Tubes
End-to-End

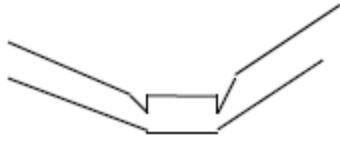


Cardboard
Wrapper for Tubes
At Right-Angles

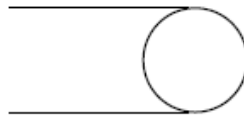


Even More Construction Tips & Techniques

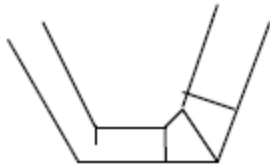
FRAME ANGLES



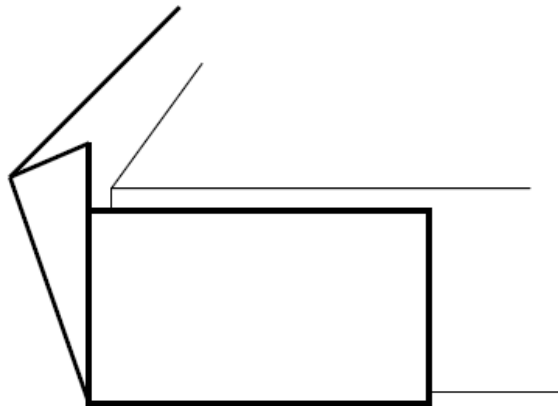
V-Shaped Cuts



TUBE CUTTING
TEMPLATE



Multiple Cuts
for Sharper Angles

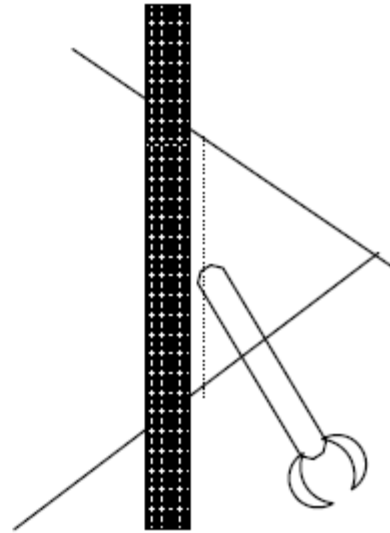


FOLD & OVERLAP
CARDBOARD
AROUND CORNERS

Last of the Construction Tips & Techniques

Crease/Score a line
for a nice

STRAIGHT
FOLD



Multiple cardboard layers
“glued” together on the sides
strengthen the hull

Multiple trapezoid-shaped pieces
“glued” together to form a
“support block”

A sheet of cardboard
could be folded &
“glued” together to
form *tubes/beams*

