Georgetown Wooden Boat Show 2016

What Floats Your Boat

Cardboard Boat Basics
Construction Rules
(Equal Opportunity)

• The ENTIRE BOAT must be built of CARDBOARD
  – Only exceptions are the decorations
  – Use cardboard boxes, “blocks”, carpet tubes
  – NO pre-treated cardboard allowed
    • No SONA-TUBES, or 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
Construction Rules (continued)

• Waterproof the boat with Varnish, Paint or Polyurethane (1-part, paint-like substance)
• Decorations are allowed - as long as they don’t affect structural strength or buoyancy
• The crew compartment can NOT be ENCLOSED so as to interfere with escape
• Every crew member must wear a life jacket
## Construction Materials

<table>
<thead>
<tr>
<th>Permissible Materials</th>
<th>Materials NOT Allowed</th>
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<tbody>
<tr>
<td>• Corrugated Cardboard</td>
<td>• Wood, Styrofoam</td>
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<tr>
<td>– Appliance or Grocery Stores</td>
<td>• Plastic sheathing</td>
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<tr>
<td>• Cardboard “blocks”</td>
<td>• Fiberglass</td>
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<tr>
<td>– Furniture stores</td>
<td>• Sona-Tubes, coated cardboard</td>
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<tr>
<td>• Cardboard Tubes</td>
<td>• Silicon, Wax, Tar</td>
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<tr>
<td>– Carpet/Linoleum stores</td>
<td>• Caulking compounds</td>
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<tr>
<td>• Fastening material</td>
<td>• Metal</td>
</tr>
<tr>
<td>– Duct or masking tape</td>
<td>• Staples, clamps, screws</td>
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<tr>
<td>– Liquid nails adhesive</td>
<td>– * Judges decide on the interpretation of the rules</td>
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<tr>
<td>– Latex Paint, Varnish</td>
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</tbody>
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Construction Materials (continued)

Cardboard Block (2-3” thick)

Carpet Tube (about 4½” dia.)

Cardboard Box - cut open
Cardboard Boat Design

• Consider its 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 harbor

• Boat decorations & crew costumes are encouraged
  - use your imagination
Cardboard Boat ‘Physics’

• “How much will you sink? - Displacement

Weight of Water = 62.4 pounds/cubic-foot

Water Displaced(ft³) = \( \frac{\text{Weight-of-boat-\&-people-lbs}}{62.4 \text{ lbs/ft}^3 \cdot \text{H2O}} \)

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

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
Cardboard Boat ‘Physics’

- “Wider is Better” - Center of Buoyancy
Cardboard Boat ‘Physics’

- Movement Through the Water

- Simple Box
- Slanted Box
- V-Shaped Bow
- Outrigger Design
- Pontoon Design
- Raft Design
Cardboard Boat
Design Suggestions

• Set the Design Goal: FUN, Speed or looks
• 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 bottoms, sit-to-paddle - are the best/easiest
• Rudders help keep you straight but make turning difficult and adds complexity to your design.
Cardboard Boat Suggestions (cont’d)

• Long boats go fast - but are harder to turn
• Short boats (<10’) - are difficult to keep straight
• Best Length: 8-12 feet
• Best Height: 18 inches
  – 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

• Cover edges of cardboard - acts like siphon
• Cardboard Tubes make great frames
  – Cutting for joining & bending
  – Fastening tubes together
• Cardboard Hull
  – 1-2 layers, fasten & cover the seams
  – With 2 layers, overlap the seams
  – Decorate, paint & varnish
• Reinforce the area where you sit, kneel or stand
• Joints taped together should be folded together-not cut together
Construction Tips & Techniques

- Carpenter’s glue works well, liquid nails
- Duct tape only non-painted surfaces (tubes or frame that will be covered)
  - Duct tape shrinks when painted
  - Duct tape can be covered with masking tape if you need to paint it.
  - No Clear tape - it melts when painted
  - Masking tape for glued edges & seams
  - Kraft paper with spray adhesive
Construction Tips & Techniques

CONNECTING TUBES

Solid Tube Frame

Center/Cross Beam Frame

Cardboard Wrapper for Tubes
End-to-End

Cardboard Wrapper for Tubes
At Right-Angles

FRAMES
Construction Tips & Techniques

FRAME ANGLES

- V-Shaped Cuts
- Multiple Cuts for Sharper Angles

TUBE CUTTING TEMPLATE
Construction Tips & Techniques

FOLD & OVERLAP CARDBOARD AROUND CORNERS
Construction Tips & Techniques

Crease/Score a line for a nice STRAIGHT FOLD
Construction Tips & Techniques

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