

**CARDBOARD
BOAT REGATTA**
River Legacy Foundation



BOAT BUILDING MANUAL
Presented by River Legacy Foundation



30TH ANNUAL CARDBOARD BOAT REGATTA

Saturday • April 13, 2019
Six Flags Hurricane Harbor



Westlake **ACE** Hardware

OFFICIAL SUPPLY HEADQUARTERS FOR REGATTA

Visit our convenient Arlington location for your cardboard boat building supplies.
We have everything you need to construct a seaworthy vessel.

Westlake's Arlington Hardware
1705 West Park Row
(corner of Park Row & Fielder)
817-461-5803

Thanks to our Sponsor Harris Packaging, you can pre-purchase a pre-cut boat kit that all you have to do is assemble, paint and decorate to make it your own theme! Cost is \$100. Order kits via the entry form or contact Kristi Payne at 817.860.6752, ext. 107 or at kristi@riverlegacy.org. LIMITED SUPPLY AVAILABLE.

SPECIAL THANKS TO SPONSORS:



PRESENTED BY:



Welcome to River Legacy Foundation's 30th annual Cardboard Boat Regatta! The first Cardboard Boat Regatta was part of the celebration when River Legacy Park opened in 1990. It has grown from a small event with 17 boat entries to an eagerly anticipated annual event attracting over 200 boat entries and thousands of spectators. In 1997, the event moved from River Legacy Park to Six Flags Hurricane Harbor. The Regatta is not only a significant fund-raiser for River Legacy Foundation, but also serves as a great outlet for practical hands-on math and science lessons for students and team building fun for all.

Our 30th annual Cardboard Boat Regatta is scheduled for Saturday, April 13, 2019, at Six Flags Hurricane Harbor, our gracious hosts for this event. In addition to the cardboard boat races, activities include a Children's Area featuring Hula Hoop Contests & the Mini-Boat Regatta; Build-on-Site boats; a raffle for a chance to win a whale of a prize & Concessions. NEW this year will be an Entertainment/Stage area where guests can enjoy a variety of music and performers.

The High School Challenge has become a fun, spirited competition among area schools. All high school entries will be entered in the High School Challenge, where schools can compete for bragging rights and the High School Challenge Trophy. Paint your boat in your school colors, make your mascot the captain of your ship, and show your school spirit!

In celebration of our 30th anniversary, we will be giving a special Spirit Award to those entrants who incorporate the 30th anniversary theme into their boat decorations and spirit cheers.

If at all possible, we ask that you bring your own life jackets and oars for this event. A limited supply will be available on race day before your scheduled boat launch time. You will receive life jackets and oars in the launch line. **Please do not pick up life jackets before then.**

River Legacy Foundation is celebrating 30 years of excellence in environmental education and stewardship! All proceeds from the Regatta, including concessions, admissions, and registrations, benefit the nonprofit Foundation that provides funding for environmental education programs at River Legacy Living Science Center. The Foundation in partnership with the Arlington ISD provides outdoor education experiences to students throughout the school district. The Foundation also partners with the City of Arlington Parks and Recreation Department to provide funding for the continued preservation and recreational amenities of River Legacy Park in Arlington.

PLEASE NO OUTSIDE FOOD, DRINKS OR COOLERS ARE ALLOWED AT HURRICANE HARBOR!

The following information will take you through the steps necessary to build a cardboard boat. Sink or float, we're certain you'll have a great time in the process.

Cardboard Boat Regatta entry forms can be downloaded from our Web site at www.riverlegacy.org, where you will also find more information about this fun, annual event. **For questions, contact Kristi Payne at 817.860.6752, ext. 107 or via e-mail at kristi@riverlegacy.org. Best of luck at the Regatta!**



BOAT BUILDING BASICS

X DEVELOPING A CONCEPT

- Determine division/class/category you want to enter
- Sketch your creative ideas on paper
 - Calculate length, width, height, draft, balance
 - Consider size and weight of crew
- Build a scale model

X PREPARING FOR CONSTRUCTION

- Secure adequate work and storage space
- Gather supplies

X SUGGESTED SUPPLIES

- Corrugated cardboard - three layers for floor, two layers for walls
- Acrylic latex caulk
- String line or straight edge; right angle or squaring tool
- Carpet knife or Exacto knife; extra blades
- Wood glue, Liquid Nail panel adhesive, or DAP contact cement
- Water sealer; polyurethane
- Foam brush
- Paint brush or roller; paints, including latex house paint
- Paper tape, masking tape - NO DUCT TAPE
- Creasing tool (scissors work well)
- Clamps (spring & quick)
- Measuring tape

X CONSTRUCTION STEPS

- Transfer model concept to cardboard
- Mark lines
- Cut cardboard
- Bend cardboard
- Brace
- Glue
- Tape
- Seal
- Waterproof

X BEING CREATIVE

- Develop a theme

X PADDLING

- Types of paddles - canoe or kayak oars only
- Consider whether you'll be rowing alone or with others

X TESTING

- Test prior to the event or take your chances on race day!

REMEMBER THIS IS A FUN EVENT!

SINKINGS ARE AS MUCH FUN FOR SPECTATORS AS AWARD WINNING TIMES ARE FOR PARTICIPANTS!



RACE DIVISIONS • CLASSES • CATEGORIES

The first step is to consider the boat division, class and category you might want to enter.

DIVISIONS:	Youth (8-13)	Adult (14 and older)	
CLASSES:	Class I	Class II - Mechanical (Adults only)	Class III - Build On Site (Guppy only)
CATEGORIES: (# of Crew Members)	Guppy (1-2)	Dolphin (3-5)	Whale (6-10)

Class I Boats

Boats in this class must be propelled by canoe or kayak oars or paddles. These propulsion tools, as well as decorations, may be constructed from materials other than cardboard. ALL OTHER PARTS of the boat must be corrugated cardboard. This includes the hull, decking, keel, cowling, superstructure, oar locks, seating and rudder. Nuts, bolts, washers and staples are not allowed.

Class II Boats - Mechanical (Adults Only)

Class II boats must meet the requirements of Class I boats, with the exception of the propulsion and steering systems.

The muscle-powered propulsion system (propellers, paddle wheels, sails) and the steering system (rudders) do not need to be made of cardboard, but materials used must not contribute significantly to the structural rigidity of the boat. Propulsion and steering systems must be designed and fabricated by the entrant. In addition, the connections between the propulsion and steering systems must be made of corrugated cardboard.

Propulsion and steering devices must not damage the bottom of the Wave Pool. Oars and paddles are prohibited, as is swimming or paddling with a surfboard of corrugated cardboard.

Class III Boats - Build On Site

Boats in this class will be built on-site at Hurricane Harbor event day. Basic boat building supplies will be provided: 3 pieces of double ply cardboard, 2 rolls of duct tape, 2 sheets of plastic, box cutter, a pencil and yard stick. Participants have 2 hours to build their Guppy boat with the supplies provided to them. Class III boats must abide by all Class I race and safety rules. Class III boats will race in the Wave Pool and will use oars or paddles to propel themselves. **Build-on-Site boats are the only boats allowed to use duct tape.** Build On Site boats can have unlimited builders, but only 2 crew members can race in the boat.



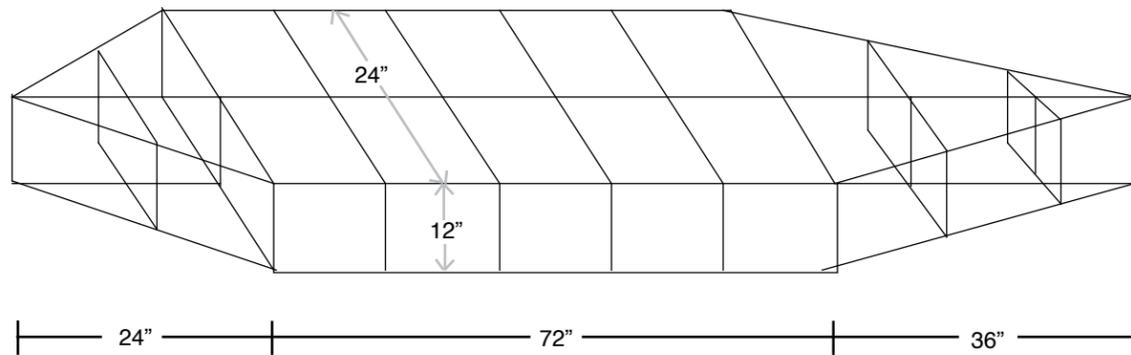
BOAT DESIGN FUNDAMENTALS

Before you develop a concept, consider these fundamentals of boat design.

A boat floats in the water and displaces a quantity of water equal to the weight of the boat and the crew. If the weight you put into a boat is greater than the weight of the water the boat displaces, the boat sinks.

Water weighs approximately 60 pounds per one cubic foot (12" x 12" x 12" cube).

For illustration, let's look at the smallest size boat, a guppy with a single crew member. Once you understand this example, it'll be easy to calculate for a larger boat.



The above boat sketch is 24" wide, 12" high and 72" long, with an additional 24" tail and 36" nose, which makes the overall length 132" or 11 feet. The inside volume of the boat is 17 cubic feet ($L \times W \times H = 6' \times 2' \times 1' = 12'$, plus 2' for the tail and 3' for the nose). As we stated earlier, water is 60 pounds per cubic foot; therefore, this boat's total displacement weight is 1,020 pounds (17' x 60 lbs.).

The side of the boat is 12" high; therefore, it takes 85 pounds to push the boat down into the water 1" (1,020 pounds divided by 12 = 85 pounds). If a single crew member weighs 170 pounds, the boat will be pushed down into the water 2" (**a 2" draft or waterline**). The weight of the boat was not included in these calculations, so the actual draft would be slightly higher. A 2" draft gives the boat approximately 10" before water enters the boat from a wave.

That's the basis of floating (designing) a boat with one crew member. If you put two crew members in this boat (add 175 pounds), the draft would be 4" and would leave only 8" to the top of the boat – maybe okay for smooth water, but a little wave action might sink the boat.

Therefore, more crew members require a larger boat, to displace more water and still keep the draft small relative to the side of the boat to protect from wave action and sinking.

Now, let's look at other aspects that influence the final design of the boat, such as:

- Hull and Prow Types
- Stability
- Balance



TYPES OF HULLS

Hulls with flat surfaces are easier to build but are not as stable in the water as others.



A



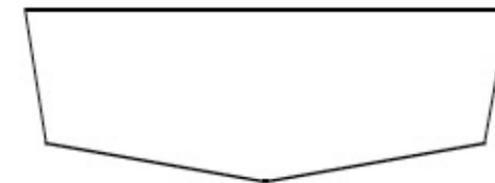
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C



D



E

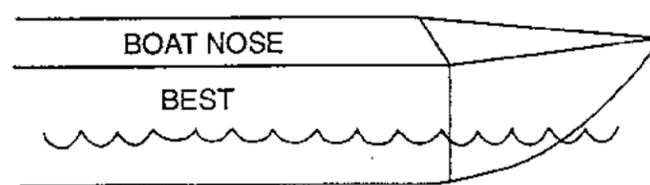
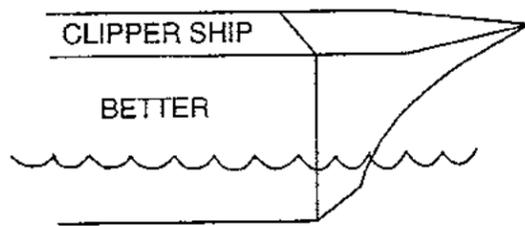
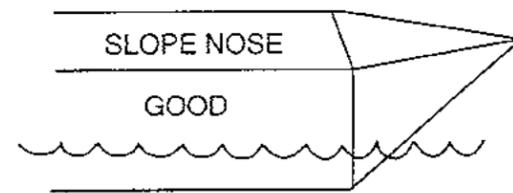
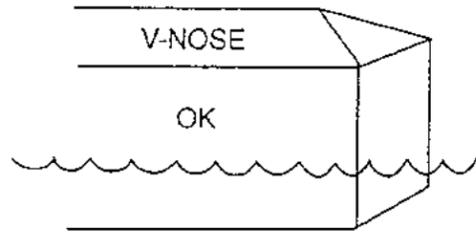
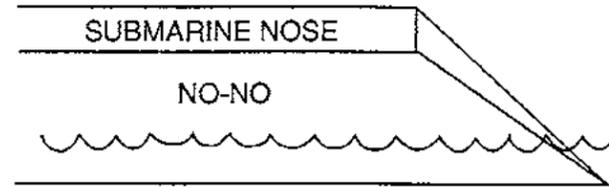
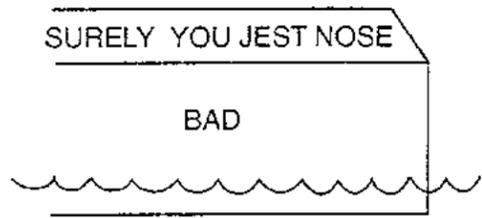


F



TYPES OF PROWS

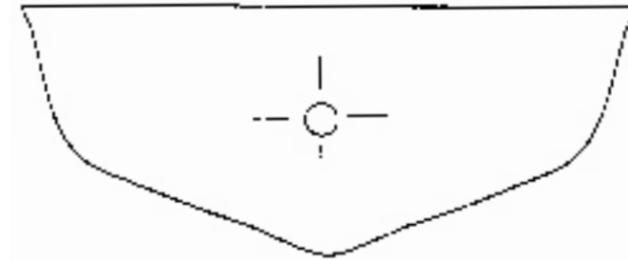
Some prow types deflect water better in wave action than others. Keep in mind that you'll need to blend your prow shape with your hull bottom shape or "footprint." Consider where the waterline will be when your boat is loaded.



BOAT STABILITY • DESIGN CREATIVITY

CENTER OF GRAVITY

The next area to consider is boat stability. The sketch below shows a cross section of a hull and the center of gravity (cg). As crew members position themselves in a boat, some of their body obviously sticks out of the boat. The lower the crew sits in the boat, the lower the cg. Your goal is to make the cg at or below the waterline or draft. This makes the boat more stable and more difficult to tip over.



BALANCE

The balance of the boat forward and aft is also very important for proper performance. The center of the boat forward and aft is approximately in the middle of the boat. When positioning the crew, keep the most weight to the rear of the boat. By doing this, the prow will tend to stay up in rough water, keeping water from entering the boat from the front.

DESIGN CREATIVITY

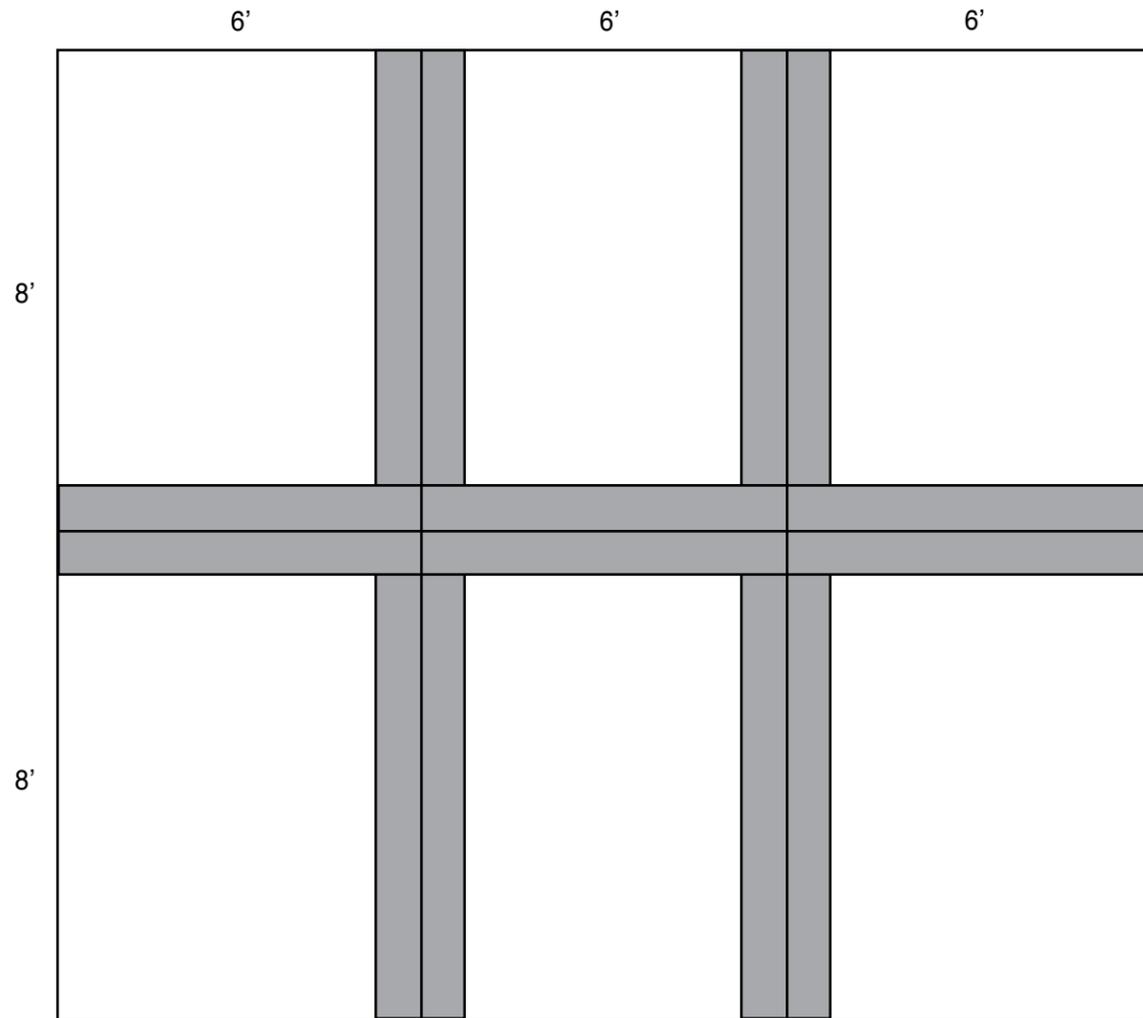
So far, we've only discussed the technical issues of boat design. The more creative part of your boat building project is the boat's theme and decoration for both boat and crew. The sky's the limit as long as you follow basic construction and safety rules, which are listed in the back of this packet.

Your boat could look like a Viking ship, a row boat, a battleship or a tug boat. It could be built to look like a banana, a tube of toothpaste or a school bus. Let your imagination be your guide!



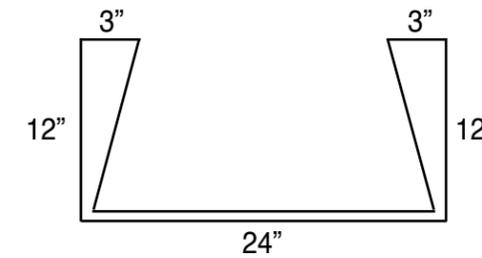
CONSTRUCTION CONCEPTS

If possible, cut your boat from one sheet of cardboard. Several sheets of cardboard can be spliced together to make a big sheet. Splicing six, 6 x 8' pieces creates one, 18 x 16' piece.

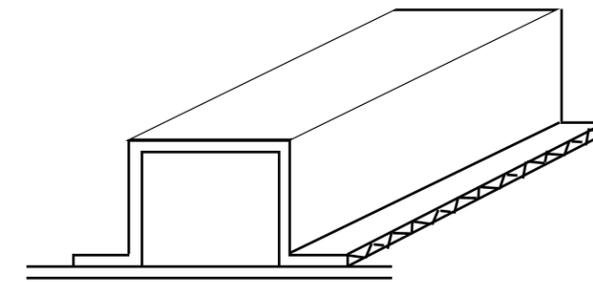


CONSTRUCTION TECHNIQUES

CROSS SECTION OF BOAT USING A LARGE PIECE OF CARDBOARD

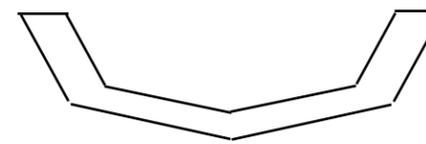


STIFFENERS GLUED TO THE INSIDE BOTTOM AND SIDE OF THE BOAT ADD STRENGTH

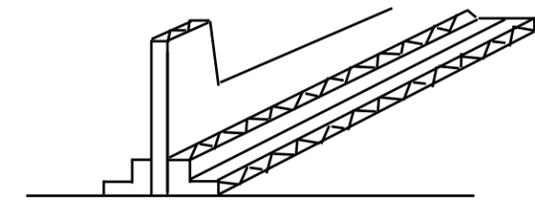


Stiffeners run the length of the boat

ATTACHING BULKHEADS TO ADJACENT CARDBOARD (OUTER BOAT SKIN)



Bulkhead side view



How to attach bulkheads



RACE RULES

- Each boat must have a designated Captain. The Captain must check in at the registration area on the day of the race during the designated time.
Youth 8:30 - 9:15 am **Adults** 9:30 - 10:45 am
- To qualify as a finalist, participants must correctly navigate the race course around the buoys and all crew members must be in the boat as it crosses the finish line.
- Boats with the fastest times in the time trials will advance to the semifinals, and/or finals.
- Filming of a perceived race violation will not be viewed or considered. The official spotters have the final say.**
- Navigating crews for Youth Class I & Class III boats must start the race in the boat. Navigating crews for Adult Class I boats must start the race out of the boat. Navigating crews for adult Class II boats must start the race in the boat. Navigating crews who start the race in the boat are not allowed to get any help pushing off.
- Any boat not ready to race at the designated time will be disqualified.
- Time trials for Class I youth boats will now be in the Wave Pool.** Youth semi-finals and finals will be in the Wave Pool, without the wave action.
- Time trials and semi-finals for adult boats will be held in the Wave Pool, without the wave action. Waves will be turned on during the finals. If no boat finishes in the finals, winners will be based on semi-final results. If three or fewer boats are entered in a category, the boats will race in the time trials and finals only.
- Participants MUST retrieve their boat – or its remains – from the water.**
- Youth will race with adults if there are fewer than two youth entries. **Any entry with a crew member age 14 or older will race with the adults.**
- A participant may compete in more than one class or category; however, the rules of each class entered must be followed and a different boat must be raced in each category.

MINI-BOAT REGATTA

The Mini-Boat Regatta provides an opportunity for children ages 4 to 12 to race mini-sailboats along rain gutters by blowing on the sail of their boat. With a huff and a puff they will race their boats to the finish line. Awards will be received in each category for 1st, 2nd and 3rd places.



Registration for the Mini-Boat Regatta is \$5 and does not include Regatta admission. Registration forms are available at www.riverlegacy.org.

Mini-Sailboat kits can be purchased at River Legacy Living Science Center's Acorns Gift Shop. A limited supply will be on hand race day for use with a refundable deposit.



TROPHIES

STEVE CALLOWAY LEGACY AWARD

Best of Show



ADMIRAL'S PRIDE

Outstanding entries in each class



RAH! RAH! AWARD

Most spirited team (NEW - 30th anniversary Spirit Award!)



FASTEST FINISH AWARDS

Winner in each division of both classes



JUDGES AWARD

To guarantee an award, simply chat with the judge\$.
Bribe\$ are gladly accepted and benefit River Legacy Foundation.



TITANIC AWARD

Each year, the Titanic Award is given to the crew of the boat that sinks in the most spectacular fashion.



HIGH SCHOOL CHALLENGE

High School with the most points/awards wins bragging rights!