

To help celebrate the upcoming Crystal Lake “America’s Cardboard Cup Regatta” we have asked a veteran of 18 races to submit a set of plans and directions to build an “Unsinkable” and competitive cardboard boat.

The attached 2 person boat plans were designed around the following parameters:

1. Easy to build
2. Strong
3. Light weight
4. Durable
5. Stable
6. Fast
7. Propelled by either Kayak or canoe paddles

This boat has been racing in one and two person configurations since 2001 and has experienced excellent results. No boat has failed to advance to the second round of heats. Chances are slim for this boat to win the “America’s Cardboard Cup”, but a good crew could pilot Her to the “Final Five”.

If you would like to save approximately 10 hours of layout and drawing time, a \$75.00 donation (tax deductible) to “One Step at a Time” summer camp for children with cancer and leukemia will get you a kit with the layout complete, ready to cut, fold and assemble. Quantities are limited, so place your order early.

You are also invited to attend two boat building seminars in late May and early June. Dates and location will be announced in early May. Come see this boat built before your very eyes. Let’s get started.

#### Tools Required

- 1) Pencils
- 2) 2” paint brush
- 3) 16’ measuring tape
- 4) 5’ – 6’ long straight edge
- 5) Razor knife with retractable blade
- 6) 1 1/2 “ putty knife
- 7) 24” x 16” framing square
- 8) #2 Phillips screw driver
- 9) 10 oz. Caulking gun

#### Materials Required

1. 6 sheets of **double** strength cardboard 44” x 120” available from the Crystal Lake Park District
2. White or yellow carpenter’s glue
3. #6 x 1 ¼” Dry Wall Screw
4. 3” wide reinforced Kraft paper carton tape
5. Masking tape
6. Jet Dry water softening solution for dish washers
7. 10 oz. tubes of siliconized acrylic caulk or acrylic latex caulk plus silicone
8. Oil base wood sanding sealer for varnish
9. Oil base polyurethane varnish
10. Paint thinner for brush cleaning

Step 1 The sheets of **double** strength cardboard provided by the Crystal Lake Park District are 88" x 120" and are difficult to move. This boat is designed around material 44" wide. When picking up the material be sure to bring a chalk line, tape measure and a razor knife. Cut each sheet into two pieces measuring 44" x 120". Now fold in half to a 44" x 60" dimension. You now have a size readily moved to your boat construction site. In the building process cover the fold line with a piece of Kraft carton tape.

Step 2 Build a work table. This is an elective. While this boat can be built on the floor, it is more easily done on a large table. This can be accomplished using 4 saw horses, 4 2x4's, 16' long and 2 sheets of ½" CDX plywood. Place the 2x4's flat on the saw horses and then place the plywood end to end on the 2x4's. Use dry wall screws to fasten the plywood to the 2x4's. You now have a 4' x 16' level work table that can easily be disassembled for storage or the material used for other projects.

Step 3 Cut 2 pieces of card board 72" x 44". Butt the factory cut end of one piece to the factory cut end of a piece 44" x 120" being sure the factory cut edges are lined up. Tape this joint together with a single piece of 3" Kraft tape. A scab will be installed to reinforce this joint on the boat bottom later in construction. Repeat to make a second large piece. When laying out the boat be sure these top and bottom joints are toward opposite ends of the boat per the drawings.

Step 4 Layout—Accuracy is critical to easy assembly. All initial measurements are made from factory cut ends or edges. All measurements are in inches. We are not using the metric system here. For the top and bottom layout measure 22" from the factory edge at each end and snap a chalk line to establish the boats center line. Transfer the plans in full scale to the cardboard blanks. All dotted lines should be drawn as dotted lines.

Steps 1, 3 and 4 can be eliminated if you buy a kit.

Step 5 Cutting—All solid lines on the drawings are "cut lines". Whether your cuts are made using a straight edge or done free hand, they must be straight and accurate. Use only fresh, sharp blades in your razor knife. Do not try to cut through the double strength cardboard with one swipe. Mark the identity and location on each piece as you cut it out.

Step 6 Assembly—Okay, the grunt work is over. Now the boat will begin to rapidly take shape.

- a. Take the rib marked rear-rear c'pit with the slots pointed up and insert the rear cockpit supports with the slots down into the rib slots. Take the rib marked front-rear c'pit with the slots pointed up and insert the rear cockpit supports into the rib's narrow slots. Fold the ends of the rear cockpit supports together and tape.

- b. Glue the longitudinal supports together in pairs. After the glue dries (approximately 15 minutes), mount onto the front cockpit ribs in a similar fashion to step 6-a. Fold front ends together and tape. Take this sub-assembly and mount to the rear cockpit sub-assembly as shown in the exploded view. This now completes the skeleton.
- c. Fold preparation/Scoring—Cardboard must be bruised along fold lines to facilitate bending. This can be done using a razor knife with the blade retracted and a straight edge. Hold the straight edge approximately 1/8” from the dotted (fold) line. Using the round pointed end of the razor knife handle apply pressure and draw the knife towards you. Do not be alarmed if you break the top paper surface of the cardboard. This will not harm the integrity of the boat. Practice on scrap pieces until you discover how much pressure to apply to obtain a good fold.
- d. Boat top assembly—To ease construction the boat top assembly is built upside down. Fold all boat flaps (sides and cockpits) a full 180°. The flaps will partially return to their original position due to the “Memory” of the material. Raise flaps to the vertical position and tape joints on boat sides to form a cup or a box bottom. To temporarily hold sides in a vertical position, tape side joint to matching side joint with masking tape. Glue side braces in place being sure it laps over all vertical side joints. Hold together with dry wall screws until glue has set (15 minutes minimum). Remove dry wall screws and temporary masking tape. Drop the skeleton into the top cup and use the cockpit flaps to position it. If any rib is too long to drop freely to the bottom of the cup, trim its length until it will do so. Apply glue to cockpit flaps one at a time and fasten with dry wall screws to the skeleton. Do not remove these screws until just prior to installing cockpits. Set assembly aside.
- e. Score, fold and tape joints in the bottom cup in a similar fashion to the top cup. Glue the joint reinforcing scab in place per the drawing. Notch the skeleton to allow for the scab and to permit the inside of the bottom cup to come in complete contact with the skeleton. Place a heavy bead of caulking along all of the exposed edges of the skeleton. This will bond the boat bottom to the skeleton and greatly improve the rigidity of the entire assembly. Turn the bottom cup over (it now becomes a lid) and lower it onto the top assembly. Place 2 temporary screws in each flap to hold top and bottom together. Locate these screws 3/4” from the boat top. Flip the entire assembly over. Remove screws. Apply glue to bottom flaps one at a time and anchor to boat top sides with dry wall screws 3/4” from the top of the boat. Allow to dry for a least 8 hours before removing screws.
- f. Cockpit installation—The floor of the front cockpit is uneven because of the joint reinforcing scab. Cut, fit and glue pieces of scrap material to make the floor flush and even. Score and fold the cockpits into box

shapes. You will have to trim the cockpit sides flush with the boat top after installation. Push the cockpit box into the cockpit opening. It will probably be a tight fit. Now, after you have struggled to get it in place, remove it. Remove cockpit flap screws. Apply glue to sides and bottom of cockpit openings. Re-insert cockpit and fasten with dry wall screws ¾" from top of boat. Trim cockpit sides flush with top of boat. Let glue dry at least 1 hour before removing screws.

Now that wasn't so hard, was it? You have been such good workers we think you should take a 10 minute break to grab some cold liquid refreshment.

All right team, let's get back to work.

- Step 7 Caulking—Neatness counts here, not only for thoroughly sealing all joints, but to make it easier to tape those joints later. Let's get rid of those little screw holes first. Place a dab of caulking in each hole slightly larger than the amount required to fill it. Using your putty knife, press the caulking into the hole and wipe it flush with the cardboard surface with one stroke. As excess caulk builds up on the putty knife, wipe it off on some nearby seams. After you are done with the holes, lay a heavy bead of caulking on the corner joints. Only work 3' of joint at a time. Press caulking into any corrugated edge flutes and gaps between adjoining pieces of cardboard and wipe any excess off with your putty knife. Transfer any excess to a nearby un-caulked joint. Don't forget the butt seams on the bottom and sides of the boat. Caulk all inside corners of the cockpits. Wipe in with a wet finger to provide a smooth round fillet.
- Step 8 Taping—Kraft reinforced carton tape requires a special moistening solution to stick well. Ordinary tap water causes the tape edges to curl up as it dries. Commercial water additives are not readily available. A suitable substitute called Jet Dry can be located at your local grocery near dishwasher soaps. Add ½ small bottle to a gallon of water. Test to see if this concentration works for you. Apply moisture to tape with a sponge. If you have access to a tape-dispensing machine, it will immensely shorten your taping time. Start by taping the bottom corners of the boat. While this bottom corner is not a joint, bending the cardboard stresses the paper fibers on an outside corner to such a degree, it is impossible to properly waterproof with any kind of sealer. Apply 2 layers of tape over butt joints—lapping 1". Tape all interior corners of cockpits. Next, thoroughly tape bow and stern. Lastly, tape all outside corner joints with 2 pieces of tape—lapping 1".
- Step 9 Waterproofing—Inspect all un-taped surfaces of the boat for damage to the outer layer of paper. If any damage is found, patch with caulk and tape. Apply 2 coats of oil base wood sanding sealer for varnish. On a

sunny day, both coats can be applied on the same day. Then apply 3 coats of oil base polyurethane varnish. Allow 24 hours of drying time between coats. Painted decorations can be added over this finish if desired.

A clear finish has one distinct advantage over a painted boat. If, after a race, you discover a dark brown spot, it indicates your waterproofing has been breeched at this point. A leak discovered early is easy to repair on the spot. Just dry it off, touch up with caulking and cover with a piece of duct tape. This patch will last the remainder of race day and permanent repair can be made at your leisure.

A leak in a fully painted boat will probably not be discovered until the boat starts to turn to mush. Be smart. Decorate only the top deck of your boat.

### Conclusion

This set of plans and directions is intended to accomplish three things:

1. To give you exact dimensions to build a boat.
2. To expose you to a construction method to use in your own boat design.
3. To encourage you to participate in this event year after year.

If we have done this, we consider our efforts to be a success.

## **SEE YA AT THE RACE!!**

### Miscellaneous

1. This boat displaces 832 pounds
2. Maximum total crew weight = 400 pounds
3. Carry boat standing on edge
4. Never set boat directly on the ground
5. The use of kayak paddles should increase your speed—but only if the crew members are well coordinated
6. Use a loose cushion i.e. soft Styrofoam- at least 2" thick. Raising your body in the cockpit will give you a stronger stroke
7. Bring a patch kit consisting of – caulk gun – caulking – putty knife – razor knife – duct tape
8. Water weighs 62 pounds per cubic foot
9. One cubic foot equals 1728 cubic inches
10. Cubic footage of boat hull x 62 pounds equals boat displacement in pounds
11. Safe crew load equals ½ of displacement
12. If your fanny will not fit in a 17" cockpit, adding 2" to the width of this boat increases the displacement by 73 pounds

13. Each 1" added to the depth of this boat increases the displacement by 119 pounds
14. The combination of 2" extra width and 1" in extra depth increases the displacement by 203 pounds
15. If you choose option 12, 13 or 14 you will need a heck of a lot more cardboard
16. Arrive early to obtain good vehicle parking and boat parking
17. Vehicle parking is across the street from Main Beach
18. Boats enter the North gate at Main Beach
19. The least congested boat parking spots are South of the playground. It is also close to the starting line
20. Unless you have a really fast boat the best starting position is the left end. This will help you avoid congestion at the first buoy.
21. Generally speaking, boats having a time of 2 minutes or less in the first heat will advance to the second round
22. Advancement is based solely on time
23. The course record set in 2003 by Ryan Stephens is 39 seconds
24. The boat was built by the author of these plans