





BOAT BUILDING GUIDE





Here's How...

PICK YOUR CATEGORY

You have a choice of building for **speed** or building for **style**. **Speed** boats compete in races and **style** boats compete for design (showboat). The category you choose will determine the nature of your boat design. Specific categories are listed below (each category is a race against similar boats).

- Racing
- Military
- Commercial
- Open
- Showboat





CREATE YOUR DESIGN

The following sizes of milk/juice cartons may be used:

One Quart Half Gallon One Gallon



A minimum of 50 half-gallon cartons or the equivalent is required for each entry except in the Commercial category where a minimum of 100 half-gallon cartons or the equivalent is required.

Flotation must rely entirely on milk cartons, but above the waterline almost anything goes. Speed boats usually feature minimal structures above the waterline. They tend to be long and narrow, like a kayak or canoe. Style boats can be any shape desired by the builder. Builders of style devote most of their attention to the above water structure since they are competing for the best look. Take time to draw a plan of your boat on paper. Work out the dimensions of the boat and try to estimate its finished weight.













The size and complexity of your craft should reflect your available resources: money, labor and time. In addition, you must consider how you will transport the boat to the lake. Do you have a station wagon, van, pick-up, trailer or flatbed truck available to you?

Determine how many crew members your boat will carry and who those people will be. Crew members usually represent the greatest weight aboard your boat (a one gallon jug will float 8 lbs.).

Your boat's stability is another important consideration. A boat that is too narrow for the weight it must carry (especially if that weight is carried high above the waterline) will capsize. This is a particular danger for racing boats with their long, slender hulls. A potentially unstable boat that rocks from side to side as it moves through the water will be slower than a stable boat that glides smoothly over the water on an even keel. Assuring adequate stability in a long, sleek hull is why many racers adopt catamaran designs or outriggers. Most people propel their boats by sitting on or in them and paddling with an oar. Some ambitious designs make use of side wheels, stern wheels or even propellers driven by chains or belts connected to bicycle peddle assemblies. Some boats feature no form of propulsion at all; their



builders swim in the water next to them and push them along. This method is usually effective only for very small boats.



Most milk carton boats do not need a rudder for steering. Usually, their crew members guiding with their paddles can turn them easily. Exceptionally long, narrow hulls may experience greater problems in maneuvering. They may not require a rudder, provided their crews can find a clear patch of lake to make a wide, slow turn. The only legal means to power your boat are human effort and wind. You may want to think twice about building a boat more than 10 feet tall. When the wind comes up, these high, flat surfaces tend to act like sails and can tip your boat over.

REMEMBER: Safety is the number one priority. ALL CREW MEMBERS MUST SUPPLY AND WEAR A COAST GUARD APPROVED LIFE JACKET WHILE OPERATING ON THE WATER.



GATHER YOUR MATERIALS

Hull structures can be built of wood, plastic or steel. The above water structures can be built of cloth, plastic, wood, Styrofoam, papier-mâché, plants, toys or just about anything you can think of. Use nails, glue (wood glue, hot glue, etc.), staples, tacks, wire, tapes (fiberglass, plastic, duct) and other fasteners to join the parts of your boat together. Decorate it with paint, carpet, linoleum and craft supplies.

Finding an adequate supply of milk cartons is usually the biggest challenge facing the boat builder. Experienced boaters collect cartons all year round. Ask your friends, relatives and neighbors to collect for you. Get collections going at your church, school, workplace, health club, apartment building or social organization. Coffee/latté stands are a great source for empty cartons. Restaurants, cafeterias, hospitals and schools are also good sources. **Seafair provides a limited number of cartons after June 1st ON A FIRST COME FIRST SERVE BASIS.**



CONSTRUCTION TECHNIQUES



Hulls should be joined together securely with nails or screws. Steel tie-downs and brackets provide added strength. A strong, secure hull frame will prevent your boat from breaking up during transport or operation.

If you are using a plywood deck on which people will sit or stand, brace the deck underneath. Use wooden 2'x4's for the areas on which boaters will be placing weight, and smaller cuts (1'x2's, 2'x2's, thin plywood sheeting) for areas that will not bear heavy weights.

Hot glue your milk cartons shut and reinforce the seal by stapling the closed mouths. Then hot glue the sealed cartons together into bundles or blocks of four-to-eight cartons. Wrap the blocks with duct tape to reinforce. Use staples, tacks or nails to fasten to the hull; you can also hot glue them into position. You may wrap the bottom of your boat with steel, plastic mesh or chicken wire to prevent cartons from breaking free in the water and floating away. (However, do not permanently enclose the cartons within the hull with wood, plastic or fabric; nor should you screen them from view.) These measures will result in disqualification.



For specific rules or questions contact Seafair Event Manager Sherry Fadely at 206.728.0123 x108 or via e-mail at <u>mailto:MilkCartonDerby@seafair.com</u>

You can build your boat as one single unit or in pieces that can be assembled at the lake. If you choose the latter, it's best to build the hull as one piece and the above water structure in components. Remember to bring necessary construction supplies to the lake and allow yourself sufficient time for assembly.

THE ALL-IMPORTANT TEST RUN

Most milk carton boat builders neglect to test the buoyancy, stability and structural integrity of their



boats with a trial run on the water (this applies to virtually all builders whose boats end up sinking on Derby Day!) Allow yourself sufficient time in your building schedule to conduct a trial run. Load your boat with the actual people who will crew it and add enough weight to simulate any additional structures you will be adding. Test the handling and seaworthiness of the boat by taking a spin around the lake. When you remove your boat from the water, examine it for breaks, cracks, separated frame pieces, detached or loosened milk cartons and other surprises. In particular, watch for evidence of flooding through punctured milk cartons. Unseen, progressive

flooding of this kind can result in a sudden loss of buoyancy on the water. Reconstruct or reinforce weakened or damaged components as needed.

REGISTRATION, INSPECTION AND OPERATION

Beginning April 1 you can visit our website at <u>www.seafair.com/milkcartonderby</u>. If you do not preregister, visit the Seafair Boat Registration table at Green Lake as soon as you arrive (before 10 a.m.). An Inspector will examine your boat to see that it complies with all the rules and regulations (study these closely to avoid the disappointment of being disqualified). He/she will assign you to the appropriate category and provide you with a registration number, which you must affix to your boat.

You are now ready to launch your boat! Take note of the Schedule of Events online at seafair.com. Listen to the public address system announcements to determine when it's your turn to race or parade your boat on event day. **HAVE FUN!**





Milk Carton Derby Raft - Options

Build a raft with a bow

Cut a point on a 4 x 8 sheet of plywood that runs from the center out to each side. Frame the bow with 2 x 4's as shown in diagram. Secure the plywood to the frame using nails or screws. Add cartons to fill the bow area. You may need to deform cartons to make them fit into voids. Materials are same as raft, except add one more 2x4 (total 4-2x4x8's). This boat will have 9 rows that are 12 cartons wide (108 cartons) plus 10-12 cartons in the bow. The approximate capacity of this boat = 472 lbs (118 x 4 lbs per $\frac{1}{2}$ -gal = 472 lbs total displacement) – 77 lbs (wood) = 395 \div 1.5 = 263 lbs.



Build a smaller boat

Build a narrower boat that is 10 cartons wide. Cut the 4 x 8 plywood to 41" wide by 96" long. Add a point and build a frame as shown above. This boat will have 9 rows that are 10 cartons wide (90 cartons) plus 6-8 cartons in the bow (total carton displacement = 384 lbs). Materials are same as raft with bow. The approximate capacity of this boat = 384 lbs (96 x 4 lbs per $\frac{1}{2}$ -gal = 384 lbs total displacement) - 77 lbs (wood) = $307 \div 1.5 = 204$ lbs.

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The following is a description of how to build a simple Speedboat. Please refer to the attached diagram when reading this section.

Look first at the bottom set of drawings on the diagrams, called the "side elevation". The four components of the hull, marked **A**, **B**, **C** and **D** are shown in "exploded" form. That its, they are shown as if separated form each other. **A+B** form the keel, the backbone, of your boat. **A** is a 2x4 approximately 12' in length. You may build a longer boat and you may use a different cut of wood if you wish. **B** is a 2x4 approximately 3' in length. The left end of **B** has been cut on an angle so that when it is attached to **A**, it gives the overall keel an upward tilt – called a *sheer* – at the front end. Use a professional strength wood glue to position B on the end of **A**, then screw steel "tie down" brackets over both sides of the join to reinforce it. Tie downs are available at most building supply stores.

C is a thin, narrow plank of plywood or siding material about 15' in length. It will provide your boat with its deck. It should be nailed securely to the upper side of the 2x4 keel. As it passes over the area where **A** joins **B** it will not be possible to nail it to the keel – doing so will cause the deck to break. Instead, allow the deck to bend naturally over the area of the joint, forming a gradual upward sweep. It may be necessary to soak the deck in water to make it pliable enough to bend. The purpose of providing a *sheer* in the forward end of your craft. When this happens, it causes the boat to bury its nose in the water – and that will slow you down.

Once the deck is securely attached to the keel, nail a seat and foot braces into positions on top of the deck. Position the seat no further forward than the mid-point of the boat's length. If you do, the balance of weight will shift forward and your boat will bury its nose. Some racers position the seat slightly aft of the mid-point. You may need to experiment during your trial run to determine the optimum position. Seats can be a simple plank of wood or a seat from a bicycle or lawn mower.

Speedboat hulls can be re-used over a period of several years. But they must be protected from the warping and decay that result from contact with the water. Before you move on to the next stage of attaching the milk cartons apply a coat of primer to seal the wood, then one or more coats of paint to protect the primer.

D represents a row of half-gallon paper milk cartons. One-gallon plastic milk jugs should not be used on speedboats. On a speedboat these should be attached so that their bottoms face outward toward the sides of your boat. After sealing their mouths shut, hot glue them together, side to side, and then reinforce these "bundles" of cartons by wrapping them in clear plastic shipping tape. The "bundles" should consist of about 4 to 8 cartons. Then staple the cartons onto the bottom side of the 2x4 keel using the "lip" at the very top of the milk carton. Staple a row of cartons in this manner along the entire length of the keel (including the upswept **B** portion) on both sides. It may be necessary to cover the carton "lips" if you are using a narrow cut of wood for the keel.











Once in position, use clear plastic shipping tape to secure the multiple "bundles" of cartons to each other. This in effect makes the bundles one continuous bundle, which is very important. Unless the cartons are all attached to each other, any separate bundle will "feather" in the water. In other words, it will move up and down in a random fashion as the water washes over the bundle, which will slow your boat down and make it less maneuverable.

E is a very thin, pliable piece of wood, like a 1x2, that can be cut into two sections: One matching the length of **A** and the other matching the length of **B**. Position the two sections of **E** over the lips of the milk cartons where they are attached to the bottom of the keel. Then screw them on to the bottom of the keel using an electric drill/screw driver. This will secure the milk cartons in place and prevent them from breaking or tearing loose in the water.

Your speedboat is now ready to race. Sit on your boat's seat and use a double-ended paddle to row from both sides. Speedboats are fast and require a little practice to handle effectively. Hint: Reduce and keep extraneous weights to a minimum; and remember that the physical conditioning of the boat operator can make the difference between a first and second place showing!

HAVE FUN!





