Make a Splash on the Maiden Voyage of the IPFW Cardboard Regatta

Saturday, June 22
The Challenge

To design, build, and race a human-powered, corrugated cardboard boat on the St. Joseph River.
Boats will race in divisions

(Divisions are based on class)
Class I: Paddles/Oars
Propelled by paddles or oars, which do not need to be made of cardboard.

Class II: Paddle-wheel/Propellers/Sails
Propelled by paddle-wheel/propellers/sails, which do not need to be made of cardboard, however, how the propulsion unit is attached to the vessel must be cardboard (i.e. mast) and follow the same rules and regulations.

Class III: School (High School & College)
Boats of either Class I or Class II, with a team consisting of all high school or college students.
Class IV: Kids (Ages 16 – 7)
Team and captain must be age 16 to 7; however, children under 12 must have an adult in the vessel (does not count as a crew member). Vessels must be propelled by paddles or oars, which do not need to be made of cardboard.

Class V: Build On-Site
You will have from 10:30 a.m. to 12:30 p.m. to build your vessel using only the items supplied. Boats will be propelled by paddles or oars, you may bring your own or use those supplied. Class V vessels are limited to 1 to 2 person crews.

* Must be 5 boats in each class to hold division. If 5 boat minimum is not met, boats will race in heats based on size.
Boats range in size from one to ten passengers.
**Guppy**
1 – 2 passenger
Team will receive 2 sheets of double-wall, corrugated cardboard sponsored by Kelly Box & Packaging and will receive one t-shirt for each crew member (maximum of two shirts).

**Dolphin**
3 – 5 passenger
Team will receive 4 sheets of double-wall, corrugated cardboard sponsored by Kelly Box & Packaging, and will receive one t-shirt for each crew member (maximum of five shirts).

**Whale**
6 – 10 passenger
Team will receive 6 sheets of double-wall, corrugated cardboard sponsored by Kelly Box & Packaging and will receive one t-shirt for each crew member (maximum of ten shirts).
AWARDS
Top 5 Fastest Boats Overall

$500 – Cash Prize, First Place Overall
$250 – Cash Prize, Second Place Overall
$125 – Cash Prize, Third Place Overall
$75 – Cash Prize, Fourth Place Overall
$50 – Cash Prize, Fifth Place Overall
Best Looking
Most attractive/spectacular boat
$50 – Cash Prize

Spirit Award
Team with the best spirit and attitude and/or having the most fun
$50 – Cash Prize

Titanic Award
Most spectacular sinking
$50 – Cash Prize

Celebrity Judges Award
Judges favorite boat
$50 – Cash Prize
People’s Choice
Free voting by fans at RiverFest and online via Facebook.
$50 – Cash Prize

Mastodon Pride Award
Sponsored by IPFW Students Today, Alumni Tomorrow (STAT)
Most creative/best use of the IPFW name, logo, mascot, and school colors: royal blue and white
$100 – Cash Prize

ROCK Awesome Award
Sponsored by ROCK104
Most creative/best use of the ROCK104 name, logo, colors, and rock theme.
Rules & Regulations
CARDBOARD
The entire boat (hull, superstructure, seats, etc.) must be made of everyday, ordinary, regular corrugated cardboard. There are no thickness requirements.

**ALLOWED:** Cardboard boxes and blocks; single and double wall corrugate cardboard; and carpet tubes.

**RESTRICTED:** Cardboard manufactured with wax, weather resistant/sealed, rolled, pressed, or reinforced; and Sona-tubes.

GLUE/PAINT

**ALLOWED:** Any one-part glue and/or paint.

**RESTRICTED:** Two part, epoxy, tar-based, fiberglass resin, or varnishes.

TAPE

**ALLOWED:** Anything goes, but on seams ONLY.

**RESTRICTED:** Covering or wrapping any portion of the boat with tape, duct tape, plastic, shrink wrap, or any product intended for water resistance.

FASTENERS

**ALLOWED:** Nuts, bolts, washers, staples, glues, etc... to fasten corrugated cardboard together.

SAFETY

Boat must be free of pointy object, sharp edges or anything that could cause injury.

Rules & Regulations - Construction
INSPECTION
Prior to racing, all boats must pass a technical inspection for compliance with the above rules to qualify for the race and any awards/prizes.

- Boats with violations will be granted a chance to fix any violations and be re-inspected, prior to racing.
- If a boat is suspected of violating the above rules pre or post-race the boat will be subject to an “icepick test”.
- If boat is found in violation of above rules, the boat and team will be stripped of all awards and prizes and deemed pirates.

REGISTRATION
All boats must pre-register and turn-in completed safety waivers for each member of the team prior to the race.

- Registration and inspection begin at 9 a.m. on Saturday, June 22, 2013 at the base of the IPFW Venderly Family Bridge, on the west bank of the St. Joseph River, IPFW main camps.

DISPOSAL
The Captain is responsible for removal of the boat from the water, as well as from the IPFW campus at the end of the day.

FINISHING
To qualify as a finisher, all members of the crew and its captain must remain in the boat at all times and 80% of the boat must cross the finish line.

Rules & Regulations
CREW VISIBILITY
Boat’s captain and crew must be visible during the entire race.
• Boats may not enclose any team members.

CREW MEMBERS
• A person may command only one (1) boat; however, they may ‘crew’ on as many boats as desired.
• No more than ten (10) humans allowed in any boat.
• No pets allowed.

PFD
All participants must wear a Coast Guard approved Personal Flotation Device (a.k.a. life vest) in their correct size, while in the boat or water.
• PFD’s will not be provided.

SHOES
All participants must wear shoes with a substantial sole.
• No flip flops or sandals.

All judges’ decisions and interpretations are final.
How to Build, and Race, a Cardboard Boat

(General Advice)
Design Consideration

1. Set a Goal: Are you building a “fun boat” or a “speed boat”?
2. Will it float? Be sure to make your boat large enough to fit your team. Take into consideration the combined weight of your team. (i.e. 1x1x3 will float about 180 lbs.)
3. A flat bottom is less likely to tip over than v-shaped, unless then v is very gradual.
4. Keep a Low Center: Sit in your boat, kneeling or standing will most likely cause a tip-over.

General Advice
**Dimension Considerations**

1. Longer boats go faster, but are harder to turn.
2. Boats shorter than 10 feet are difficult to steer straight.
3. Plan the width of your vessel based on the number of people. For a single boater, 30” is ideal, for two boaters, we suggest 48”.

**Waterproofing Tips**

1. Glue multiple layers of corrugated cardboard together.
2. Paint all surfaces of the corrugated cardboard before gluing.
3. Avoid oil-base stains, caulk and glue. It soaks in and may never dry.
4. Avoid using hot-melt glue. It “melts” on warm days.
5. Reinforced paper tape is the best over caulked edges and seams.
   i. Duct tape shrinks when painted
   ii. Clear tape melts when painted

**General Advice**
Other Advice

1. Come prepared to make repairs between races. Should you win your division, you will race in the finals.
2. Bring a lawn chair/blanket and sunscreen!
3. Bring a change of dry clothes... but hopefully you won’t need them.

SUPPLIES - What You’ll Need*

- Corrugated Cardboard
- Wood Glue and Tape
- Straight Edge – ruler, yardstick, measuring tape
- Cutting Utensil – utility knife, box cutter, tin snips
- Writing Utensil – marker, pencil, pen
- Weights – bricks, heavy stones—and Clips/Clamps
- Putty Knife
- Paint (any one part) & Brush/Roller

*See RULES & REGULATIONS for a list of approved and restricted items.

WHEN TO START?

Although a boat can be built in a weekend, or the day of—depending on your class and size—we suggest at least two weeks. This allows the glue and paint to dry completely.
BOAT BUILDING PROCESS

Step 1: Draw a design and build a small, to scale, model version. Use that model to determine how much cardboard you will need.

- The first 15 paid boats in each category receive free, 60” x 78”, double wall, corrugated cardboard from Kelly Box & Packaging.
  - Guppy – 2 sheets; Dolphin – 4 sheets; Whale – 6 sheets.
  - Additional corrugated cardboard may be purchased from Kelly Box at a discounted price: Single Wall - $1.60, Double Wall - $2.40.

Step 2: Once you are satisfied with your model, transfer the design to graph paper, using the appropriate dimensions, this can be used to draw your pattern on the cardboard sheets.

- **Hint:** Identify cut and bend lines differently.
Step 3: Begin with flat sheets of corrugated cardboard. *(Bends and folds weaken the corrugated cardboard, and therefore your boat.)* Now it’s time to start cutting and bending your vessel.

- **Hint:** For a clean bend, dent or crease the flat cardboard by using a blunt, rounded tool—like a crescent wrench.
- **Hint:** Don’t attempt to cut through the cardboard the first time, cut the same line multiple times to achieve a nice edge.

Step 4: Begin assembling the pieces of your boat together with glue and/or tape.

- **Hint:** After gluing, use a clamp/clip to hold the glued parts together until dry.

Step 5: Caulk all folds and corners of the individual pieces of your vessel.

General Advice
Step 6: Put the pieces together and glue. Once glue has dried, you may need to apply another coat of caulking.

Step 7: The fun part! Begin painting and decorating your vessel. You may use anything to decorate, as long as it does not influence the structure of your vessel.

Step 8: Create your costumes! Multiple awards will be given for things other than speed: team spirit, mastodon pride, ROCK 104 spirit and pride, and more...

Step 9: Chronicle your cardboard boat building and race experience.

- Prizes will be given for People’s Choice, so upload your photos to facebook, Flickr, etc... at hashtag us! #ipfwcbr
- Bring a cheering section! The IPFW Cardboard Regatta and IPFW RiverFest are free to attend.

General Advice
Step 10: Show up at IPFW RiverFest, Saturday, June 22, for check-in at 9 a.m. and be ready to paddle hard!

- **Hint:** Getting into your boat can be tricky, watch your balance. All races will begin from a stopped position, with the entire team in the boat. No running or pushing start.
Cardboard Boat Construction

Tips & Guidelines
Keep from Buckling

• Cardboard sheets can be fairly stiff in-plane, but are prone to buckling/bending
• Use special techniques when building your boat like creating bulkheads

Construction Techniques
Overlap corners by creating seams
Joining Tubes

• To join tubes, create a “wrap” around the tube join
Even Out the Load

- Distribute all loads evenly through the structure of the boat
  - Don’t apply a concentrated load on a sheet of cardboard
    - i.e. sitting or standing on a sheet – you’ll go right through and into the deep!

‘Laminate’ Corrugate Cardboard Sheets

- Makes corrugated more stiff
  - Alternating orientation of the corrugated sheets
  - HINT: Add a layer of Titebond
    - [http://www.titebond.com/index.aspx](http://www.titebond.com/index.aspx), or other wood glue, between the corrugated sheets
Shape and strengthen your boat with bulkheads and stiffeners. Box sections add significant stiffness and strength to sheet cardboard. Laminate bulkheads for additional rigidity and strength (alternating ply directions).

Stiffeners run the length of the boat

Bulkhead side view

How to attach bulkheads

Construction Techniques
Construction Techniques
Length

The distance from the tip of the stern to the tip of the bow, this simple measurement has a big impact on performance. With all else equal, a longer canoe is faster, tracks a straighter line and provides more carrying capacity than a shorter one. The tradeoff is decreased maneuverability: a longer canoe can’t make the tight turns or respond as quickly as some paddling demands. But that doesn’t mean a long canoe will be hard to steer—it just might not be the best choice for things like whitewater. For most uses you may find that the efficiency gained in tracking will outweigh any extra effort required for turning.

Hull Design Basics
**Beam**

Beam, or width, is measured at the widest part of the canoe. Most manufacturers provide three measurements: the gunwale, the waterline and the widest point. The 4” waterline accounts for displacement when fully loaded and tells you the most about performance. A narrow canoe tends to be faster but less stable, whereas a wider canoe provides more stability at the expense of some efficiency.

**Depth**

Also measured in three places—bow, stern and center—depth affects more subtle aspects of paddling. Increasing depth provides more carrying capacity and freeboard, allowing the canoe to paddle through waves with more ease. But it can also make the canoe heavier and less responsive in wind.
Hull Design Basics

HULL PROFILE:

The cross-section of a canoe’s hull hints at its true nature on the water. Most fall into one of four categories:

**Flat Bottom**

These hulls look just like they sound: the canoe’s belly has very little curve, making it highly stable on calm water. This initial stability, however, comes at the expense of secondary stability. Flat bottomed canoes are vulnerable to wind, waves and even leaning. Once initial stability is breached, it’s difficult to avoid capsizing.

**Round Bottom**

Exactly the opposite of the flat bottom, the belly of a round bottom canoe is extremely curved. Built for speed and efficiency, they can be difficult to balance in an upright position—particularly for inexperienced paddlers. In other words, initial stability is poor. In contrast, when leaned on an edge these canoes are hard to tip over. They feel tippy, but they’re hard to tip!
Shallow Arch
Designed to give paddlers the stability of a flat hull and the flexibility of a round hull, shallow arches are increasingly popular. Design varies widely with manufacturer. Some err toward initial stability with less arch, and others strive to provide more maneuverability. The result is an impressive selection that promises something for everyone, but it does require research, talking to experts, and even trying canoes out before purchasing.

Shallow Vee
Another blend of the flat and round hull, the shallow vee incorporates a v-shape at the bottom of the arch. This creates decent initial and secondary stability, and improved tracking. It does, however, result in a higher surface area in the water, which can make the canoe less efficient.
Monohull
• Probably most common and most versatile design
Catamaran

- Twin hull designs can be fast
- Best for multiple paddlers using canoe paddles
Outrigger

- Great way to create a stable design with a narrow hull.
**Length/width ratio** (applies only to waterline)

- longer/narrower is faster, but wider is more stable.

**Bow Design**

- sharp entry with a gradual taper to the full width of the boat is best for speed. Full waterline with minimal “deadwood” is desirable for speed & maneuverability.

**Stern Design**

- gradual taper to sharp exit is desirable for speed
- Some “deadwood” is desirable for tracking.
Seat height

- Low seat is better for stability (think of a kayak); high seat is better for paddling efficiency (think of a canoe).
- With a low seat, you may be able to get away with an 18” – 24” beam; with a higher seat, you’ll probably want 27” – 34” width.

Wider is Not Always Better

- Extra width not only slows the boat, but it makes it more challenging to paddle (paddler has to reach further over).
- Excess freeboard can be a problem in this regard as well.

Use Your Feet

- A simple foot-pedal rudder system can greatly aid directional stability and paddling efficiency.

Other Considerations
Brace Your Feet

• A foot brace is a great aid to paddling efficiency.

John Boat

• Sometimes a “john boat” design (pictured below) with a good paddler will beat all others.
Paddles

- Kayak paddles will probably be best for most.
- Canoe paddles work well with multiple paddlers.

Rowing

- A rowing setup has the potential to be the fastest, but there are challenges with facing backwards and installing oarlocks, etc.
Sails

- Sails probably won’t work well on a race of this type.

Foot Power

- Foot-powered systems have a lot of potential
- Can be complex
  - Keep price in mind, you don’t want to lose an expensive drive system if your boat falls apart.

Propulsion Considerations
EXAMPLES

PHOTOS
EXAMPLES

VIDEO
Great boat design and structure

• Creative & Artistic
  ❑ Some may not be the fastest, but they look cool!
  http://www.youtube.com/watch?v=Z50bslZcLhg

• Made for Speed!
  http://www.youtube.com/watch?v=N3ttAHF950E

• Many Different Boats – Not one disaster!
  http://www.youtube.com/watch?v=TyHgIAQzGcw
Not So-Great Boats...

• Boat Disaster 1 – Tipping
  http://www.youtube.com/watch?v=PVQkIWMVyWg
  http://www.youtube.com/watch?v=yh-JbcUXpu0&NR=1&feature=endscreen  (Watch from :24 to 1:07)

• Boat Disaster 2 – Water Displacement Issues
  http://www.youtube.com/watch?v=LQiKTuRC_uM

• Boat Disaster 3 – Bad Paddling Technique & Tipping
  ➢ Few of the boats are actually really well designed!
  http://www.youtube.com/watch?v=ly0PD92n8tg

• Many Boat Disasters – Tipping, Water Displacement, Weak Structure
  http://www.youtube.com/watch?v=wgKieMcf3_k

Examples – What Not to Do!
Great Boats from Beginning to End

- Police Lego Boat
  [Link](http://www.youtube.com/watch?v=WlzcKe-pJ-I&feature=endscreen&NR=1)
- El Dorado
  - Notice how they use the laminating technique
  [Link](http://www.youtube.com/watch?v=p2RONQFEfFo)

Examples – Great Boats
Still Want More?
IPFW Cardboard Regatta

Website: http://new.ipfw.edu/offices/alumni/cardboard-regatta.html
Awards: http://new.ipfw.edu/dotAsset/40711ac7-bdc1-4592-b94f-6e6730e63d48.pdf

Registration Form: https://purdue.qualtrics.com/SE/?SID=SV_40BH0Z6ovqTkHpb
Corrugated Cardboard Order Form: https://purdue.qualtrics.com/SE/?SID=SV_6osJ35JjWhq9qqF

Resources
Advice from Other Cardboard Regattas

http://www.usps.org/d33/Regaton/buildAboat.pdf


http://www.gscunitedway.org/media/How_do_you_build_a_cardboard_boat.pdf


Other cardboard regattas may have different rules and regulations, to avoid disqualification, be sure your boat complies with the IPFW Cardboard Regatta Rules & Regulations.

Advice
If you have any questions at anytime, don’t hesitate to call or email.

IPFW Alumni
260-481-6807 | alumni@ipfw.edu

Questions?