

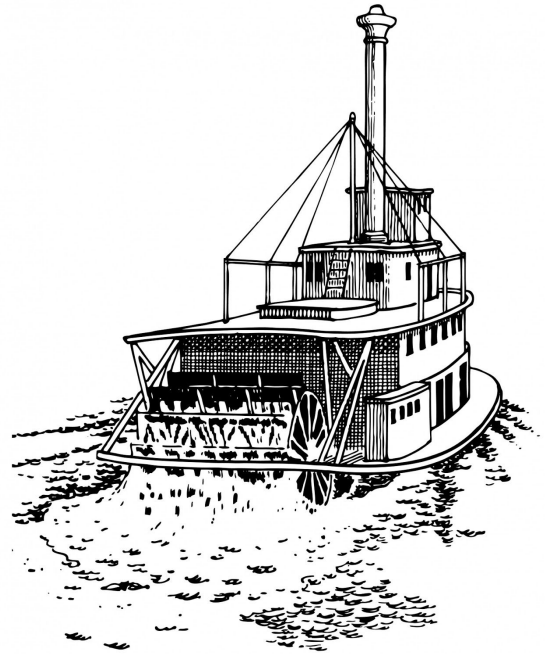
# Design Challenge - Build and Test a Buoyant Delivery Boat

## **Design Challenge**

You are to follow a design process to design, build, and test a device that can meet the challenge constraints that are outlined.

## **Objectives**

- ☐ Research, plan, and organize the project using the design process, and appropriate methods and tools.
- ☐ Apply appropriate methods for generating and graphically representing design ideas and solutions;
- ☐ Create and test using a variety of techniques, tools, and materials.



## **Real World Application Connection**

Have you ever wondered how a ship made of steel can float? If you drop a steel bolt into a bucket of water, the bolt quickly sinks to the bottom. Then how can a steel ship float? And better yet, how can a steel ship carry a heavy load without sinking? In this activity, you'll make little "boats" to explore how their size and shape affects the amount of weight they carry and how well they can move across water.

## **Design Criteria**

- ☐ A canned good item (of any size, but unopened) must be kept afloat and dry.
- ☐ The boat must be able to move under its own power and mechanism.
- ☐ Demonstrate something you learned from the Exploring Areas of Design unit.
- ☐ Additional challenge #1 is to have the boat travel the greatest distance.
- ☐ Additional challenge#2 is to have the lowest ratio of hull displacement (at sinking point) to load displacement. For example - a 2-litre bottle carrying a 500ml can would have a ratio of 4 to 1 (4:1); a 1-litre milk carton carrying the same can, (2:1).

## **Constraints**

- Pre-made, enclosed containers are not allowed to be used in the build.
- Use common materials found around your home. No going and buying stuff.
- Follow the design process in the time provided.

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### Materials:

<u>Some Ideas for</u>	<u>Possible Materials</u>
<ul style="list-style-type: none"><li>✓ Cardboard &amp; other paper products</li><li>✓ Aluminum Foil</li><li>✓ Straws</li><li>✓ Adhesive (glue, tape, hot glue)</li><li>✓ Dowel (or a pencil)</li></ul>	<ul style="list-style-type: none"><li>✓ Popsicle Sticks</li><li>✓ String</li><li>✓ Paper clips</li><li>✓ Elastic Band</li><li>✓ Plastic wrap</li></ul>

### Required Tools:

- ✓ Engineering Journal – Take notes throughout the design process (this journal will be in a Google Slide format that will be shared with the whole class)
- ✓ Ruler (or other measuring device) to measure distance travelled
- ✓ A container that can hold water that your boat can travel through.
- ✓ Hot glue gun (if you choose)
- ✓ Measuring cup (for additional challenge)
- ✓ Scissors or utility knife (if working under parent or guardian supervision)\

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### Design Process:

1. **Conduct research.** This can be a search on different types of boat hull designs and how they work, or different mechanisms to make the boat move.
2. **Brainstorm** ideas of possible solutions that meet the design criteria and constraints. When in doubt about an idea, list it anyway.
3. Each student is to **sketch 2** (two) possible solutions. **Include enough detail and notes in your sketch to effectively communicate your ideas.**
4. **Choose the best solution** based on discussion with at least one classmate, using a pros and cons list to evaluate each design against the constraints.
5. Create a **technical drawing, or 3D model** of any part of your boat, **or create a decorative decal** for your boat, **or a dock sign design.** Provide a

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two-dimensional graphical representation of your design with dimensions and labelled parts/information as necessary to communicate sizes and details.

6. **Build a prototype.** Take notes of issues that you encountered during the build.
7. **Test your prototype.** Make any necessary changes to ensure the design meets the criteria. Note all changes in your journal and mark up your sketch.
8. Finalize your design and test.
9. Make sure that your progress journal is up to date and clearly outlines what you've worked on.