BARGE BUILDERS
An Introduction to Weight Distribution and Grain Trade

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**Barge Builders**
*An Introduction to Weight Distribution and Grain Trade*

**Skill Level**
Beginner

**Learner Outcomes**
*The learner will be able to:*
- Define weight distribution.
- Describe grain transport in the U.S.
- Describe ideal barge designs.

**Educational Standard(s) Supported**

4th Grade
4.E.TS1.1, 4.E.TS2.1, 4.E.TS2.2

5th Grade
5.E.TS1.1, 5.E.TS1.2, 5.E.TS1.3

**Success Indicator**
*Learners will be successful if they:*
- Build their own aluminum foil barge.
- Identify strengths and weaknesses in their designs.
- Understand the importance of barges in the U.S. grain market.

**Time Needed**
30 Minutes

**Materials List**
- Aluminum foil sheets — one per group
- Dried peas, corn or soybeans
  - (about 1 lb / 3 barges)
- Large washtub or plastic bin
- Water
- Tablespoon
- Computer and projector (optional)

**Introduction to Content**

Barges and the people involved in their creation and operation are the unsung heroes of many industries — including grain trading. By using barges, much of the grain produced in the United States is moved from one port to another efficiently and safely.

**Introduction to Methodology**

Students will first get a brief overview of the journey commodities like corn or soybeans take from the local area to the Mississippi River and on to the Gulf of Mexico. Then, they will work either as individuals or teams to create their own barges from aluminum foil. After the barges are tested, a discussion on density, weight distribution and surface tension will be used to debrief the experiment. Any remaining time can be used to discuss products made from the ones carried on the barges around the world.

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**Terms and Concepts Introduction**

- **Density** — the degree of compactness of a substance.
- **Surface Tension** — the attractive force exerted upon the surface molecules of a liquid by the molecules beneath that tends to draw the surface molecules into the bulk of the liquid and makes the liquid assume the shape having the least amount of surface area.
- **Weight Distribution** — portion of total weight that will be supported per unit area.

**Setting the Stage and Opening Questions**

Fill the washtub or bin two-thirds full with water ahead of time.

Ask the students, **“After the farmers here in (insert local community or area) plant their (crop of choice), and it grows all summer, what happens to it?” “Then, where does it go?” “How does it get there?”**, allowing time for them to discuss and answer in between.

Explain to the students that once the crop you are discussing is harvested, it is loaded onto trucks, then sometimes trains, and then usually onto a barge in one of the major rivers. You can use the video from Consolidated Grain and Barge ([https://youtu.be/CBwpqc-ifSw](https://youtu.be/CBwpqc-ifSw)) and a map of the barge system from USDA (included in this lesson plan) to explain this.

To explain how much grain is transported by barge and to give the students an idea of how big barges are, share these statistics:

*An average barge can hold 54,750 bushels of soybeans. One bushel of soybeans weighs 60 pounds. Therefore, each barge floats while carrying 1,643 tons or the weight of about 21,000 adults or 55,000 elementary school children!*

**Experience**

Begin by dividing into groups if necessary and giving each person or group a sheet of aluminum foil. Ask the students to build their own barge with the foil in five to eight minutes, depending on the age group. Use the drone video of barges on the Mississippi River for inspiration ([youtube.com/watch?v=o1w6haAOreO](https://youtube.com/watch?v=o1w6haAOreO)).

Once the barges are completed, place them in the “river” you have made with the tub of water. Add your dried peas by the tablespoon until the barges sink and invite the students to try to guess which one will be able to hold the most weight while remaining afloat.
Share

Ask the students, “Which barge shapes worked best? Which ones did not work? Why?”

Possible answers include sides being too short, weight not being evenly distributed, etc.

Process

Ask students to relate the barge designs to their experiences in a swimming pool by asking, “When you jump off a diving board, would you rather do a cannonball or belly flop? If you are standing in the shallow end and you tuck your knees into your chest like a cannonball, what happens? What if you lay back flat?” (It helps if you act this out while speaking so they can get a visual of your body spreading out and curling into itself.) Use this example to explain that the surface tension helps to keep you and barges afloat, but if too much weight is concentrated in one small area, it will let things sink.

Generalize

Once the students have a better understanding of surface tension, density and weight distribution, discuss with them other ways that weight distribution is important in agriculture (i.e., tractors and implements, trucking, etc.). Then, discuss the commodities being moved with these barges they just modeled.

Ask them what happens to the grain once it enters the Gulf of Mexico. It is sent to manufacturers of commodities or exported to other countries since the commodity is a raw product.

Ask them if they know of any products made from those commodities. Commodity posters are included in this lesson plan.

Share any information that fills the gaps in their knowledge of the grain trade at this stage.

Apply

Ask the students, “If you were to build a real barge, how would you do it? What shapes, materials, etc., would you use?”

Life Skill(s)

4th Grade
Participate in 4-H club meetings by saying pledges, completing activities, and being engaged (Head).

Follow Instructions (Heart)

5th Grade
Participate in 4-H club meetings by saying pledges, completing activities, and being engaged (Head).

As part of a group, identify and agree on a common task (set a goal) (Hands).
4th Grade

4.ETS1.1) Categorize the effectiveness of design solutions by comparing them to specified criteria for constraints.
4.ETS2.1) Use appropriate tools and measurements to build a model.
4.ETS2.2) Determine the effectiveness of multiple solutions to a design problem given the criteria and the constraints.

5th Grade

5.ETS1.1) Research, test, re-test, and communicate a design to solve a problem.
5.ETS1.2) Plan and carry out tests on one or more elements of a prototype in which variables are controlled and failure points are considered to identify which elements need to be improved. Apply the results of tests to redesign the prototype.
5.ETS1.3) Describe how failure provides valuable information toward finding a solution.

For a short video demonstration of this lesson created by the author, please view the following YouTube link:

Soybeans A to Z

Did you know all of these products are made from soybeans?

A: Adhesives
B: Biodiesel
C: Crayons
D: Detergent
E: Edamame
F: Fish Food
G: Glycerin
H: Hog Feed
I: Ink
J: Jolly Rancher Hard Candy
K: Kitten Food
L: Laundry Detergent
M: Margarine
N: Noodles
O: Oil
P: Protein
Q: Pudding
R: Rainbow Sherbet
S: Soymilk
T: Tub
U: Upholstery
V: Varnish
W: Wax
X: X-Ray Film
Y: Yogurt
Z: Zebra Feed

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For more information visit www.nfbfoundation.org
Barge Tonnage by Commodity Group

- Petroleum and related products, 29%
- Coal, 22%
- Crude, 18%
- Food & Farm, 16%
- Chemicals, 9%
- Manufactured Goods, 5%
- Equipment, 1%

Source: U.S. Army Corps of Engineers
Barge Flows: Agriculture vs. Total Freight

Source: U.S. Department of Transportation. The map uses U.S. Army Corps of Engineers 2012 waterborne commerce data.