



Natural Hazards Engineering Research Infrastructure

Harnessing Wind

2023 NHERI REU Boundary Layer Wind Tunnel University of Florida

Summary

This project will replicate a wind tunnel test such as the Boundary Layer Wind Tunnel at the University of Florida in a fun and engaging way for the target level of middle school students but can be applied to various age groups. This project will have the students create paper mâché sail boats and race them in a tub of water that has an office fan placed behind the tub powering the sail boats. This can be fun and competitive for the kids by creating prizes for the best designs and fastest boats. The kids can be given a book on how to make paper mâché boats or they can try their own methods.

Engineering Connection

The connection to engineering is through wind studies on how the wind will push the little boats. The idea is to make a boat that can take the advantage of the wind flow and get to the finish line first. It all comes down to the aerodynamics and design of the boats to keep afloat. Effectively making a boat that uses the mayor wind flow while still being able to float on the water.

Audience- Middle school students (grade 6 – 8)

Lesson Objectives

- The students will learn how to build their own boat
- The students will learn about water displacement.
- The students will learn about wind-wave interaction.
- The students will overcome failed attempts and create problem-solving solutions.

Educational Standards

- MS-ETS1-3 Engineering Design: Analyze data from test to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- MS-ETS1-4 Engineering Design: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Material List

- Water Tub (Preferably as long as possible for racing)
- Office Fan
- Paper Mache
- Prizes (Candy)
- Glue or tape

Introduction

This lesson plan will provide you with what is required to run this project. It should be a fun and interactive experience for the children. Importunately try and make a boat yourself and test it in the tub of water with the fan blowing to see if it works before the children arrive.

Procedure

- Background knowledge
 - These must be tested beforehand:
 - Fan speed, amount of water needed in the tub.
- Before the activity
 - Test fan speed for effectiveness
 - Layout paper for the students
 - Fill tub of water to appropriate height that the boats will be able to sail effectively
- During the activity
 - Allow students to try and come up with their own solutions to the problem at first.
 - Then help them by providing a paper mache book or building along with them
 - Have the students race their boats against each other. This can be like a tournament but make sure all students are included.
 - If a student's boat fails or sinks have them make a new one and join back in the racing.
- After the activity
 - Ask the students what they learned.
 - Which boats were the fastest? Why?
 - Which boats sank? Why?

Assessment

The students will succeed in this experience when they see how much displacement in the water their boat reached or how well it floated. Another way to succeed is to reach the end of the tub of water meaning they understood how to

take advantage of the design of the boat and used the wind-wave interaction to get to the finish line.

Wrap-up

Ask the students what they would do differently next time. How would they improve their design? What would work better? Have them help clean up. This will get a little messy.