



NASA Engineering Design Challenge The Great Boomerang Challenge – Lesson Overview

Subject(s) Covered: Engineering, Physical Science

Topic(s) Covered: Engineering design process, Aerodynamic forces, Bernoulli's Principle

Activity Type: Engineering Design Challenge

Grade Level: 9-12

Description:

Students think and act like engineers and scientists as they follow the eight steps of the engineering design process to successfully complete a team challenge. Within this task, students design, build, test and re-design a boomerang. Once the boomerang is built, students explain and demonstrate how different forces affect its flight. Students research and explore basic aerodynamic forces and explain their applications to boomerang flight.

Essential Question:

Why does a boomerang fly and return to the thrower?

Instructional Objective:

Students will: 1. Research and explain how airfoil shape affects flight characteristics. 2. Use the steps of the engineering design process to complete a team challenge. 3. Demonstrate and explain how basic aerodynamic forces, including those that arise from Bernoulli's Principle, influence the flight characteristics of their designs.

Time to Complete the Activity:

This lesson can be accomplished in two class periods and one homework assignment.

Meeting 1:

Introduce the lesson.

Select teams of 3 or 4 students (the team members will share their ideas, and feed off each other's successes and failures).

Students each design, build and test her/his first boomerang.

Homework - Students are then sent home with enough supplies to develop one or more additional booms, based on lessons learned.

Meeting 2:

Testing for all final designs - (students compete as individuals and as teams)

Presentations of design logic by each team

Teacher can choose an existing team, or make a new team of the four best designs - and submit to contest.

Materials Needed:

- Per student
 - Middle and High School Design Packet
 - Copy, on cardstock, of the four-wing boomerang found on Page 8 of the guide
 - Scissors
 - Safety Goggles



- Per group of three
 - Sheets of craft foam (Foam with adhesive backing preferred. Craft foam is available in local craft stores.)
 - Cardboard
 - Card stock
 - Glue or other adhesive
 - Metal duct tape (To add weight. Metal duct tape is available at local hardware stores.)
 - Regular duct tape
 - Permanent markers
 - Scissors or craft knife
 - Computer with Internet access
 - Ruler or straight edge
- Per class
 - Tape measure of at least 5 meters
 - Stopwatch
 - String or rope with marks at every meter

National Content Standards:

- Science
 - Physical Science
 - Motion and Forces
 - Properties and changes of properties in matter
 - Science as Inquiry: Understanding about scientific inquiry
- Technology
 - Design: Students will develop an understanding of engineering design
 - Abilities for a technological world: Students will develop the abilities to apply the design process
- 21st Century Skills: Learning and Innovative Skills
 - Creativity and innovation: Work creatively with others
 - Communication and collaboration: Collaborate with others

Remember to register with NES, or your students' entries will be ineligible for the contest. Go to explorerschools.nasa.gov where you will find complete registration instructions.

