DESIGN PROJECTS



FLYING GLIDER

GRADE LEVEL

Grades 6-8

MODELING TIME

1-2 hours

DESIGN OBJECTIVES

- Use a laser-cutter for manufacturing
- Adhere to flat-pack design principles
- Explore design intent and design for manufacturing in CAD software

MATERIALS

- ~1/16th inch balsa wood, foam board, or equivalent (min. 12" x 6" per glider)
- Super glue or equivalent

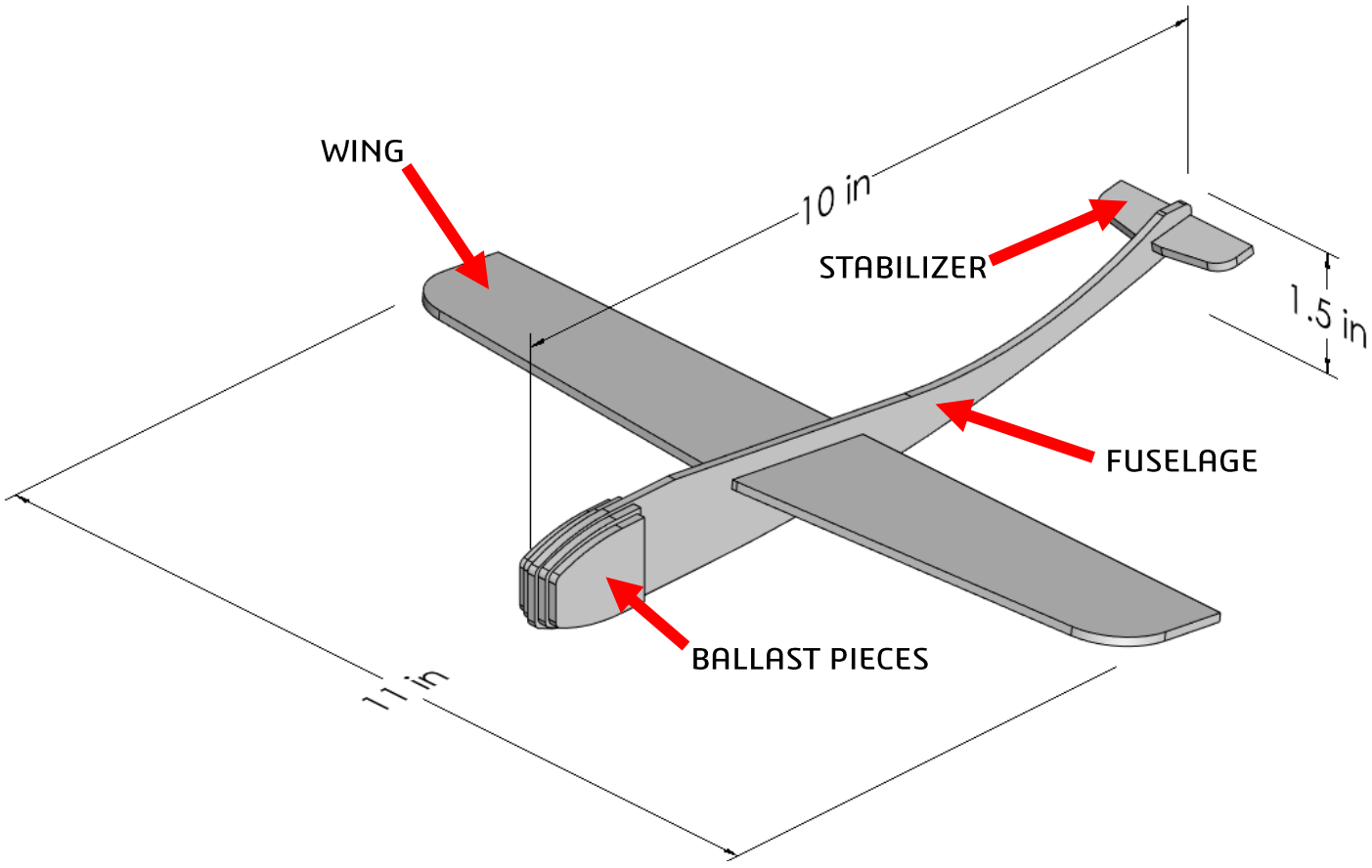
DESCRIPTION

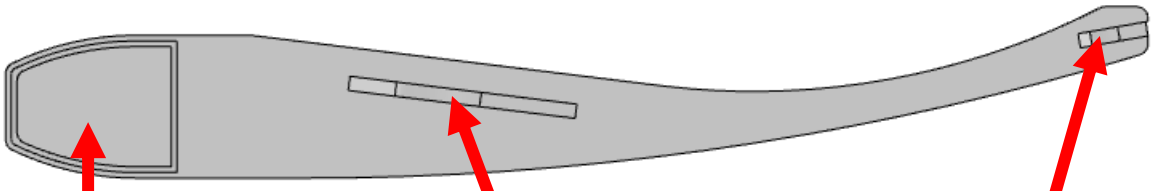
In this STEM project, students will design a flying glider to be manufactured from a thin and light material like balsa wood or foam board. In the design process, students will have the opportunity to apply design intent for their glider in CAD software. Students will manufacture their designs by exporting DXF files as drawings to be imported to laser cutting software. This project is great for students comfortable with the basics of CAD software. Students are encouraged to explore unique designs of their interest, whether it be historically significant airplanes, nature, or science fiction!

HISTORY

Modern aviation has a long history rooted in the human obsession with flight. Dating all the way back to early kites constructed from bamboo and silk in China around 500 BCE. Larger aircraft came in the form of hot air balloons in the early 1700s, evolving into what we now call blimps. In the early 1900s, the Wright brothers were the first to fly powered aircraft, achieving a maximum flight time of 39 minutes. From then, modern aviation has taken off, with technological advancements opening the door for new frontiers of aviation, from jet-powered aircraft to flight in outer space! Explore the principles of flight with this fun, engaging design project.

FLYING GLIDER COMPONENTS





Ballast pieces change the center of mass, dictating flight style.

The slight angle on the wing allows for a slow, controlled descent.

A small stabilizer far from the wing smooths the flight path of the glider.

EDUCATIONAL CONCEPTS

This project offers valuable opportunities for educators to introduce or connect to many common STEM curriculum points, including:

SCIENCE

- Explore kinetics: teach students about velocity, trajectory, angles, and gravity.
- Discuss conservation of energy, including potential and kinetic energy.
- Explain the flight of the glider using the concept of forces and torques.

TECHNOLOGY

- Teach students to use 3D modeling for creating their glider designs.
- Emphasize the importance of Designing for Manufacturing (DFM) by considering manufacturability and minimizing waste through smart design decisions.

ENGINEERING

- Introduce the engineering design cycle and the importance of design considerations throughout all steps of the project cycle.
- Discuss structural stability and how to prevent the glider from breaking on impact.
- Introduce failure analysis and iteration to identify and fix weak points in the design.

MATHEMATICS

- Analyze the angles involved in flight, from the angle of the wing to the launch angle of the glider.
- Utilize formula driven, parametric design in software.
- Solve for unknown variables such as total flight length or initial velocity.
- Explore how material density and distribution contribute to calculating the center of mass of an object.
- Calculate environmental and monetary impact of making a glider. Considerations can include product supply chain, material biodegradability, and waste material generated.

OPTIONAL CHALLENGES

- Design a glider with intent to do a trick: a barrel roll, loop-de-loop, or more.
- 3D print a rubber-band powered propellor to attach to the glider.
- Research and implement a different wing setup. This can include a dual wing setup, front canards, or a delta wing.
- Outline a design competition for a glider to travel the furthest distance with a defined payload.
- Attach electronics to control the roll and pitch of the plane during its flight.

DISCUSSION STARTERS

- How will the center of mass of the glider affect how it flies?
- How would a different material affect flight, manufacturability, and design?
- What is the purpose of the stabilizer? How does the plane fly without one?
- Why do some of the gliders fly faster or slower than others?

ASSESSMENT CRITERIA

- **SUSTAINABILITY** – How was environmental impact minimized in production? What was the total environmental impact of the manufacturing process?
- **ASSEMBLY AND MANUFACTURABILITY** – How well does the model stay together? How easy was it to cut out and assemble the pieces? Were there any pieces that were difficult to manufacture?
- **PERFORMANCE** – Does the plane fly as intended?

PROJECT RESOURCES

LINK TO DOCUMENTS

LINK TO YOUTUBE VIDEO

LINK TO STEP-BY-STEP INSTRUCTIONS