**If You Build It, Will It Fly??????**

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**Courses:** Math, Science, Manufacturing

**Grade Level:** Grades 6-8

**Purpose:** Students will participate in project based learning activities to investigate how the forces affect the motion objects. Students will design and construct a model glider and consider the combination of forces that impact their design and construction of a model glider.

**Key Terms:**

Math terms Science terms

angles, area, aerodynamics, angle of attack,

measurement, airfoil, center of gravity, drag,

symmetry, right angle, fuselage, gravity, high pressure,

 acute angle, lift, low pressure, rudder,

 scale (drawing), vertical stabilizer(fin), wing, thrust

supplementary angles, mass, weight, force, friction,
 complementary angles Bernoulli’s principle

**Learning Objectives:**

Student will be able to…

1. Identify the four forces affecting flight (weight, lift, drag, thrust).
2. Explain why engineers build models, collect and analyze data from the models to form conclusions and make design decision base on evidence.
3. Give examples of how aircraft models can be modified to improve flight based on evidence.
4. Measure and Identify types of angles (right, acute, obtuse, supplementary, complementary)

**Common Core Standards in Math**

**Geometry 7.G**

**Draw, construct, and describe geometrical figures and describe the**

**relationships between them.**

1. Solve problems involving scale drawings of geometric figures,

including computing actual lengths and areas from a scale drawing

and reproducing a scale drawing at a different scale.

2. Draw (freehand, with ruler and protractor, and with technology)

geometric shapes with given conditions. Focus on constructing

triangles from three measures of angles or sides, noticing when the

conditions determine a unique triangle, more than one triangle, or no

triangle.

**Solve real-life and mathematical problems involving angle measure,**

**area, surface area, and volume.**

5. Use facts about supplementary, complementary, vertical, and adjacent

angles in a multi-step problem to write and solve simple equations for

an unknown angle in a figure.

**Wisconsin** **Model Academic Standards in Science**

*POSITION AND MOTION OF OBJECTS*

D.4.6 Observe and describe physical events in objects at rest or in motion

D.4.7 Observe and describe physical events involving objects and develop record-keeping systems to follow these events by measuring and describing changes in their properties, including:

* position relative to another object
* motion over time
* and position due to forces

D.8.5 While conducting investigations, explain the motion of objects by describing the forces acting on them

 D.8.6 While conducting investigations, explain the motion of objects using concepts of speed, velocity, acceleration, friction, momentum, and changes over time, among others, and apply these concepts and explanations to real-life situations outside the classroom

**Wisconsin Model Academic Standards in Information and Technology Literacy**

* A.8.2 Explain the need for and application of knowledge and skills from other disciplines when engaging in technological activities.
* B.8.2 Analyze various systems and identify the ways in which they are controlled to produce a desired outcome.
* C.8.2 Explain and demonstrate several solutions to a problem or opportunity using technological design, tools, careful planning, experimentation, and testing.

**Career Cluster Pathways in Manufacturing**

* Production
* Manufacturing production process development
* Installation and repair

**Materials**

Lab Notebooks

Materials and tools for constructing styrofoam glider;

Various types of styrofoam containers, food trays,



Paper clips

poster putty or other weighted and attachable materials

adhesive tapes

**Tools**

Razor Knife

Cutting Board

Cardboard or backer material

 rulers/straight edge

 pencil

protractor

straws

bread twist-tie

**Scenario**

**Career Cluster:** Manufacturing

**Career Pathway:** Engineering, Quality Assurance

**Project: If You Build it, Will it Fly?**

Of all the attempted prisoner of war escapes, the one involving the Colditz glider during WWII in Germany, is certainly among the most ingenious. Built secretly in an attic of Colditz castle, the glider was an airworthy craft that had the war not ended when it did, two POWs would have stood a decent chance at making a successful flight. The greatest escape that never happened was ready to take flight – literally – when Allied troops occupied the castle a few weeks before the end of the war. Behind a dummy wall high in an attic above the chapel, British prisoners had spent months secretly cobbling together a glider. They built it in sections from wooden shutters, mattress covers, and mud fashioned out of attic dust. A German discovered the dummy wall at one point but was silenced with a bribe of 500 cigarettes. After the war, locals broke up the glider. As is chronicled in the NOVA program “Nazi Prison Escape,” a replica of the glider recently built by ex-Colditz POWs flew successfully, proving that the inmates’ most extraordinary escape vehicle ever may very well have worked, if only given the chance.

You too will be given the chance to build a glider that will fly! Students will look at the necessary elements of flight through lessons and experimentation to build a glider which will ultimately land them into the ‘safe’zone.

\*You can try your hand at flying a virtual replica of the Colditz Glider at: http://www.pbs.org/wgbh/nova/naziprison/glid\_fly.html

**Methods/Teaching Strategies**

* Group-work
* Inquiry-based science
* Project-based learning
* Computer simulation- Gizmos
* Contextual teaching/learning
* Multiple Intelligence

**Lesson Design**

**Day 1 - Lesson 1: Building a Cookie Cutter Glider**

**Day 2 - Lesson 2: Forces involved in Flight**

**Day 3 - Lesson 3: Gizmo-Investigating Angle Theorem-Act. A(www.explorelearning.com)**

**Day 4- Lesson 4: Angles Properties**

**Day 5-6 Lesson 5: Design and construct gliders (2days)**

**Day 7- Lesson 6: Let ‘em Fly- collect Data**

**Faculty Resources**

Forces that Act on Aircraft in flight

- <http://www.youtube.com/watch?v=_rQAUHSTJIQ&feature=related>

Bill Nye The Science Guy Flight <http://www.youtube.com/watch?v=cZzD_mOp5oE&playnext=1&list=PLC4F4F8129107CD1B>

The Four Forces of Flight <http://www.faa.gov/education/educatorresources/educatorscorner/grades7_8/four_forces_of_flight/>

Bernoulli's Principal

<http://scifiles.larc.nasa.gov/text/kids/Problem_Board/problems/flight/lift2.html>

<http://www.sciencekids.co.nz/lessonplans/flight/flightintroduction.html>

<http://www.ueet.nasa.gov/StudentSite/dynamicsofflight.html>

<http://er.jsc.nasa.gov/seh/X_Gliders.pdf>

**Assessment**

* Pre/Post Test- Forces & motion, Geometry
* Performance based assessment rubric

**Extension Options**

1. Write a summary of the results of their foam airplanes flight
capabilities.
2. Write a set of directions on how to construct their foam airplane model.
3. Calculate the average distance flown for the class using a calculator.
4. Measure the time the planes are in flight using stopwatches, and
create line plots and bar graphs to show the results.
5. Compare and contrast their glider design to a different style of glider in a short essay

6. Flight Simulator- http://orbit.medphys.ucl.ac.uk/

**STEM Careers**

* *Assembler*
* *Calibration Technician*
* *Pattern & Model Maker*
* *Precision Layout Worker*
* *Engineering and Related Technician and Technologist*
* *Manufacturing Engineer*
* *Manufacturing Technician*
* *Precision Inspector, Tester, and Grader*
* *Process Improvement Technician*
* *Production Manager*