	STEM Committee **Michigan Crossroads Council**	**Name:**	
	Supernova Activity Topic: Engineering **Build and Test:** **High Performance Paper Gliders**	**Troop:**	**Date:**

Supernova Activity Topic: Engineering

Have you ever studied how your bicycle works? To learn how a bicycle is put together (or engineered), here is a project for disassembling one. Or what about making a high-performance paper glider? Or having a contest to see who can drop a raw egg without breaking it? Choose any one of these activities to learn more about engineering.

Build and Test: High Performance Paper Gliders

This activity can be done individually, but works much better with at least two people. Your task is to measure how differences in design affect the flight characteristics of a glider. You will accomplish this by building and testing some high-performance paper gliders. These gliders use a laminated construction method that helps simulate a real glider much more closely than a simple folded piece of paper.

Part 1: Background Research, Baseline Design Selection, and Test

1. Research and discuss the following with your mentor:
   A. The fundamental parts of a glider

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   B. The basic elements of the physics of stable flight

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2. Choose a glider design from a kit or plans. (You do not need to design the glider yourself.) Then do the following:
   A. Identify one quantitative characteristic to test, such as flight distance, flight time, average flight speed, and so on. Then identify one qualitative characteristic to test, such as presence of a stall, dive, flip, left turn, right turn, and so on.

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   B. Hypothesize how variations in one part of the glider, such as wing size, fuselage length, center of gravity, flap size, and so on, might influence these characteristics of the glider's performance.

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   C. Build four high-performance gliders, identical except for variations in the relevant glider part.

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D. Establish a consistent method to measure each characteristic during a test flight. Then find a way to launch the gliders in a consistent manner so that they are launched at the same speed every time. You should perform test flights with each model five to six times to account for variations in flight performance. Try to keep the conditions of each test flight the same as for all the other test flights. Keep records of the results for each test flight.

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Part 2: Analyze and Report

Present to your mentor your recorded data in a tabular format as well as a graphical format. (You may use Excel if you wish.) Then do the following:

1. Evaluate the data and determine how the variations in the tested glider part influenced the flight characteristics you observed. Based on the data you gathered, predict how the glider would perform relative to the flight characteristics you observed if you were to build a glider with another variation in the same glider part.

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2. Suggest an ideal design of your tested glider part that would maximize the glider's performance relative to the flight characteristics you observed and explain your reasoning for this design.

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3. Create a report that describes your glider, the flight tests, the flight data, and your conclusions. Include the procedures you followed to ensure consistent test conditions.

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4. Share the flight records and data you have gathered with your mentor. Discuss what you have learned.

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Source: The idea for this activity is based on the work of Andrew Olson, Ph.D., Science Buddies, What Makes a Good Aerodynamic Design? Test Your Ideas with High-Performance Paper Gliders. Visit http://www.sciencebuddies.org/ science-fair-projects/project_ideas/Aero_p009.shtml .

Resources

Science 85 Magazine. *The Paper Airplane Book: The Official Book of the Second Great International Paper Airplane Contest* (best book for laminated paper techniques). Science 85 Magazine, 1985.

Hubert Smith. *The Illustrated Guide to Aerodynamics* (for background research). McGraw-Hill Professional, 1991.

AG Industries WhiteWings

Website: http://www.whitewings.com (glider kits)

NASA Beginner's Guide to Aeronautics

Website: http://www.grc.nasa.gov/WWW/K-12/airplane/guided.htm (For background research, look at the gliders section.)

The Online Paper Airplane Museum

Website: http://www.theonlinepaperairplanemuseum.com (free glider plans)

Zovirl Industries

Website: http://www.zovirl.com (For glider plans, click on the Paper Airplanes tag.)