Student Log Sheet – Research Engineer

Plane Type Blended Wing Body	Altitude (m)	Distance Flown (m)	Glide Ratio
Trial 1			
Trial 2			
Trial 3			
Trial 4			
Trial 5			
Trail 6			
Trail 7			
Trial 8			
Trial 9			
Trial 10			

Plane Type - Cylinder Body	Results	Distance Flown	Glide Ratio
Trial 1			
Trial 2			
Trial 3			
Trial 4			
Trial 5			
Trial 6			
Trial 7			
Trial 8			
Trial 9			
Trial 10			

Controls = what stayed the same
Variable = what did you change
Altitude = height from which plane was flown

Research Engineer – Aerodynamics

What would happen to an airplane if it suddenly lost its power? Would it drop like a rock? Would it glide for a while? How far could the pilot expect to fly before reaching the ground?

GLIDE RATIO – the glide ratio of a plane helps to answer questions like these. It describes the horizontal distance that the plane will travel from a given altitude in the absence of power and wind.

$$\text{Glide Ratio} = \frac{\text{Horizontal Distance Flown}}{\text{Change is Altitude}}$$

The glide ratio is usually expressed as a negative number, since the change in altitude is a loss of altitude and is therefore expressed as a negative distance.

Experiment 1: Make a model airplane of the Blended Wing Body and the Cylinder Body. Use the "Test Area" to launch your planes. Be sure to launch your plane from a constant height for each trial in your experiment.

Conduct a minimum of ten test flights. Be as consistent as possible in the force you use to launch the plane.

Analyze the data and determine the glide ratio. Look at the distances flown for each of your test flights. Put these distances in order. Find the shortest distance; the longest distance, the mean distance, and the median distance. For each of these distances compute the glide ratio. Which of the glide ratios that you have computed is the "BEST" one to use in describing your plane's glide ratio? Explain.

Write a description of this model plane, giving an account of its glide ratio and detailing the methods you used to test it.

Research Engineer – Structure

Air moving under an airplane's wings gives it lift. It might seem that having larger wins would help the plane stay in the air longer. This experiment will let you test that idea (hypothesis).

Experiment 2: Determine the ratio of the area of the wings to the total surface area.

Begin this experiment buy determining how much of your airplane's total material is devoted to its wings. We can use surface area to find the ratio of the material in the winds to the total material in the plane. Unfold your airplane. Determine the total surface area of the paper. (length x width)

Next measure each of the smaller areas that help form the wings of your plane. Calculate the ratio of the areas:

$$\frac{\text{Area of Wings}}{\text{Total area of paper}}$$

This ratio can be used to test the hypothesis.

<u>Increase the ratio.</u> Modify the design of your plane to increase the size of the wings. You will be reducing the amount of paper used for the other surfaces of the structure and increasing the amount of material used for the wings..

<u>Gather & analyze data for the modified design.</u> Test fly your new design to see if your modifications have increased the glide ratio. Conduct experiment 1 using your new design. Plotting the data for both planes can help you analyze the effects of your redesign.

<u>Compare your findings with other students' results.</u> If other students in your class have been conducting similar experiments, you can exchange data to see whether their results support the hypothesis that the relative size of a plane's wings influences its glide ratio.

Write a report of your work on this experiment. Do your finding support the hypothesis?

Research Engineer – Planning a Flight

Depending on an airplane's altitude when it loses propulsion, the pilot can expect to glide a certain distance before landing. The higher the plane was when it began to glide, the farther the pilot can expect to travel before touching down.

Experiment 3: In this experiment, you will use the data that you've already collected to make some prediction about flights begun from other altitudes. You will also test the hypothesis that the glide ratio of the paper airplane will not change if it is launched from a different height.

Do the math! If the glide ratio of a paper airplane does not change, then the following proportion will hold true:

$$\frac{\text{Height}_1}{\text{Distance}_1} = \frac{\text{Height}_2}{\text{Distance}_2}$$

Substitute for height_1 the height you used as a launch in experiment 1. Substitute for distance_1 the distance that you used to determine the "best" glide ratio.

- How far would you predict the plane would glide if it were launched from a height twice your experimental height?
- Predict the height from which you would have to launch the plane in order to have it glide three times as far as the distance you determined the "best" glide ratio.

Verify the hypothesis. Determine a launch height that you can reach by standing on a stairway or another safe platform. You will need to be able to determine the height and the glide distance, so plan this part of your experiment carefully.

Conduct experiment 1 again from this new height. Find the glide ratio of the plane from this launch height. Compare you data with the original data you collected in experiment 1. Is the glide ratio the same?

Write up the finding from this experiment. Be sure to tell if your data support the hypothesis.