



Preparing for the activity

Familiarize yourself with all the information:

1. Review the **Introduction Video**.
2. Review each job's **Instruction Page** and **Activity Page**. It will help you and your students complete the activity. The **Meet A Teammate Pages** are supplemental material.

NOTE: If the website/webpage is running on a device that does not have a camera, the **Materials Teammate Job Activity** will not work and you will not need the QR codes in the **Table Slides**.



Set Up

1. Set up the **Materials Store**. Ensure there is enough of each item for each team.

2. Set up the **Team Tables** with the following:

- Calculator
- Ruler
- Printed **Table Slides**

Materials Store

- 3 types of 8.5"x11" paper with different weights
Ex: notebook paper, construction paper, printer paper, cardstock
- Pens/pencils
- Popsicle sticks
- Large paperclips
- Small paperclips
- Tape, to be dispensed in 1" pieces
- Test airplanes
Folded examples of each design

3. **Select/Assign job roles.** Divide the group into teams of five to six people. Each person will have a specific job role. For teams of six, decide if you'd like to have an additional Engineer or additional Mechanic.

Example Team Roster	
Finance Teammate	
Materials Teammate	
Engineer	
Engineer (optional)	
Mechanic	
Mechanic (optional)	
Pilot	

4. Set a timer for **20 minutes** to complete the activity.



Judging the Winners

Each activity scenario is unique. Choose the most applicable way to judge your specific group based on grade level and resources available.

Examples:

- ✓ Math on the Budget Sheet is complete and correct
- ✓ Airplane and Finance Quality checks on the Budget Sheet are complete
- ✓ Airplane build is complete
- ✓ Airplane flies the farthest
- ✓ Airplane flies at least a specified distance (e.g.: five feet)

Use multiple judging criteria by applying a point system. Assign one point to each item above and the student who has the most points wins.



Team Roles & Salaries



Finance Teammate: \$2,500

Responsible for the budget



Materials Teammate: \$2,000

Responsible for the purchasing and inventory of the supplies



Engineer: \$3,000

Designs and monitors the building of the airplane based on the blueprints



Mechanic: \$2,000

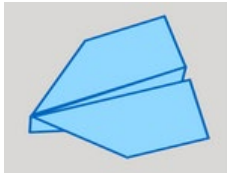
Builds the airplane



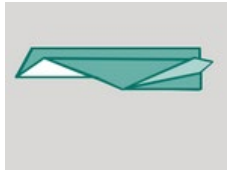
Pilot: \$3,000

Flies the plane and reports issues

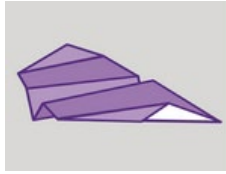
Airplane Tip Sheet



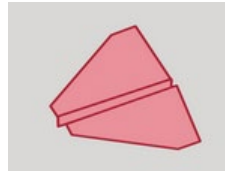
DESIGN 1:
Glider
(Elementary school)



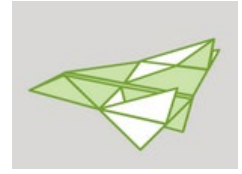
DESIGN 2:
Dart / Stunt
(Elementary school)



DESIGN 3:
Glider
(Elementary school)



DESIGN 4:
Glider
(Middle school)



DESIGN 5:
Dart
(High school)

Things to consider when choosing airplane design

Dart airplanes:

- Fly far and fast
- Have slimmer profile and produces less drag

Glider airplanes:

- Fly high and long
- Have wider wings and provide more lift

Stunt airplanes:

- Fly in loops, circles and dives
- Combines lift with maneuverability

To improve flight performance:

- ✓ Adjust the angle of the wings from the fuselage
- ✓ Check the symmetry; ensure neat and even folds
- ✓ Adjust the throw
 - » Throw **Dart** airplane designs straight or at an upward 45 degree angle; forcefully
 - » Throw **Glider** airplane designs with a soft, smooth, and even motion
 - » Throw **Stunt** airplane designs with medium strength; throw upward and away from your body



Penalty Charges

\$1,000 for each offense

- 1) **Doing someone else's job.**
For example: unauthorized personnel at the Material Store, Flight School or touching the airplane
- 2) **Changing airplane designs after the build has started or Pilot has started practice flights.**
- 3) **Flying airplanes outside the Flight Line.**
- 4) **Bringing test airplanes to the team tables.**



Cost Sheet

Items:	Cost:
Plane design #1	\$ 10,000
Plane design #2	\$ 12,000
Plane design #3	\$ 15,000
Plane design #4	\$ 17,500
Plane design #5	\$ 22,000
Paper 1	\$ 6,000 each
Paper 2	\$ 9,000 each
Paper 3	\$12,000 each
Small Paper Clips	\$ 1,000 each
Large Paper Clips	\$ 2,000 each
1 inch of Tape	\$ 4,000 each
Clothes Pins	\$ 1,200 each
Popsicle Stick	FREE
First Flight Test	FREE
Additional Test Flights	\$ 5,500 each



Budget Sheet

Team #: _____

Items:	Starting Budget: <u>\$55,000</u>
Finance Teammate Salary	\$ 2,500
Materials Teammate Salary	\$ 2,000
Engineer #1 Salary	\$ 3,000
Engineer #2 Salary	
Mechanic #1 Salary	\$ 2,000
Mechanic #2 Salary	
Pilot Salary	\$ 3,000
Airplane Design Cost	
Paper Cost	
Small Paper Clips	
Large Paper Clips	
Tape	
Clothes Pins	
Popsicle Sticks	\$ 0
Flight Test #1	\$ 0
Additional Flight Tests	
Penalty Charges	
Ending Balance:	\$

Airplane Quality check _____
(adult signature)

Finance Quality check _____
(adult signature)

Materials Teammate Activity

In the **DreamLearners website**, use the Materials Teammate's Activity tab to scan the QR Codes to learn more about each item at the **Materials Store**.





Pilot Activity

Forces of Flight Discussion

Let's talk for a minute about what makes an airplane fly.

What is the key ingredient? Air is the key ingredient, but there are four basic forces that air exerts on an airplane which make flight possible when they are in balance.

(1) Lift is the force provided by the wings of the airplane. The shape of an airplane's wing causes air to move more quickly over the top of the wing than it does underneath the wing. The resulting difference in air pressure above and below the wing creates lift.

(2) Weight is the force of (what) _____? gravity on the airplane, and it pushes the airplane (where) _____ down. Lift works against weight in flight. The heavier the airplane, and the higher it flies, the more lift it must produce to overcome weight.

(3) Drag is the force that pushes against the airplane in motion. Drag is caused by friction as the airplane moves through the air. More aerodynamic designs mean less drag and better efficiency.

(4) Thrust is what the engines provide – the force that moves the airplane in its direction of flight. The larger and heavier the airplane, the greater the thrust the engine must produce.

When does the airplane use the most thrust? On takeoff



Engineer Activity

Aerodynamics Discussion

What are wind tunnels? Why are they used?

A wind tunnel is a large, narrow room with powerful fans at one end. They help aeronautical engineers simulate the movement of air around an aircraft in flight. The orange and green in the simulation, display the air turbulence around the airplane.

How does the airflow differ around each of the airplane designs?

If the airflow is steady behind the aircraft, it's a sign of an aerodynamic design. The opposite is true if it whips around wildly. When a design exhibits more air turbulence, more drag is exerted on the airplane.

How do wind tunnels help engineers build efficient airplanes?

Wind tunnel tests help engineers identify important changes to build more efficient airplanes. They might alter the airplane's body to give it a more aerodynamic shape, which can reduce drag and boost speed. Or engineers might change the angle of the wings to increase lift, and help it fly more efficiently. Read Table Slide 2, the Airplane Tip Sheet, for tips on how you might be able to improve your airplane's performance.