

Fling Flyer Design Challenge 1 (Version for the Making Things Zoom Kit)

Note to Volunteers on the GoldieBlox Making Things Zoom kit:

This version of the badge uses the GoldieBlox Making Things Zoom kit. Each kit includes 6 sets of GoldieBlox parts for the badge, (i.e. you can create 6 of any Brownie Design Challenge badge from one kit). Inside the kit are six sets of GoldieBlox parts that allow girls to earn all 3 Brownie Design Challenge badges. Two to four girls can use each set. So, if you have 12 girls, you will need one kit for them to work in pairs.

The kit is no longer available to purchase, but you can find a full parts list at the end of this handout if you want to pull together the GoldieBlox for the badges. If you do not have the GoldieBlox, we recommend completing the badge using the DIY instructions now included as the Meeting Plan on VTK.

Materials List

As Girls Arrive: Engineering Paper Airplanes

- Paper (Construction, white, etc. A variety of papers gives girls the opportunity to try making planes with different paper weights.)
- Crayons, colored markers

Opening Ceremony: Taking Flight!

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step One: Learn About Forces that Affect Flight

- Paper Airplanes from As Girls Arrive: Engineering Paper Airplanes

Step Two: Design and Build a Fling Flyer

- GoldieBlox Making Things Zoom kit (one set for each girl, pair, or small team)
- Sample Fling Flyer
- Paper
- Pencils
- Optional: **Fling Flyer Investigation worksheets**

For each Fling Flyer, girls will need these GoldieBlox:

- 2 mini axles
- 1 long axle
- 2 star stoppers
- 1 angle joint

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- 2 T-joints
- 1 craftstruction wing (Alternatively, you can prepare or have girls create their own wings using cardstock, construction, or copy paper and scissors/paper hole push.)
- 1 rubber band

Closing Ceremony: Fling Flyer Forces

- None

Awards

Girls do not receive any awards in this meeting.

Detailed Activity Plan**As Girls Arrive: Engineering Paper Airplanes (10 minutes)****Materials**

- Paper (Construction, white, etc. A variety of papers gives girls the opportunity to try making planes with different paper weights.)
- Crayons, colored markers

Steps

Welcome Brownies, and ask them to create paper airplanes.

SAY:

Today, you're going to engineer a Fling Flyer that flies across the room!

To start thinking about flight, can you make a paper airplane?

Here are some different types of paper and supplies to try out and decorate your paper airplane.

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Opening Ceremony: Taking Flight! (10 minutes)

Materials

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Steps

Recite the Pledge of Allegiance and the Promise and Law.

Conduct any troop business.

Introduce Brownies to the Fling Flyer Design Challenge.

SAY:

Today, we're starting the Fling Flyer Design Challenge badge!

You're going to learn how to create a Fling Flyer, an airplane made with GoldieBlox, and explore what keeps it and other things, like birds, planes, and space ships, in the air.

Engineers use their imaginations to solve problems. They invent and build things. You'll do the same thing today!

Step One: Learn About Forces that Affect Flight (20 minutes)

Materials

- Paper Airplanes from Activity 1: As Girls Arrive: Engineering Paper Airplanes

Steps

Brownies learn about thrust, drag, gravity, and lift for Step One of the Fling Flyer Design Challenge.

Have Brownies line up (side to side) with their paper airplanes from Activity 1: As Girls Arrive: Engineering Paper Airplanes.

SAY:

Let's see you fly your paper airplanes. On the count of three, release your plane!

One, two, three...fly!

Brownies release their paper airplanes.

Introduce the forces that affect flight using the paper airplanes as an example.

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SAY:

What makes the best paper airplane?

Girls may say: One that flies farthest, stays airborne longest, or does the most flips and tricks.

To design the best paper airplane or a Fling Flyer, we need to know a little bit about the forces that act on things when they fly.

What pushes the paper airplane forward through the air?

Girls may say: My arm, I threw it, etc.

By bending your elbow and throwing the airplane, you can add extra strength or force into your airplane's flight.

Does anyone know what force is? (Answer: Force is the strength or energy that creates movement.)

Everything in our world moves because of different forces at play. Push and pull are two examples of forces.

You threw the paper airplane, propelling it through the air with force. This is called the "thrust". Thrust is an example of a force, or a push and pull that creates movement.

Why do the paper airplanes slow down?

Girls may say: The air stops them, I didn't throw hard enough, etc.

The airplanes slow down because there are little molecules of air that act with force against the airplane, slowing it down.

When you threw the paper airplane, it came back down, right? Why did that happen? (Answer: Gravity.)

Who knows what gravity is?

Girls may say: What makes things fall to the ground or I don't know.

Gravity is another force. Gravity is a force that pulls objects toward each other.

For example, when you drop a ball, it falls to the ground. That's because the earth's gravity pulls the ball toward it.

If you jump up, gravity brings you back down to the ground.

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Can you show me how gravity brings you back when you jump? Try it out!

Brownies jump up and down.

Use the paper airplanes to explain lift and balanced forces.

SAY:

Did your airplane fly straight? If it didn't, why do you think this happened? (Answer: Air is in the way.)

The wings deflect the air, which pushes back up on the wings. It's why paper flutters to the ground instead of falling straight down. This force is called "Lift."

For example, if you dropped a ball, would it flutter like dropping a paper airplane? (Answer: No or very little.)

The wings help the airplane to move against and through the air. Even when the airplane is falling, its wings are still at work, slowing its fall to the ground.

Now, whose airplane went the farthest? Raise your hand!

The Brownie whose airplane went the farthest raises her hand.

Explain balanced forces.

SAY:

Great job! You designed the airplane that moved through the air with the most force!

Now, what do you think would happen if you tried to fly your airplane outside on a very windy day?

Girls may say: It would be harder, it wouldn't fly straight, it wouldn't go very far, etc.

It would be very windy, adding more force that would act against your airplane, making it very hard to fly straight or even at all!

What way would your airplane move in the wind? (Answer: In the direction of the wind.)

The force of the wind is stronger than the force you put into throwing your airplane, so your airplane would go in the direction of the wind. This is called an unbalanced force.

When forces are unbalanced, the object moves in the direction of the greater force, like your airplane moving with the wind on a windy day.

What do you think happens when forces are balanced though? (Answer: Neither force moves the object.)

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The object, like the airplane, doesn't move at all! The paper airplane won't fly itself, so you add force when you throw it.

Now, let's use all this information to build our own Fling Flyers.

Step Two: Design and Build a Fling Flyer (20 minutes)

Materials

- GoldieBlox Making Things Zoom kit (one set for each girl, pair, or small team)
- Sample Fling Flyer
- Paper
- Pencils
- Optional: **Fling Flyer Investigation worksheets**

For each Fling Flyer, girls will need these GoldieBlox:

- 2 mini axles
- 1 long axle
- 2 star stoppers
- 1 angle joint
- 2 T-joints
- 1 craftstruction wing (Alternatively, you can prepare or have girls create their own wings using cardstock, construction, or copy paper and scissors/paper hole push.)
- 1 rubber band

Steps

If you don't have enough supplies for each Brownie to make her own Fling Flyer, divide Brownies into pairs or small groups for Step Two of the Fling Flyer Design Challenge.

Show Brownies your sample Fling Flyer.

Optional: Distribute **Fling Flyer Investigation worksheets** for girls to design their Fling Flyer, thinking and considering the forces at work. Give the girls time to design their investigations.

Hand out paper and pencils to each team for Brownies to design their Fling Flyer.

SAY:

Now, you're going to use your GoldieBlox to create a Fling Flyer.

Before engineers build things, they plan their design. Designing your product before you build allows you to think through any problems and troubleshoot them ahead of time.

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Draw your fling flyer to help figure out how to build it. If you already have ideas to make the Flyer fly even better, feel free to try them out!

When they're finished designing, hand out the GoldieBlox sets.

(Note to Volunteers: If you do not have enough craftstruction wings for every Fling Flyer, have girls use one as a template to cut and create others with heavy paper and scissors/hole punch.)

Let the girls build their Fling Flyers and practice flying them.

Keep It Girl-Led: By having girls reverse engineer the Fling Flyer, Brownies have a hands-on opportunity to learn about the different parts instead of following directions. If they're having trouble, ask them questions like, "What GoldieBlox do you recognize in the Fling Flyer? How are they stuck together?"

If girls need help, lead them to connect the angle joint to the long axle. On the other end of the long axle, add a T-Joint, mini axle, and another T-joint. Connect the craftstruction or paper wing by placing the holes on top on the T-joints and attaching the star stoppers.

Optional: Show Brownies the "How to Build a Fling Flyer" video [here](#) for video instructions.

Circulate among the groups, asking questions to prompt further exploration.

(Note to Volunteers: You may want to save the Brownies' Fling Flyers for the next meeting, Fling Flyer Design Challenge 2. If you are able to, label each Flyer with the girl or group's name(s) and put away until the next meeting. If you are unable to keep them together, don't worry, the girls will have a chance to rebuild at the start of the next meeting.)

Closing Ceremony: Fling Flyer Forces (10 minutes)

Materials

- None

Steps

Have Brownies form a Friendship Circle, and discuss with girls how they designed their Fling Flyers.

SAY:

What forces did you think about when designing and building your Fling Flyer?

What pushes the Flyer forward through the air? (Answer: The rubber band. This is called "Thrust.")

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Why does the Flyer slow down? (Answer: It has to push air molecules out of the way. This is called “Drag.”)

What pulls the Flyer back down to the ground? (Answer: Gravity.)

Why doesn't it fall straight down if gravity is pulling on it? (Answer: Air is in the way—the wings deflect the air, which pushes back up on the wings. It's why paper flutters to the ground. This force is called “Lift.”)

When forces on an object are balanced, like a box being pushed equally by two girls on opposite sides, what happens? (Answer: Neither force moves the object.)

When forces are unbalanced, like two girls pushing on one side of the box or trying to walk on a windy day, what happens? (Answer: The object moves in the direction of the greater force.)

End the meeting with a Friendship Squeeze.

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Fling Flyer Design Challenge 1 (Version for the Making Things Zoom Kit)

GoldieBlox Making Things Zoom kit – Parts Breakdown

GoldieBlox	# in set	# in kit (6 sets)
Quarter Pegboard	1	6
Small Wheel Hub	6	36
Small Wheel End	8	48
Big Wheel End	2	12
Blox (18 mm)	8	48
Coupler Joint	4	24
Elbow Joint	6	36
T-Joint	4	24
Corner Joint	4	24
Cross Joint	4	24
5-way Joint	8	48
Popcorn Joint	2	12
Peg	18	108
Mini Axle	16	96
Short Axle	12	72
Long Axle	8	48
Short Flexi Axle	6	36
Long Flexi Axle	2	12
Washer	8	48
Spacer	12	72

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Crank	1	6
Star Stopper	10	60
Suction Cup	2	12
Tire	4	24
Noodle Belt	1	6
Spring - medium	2	12
Spring – short	2	12
Rubber band	1	6
Pom Poms	10	60
Stickers	2	12
Punch Outs	2	12
Poster	1	6

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Fling Flyer

engineering concept:
AERODYNAMICS

build date:

I built it!



x1



x1



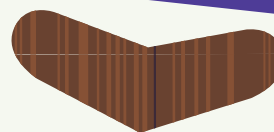
x2



x2



x1



x1



x1



Fling Flyer Design Challenge badge

NAME _____

Fling Flyer Investigation

1. Choose the criteria for success (Response Variable). Circle one or write your own:

Flies farthest

Stays airborne longest

Does the most flips

2. Which forces do you need to maximize? Which do you need to reduce?

MAXIMIZE	reduce

3. Choose a design to test (Independent Variable). Circle one or write your own:

Tail Width

Tail Length

Tail Shape

Bend Tips Up

Bend Tips Down

Cut Slits Along the Back

4. Write your research question:

How does _____ affect _____?
independent variable *response variable*

5. Predict how you think the shape of your Fling Flyer will affect its motion. This is your *hypothesis*.

6. How will you measure your Fling Flyer's motion?

7. How will you make your trials "fair tests"?

8. How many times will you measure your design to be sure of your results?

Draw a table on the back of this page to record your data.

Brownie Design Challenge Badges: Materials List

Leap Bot Design Challenge 1

Opening Ceremony: All About Solving Problems

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step One: Learn About Springs

- Sample Leap Bot made from the GoldieBlox Making Things Zoom kit

Step Two: Build Your Leap Bot

- GoldieBlox Making Things Zoom kit (one set for each pair or small team)

For each Leap Bot, girls will need these GoldieBlox:

- 4 mini axles
- 1 long axle
- 2 angle joints
- 2 elbow joints
- 4 spacers
- 4 pegs
- 1 star coupler
- 3 wheel hubs
- 3 small wheel ends
- 2 big wheel ends
- 1 long spring

Leap Bot Design Challenge 2

As Girls Arrive: Prepare For Testing

- Leap Bots created by girls in Leap Bots Design Challenge 1. (**Note to Volunteers:** If you were unable to save the Bots between meetings, Brownies can rebuild them during this activity.)
- Leftover pieces from the GoldieBlox Making Things Zoom kit (one set for each pair or small team).

Opening Ceremony: Leap Bot Forces

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step Three: Create a Way to Test How Well Your Leap Bot Performs

- Leap Bots created by girls in Leap Bot Design Challenge 1 or As Girls Arrive: Prepare for Testing
- Rulers, yardsticks, etc.
- Tape
- Paper

Brownie Design Challenge Badges: Materials List

Leap Bot Design Challenge 2 (continued)

Step Four: Record the Results of Your Test

- Leap Bots created by girls in Leap Bot Design Challenge 1 or As Girls Arrive: Prepare for Testing
- Leap Bot Testing Stations created by girls in Step Three: Create a Way to Test How Well Your Leap Bot Performs
- **Leap Bot Recording Sheet**, one for each girl or team
- Long and Short springs from the GoldieBlox Making Things Zoom kit (3 or more from each set for each pair or small team)
- Leftover pieces from the GoldieBlox Making Things Zoom kit (for each pair or small team)

Step Five: Share Your Results

- **Leap Bot Recording Sheets**, filled out by girls in Step Four: Record the Results of Your Test

Closing Ceremony: Awards

- Leap Bot Design Challenge award, one for each girl

(Note to Volunteers: You can buy these awards from your council shop or on the Girl Scouts' website.)

Fling Flyer Design Challenge 1

As Girls Arrive: Engineering Paper Airplanes

- Paper (Construction, white, etc. A variety of papers gives girls the opportunity to try making planes with different paper weights.)
- Crayons, colored markers

Opening Ceremony: Taking Flight!

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step One: Learn About the Forces that Affect Flight

- Paper Airplanes from As Girls Arrive: Engineering Paper Airplanes

Step Two: Design and Build a Fling Flyer

- GoldieBlox Making Things Zoom kit (one set for each girl, pair, or small team)
- Sample Fling Flyer
- Paper
- Pencils
- Optional: **Fling Flyer Investigation worksheets**

For each Fling Flyer, girls will need these GoldieBlox:

- 2 mini axles
- 1 long axle
- 2 star stoppers
- 1 angle joint
- 2 T-joints
- 1 craftstruction wing (Alternatively, you can prepare or have girls create their own wings using cardstock, construction, or copy paper and scissors/paper hole push.)
- 1 rubber band

Brownie Design Challenge Badges: Materials List

Fling Flyer Design Challenge 2

As Girls Arrive: Prepare for Testing

- Fling Flyers created by girls in Fling Flyer Design Challenge 1. (**Note to Volunteers:** If you were unable to save the Flyers between meetings, Brownies can rebuild them during this activity.)

Opening Ceremony: Forces that Affect Flight

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step Three: Test Your Fling Flyer

- Fling Flyers created by girls in Fling Flyer Design Challenge 1 or As Girls Arrive: Prepare for Testing
- Cardstock, construction paper, or copy paper (the heavier the better)
- Scissors or hole punches
- Leftover pieces from the GoldieBlox Making Things Zoom kit (one set for each pair or small team)
- Masking tape
- Cone, rock, or anything else to mark the furthest distance flown

Step Five: Brainstorm Ways to Improve Your Design

- Fling Flyers from Step Three: Test Your Fling Flyer
- Cardstock, construction paper, or copy paper (the heavier the better)
- Scissors or hole punches
- Leftover pieces from the GoldieBlox Making Things Zoom kit (one set for each pair or small team)

Closing Ceremony: Awards

- Fling Flyer Design Challenge award, one for each girl

(**Note to Volunteers:** You can buy these awards from your council shop or on the Girl Scouts' website.)

Race Car Design Challenge 1

As Girls Arrive: Playing with Force and Friction

- Sports and game balls (one for each pair of girls). Bring different types of balls for girls to roll and observe friction. For example, you might bring a marble, tennis ball, basketball, ping pong ball, baseball, etc.
- Create two lines with masking tape on the floor. Each Brownie should sit on the line, facing their partner.

Opening Ceremony: Engineering Speed

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step One: Learn How Design Can Affect Speed

- Toy car to demonstrate force and friction

Brownie Design Challenge Badges: Materials List

Race Car Design Challenge 1 (continued)

Step Two: Design and Build Your Race Car

- GoldieBlox Making Things Zoom kit (one set for each pair or small team.) Feel free to add additional pieces from personal GoldieBlox kits that you or your Girl Scouts may own.

Closing Ceremony: Share Your Design

- Race Cars built by Brownies in Step Two: Design and Build Your Race Car

Race Car Design Challenge 2

As Girls Arrive: Build A Simple Ramp

- Race cars created by girls in Race Car Design Challenge 1. (**Note to Volunteers:** If you were unable to save the race cars between meetings, Brownies can rebuild their cars during this activity.)
- Folders, poster boards, cardboard, etc., to lean against something to create a ramp
- Books, boxes, tables, etc. to create the height and top of a ramp

Opening Ceremony: Reviewing Force and Friction

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step Three: Design Your Racetrack

- Poster boards, cardboard, etc., to lean against something to create ramps
- Table(s) or books to create the top of ramps
- Paper or newspaper
- Masking tape

Step Four: Conduct a Fair Test and Record Results

- Yardstick
- Ramp created by girls in Step Three: Design Your Racetrack
- Race cars created by girls in Race Car Design Challenge 1 or rebuilt in As Girls Arrive: Build a Simple Ramp
- Optional: Phone or camera to capture “photo finishes”

Step Five: Share What You Learned

- Race cars redesigned by girls in Step Four: Conduct a Fair Test and Record Results

Closing Ceremony: Awards

- Race Car Design Challenge award, one for each girl

(**Note to Volunteers:** You can buy these awards from your council shop or on the Girl Scouts’ website.)