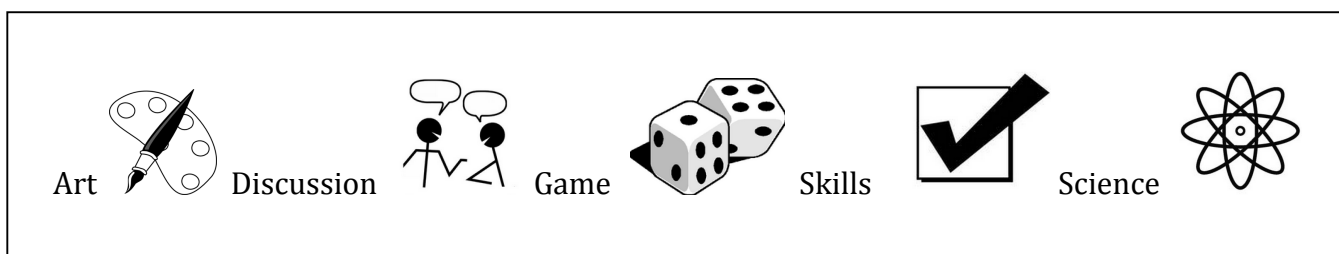


# Meeting-in-a-Box: Engineering

This meeting is aimed at **Pathfinders** and covers the **Everything Comes from STEM** badge as well as other parts of the program. It was originally created for **National Engineering Month** (March) but can be used at any time of the year.

There are enough elements for about **three and a half hours' worth of activities**, but you can pick and choose or run more than one meeting with this theme.



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## Supplies

- |  |  |
|--|--|
| <input type="checkbox"/> Lemons                      | <input type="checkbox"/> Small screwdrivers              |
| <input type="checkbox"/> Baking Soda                 | <input type="checkbox"/> Egg drop items (see activity 2) |
| <input type="checkbox"/> Cups                        | <input type="checkbox"/> Scissors                        |
| <input type="checkbox"/> Spoons                      | <input type="checkbox"/> Eggs                            |
| <input type="checkbox"/> Sugar                       | <input type="checkbox"/> Pie-plates                      |
| <input type="checkbox"/> Lemon Juicer                | <input type="checkbox"/> Spoons                          |
| <input type="checkbox"/> Paper                       | <input type="checkbox"/> Cotton balls                    |
| <input type="checkbox"/> Target                      | <input type="checkbox"/> Dish soap                       |
| <input type="checkbox"/> Sheets of newspaper         | <input type="checkbox"/> Feathers                        |
| <input type="checkbox"/> Masking Tape                | <input type="checkbox"/> Large rocks                     |
| <input type="checkbox"/> Stuffed animals             | <input type="checkbox"/> Water                           |
| <input type="checkbox"/> Unwanted electronic devices |  |

### Activity 1: Intro

(10 minutes)

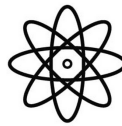


Start by asking questions:

- Have you heard the phrase STEM (Science, Technology, Engineering and Math)? Do you know what the E stands for?
- Do you know what an engineer is?
- Do you know any engineers?
- What kind of work does an engineer do?
- Can you name things around you that engineers were involved in making?
- Do you know some of the different types of engineering? (Chemical, civil, Aerospace, Mechanical, etc.)
- What kind of education does it take to become an engineer?

### Activity 2: Engineer your Lemonade

(20 minutes)



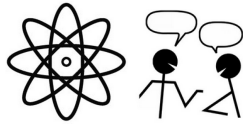
Have you ever made a rocket or volcano out of baking soda and vinegar? You're going to use the same science to make something to make the tastiest, coolest, sciencyest, engineeriest lemonade ever.

- Squeeze a lemon into a glass and add an equal amount of water.

- Stir in a teaspoon of baking soda
- Add sugar to taste

Take a sip and notice how fizzy your lemonade is. As you mixed the baking soda and lemon juice you created a chemical reaction. Bases (baking soda) and acids (lemon juice) mix together to release carbon dioxide (CO<sub>2</sub>), which is the same gas as makes pop fizzy.

### **Activity 3: Egg Drop** (45 minutes)



Think about ways objects are engineered to protect them upon strong contact. Chip bags are filled with air to keep the chips from breaking and cars come with airbags to protect passengers in an accident. Can your Pathfinders think of any other ways objects are protected?

Split your Pathfinders into small groups and give each team a subset of these items (or any other items you like that you have lying around)

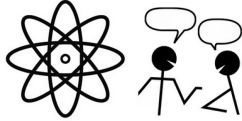
- Straws
- Styrofoam cups
- String
- Tape
- Popsicle sticks
- Egg cartons
- Cotton balls
- Kleenex
- Plastic bags
- Paper
- Yarn

Each team should also get scissors, a pen and a piece of paper.

Tell each team that you are going to give them 10 minutes to plan a structure that will protect an egg when dropped. They should draw a plan on the piece of paper before you give them the materials.

After ten minutes, if they can explain their plan, give them the materials and an egg and 15 minutes to build.

Then, test out the structures by dropping them from increasingly high places (knee height, table height, above your head, from the top of the stairs, etc.) Which one survived the longest? Why do you think that is?



### **Activity 4: Oil Clean-up** (45 minutes)

Environmental engineers are often needed to help during major oil spills.

Depending on the number of girls in your unit, you can divide them into groups or do this activity as a whole. Each group will need a pie plate or other flat container filled with water, a large rock placed in the middle of it and a feather.

Oil has a lower density than water which means that it floats on the surface. It is also hydrophobic which means that it sticks to everything around the water instead of mixing in.

Add some oil (about 1 Tbsp) mixed with food colouring to the water in the pie plate and watch what happens. Tell the girls that the rock symbolises the land. The feather symbolizes animals like birds. Ask the girls to brainstorm ways to remove the oil. Then, discuss how environmentally friendly and costly each method would be.

Ask the girls whether they think you can just skim oil off the top of a lake. Using a spoon, have them try to remove all of the oil without removing any water. How well did it work? How cost effective do they think it would be?

Next, use cotton balls to try to remove oil that still remains. Would the real-life equivalent to cotton balls (oil-absorbing cloth) be expensive? How well did it work?

Lastly, add a few drops of dish soap to the mixture and stir it around. Is the oil dispersing into tiny droplets? Add a new feather to the mix and watch as it doesn't get covered in oil. How expensive do they think chemicals like this would be in real-world situations? Even though it worked, the oil and chemicals are both still in the water. Is this okay from an environmental perspective?

What do the girls think was the best method and why?

*This activity comes from: <https://www.teachengineering.org/index.php>*



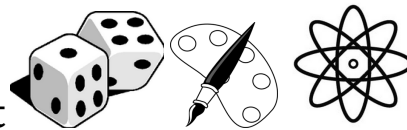
## Activity 5: Device Dissection

(35 minutes)

Have you ever taken apart an electronic device to see what's inside? Search for or have the girls bring in old electronic devices such as computer mice, cell phones, keyboards, gaming consoles, music players, computers etc.

Use a tiny screwdriver (like one you might find in a glasses repair kit) to take the devices apart. What do you find inside? Can you tell what each part is for? Do similar devices have the same parts inside? Do different devices have some of the same parts inside? Can you put it all back together again when you are done?

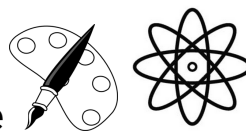
After the activity, discuss e-waste and find out where in your community you can take the devices so that they don't end up in the trash.



## Activity 6: Paper Airplane Contest

(35 minutes)

Most people have made a basic paper airplane before but have you ever tried to make a more complicated one? Check out appendix 1 for some fancy airplane instructions. Set up a target and see who can hit it most exactly. Have a contest to see which plane goes furthest. Challenge the girls to modify the instructions to improve their airplanes.



## Activity 7: Teddy bear Throne

(25 minutes)

Divide pathfinders into teams and give each team 5 sheets of newspaper and 2 meters of masking tape. Challenge them to create a throne that will hold a stuffed animal at least one foot off the ground.

Have them think about different types of structures and what shapes are stronger than others. Should they crumple or roll the paper? Should they aim for height or solidity?

## Program work completed

Activity	<b>Pathfinder Program Work Completed</b> * Please note that the program doesn't necessarily match up exactly with the numbers indicated, but that the activities accomplish similar goals
Introduction	Everything Comes from STEM #4, 6
Lemonade	We are What we Eat #5 Now You're Cooking #1, 4, 6
Egg Drop	Girls Just Want to Have Fun #4 Galactic Adventures #4 Everything Comes from STEM #1, 4, 6
Device Dissection	Computer Whiz #1 Everything Comes from STEM #5 Our Environment #6
Oil Clean-up	Everything Comes from STEM #1, 4, 6, 7 Our Environment #1 Getting Food on the Table #2
Paper Airplanes	Girls Just Want to Have Fun #4 Everything Comes from STEM #1, 6
Teddy Bear Thrones	Everything Comes from STEM #1

*Meeting Submitted by Elizabeth Knowles with help from Robin Yee in February 2015*

## Appendix 1: Paper planes The Standard



**Step 1:** Fold the paper in half.



**Step 2:** Fold the top right corner down the left edge.



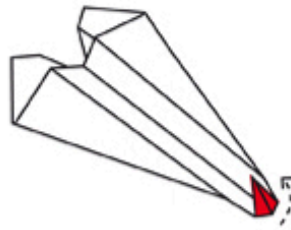
**Step 3:** Fold the new flap over again.



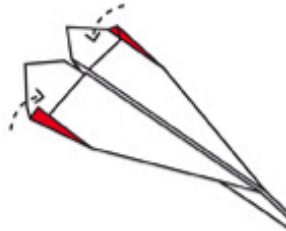
**Step 4:** Fold it over along the dotted lines shown here.



**Step 5:** Turn your plane over and repeat steps 3 to 4.

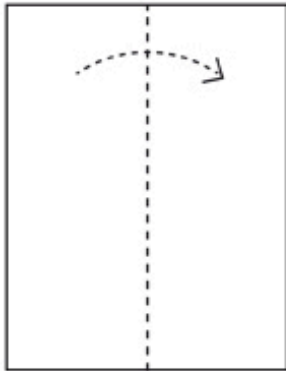


**Step 6:** Fold top inside plane.

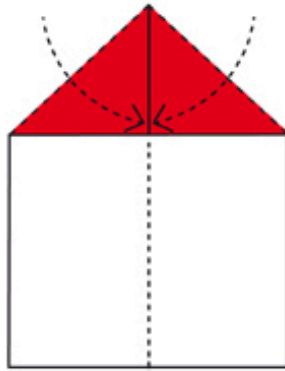


**Step 7:** Fold up the ends of the wings to make wing tips.

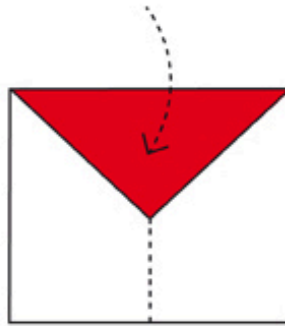
# The Adjustable Glider



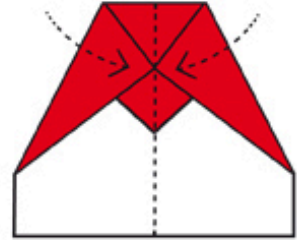
**Step 1:** Fold the paper in half and open it out again.



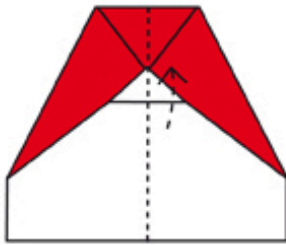
**Step 2:** Fold the top right and top left corners to the middle.



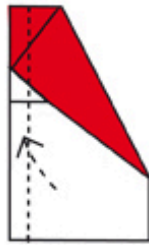
**Step 3:** Fold front inwards.



**Step 4:** Fold down new front corners to the centre point of the triangle.



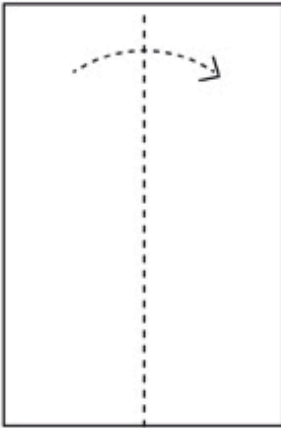
**Step 5:** Fold up the remaining tab over the two wings. It should overlap the previous fold slightly.



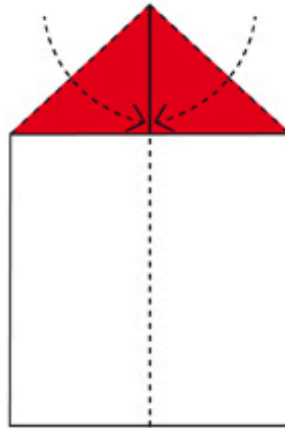
**Step 6:** Fold in half along the centre line with the tab on the outside. Fold both wings down so that their outer edge is in line with the centre line.



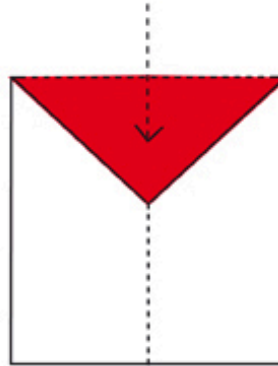
# The Jet



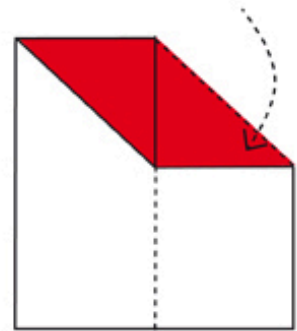
**Step 1:** Fold the paper in half and open it out again.



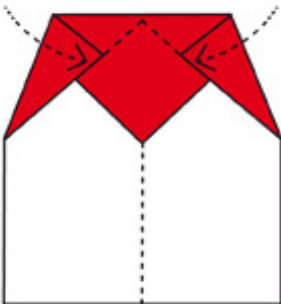
**Step 2:** Fold the top right and left corners to the middle.



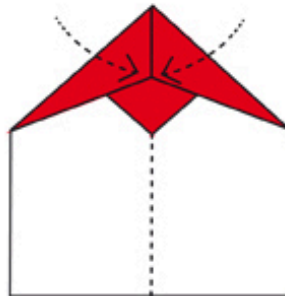
**Step 3:** Fold front inwards.



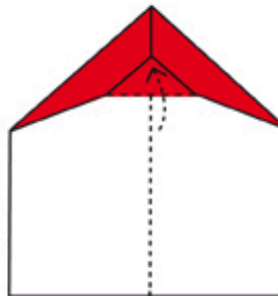
**Step 4:** Fold down new front corner into centre, then fold back out again. Repeat on the other side.



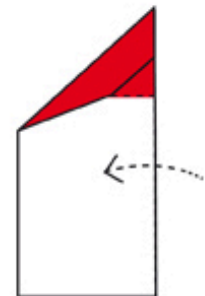
**Step 5:** Fold edges in so they align with the creases created in step 4.



**Step 6:** Fold back along lines created at step 4, this time leaving them there.



**Step 7:** Fold flap forwards towards the front.

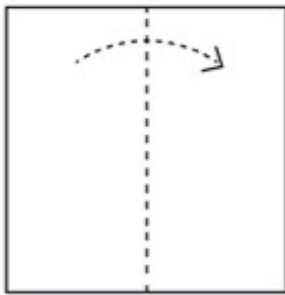


**Step 8:** Fold in half along the centre line so that the clouds face outwards.

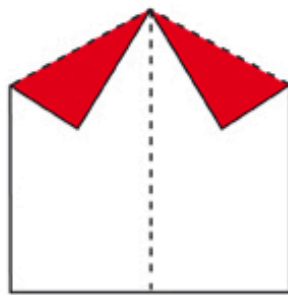


**Step 9:** Fold back to make a wing. Repeat on the other side.

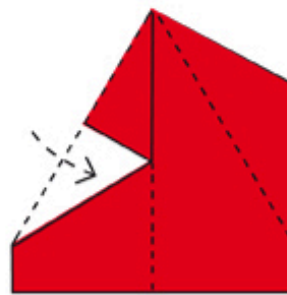
## The Modern Dart



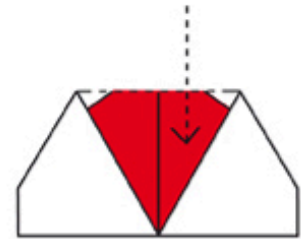
**Step 1:** Fold a square piece of paper in half and open it out again.



**Step 2:** Fold the top right and left corners.



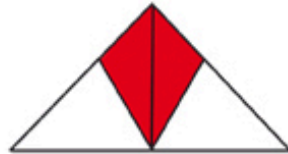
**Step 3:** Turn the paper over and fold the new corner into the middle. Repeat on the other side.



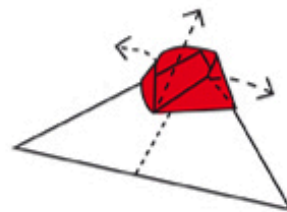
**Step 4:** Turn the paper over and fold in half.



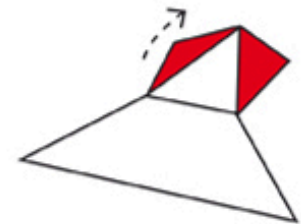
**Step 5:** Turn the paper over and fold into the middle. Repeat on the other side.



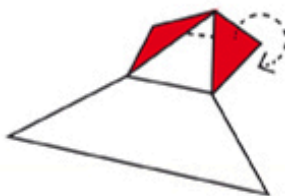
**Step 6:** Turn the paper over.



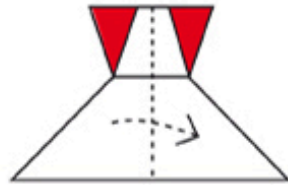
**Step 7:** Lift and open up the diamond shape.



**Step 8:** Flatten.



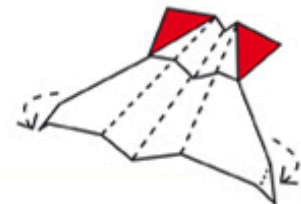
**Step 9:** Fold the top of plane along dotted line shown here. Fold under.



**Step 10:** Fold in half from left to right.

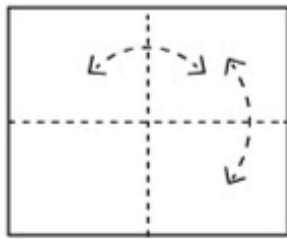


**Step 11:** Fold back wing along dotted line shown here. Repeat on the other side.

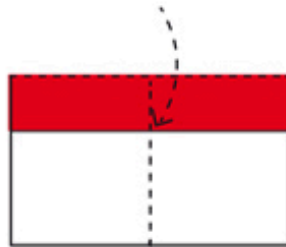


**Step 12:** Fold down the ends of the wings to make wing tips.

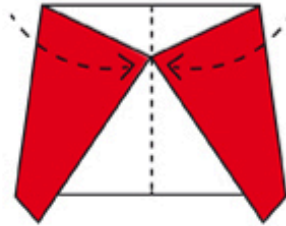
## The Glider



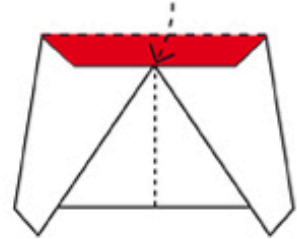
**Step 1:** Turn the paper to the right. Now fold it in half width and length ways and open it out again.



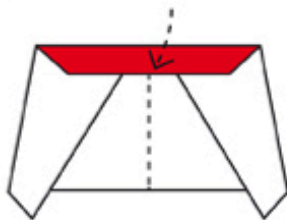
**Step 2:** Fold the top down to the crease in the middle.



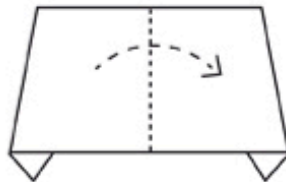
**Step 3:** Fold both corners so they touch the bottom of the flap and the crease in the middle.



**Step 4:** Fold the top down.



**Step 5:** Fold the top down again.



**Step 6:** Turn the plane and fold it in half from left to right.



**Step 7:** Fold back both wings along the dotted line shown here.

All plane instructions came from: <http://www.shortlist.com/cool-stuff/design/printable-paper-planes>