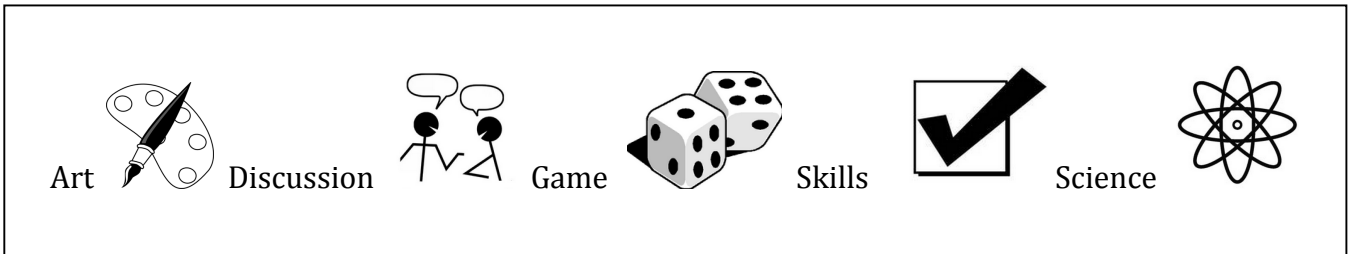


# Meeting-in-a-Box: Engineering

*This meeting is aimed at **Guides** and covers the **Engineering** 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 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"/> Tooth picks     |
| <input type="checkbox"/> Baking Soda         | <input type="checkbox"/> Paper           |
| <input type="checkbox"/> Cups                | <input type="checkbox"/> Target          |
| <input type="checkbox"/> Spoons              | <input type="checkbox"/> Popsicle sticks |
| <input type="checkbox"/> Sugar               | <input type="checkbox"/> Straws          |
| <input type="checkbox"/> Lemon Juicer        | <input type="checkbox"/> Masking tape    |
| <input type="checkbox"/> Sturdy Paper Plates | <input type="checkbox"/> Paper clips     |
| <input type="checkbox"/> Markers             | <input type="checkbox"/> Tinfoil         |
| <input type="checkbox"/> Pencils             | <input type="checkbox"/> Small container |
| <input type="checkbox"/> Balloons            | <input type="checkbox"/> Marbles         |
| <input type="checkbox"/> Mini Marshmallows   |  |

### Activity 1: Intro

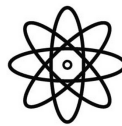


(10 minutes)

Start by asking questions:

- 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

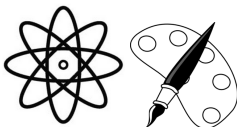


(20 minutes)

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: Hovercraft** (25 minutes)

Have you ever wanted your very own hovercraft? Now is your chance.

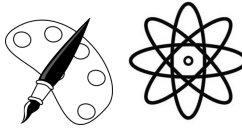
Use markers to decorate the underside of a paper plate before poking a pencil through the middle to make a hole.

Push the end of the balloon through the hole and blow it up. Don't tie a knot. Instead, hold it closed right above the plate and release it over a flat surface. You should be able to guide it by gently pushing the side of the plate.

As the air tries to escape from under the plate, it will cause it to rise slightly and thus hover over the surface. Real hovercrafts use the same principle with propellers instead of balloons.



<http://www.highlightskids.com/science-experiment/make-hovercraft#>



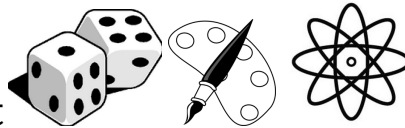
### **Activity 4: Marshmallow Structures**

(25 minutes)

Divide your Guides into teams and give them an equal number of mini marshmallows and toothpicks. Challenge them to create the highest structure they can in 15 minutes.

After they are done, have a discussion about what techniques worked best. Was it hard to decide between height and stability? What shape was the strongest (Triangles are great!)? Did they get inspiration from any famous bridges or buildings?

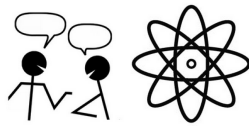
If you have time and they are interested, challenge them to try again with their new knowledge.



### **Activity 5: 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 6: Walk Around**

(20 minutes)

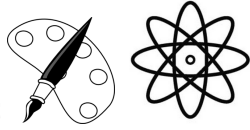
Engineering can be found most anywhere.

Brainstorm a list of characteristics that you think indicate that something is a machine (levers, pulleys, wedges, screws, ramps, wheels, axles, pistons, gears, etc.).

Use a dictionary to read the definition of a machine or read out the one below.

*A machine is defined as an apparatus using or applying mechanical power and having several parts, each with a definite function and together performing a particular task.*

Divide into teams and see how many machines you find around the meeting place. After 10 minutes, come back and share with the group. What convinced you that the items you found were machines?



## Activity 7: Boats

(45 minutes)

Divide the girls into teams and show them the material below. Tell them that they have to build a boat that will hold a small container with marbles. They should think about how to make it float but also consider how solid it is, where the container will go, how the materials will change when they get wet and whether all team members are participating. The girls can look at the marbles and container but they cannot be built into their boats, as you will use the same ones for each team.

- 2 straws
- Tinfoil
- 50 cm of tape
- 5 paper clips
- 4 popsicle sticks
- 1 piece of paper

Give them a piece of paper and 10 minutes to plan before they get their material. After the time is up, give each team the material and 20 minutes to build their boat.

Then, in a washbasin filled with water, test out how many marbles each boat can hold before it topples or sinks.

## Program work completed

Activity	<b>Guide 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	Career Awareness #2 Engineering #1
Lemonade	Tasty Treats #3 Chemistry #2 Engineering # 4
Hovercrafts	Creative Craft #5 Inventing #6
Marshmallow Structures	Art Production #2 Inventing #6 Engineering #5
Airplanes	Aeronautics #5, 6 Engineering #5
Walk Around	Engineering #2, 3
Boats	Creative Craft #5 Inventing #6 Engineering #5, 6

*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.



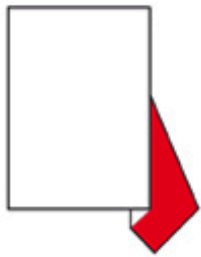
**Step 2:** Fold the top right corner down the left edge.



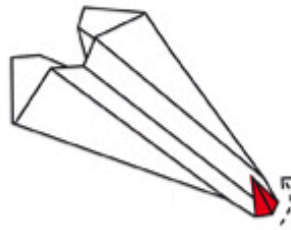
**Step 3:** Fold the new flap over again.



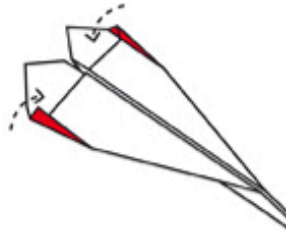
**Step 4:** Fold it over along the dotted lines shown here.



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

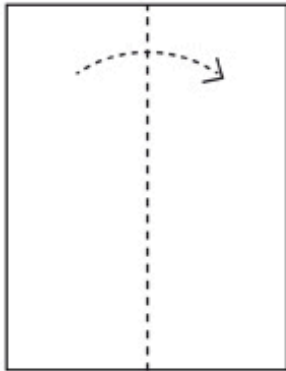


**Step 6:** Fold top inside plane.

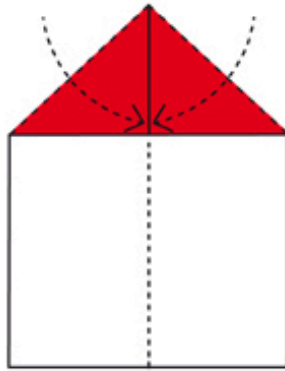


**Step 7:** Fold up the ends of the wings to make wing tips.

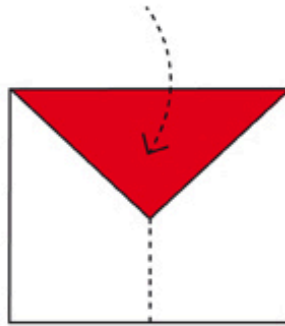
# The Adjustable Glider



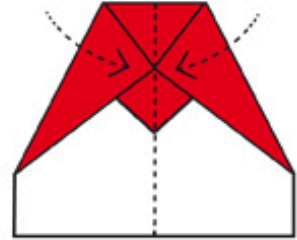
**Step 1:** Fold the paper in half and open it out again.



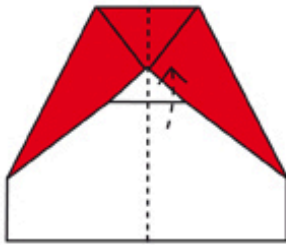
**Step 2:** Fold the top right and top left corners to the middle.



**Step 3:** Fold front inwards.



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



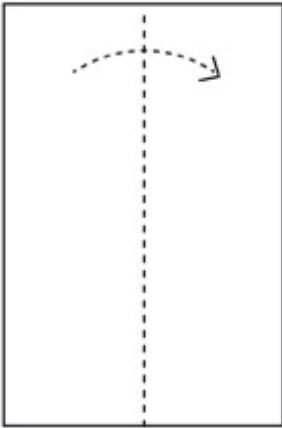
**Step 5:** Fold up the remaining tab over the two wings. It should overlap the previous fold slightly.



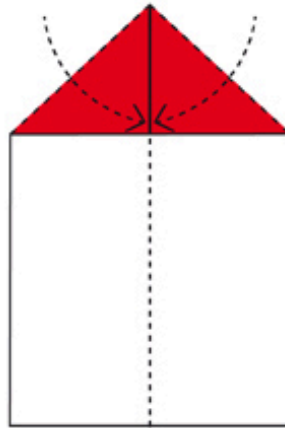
**Step 6:** Fold in half along the centre line with the tab on the outside. Fold both wings down so that their outer edge is in line with the centre line.



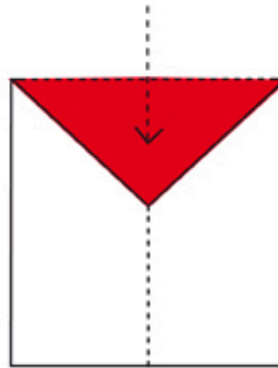
# The Jet



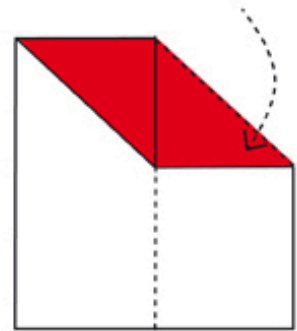
**Step 1:** Fold the paper in half and open it out again.



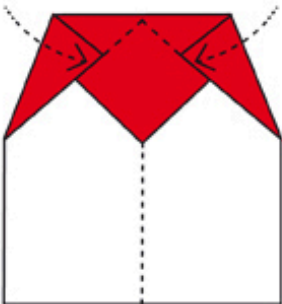
**Step 2:** Fold the top right and left corners to the middle.



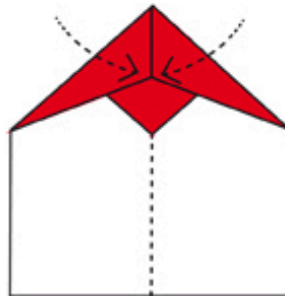
**Step 3:** Fold front inwards.



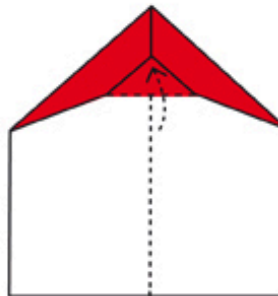
**Step 4:** Fold down new front corner into centre, then fold back out again. Repeat on the other side.



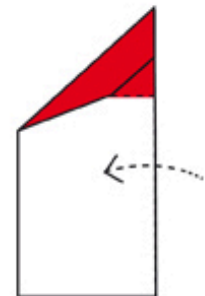
**Step 5:** Fold edges in so they align with the creases created in step 4.



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



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

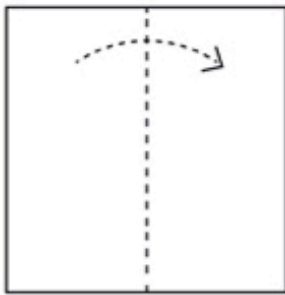


**Step 8:** Fold in half along the centre line so that the clouds face outwards.

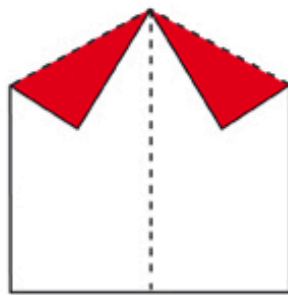


**Step 9:** Fold back to make a wing. Repeat on the other side.

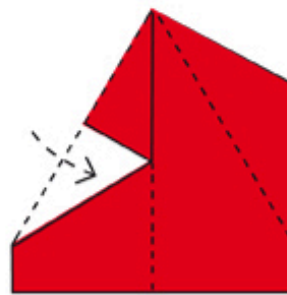
## The Modern Dart



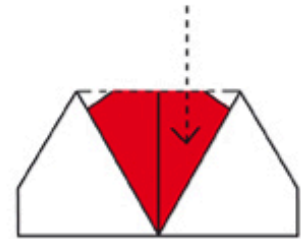
**Step 1:** Fold a square piece of paper in half and open it out again.



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



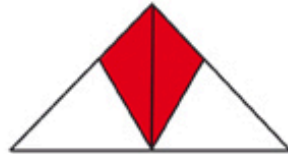
**Step 3:** Turn the paper over and fold the new corner into the middle. Repeat on the other side.



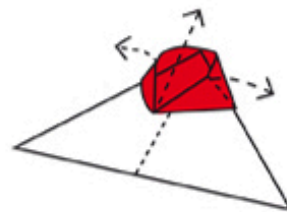
**Step 4:** Turn the paper over and fold in half.



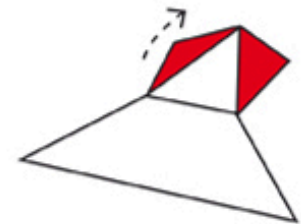
**Step 5:** Turn the paper over and fold into the middle. Repeat on the other side.



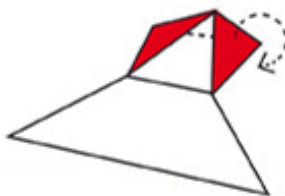
**Step 6:** Turn the paper over.



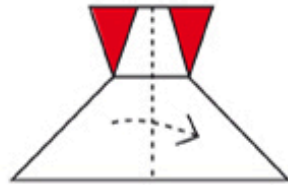
**Step 7:** Lift and open up the diamond shape.



**Step 8:** Flatten.



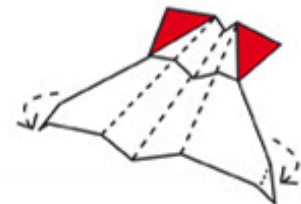
**Step 9:** Fold the top of plane along dotted line shown here. Fold under.



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

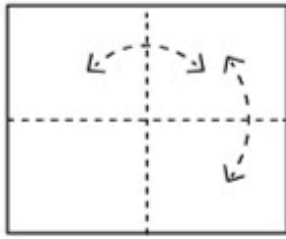


**Step 11:** Fold back wing along dotted line shown here. Repeat on the other side.

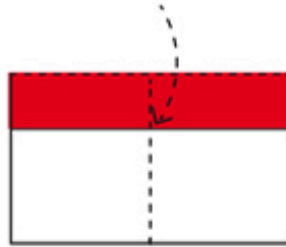


**Step 12:** Fold down the ends of the wings to make wing tips.

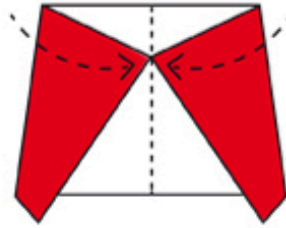
## The Glider



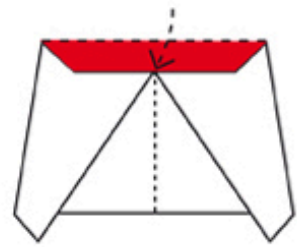
**Step 1:** Turn the paper to the right. Now fold it in half width and length ways and open it out again.



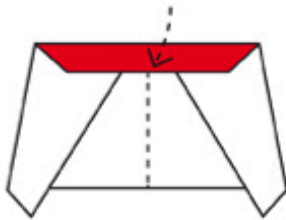
**Step 2:** Fold the top down to the crease in the middle.



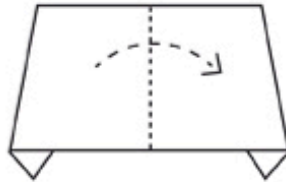
**Step 3:** Fold both corners so they touch the bottom of the flap and the crease in the middle.



**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>