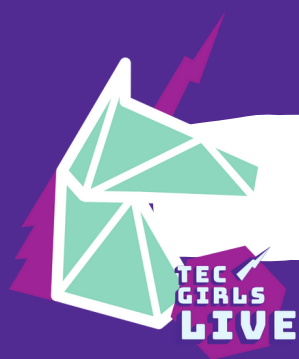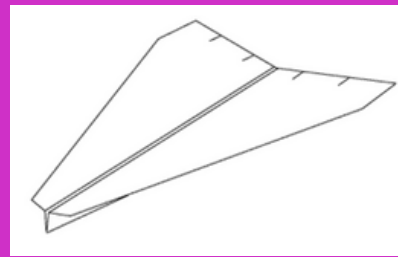# Amazing Aerospace

Check out three different paper airplane designs. After trying these why not come up with your own design?

EXTRA CHALLENGE:
Can you transport cargo with your design?

Arrow

1 Orient the template with the "UP" arrow at the top of the page. Then, flip the paper over onto its back, so that you cannot see any of the fold lines. Pull the top right corner down toward you until fold line 1 is visible and crease along the dotted line. Repeat with the top left corner.

2 Fold the right side over again and crease along fold line 2. Repeat with the left side.

3 Fold the tip down toward you and crease along fold line 3.

4 Now, flip the paper over. Then, fold the left side over onto the right side and crease along fold line 4 so that the outside edges of the wings line up.
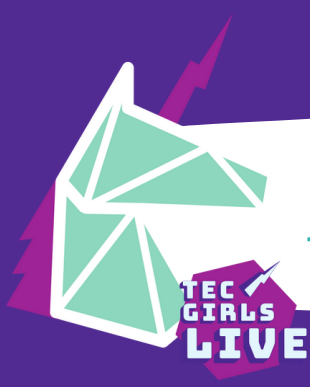
5 Fold the wings down along fold lines 5. Partially open the folds you just created so that the wings stick out straight. Cut two slits, one inch apart, along the back edge of each wing. Fold the flaps up to counterbalance the weight of the nose. Tilt the wings up slightly to create a slight "V" shape when viewed from the front. This is called wing dihedral. It helps the plane automatically adjust itself to stay balanced, making it fly more smoothly. You are ready to fly!

⭐ Explore attaching sweets to your plane. How much cargo can it carry and still glide?
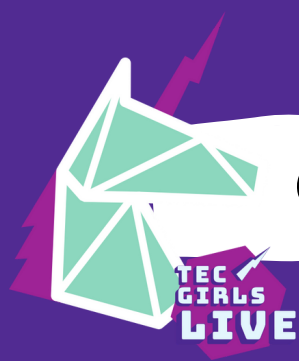
⭐ Experiment creating your own paper plane design! See the back of this sheet for some variables to consider when constructing your aircraft.
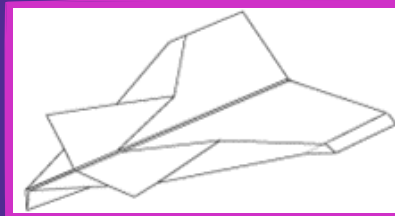
Designing your own paper plane
Things to consider

- Create crisp and precise folds to ensure symmetry and stability in the aeroplane's structure

- Consider weight distribution. It's important for achieving balance and stability.

- Consider the mass of the plane. Heavier planes can better resist wind and turbulence.

- Create a sleek, streamlined (aerodynamic) design to minimise drag

- Consider reinforcements to limit damage to your plane as you use it

- Experiment with different wing shapes to optimise lift and stability

- Adjust the size of the wings to find the right balance between lift and weight. Larger wings generally provide more lift but can increase drag.

- Most planes benefit from a little weight in the nose. This helps balance the plane, so it doesn't have a tendency to fly straight up. Cover the nose in a layer or two of tape or add a paper clip. Test the plane and make adjustments as necessary.

- Experiment with different launch angles and speeds to optimise the initial thrust and trajectory of the airplane.

- Bending the back end of planes upwards prevents nosediving due to the resistance of the air on the tail flaps.

- Conversely, for planes that try to fly upwards when launched, bending the wing tips downwards is useful

Canard

1 Orient the template so that the "UP" arrow is at the top of the page. Then flip the paper over so that none of the fold lines are showing. Fold the top edge of the paper down toward you until fold line 1 becomes visible. Make a crease along the dotted line.

2 Fold the top right corner down and toward you and make a crease along fold line 2. Be aware that you will not be able to see the fold line after making this fold.

3 Fold the top left corner down and toward you and make a crease along fold line 3.

4 Fold the corners of the flaps you just folded up along fold lines 4.

5 Fold the left half of the plane onto the right half along fold line 5 so that the outside edges of the wings line up.
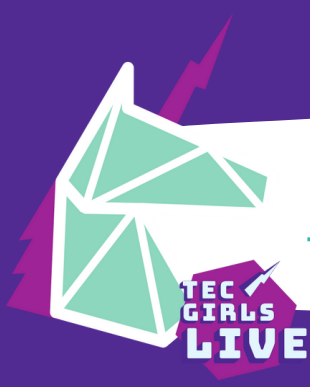
6 Fold the wings down along fold lines 6.

7 Fold the winglets down along fold lines 7. Tilt the wings up slightly to create a slight "V" shape when viewed from the front. This is called wing dihedral. It helps the plane automatically adjust itself to stay balanced, making it fly more smoothly. You are ready to fly!

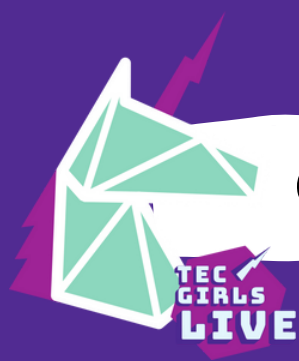⭐ **Explore attaching sweets to your plane. How much cargo can it carry and still glide?**

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Classic Dart
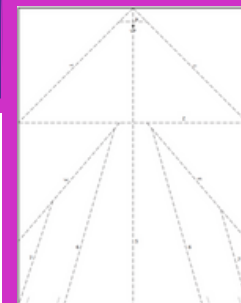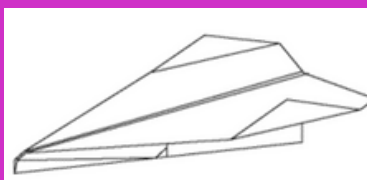
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2 Fold the top point down toward you until fold line 2 is visible and crease along the dotted line.

3 Fold the top left and top right corners down and toward you and crease along fold lines 3.

4 Fold the tip up and over the two diagonal folds along fold line 4 to secure them in place.

5 Flip the plane over and fold the right side over along fold line 5 so that the outside edges of the wings line up. Also make sure the diagonal folds do not become untucked from the tip you folded up in the previous step.
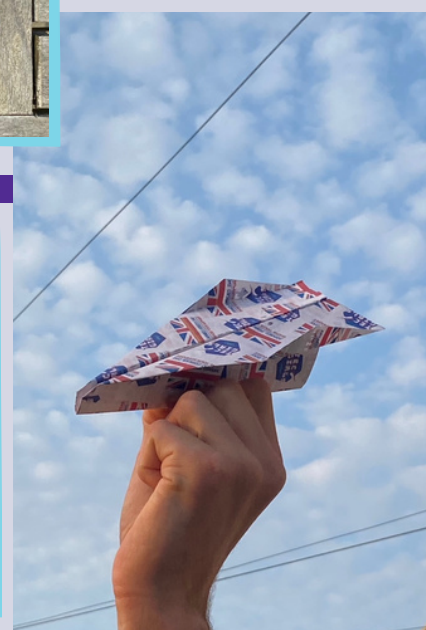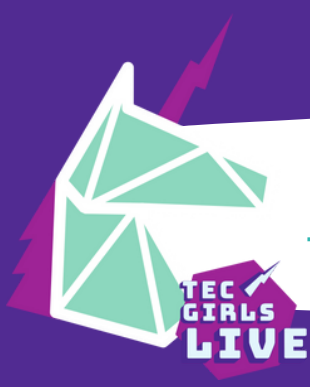
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Attaching sweets to your plane

Some ideas

1 We attached sweets alternately to our plane using tape. Try exploring how their placement affects your plane's flight!

2 We also wedged sweets in a paper tube to see how this concentrated weight affected the flight.

3 Finally, we attached a hanging carrier filled with sweets. To do this, we created an origami box. Then we attached it using a needle and string. Having threaded the string through the middle of the box, we attached it to the front and back of the plane by poking a hole and tying a knot at either end.

Making an origami box

1. Take a piece of square paper. We measured 5 inches but you can use a bigger sheet if you want a bigger box.

2. Fold the top left hand corner down to the bottom right so it makes a triangle. Open up at repeat, folding top right to bottom left.

3. Then fold the top edge over to the bottom edge so you have a rectangle. Unfold and repeat, folding the right hand edge to the left hand edge.
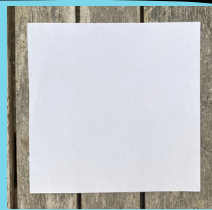
4. Unfold your paper. You should be able to count 8 triangles.

5. Next, fold each corner into the centre point.

6. Now, you need to fold the bottom edge up (over half way) and the top edge over it so that you have folded the paper into equal thirds. This can be a bit tricky. Fold the paper very lightly at first so you can adjust it to become even with no harsh creases.

7. Unfold your paper and do the same thing but this time folding the left and right hand edges to separate the square into vertical thirds.
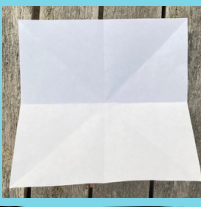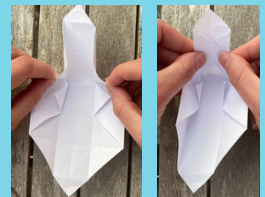
8. Unfold your paper so it looks like this.

9. Refold the middle two creases and run your finger along them so they are really defined.
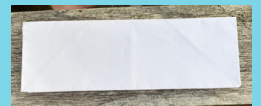
10. Then pull the two corners shown in and press them onto the flap behind it.

11. Fold down the flap and repeat steps 9 and 10 on the other side.

12. You have your box! Fill it with sweets and make another box you can slot on top as a lid.