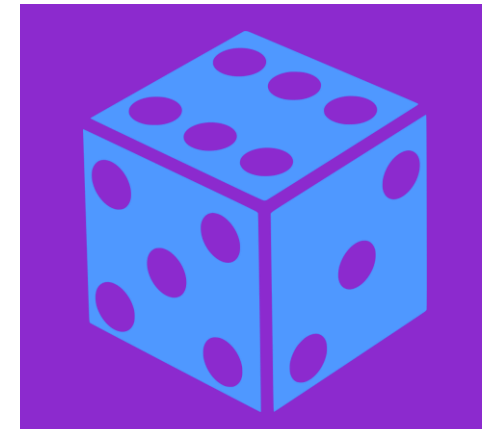
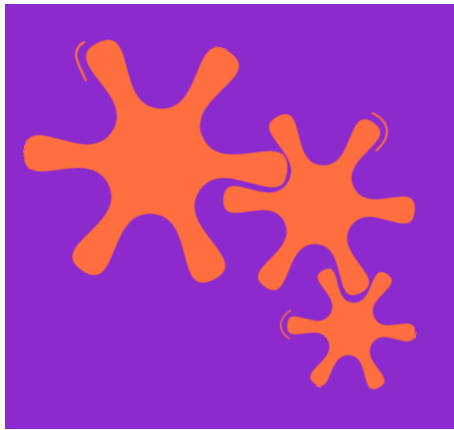


SPIRIT OF INNOVATION

STEAM

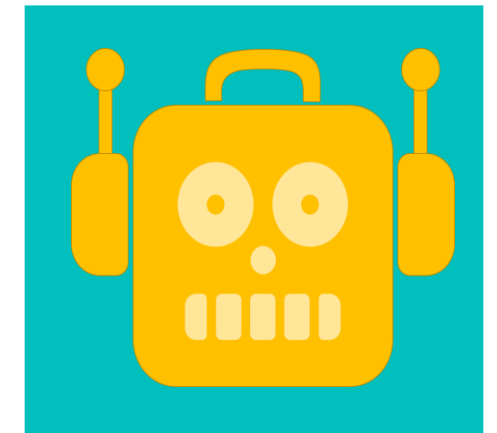
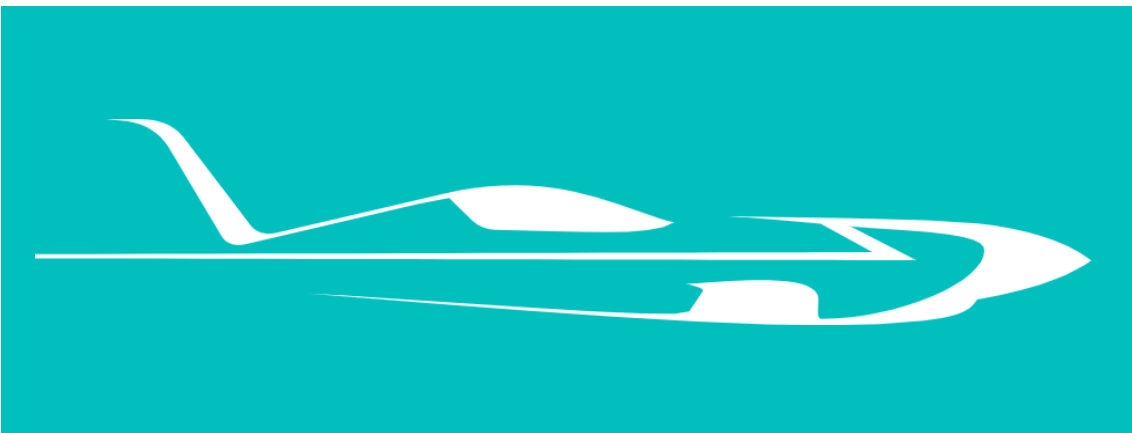
RESOURCES



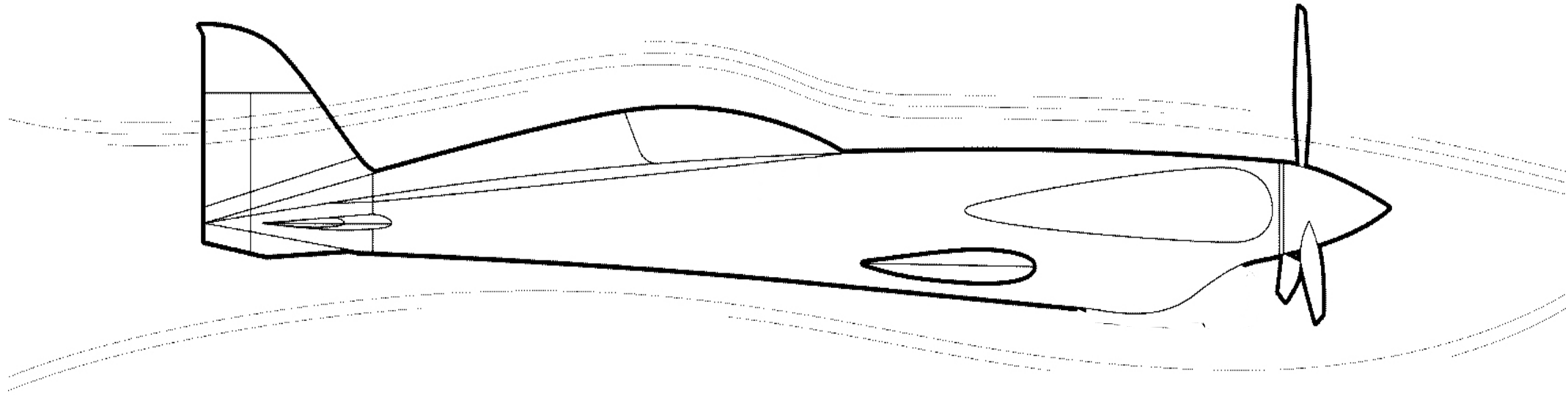
Spirit of Innovation

Year Three

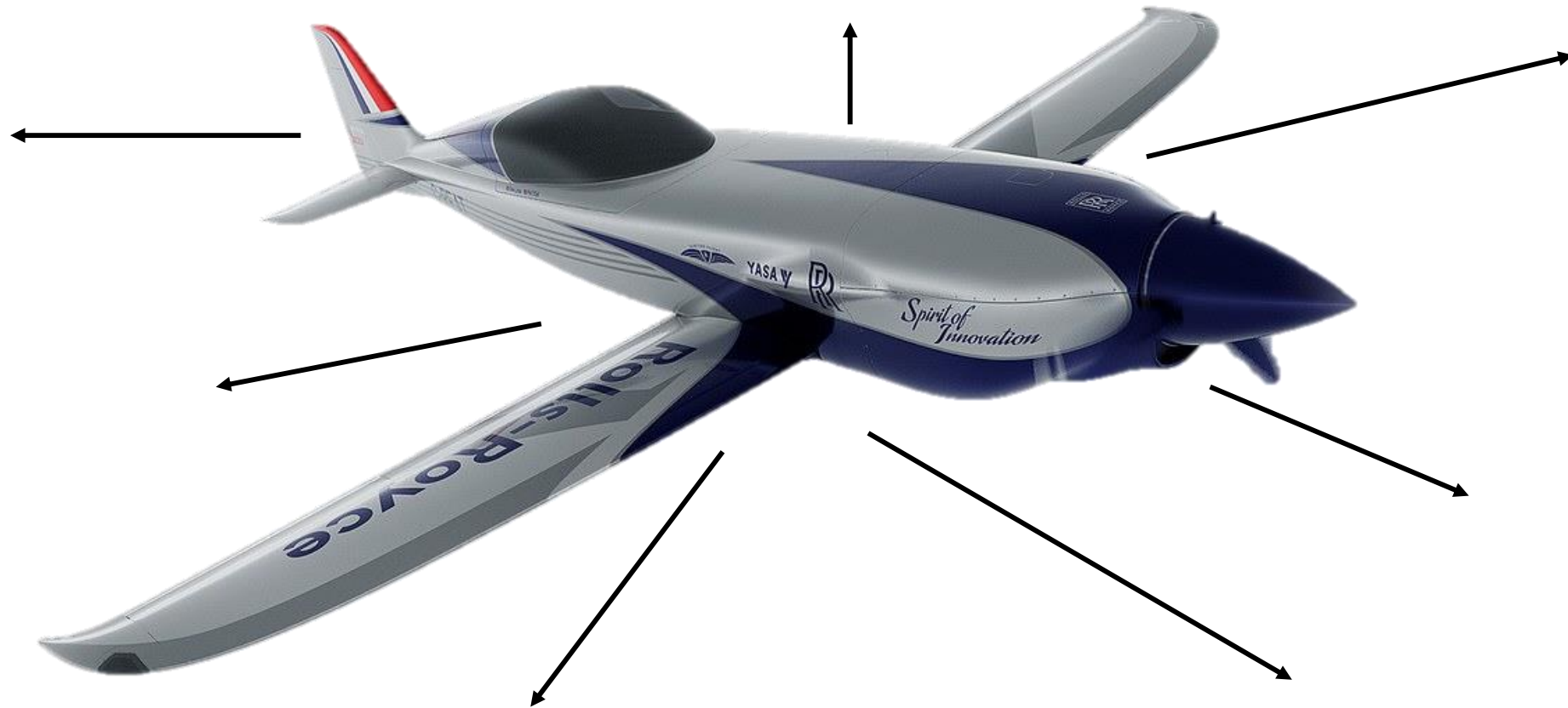
Everyday Materials



Forces on an Aeroplane



Aeroplanes do you know how they work?



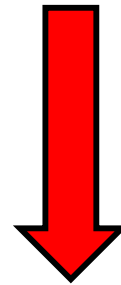
Add your thoughts to slide.

How does an aeroplane stay in the air?

First we need to know about the forces that act upon an aeroplane which push it around in many directions. This is the same for many other vehicles, but we are only focusing on aeroplanes today.



Weight force

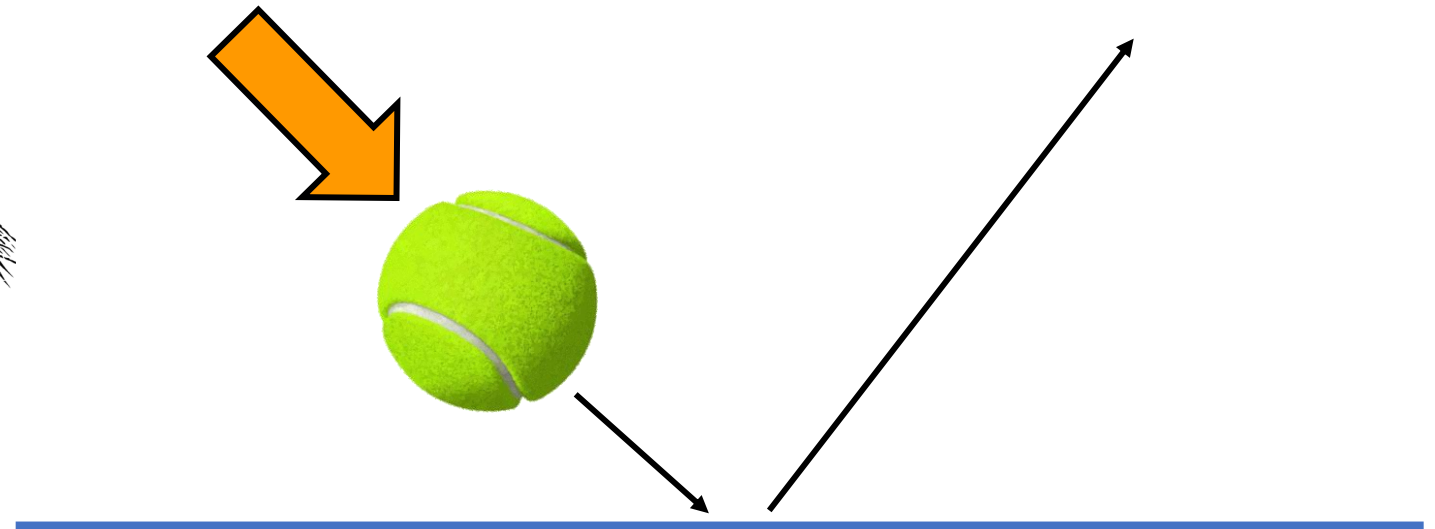


The first force we will look at act on everything.

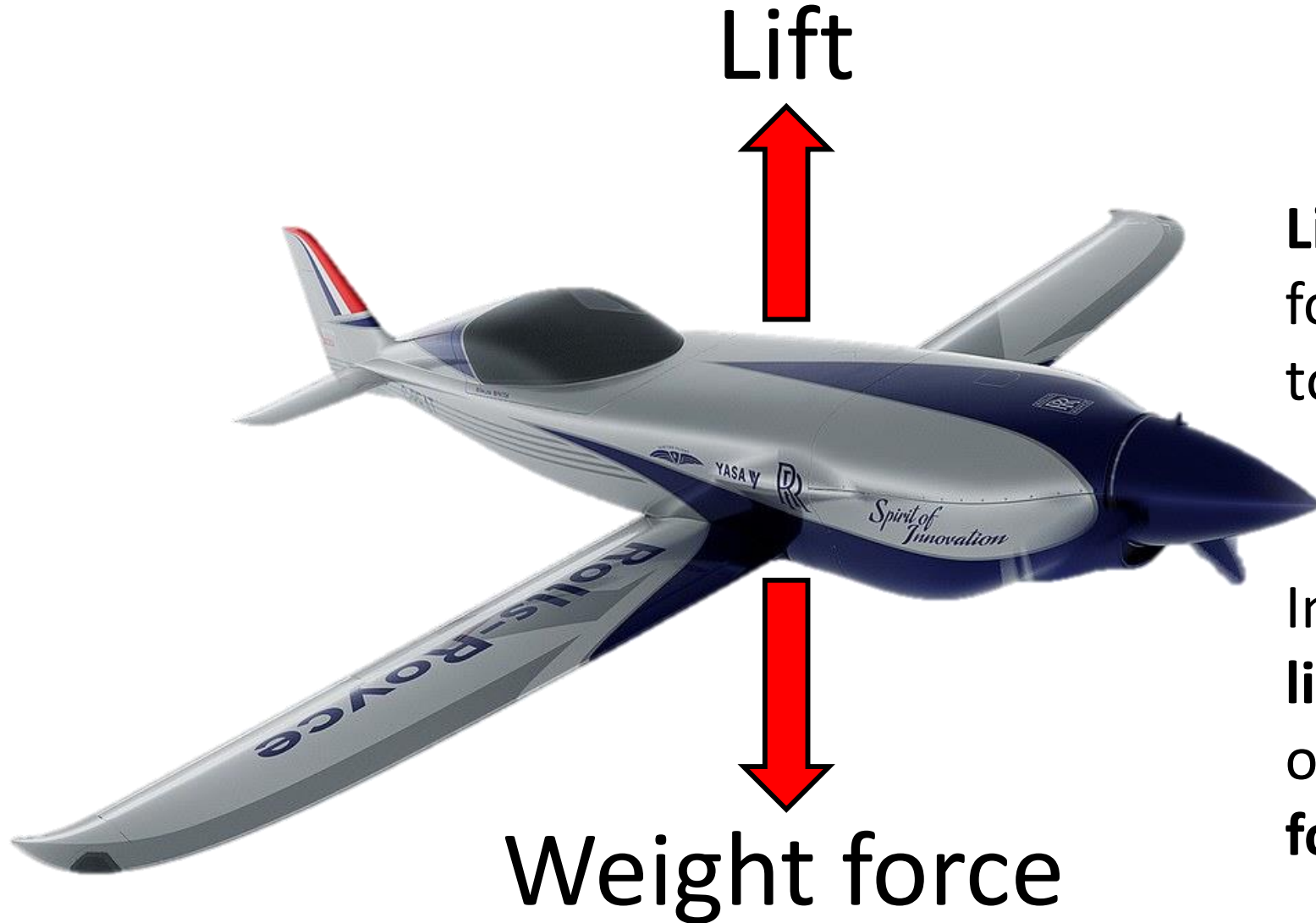
This pulls the plane towards the centre of the Earth

Newton's Third Law

For every **action**, there is an **equal and opposite reaction**.



Opposing the force of weight and pushing the aeroplane up is **lift**.



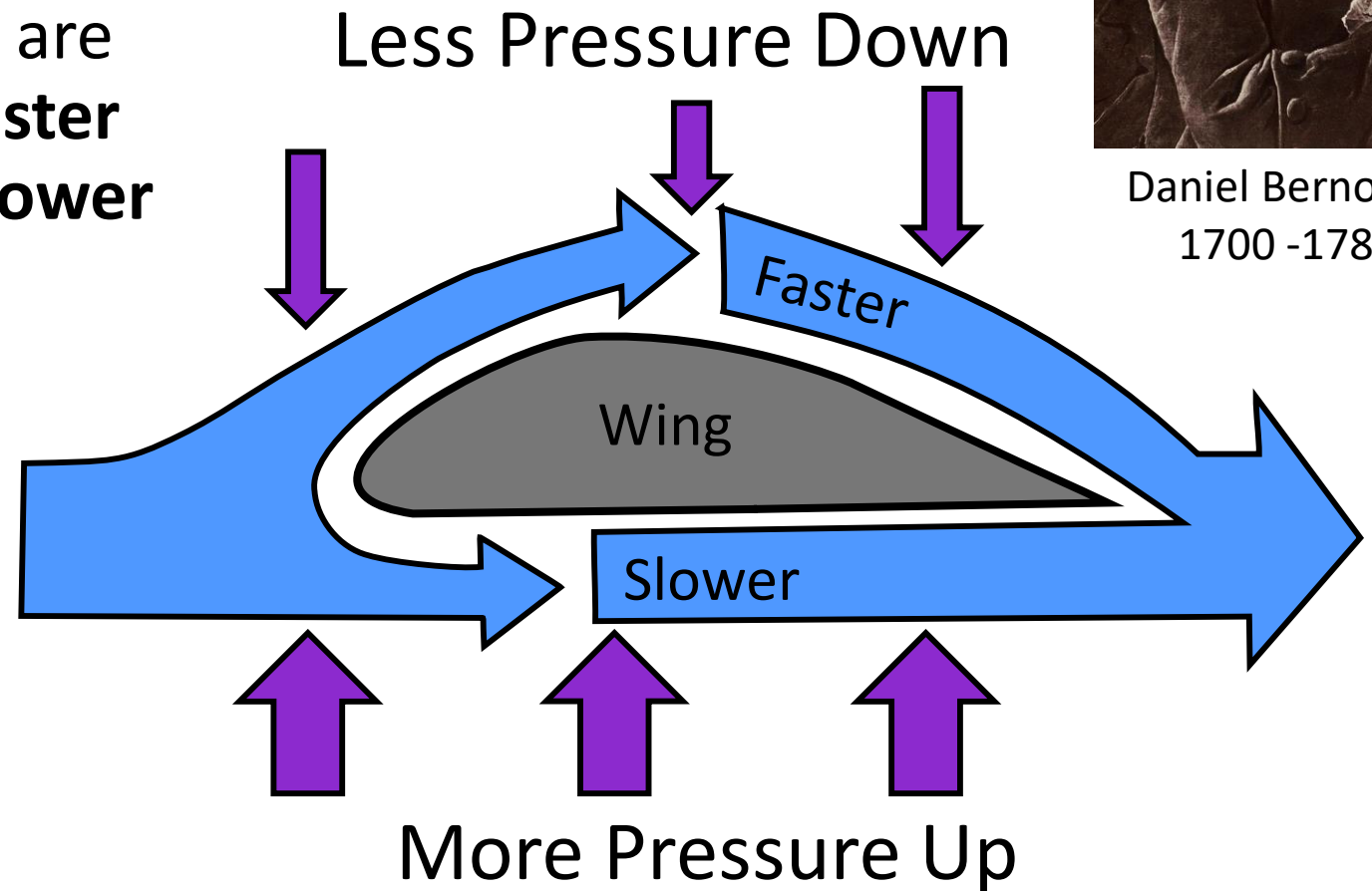
Lift is the key **aerodynamic** force that brings an aeroplane to fly.

In order to achieve flight the **lift** must be **greater than** that of the opposite force – **weight force**.

Bernoulli's Principle

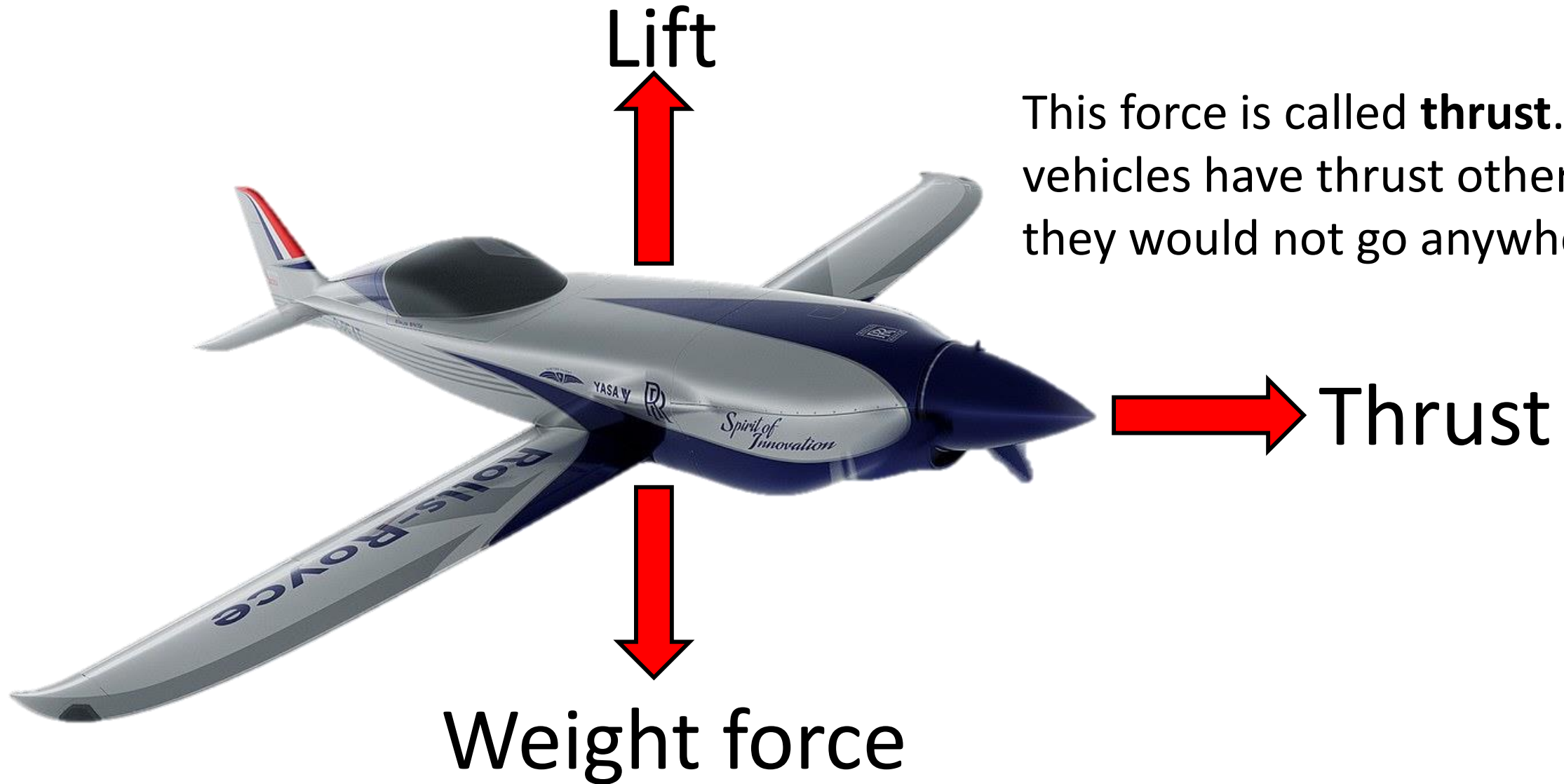
Bernoulli's principle helps explain that an aeroplane can achieve lift because of the shape of its wings. They are shaped so that that air flows **faster** over the **top** of the wing and **slower** underneath.

Fast moving air equals **low air pressure** while **slow** moving air equals **high air pressure**.



Daniel Bernoulli
1700 -1782

If these were the only two forces the aeroplane could go up and down, but it would not go anywhere. We need a force that pushes the aeroplane forward.

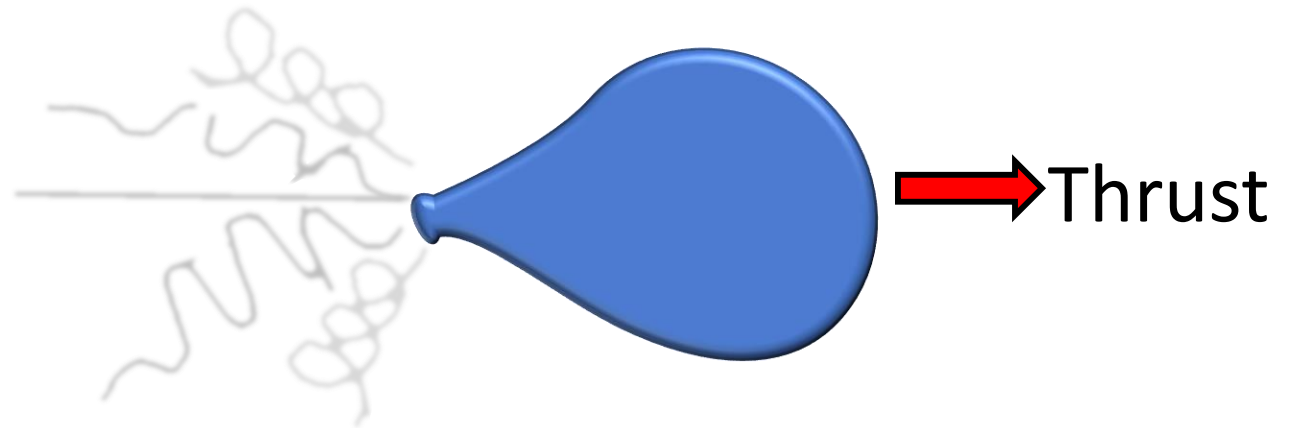


This force is called **thrust**. All vehicles have thrust otherwise they would not go anywhere.

In an aeroplane the thrust is produced by an engine; there are two types of engine; either propeller or jet. Spirit of Innovation will have a propeller. However, they both use the same principle.

Again we need Newton's third law:
For every **action**, there is an **equal** and **opposite reaction**.

When you blow up a balloon and you let it go, the air comes out of the back and the balloon moves forward.

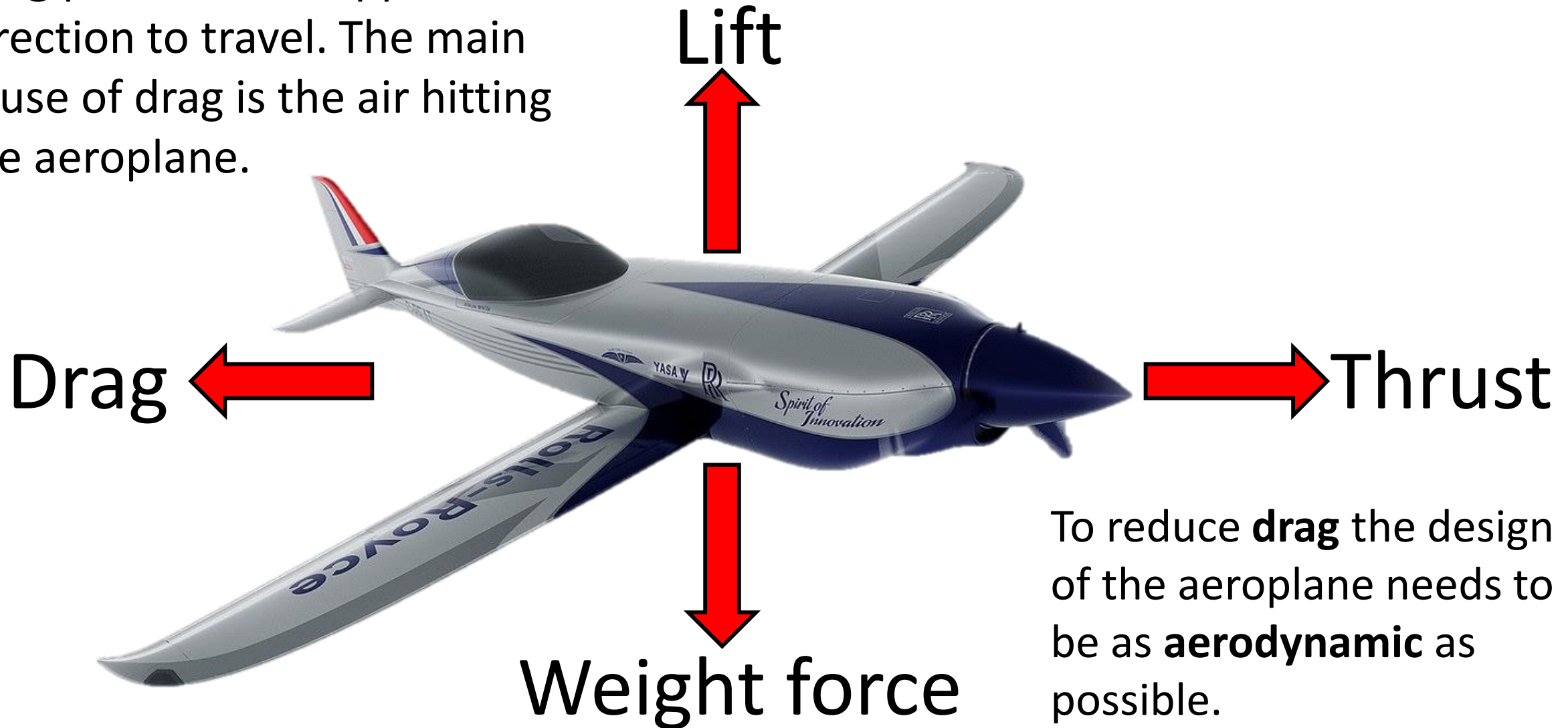


Like a balloon, the engine accelerate air out of the back, then due to Newton's third law, the thrust forces pushes the aeroplane forwards.



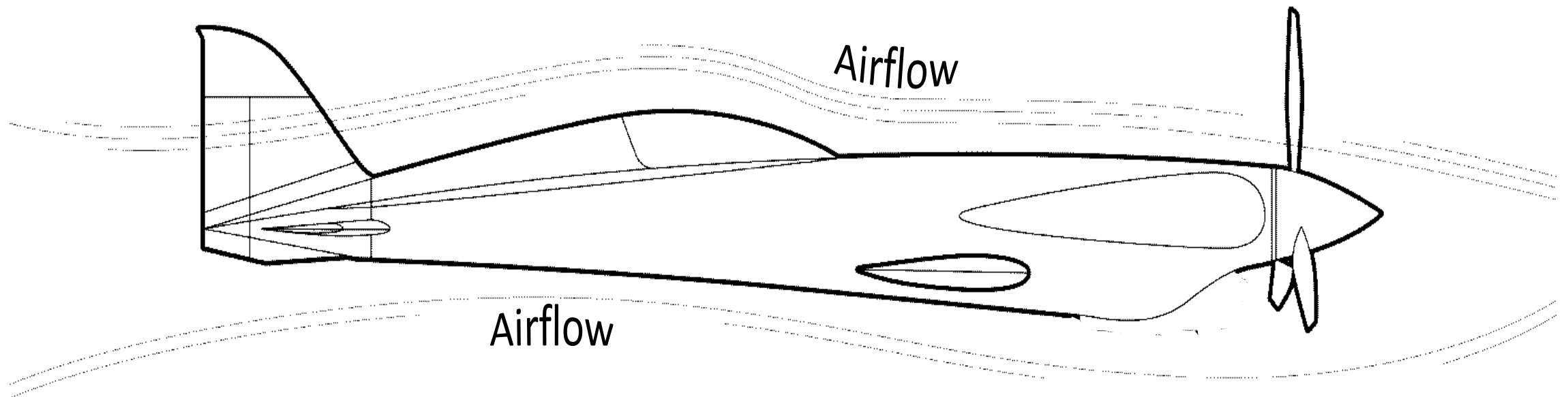
We have one last force, it oppose the thrust. It is known as **drag**.

Drag points in the opposite direction to travel. The main cause of drag is the air hitting the aeroplane.

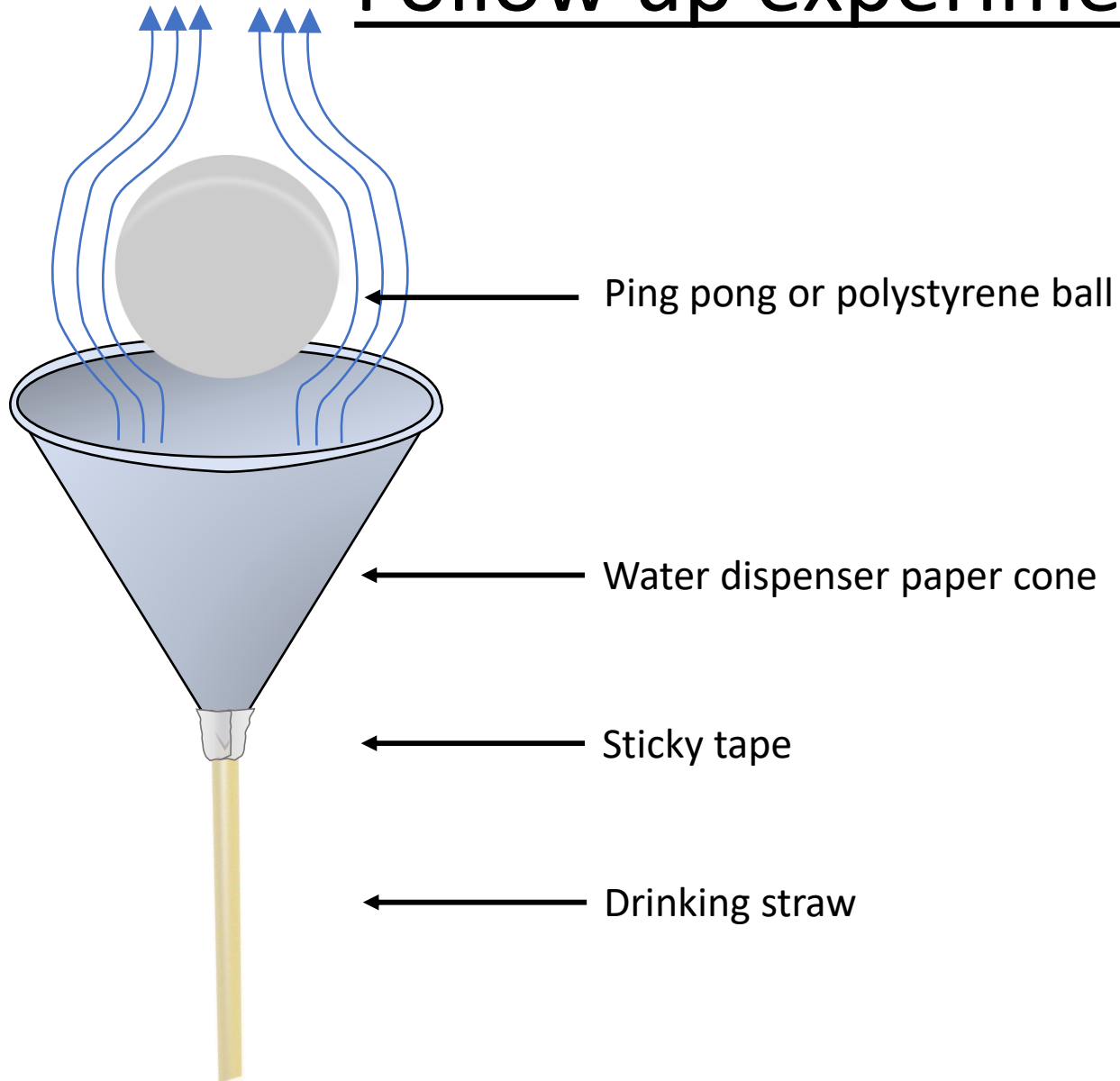


To reduce **drag** the design of the aeroplane needs to be as **aerodynamic** as possible.

Engineers try to **minimize** the drag by making the aeroplanes as aerodynamic as possible. Especially one that is designed to break an air speed record. The airflow needs to move over the front of the aeroplane smoothly.



Follow up experiments - Bernoulli Blower



When the fast moving air meets the ball, it is just like an aeroplane wing moving quickly through the air. A wing is shaped and angled so that the air moves faster over the top of its surface than under the bottom surface.

Fast moving air equals **low air pressure** while **slow** moving air equals **high air pressure**.

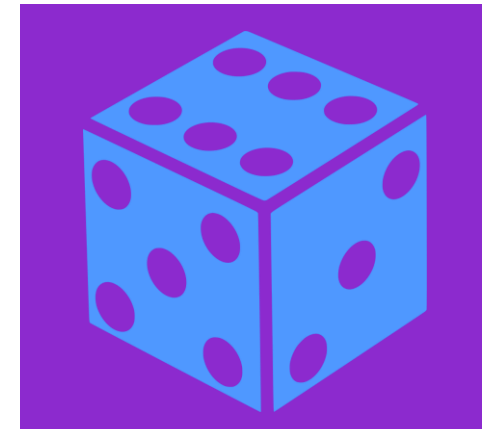
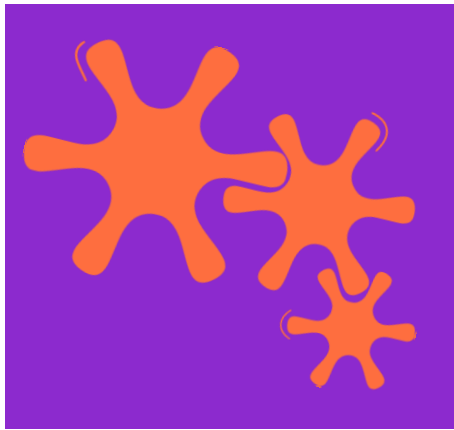
The ball floats in the centre of a stream of air. Still air surrounding the air stream creates a “wall” of high pressure that helps to keep the ball from falling out.

The air hitting it from below cancels the downward force of gravity.

SPIRIT OF INNOVATION

STEAM

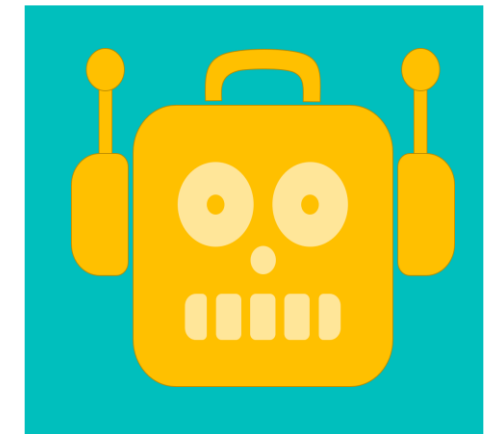
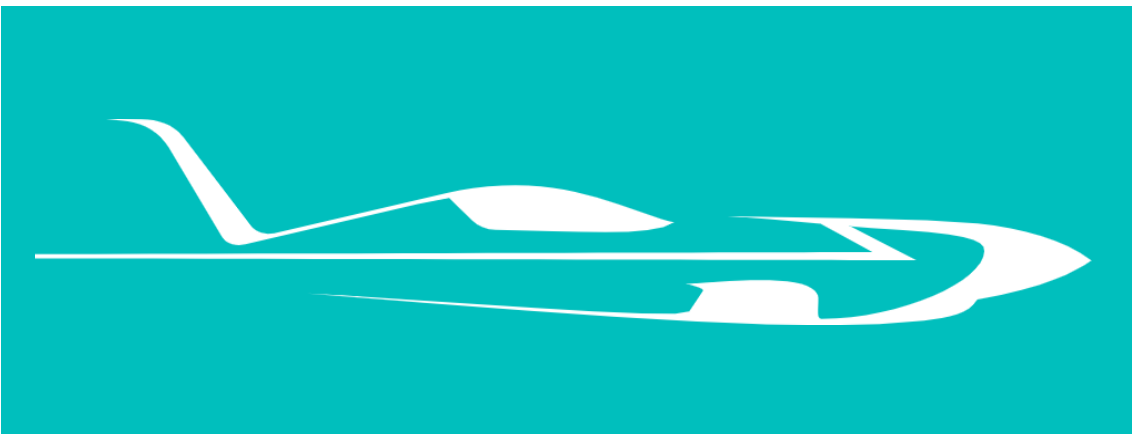
RESOURCES



Spirit of Innovation

Year Three

How to make a Compass

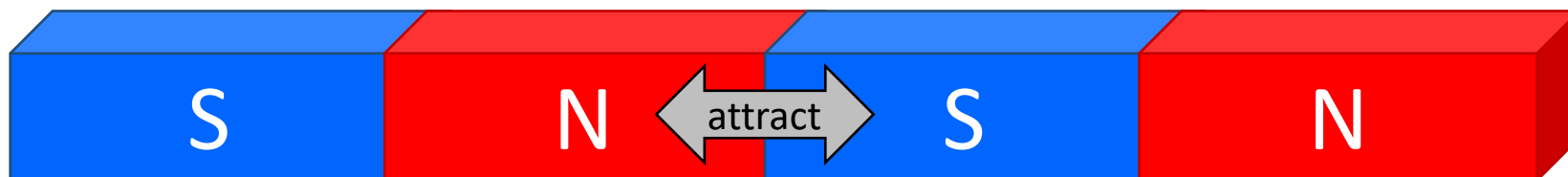
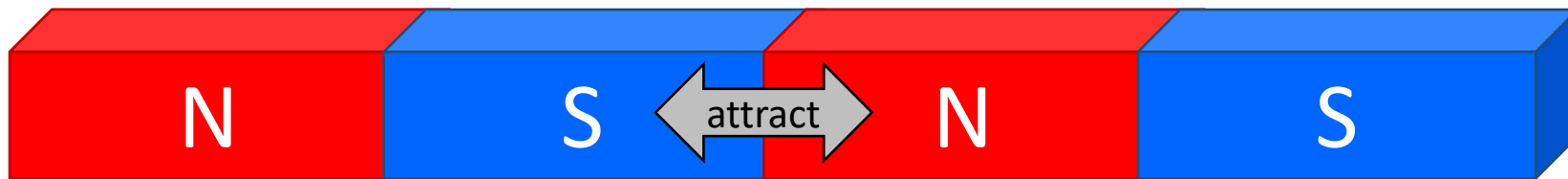
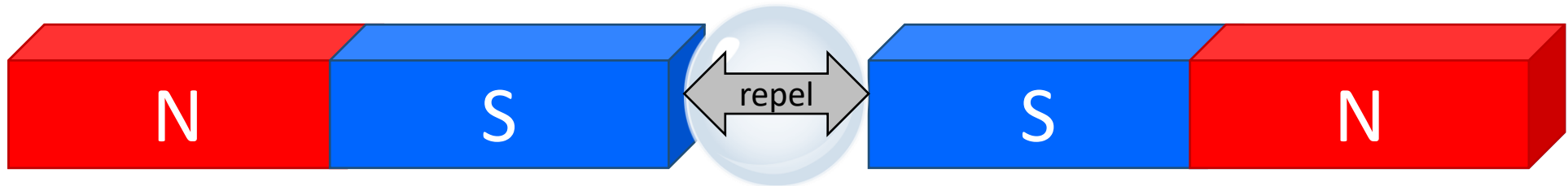
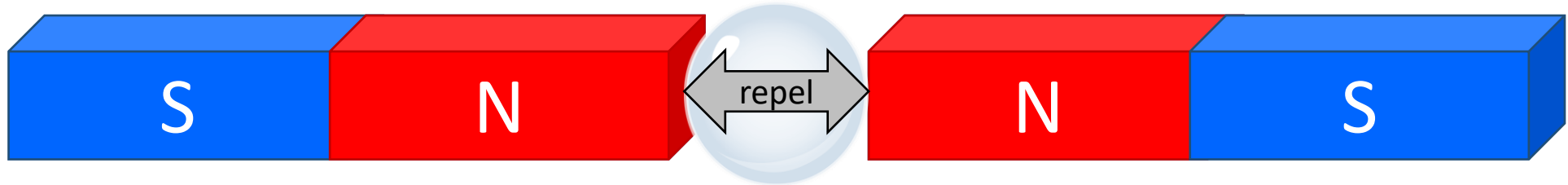


How to Make a Compass



The Law of Magnets Reminder

Like pole **repel** unlike pole **attract**

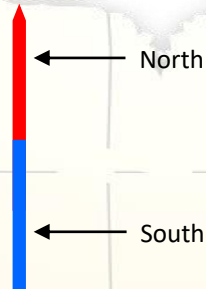


A compass is one of the best tools for navigation

So how does it work?

Earth has an **iron core** that is like a **giant magnet** hidden beneath the surface. This produces a magnetic field that has two poles the **Magnetic South Pole** and the **Magnetic North Pole**.

Inside a compass there is a tiny needle. This needle is in fact a very small magnet. One end of the needle is North and the other is South



The **North** end of the needle is attracted to the **Magnetic South Pole**.

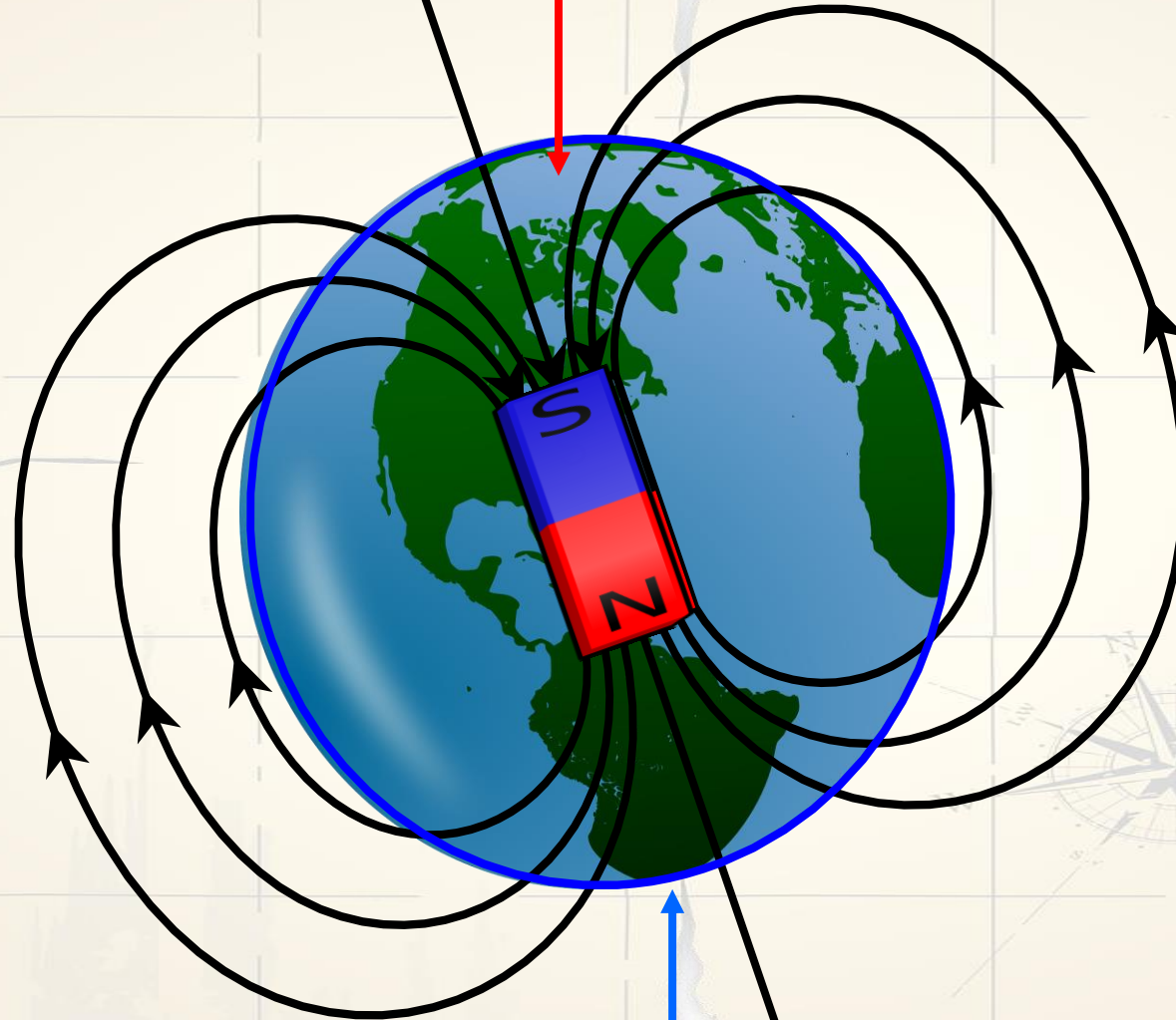
But just to confuse you!

The **Magnetic South Pole** is what we on Earth call the **North Pole**!



South Magnetic Pole

Earth's North Pole



Earth's South Pole

North Magnetic Pole

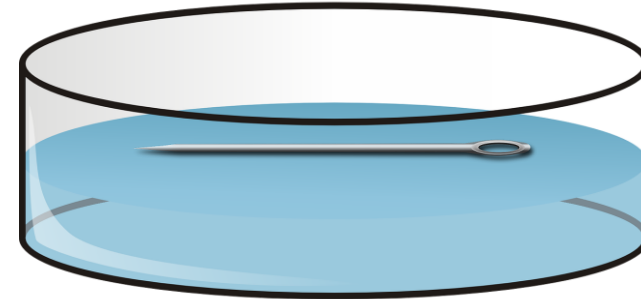
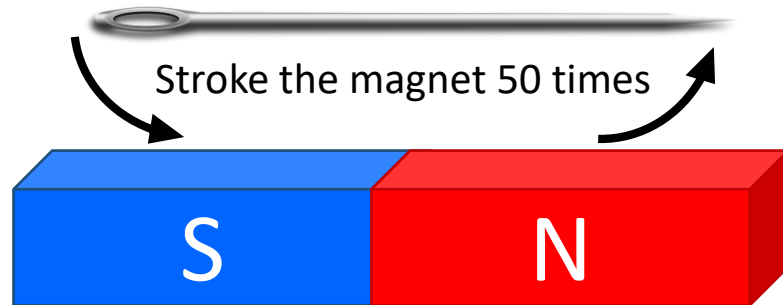
How to Make Your Own Compass

You Will Need:

Bar magnet
Steel needle
Small dish
Water

What to do:

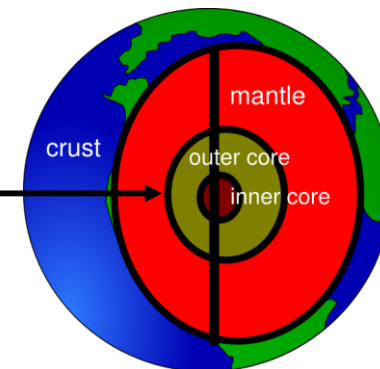
1. Fill a small dish with water.
2. With the needle pointing towards north over the bar magnet, stroke the magnet in this circular motion 50 times .
3. Place the needle carefully on the top of the water – to let it rest on the surface tension



Why does it work?

Because the needle is magnetised, it is attracted to the Earth's magnetic field. This field is also known as the **magnetosphere**, it is created by the churning molten **iron** core in the centre of the Earth.

The Earth acts just like a bar magnet, with the **South** end of this imaginary bar magnet located near **Earth's North Pole**. As opposites attract the needle is always drawn towards the North Pole (Magnetic South.)





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