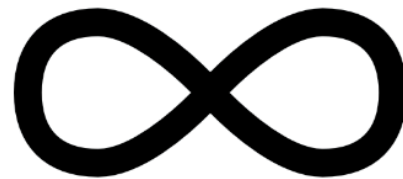
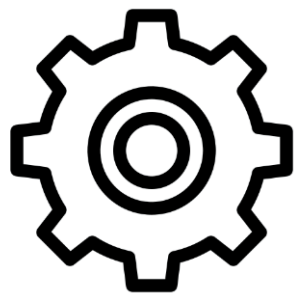
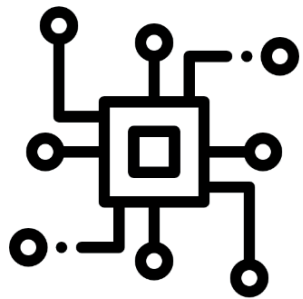
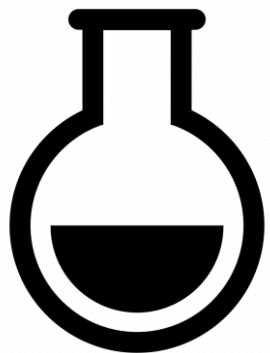
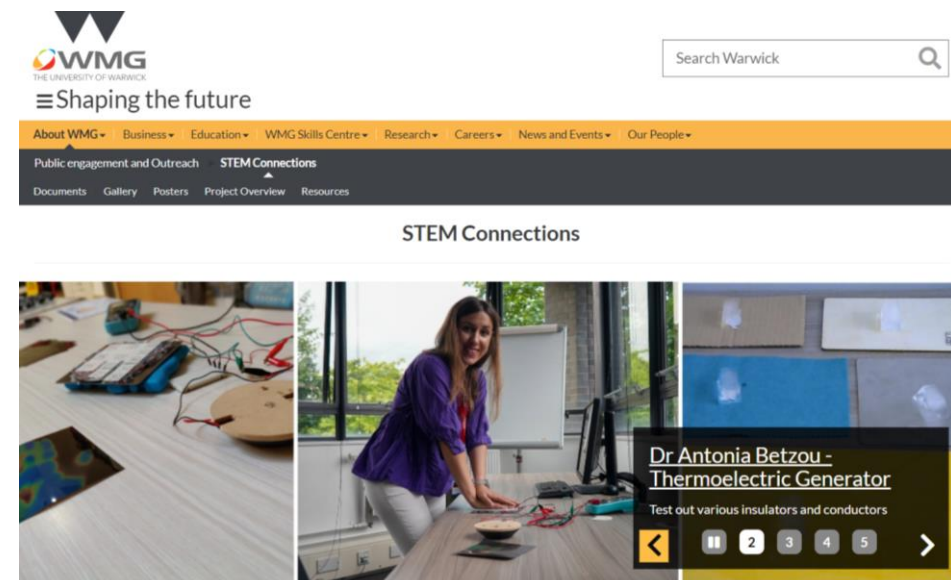


# STEM Connections



# STEM Connections

STEM Connections is a Research England funded project at the University of Warwick that highlights the technology that is being researched at the university, the impacts that research could have on the local population and wider society, and the personal stories of the people involved in that research.



# STEM Connections

Meet the Academic

Dr Karen Kudar

## What would be your dream research project?

It would be to go out there and have time and resources to go and try new ways of being creative with maths. It's a very under-researched topic and I would love to find new ways to get people to love maths..

Find out more:



[www.warwick.ac.uk/stemconnections](http://www.warwick.ac.uk/stemconnections)

  
WARWICK  
THE UNIVERSITY OF WARWICK

## Application of Maths - Dr Karen Kudar



**Meet Karen Kudar**, an Assistant Professor who wants to show people why maths is such an important subject. Karen is an inspiring speaker and makes the subject fun and engaging for students on our Degree Apprenticeship programmes.



PLAY VIDEO

# Application of Maths - Dr Karen Kudar



PLAY VIDEO

## How do aircraft fly?

What is happening to the air.....

**Dr Karen Kudar**

STEM  
Connections

The wings of planes are beautiful things but up in the sky they're too far away to see how they work! Karen has built a model of a wing to show how the air flowing over the peculiar shape - an aerofoil - lifts the whole thing into the air.



# Investigating how to control a paper plane

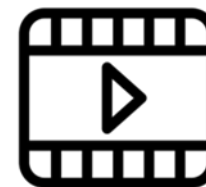
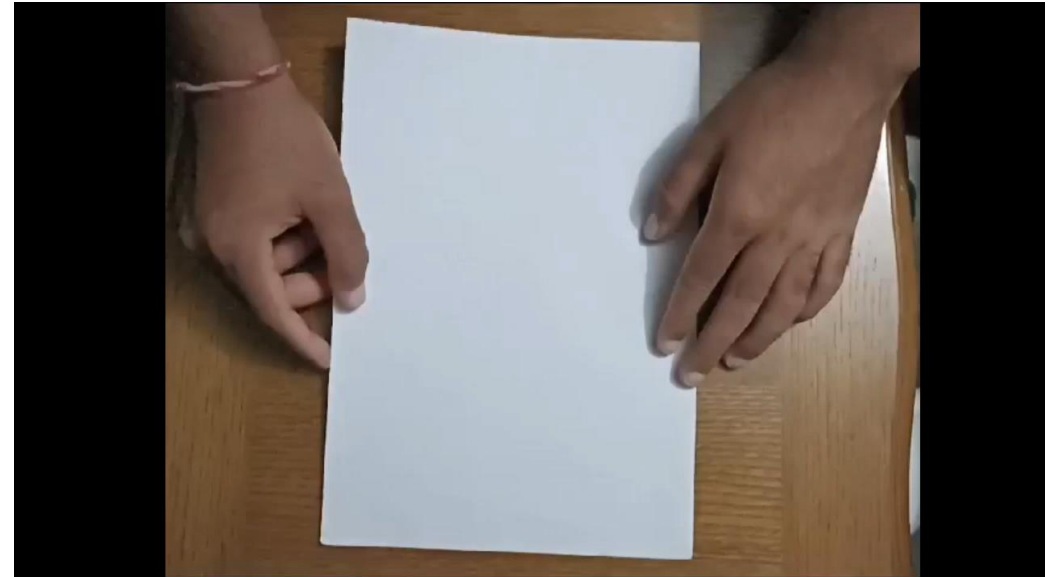
## Materials Required:

- Paper
- Scissors

## Idea:

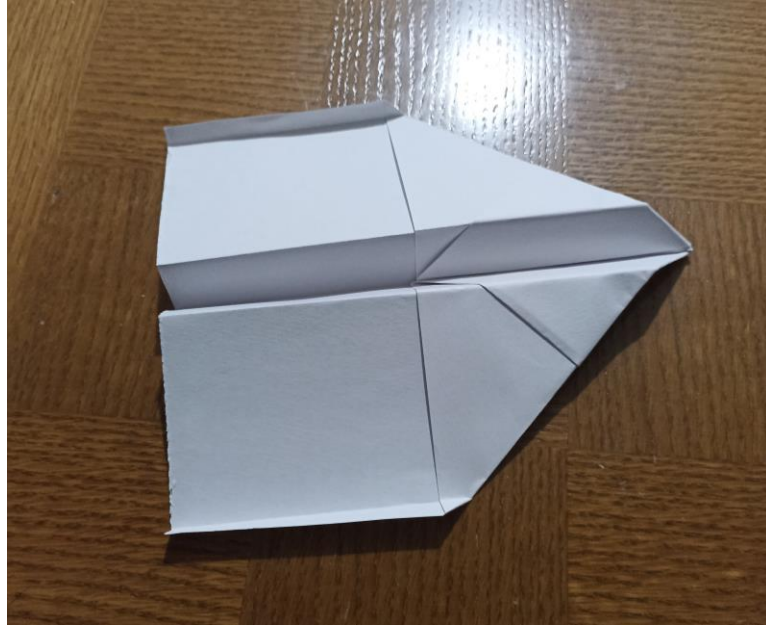
To make a well-balanced paper plane and then try and control the lift acting over it. The lift acting on the plane is dependent on the following:

- **Density of the fluid** which in this case is air and we cannot alter that
- **Coefficient of lift** which relates to the shape that the air is interacting with
- **Area** of the top surface of the paper plane
- **Speed** of air going over the plane

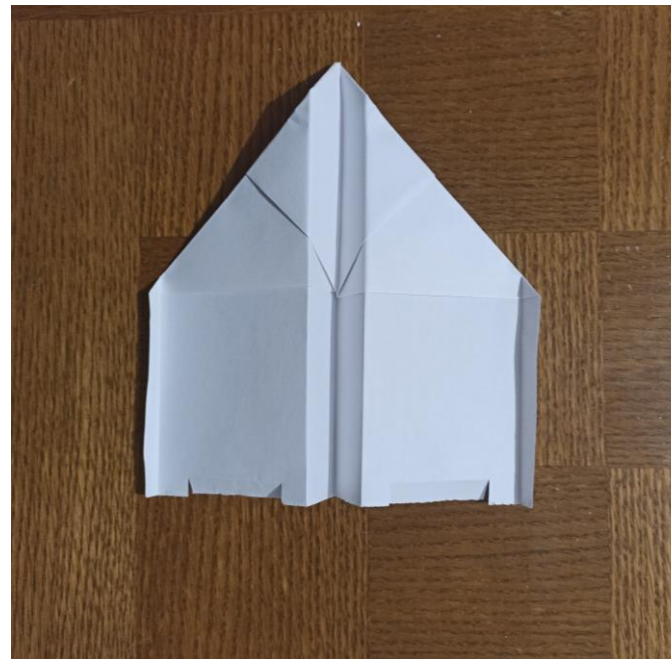


PLAY VIDEO

Use the video to see how the paper plane is made.



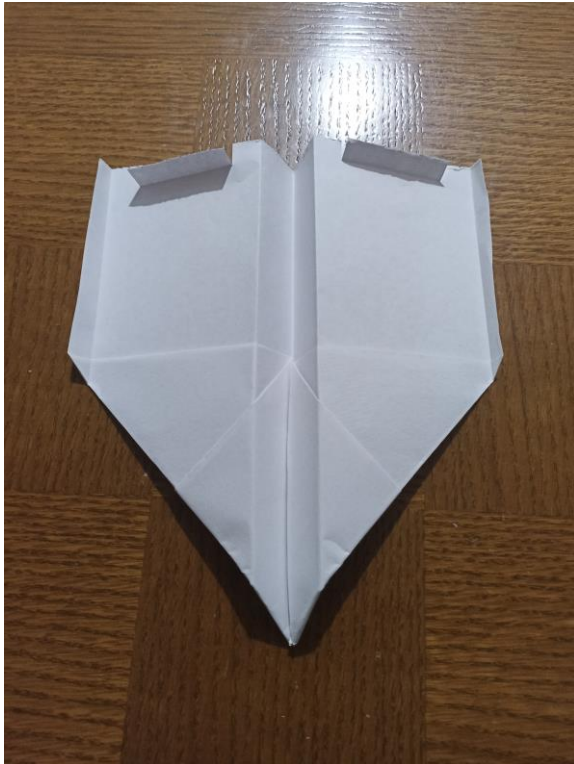
It is a well-balanced plane and can glide through well.  
Try it out!



Make cuts to reveal two flaps as shown in the picture, these would be used to demonstrate how the lift changes through changing the setting of these flaps.

When trying it out, think about the lift equation as described earlier.

- Try throwing it very fast and then very slow. This changes the **speed of air** going over the plane.
- Once the cuts are made, we are changing the **area** on the top surface, as well as the **shape** that the incoming air interacts with.



**Flaps up:** In this case, no matter how you throw it, initially the plane should tend to go upwards. Try throwing it straight down and see how it manages to balance itself.

**Flaps down:** In this case no matter how, you throw the plane it tends to go down. Try throwing it upwards and see if you can make it do half a loop.

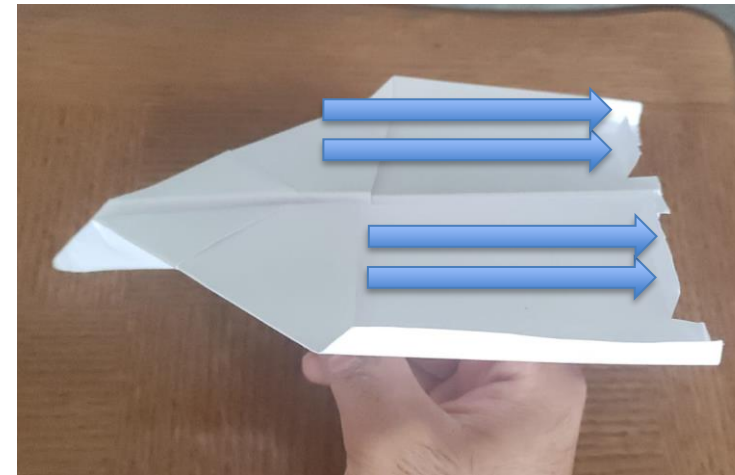


### Think about:

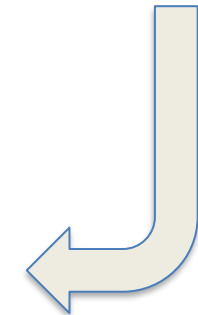
- How the shape and the area of the top surface has changed
- Fluids: Air in this case. How is air hitting the plane? In each case how is it pushing the plane downwards and upwards.
- Clues and hints on the next slide

## What I think is happening

- Imagine when you throw the plane in a fluid ( air ) - there is an interaction where the air is directly hitting the plane from the front.
- When the flaps are up – the air hits these flaps pushing the backside of the plane downwards - the paper plane tilts in air.
- What is the direct effect of backside going down? The front side goes up! The plane as a result tends to go up initially until it loses its speed, glides and then falls.
- Now, it is your turn to think about what happens with the flaps are down.



Air hitting the flaps-up, pushing the backside down





## Extension tasks

- Experiment with the things you can alter in the paper plane for example increasing the area of the cuts made
- Try to do a barrel roll with the paper plane by adjusting the surfaces accordingly
- Ideas for more balanced planes?
- What is special about this plane that is more balanced than an average paper plane? Make a normal paper plane and compare it to this one, try and justify why this one is better

If you have more interest next time you are in a plane look out of the window to see the wing which will have a lot of features like these. Though much more complicated, it is very fascinating to watch especially during take-off and landing! This is definitely something you can look further into and maybe make more advanced paper planes!

SECONDARY: Linking Academics area to careers and industry  
Other useful websites

PRIMARY: Linking to subjects offered in Secondary schools  
Maths, Science (Biology, Chemistry, Physics), Design &  
Technology (Engineering)

Thank you!

STEM Connections

