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DRONES: FRIEND OR FOE?

Teacher guide

This resource aims to give students the opportunity to investigate the science, technology, engineering and mathematics (STEM) involved in making and operating a drone.

INTRODUCTION TO THE RESOURCES

The drone resource box is aimed at KS3 or KS4 students and could be used as a six-session curriculum resource or a drop down activity day.

The resource explores how drones work and how they can be used for civilian, humanitarian and commercial purposes. Each session will be based around a different system in the drone.

Each resource has a copy printed as a brochure with a *notes for teacher's* section in the back (remember to remove any answer pages before copying for students!)

All the resources are also available on our website. The resources can be used however you wish, but some initial explanation and guidance is given in this teacher guide.



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WHAT IS A DRONE?

Explanation:

This resource is designed as an introduction to the uses of drones, aimed at dispelling the myth that they are just weapons or toys. In fact they have wider ranging practical civil, humanitarian and commercial applications.



Curriculum map:

Activity	Topic	National Curriculum
Activity 2	Mathematics	KS4 Geometry and measures: interpret and use bearings.
Activity 3	Science	KS4 Working scientifically: appreciating the power and limitations of science and considering ethical issues which may arise; explaining everyday and technological applications of science; evaluating associated personal, social, economic and environmental implications; and making decisions based on the evaluation of evidence and arguments.

Time:

This resource could be used in a one-hour session, or could take longer if you decide to run different routes for activity two.

Resources included:

- Blindfolds

Resources required:

- A3 paper
- Pens
- Obstacles – chairs, tables, bins

THINKING LIKE A DRONE

Explanation:

This resource is based around line-tracking robots to get students thinking about sensors. It includes several problem-solving activities and discussions.



Curriculum map:

Activity	Topic	National Curriculum
Activity 1	Computing	KS3&4 Develop and apply their analytic, problem solving, design and computational thinking skills.
Stretch and challenge 1	Design and Technology	KS3 Evaluate: test, evaluate and refine their ideas and products against a specification
Activity 2	Mathematics	KS3 Ratio, proportion and rates of change: use scale factors, scale diagrams and maps; use ratio notation KS4 Ratio, proportion and rates of change: compare lengths, areas and volumes using ratio notion and/or scale factors
Stretch and challenge 2	Design and Technology	KS3 Evaluate: test, evaluate and refine their ideas and products against a specification

Time:

The resource is adaptable in terms of the time required, but as a guide you should allow two hours to cover all activities and extension ideas fully.

Resources included:

- Line tracker robot, assembly required
- Tracks for the robot to follow
- Electrical tape

Resources required:

- AA batteries
- Obstacles

THE OPTIMAL PROPELLER

Explanation:

This resource is designed to be a practical way to explore the physics of lift, with stretch and challenge activities to get students working scientifically.



Curriculum map:		
Activity	Topic	National Curriculum
Activity 2	Science	KS3&4 Working scientifically: experimental skills and strategies
Activity 3	Science	KS3&4 Working scientifically: analysis and evaluation
Stretch and challenge activity 1	Science	KS4 Working scientifically: being objective, evaluating data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error.
Stretch and challenge activity 2	Science	KS3&4 Working scientifically: experimental skills and strategies; analysis and evaluation
	Mathematics	KS3 describe simple mathematical relationships between two variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs KS4 use and interpret scatter graphs of bivariate data; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit

Time:

The main activities should take around an hour but the stretch and challenge activities will add time to this.

Resources included:

- 210 mm long plastic straw (4mm diameter)
- Connector
- Corrugated plastic (100 mm x 20 mm x 3 mm)
- Card (100 mm x 20 mm)

Resources required:

- Scissors
- Adhesive tape

SAFE DELIVERY

Explanation:

This resource is based on the idea that drones could be used as delivery vehicles. It looks both theoretically and practically at the engineering involved in creating a safe way to deliver goods and humanitarian aid.



Curriculum map:

Activity	Topic	National Curriculum
Activity 1	Science	<i>KS3 Forces: Non-contact forces</i> <i>KS4 Forces: Forces as vectors</i> <i>KS4 Forces and Motion: acceleration caused by forces</i> <i>KS4 Energy: conservation of energy in a closed system.</i>
Activity 2	Science	<i>KS3 Forces: Non-contact forces</i> <i>KS4 Forces: Forces as vectors</i> <i>KS4 Forces and Motion: acceleration caused by forces</i> <i>KS4 Energy: conservation of energy in a closed system.</i>
	Design and Technology	<i>KS3 Evaluate: test, evaluate and refine their ideas and products against a specification</i>
Stretch and challenge	Science	<i>KS4 Forces: Forces as vectors</i> <i>KS4 Forces and Motion: acceleration caused by forces</i> <i>KS4 Energy: conservation of energy in a closed system.</i> <i>KS4 Solving Problems: model situations mathematically</i>
	Mathematics	<i>Algebra: simplify and manipulate algebraic equations.</i>

Time:

The time required to complete the resource is adaptable but two hours should be allowed if the practical work and all tasks are to be completed.

Resources included:

- Water balloons

Resources required:

- Various materials for making a lander

REMOTE DATA

Explanation:

This resource is based around how space probes send data they have collected back to earth. The activities explore the science and computing involved in collecting, sending and interpreting data from remote locations.



Curriculum map:

Activity	Topic	National Curriculum
Activity 1 and 2	Computing	KS3&4 Understand how numbers can be represented in binary KS3&4 Understand how data of various types can be represented and manipulated digitally, in the form of binary digits
Activity 3	Science	KS3 Light waves
Activity 4	Computing	KS3&4 Understand how numbers can be represented in binary KS3&4 Understand how data of various types can be represented and manipulated digitally, in the form of binary digits
	Science	KS3&4 Wave motion

Time:

This resource could be used in a 45-minute to one-hour session.

Resources included:

- Bitmap grid
- Graphite pencils
- Colour filters

Resources required:

- None

MISSING DRONES

Explanation:

This resource is designed as an introduction to the mathematics involved in GPS location.



Curriculum map:

Activity	Topic	National Curriculum
Activity 1	Mathematics	KS3&4 Geometry and measure
Stretch and challenge	Mathematics	KS3&4 Geometry and measure
	Science	KS3 Describing motion speed and the quantitative relationship between average speed, distance and time (speed = distance ÷ time)
Activity 2	Mathematics	KS3&4 Geometry and measure

Time:

The resource is adaptable in terms of the time required, but as a guide you should allow two hours to cover all activities and extension ideas fully.

Resources included:

- None

Resources required:

- Pair of compasses
- Pencils
- Various materials for making model



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Together we're working to tackle the greatest challenges of our age.

What we do

Talent & diversity

We're growing talent by training, supporting, mentoring and funding the most talented and creative researchers, innovators and leaders from across the engineering profession.

We're developing skills for the future by identifying the challenges of an ever-changing world and developing the skills and approaches we need to build a resilient and diverse engineering profession.

Innovation

We're driving innovation by investing in some of the country's most creative and exciting engineering ideas and businesses.

We're building global partnerships that bring the world's best engineers from industry, entrepreneurship and academia together to collaborate on creative innovations that address the greatest global challenges of our age.

Policy & engagement

We're influencing policy through the National Engineering Policy Centre – providing independent expert support to policymakers on issues of importance.

We're engaging the public by opening their eyes to the wonders of engineering and inspiring young people to become the next generation of engineers.