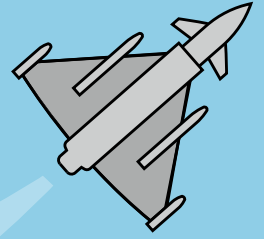
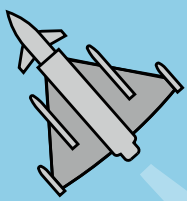


ROAD TO RIAT



# ACTIVITY BOOKLET

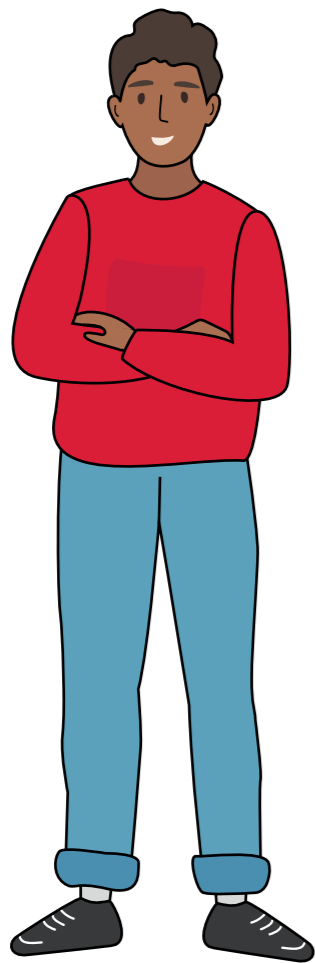


## MEET THE TEAM

To design an aircraft and make it fly requires lots of different people working together. These include designers, manufacturers, engineers and pilots. We've brought together these characters to guide us through the activities in this booklet.



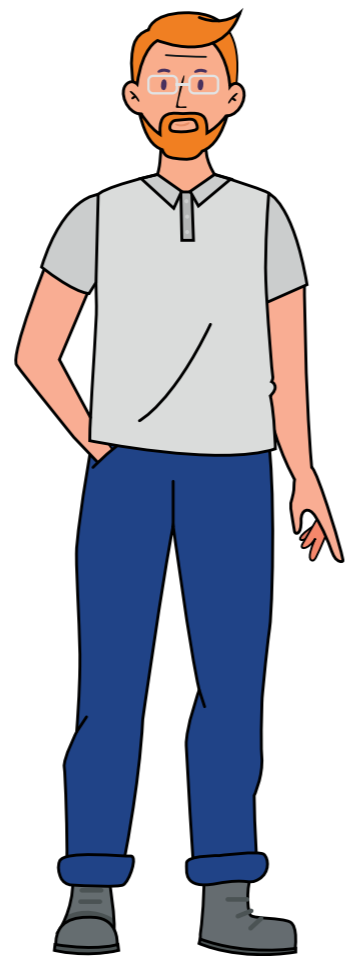
### DYLAN THE DESIGNER



As an Aerospace Engineer, he works on the design, shape and style of the aircraft.



### MICHAEL THE MANUFACTURER



As a manufacturer he works on building the aircraft.

## MEET THE TEAM

They all work together as a team to make the best aircraft they can. Can you work with them throughout this booklet and complete some of the challenges that they face?



### ELLIE THE ENGINEER



As a software developer, she works on the software and communications needed to help make the aircraft fly.

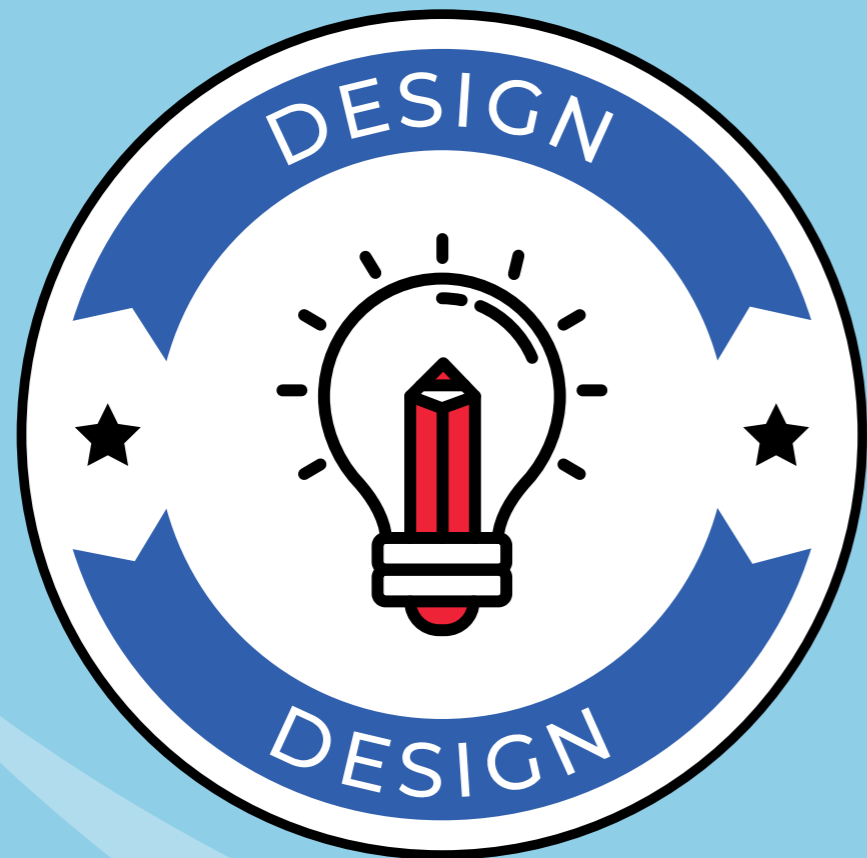


### PENNY THE PILOT

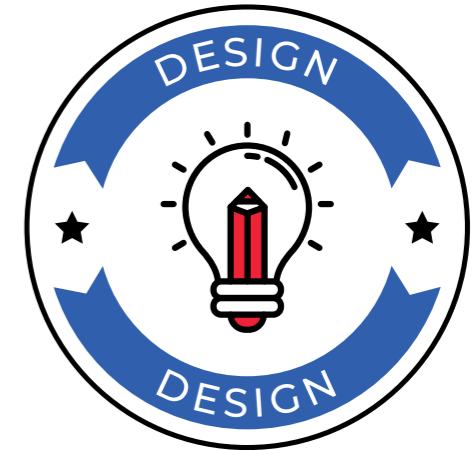
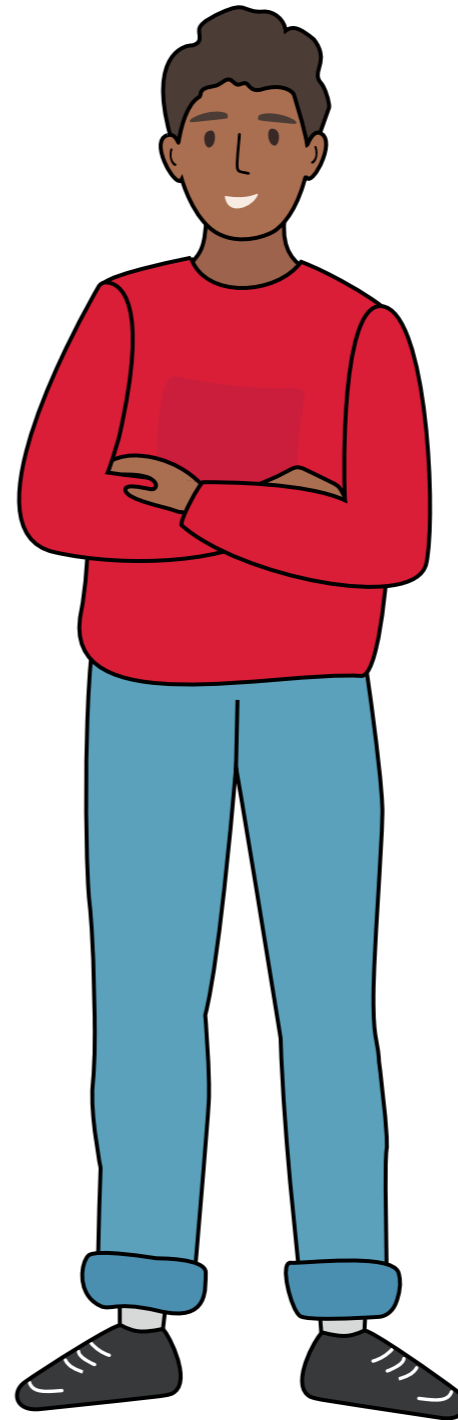


As a pilot she tests the aircraft to see how it flies.

# DESIGN AND TECHNOLOGY OF AIRCRAFT

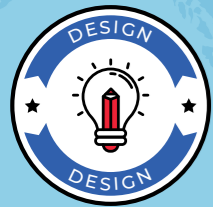


## DYLAN THE DESIGNER



The RAF have been operating in outer space for many years. It uses the latest technology to manage activities on Earth and in outer space and to design equipment capable of operating in space. It works with partners around the world to make space safe, secure, and sustainable for future generations.





# DESIGN YOUR OWN AIRCRAFT

## ACTIVITY

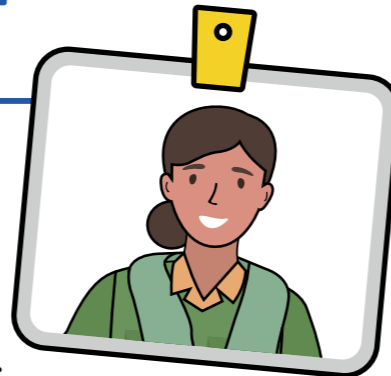
Penny the Pilot is really excited. Thousands of students will be attending the Royal International Air Tattoo (RIAT) this year. It will be a chance to think creatively about air and space.

Can you design a new aircraft for Penny? Use your wildest imagination to make it as exciting and as interesting as you like.

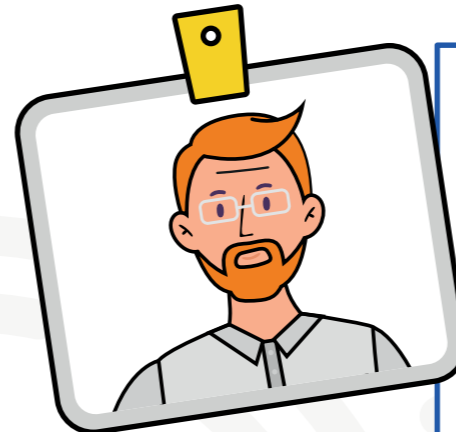
If you are using the interactive version of this workbook you will need to grab a pen or pencil and print out this page to work on this activity.

Add some special cockpit instruments and equipment. Think about the shape of the wings, the tail, and the nose. You could draw an instrument panel perhaps with an airspeed indicator, an altitude (height) meter or a direction display.

You could add labels and write a few sentences to describe what makes your aircraft special. Can you think of ways to make your aircraft environmentally friendly?



# ROCKET DESIGN



Michael the Manufacturer knows a lot about rockets. The largest space rocket to be launched from Britain will contain engineering work by the RAF. A rocket is the most effective vehicle to travel from earth into space.

Look at the shape of the rocket. To be able to launch into space a rocket has to have an aerodynamic design so it can travel through the air very, very fast.

Can you write the labels on the rocket and then draw a line to the correct definition?

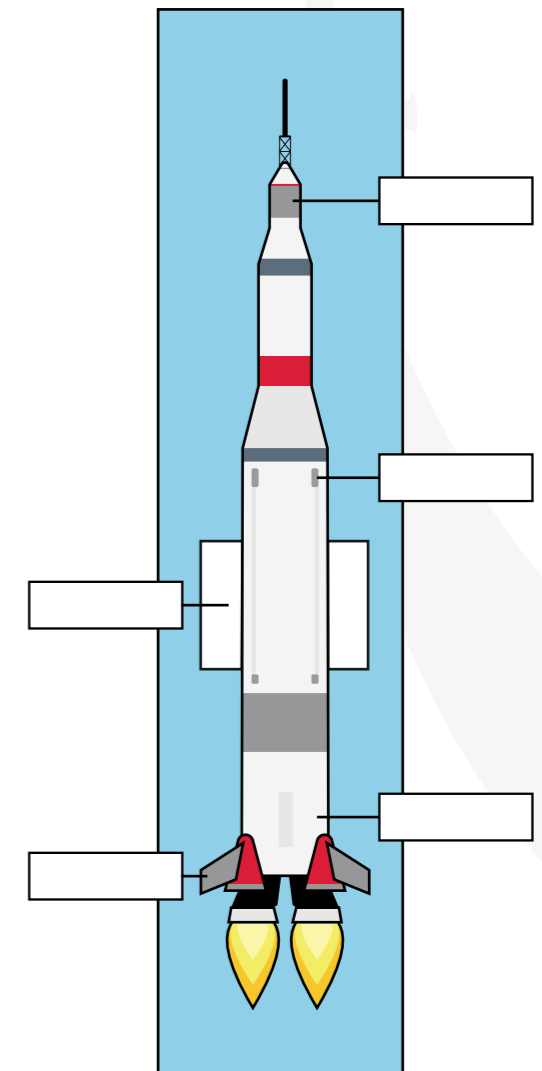
## ACTIVITY

### LABELS:

- Fuel Tank
- Nose Cone
- Body
- Fins
- Engine

### DEFINITIONS:

- The top of the rocket is pointed to reduce the effect of drag through the air
- The bottom part of the rocket that keeps it moving in the right direction
- The outer casing of the rocket that is made of very strong but lightweight materials
- The heart of the rocket that turns power into motion
- A container within the rocket to hold chemicals and oxygen to provide power

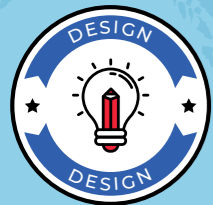


○  
○  
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### DEFINITION - COCKPIT

The place where the pilot sits in an aircraft. This is also called the 'flight-deck' on larger aircraft.





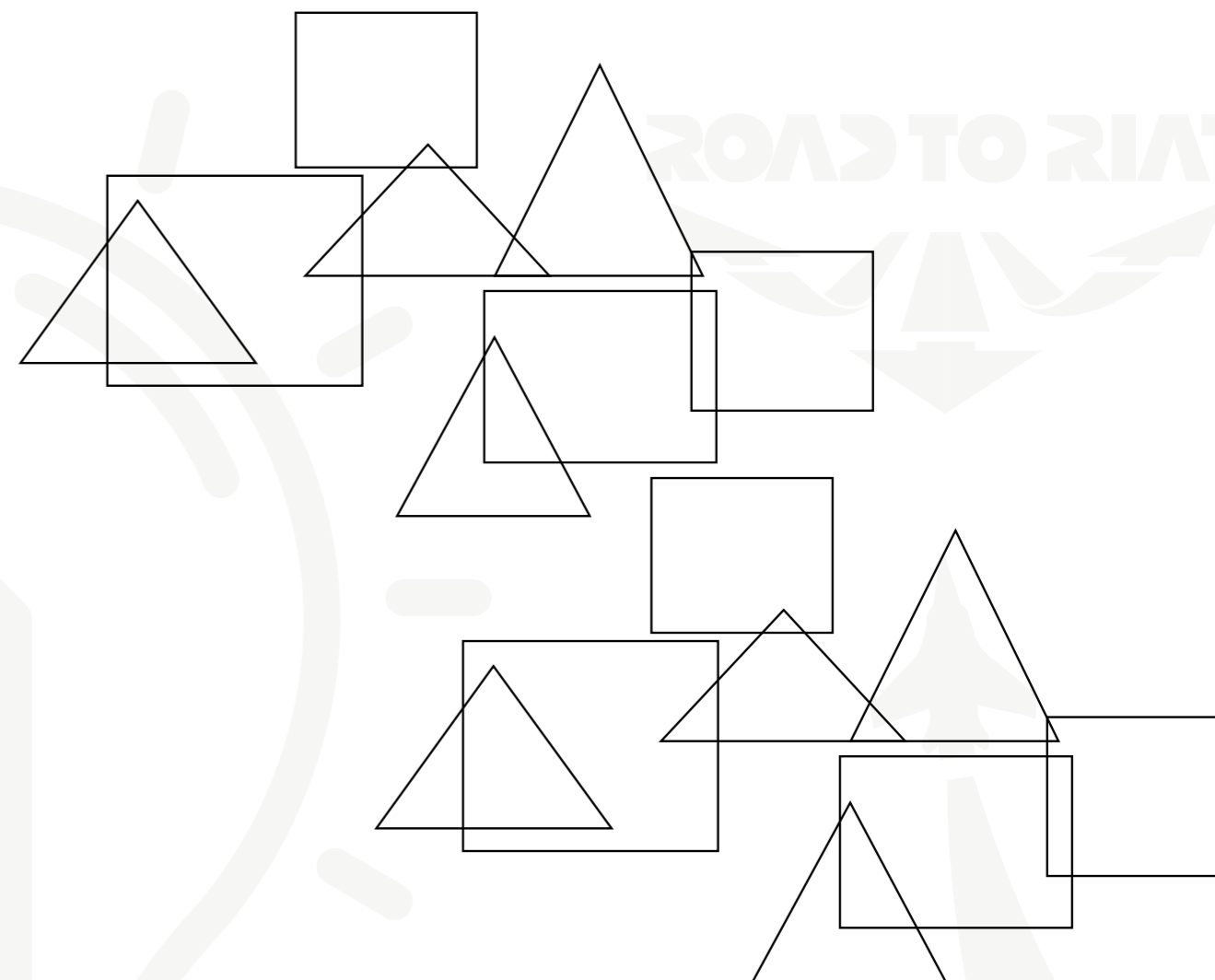
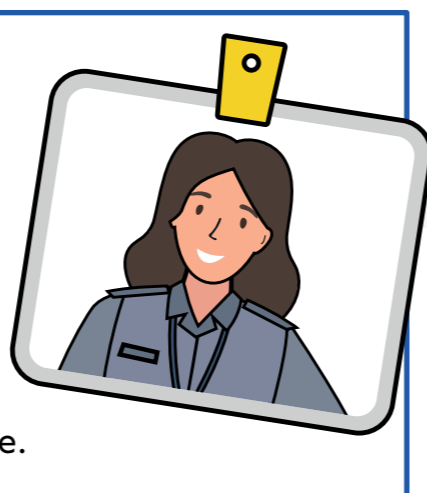
# JUMBLLED GEOMETRY

## ACTIVITY

Ellie the Engineer has created this maths puzzle for you. Maths is one of the key subjects used in design. The picture on the opposite page shows a jumble of triangles and squares. Where they overlap they make even more triangles, squares and rectangles.

Can you count how many of each there are?

To keep track it's a good idea to outline each shape as you find it. It helps to use a different colour for each type of shape.



How many triangles did you find?

How many squares did you find?

How many rectangles did you find?

### DEFINITION - GEOMETRY

Geometry is the part of mathematics that studies the size and shape of things. Squares, circles and triangles are some of the simplest shapes in geometry.



### PRONUNCIATION - GEOMETRY

We say je-om-etry.



### DEFINITION - TRIANGLE

A triangle is a shape formed when three straight lines meet. All triangles have three sides and three corners (angles).



### DEFINITION - SQUARE

A square is a shape with four equal sides and four equal right angles.



### DEFINITION - RECTANGLE

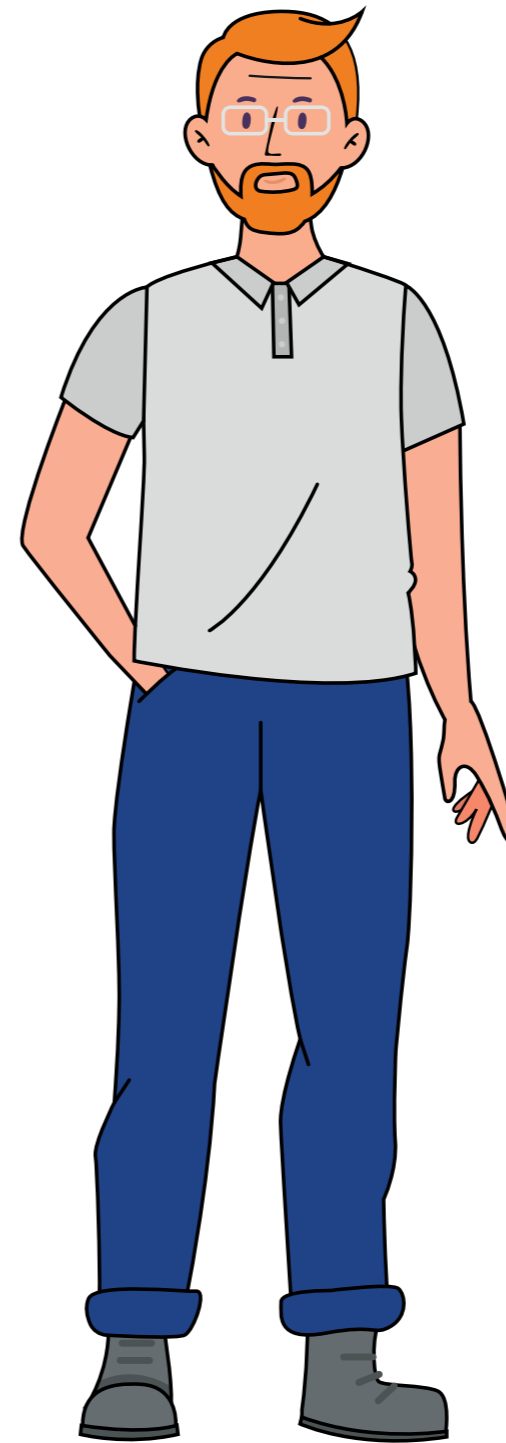
A rectangle is a shape that has 4 sides, 4 corners, and 4 right angles. Opposite sides of a rectangle shape are the same length, with one pair being longer than the other pair.



# MANUFACTURING AND BUILDING



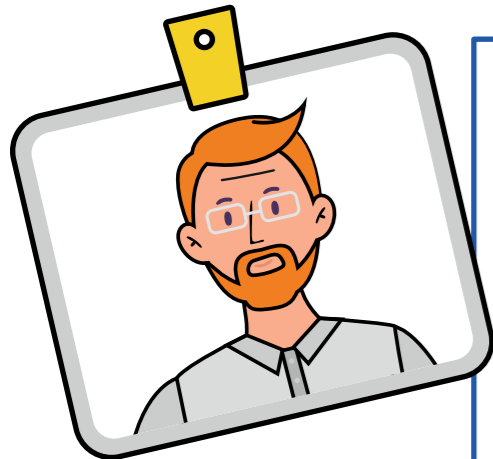
## MICHAEL THE MANUFACTURER



The RAF are working with partners to manufacture and build state of the art aircraft and equipment to protect the UK and other countries. The development and building of defence equipment, security and information technology systems is done by thousands of staff in their offices and factories.



# ROCKET DESIGN



Michael the Manufacturer would like you to help him to do a stocktake to count all the tools in the workshop. A stocktake is a good exercise in any factory to make sure that all the tools are in a good condition and that there is enough of everything.

Can you count the quantity of each tool and write your answers below? You can colour the different boxes in if you like too.

ACTIVITY

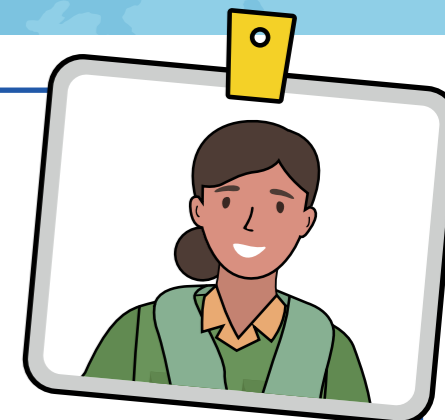
🔨	🔩	🌀	🪚	🔩	🔨	🔨
🔩	🔩	🔧	🔧	🔨	🔧	🔩
🔩	🔧	🔨	🔩	🌀	🔩	🪚
🌀	🪚	🔩	🔧	🔨	🔨	🔩
🔨	🔨	🌀	🪚	🔩	🔩	🔨
🔩	🔨	🔩	🔩	🔨	🔨	🌀
🔨	🔩	🪚	🔧	🌀	🔧	🪚
🔩	🔨	🔩	🔩	🔩	🔩	🔨



TOTAL = + + + + + + + + =



# MAXIMUM WEIGHT



To fly an aircraft safely requires careful planning and a skilled pilot. It is also important to make sure that any cargo it carries doesn't weigh too much.

Penny the Pilot and her team are loading the aircraft ready for take-off but there is a problem. They have put too much cargo on board, so the aircraft is too heavy.

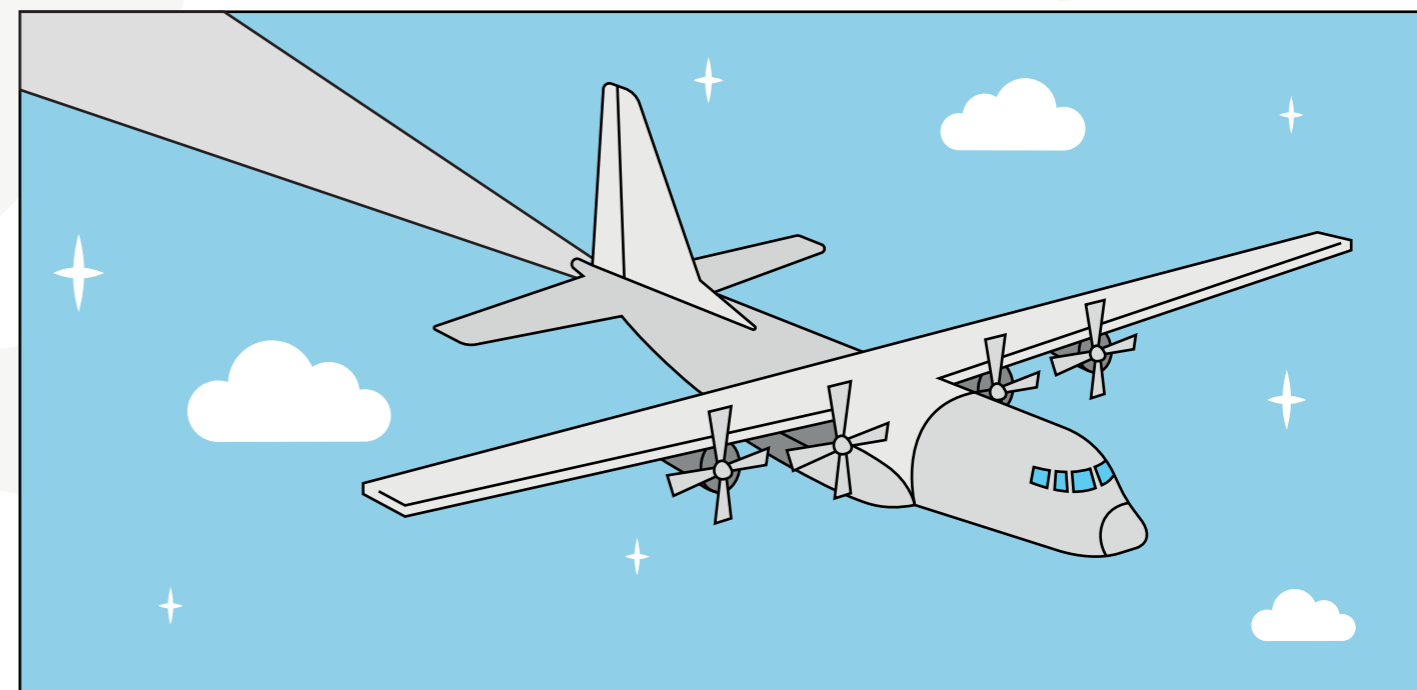
We know that the maximum cargo weight is 6,800 kg for this aircraft.

The current cargo weighs 7,200 kg.

Each crate of cargo weighs 25 kg.

So, how many crates of cargo do they need to remove?

ACTIVITY



Number of crates of cargo to remove:

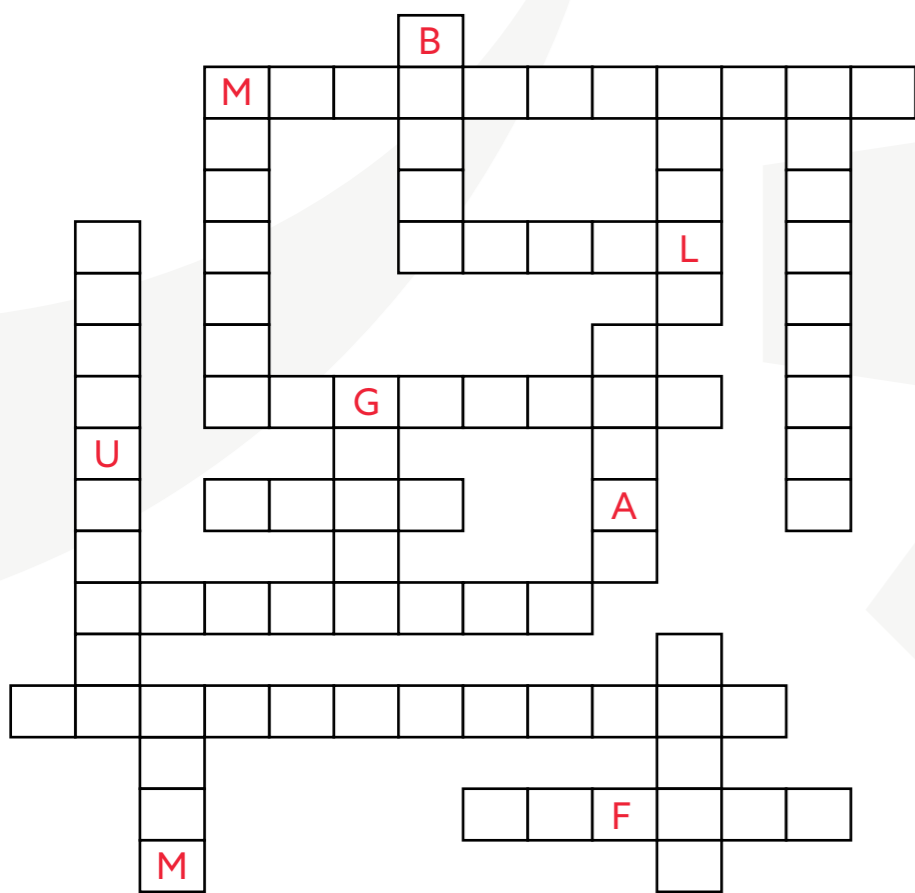
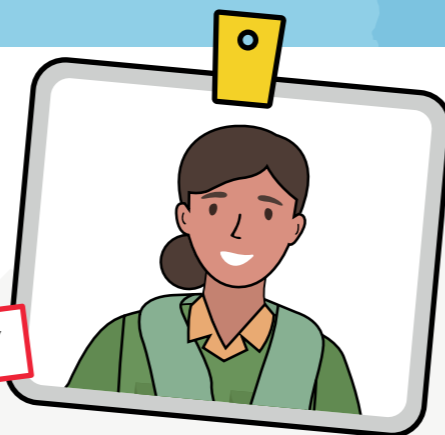




# KRISS KROSS

Penny the Pilot loves doing these puzzles where the words cross over each other. Can you fit these listed words all about manufacturing into the grid? Some letters have been left in to help you.

ACTIVITY



- INDUSTRY
- PRODUCTION
- MANUFACTURE
- INSTALLATION
- RESOURCES
- SAFETY
- MACHINE
- ENGINEER
- METAL
- TOOLS
- POWER
- GLASS
- BUILD
- DRILL
- TEAM
- STEM

### DEFINITION - PRODUCTION

Production is the process of making or growing something in large amounts.



### DEFINITION - INSTALLATION

Installation means putting something in place or position (such as equipment or machines)



# MANUFACTURING

Ellie the Engineer works in a place that has lots of machinery to make equipment for RAF aircraft. She has set you a challenge. See how many of these words you can match to the correct definition by writing the definition letter in each box.

ACTIVITY



TOOLKIT	ELECTRONICS	MACHINE
<input type="text"/>	<input type="text"/>	<input type="text"/>
SWITCH	ENGINEER	FACTORY
<input type="text"/>	<input type="text"/>	<input type="text"/>
ENGINE	ELECTRICITY	ASSEMBLE
<input type="text"/>	<input type="text"/>	<input type="text"/>

### DEFINITIONS:

- (A) The main power used in manufacturing.
- (B) A piece of equipment with lots of parts that uses power to perform a job.
- (C) A person who designs and builds machines.
- (D) A collection of instruments that are used to help with a task.
- (E) Technology that uses circuits to make electricity flow.
- (F) A building where workers use machines to make things.
- (G) Something that changes the flow of an electrical current.
- (H) To build or put parts together to make a complete thing.
- (I) A machine or motor that turns power into movement.



# ENERGY COMBINATIONS



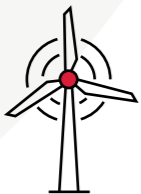
ACTIVITY

There are many sources of energy being used across the world but some are damaging our planet. The RAF design their aircraft to be as efficient as possible.

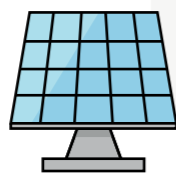
Dylan the Designer has a puzzle for you all about power and energy sources.

How many different combinations of these three types of power can you make? Can you make six different combinations? We've completed the first one for you.

ELECTRICITY



SOLAR



BIOFUEL



EXAMPLE

1	ELECTRICITY	SOLAR	BIOFUEL
2	ELECTRICITY	BIOFUEL	
3			
4			
5			
6			

## DEFINITION - BIOFUEL

Biofuel is any fuel that is derived from plants or animal waste.



**FACT:** Renewable energy is made from resources that nature will replace, like wind, water and sunshine. Renewable energy is also called "clean energy" or "green power" because it doesn't pollute the air or the water.



Dylan has asked you to think about how we can all use renewable energy sources. He would like you to design a building that is powered by renewable energy. Think about the building and how it is powered. Think about outside and what it would look like. Add some notes to describe your design. You can colour it in too.

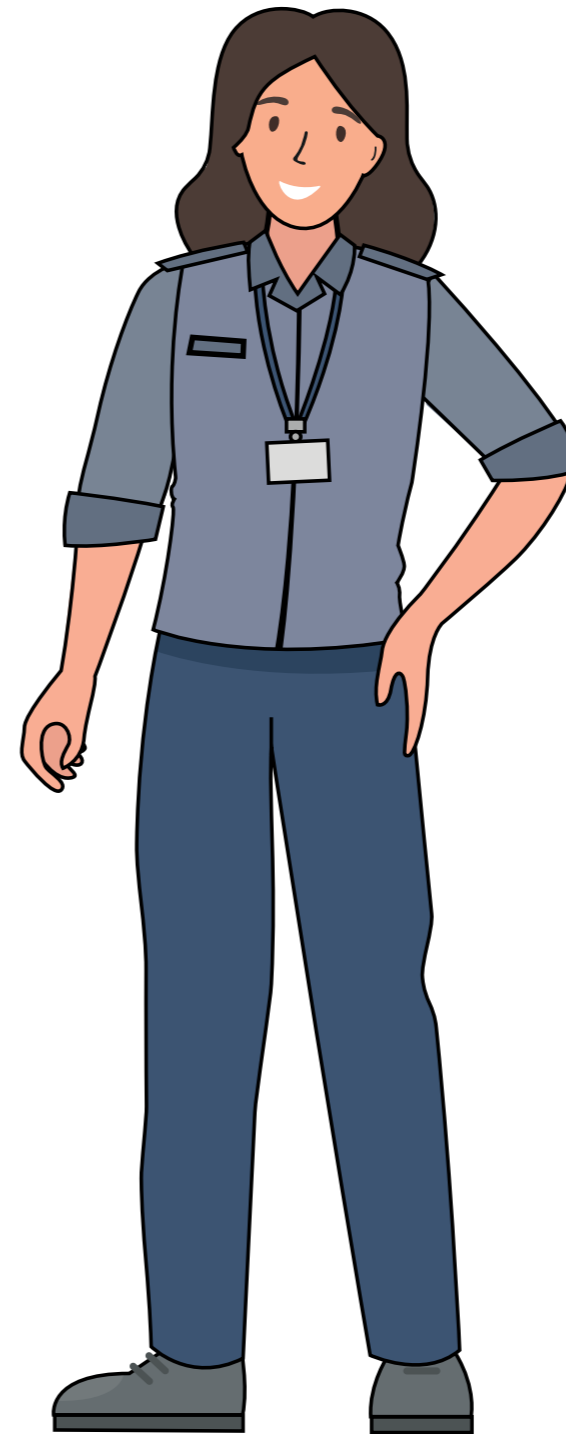
If you are using the interactive version of this workbook you will need to grab a pen or pencil and print out this page to work on this activity.

## MY RENEWABLE ENERGY BUILDING

# SOFTWARE AND COMMUNICATIONS



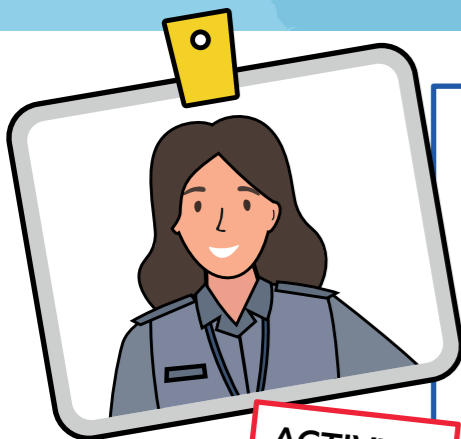
**ELLIE THE ENGINEER**



The RAF has some of the best computer systems and software technology needed for protection and defence. Engineers, like Ellie, are the experts who create these systems and use this technology in their everyday work. This is at the core of the RAF's work both here on Earth and in outer space.



# COMPUTER VIRUS



ACTIVITY

A computer virus is a piece of code that can cause damage to the data on a computer. It was named after germs because it makes computers poorly. Ellie the Engineer knows that everyday millions of viruses are put onto computers everywhere around the world. But there is a lot of software to prevent the viruses causing any damage and the RAF have developed some of the best virus protection and monitoring systems in the world.

Ellie has created a maths puzzle for you. These viruses all have a different value. Can you work out the values of each virus?

HERE IS A CLUE:  = 6

$$\text{Microbe} + \text{Microbe} = 9$$

$$\text{Microbe} + \text{Spider} = 8$$

$$\text{Microbe} + \text{Microbe} = 6$$

$$\text{Microbe} + \text{Spider} = 11$$

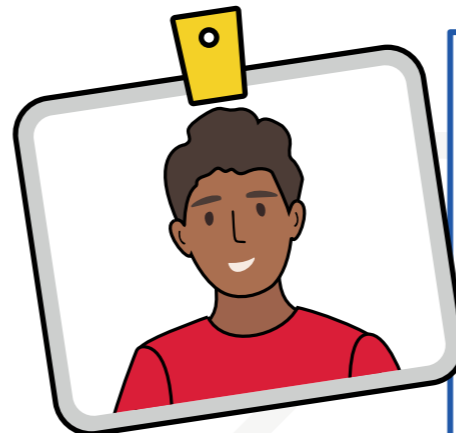
$$\text{Microbe} = \square$$

$$\text{Spider} = \square$$



# SOFTWARE WORDSEARCH

ACTIVITY



Dylan the Designer has decided to do a wordsearch all about the RAF's information technology. Can you help him with this one?

Can you find all these words hidden in the grid? They can be found either across or down the grid. Circle each word as you find it. **If you are using the interactive version of this workbook you will need to grab a pen or pencil and print out this page to work on this activity.**

- ENTER
- CODE
- DATA
- SOFTWARE
- COMPUTER
- PROGRAMME
- DEVELOPER
- DOWNLOAD
- INFORMATION
- PACKAGE
- FOLDER
- FILE

C	U	G	M	W	Q	R	F	N	U	P	I	L	F
D	G	U	V	F	O	L	D	E	R	C	N	H	C
D	G	R	D	W	Q	B	H	C	E	Y	F	G	O
F	C	G	A	W	S	P	A	S	S	W	O	R	D
S	O	F	T	W	A	R	E	B	S	K	R	F	E
D	M	F	A	B	J	O	N	B	D	B	M	T	F
F	P	D	J	D	F	G	T	T	E	E	A	M	J
R	U	E	I	O	T	R	E	W	V	M	T	I	T
E	T	W	T	W	N	A	R	M	E	L	I	P	W
W	E	L	K	N	H	M	A	O	L	P	O	L	X
M	R	F	I	L	E	M	W	L	O	A	N	S	N
U	F	Y	K	O	G	E	S	K	P	W	D	W	Q
H	T	H	P	A	C	K	A	G	E	J	E	G	S
Y	H	N	R	D	S	I	N	Y	R	F	B	R	O

### DEFINITION - SOFTWARE DEVELOPER

A software developer writes software and computer programmes for businesses to use.



### DEFINITION - DATA

Data is information such as facts and numbers used to analyse something or make decisions. Computer data is information in a form that can be processed by a computer.



# CRACKING THE CODES

## ACTIVITY

Secret codes have been created by the military for many years to send secret messages. In some code systems symbols are used in place of letters. Michael the Manufacturer thinks you could work out these words using the codes below.

### CODE SYSTEM:

A	B	C	D	E	F	G	H	I	J
£	±	¥	≠	√	↙	∩	Ⓟ	¤	↑
K	L	M	N	O	P	Q	R	S	T
Δ	≡	◇	!	&	#	†	*	@	}
U	V	W	X	Y	Z				
⌂	§	«	~	¶	©				



### USE THE CODE TO FILL IN THE MISSING WORDS:

@	√	¥	⌂	*	¤	}	¶

*	£	≠	¤	&			
¥	&	◇	#	⌂	}	√	*

### USE THE SPACE BELOW TO WRITE YOUR NAME IN CODE

(If you are using the interactive version of this workbook you will need to grab a pen or pencil and print out this page to work on this activity):

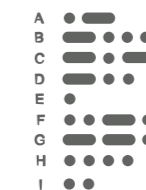
**FACT:** There are other types of code systems developed by the military. These include semaphore and Morse Code.



**Semaphore** is a way of communication using flags held in different positions.



**Morse code** is a way of communicating using dots and dash sound patterns for each letter to spell out words.



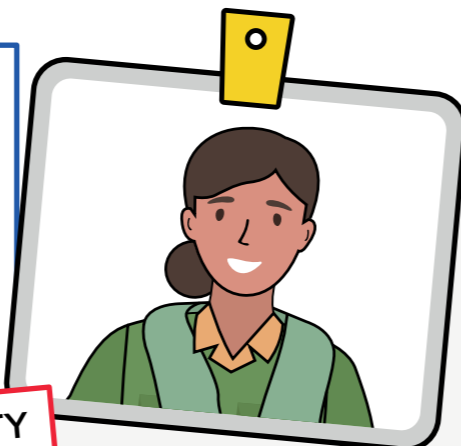


# FILL IN THE GAPS

The RAF use computers and lots of software to manage their work and to protect their information. Penny the Pilot was talking to Ellie the Engineer about her new job. This is what she has told her. But some of the words have disappeared.

Can you read it and put the words below back in their correct places?

ACTIVITY



LOGGED OFF

SPECIAL

RESPONSIBILITY

RISK

JOB

MONTHS

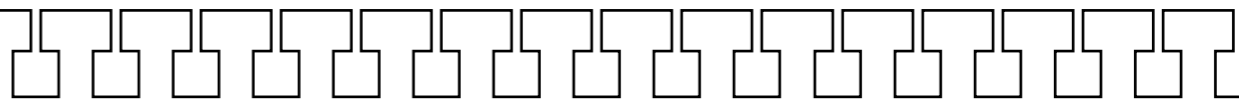
SAFE

COMPUTERS

DEFINITION - AUTHORISED  
Authorised means allowed.



DEFINITION - CONFIDENTIAL  
Confidential means secret.



Being a Computer Systems Officer is a very [ ] job. Ellie has been working for the RAF for six [ ] and is enjoying learning. The RAF have developed strong software programmes to keep everything working and to protect the information stored in the [ ] .

It was her [ ] to make sure that the RAF's information was kept [ ] . Some RAF information is confidential, so she has a private password to access the computers. Only authorised people are permitted to use the computers.

She was proud that the RAF computer systems had the latest software technology needed to protect the computers from [ ] of attack.

Ellie was very good at her [ ] . She enjoyed working with the software and monitoring the activity. She always made sure that the computer was [ ] securely before she left her desk.



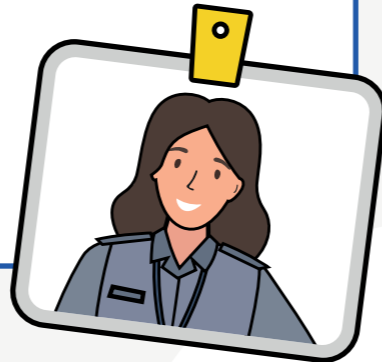
# THE PHONETIC ALPHABET

The Phonetic Alphabet is a code system created by the military over the radio or telephone to ensure communication is understood correctly. Some letters sound very similar. For example, the sounds of the letters M and N. So, this system helps to prevent a misunderstanding. The radio operator would say Mike for the letter M and November for the letter N.

Ellie the Engineer would like you to write a list of the words from the phonetic alphabet that spell out the words below.

Can you write the phonetic code for these words?

ACTIVITY



<b>A</b> ALFA	<b>B</b> BRAVO	<b>C</b> CHARLIE	<b>D</b> DELTA	<b>E</b> ECHO	<b>F</b> FOXTROT	<b>G</b> GOLF	<b>H</b> HOTEL	<b>I</b> INDIA
<b>J</b> JULIETT	<b>K</b> KILO	<b>L</b> LIMA	<b>M</b> MIKE	<b>N</b> NOVEMBER	<b>O</b> OSCAR	<b>P</b> PAPA	<b>Q</b> QUEBEC	<b>R</b> ROMEO
<b>S</b> SIERRA	<b>T</b> TANGO	<b>U</b> UNIFORM	<b>V</b> VICTOR	<b>W</b> WHISKEY	<b>X</b> X-RAY	<b>Y</b> YANKEE	<b>Z</b> ZULU	

WING =

NOSE =

ROCKET =

COCKPIT =

## DEFINITION - PHONETIC

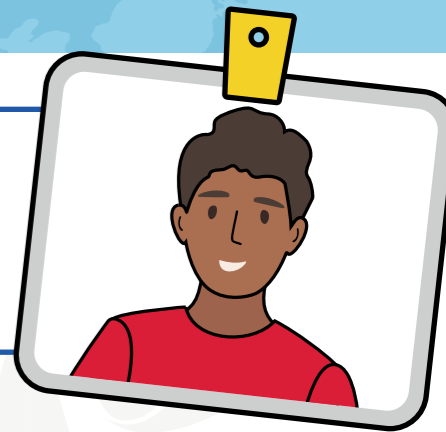
The word phonetic means speech sounds. We say FONETIC.



# WORKING IN PAIRS

Dylan the Designer works with lots of people to do his job. Can you follow the line on each day he works to find out who he is working with on that day? Write the name in the space provided.

ACTIVITY



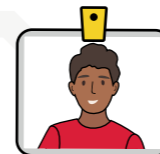
MONDAY



TUESDAY



WEDNESDAY



ELLIE



MICHAEL



PENNY

On Monday Dylan works with

On Tuesday Dylan works with

On Wednesday Dylan works with

# FLIGHT, AERODYNAMICS AND SPACE



## PENNY THE PILOT



The RAF use cutting-edge aerodynamic technology and design features to create their aircraft. Some of the aircraft are capable of speeds fast enough to reach Mach 2 (twice the speed of sound) and even to propel rockets into space.



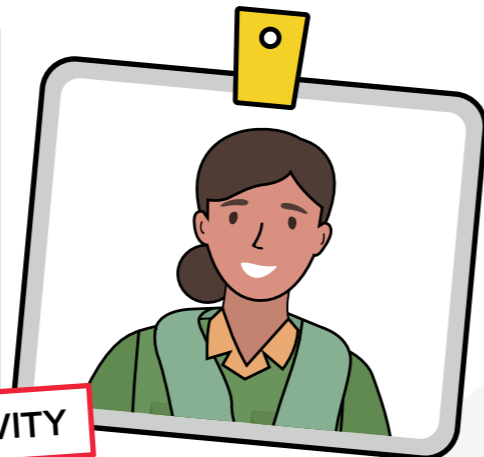


# AERODYNAMICS

Aerodynamics is the way objects move through air. Anything that moves through the air is affected by aerodynamics, from a flying kite to a rocket blasting off. The RAF use the science of aerodynamics in the design and manufacture of their aircraft.

Can you help Penny the Pilot to put these things in order from the slowest to the fastest?

ACTIVITY




-  JET
-  KITE
-  HELICOPTER
-  GLIDER
-  AEROPLANE
-  BIRD
-  BALLOON
-  ROCKET

SLOWEST

FASTEST

## DEFINITION - AERODYNAMICS

AERODYNAMICS is the way objects move through air. 

**FACT:** Being aerodynamic may be more environmentally friendly because less fuel is needed so there is less of an impact on the environment. 



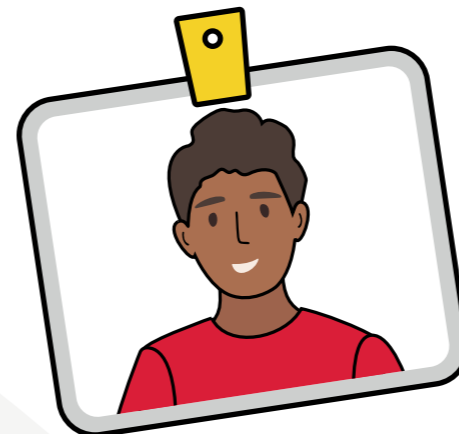
# FASTEST RAF AIRCRAFT

The English Electric Lightning is a British aircraft that served during the 1960s to the 1980s. It is the fastest aircraft to have ever been designed and built in the UK.

Mach 2 is the term used to describe a speed that is twice as fast as the speed of sound. That's fast!

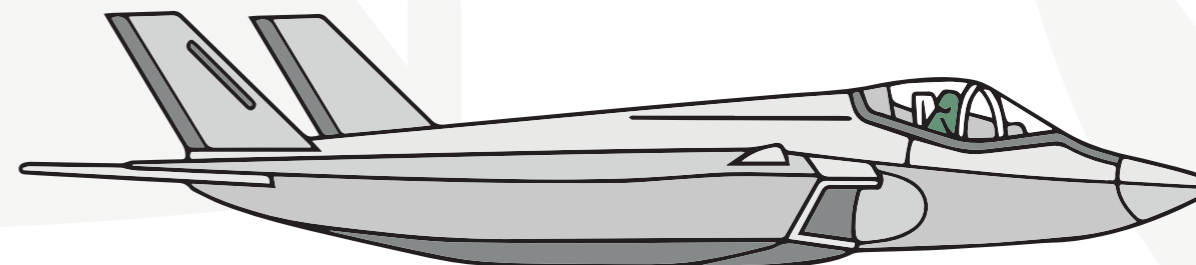
Dylan the Designer knows that the maximum speed we can travel in the UK in a car is 70 mph (miles per hour). To find out how fast Mach 2 is in mph can you work out this sum below?


ACTIVITY



$$50 \times 12 + 300 + 100 + 100 + 150 + 100 + 50 + 70 + 30 + 25 + 6 + 4 = \text{[ ]}$$

Can you now work out how much faster than the F35B (below) this is?



**FACT:** The newest aircraft used by the RAF (the F35B) can fly at Mach 1.6 (that's 1,228 mph). 



# GRID REFERENCE GAME



ACTIVITY








THE RAF work with specialist manufacturers to design their air traffic control rooms and the high-tech communications equipment they have.

Penny the Pilot has just received a message from Air Traffic Control alerting her to an emergency. She has asked you to join her in the RAF's Chinook helicopter as she goes on the rescue mission.

Using the grid reference letters and numbers on this map can you locate each of the people lost on a jungle expedition?

## EXAMPLE

There is a man sheltering under the tree. Can you write the grid reference so the helicopter can locate him? **Answer is C2.** The tree is in row C and in column 2.






	1	2	3	4	5
A	 Mountain				
B					 Rocks
C		 Tree			
D				 Stream	
E		 Hillside			

There is a group of people sitting on the hillside. What is the grid reference?

There is a teacher and her pupils at the bottom of the mountain. What is the grid reference?

There is a man sitting near some rocks. What is the grid reference?

There is a lady with her dog standing near a stream. What is the grid reference?

	1	2	3	4	5
A	 Mountain				
B					 Rocks
C		 Tree			
D				 Stream	
E		 Hillside			



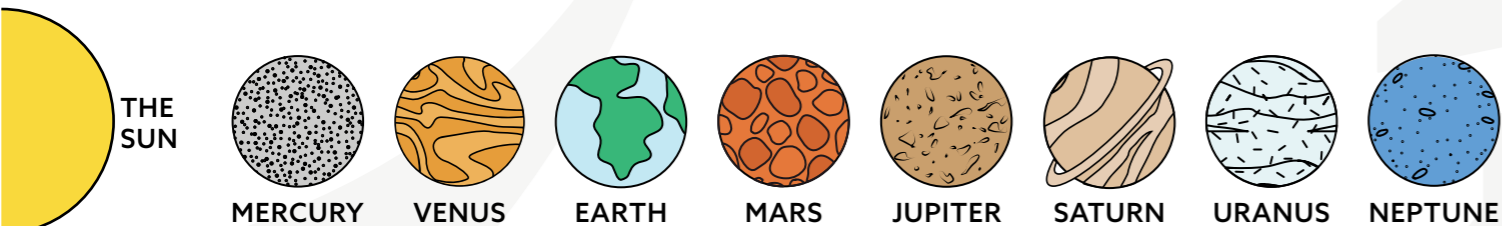
# MEMORY HELPER

## ACTIVITY



The UK has been operating in space since 1969. The RAF's UK Space Command was established in 2021. Its mission is to protect and defend space and keep it sustainable for future generations.

Michael the Manufacturer is fascinated by the subject of space, but sometimes he finds it difficult to remember the names of all the planets and their correct order from the sun.



A good way to remember a list of things is to use a mnemonic. Dylan has made up this mnemonic to remember the order of the planets. You can see that the initial letter of each word in this sentence is the initial letter of the planets in order:

**Most Very Early Martians Just Spoke Utter Nonsense**

Can you use the initial letter of each planet to make up your own mnemonic?

MERCURY	VENUS	EARTH	MARS
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
JUPITER	SATURN	URANUS	NEPTUNE
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

### DEFINITION - MNEMONIC

A MNEMONIC can be a sentence that is used to help you to remember things.



PRONUNCIATION - We say nu-mon-uk.

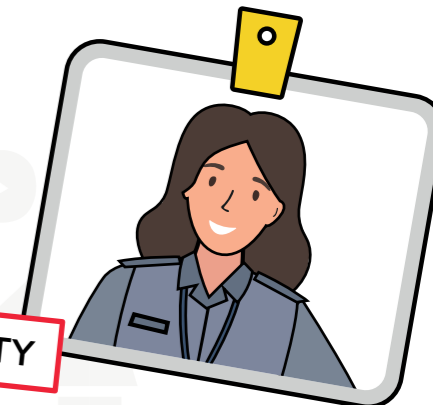


# SMALLER WORDS

The RAF's aerodynamic design of rockets enables them to go beyond Earth's atmosphere and into outer space.

Ellie the Engineer loves word puzzles. She was wondering how many smaller words can you make from this long word.

## ACTIVITY



## AEROSPACE

3 LETTER WORDS:

4 LETTER WORDS:

5 LETTER WORDS:

### DEFINITION - AEROSPACE

AEROSPACE is the area within Earth's atmosphere and beyond into outer space.



# QUIZ



Dylan, Michael, Ellie and Penny want you to show how much you know about the work they do. Can you answer these quiz questions correctly?

1. What does the term Mach 2 mean?

- a. Twice as fast as the speed of light
- b. Twice as fast as the speed of sound
- c. Twice as fast as the speed of air

2. What is meant by Aerospace?

- a. The area within Earth's atmosphere and beyond into outer space
- b. A factory where aircraft are made
- c. A space station in outer space

3. The RAF are on a mission to help tackle climate change and reduce what?

- a. The amount of time spent at their computers
- b. Their carbon emissions
- c. The number of trees planted

4. What does the word ALTITUDE mean?

- a. Height
- b. Weight
- c. Length

5. Which of these words is not in the phonetic alphabet?

- a. Bravo
- b. Oscar
- c. Jet

6. What is the most effective vehicle to travel from earth into space?

- a. Passenger aeroplane
- b. Helicopter
- c. Rocket

7. Which of these is an environmentally friendly power source?

- a. Coal
- b. Solar Energy
- c. Gas

8. What is a computer virus?

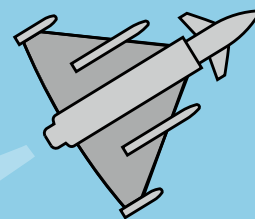
- a. A piece of code that can cause damage to the data on a computer
- b. A germ from a dirty keyboard that makes us poorly
- c. A computer programme that works like a calculator

9. Which of these is the definition of electronics?

- a. The energy used to power things
- b. Technology that uses circuits to make electricity flow
- c. Physical activity

10. Which planet is closest to the sun?

- a. Neptune
- b. Earth
- c. Mercury



# ROAD TO RIAT

