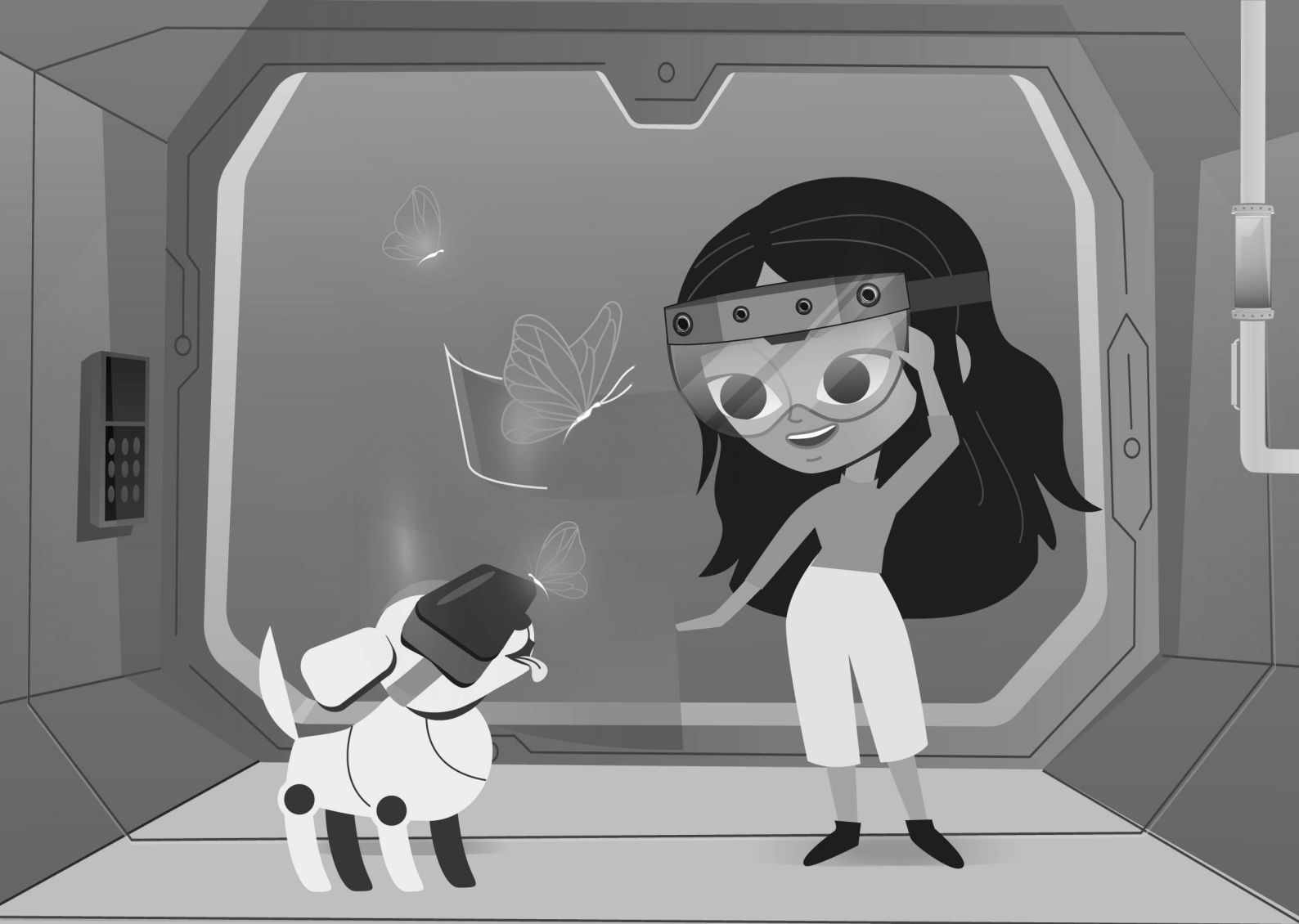


KATIE AND TEX

LET'S EXPLORE
DEVELOPMENTS
IN TECHNOLOGY





AUGMENTED REALITY (AR)

AR adds digital pictures, animation, sounds, and text to the real world so when you look through a camera the added parts look like they are in the 'real' world.

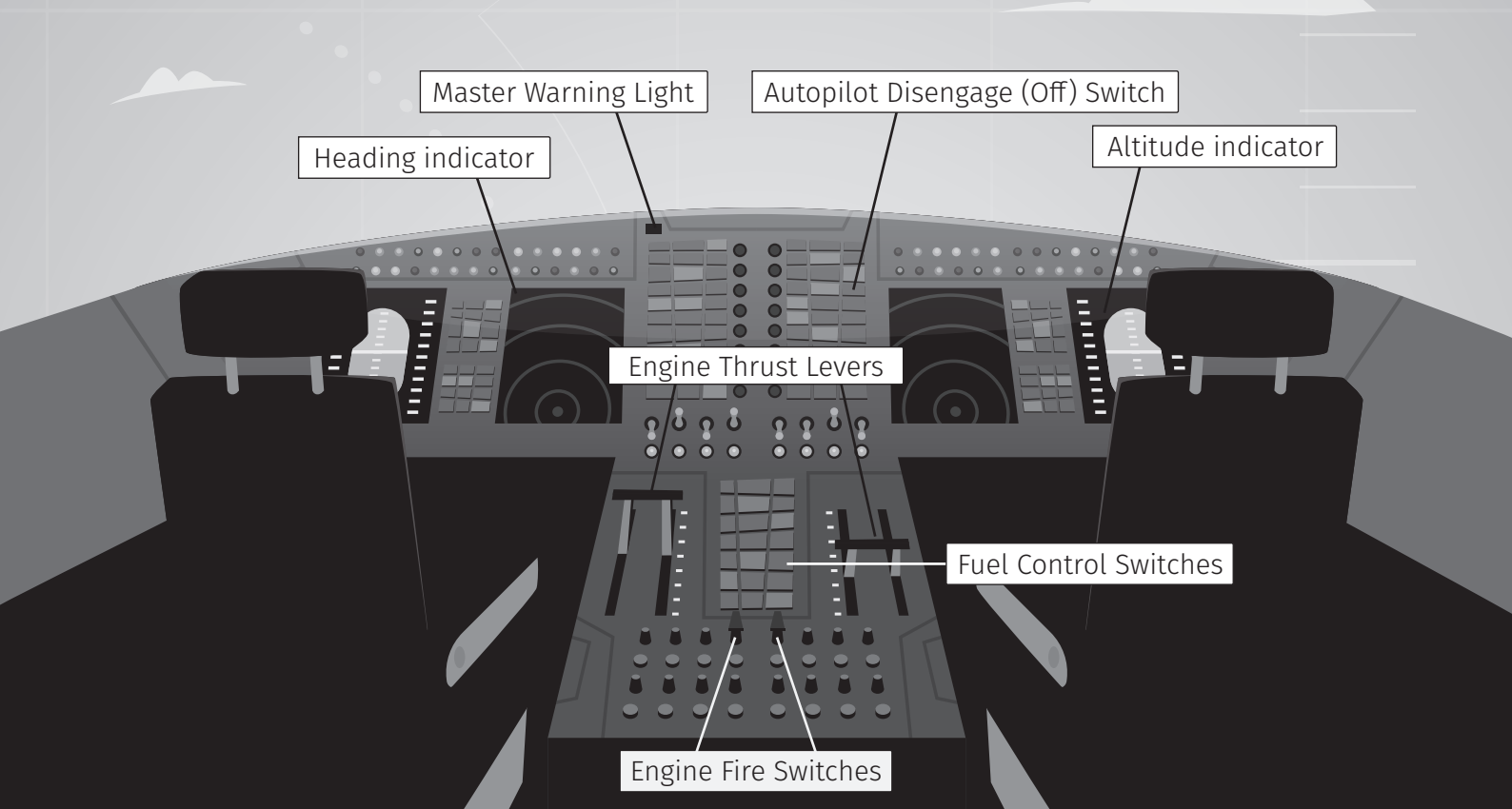
VIRTUAL REALITY (VR)

Virtual reality (VR) is the use of computer technology to create a pretend environment. Instead of the user seeing something on a screen in front of them or in real life, they put on a VR stereoscopic viewer headset and they are immersed in an interactive 3D world.

COCKPIT INSTRUMENT PANEL

The RAF's Team Tempest are doing research and development into creating a cockpit without physical buttons, levers and dials. The future idea is for pilots to be able to wear AR helmets that have the cockpit display projected onto the visor.

Here is a picture of an aircraft cockpit.



Which of these instruments do you think could work easily as AR and be superimposed (projected) onto a pilot's helmet visor? Write down why you think this.

DEFINITION

'Superimposed' means to put on top of something else so you can see the normal view and the 'superimposed' picture.



Scan this QR code to find out more about Team Tempest.

AUGMENTED REALITY WORDSEARCH

Can you help Katie to find these words about augmented reality hidden in the grid?

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

ANIMATIONS

AUGMENTED

GRAPHICS

REALITY

ARTIFICIAL

CAMERA

INFORMATION

VIEW

DEFINITION

The word '*augment*' means '*to add*'.

SPOT THE DOG ENTERS THE WORLD OF VIRTUAL REALITY

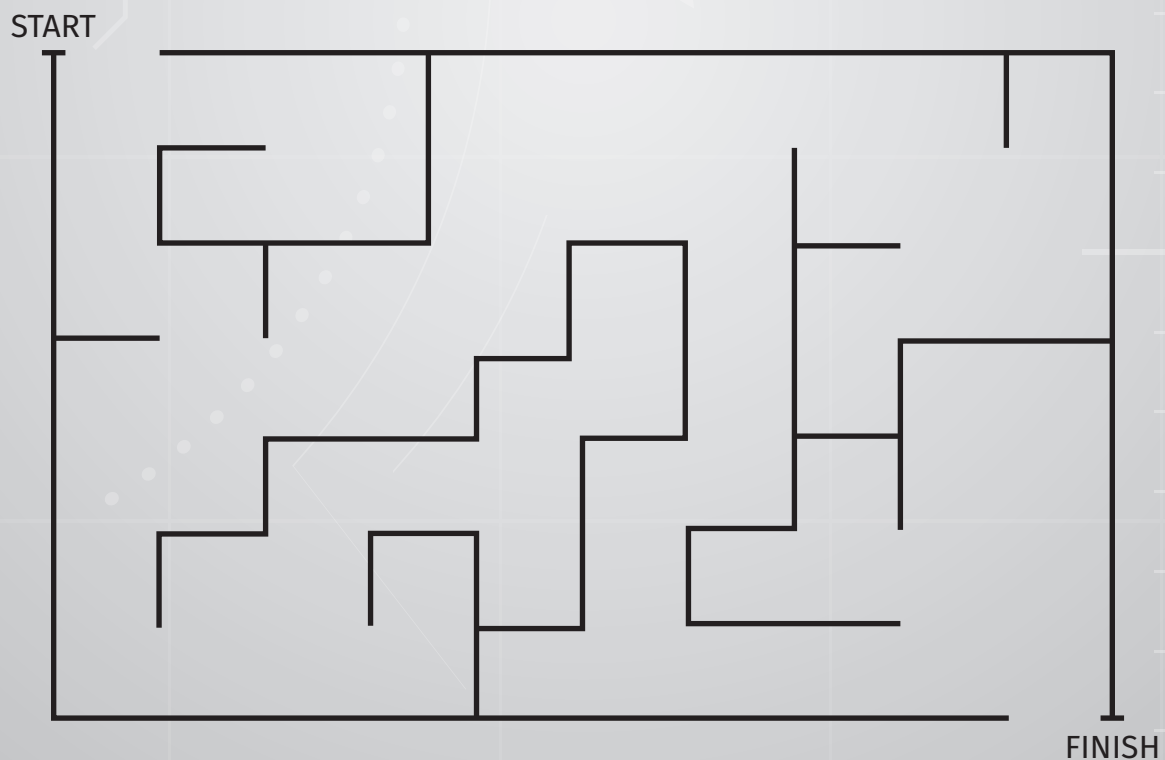
The RAF have developed a robotic dog. His name is Spot. It is a four-legged, mobile robot that can cross rough ground and gather data (information). Spot the dog has put on his VR stereoscopic viewer (headset) and found himself right at the start of a maze. How exciting!

He would like you to help him to find the way from the start to the finish. Be careful though as there are lots of dead ends and we don't want to lose Spot.

But don't worry. The maze is in a virtual world which is a computer-generated environment. So, Spot will be back as soon as he removes his viewer.

FACT

Although VR is mainly limited to sight and sound, there is ongoing work to make VR include touch, taste and smell.



Can you make Spot's maze more interesting by adding pictures or words of things he might have seen or heard on his journey through the maze? A tasty bone near the finish perhaps?

MIXED REALITY

The RAF has a maintenance team who check and repair the aircraft. The team can wear mixed reality headsets to help them when working.

The headset allows them to see a digital version of the actual aircraft they are working on. This digital version is a technical drawing. It allows them to see inside the aircraft without even touching it. And they can also read the digital, technical manuals and work logs that appear in the headset whilst keeping their hands busy working with the tools.

Seeing the real world and the virtual world at the same time makes their job faster, smarter and reduces cost.

Can you use this list below to label the parts of the RAF jet on the next page?

NOSE	COCKPIT	WING
TAIL FIN	FUSELAGE	ENGINE

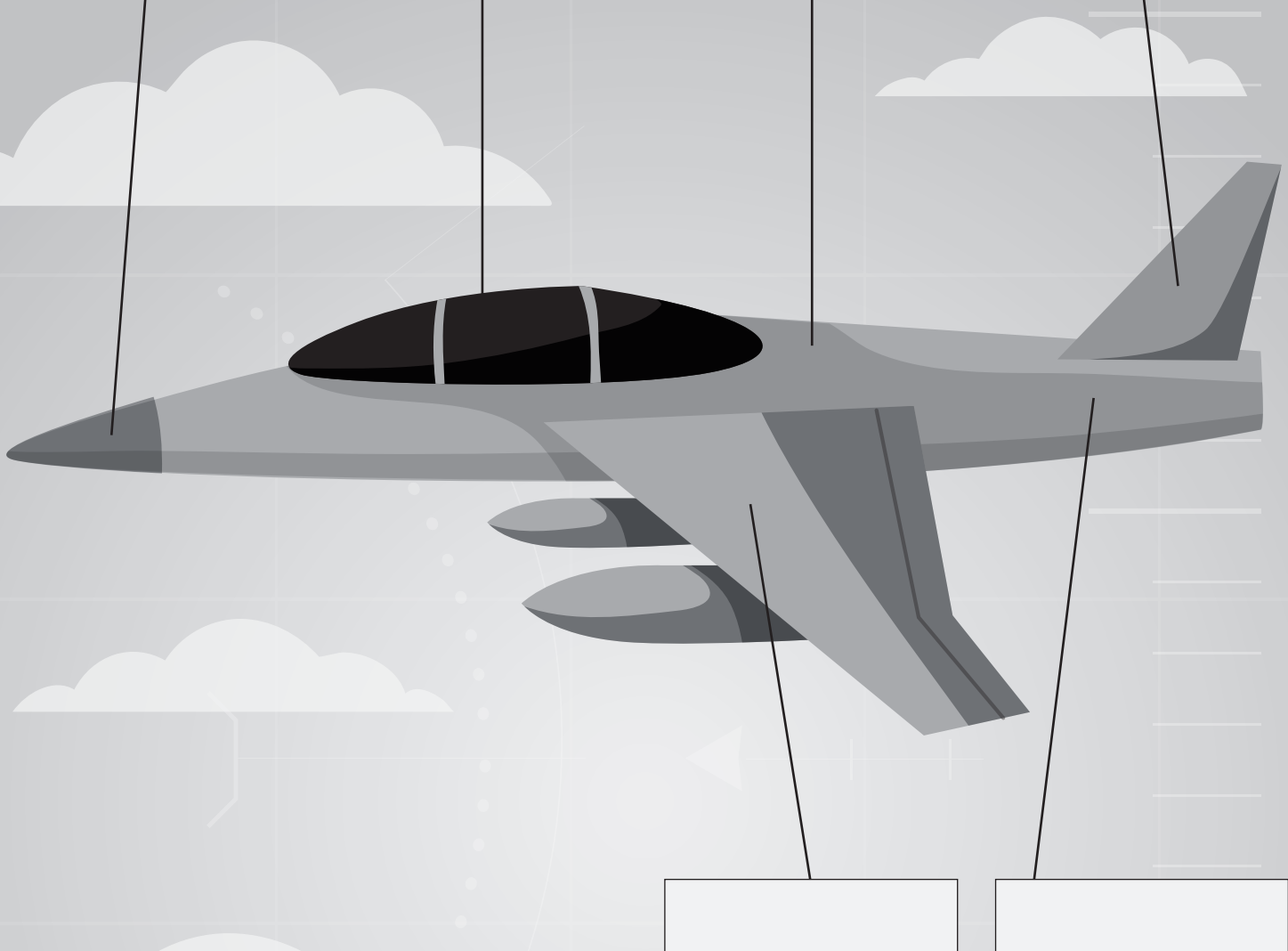
Next, imagine you are working with the maintenance crew and wearing the mixed reality headset. What do you think you might see inside the aircraft?

[]

[]

[]

[]



[]

[]

DEFINITION

'Immersion' means completely covered or completely within something.

VIRTUAL REALITY FLIGHT SIMULATOR

Katie has been invited to have a training session in the RAF Flight Simulator.

DEFINITION

A Flight Simulator is a machine designed to look like the inside of an aircraft with a screen that shows the pilot's view and the aircraft's motion. This 3D simulated experience is used for training pilots to fly and is also used for stealth missions. The pilots are fully immersed into their surroundings.



Can you read the control panel on the following page and answer the following questions:

A. What direction is the aircraft flying?

B. What is the air speed Katie is travelling?

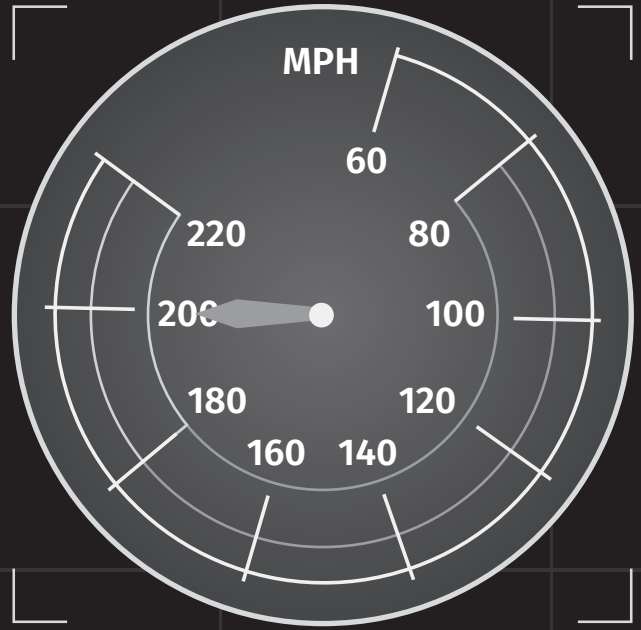
C. How many feet high is the altitude (height) meter showing?

D. What volume of fuel does Katie have left?

A



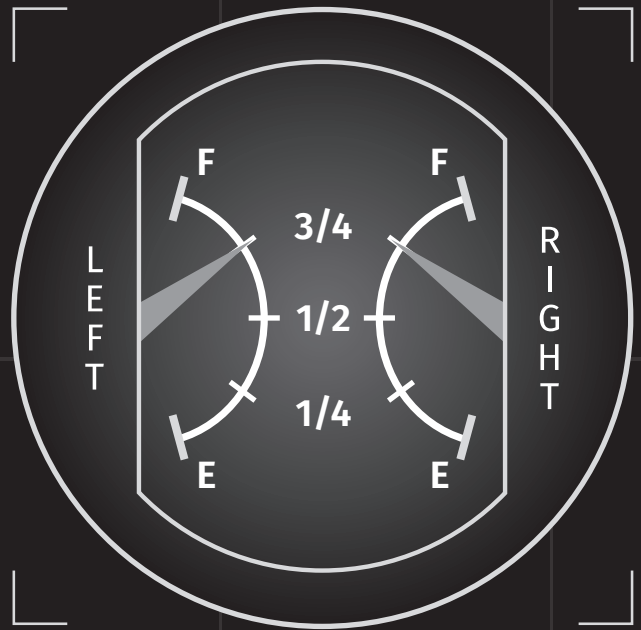
B



C



D



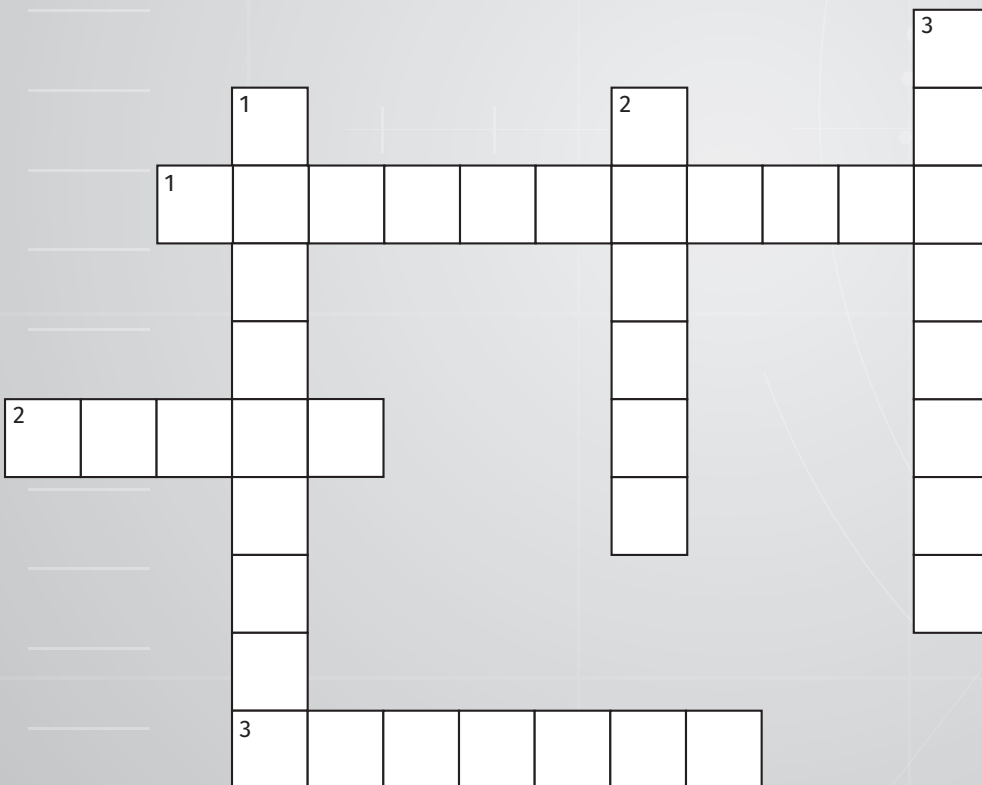
VIRTUAL REALITY CROSSWORD

Some of the words and phrases that Katie came across when she first started learning about VR were very new and exciting.

She has put together this crossword for Tex to complete. You could have a go at it too.

Each clue has only half of the two-word phrase. Here is an example: Hot -. The answer is Hot Dog.

Can you work out the missing word and put it in the crossword grid? See how many of the answers you can get.



ACROSS

1. THREE -
2. HIDDEN -
3. VIRTUAL -

DOWN

1. FLIGHT -
2. STEREOSCOPIC -
3. OPTICAL -

DEFINITION

An **optical illusion** is a trick on the brain to make it think it is seeing something.

SMALLER WORDS

The RAF uses advanced VR for everything from pilot training to simulated stealth missions.

Katie has been reading about the exercises that the RAF do using VR, and Katie just loves word puzzles.

She was wondering how many smaller words you make from the letters within VIRTUAL REALITY.

VIRTUAL REALITY

3 LETTERS

4 LETTERS

5 LETTERS

6 LETTERS

FACT

Virtual reality uses 2-D technology and using a stereoscopic viewer creates the optical illusion of 3-D images.



VIRTUAL REALITY ANAGRAMS

An anagram is a word where the letters are rearranged.

Tex has made an anagram puzzle for you. Can you unjumble these letters to find the words all about virtual reality?

A S M U L R O T I A

CLUE: A machine that gives a virtual but realistic experience.

B L U S L O I I N

CLUE: Something that appears in a way that is not real.

C M M S O I R N E I

CLUE: Deep involvement in something.

D W V E E I R

CLUE: A headset that joins still pictures together to make moving images.

A.

C.

B.

D.

AR, VR, OOH-AH. . .WHAT?

So, what are the differences between AR and VR?

Although they may have many similarities, AR and VR are different types of technology.

Have a look at this list of descriptions below.

Can you help Tex to spot which ones are describing AR and which ones relate to VR?

AR or VR?

Uses real-world setting.

The actual surroundings are hidden from the user.

Users have visibility of their real surroundings.

Digital data is added to the live surroundings.

Completely virtual.

Both the real world and the virtual world are combined.

This is controlled by the machine.

This requires a headset called a stereoscopic viewer.

Can be used with a smartphone.

Completely immersed.

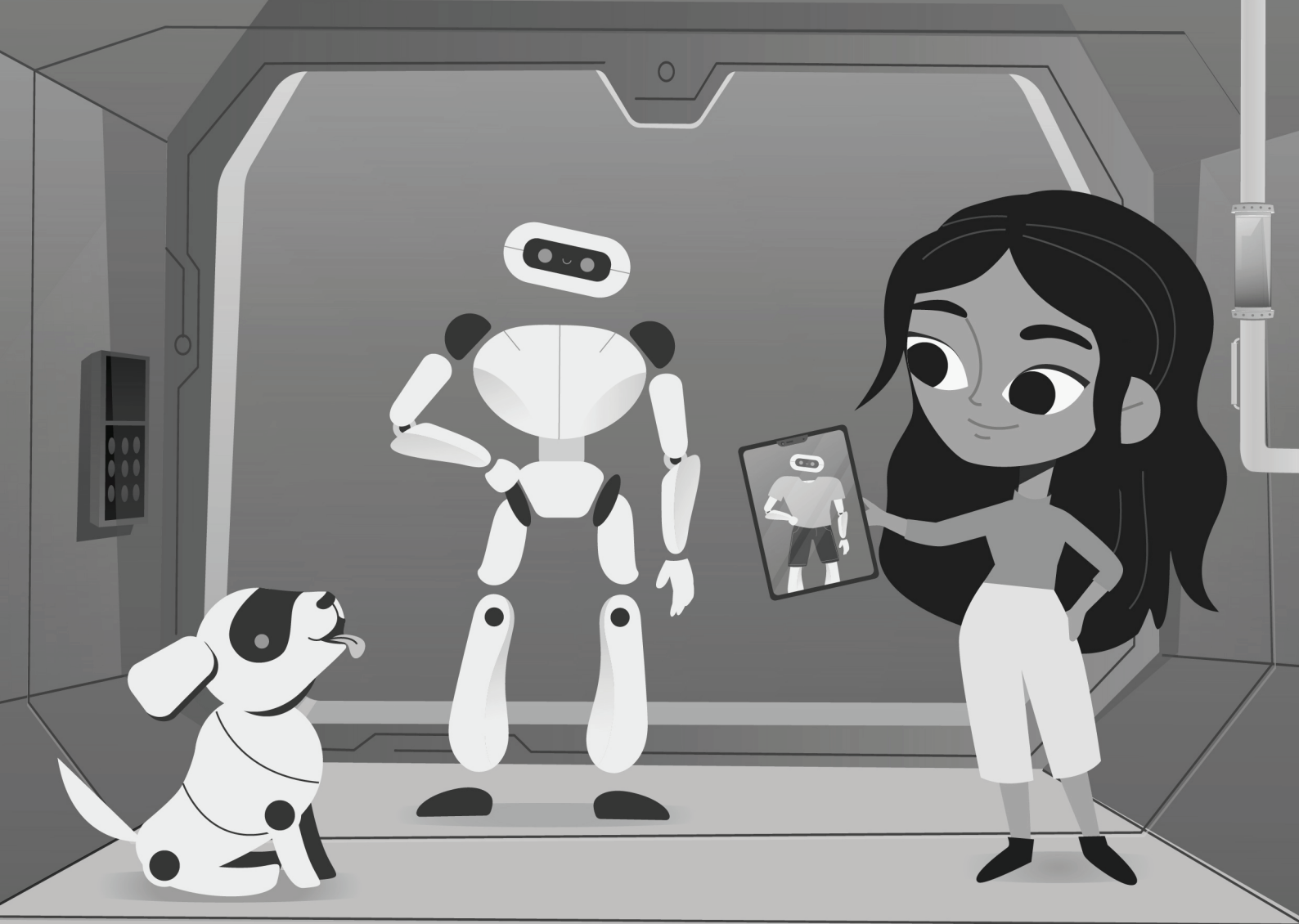
Overlays digital information on top of the real world.

Fictional settings.

Partially immersed.

DEFINITION

The word '*virtual*' means it is very like something but isn't actually it.



ROBOTS

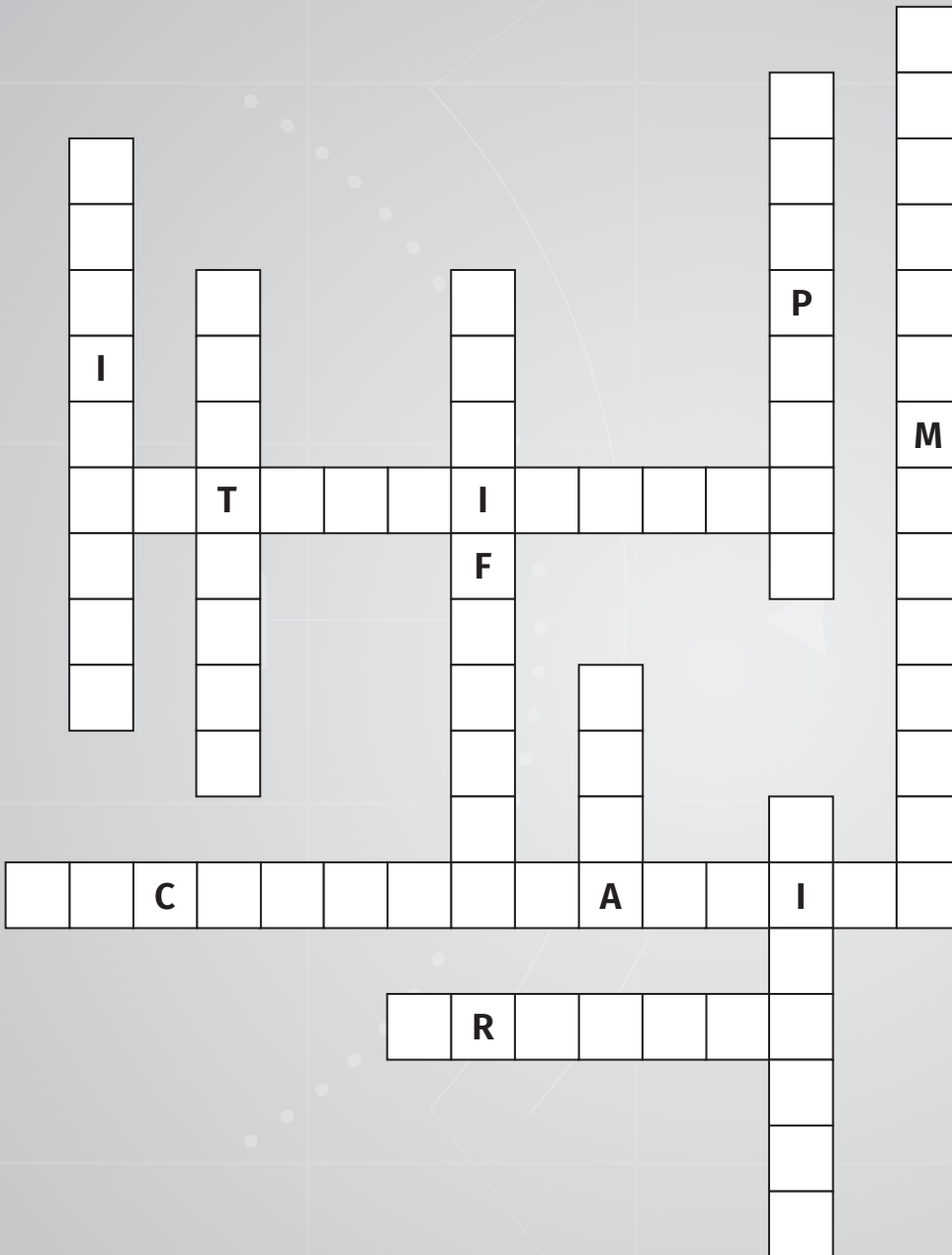
A robot is a machine that is programmed to perform tasks quickly and efficiently without a human. Many have been created to take on repetitive or dangerous tasks. There are lots of types of robots, which you will discover in this activity book.

ARTIFICIAL INTELLIGENCE (AI)

AI is the ability of a computer to process huge amounts of data, and then recognise patterns to enable it to make decisions and judgements as a human would. This is called machine learning. AI computers can process language, solve problems, and predict outcomes.

KRISS KROSS

The words in the list below are all related to Artificial Intelligence. Can you fit each of the words into its correct place? Tex has kindly added a few letter clues to help you.



- ARTIFICIAL
- INTELLIGENCE
- COMPUTER
- MACHINE LEARNING
- DATA
- PROBLEM SOLVING
- PATTERNS
- DECISIONS
- VIRTUAL
- PREDICT

FACT

The RAF's **Project Immersive** is a virtual operations room. It is used to provide joint operations across the military services and the government from a single control centre.

ROBOTS IN THE FACTORY

Robots are used widely in manufacturing. They require very little human involvement in their work. 1 million robots are used in the car industry. They are even used for making the RAF's newest aircraft being produced by Team Tempest.

Robots can perform repetitive tasks at a much greater speed than humans, with less cost and much more accuracy.

Here is a maths puzzle for you:

If it takes a human 20 hours to put together a fuselage and it takes a robot just 1 minute to do the same, how many fuselages can a robot make in the same time it takes a human?

Answer =

DEFINITION

Fuselage – the main body of an aircraft.

FACT

The word '**robot**' comes from the Czech word 'Robota' which means 'hard work.'

FACT

Have you heard of the artist Leonardo da Vinci? He was born in Italy in 1452. That was such a very long time ago. Well, he wasn't just an artist. He was also a scientist and an engineer, and he believed everything in life was connected. Around 1495 it is believed he designed and constructed a robotic humanoid knight. And these design ideas were used in 2002 by US robotics engineer Mark Rosheim to create robots for NASA.

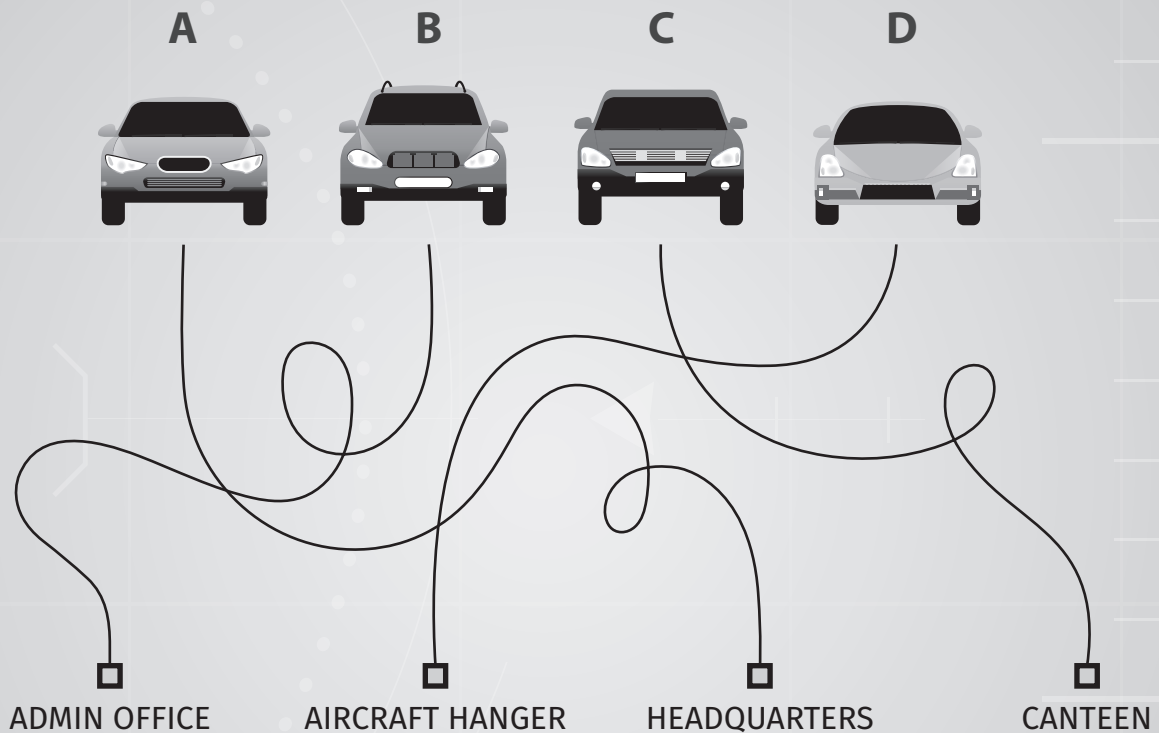
ROBOT CARS

RAF Brize Norton in Oxfordshire has been experimenting with the use of robot cars. These cars are self-driving, unmanned vehicles. They can deliver supplies across the station, saving time and money.

Can you follow each of these twisty lines to show Katie where each robot car has been programmed to deliver its latest cargo of goods?



Find out about robot cars at RAF Brize Norton.



FACT

There are five things that robots can do better than humans, making them really useful:
They don't get bored.

They can tolerate more extreme conditions.

They can be built to be strong and fast.

They don't get distracted or daydream.

They are consistent.

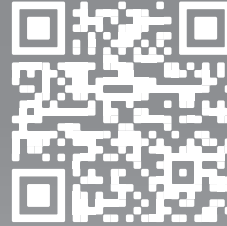
But robots can only do what they are programmed to do by humans.

Did you know? NASA's robots 'Opportunity' and 'Spirit' have walked over 10 miles across Mars for over 3 years.

SO MANY ROBOTS!

There are many types of robots, and not all of them look like humans.

See if you can match these descriptions with the robot types listed.



Find out about the different types of robots.

Aerospace Robots

Aquatic Robots

Autonomous Cars

Disaster Robots

Drones

Educational Robots

Humanoid Robots

Industrial Robots

Medical Robots

Military Robots

- A** Robots that float or dive deeply and are used to collect information about the world's oceans and carry out surveillance.
- B** Ground and aerial robots that perform dangerous jobs after an emergency.
- C** Robots and kits that can be found in homes and classrooms. They are used for problem-solving and teaching.

- D** Robots that perform repetitive tasks like those found within manufacturing.
- E** Robots equipped with cameras, computers, and navigation systems that enable them to drive without a person. These are used by the RAF to deliver equipment around the airbase.
- F** Flying robots that capture data. Some military ones are used for long-duration surveillance.
- G** Robots with a mechanical body that look and move like a person.
- H** Robots that help people in hospitals. Some robots can perform small operations whilst being remotely controlled.
- I** Tough robots that carry out missions that are too dangerous for humans.
- J** Robots that can fly and are used to take pictures. These types of robots are also used in space and may help to build future space stations.

FACT

Did you know that Japan uses about half a million industrial robots. That is 50% of the world's entire robot population!

A TORTOISE AND PENCIL POT?!

Some AI applications can be really creative. One example of a creative AI app is 'Craiyon.com'.

It can generate a picture just by typing in a couple of words. It does this by using a very large database of images and merging some of the pictures together.

Have a go. Katie and Tex can't wait to see what your creative imagination can come up with.



Try out 'Craiyon'.

Firstly, think of an animal

Next, think of an object you would find in your classroom

Can you create a picture that brings the two together? Make it as funny as you like.

A large, empty white rectangular box with a black border, intended for the user to draw a picture based on their prompts.

You can do this activity again with anything you like. How about a vehicle with a piece of fruit? Let your imagination run wild.

ARTIFICIAL INTELLIGENCE - WHAT IT IS USED FOR?

AI uses large amounts of data. It looks for patterns that allow it to make predictions, give probable answers to questions, process language and solve problems. This can save a lot of time and human effort and help in decision-making. But accuracy is not always guaranteed so some human thinking is needed as well.

Below is a list of some of the ways that AI is used across the world. But wait a minute! Some of the letters are missing.

Can you replace them so that the list is complete again? There are some picture clues that will help you. Once you have replaced all the letters, link the words to their correct image.

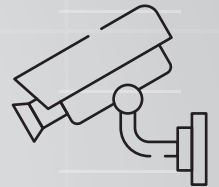
RO_OTI_S



SC_EN_E

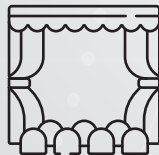


TRAN_POR_ATION



A_RICU_TURE

FI_AN_E



_DUCA_ION



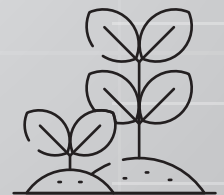
SUR_EILLA_CE



RE_AIL



WEA_HER PRE_ICTIO_

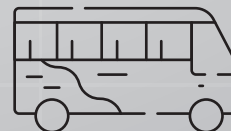


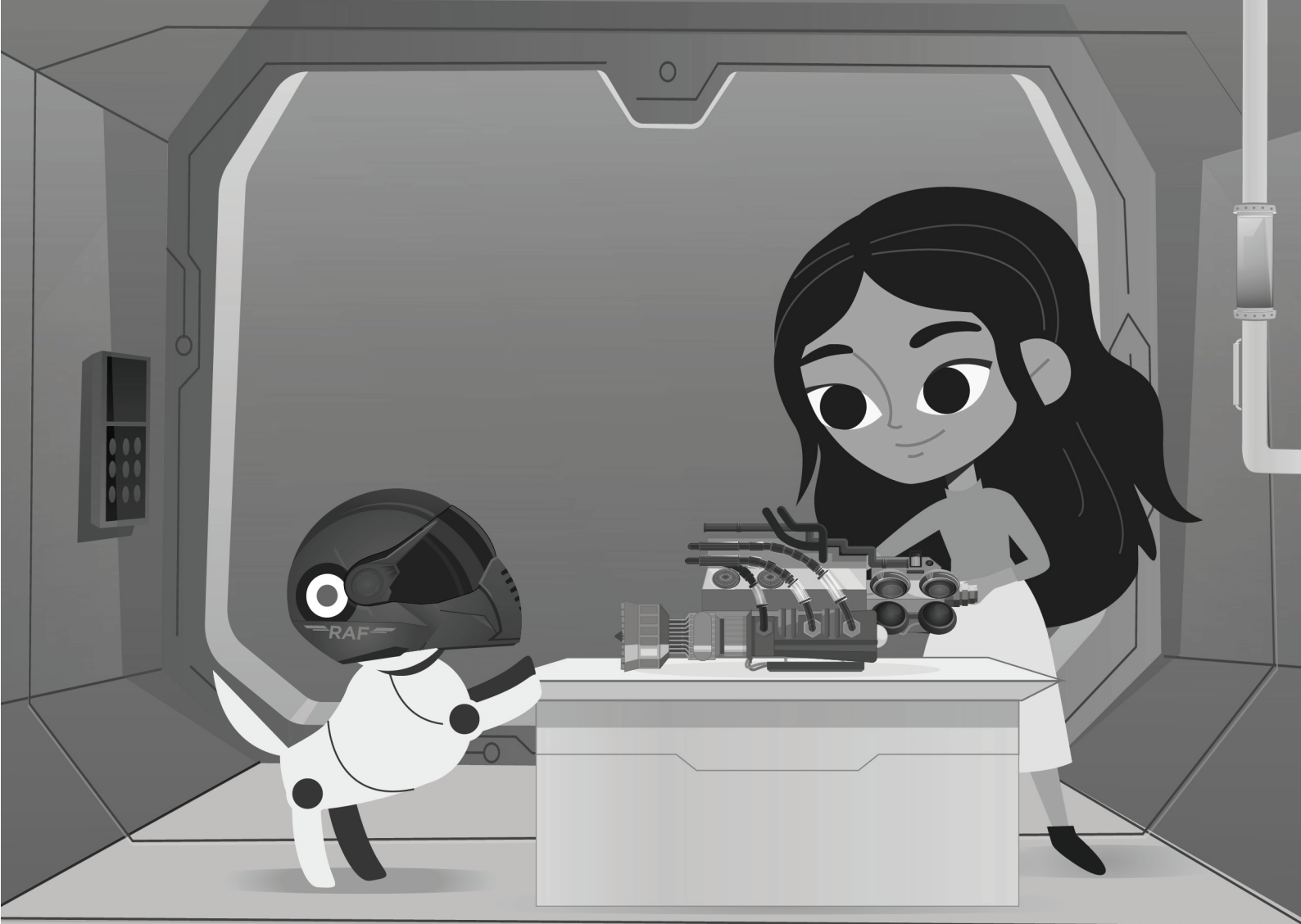
FACT

The RAF uses AI to save time, predict behaviour, monitor environmental conditions and assess situations.

Alexa and Google use AI technology.

ENTER_AIN_ENT





JET PACKS

A jet pack is worn on the back. Like a rocket it combines fuel and oxygen. The chemical reaction causes jets of hot gas to shoot downwards and thrust the wearer into the air. Jet packs can be worn to transport the wearer short distances across water or land. They can help in rescue operations.

JET PACK TAKE OFF!

Katie has been given the opportunity to watch an RAF pilot take flight wearing a jet pack. After the experience she wanted to write down all she had learned.

Here is what she wrote. But oops! Some of her words have disappeared. Can you put the words below back into their correct places?

I had a great time today watching the pilot with a jet pack. It worked like a rocket. It _____ him up into the air to 3,000 feet and he was up there for over half an _____.

It was very fast! The thrust is caused by hot _____ shooting downwards when the _____, air and oxidising chemicals react together. I was told it can go up to 46 _____ per hour. The fuel is very expensive though and lasts a very _____ time.

Although it was thrilling, the jet pack pilot said it was very _____ and very _____. He needed a lot of _____ to control it. He was worried that if he ran out of fuel he would _____ to the ground.

heavy
fall
fuel
loud
thrust
hour
miles
strength
short
gas



Find out about the Royal Marines using jet packs.

FACT

RAF British Royal Marines have used jet packs on a training exercise to get personnel from a small boat onto a ship. Jet packs are still not considered as practical for regular military purposes though.

WHICH TRAVELS FASTER?

A jet pack can travel up to 46 miles per hour.

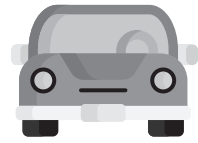
Have a look at the list below. Half of these things on average can travel faster than a jet pack, and half of them are slower. Which ones do you think travel faster than a jet pack and which ones are slower?



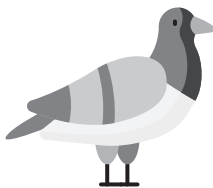
SKATEBOARD



MOUNTAIN BIKE



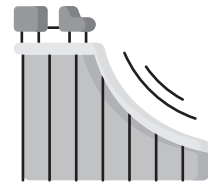
MOTOR CAR



PIGEON



JOGGER



ROLLERCOASTER

FACT

Did you know that the average greyhound racing dog also travels at 46 mph!

WOW THAT'S HIGH!

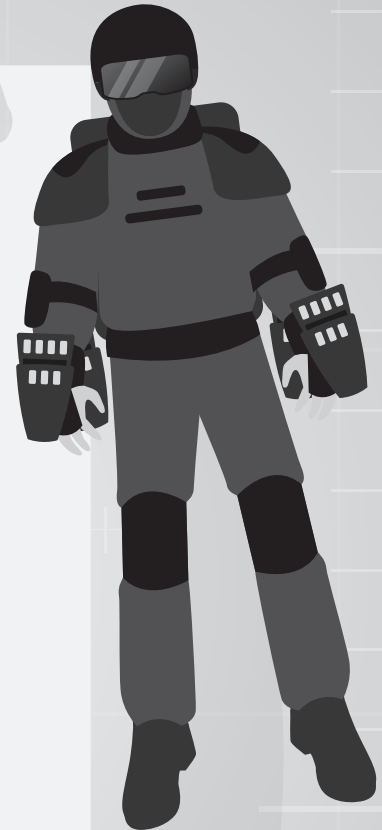
Tex was watching a pilot get into a jet pack suit. The pilot got himself ready to take off and whoosh! He was thrust high up into the air. He reached 3000 ft before he came back down to land.

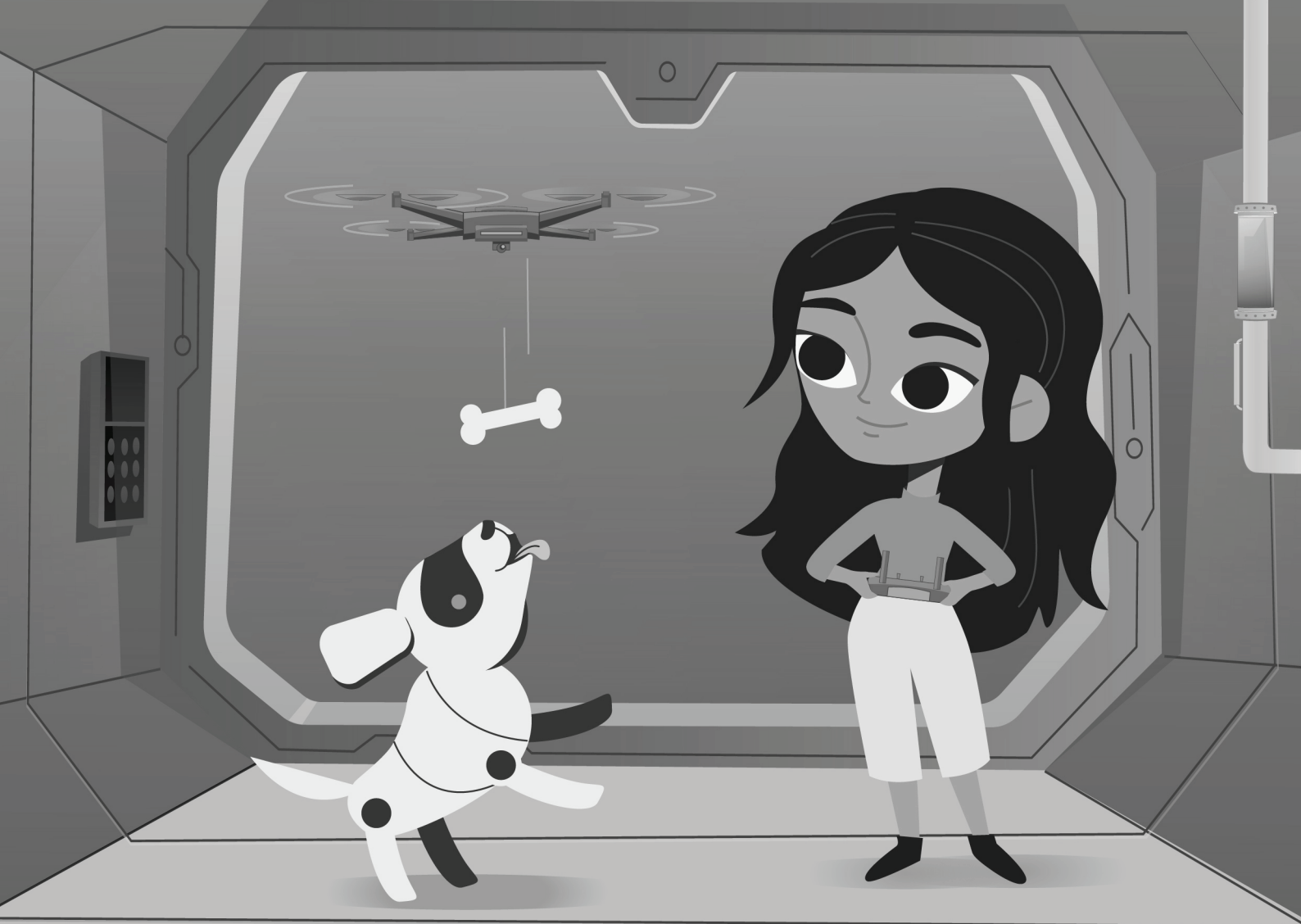
Tex was really excited to see this and was inspired to create a maths puzzle for you.

An RAF helicopter is 10ft tall and an
Air Traffic Control tower is 350 ft high.

If you stacked air traffic control towers
and RAF helicopters on top of each other,
what is the least amount of each you
would need to reach the same height as
the pilot did?

Answer = Air Traffic Control towers
and
 RAF Helicopters





DRONES

A drone is an aircraft that doesn't have a pilot. They are used for many things including military operations. Some drones are very small, whereas others are the size of an aircraft. Drones are remotely controlled from the ground using a computer system called a GCS (Ground Control System).

IF YOU HAD A SUPER-DUPER DRONE...

If you had a super-duper drone with unlimited flight time, height or distance where would you send it? It could be anywhere in the world or even in outer space.

Let your imagination take some fantastic photographs and write about the intelligence it gathers in the space below. You could even write it as a poem if you like. Katie loves reading stories and poetry to Tex.

FACT

The RAF has a new drone called Protector RG Mk1. This drone will replace the MQ-9A Reaper which is used for intelligence and surveillance.

NORTH, EAST, SOUTH AND WEST PUZZLE

Can you follow the flight of this RAF drone which is on a surveillance mission to take photographs?

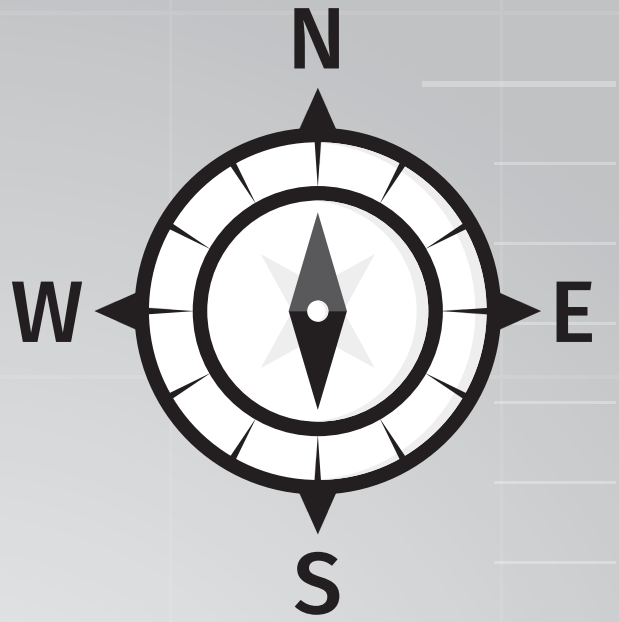
Follow the drone's directions below to see in which order the mission takes place.



START

					Military Camp	
	Airport					
			Factory			

- 1 The drone flies east for 6 squares. Then it changes direction.
- 2 It travels south for 2 squares.
- 3 It then goes west for 4 squares before changing direction.
- 4 And turns south for 1 square.
- 5 The drone continues south for 3 squares
- 6 Then heads east for 2 squares.



In what order did the drone reach the places?

FACT

The Thales Watchkeeper WK450 is a drone used by the military for intelligence and surveillance.

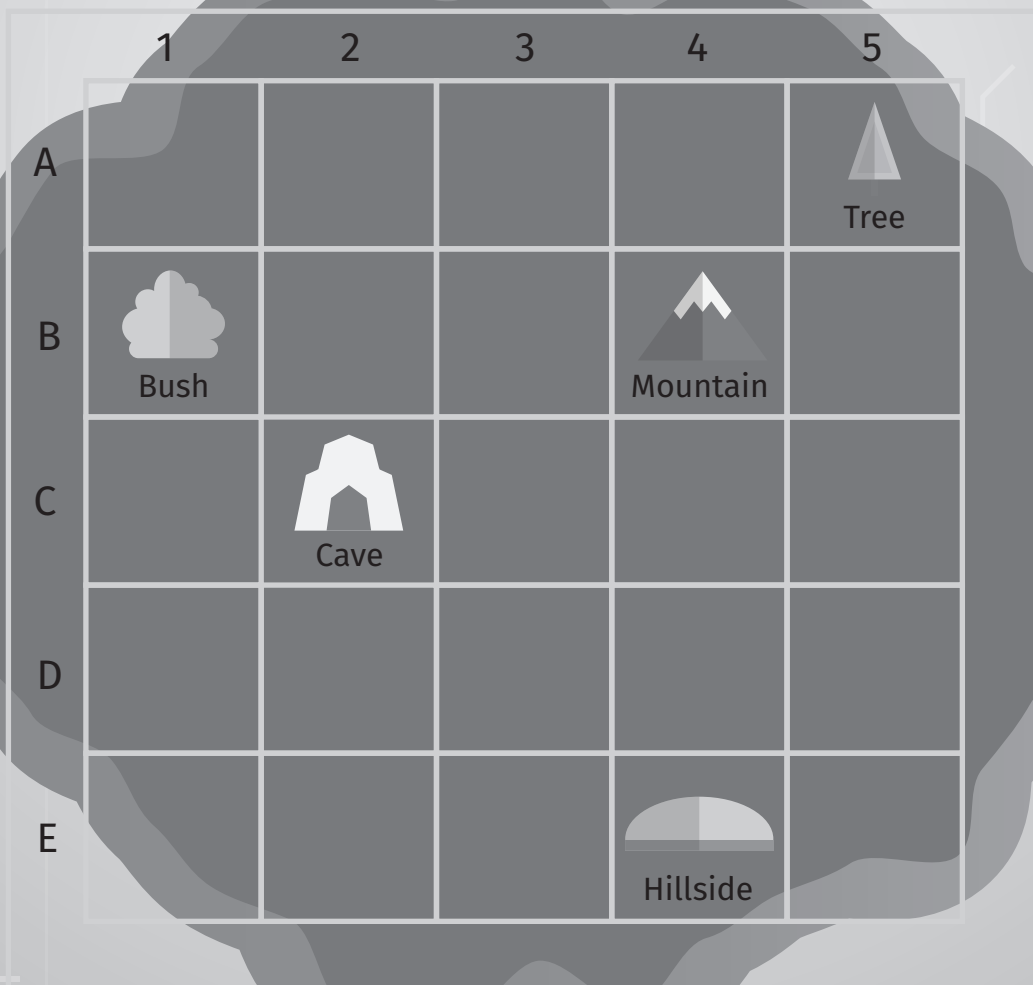
GRID REFERENCE GAME

Get your drone ready! You are needed on a military rescue mission.

Can you survey the ground to locate a group of people who have got lost whilst trekking in the mountains? It won't be easy because they have all gone separate ways.

Your job is to remotely control the drone, and use the pictures it captures to communicate the coordinates of their locations back to Katie, Tex and your RAF rescue team on the ground.

Using the grid reference letters and numbers can you locate each of the people?



Example:

There is a man waving at you from near a tree. Can you communicate the grid reference so the rescue team can reach him?

Answer is A5. The tree is in row A and in column 5.

Now, can you provide the coordinates to find the following:

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

There is a man at the bottom of the mountain.
What is the grid reference?

There is a man with a child standing at the
mouth of a cave. What is the grid reference?

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

FACT

A grid reference on a map uses vertical and horizontal grid lines to show a location using numbers and letters. Grid references are sometimes also known as coordinates.

PRONUNCIATION

We say the word COORDINATES like this 'Co ordinates'.

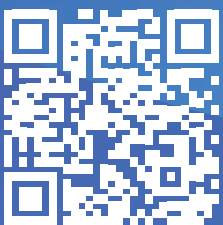
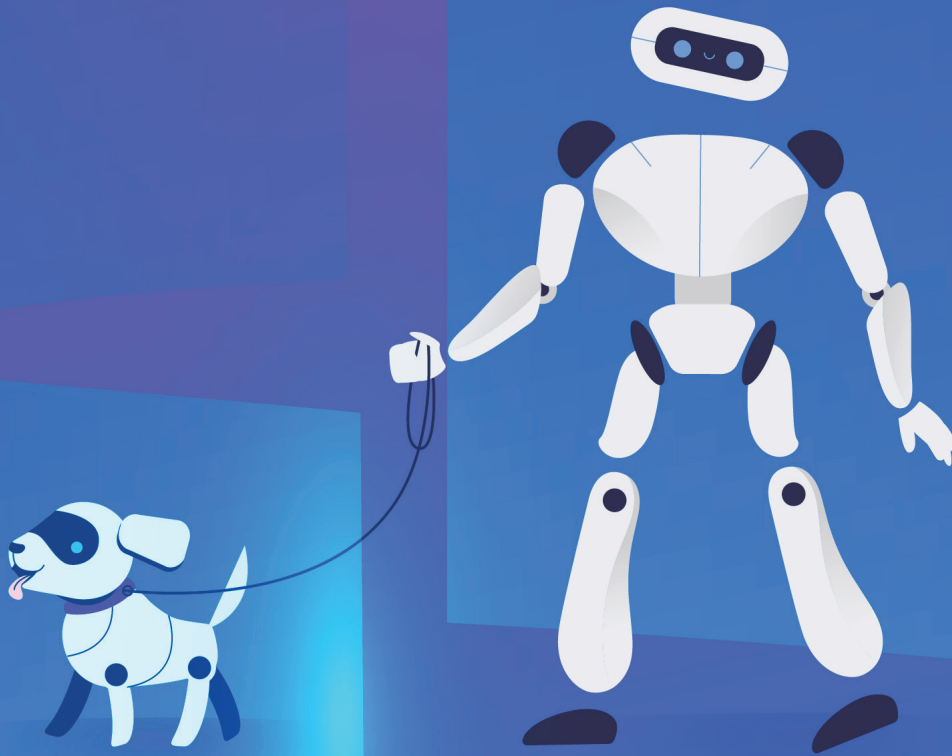
ABOUT KATIE AND TEX

KATIE

Katie is a research scientist. She carries out experiments and investigations across a wide range of subjects. Katie loves learning about technology and often talks to her friends to find out how it's used in their areas of work.

TEX

Tex is an advanced and very clever robotic dog created by Katie as a research experiment. He's programmed to know lots of facts and to help Katie around the lab - and has a mischievous sense of humour.



Scan the QR code here to access more of Katie and Tex's adventures exploring the world of technology.

These short animations, covering a range of technology topics, are aimed at inspiring primary school-aged children to think and talk about technology and the role it plays in their lives.