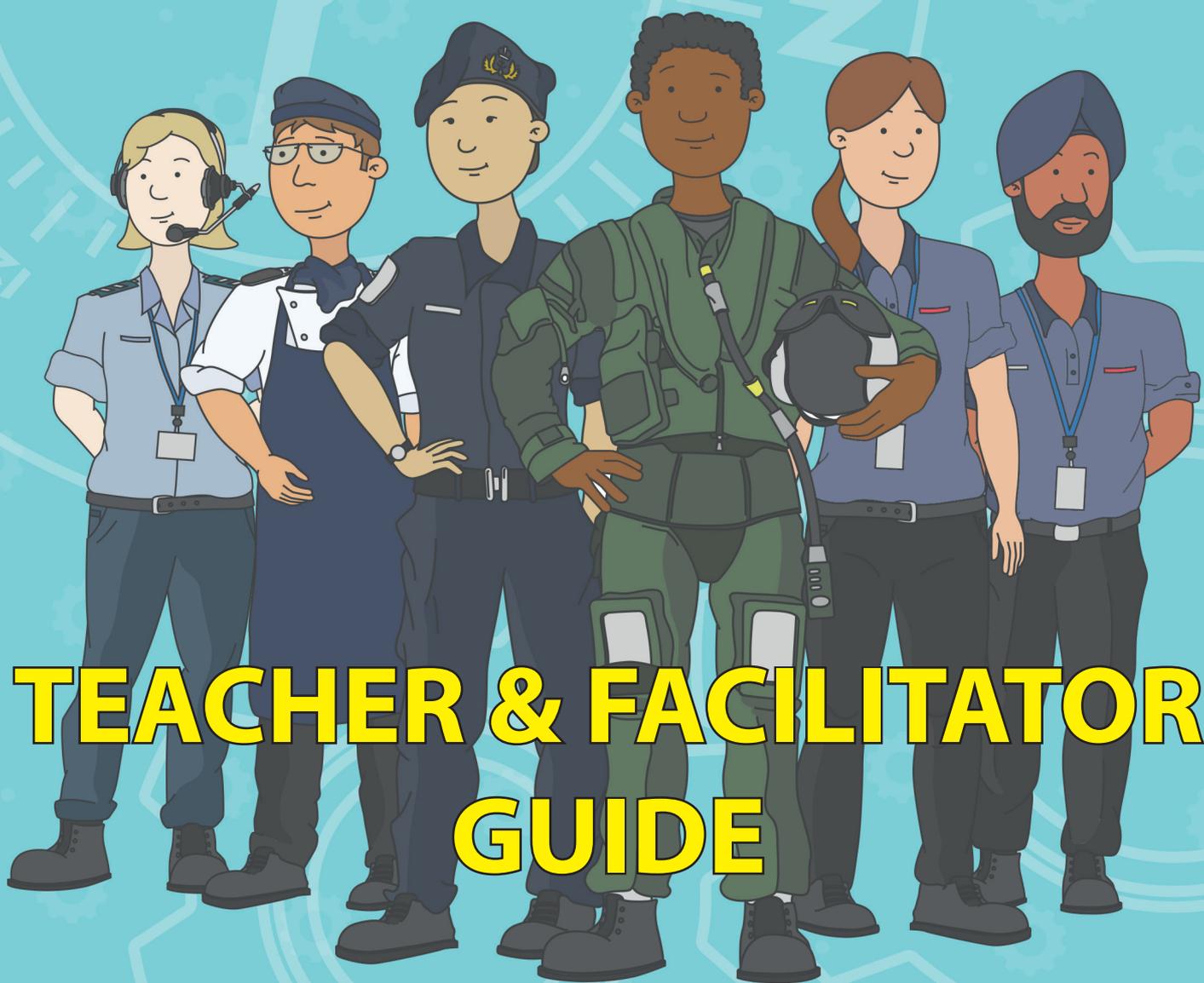
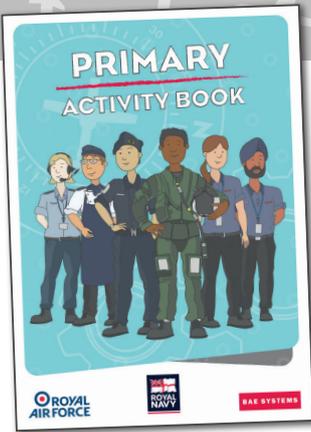


PRIMARY

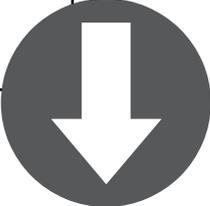
ACTIVITY BOOK



TEACHER & FACILITATOR GUIDE



Our activity book introduces a number of characters from our sponsors. Each character has a different job and they are representative (in terms of gender and ethnicity) of the people who work for the RAF, NAVY and BAE Systems.



THIS ACTIVITY BOOK HAS BEEN MADE WITH THE HELP OF:



The Royal Navy is the military sea force of the United Kingdom. They work to defend the United Kingdom and other countries worldwide.



The RAF is the military air force of the United Kingdom. They work to defend the United Kingdom and other countries worldwide. RAF is short for 'Royal Air Force'.



BAE Systems makes equipment and provides services that support the RAF and Royal Navy.

Meet some of the people who work for them!
They will be helping you with the activities in this workbook:



RHIANNON

Rhiannon is an RAF Air Traffic Controller.



PATRICK

Patrick is an RAF Pilot.



CARL

Carl is a Royal Navy Chef.



Why don't you colour the characters in?



RANI

Rani is a Naval Weapons Engineer Officer.



ERICA

Erica is a BAE Systems Manufacturing Engineer.



DAN

Dan is a BAE Systems Design Engineer.

2 3

LOADING THE AIRCRAFT CARRIER

The Royal Navy has two aircraft carriers, the HMS Queen Elizabeth and the HMS Prince of Wales. These are designed and built by BAE Systems engineers.

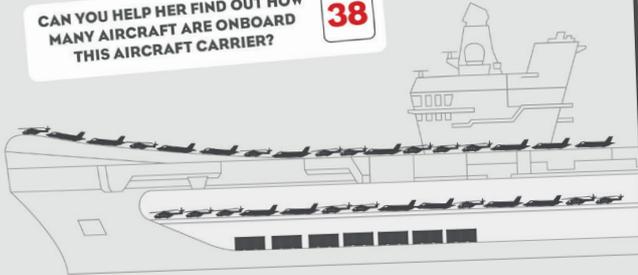
An aircraft carrier is a ship that can carry helicopters, other aircraft and supplies. It has a flight deck on which aircraft can land and take off from.

This aircraft carrier below is where Rani the Naval Weapons Engineer Officer works.



CAN YOU HELP HER FIND OUT HOW MANY AIRCRAFT ARE ONBOARD THIS AIRCRAFT CARRIER?

38



HOW MANY JETS IS IT CARRYING?



15

HOW MANY HELICOPTERS IS IT CARRYING?



16

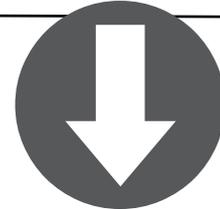
HOW MANY SUPPLY CONTAINERS IS IT CARRYING?



7

4

Throughout this guide, we have included the 'answers' to the tasks set, along with additional contextual information.



HOW MANY WORDS?

Carl thinks it is fun to make smaller words out of the letters of a bigger one.

He has made ten words from the word HELICOPTER and ten words from the word SUBMARINE.

He was very clever as one of the words he found from HELICOPTER is linked to the military. Maybe you will find that one too.



How many smaller words can you make out of the letters of these long words?



HELICOPTER

SUBMARINE

WRITE YOUR HELICOPTER WORDS...

Choir Pitch Tip
Chop Polite To
Clip Porch Top
Helper Port Trip
Hit Price
Hop Recipe
Ice Reel
Lip Rich
Lit Ripe
Lot The
Petrol Tie
Piece
Pilot

WRITE YOUR SUBMARINE WORDS...

Air Numbers
An Nurse
Are Rain
Arms Remains
Bean Run
Bear Surname
Brains Use
Bun
Is
Menus
Miner
Name

DEFINITION

A submarine is a boat designed to stay under the sea for long periods of time. It has a periscope sticking out of the top so the crew can see above the water too.

DEFINITION

A periscope is a set of lenses, mirrors or prisms on a tube allowing the viewer to see objects reflected on the other end.

6

CIRCUIT BOARD GAME



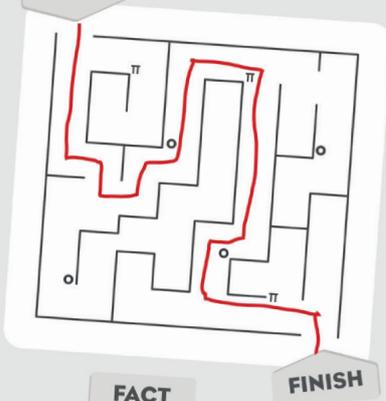
Dan the BAE Systems Design Engineer has found an old circuit board whilst looking through some rubbish.

He thinks it would be fun to play with it and turn it into a maze game.

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!

START



FACT

FINISH

A circuit board is a thin rigid board that contains electrical parts to enable machines to be powered.

BAE Systems use circuit boards when they are manufacturing equipment.

5

WORDSEARCH



CAN YOU HELP CARL TO FIND THESE WORDS?

TECHNOLOGY

LOG

WEATHER

PORT

FUSELAGE

RANK

LOGISTICS

DEFENCE

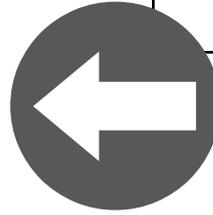
NAVIGATION

STARBOARD

There are more words to find that are not listed. Can you find TWO of them?

7

Two additional words in the wordsearch are **PILOT** and **FLIGHT**.



UNION JACK - COLOUR ME IN

Erica the BAE Systems Manufacturing Engineer has been asked to paint a picture of the Union Jack to hang on the wall.

She has not had time to finish it. Can you colour it in for her? She has left these instructions for you.



FACT

The Union Jack is the national flag of the United Kingdom. It was designed by putting together the flags of England, Scotland and Northern Ireland.

FACT

Most people call our flag the Union Jack but it is really called the Union Flag. It is known as the Union Jack when the Royal Navy attach it to a jack staff.

All the triangle shapes are blue, the big cross in the centre is red and the four diagonals that go to the corners are red. The rest of the flag is white.



8

SILHOUETTES

Erica can see lots of silhouettes of equipment. Can you help her to identify what each one is?

DEFINITION

A silhouette is a dark, solid shape that you see when it has a bright light behind it.

JET

SUBMARINE

HELICOPTER

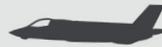
PARACHUTE

HELMET

DESIGN EQUIPMENT

TOOL KIT

SUBMARINE



JET

HELICOPTER



DESIGN EQUIPMENT

PARACHUTE



TOOLKIT

HELMET



9

THE PHONETIC ALPHABET

The Phonetic Alphabet is a code system used over the radio or telephone to ensure communication is understood correctly. Air Traffic Control are one of the teams who use this system.

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.



RHIANNON

PHONETIC ALPHABET

A - Alpha	F - Foxtrot	M - Mike	T - Tango
B - Bravo	G - Golf	N - November	U - Uniform
C - Charlie	H - Hotel	O - Oscar	V - Victor
D - Delta	I - India	P - Papa	W - Whiskey
E - Echo	J - Juliet	Q - Quebec	X - X-ray
	K - Kilo	R - Romeo	Y - Yankee
	L - Lima	S - Sierra	Z - Zulu

Write your name using the Phonetic Alphabet here:

DEFINITION

The word 'phonetic' means speech sounds.

Write a list of words using the Phonetic Alphabet that spell out your best friend's name, or the name of your pet:

FLIGHT SIMULATOR



PATRICK

Patrick the Pilot is having a training session in the RAF Flight Simulator.

Can you read the control panel and answer the questions below?

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. It is used for training pilots.

ALTITUDE INDICATOR



How high is the aircraft?
(CLUE: 1 = 1000 feet)

3000 feet

FUEL INDICATOR



How much fuel does Patrick have left?

1/2 (half) tank of fuel

DIRECTION INDICATOR



What direction is the aircraft flying?
(CLUE: N = NORTH)

West

HELICOPTER AIR SPEED INDICATOR



How fast is the aircraft travelling?
(CLUE: Airspeed is measured in 'knots')

75 knots



If the aircraft was travelling twice as fast, where would the indicator be?
(Draw this in here.)

SPOT THE DIFFERENCE

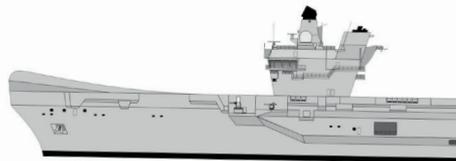
Erica and Rani are having a walk because it is a nice day.

Rani has taken two photographs, but they are slightly different and she has asked Erica to tell her where the 10 differences are.

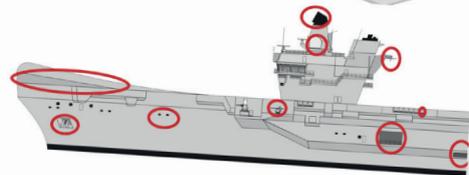
Can you help Erica by circling on the second photograph where the differences are?



ERICA



CIRCLE THE 10 DIFFERENCES



FEED THE TROOPS - BOARDGAME

A GAME FOR TWO TO THREE PLAYERS

It's time to feed the troops and the RAF, BAE Systems and the Navy are having lunch together. They have ordered pizza.

Can you be the first person to race to the end of the pizza slices and collect all four of their favourite ingredients?

PLACE YOUR PILE OF ACTION CARDS (FACE DOWN) HERE.

Download the cards for this game (look under 'Resources') <https://rafyouthstem.org.uk> (you can also download copies of this activity book).

FAVOURITE INGREDIENTS


BREAD


TOMATO


CHEESE


PEPPER

INSTRUCTIONS

In turn, each player turns the top card from the pile and follows the instruction. If the card shows:

QUESTION
If you answer correctly move forward two spaces and keep the card for your set. If you are incorrect or if you already have the ingredient on the card then return it to the bottom of the pack.

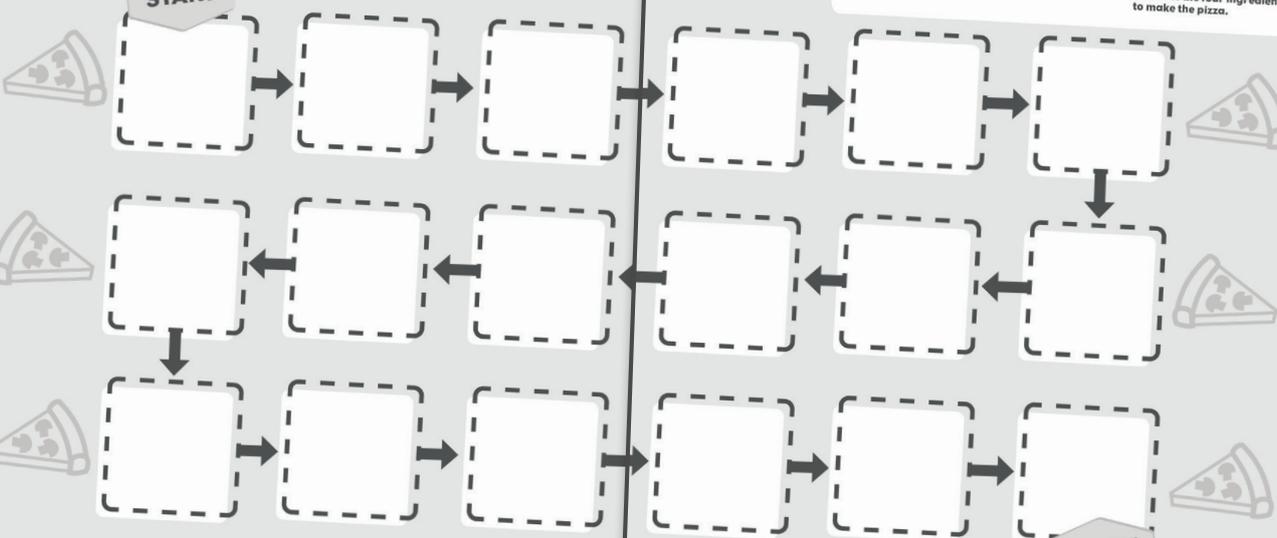
Other players, don't shout out the answer because you might get that card later on!

FORWARD
Go forward the number of spaces and keep the card if you do not already have the ingredient on it. If you already have it, return the card to the bottom of the pack.

You are trying to get a full set of the four ingredients. If you reach the end without all the ingredients, you stay where you are and keep turning a card in your turn until you get the full set.

BUT BEWARE!
The other player/s might catch up! The winner is the player who has reached the end and has each of the four ingredients to make the pizza.

START



FINISH

16
17

FEED THE TROOPS CARDS
You need to cut these out (and shuffle them with the rest of the cards) ready to play the game.
(Note: Cards 1 to 9)

<p>QUESTION <small>(IF CORRECT MOVE FORWARD TWO SPACES)</small></p> <p>FACTS</p> <p>Can you name the three authors of the Union Flag? The Union Flag is commonly known as the Union Jack.</p>	<p>QUESTION <small>(IF CORRECT MOVE FORWARD TWO SPACES)</small></p> <p>MATHS</p> <p>There are 4 jobs and 2 helicopters about to land on the Royal Navy aircraft carrier. How many aircraft are about to land?</p>	<p>QUESTION <small>(IF CORRECT MOVE FORWARD TWO SPACES)</small></p> <p>SCIENCE - PHYSICS</p> <p>Do you know what the word 'altitude' means?</p> <p>1) Length 2) Weight 3) Depth</p>
<p>QUESTION <small>(IF CORRECT MOVE FORWARD TWO SPACES)</small></p> <p>TECHNOLOGY</p> <p>Do you know the alphabetic alphabet letter for the letter X?</p>	<p>QUESTION <small>(IF CORRECT MOVE FORWARD TWO SPACES)</small></p> <p>ENGINEERING</p> <p>How many wheels (total)?</p> <p>1) 4 wheels 2) 6 wheels 3) 8 wheels</p>	<p>QUESTION <small>(IF CORRECT MOVE FORWARD TWO SPACES)</small></p> <p>MATHS</p> <p>The Morris motorcar can hold 2,358 litres of fuel. It has 160 wheels. How many litres of fuel is in each wheel? (Show working)</p>
<p>QUESTION <small>(IF CORRECT MOVE FORWARD TWO SPACES)</small></p> <p>FACTS</p> <p>What is a parachute used for?</p>	<p>QUESTION <small>(IF CORRECT MOVE FORWARD TWO SPACES)</small></p> <p>MATHS</p> <p>2 items were collected from quantity 8. RAF Flight Engineers work 3 BAe Systems. How many people are in the quantity?</p>	<p>QUESTION <small>(IF CORRECT MOVE FORWARD TWO SPACES)</small></p> <p>SCIENCE - BIOLOGY</p> <p>Counting on your fingers is similar to counting in the binary system. Can you name an animal that uses binary code?</p>


FEED THE TROOPS


FEED THE TROOPS


FEED THE TROOPS

FORWARD

Carl has travelled a lovely new camp system.

MOVE FORWARD ONE SPACE

FORWARD

Erica has been working out the tasks in the workshop.

MOVE FORWARD ONE SPACE

FORWARD

Can the developer have legs for BAe Systems Engineering?

MOVE FORWARD ONE SPACE


FEED THE TROOPS


FEED THE TROOPS


FEED THE TROOPS

FORWARD

Patrick has travelled three new planets this week.

MOVE FORWARD TWO SPACES

FORWARD

Elizabeth has been fundraising for charity.

MOVE FORWARD TWO SPACES

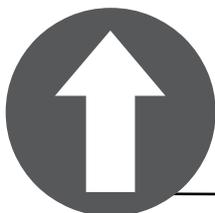
COUNTERS
(Cut these out - or cut out the other characters from the front of the activity book)



COUNTERS


FEED THE TROOPS

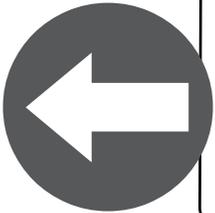

FEED THE TROOPS



Our boardgame on the centre pages of the activity book can be played by two or more pupils.

Each player selects one of our characters as a counter for the game.

'Action cards' for the game can be downloaded from <https://rafyouthstem.org.uk>.



COLOUR BY NUMBERS

Using the colour key below can you help Dan the BAE Systems Design Engineer to colour in these logos?
Can you see how the colours are the same as the ones in the Union Jack?



BAE SYSTEMS

FACT

The Union Jack is the national flag of the United Kingdom. It was designed by putting together the flags of England, Scotland and Northern Ireland.

Most people call our flag the Union Jack but it is really called the Union Flag. It is known as the Union Jack when the Royal Navy attach it to a jack staff.

COLOUR KEY

- 1 RED
- 2 WHITE
- 3 BLUE

ROYAL AIR FORCE

18

FILL IN THE CAPS

THE RESCUE MISSION

Some of the words have dropped out of this story. Patrick the Pilot would like to read it so has asked if you can help to put the words back into their correct places?



COMPLETE THE STORY

It was the early hours of the morning. An urgent call came in over the radio. A flood had caused a river to burst its banks and water was getting into some of the houses.

Patrick and his team loaded the aircraft with food, water and equipment. Off they flew to reach the people who needed rescuing.

When they landed, they joined other rescue teams with inflatable boats and set out to find the people and lead them to safety. They set up temporary shelters and gave them food and water.

Once all the people had been found and led to safety, the teams worked together to tidy up the mess made by the water. They worked together to make sure the power supplies were safely switched back on. The people would then be able to return home safely.

WORD BANK

power

radio

water

aircraft

morning

food

people

safety

19

THE PHONETIC ALPHABET

Earlier in this workbook, Rhiannon the RAF Air Traffic Controller asked you to write your name using the phonetic alphabet. This time she would like you to help her work out the words below:



ROMEO OSCAR YANKEE ALPHA LIMA
NOVEMBER ALPHA VICTOR YANKEE

ROYAL NAVY

ROMEO OSCAR YANKEE ALPHA LIMA
ALPHA INDIA ROMEO FOXTROT OSCAR
ROMEO CHARLIE ECHO

ROYAL AIR FORCE

ALPHA ECHO ROMEO OSCAR SIERRA
PAPA ALPHA CHARLIE ECHO

AEROSPACE

ECHO NOVEMBER GOLF INDIA
NOVEMBER ECHO ECHO ROMEO

ENGINEER

PHONETIC ALPHABET

- A - Alpha
- B - Bravo
- C - Charlie
- D - Delta
- E - Echo
- F - Foxtrot
- G - Golf
- H - Hotel
- I - India
- J - Juliet
- K - Kilo
- L - Lima
- M - Mike
- N - November
- O - Oscar
- P - Papa
- Q - Quebec
- R - Romeo
- S - Sierra
- T - Tango
- U - Uniform
- V - Victor
- W - Whiskey
- X - X-ray
- Y - Yankee
- Z - Zulu

20

TOOLS IN THE WORKSHOP



Erica the BAE Systems Manufacturing Engineer has a group of young apprentices starting work at BAE Systems tomorrow. She thinks it would be a good idea to help them to get settled in by giving them a fun task to do.

She is going to ask them to label the tools in the workshop. Do you think this is something you could do too?

Write the correct word in the box.



- | | | |
|--------------|-------------|-------------|
| PLIERS | HAMMER | SAW |
| TAPE MEASURE | TOOLBOX | DRILL |
| PAINT | PAINT BRUSH | SCREWDRIVER |

SAILING SUM

Rani the Weapons Engineer Officer is sailing across the sea towards an island in the Atlantic Ocean.

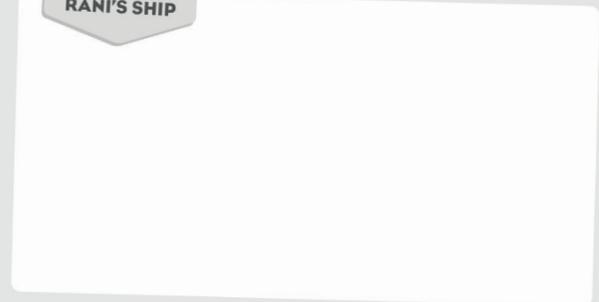
Her ship can travel 20 knots per hour and she has to travel 200 nautical miles to reach the island. A knot measures speed and is the same as one nautical mile per hour.

How many hours will she be sailing for?
Write your answer in the box.

10 hours



DRAW RANI'S SHIP



If Rani was travelling half as fast, can you work out how long (in hours) it would take her to reach the island?

Write it in the box here:

20 hours

KRISS CROSS PUZZLE



Erica the BAE Systems Manufacturing Engineer really enjoys these puzzles where the words cross over each other. She has left this one for you to complete and hopes you enjoy it too.

See if you can fit the listed words into the grid.

- | | | |
|-----------|---------|-----------|
| EQUIPMENT | MACHINE | PERSONNEL |
| MERLIN | UNIFORM | RECRUIT |
| RESCUE | GEAR | SIERRA |



CRACKING THE CODES



RHIANNON

Encryption has been used by the RAF and the Royal Navy for many years to send secret messages. Encryption is a way of changing information into code to keep it safe and secure. In some code systems symbols are used in place of letters.

Rhiannon the Air Traffic Controller was wondering if you could work out these words using the codes below?

CODE 1



S H I P

CODE 2



A I R F I E L D

CODE 3



I N V E N T I O N

KEY



24

SEMAPHORE

Semaphore is a system of sending messages by holding two flags in certain positions. Each letter of the alphabet is displayed in a different position. Semaphore is used to send messages when voices cannot be heard. It is used for communicating to pilots before they take off.

Rani the Weapons Engineer Officer has set you a challenge. Can you work out what words are being communicated here?



RANI



25

AIRCRAFT ALTITUDE



PATRICK

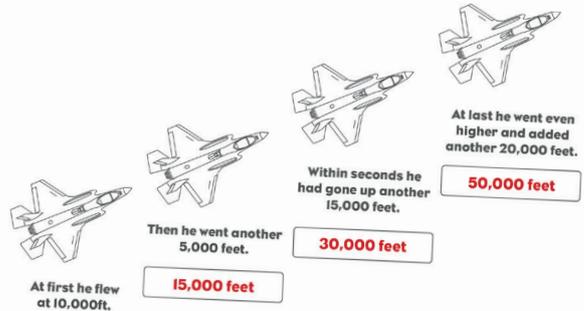
Today Patrick the Pilot has flown an F35 Lightning Stealth Aircraft.

Can you work out what altitude he reached today?

DEFINITIONS

The word ALTITUDE means the height reached above sea level or ground level.

The word FEET is a measurement term used by the military. One FOOT equals 30.48 cms.



If you work out this answer correctly you will learn that this is the maximum altitude of the F35 Lightning Stealth Aircraft.

MAXIMUM ALTITUDE:

50,000 feet

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WHO DOES WHAT?

Lots of people work for the RAF, Royal Navy and BAE Systems. They all do different jobs.
Can you help Rani the Weapons Engineer Officer to match the job titles with the job description?



JOBS

- ELECTRICIAN **F**
- LOGISTICS OFFICER **A**
- MEDICAL OFFICER **C**
- SYSTEMS SECURITY SPECIALIST **G**
- HELICOPTER PILOT **D**
- MANUFACTURING OFFICER **H**
- PURCHASING SPECIALIST **E**
- RADIO CONTROLLER **B**
- AEROSPACE ENGINEER **I**

JOB DESCRIPTIONS

- A** Your job is to make sure the troops have what they need, when they need it. That means everything including vehicles, equipment, clothes, fuel and food.
- B** Your job is to use radio and communication equipment to send clear messages to your teams to ensure that operations run smoothly.
- C** Your job is to make sure everyone stays healthy and is given any medicines they require.
- D** Your job is to fly helicopters and to deliver equipment to places.
- E** Your job is to purchase equipment and other supplies, and manage stock levels.
- F** Your job is to look after and repair any electrical equipment.
- G** Your job is to ensure that computers and information are kept secure.
- H** Your job is to make large pieces of equipment using machinery.
- I** Your job is to check the designs of aircraft and test them before they go into service.

27

RADAR REFLECTIONS



Rhiannon the Air Traffic Controller is checking her Radar system to see if she can spot the presence of any ships or aircraft.
Can you put the words into the correct order to show what RADAR stands for?

- AND
- RANGING
- RADIO
- DETECTION

RADIO
DETECTION
AND
RANGING

DEFINITION

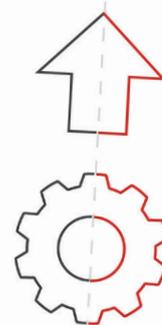
Radar is a system for showing the presence, direction, distance and speed of aircraft, ships, and other objects. It works by sending out pulses of radio waves which are reflected off the object back to the source.
The objects show up as dots on a screen.



28

DESIGN AND SYMMETRY

Dan the BAE Systems Design Engineer is having a tea break and is doodling. He has asked you to join him.
Can you complete the other side of these boxes to match and complete the arrow and the gear cog?
Can you make a fancy pattern on each that is the same on both sides?



FACT

A cog is one of several wheels in a machine that have prongs on their edges. When they turn, the prongs push each other and transfer movement. This makes the parts of the machine move.

DEFINITION

A picture or thing is symmetrical when it is the same on both sides. A shape has symmetry if a central dividing line can be drawn on it and both sides match.

29

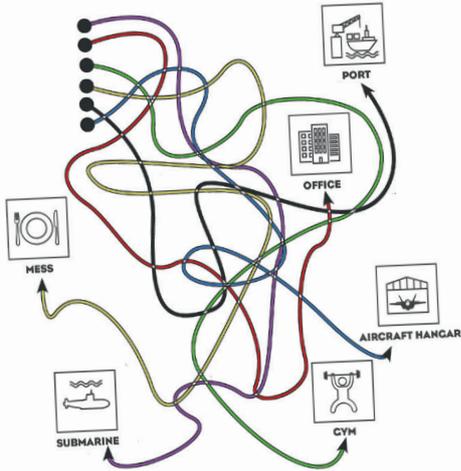
WHICH WAY?



PATRICK

Patrick the Pilot needs to make his way to the office and then the aircraft hangar (where the aircraft are kept).
Can you help him by colouring in the correct paths he should take?

WHICH PATHS SHOULD PATRICK TAKE?



30

BE A DESIGNER

Design is a large part of military work and the teams are always working hard to research, plan and develop new design ideas.

At BAE Systems they develop important new designs to improve equipment and machines. Dan the BAE Systems Design Engineer works for BAE Systems and he is always thinking of ideas to build something new.

Would you like to design something? Use your imagination and see what you can create.



DAN

DRAW YOUR DESIGN HERE:

SOME IDEAS IF YOU NEED HELP DECIDING:

You could design a helicopter, ship or aircraft.

You could design a radio or some communication equipment.

You could design a brand new encryption system (like the Phonetic Alphabet or Semaphore).

You could design a machine with lots of gadgets and tools.

You could even design a new kitchen layout for Carl the Chef and his team to work in.

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Developed by Research Toolkit Limited
Partners: The Royal Air Force, The Royal Navy, BAE Systems
Activities created and developed by Carrie Jackson
Design and Illustration by Knotwork