



## TEACHERS' GUIDE

### Introduction

**This guide is written to provide teachers and school leaders with a framework for the use of London's Air Ambulance HELIMED Learning Resource Pack. In this pack you will find:**

- A set of STEM learning resources, which can be used flexibly as stand-alone lesson activities or as part of a London's Air Ambulance Week, including presentation notes
- Curriculum links to aid lesson planning

### Background on London's Air Ambulance and HELIMED

London's Air Ambulance is the charity that delivers an advanced trauma team to critically injured people in London. The service provides pre-hospital medical care at the scene of the incident and serves the 10 million people who live, work and travel within the M25.

The team, which at all times includes an advanced trauma doctor and paramedic, perform advanced medical interventions, normally only found in the hospital Emergency Department, in time critical, life threatening situations. Missions commonly involve serious road traffic collisions, falls from height, industrial accidents, assaults and injuries on the rail network.

Based at The Royal London Hospital and founded in 1989, the service operates 24/7, with the helicopter running in daylight hours and rapid response cars taking over at night and in adverse weather conditions.

As a charity, London's Air Ambulance relies on donations to function. It costs around £10 million a year to run London's Air Ambulance. The charity developed the HELIMED app to raise awareness of its work. HELIMED app is available to download free of charge from the App Store and Google Play.

The accompanying HELIMED Learning Resources have been designed to raise awareness of London's Air Ambulance within schools, and to provide an opportunity for students to be involved in London's Air Ambulance work through London's Air Ambulance Week and related STEM activities.



## Using these Resources

These resources have been designed to allow flexible usage either as standalone activities, assemblies or as a framework for hosting and coordinating a London's Air Ambulance Week. They are designed to be used by school leadership, teachers and student leaders, with classroom teachers being the target of the Learning Resources. For use as part of a scheme of work, curriculum links are provided at the end of this guide, as well as additional links that teachers and practitioners may find useful related to London's Air Ambulance and its work.

## THE HELIMED STEM LEARNING RESOURCE PACK

### Introduction

The resources in this pack have been written by teachers for teachers across the STEM subjects and Geography KS3. Each has been planned as a 30 minute activity and includes a 5-10 minute teacher presentation, with relevant student information and teacher's notes. Due to the cross-curricular nature of the subject matter it is anticipated that teachers may wish to combine more than one activity in a longer lesson, or may wish to use one activity in a shorter context, such as PSHE or form time. These activities could also be used as a whole scheme of work, either across the relevant subjects as a whole-school London's Air Ambulance Week, or in one subject across a number of lessons, as a cross-curricular STEM module.

Sketching Maps with London's Air Ambulance could also be adapted into longer activities depending on the expected outcomes of the teacher and time available.



## Planning

We understand that teachers may wish to use these resources in many different ways, however we have provided an activity plan to help incorporate these activities into your schemes of work and classes. Also included is guidance on which STEM subject each activity would be most suited to. Geography is also included.

Activity	Subject Relevance				Activity Plan			
	Science	Design & Technology	Engineering	Maths	Geography	Teacher Activity	Student Activity	Materials required
<b>Helicopter Engineering with London's Air Ambulance</b>		x	x			Teacher to introduce the work of London's Air Ambulance, introducing the work of the pilot and the engineering features of the MD902 Explorer helicopters and uniforms using the provided presentation notes. Teacher to discuss careers links as plenary, and may wish to link composite materials to prior learning. Teacher may wish to signpost to the free HELIMED app.	Students are to identify the engineering features of the MD902 using the worksheet, and link the uniform designs to subject knowledge of PPE. Students are to research two examples of composite materials for homework or recall from prior knowledge.	Worksheets, teacher presentation
<b>Navigation with London's Air Ambulance</b>			x	x	x	Teacher to introduce the work of London's Air Ambulance, introducing the work of the pilot and the features of the MD902 helicopter control panel using the presentation notes. Teacher to introduce bearings using the presentation questions. Teacher to discuss careers links as a plenary. Teacher may wish to signpost to the free HELIMED app.	Students are to use the provided London map to calculate the bearings and distance in km to each marked location, as well as identify the location's borough.	Worksheets, teacher presentation, circular protractors, angle measurers or compasses



Activity	Subject Relevance					Activity Plan		
	Science	Design & Technology	Engineering	Maths	Geography	Teacher Activity	Student Activity	Materials required
<b>Raising Funds for London's Air Ambulance</b>				x		Teacher to introduce the importance of charitable donations to the work of London's Air Ambulance, and the concept of income and outgoings using the onscreen activities as worked examples. Teacher may use the 5 minute fundraising ideas activity as a starter or plenary activity. Teacher may wish to signpost to the free HELIMED App.	Students to calculate London's Air Ambulance income from each funding stream using percentages and solve the additional Maths problems based around percentages and fuel costs.	Worksheets, teacher presentation, calculators
<b>Medical Biology with London's Air Ambulance</b>	x		x			Teacher to introduce the work of London's Air Ambulance, introducing the work of specialist doctors and paramedics, and the structures and functions of the respiratory and cardiovascular systems, and the role of specialist equipment in pre-hospital care using the provided presentation notes. Teacher to discuss careers links as plenary. Teacher may wish to signpost to the free HELIMED App.	Students are to read the research sheet and complete the short fill the blank exercise. This may be an opportunity for reading aloud or in small groups. Students are to identify the specialist equipment found on board a London's Air Ambulance MD902 Explorer helicopter.	Worksheets, teacher presentation



Activity	Subject Relevance					Activity Plan		
	Science	Design & Technology	Engineering	Maths	Geography	Teacher Activity	Student Activity	Materials required
<b>Sketching Maps with London's Air Ambulance</b>				x	x	Teacher to introduce the work of London's Air Ambulance, introducing the role of the pilot in navigation and landing, as well as the roles of school playgrounds as landing sites in urban areas. Teacher to introduce the concept of sketch mapping, and the use of measuring equipment in mapping the school playground. Teacher to discuss careers links as plenary. Teacher may wish to signpost to the free HELIMED App.	Students are to use tape measures and trundle wheels to produce a sketch map. The detail and expectations of outcome may be adapted to the ability of the pupils accordingly. Students should be encouraged to locate a suitable landing point for a helicopter and interpret its coordinates.	Worksheets, teacher presentation, tape measures, trundle wheels
<p>Each resource includes careers information relevant to the activity and a specific job role within London's Air Ambulance. Each resource includes an introduction and careers information from a real-life pilot and doctor, with the fundraising resources being introduced by the CEO. This has been included in order to offer STEM careers support, and to provide valuable real-life context for the activities. Additional information about STEM careers at London's Air Ambulance is available as part of the HELIMED app, which these resources support. The HELIMED app is available free of charge from the App Store and Google Play.</p>								

## Activity Presentations

Although each activity sheet comes with a presentation, it may be useful for teachers to read the background and history of the London's Air Ambulance in order for them to provide a deeper context for each activity. In addition, each sheet and presentation is introduced by a member of the London's Air Ambulance team to add a real-life context as well as a STEM careers focus to each activity.



## Helicopter Engineering with London's Air Ambulance Presentation Notes

<b>1</b>	<p><b>Learning objectives</b></p> <p>Students will learn:</p> <ul style="list-style-type: none"> <li>• How engineering helps London's Air Ambulance.</li> <li>• How the design features and materials of an MD902 Explorer helicopter help it to function.</li> <li>• To understand the design features of London's Air Ambulance uniform and how it helps paramedics, doctors and pilots.</li> </ul>		
<b>2</b>	<p><b>Introduction</b></p> <p>An introduction by London's Air Ambulance pilot, Dave.</p>		
<b>3</b>	<p><b>The MD902 Explorer helicopter</b></p> <p>This slide introduces the MD902 Explorer helicopter and its design features.</p> <ul style="list-style-type: none"> <li>• Two engines for safety in case one fails.</li> <li>• Rotorless tail for flying in urban areas, as tail rotor is dangerous in busy areas. This is known as a NOTAR (No tail rotor).</li> <li>• Lightweight body of aluminium and carbon fibre. This makes flying more fuel efficient.</li> <li>• Pitot tubes on the nose measure the helicopter's speed in knots and air temperature.</li> <li>• Skids for landing on soft surfaces. These are made of steel as these must bear the whole weight of the helicopter.</li> <li>• Space inside for two pilots and a medical team of a specialist trauma doctor and paramedic, as well as their equipment.</li> </ul>		
<b>4</b>	<p><b>Modified Interior</b></p> <p>This slide introduces the MD902 interior. The interior is specially modified. It has a medical grade floor for cleanliness, and 176kg of medical equipment including everything needed for open heart surgery, blood transfusions, chest drains and other procedures not normally performed outside of hospital.</p>		
<b>5</b>	<p><b>Uniforms</b></p> <ul style="list-style-type: none"> <li>• This slide introduces the uniforms.</li> <li>• Pilots, paramedics and doctors wear flame-retardant, reflective, high visibility nomex jumpsuits that are not only hard-wearing but keep them safe, visible and comfortable in dangerous environments.</li> <li>• Steel cap boots protect the feet and are adjustable and quick to put on, whilst an array of loops and belts allow easy carrying of medical equipment.</li> <li>• Knee-pads protect the knees and shins whilst doctors and paramedics treat casualties.</li> </ul>		
<b>6</b>	<p><b>Rapid Response by Road</b></p> <p>This slide introduces the rapid response cars. To ensure 24/7 cover for London, the MD902 helicopter is replaced by high performance Skoda Octavia estate cars after dusk or in adverse weather conditions. These are navigated by doctors and driven by paramedics after special training for driving in blue light conditions. Click on image of car to watch a short video.</p> <table border="0" style="width: 100%;"> <tr> <td style="vertical-align: top;"> <p>London's Air Ambulance serves:</p> <ul style="list-style-type: none"> <li>• 600 square miles</li> <li>• 10 million people</li> </ul> <p>The average flight time is 6 minutes.</p> </td> <td style="vertical-align: top;"> <p>Average traffic speed</p> <ul style="list-style-type: none"> <li>• Normal traffic is 9mph</li> <li>• Emergency vehicles: 20mph</li> </ul> </td> </tr> </table>	<p>London's Air Ambulance serves:</p> <ul style="list-style-type: none"> <li>• 600 square miles</li> <li>• 10 million people</li> </ul> <p>The average flight time is 6 minutes.</p>	<p>Average traffic speed</p> <ul style="list-style-type: none"> <li>• Normal traffic is 9mph</li> <li>• Emergency vehicles: 20mph</li> </ul>
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<b>7</b>	<p><b>Activity &amp; Careers</b></p> <p>This slide introduces the activity sheet and offers additional information for those wishing to follow a career in STEM focusing on Dave, a London's Air Ambulance pilot.</p> <p>Students can also download the HELIMED App to support their learning, available on iPhone and Android.</p>		



## Navigation with London's Air Ambulance Presentation Notes

### 1 Learning objectives

Students will learn:

- How London's Air Ambulance navigates
- How to use a map to work out bearings
- How to use the controls in the cockpit of a helicopter

### 2 Introduction

An introduction by London's Air Ambulance Pilot, Dave.

### 3 Inside the Cockpit

This slide introduces the cockpit and controls of an MD902 Explorer helicopter. Helicopters are very different from controlling a car. They can rotate left or right, tilt at different angles and fly at different heights. The controls are:

- Cyclic control stick - controls the tilt and acceleration in any direction by tilting the rotor blades
- Anti-torque pedals - these can turn the helicopter 360° using the tail
- Collective lever - changes the angle of all blades together. You can twist the collective lever to control the throttle – this level controls the speed of the rotors.
- The control panel and headset - give the pilot all the information that they need to help them fly, including helicopter speed and wind speed.

### 4 Flying with bearings

A class activity introducing bearings.

Answers: a) East = 090° b) South = 180° c) West = 270° d) North East = 045°  
e) South West = 225°

### 5 Activity & Careers

This slide introduces the activity sheet and offers additional information for those wishing to follow a career in STEM focusing on Dave, a London's Air Ambulance Pilot.

Students can also download the HELIMED App to support their learning, available on iPhone and Android.



## Financing London's Air Ambulance Presentation Notes

### 1 Learning objectives

Students will learn:

- How London's Air Ambulance funds itself
- How to use percentages to work out real life number problems
- How to calculate the amount of fuel used in a real-life air ambulance mission

### 2 Introduction

An introduction by Jonathan Jenkins, Chief Executive Officer for London's Air Ambulance.

### 3 Analysing Income

This slide introduces the different funding streams that help to finance London's Air Ambulance. London's Air Ambulance is a charity, and therefore relies on donations. It receives some funding from the Government, but mostly relies on charitable donations and activities and commercial income to keep operational.

Incorporated is a question led activity to help students to analyse the chart.

Answers: a) commercial, b) collections, c) 5%

### 4 Task: Raising Funds

This slide introduces fundraising, an important income stream for London's Air Ambulance which relies heavily on support from individuals, businesses and organisations in London. You might be raising money at your school.

This slide incorporates a 5 minute activity for groups or individuals to come up with as many fundraising ideas as they can, presented as a mind map.

### 5 Calculating Income

This slide introduces a worked example of calculating the amounts raised from each stream using percentages and the total income. This is useful to help with the worksheet activities.

### 6 Outgoings

This slide examines fuel costs as a major outgoing, one of the many costs involved is fuelling the helicopters. No fuel is kept on site at the Helipad for safety reasons, however London's Air Ambulance can refuel at four locations across the capital.

There is an example fuel calculation problem.

Answer: 42 litres

### 7 Activity & Careers

This slide introduces the activity sheet.

Students can also download the HELIMED App to support their learning, available on iPhone and Android.





## Medical Biology with London's Air Ambulance Presentation Notes

### 1 Learning objectives

Students will learn:

- What types of care are offered by London's Air Ambulance
- About the organs and tissues that help us to breathe and circulate oxygen
- About the specialist equipment carried by London's Air Ambulance

### 2 Introduction

An introduction by London's Air Ambulance doctor, Gareth.

### 3 Pre-hospital care

This slide outlines the types of injury that London's Air Ambulance monitors. London's Air Ambulance monitors all London 999 calls, and responds to those with critical injuries.

These often involve injury to the circulatory or respiratory systems, the main organ systems by which oxygen is breathed in and circulated around the body.

On average, five patients a day require the services of London's Air Ambulance.

### 4 Circulatory System

This slide outlines the structures and functions of the circulatory system. The circulatory system consists of the heart as well as veins, arteries and capillaries, taking oxygenated blood from the lungs in arteries to every cell in the body for respiration. Severe bleeding could cause a lack of oxygen to the brain and over 40% loss could cause death.

London's Air Ambulance carry the equipment not only to perform open heart surgery (thoracotomy), to fix a punctured heart and perform heart massage, but they also carry a blood transfusion kit and a special balloon to plug broken arteries and stop patients bleeding to death - a procedure called REBOA.

### 5 Respiratory System

This slide aims to outline the structures and functions of the respiratory system. The respiratory system is vital to providing the oxygen needed for humans to survive. As the diaphragm and intercostal muscles pump air in through the trachea, it splits at the bronchi, and then branches off into the bronchioles. Oxygen then enters the blood at the air sacs.

A punctured lung or a broken rib cage from a fall or car accident could be fatal. London's Air Ambulance can install a chest drain to remove trapped air or leaked blood from the pleural cavity, as well as provide artificial breathing through a ventilator.

### 6 Specialist Equipment

This slide recaps on the specialist equipment used by London's Air Ambulance to treat damage to the respiratory or circulatory systems. Note that patients are rarely transported by air. The primary purpose of London's Air Ambulance is to deliver the advanced trauma care to the patient's side. The time critical procedures are often performed at the scene and the patient is then taken to the hospital by road ambulance.

### 7 Activity & Careers

This slide introduces the activity sheet and offers additional information for those wishing to follow a career in STEM focusing on Gareth, a London's Air Ambulance doctor.

Students can also download the HELIMED App to support their learning, available on iPhone and Android.



## Sketching Maps with London's Air Ambulance Presentation Notes

<b>1</b>	<b>Learning objectives</b> Students will learn: <ul style="list-style-type: none"><li>• How London's Air Ambulances land safely</li><li>• How to create a sketch map</li><li>• How to work out if your school could host a London's Air Ambulance landing</li></ul>
<b>2</b>	<b>Introduction</b> An introduction by London's Air Ambulance pilot, Dave.
<b>3</b>	<b>Landing Safely</b> This slide outlines the minimum landing area for a helicopter. London's Air Ambulances are built for urban environments and can land in relatively tight spaces. Their steel skids also allow them to land on soft surfaces spreading out the weight of the helicopter. A London's Air Ambulance helicopter can land in an area as small as a tennis court, but ideally needs a 25m x 25m area.
<b>4</b>	<b>Task: Drawing Sketch Maps</b> This slide outlines the task and provides students with an example. Students are to use the grid to draw their own sketch maps, using observations and some measuring equipment. Students should aim to find the most suitable area for a helicopter to land around or on their school.
<b>5</b>	<b>Activity &amp; Careers</b> This slide introduces the activity sheet and offers additional information for those wishing to follow a career in STEM focusing on Dave, a London's Air Ambulance pilot.  Students can also download the HELIMED App to support their learning, available on iPhone and Android.



## Worksheet Answers

Provided here are answers to the HELIMED STEM learning worksheets.

### Module 1: Helicopter Engineering

- **Activity 1:** A, G, B, E, C, D, F
- **Activity 2:** Any three of the following:
  - The suit is flame-proof
  - The suit is high visibility
  - The kneepads protect the shins and knees of paramedics or doctors
  - The rubber gloves protect from infection
  - The boots protect paramedic's feet from injury
- **Activity 3:** Any reasonable answer, e.g. Carbon Fibre, GRP, Kevlar

### Module 2: Navigation

- **Activity 1:**

Casualty	Borough	Coordinates	Bearing	Distance (km)
1	Hillingdon	C14	285°	9.75
2	Sutton	J5	014°	6
3	Enfield	L17	000°	5.25
4	Richmond upon Thames	G9	250°	6
5	Havering	S15	066°	7.5
6	Bromley	O3	160°	8.25
7	Camden	K12	300°	2.25
8	Newham	O12	068°	3

### Module 3: Financing

- **Activity 1:**

Gifts in kind	2%	£180,000
Institute	2%	£180,000
Commercial	48%	£4,320,000
Barts Health NHS Trust	11%	£990,000
Events	5%	£450,000
Collections	1%	£90,000
Corporate Giving	5%	£450,000
Individuals	23%	£2,070,000
Trusts & Foundations	3%	£270,000

- **Activity 2:** Top left = £5,670,000 Top right = £13.5million Bottom left = 42 litres Bottom right = 66 litres

### Module 4: Medical Biology

- 1 Oxygen is vital to your survival. Oxygen is absorbed by **air sacs** in your **lungs** and transported around your body in your **arteries**. Your **heart** pumps the blood to every **cell** in your body for **respiration**.
- 2 Ventilator, REBOA, Chest Drain, anaesthetic

### Module 5: Sketch Mapping

- **Activity 1:** Mark according to student progression
- **Activity 2:**
  - 1 = a tennis court or 25m x 25m,
  - 2 = Piccadilly Circus, Trafalgar Square, Horse Guards Parade.
  - 3 = Accept any accurate or sensible answer,
  - 4 = Accept any accurate calculation or sensible answer



## Curriculum Links

This section highlights the cross curricular links for each activity. The relevant link is quoted in its entirety along with its section heading.

## KS3 National Curriculum for England & Wales

Activity	Subject Relevance*					Curriculum Subject Content Links
	Science	Design & Technology	Engineering	Maths	Geography	
<b>Helicopter Engineering with London's Air Ambulance</b>		x	x			<p><b>Design &amp; Technology (Incorporating Engineering):</b></p> <p><b>Evaluate</b></p> <ul style="list-style-type: none"> <li>analyse the work of past and present professionals and others to develop and broaden their understanding</li> <li>investigate new and emerging technologies</li> <li>understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists</li> </ul> <p><b>Technical knowledge</b></p> <ul style="list-style-type: none"> <li>understand and use the properties of materials and the performance of structural elements to achieve functioning solutions</li> <li>understand how more advanced mechanical systems used in their products enable changes in movement and force</li> </ul>
<b>Navigation with London's Air Ambulance</b>			x	x	x	<p><b>Maths</b></p> <p><b>Geometry and measures</b></p> <ul style="list-style-type: none"> <li>draw and measure line segments and angles in geometric figures, including interpreting scale drawings</li> <li>derive and use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); recognise and use the perpendicular distance from a point to a line as the shortest distance to the line</li> <li>describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric</li> <li>interpret mathematical relationships both algebraically and geometrically</li> </ul>



Activity	Subject Relevance*					Curriculum Subject Content Links
	Science	Design & Technology	Engineering	Maths	Geography	
						<p><b>Geography</b></p> <p><b>Key Aim</b></p> <ul style="list-style-type: none"> <li>communicate geographical information in a variety of ways, including through maps, numerical and quantitative skills and writing at length</li> </ul> <p><b>Human and physical geography</b></p> <ul style="list-style-type: none"> <li>understand, through the use of detailed place-based exemplars at a variety of scales, the key processes in:               <ul style="list-style-type: none"> <li>human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors; and the use of natural resources</li> </ul> </li> </ul> <p><b>Geographical skills and fieldwork</b></p> <ul style="list-style-type: none"> <li>build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field</li> <li>interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs</li> </ul>
<b>Raising Funds with London's Air Ambulance</b>				x		<p><b>Maths</b></p> <p><b>Ratio, proportion and rates of change</b></p> <ul style="list-style-type: none"> <li>solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics</li> <li>use compound units such as speed, unit pricing and density to solve problems</li> </ul> <p><b>Number</b></p> <ul style="list-style-type: none"> <li>define percentage as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express 1 quantity as a percentage of another, compare 2 quantities using percentages, and work with percentages greater than 100%</li> <li>interpret fractions and percentages as operators</li> <li>use standard units of mass, length, time, money and other measures, including with decimal quantities</li> <li>use a calculator and other technologies to calculate results accurately and then interpret them appropriately</li> </ul>



Activity	Subject Relevance*					Curriculum Subject Content Links
	Science	Design & Technology	Engineering	Maths	Geography	
Medical Biology with London's Air Ambulance	x		x			<p><b>Design &amp; Technology (Incorporating Engineering):</b></p> <p><b>Evaluate</b></p> <ul style="list-style-type: none"> <li>investigate new and emerging technologies</li> <li>understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists</li> </ul> <p><b>Science</b></p> <p><b>Gas exchange systems</b></p> <ul style="list-style-type: none"> <li>the structure and functions of the gas exchange system in humans, including adaptations to function</li> <li>the mechanism of breathing to move air in and out of the lungs, using a pressure model to explain the movement of gases, including simple measurements of lung volume</li> </ul>
Sketching Maps with London's Air Ambulance				x	x	<p><b>Geography</b></p> <p><b>Key Aim</b></p> <ul style="list-style-type: none"> <li>communicate geographical information in a variety of ways, including through maps, numerical and quantitative skills and writing at length</li> </ul> <p><b>Geographical skills and fieldwork</b></p> <ul style="list-style-type: none"> <li>interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs</li> </ul> <p><b>Maths</b></p> <p><b>Geometry and measures</b></p> <ul style="list-style-type: none"> <li>derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders)</li> <li>calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes</li> <li>draw and measure line segments and angles in geometric figures, including interpreting scale drawings</li> </ul>

\*This guide uses the KS3 National Curriculum for England & Wales