one million interactions

STEM AMBASSADORS

Space sector STEM Ambassador guide

Created by ESERO-UK, the largest provider of space education and careers support in the UK.

One million interactions is an initiative to attract more young people into science, technology, engineering, mathematics (STEM) and the space industry. Supporting STEM Ambassadors to deliver successful interactions with young people, inspiring and encouraging the next generation of space professionals.

Contents

What is one million interactions?

One million interactions initiative has been launched in order to attract more young people into science, technology, engineering and mathematics (STEM) and the space industry, which generates billions of pounds for the economy and is creating 42,000 jobs.

This initiative launched by the UK Space Agency, ESERO UK, STEM Ambassadors and The Careers and Enterprise Company, has pledged to deliver one million interactions per year with young people to inspire and encourage the next generation of space professionals.

STEM Ambassadors, volunteers from a broad range of jobs and backgrounds, who are passionate about inspiring young people to pursue STEM studies and careers, are being sought from the space industry to engage with young people to demonstrate the connection between the STEM subjects they study and the potential careers in space travel and exploration.

"There are an enormous variety of careers available in the space sector," says Astronaut Tim Peake, "and during my mission to the International Space Station I was part of a team of thousands of people working behind the scenes to make it possible.

"As an ambassador for space careers in the UK I have seen the power of professionals sharing their experiences with young people. This scheme is a great way of helping those young people take their first steps towards an exciting career in space."

Thank you for volunteering as a STEM Ambassador. By giving your time and sharing your enthusiasm for science, technology, engineering and mathematics (STEM), you are making a measurable difference to young people across the UK. You are helping ensure that every young person can understand the value and relevance of STEM subjects to them and their lives in an increasingly technological world. You are also helping inspire more of those young people to consider careers using STEM that will help us all lead healthy, productive and sustainable lives.

Have you signed up to one million interactions?

1 / Register online

Go to stem.org.uk/register and select STEM Ambassador.

2 / Register on the Space Ambassador scheme

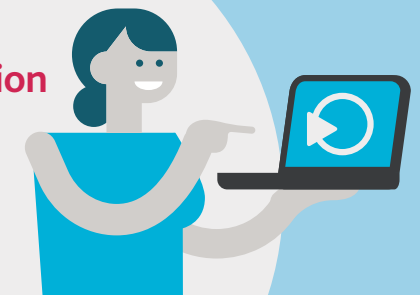
- When registering, under the 'Skills and qualification' tab find the 'Schemes Participation' box
- Search for and select 'One Million Interactions' to add this scheme
- If you're happy to, tick the box to share your details with any schemes so you can be contacted about additional training opportunities and resources.

3 / Connect with your local STEM Ambassador Hub

Once registered you will automatically be linked to your local Hub who will be your main point of contact for any questions.

4 / Online induction

Find out what to expect as a STEM Ambassador. A link will be sent from your STEM Ambassador Hub.



5 / Apply for a free DBS or PVG check

Essential for working with young people, this will also include an ID check by someone from an approved profession or your local Hub.

6 / Begin volunteering

Once you've received your approved DBS or PVG certificate you're ready to go! You'll receive your STEM Ambassador badge when you've done your first activity.

YOU COULD START BY:

- Signing up for an activity with a teacher or youth leader
- Improving your skills with our free online courses on FutureLearn
- Offering an activity to teachers and youth leaders near you

Go to stem.org.uk/esero/inspiring-next-generations for more information

What are the benefits of space sector One million interactions?

Pupils:

- pupils can apply skills and knowledge from the curriculum to real-world situations
- pupils can work scientifically, think creatively, reason, find problems for themselves and try out ideas to solve them
- gives pupils access to an inspiring role model
- provides an insight into careers in science, technology, engineering and maths (STEM within the space sector)
- builds pupils' science capital

Teachers and schools:

- brings the curriculum to life for pupils, helping them to see the real-life application of what they are learning in school
- brings in outside STEM expertise

Space sector STEM Ambassadors:

- be able to make a genuine difference in the lives of pupils, inspiring the next generation of scientists, technologists, engineers and mathematicians
- gain a sense of achievement as you share your experience with a new audience
- develop your own careers skills, especially communication, and give your confidence a boost

About science capital

Real-life science and contact with adults working in the STEM industry, helping to build pupils' science capital, which can help them to consider a rewarding future in a STEM career, and see that science can not only be fun, but also 'for them'.

Before your session

This may be the first time you have worked with young people or it may be some time since your last activity, so this section will support you with information about how to prepare for your session.

Know your audience

See section six for information about the curriculum for each year group, and the prior knowledge that pupils are likely to have. Also section seven to understand what the audience may misunderstand about space.

Talk to the teacher

Talk to the teacher before the session to run through the overview of what you will be covering.

Ask about what pupils will already know:

- does the school follow the national curriculum (for England, Northern Ireland or Wales or the curriculum for excellence (Scotland)
- have pupils covered the topics of space yet, or will they soon? Is there anything that the teacher would like you to focus on

Find out as much as you can about the pupils:

- are there any behaviour routines that you should know, e.g. the best way to get the class's attention, and is there a reward scheme for positive behaviour
- are there any special education or behaviour needs that you need to be aware of
- do pupils have any relevant allergies

Working with young people

Asking the right questions

The right questions will help you to involve pupils, establish and unpack their ideas, generate and confirm new understanding and apply this in new ways:

- ask one question at a time
- give pupils time to think before inviting answers
- ignore calling out and praise pupils who use the agreed on rule to contribute
- avoid multiple questions at once, leading questions or trick questions
- try to include a balance of open questions (with more than one correct answer) and closed questions (with one correct answer)
- avoid jargon and use curriculum vocabulary which pupils will be familiar with (see 'What should pupils know and understand?')
- accept questions at any time. Either answer them straight away or agree to answer them later in the session

Making it personal

- what scientific question could we ask, to find the best solution to this
- what could we investigate, to answer this question
- help pupils share their own real life and scientific experiences that are relevant
- encourage pupils to use scientific language, such as the correct terms and units

During investigations (if applicable):

As you circulate around the groups during the investigations, ask questions to help pupils reflect on what they are doing:

- what are you going to do during this investigation? / what method are you going to use?
- what are you trying to find out? / what scientific question are you answering?
- how are you making this a fair test
- what things (variables) are you going to change
- what things (variables) are you going to measure or compare
- what things (variables) are you going to keep the same
- what will you use to make your measurement or help you compare

Background information on the space sector

Although you work in space, we know that even more information on the sector will help promote it to young people. This section gives a quick overview of the size and importance of the space industry and just how encompassing it is to everyday life.

Fast Growing

The space sector is one of the fastest growing sectors of the UK economy. In the last four years it's grown at a rate of 6.6% compared to 1.7% for the rest of the economy, 30,000 new jobs will be created in the sector by 2030.

World Leading

The UK is a world leader in space technology and science, and UK teams are involved in dozens of missions from spacecraft orbiting other planets to the many satellites monitoring the Earth. The UK is also a leader in the application of space derived data, and has become a very attractive place to incubate or start a new business.

"Space is not only about pushing the boundaries of human knowledge, it is a rapidly growing sector of our economy which plays a key role in our modern industrial strategy, promotes global Britain and ensures our national security."

Business Secretary Greg Clark, June 2019

All Encompassing

Space technology affects almost every part of our lives from weather forecasting and satellite TV, to global communications and navigation. A career in the space industry could include any of these areas and much more.

You might be working on a new satellite or developing technology to map a distant planet. You could be helping to make new discoveries about our solar system or using satellites to study pollution on Earth. You might be connecting the world's most remote communities or helping aid agencies reach a disaster zone.

www.spacecareers.uk

Examples of future space careers

The space industry is growing fast and new jobs are created every day. Below are just a few of the careers in the sector – it's not just about astronauts!

www.spacecareers.uk

Planetary scientist

– studies planets and moons to try to understand what they are made of and how they are formed.

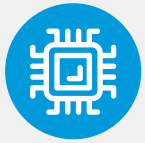
Space medic

– doctors and scientists who study the effect of being in space on the human body, viruses and medicines.

Space engineer

– to design components, software and systems improving on current designs and creating totally new ones.

Technician



– technicians are at the forefront of building and testing spacecraft and space systems, a hands on career!

Earth observation scientist

– use remote sensing to gather images and data about the Earth which can then be used to learn more about the natural and built environment and the changes that are taking place.

Space lawyer

– space law governs all space-related activities. It covers things like the protection of planets from human contamination, to the rescue of stranded astronauts.

Where does space fit in to the curriculum?

It is important to understand where the teaching of space fits in to a young person's education. You want to make sure that you are pitching your session at the correct academic level. Don't forget the teacher can support you on making sure your session suits the age group you are working with.

England: do all schools follow the national curriculum?

The national curriculum is a set of subjects and standards used by primary and secondary schools so children learn the same things. It covers what subjects are taught and the standards children should reach in each subject. Some types of school, like academies and private schools, don't have to follow the national curriculum, though academies must teach a broad and balanced curriculum including English, maths, science and religious education.

England: how does space fit in with the English national curriculum?

Age 5-6 students should be taught to:

- observe changes across the four seasons
- observe and describe weather that is associated with the seasons and how day length varies

Age 9-10 students should be taught to:

- describe the movement of the Earth, and other planets, relative to the Sun in the solar system
- describe the movement of the Moon relative to the Earth
- describe the Sun, Earth and Moon as approximately spherical bodies
- use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky
- explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object

Age 11-14 year students should be taught to examine physics:

- gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and sun (qualitative only)
- our sun as a star, other stars in our galaxy, other galaxies
- the seasons and the Earth's tilt, day length at different times of year, in different hemispheres
- the light year as a unit of astronomical distance

Age 14-16 year students should be taught to examine physics:

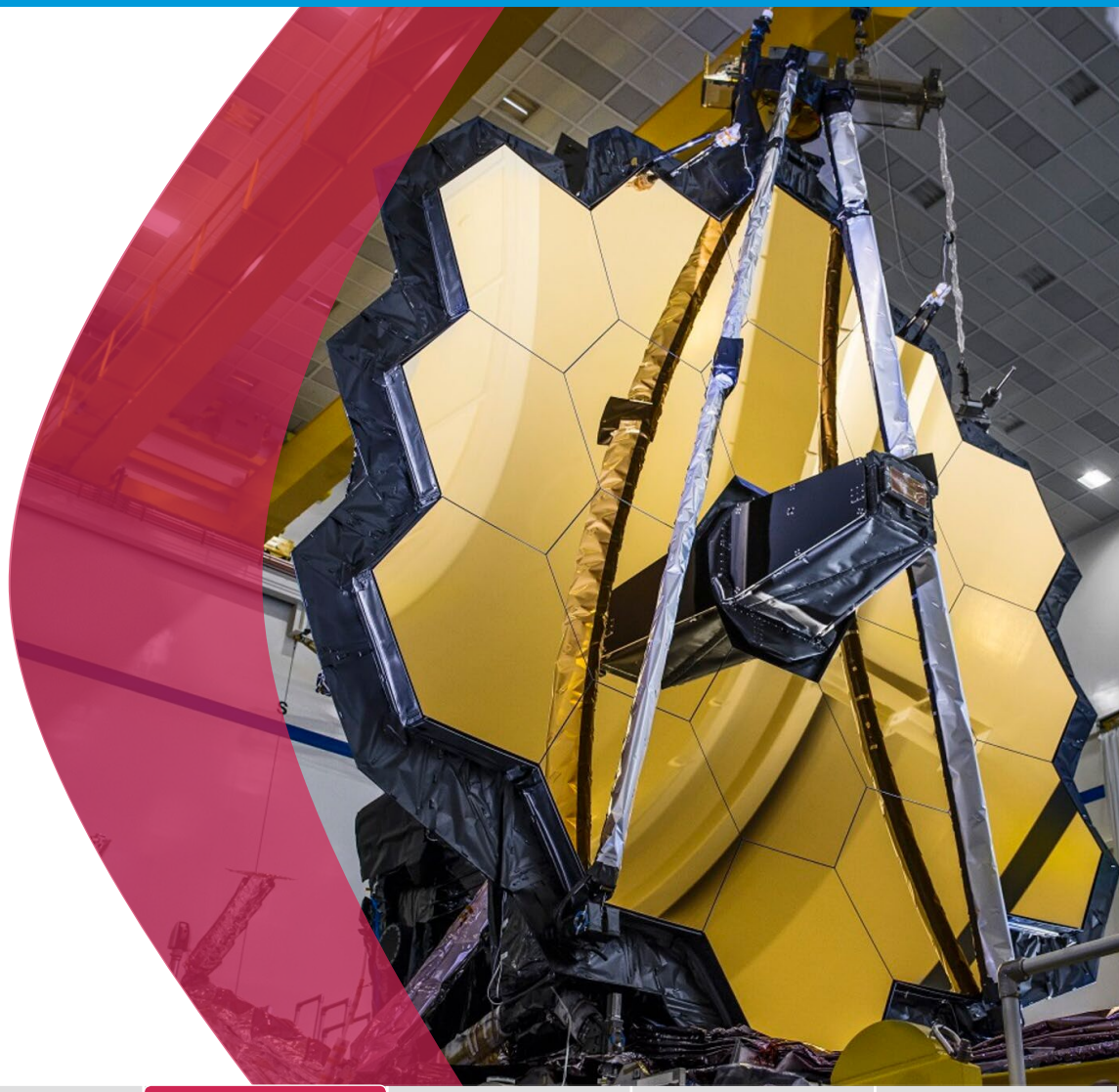
- the main features of the solar system

Scotland: how does space fit in with the Scottish curriculum for excellence?

PLANET EARTH

	Early	First	Second	Third	Fourth
Space Learners develop their understanding of the Earth's position within the universe while developing a sense of time and scale. They develop their understanding of how our knowledge of the universe has changed over time and explore ideas of future space exploration and the likelihood of life beyond planet Earth.	I have experienced the wonder of looking at the vastness of the sky, and can recognise the sun, moon and stars and link them to daily patterns of life. SCN 0-06a	By safely observing and recording the sun and moon at various times, I can describe their pattems of movement and changes over time. I can relate these to the length of a day, a month and a year. SCN 1-06a	By observing and researching features of our solar system, I can use simple models to communicate my understanding of size, scale, time and relative motion within it. SCN 2 06a	By using my knowledge of our solar system and the basic needs of living things, I can produce a reasoned argument on the likelihood of life existing elsewhere in the universe. SCN 3-06a	By researching developments used to observe or explore space, I can illustrate how our knowledge of the universe has evolved over time. SCN 4-06a

Wales: how does this session fit in with the Welsh curriculum?



Curriculum 2022 has some generic statements:

Learners need to experience:

- motion in a range of contexts with opportunities to measure, describe and quantify observations
- how forces and motion apply to celestial bodies in space

Learners need to know:

- the relationship between force and motion

Learners need to be able to:

- describe the effects of forces on the motion of objects

Northern Ireland: how does this session fit in with the Northern Irish curriculum?

FOCUS: PLACE

From (Foundation Stage) Pupils are learning the following:	Towards (Key Stage 1) Pupils are learning the following:	To (Key Stage 2) Pupils are learning the following:
There are objects in the sky around our earth - the sun, moon and stars. PL4	Our earth is a planet, and there are other planets in the solar system. PL1	The earth is one of eight planets that travel around (orbit) the sun in our solar system. PL4
Humans learn about space by observing it from the earth or going into space itself. PL4	The sun is our closest star and gives heat and light to the earth. PL3	The moon gives out no light of its own but reflects the sun's light. PL4
	The moon appears to change its shape over the period of about a month. PL4	A year is the time taken for the earth to orbit the sun. PL4
		The orbit of the earth around the sun causes our seasons. ME1
		The moon orbits the earth every 28 days (approximately one month). ME1
		The earth spins once every 24 hours on its axis and gives us day and night. ME1

Northern Ireland (continued)

Generic statements for KS3 and KS4 in terms of science content, examining the topic of the solar system and universe also includes:

Media awareness: space exploration related to technological developments in the news.

Ethical awareness: is the amount spent on space research justified?

Economic awareness: consider the advantages of space exploration and research:

- satellite TV
- satellite navigation
- Google Earth
- mobile phones
- weather forecasting

Education for sustainable development: the use of satellites to monitor environmental factors, for example the integrity of ozone layer.

Common misconceptions in space

It is important to recognise what young people understand about space and what they might think is correct. The following pages highlight some of the misconceptions young people have about space.

Primary level

- the Earth centred solar system. Sun revolves around Earth
- day and night are caused by the Sun moving around the Earth once a day
- the Moon is a source of light
- seasons are caused by changes in distance from Earth to the Sun
- moon phases are caused by Earth's shadow
- the Moon and stars are only there at night
- there is no gravity in space (that's why astronauts float)
- objects always fall in the same direction (i.e. down in Northern Hemisphere and up in Southern Hemisphere)
- heavier objects fall faster

Secondary level

- brighter objects in the sky are closer
- confusion between Moon phases and eclipses
- seasons are caused by the varying distance between the Sun and Earth – either because of the orbit or the axial tilt bringing it closer
- stars are part of the solar system
- all stars are the same
- stars are much smaller than the Sun
- the Milky Way is the only galaxy
- all galaxies are the same

Resources

These resources are examples from the ESERO-UK collection.
More can be accessed online through the ESERO-UK website.

Space STEM Ambassador resources for primary:

The Mars mission: building on Mars
If humans are to live on Mars , they will need shelter to survive its harsh conditions as well as a supply of water, oxygen, food and energy.

Moon Shelter
Analyse the importance of having shelter for protection and compare the environmental conditions on Earth and in space.

James Webb Space Telescope: vibration design testing
Build a model telescope, carry out vibration tests, then modify to ensure that they can withstand a simulated launch.

Space STEM Ambassador resources for all ages:

Bionic Hand
The development of bionic hands that can be remotely operated can help to complete tasks which would be difficult or tiring for a human.

Space materials case
Investigate properties of materials and decide which would be suitable for use on a spacecraft. The case is available for use from your local STEM Ambassador Hub.

Mission X resources
Physical and scientific activities linked to how the body works on earth and in space and the impact of health and nutrition.

Space STEM Ambassador resources for secondary:

Survive an asteroid impact
Investigating the science involved in surviving an asteroid impact.

3... 2... 1... Lift off! – building your own paper rocket
Design and build your own paper rockets and launch them.

Landing on the Moon - Planning and designing a lunar landing
Plan, design, and build a landing module to secure the survival of the crew (in the form of an egg-naut) landing on the Moon.

Technical textiles
A collection of resources inspired by space.

Role models in the space sector

Suzie Imber

Education:

A Levels:	Maths, further maths, physics, chemistry
University:	MSc physics at Imperial College London, PhD University of Leicester

Career story:

Summer placements:	NASA Goddard Space Flight Centre
Roles:	Research Scientist for NASA, Research Scientist at the University of Leicester
Current role:	Associate Professor in Space Physics at the University of Leicester

Why space and any career highlights?

I love working in space science because we're always pushing the boundaries of our capabilities. We're constructing spacecraft that go to new regions of the solar system, often having to overcome huge engineering and technical hurdles and in doing so we solve the key gaps in our understanding of how our solar system works. There's no subject like it!

Libby Jackson

Education:

GCSES	5 A*s, 2 A's, 3 B's
A Levels:	Physics (A), maths (A), further maths (B), music (B)
University:	BSc physics (2:1) Imperial College London, MSc astronauts & space engineering, Cranfield University

Career story:

Work experience:	Johnson Space Centre in Houston
University summer placement:	Astrium (now Airbus)
Previous roles:	Satellite Control Centre at Airbus, Instructor for the flight control team in Munich at Airbus and Education Programme Manager for Tim Peake's expedition at the UK Space Agency
Current role:	Human Exploration Programme Manager at the UK Space Agency

Why space and any career highlights?

Space was always a fascination and interest of mine, I found out about Space School when I was about 15/16 which really started my career in the sector. I thought you had to work in America for NASA to work in space, so was excited to find I could work in the UK.

Career highlights would have to be the day that Tim Peake went to space. To find myself waiting for Tim to dock at the ISS, being asked for expert opinion on the events of the day and having heard 3,000 or so school children cheer Tim on his way was quite an amazing moment.

Credit: German Zoeschinger

Chris Toth

Education:

GCSEs: Mainly Bs

A Levels: Physics, biology, chemistry and maths

University: BSc physics, the University of Hull

Career story:

I graduated and decided I wanted to be a teacher, I completed a year in teaching and realised teaching wasn't for me.

I needed a change, but wasn't sure which direction to go in. I decided to do top up courses through the job centre which included most importantly, a forklift truck driving license course.

I decided to talk to labs directly for jobs. One lab weren't interested in my physics degree but were most taken by the fact I had a forklift driver's license and offered to work for free for 8 weeks which I did. They really appreciated my work and offered me a job as a technician and I've been here ever since and really enjoying it.

My path was very unconventional but whatever you're interested in doing, however obscure, just pursue it!

Current role: Lab technician at Boulby Mine whilst also pursuing a PhD part time with Sheffield university into neutrino physics at the University of Leicester

Abigail Hutty

Education:

A Level:	Design technology, maths, physics, French
University:	Mechanical engineering MEng – University of Surrey

Career story:

Placement Year:	Surrey satellite technology as part of my degree
Graduate role:	Airbus Graduate Scheme, rotating various engineering roles and am now working on the new Mars rover mission

Why space and any career highlights?

The buzz of sending stuff to explore new planets and discover new things about our solar system and our universe at large! In my job I've been able to design board launching and then watch those satellites at night, it's amazing to think something that was once just an idea in my mind has been manufactured and will one day be on another planet!

Space careers videos

A collection of videos, from the European Space Education Office (ESERO-UK), presents a cross-section of people with careers in UK space industry.

The majority of the videos include a version that can be used in the primary classroom and a version to use in secondary schools or colleges.

Many of the videos include a simple challenge, aimed at pupils or students watching the video.

They could be used as part of a lesson in one of the STEM subjects, or lessons focusing on careers.

Space careers videos


Photo: ESA

This guide has been created by ESERO-UK, the largest provider of space related STEM education and careers support in the UK.