



SPACE
INSPIRATIONS

A large, detailed image of a full moon in a dark, starry night sky. The bottom of the image shows the dark silhouettes of evergreen trees.

SPACE

**A RESOURCE BOOKLET FOR TEACHERS
AND STUDENTS TO EXPLORE THE EXCITING
WORLD OF SPACE AND SPACE CAREERS**

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SPACE EAST



WITH THANKS TO OUR SPONSORS



SPACE EAST

Space East is the UK's newest space cluster and brings together leaders from across industry, research and Government in the East of England to develop and champion exciting new opportunities in space technology.

The applications of space and satellite technologies stretch across the region's leading industries including food and agriculture, offshore wind, ICT & telecoms, advanced manufacturing & engineering, coastal & marine science, health & social care, transport & logistics. The East of England is home to many exciting businesses delivering advances in technologies and solutions such as artificial intelligence, 5G communications, microgravity R&D, agri-tech, life sciences and health tech.

For more information visit www.spaceeast.co.uk

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Hertfordshire **UH**



Exploring Space with Bayfordbury Observatory

Are your students asking endless questions about space? Do you want to give your students a science experience they will never forget? Look no further- Bayfordbury Observatory is here to take your students on an educational journey through the universe!

Visit Us:

Bring your students on a School Trip to Bayfordbury Observatory for an immersive experience they'll cherish. We offer curriculum-linked interactive talks, key stage relevant planetarium shows, and a tour of our telescopes with the opportunity to safely view the Sun's surface (weather permitting).

We Come to You:


If visiting us is a challenge, we'll bring the universe to your school with our mobile inflatable planetarium experience: Cosmos in the Classroom. From EYFS to A-Level, our awe-inspiring shows cater to all levels and can be customised for half days or full days.

Contact Us Today

Ready to offer your students an unforgettable experience that sparks curiosity and passion for science? Connect with Bayfordbury Observatory, where our experiences are led by astrophysics students or astrophysics experts skilled at engaging diverse audiences.

Get in Touch:

 <https://www.herts.ac.uk/bayfordbury/bayfordbury-observatory/visit-bayfordbury-observatory>

 e.riley@herts.ac.uk

 Lower Hatfield Rd, Bayfordbury, Hertford SG13 8LD



e2E is an established, leading UK independent space engineering consultancy, who've been providing specialist services and bespoke technical support and expertise primarily but not exclusively in the satellite communication industry since 1999. We have wide ranging capabilities that enable us to support the entire system life cycle of a space programme. Our work ranges from developing software for satellite operations, through integrating and testing new space systems and services, to providing policy and strategic advice to clients. From this perspective, we know the critical importance of having people with skills and knowledge to work on space systems, but also the dedication and enthusiasm to work in the sector. We are therefore committed to inspiring and giving young people the opportunity to experience what it is like to work as engineers in the space industry.

We are developing a series of STEM engagement activities to attract students into the space sector. Our targeted STEM ('Science, Technology, Engineering and Mathematics') events provide the opportunity to experience "A week in the life of a space engineer" and are packed with space related seminars, mission design projects and demonstrations.

Would you like to experience a career in space?

Contact our STEM Team to learn more about our experiences and events.

e2E-StemEvent@e2egroup.co.uk

www.e2egroup.co.uk



Inspiring the next generation

Space Inspirations 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.

SPACE FOR YOU RECORDING

[LISTEN IN AS OUR SPACE EXPERTS SPILL THE COSMIC BEANS ON THEIR OUT-OF-THIS-WORLD CAREERS! SHARING THEIR EXPERIENCE OF CAREERS IN THE SPACE INDUSTRY, SKILLS NEEDED AND CAREER ROUTES TO INSPIRE AND INFORM YOUR STUDENTS. FOR YEARS 9-13, BUT ALL WELCOME TO LISTEN TO THE RECORDING HERE.](#)



WHAT IS SPACE ?



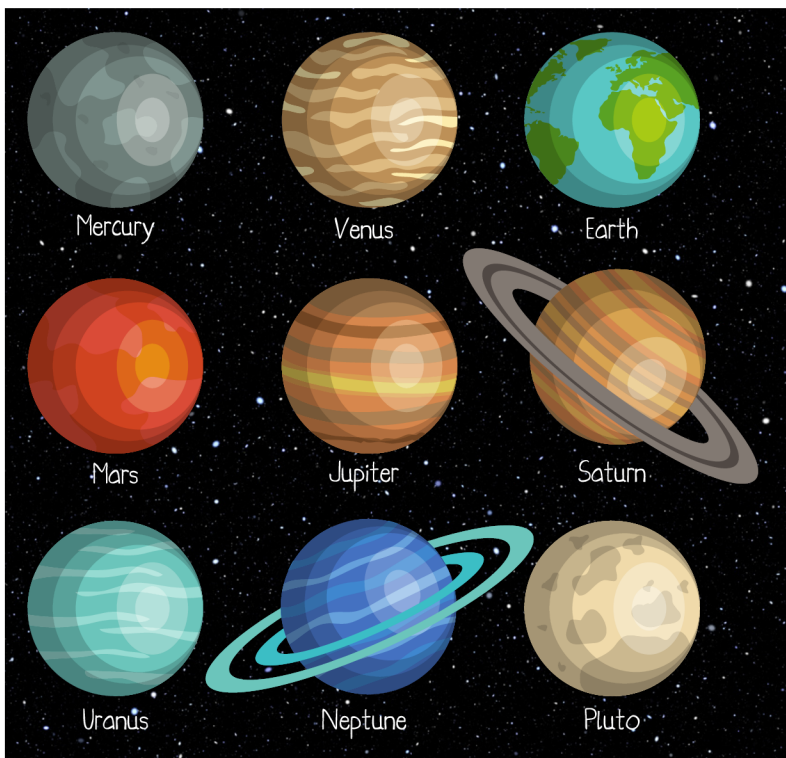
From Earth, outer space is thought to be approximately 62 miles above sea level at what is known as the Kármán line. This is an imaginary boundary at an altitude where there is no appreciable air to breathe or scatter light. Passing this altitude, blue starts to give way to black because oxygen molecules are not in enough abundance to make the sky blue.



No one knows exactly how big space is. It's difficult to determine because of what we can see in our detectors. Long distances in space are measured in "light-years," which is the distance it takes for light to travel in a year (roughly 5.8 trillion miles). Additionally, astronomers are not 100% sure that our universe is the only one that exists. This means that space could be a whole lot bigger than we even think.



Stars (like our sun) are immense balls of gas that produce their own radiation. They can range from red supergiants to cooling white dwarfs that are the leftovers of supernovas, or star explosions that occur when a big one runs out of gas to burn. These explosions spread elements throughout the universe and are the reason that elements such as iron exist.



A planet is a celestial body that orbits the sun, and is massive enough to have a nearly round shape, and has cleared its orbit of debris.

The current count orbiting Earth's sun is eight planets:

The inner, rocky planets are Mercury, Venus, Earth, and Mars. The outer planets are gas giants Jupiter and Saturn and ice giants Uranus and Neptune.

A new record for the number of people in space at once was reached on 25 May 2023. 20 people were in space simultaneously, with eleven people aboard the ISS, three on Tiangong, and six on SpaceShipTwo. 5 days later on 30 May, the record for the number of people in orbit simultaneously was broken as well, with 17 people in orbit at once; 6 people on Tiangong from Shenzhou 15 and 16, 7 people from Expedition 69 on the ISS as well 4 crew members from Axiom-2 also on the ISS.

https://en.wikipedia.org/wiki/2023_in_spaceflight



[CLICK HERE TO LISTEN TO SPACE
ENTHUSIASTIC CHRIS GRIFFITH TALK ABOUT
HER RESEARCH INTO ROCKS AND METERORITES](#)

[HEAR FROM SPACE EXPERT EMMA FORBES -LAIRD
ABOUT WHAT TO CONSIDER WHEN DESIGNING A
SPACE CRAFT
CLICK HERE](#)

SPACE CAREERS

There are some excellent career opportunities that space can offer, take a look at these out of this world careers below!

SCIENTIFIC RESEARCHER

As a scientific researcher you could work in the School of Earth and Environment. You could be using images taken by satellites to look the movement of structures such as railways, roads and gas lines as well as examining the movement of the Earth due to volcanic eruptions and earthquakes.

EMERGING TECHNOLOGY LEAD IN DIGITAL INTELLIGENCE

You could be looking at new technologies that advance the space industry. The possibilities are endless, you could show how image processing techniques used in the satellite industry can be used in the medical imaging. Imaging data has also been used to prevent illegal logging and to reduce the use of pesticides in agriculture.

ASTROBIOLOGIST

You could be investigating whether there is life on other planets, study life in extreme environments, such as in volcanoes or on the International Space Station.

SOFTWARE ENGINEER

Working at the UK Astronomy Technology Centre designing software for the James Webb Space Telescope. You could work on the mid infrared instrument which will look at the formation of galaxies in the early universe. By using coding in this job and explaining how you need to write algorithms to a fine level of detail to get the code right, this could be the perfect role for you.

SPACE LAWYER

As a Space Lawyer you will be using your skills and knowledge to advise satellite operators on the legal aspects of launching and operating a satellite in space. With the growth of more commercial satellite companies there is a demand for more lawyers to advise and write the rules governing space activities across the globe.

Dr Olly Bartlett

Lecturer in Remote Sensing and Geography

I use satellite imagery to monitor and research how the Earth's surface environments are responding to climate change.



What do you like most about your job?

For the science bit of my job, I love problem solving and using beautiful images of the Earth to answer research questions about how it is changing. Part of satellite imagery work (remote sensing) often requires field validation which involves going out to amazing natural places to check that what we are measuring from space is what we see on the ground. In the teaching part of my job, I like training others in the skills I have which allow me to do the science I enjoy so much.

When you were at school, what did you want to be?

At school I wanted to be an Aerospace Engineer, making planes or satellites rather than using them. Even though I now have a PhD in Geography I have come full circle by using drone, aircraft and satellite imagery to do my job. Sometimes your interests may appear in other subjects you might not originally think of.

What sparked your interest in Space?

I have had an interest in space for as long as I can remember. I have always found it beautiful and inspiring. When I was in school, I particularly liked design and technology as well as physics and geography, all of which have elements which are used in all sorts of space roles.

What would a student need to do to follow your career path?

I took A-levels in Physics, Maths, and Product Design with an AS in Geography. My BSc Physical Geography degree introduced me to remote sensing (you do not necessarily need Physics and Maths to get on to a Geography degree, though would recommend). I then took a Masters in Polar and Alpine change (I mostly use satellites to investigate the poles). Finally, a PhD in Physical Geography where I developed expertise in remote sensing.

You can get Earth Observation jobs however with a BSc Geography degree alone if you take GIS and Remote Sensing modules, you do not need to go all the way up to a Dr (unless you want an academic job or higher science role).

Brian Zielinski-Smith

Technical Services Director



What do you like most about your job?

Meeting so many amazing people and companies all doing really interesting things to further space exploration, develop our in-space economy, and better life on earth.

When you were at school, what did you want to be?

I wanted to be an astronaut or drummer in a rock band.

What sparked your interest in Space?

The romance of infinite possibilities and the fact that we know so much already about space, but it's so little in comparison to what is unknown. Space can answer so many questions, most of which have not yet been asked.

What would a student need to do to follow your career path?

Follow your passion, if it's a career in Space that is being aimed for, decide where you want to be, and trace it back from there defining the steps along the way. Space is a hot topic with strong investment coming in, the UK is set to be a strong space power, especially in the new-space sectors. Just be firm in your mind where you want to end up, and work towards it, there will be so many opportunities along that path.



The Space Education Quality Mark (SEQM) is designed to support schools and colleges using the subject of space to inspire and engage their students in science, technology, engineering and mathematics (STEM) subjects.

<https://www.stem.org.uk/esero/primary/professional-development/seqm>

Penny Clarke

Marine Conservationist studying whale and dolphin strandings from space



What do you like most about your job?

Engaging and sharing with inspiring people from across the world and from different journeys: local people, marine conservationists; space and remote sensing experts; and artificial intelligence; to develop new tools to monitor and protect whales and dolphins and ocean health. I also love the opportunity to share stories of our oceans, to raise awareness of ocean change and foster a collective connection to the blue planet.

When you were at school, what did you want to be?

I always wanted to be a marine mammal researcher. Growing up visiting my grandparents in Tenerife, I was captivated by the local whale and dolphin populations, only I never grew out of my fascination. I was also inspired by David Attenborough and wrote to him for careers advice as a teenager. Despite my dreams, I let a careers adviser tell me I shouldn't. Now 15 years later after spending time working with marine mammal expert, the incredible Asha de Vos, I gained the courage to dare to dream and I began my journey to become a marine mammal researcher.

What sparked your interest in Space?

I loved the idea of exploring new technologies to understand our oceans and to save whales, and when I met whale researchers at the British Antarctic Survey using satellites in space to study whales, I thought 'wow... this is 'whaley' cool!' After interning at the British Antarctic Survey, I am honoured to now to work alongside fellow experts in the Wildlife from Space team. Yes this is a real team... we are looking to space to understand penguins, seals, whales, walrus and albatrosses.

What would a student need to do to follow your career path?

Be courageous, believe in yourself and dare to dream! There is no right or wrong journey, I worked in the event and ski industry for seven years between my Geography degree and PhD, and I never did a master. Along my path, I learnt many invaluable skills to my current role; from how to build relationships; communication and organization, and project management skills. The main advice I can offer would be to try everything, have the courage to reach out to people who inspire you. If you are in a position to complete internships and build relationships with these people, do it. Very few career paths will be simple, getting where you want to be requires perseverance, hard work, loving what you do and lots of laughter along the way.

Bryony Freer

PhD Researcher at the British Antarctic Survey Polar Science (Glaciology) and Earth Observation



Describe your job and career path:

I am a PhD student at the British Antarctic Survey, where I study the Antarctic ice sheet and the interaction between its floating ice shelves and the ocean. I use data collected by satellites orbiting hundreds of kilometers above the Earth that can measure the height of the ice surface to the nearest cm! Day-to-day, my work varies from coding to writing, making maps and communicating my research to other scientists and students. A PhD is typically a 3-4 year research degree - at the end I'll be Dr Freer!

What do you like most about your job?

Some parts of Antarctica are the most remote places on Earth, and it is exciting to realise you are probably one of the only people looking at what is happening there. It's like spying from Space! It is rewarding to be working in a field where I feel I am helping to better understand our planet, in the face of threats caused by climate change. There is also a small, but very international, community of polar researchers. Accordingly, there are many exciting opportunities to work with people all over the world, and, if you're lucky, to go to Antarctica for fieldwork!

When you were at school, what did you want to be?

I don't think I was ever certain of what I wanted to be when I was at school. All I knew was that Geography was my favourite subject, and I loved anything to do with maps. I also enjoyed physics, but I didn't really see the connection between the two subjects. I ended up studying Geography at university, and took a keen interest in all of the ice-related modules and enjoyed working on projects where I got to use satellite imagery! Despite this, I always imagined that after graduating I would go and get a job in the city, maybe in finance or the civil service, and I even spent one summer doing an internship in an insurance company.

But during a post-uni gap year in New Zealand, I took a course in Antarctic Studies that took me on a fieldtrip-of-a-lifetime to Antarctica. This gave me the chance to experience life as a polar scientist on the ice and after this incredible experience I well and truly had the Antarctic bug! I'd never considered doing a PhD before (and to be honest I didn't really know what a PhD involved), but after this I knew I wanted to carry on working in this field. Looking back, it now makes perfect sense that I work at the intersection of Geography and Physics - I just wish I had known about Earth Observation when I was at school.

What would a student need to do to follow your career path?

There is not one set path to get into Polar Research or Earth Observation. I studied A Levels in Geography, Physics, German and Music - so a real mix! My colleagues come from a wide range of STEM backgrounds, from engineering and maths to biology and geography. Following my Geography degree (and gap year), I studied a masters in Geographic Information Science and Earth Observation. Learning to code during my masters was a challenging but rewarding experience, and is now an invaluable skill in my day-to-day research. I was very daunted by coding before this, but I would urge any students to give it a try and persevere through the steep learning curve, as it is an amazingly useful and sought-after skill in any technical field now (I promise it can be fun!). More than anything, I would say to keep following your passions as it is so important in any career to be inspired and motivated by the work that you do. Taking some time to work out what your passions are, maybe by working a few different jobs or taking some time out to travel, is never a bad idea. And if you're interested in learning more about Earth Observation, do check out SatSchool - a fun project I've co-founded with my PhD colleagues to provide free interactive resources introducing satellites and environmental research to school pupils: <https://satschool-outreach.github.io/>

HOW TO BECOME AN ASTRONAUT



Requirements:

- Excellent physical health
- A masters in a physical science, engineering or medicine
- Several years of work experience
- A decorated military history or over 1,000 hours of flight experience.

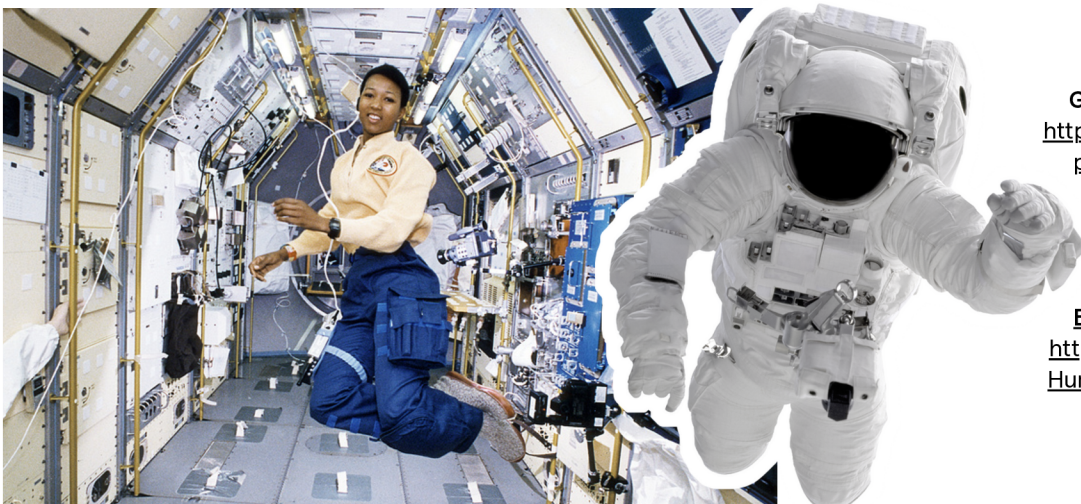
Becoming an astronaut is neither simple nor straightforward; there are no schools for astronauts or university courses. So how do you become an astronaut and what qualifications and qualities do you need?

If you're applying to NASA, who select around a dozen candidates every few years, then you'll need to have US citizenship. For Europeans there might be a bit more of a fight, as the European Space Agency (ESA) hasn't selected a new class of astronauts since 2008, when 8,414 people applied for just 6 places.

Astronauts need to be able to apply their considerable knowledge and skills to the tasks for which they have been trained; be able to bear tremendous responsibility while in orbit; and be determined to succeed. This is what makes them special.

Equally essential is excellent physical condition. Astronauts have to undergo intensive periods of training and may participate in spaceflights that last for months. During this time their body will be subject to a great deal of stress and good health and physical endurance are essential.

Astronauts must be willing to travel long distances, both on Earth and in space, and to spend long periods away from home as astronaut training takes place in a number of countries and they may participate in long-duration missions.



Guide to becoming a NASA astronaut
<https://www.nasa.gov/feature/application-procedures-for-astronaut-candidate-program/>

ESA guide to becoming an astronaut
https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Astronauts/How_to_become_an_astronaut

GETTING TO SPACE ?



We launch things into space by putting them on rockets with enough fuel — called propellant — to boost them above most of Earth's atmosphere. Once a rocket reaches the right distance from Earth, it releases the satellite or spacecraft.

Have you ever wanted to travel into space?

These days getting to space is becoming more of a reality for non-astronauts, even if the cost of doing so remains astronomical.

60 years ago the idea of anyone going into space was just a dream. Today, more than 550 people have achieved this ambition, journeying beyond our planet and into low Earth orbit.

It used to be the governments paying for training and flying astronauts, but space tourism has become more of a reality recently.

Private spaceflight companies such as SpaceX and Boeing are very close to being able to carry private passengers into space, allowing anyone who wants to travel to the stars to do so – provided they have the money!

NASA estimates the cost of a round trip ticket to the International Space Station (ISS) on a Crew Dragon or Starliner module at massive \$58 million per person!



On 30 April 2001 Dennis Tito (left) became the first space tourist to fund his own trip into space when he visited the ISS. Here he is pictured with cosmonauts Talgat Musabayev and Yuri Baturin. Credit: NASA

LIVING IN SPACE: THE INTERNATIONAL SPACE STATION

The Space Station's living space is about the size of a 6-bedroom house.

Weightless Station astronauts sleep in any direction with no bed, just a sleeping bag strapped to a wall so they don't float around.

The Station's weightless environment means toilets have to be specially designed to work like vacuum cleaners and suck wastes in, recycle most of the water, and seal the rest in plastic bags.

Weightlessness also makes showering a challenge – water droplets can float anywhere and really damage computers, machines, and so on – so astronauts rub water and soap on and sponge it off again.

There are about 8 miles of wiring in the Station's electrical system.

Over 100,000 people around the world worked together to make the Space Station possible.

Astronauts have to exercise hard for at least 2 hours every day to keep their muscles and bones from getting too soft, which is what they would otherwise do without having gravity to work against.

Over 50 computers keep the Station's systems working.

Astronauts, when they're enjoying what little free time they get, often spend it reading, listening to music, emailing or otherwise keeping in touch with their families and friends on Earth, or taking pictures of Earth and space out the windows.

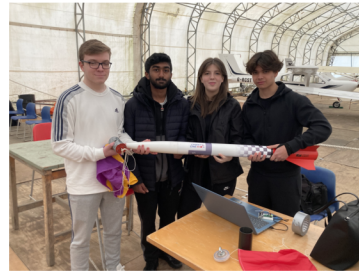
Dr. Tara Ruttle shares her experience of managing the science activities on the space station during her career at NASA.

[View on YouTube](#)



www.stem.org.uk/esero/cansat

CanSat is an engineering competition run by the European Space Agency in partnership with the UK STEM Council. It sees teams tasked with designing and building a functional weather satellite, integrated within the volume and shape of a 330ml drink can. Teams are tasked with fitting all of the major subsystems found in a satellite, such as power, sensors and a communication system, into this minimal volume. The competition culminates in a launch event, where the satellites are loaded into rockets, then dropped from around 400m in the air to fall with a parachute.



Launch Day at West Hatch School



Kings School,
Peterborough

INDIVIDUALLY AND AS TEAMS WE LEARNT A LOT THROUGHOUT THE PROJECT, BOTH TECHNICAL KNOWLEDGE AND PROJECT MANAGING SKILLS. THIS CEMENTED TEAM MEMBERS' AMBITIONS TO STUDY STEM AT UNIVERSITY SUCH AS COMPUTER SCIENCE, ENGINEERING AND MATHS – AND HOPEFULLY GO ON TO EVEN BIGGER PROJECTS! A FEW OF US HAVE CHOSEN TO REMAIN INVOLVED AND SUPPORT THE PROJECT NEXT YEAR, BUILD ON OUR OUTREACH TO INSPIRE MORE STUDENTS TO TAKE PART IN THE CANSAT COMPETITION IN FUTURE YEARS AND TO STUDY PHYSICS, TECH, COMPUTER SCI AND MATHS AT A-LEVEL.

STEM AMBASSADORS



Create a **FREE** teacher account at
www.stem.org.uk/dashboard

STEM Ambassadors supporting schools and colleges
As a school or college you can book a STEM Ambassador to come into your classroom, either face-to-face or virtually, free of charge.

STEM Ambassadors make an impact by:

- Supporting learning: help young people to understand the real world applications of their learning
- Illuminating careers: showcase different roles and pathways into industry, raising awareness of important skills in the workplace.
- Raising aspirations: help young people meet a wide range of inspiring role models, encouraging them to think about their future.



CHALLENGES AND RESOURCES



WHO ARE ESERO-UK?

ESERO-UK aim to use the context of space to open doors for young people by delivering engaging, world-class teaching in science, technology, engineering and mathematics.



MISSION X

TRAIN LIKE AN ASTRONAUT

An international educational challenge, focusing on fitness and nutrition for students

<https://trainlikeanastronaut.org/>



ASTRO PI

Conduct scientific experiments in space by writing computer programs that run on Raspberry Pi computers on-board the International Space Station.

<https://astro-pi.org/>



CLIMATE DETECTIVES

A project in which students aged 8-15 team up and solve climate problems

www.stem.org.uk/esero/climate-detectives



→ MOON CAMP

Use innovative learning technologies to design your very own Moon settlement with a 3D modelling tool.

www.esa.int/Education/Moon_Camp

WEBSITES TO VISIT

SatSchool

<https://satschool-outreach.github.io/>



How to build a water rocket

www.waterrokit.com/stem-sessions/



Tim Peake

www.funkidslive.com/learn/top-10-facts/top-10-facts-about-astronaut-tim-peake



[ESERO Space Inspirations resources](#)

www.stem.org.uk/esero



NASA: STEM Lessons From Space

https://www.nasa.gov/audience/foreducators/stem-on-station/lessons_from_space/index.html



Teachers: Request a Space Champion to speak at your school:

ESERO Space Inspirations www.stem.org.uk/esero/space-inspirations/teachers-and-schools



Space Exploration Resource

<https://www.stem.org.uk/resources/community/collection/425360/space-exploration>



Dr. Tara Ruttley shares her experience of managing the science activities on the space station during her career at NASA.

[View on YouTube](#)





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SPACE EAST



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