At the birth of the Space Age, the USSR and the United States were the only nations involved, with funding largely provided by the government and with a small number of jobs mainly for specialist engineers, scientists and pilots. Over time, other nations began to form their own space agencies. There are now over 70 around the world at varying stages of development, and the range of jobs in the space sector require education both within and beyond STEM (science, technology, engineering and mathematics).

The global space sector has seen, on average, a 6.7 per cent annual growth since 2005. With this trend set to continue, it is important that young people are informed and educated about the vast range of space sector activities and their importance to our daily lives, as well as our aspirations to explore the universe.

Opportunities for young people in the space sector

With space becoming more and more important in our daily lives, we need to educate young people about space-related activities and careers and provide them with the skills needed to enter the sector. There are year-round events for students of all ages, backgrounds and abilities and, if they know where to look, young people can find opportunities targeted to each stage of their development, leading to an exciting and rewarding career in the space sector.
Space in the classroom

Today there are countless space-related educational resources available that use space as a context for teaching science, maths and other subjects. Online materials from NASA, the European Space Agency (ESA) and other organisations, can be used to provide opportunities for children to take part in space projects, such as Mission X: Train Like an Astronaut, an international challenge which focuses on topics in space, science, fitness and nutrition. Citizen science portals like Zooniverse offer free and online-accessible activities that teachers can use for class projects, giving students the opportunity to engage in real science work.

It is not only teachers who can inspire students in the classroom. Many countries have Space Ambassador programmes to educate students and the general public about the importance of space activities and progress being made, while outreach teams from local museums, space centres and observatories can engage students in space through exciting activities. Such activities can provide a great opportunity for older students to share their passion for space with younger students, while simultaneously improving their confidence and communication skills.

Resources that incorporate careers education can also be beneficial. Students tend to presume that to do science they have to be ‘clever’ in a particular way. Opportunities that demonstrate attainability, by highlighting the variety of careers paths available in the space sector, are incredibly important. The Skype a Scientist programme, for example, gives students who may never have interacted with a scientist before the opportunity to pose any questions they have about a career in the space field. This programme, which includes scientists from many fields, has proved a hit in schools and also with families self-isolating during the Coronavirus pandemic. Outside of the classroom, physical careers-related events, such as SpaceCareers.uk’s Careers Launch, enables school and university students to hear from and interact with space students and professionals about careers and pathways into the sector.

Learning by doing

A range of space-related summer schools held around the world in fields such as astronomy, robotics, biomedical engineering and rocketry, offer a hands-on way to learn new skills. Some include students from many different countries, allowing them to work and socialise with each other as part of an international community.

Summer schools cater to a wide range of ages. For example, Space Camp, based in the US Space & Rocket Center, has programmes across ages 9-18 years; and at Space School UK, 13-18 year old students take part in simulated space missions and can even train like an astronaut through scuba diving sessions. Opportunities for university students include the Alpbach Summer School, in Austria, where participants work in international teams to design a space mission in 10 days under the supervision of experts, and...
the Space Astronomy Summer programme in Maryland, USA, where students can work with Space Telescope Science Institute researchers on data interpretation, software development and scientific writing.

ESA training weeks and competitions, held throughout the year, deliver training for future scientists and engineers in the space sector and also educate on topics such as space debris and space law. The Agency’s technical competitions challenge university students across Europe to design and build experimental payloads and CubeSats, for example. They are run with a condensed format of a real industry project, giving participants an invaluable understanding of how the industry works before entering it. The Spaceport America Cup is similar, pitting student rocketry teams from around the world against each other to launch rockets up to heights of 30,000 feet.

**Space for everyone**

Some activities aim to showcase a spectrum of space-related jobs, not just focusing on the traditional STEM areas. The Space Science and Engineering Foundation’s international Space Design Competitions, for students aged 15-18, and Galactic Challenge for 9-14 year olds, are described as a “simulation of life in industry”, with students working in ‘companies’ to design a space settlement. In addition to STEM roles, there is a focus on business, marketing and management. A space company, after all, is a business like any other and an interest in STEM subjects is not necessarily a prerequisite for a career in space.

**There is now an abundance of opportunities for students of all ages, backgrounds, and abilities to engage with the space sector and learn valuable skills**

University students can receive outreach training from professionals enabling them to effectively enthuse and engage younger students in the space sector.
NASA’s Space Apps Challenge is a 48-hour international hackathon which takes place in many locations around the world. Students and young professionals from different fields come to present innovative ideas and projects to solve space problems.

Accessibility and inclusivity are key issues that must be addressed within the sector. A diverse workforce inspires innovation, and for the global space industry to grow and meet its targets, barriers to accessibility for underrepresented groups must be removed. Initiatives to encourage young people from underrepresented groups into STEM subjects include the WISE Campaign’s People Like Me: space sector careers pack, which provides educators with resources to demonstrate to girls and young women that opportunities in the space sector are available to them as well.

Many universities and societies offer scholarships for students from underrepresented groups in the space industry. The Brooke Owens Fellowship programme is a paid internship and mentorship programme for women undergraduates and gender minority students around the world seeking a career in aviation or space exploration. Underrepresented university students who have an interest in or are pursuing a degree in aerospace are invited to apply to the American Institute of Aeronautics and Astronautics’ (AIAA) Diversity Scholars programme. Through this, students can attend an AIAA forum, where they can network while learning about the latest research in the aerospace industry.

Making connections
Networking can be highly beneficial for expanding opportunities and learning from others. A great way for students to increase their network is to get involved with a group of like-minded people, such as their local chapter of Students for the Exploration and Development of Space (SEDS), or the Space Generation Advisory Council (SGAC). Through space projects and events, these international organisations provide unique development opportunities to their student and young professional members. Annual conferences, for example, bring together students, subject matter experts and a variety of large and new industry players for a special learning and networking opportunity. Careers fairs and networking events also provide a great opportunity to make mutually beneficial connections that could lead to new partnerships or even employment.

Small professional steps
There are many opportunities for students to gain work experience at space-related companies and agencies ranging from short schemes for school students to university student internships that typically range from a few months to a year.

The second day of the 2020 UKSEDS National Student Space Conference (NSSC) coincided with International Women’s Day.
Internships allow students to gain and develop skills and experience that they wouldn't at university, and apply their knowledge to real life problems. Students are given similar tasks and responsibilities to employees, making it a truly meaningful and rewarding experience. Learning how the space sector operates, and how organisations operate within it is highly valuable both at the time and when making future job applications.

Companies in many countries offer apprenticeship programmes, an alternative route into the space sector, aimed at those with a preference for hands-on learning. Apprentices undertake practical training while studying for relevant qualifications in areas such as computing, technology, engineering and business. There is a great need for qualified technicians in the space industry and more and more companies are welcoming apprentices through these schemes.

**Giant leaps for the future**

Large parts of the sector (on Earth and in space) are heavily reliant on complex software, making young people increasingly needed in programming, computer science and software engineering. Earth observation is one area where data scientists are in high demand and with space missions and analysts demanding higher processing capabilities, artificial intelligence, machine learning and quantum computing are all technologies that will aid both ground and in-space operations as the sector evolves.

More specialised opportunities are arising as a means to educate students about these careers and the skills needed. The Technical University of Berlin, for example, runs international summer and winter schools, with programmes including space robotics, artificial intelligence, machine learning and data science. Hackathons, such as The NASA International Space Apps Challenge, are also a good way to demonstrate to computer science students, who may have never considered a space career before, how they can join the sector.

Specialist degree courses and PhD research topics are available in a wide variety of fields, with the opportunity for students to go into academia or industry upon completion. All large space companies will offer graduate training programmes, typically lasting 1-2 years, or students can enter through a direct entry job. ESA runs a one-year Young Graduate Trainee (YGT) programme with around 100 posts in areas including engineering, medicine, business, law, IT, and natural and social science, offering training and experience in space operations and a fantastic stepping-stone to future employment within the sector.

There is now an abundance of opportunities for students of all ages, backgrounds and abilities to engage with the space sector and learn valuable skills. With a willingness to learn and explore, young people anywhere in the world can forge a path to an exciting career in the space sector, whether they are STEM orientated or not.

**About the authors**

Jacob Smith has a BEng in Mechanical Engineering from the University of Bath and is studying for an MSc in Astronautics and Space Engineering at Cranfield University. Jacob is the current Chair of UKSEDS and an advisor to the SpaceCareers.uk team. He has taken part in multiple space-related activities across Europe and is working to bring more personal development opportunities to students in the UK.

Antonio Duduianu is an Executive Committee At-large Member for UKSEDS, helping to run the charity and the organisation of various local and national events. He worked for five years as a tutor and mentor for 12-16 year olds and wants to continue using his free time to inspire the next generation. Antonio is currently completing a year in industry as part of an integrated Master’s in Aerospace Engineering at the University of Bath.

Laura Martin is studying for an MSc in Observational Astrophysics from Liverpool John Moores University. A volunteer for UKSEDS and a member of their careers team, she is keen to increase awareness of the variety of paths to a career in the space sector. Laura has a PGDip in Astronomy from the University of York, and an undergraduate background in mathematics.

Christina MacLeod is studying for a BEng in Mechanical Engineering at the University of Edinburgh. She wants to share her passion for space exploration and to that end she is a content writer for SpaceCareers.uk, the Sponsorship Manager for Edinburgh University’s rocketry team, and Engineering Representative for Edinburgh University’s Women in STEM Society.

Justyna Barys, a young graduate trainee in ESA’s Life and Physical Sciences Instrumentation section in the Netherlands, working on the MELiSSA (Micro-Ecological Life Support System Alternative) project to develop closed-loop life support for future deep-space expeditions.