

UK Space Agency Education, Skills and Outreach Strategy

Using space to inspire learning. Helping to build a skilled workforce.

1 Executive Summary

The UK Space Agency's education, skills and outreach strategy addresses two distinct, though related, issues:

1. Space has demonstrated a remarkable power to inspire widespread interest in science, technology, engineering and mathematics (STEM) and provides exciting contexts for the teaching of a range of subjects.
2. Growth of the space sector is hampered by the scarcity of graduates and technicians with relevant qualifications;

The first of these presents an opportunity to use *space for education* and the second is a problem that can be addressed by using *education for space*.

These two equally important aspects are intimately related since harnessing space to improve the take-up of STEM subjects for the benefit of the UK economy will have corresponding benefits for the space sector by increasing the potential pool of graduates and technicians.

This strategy aims to set out how the UK Space Agency intends to use space to inspire and motivate learners to study STEM subjects and **aims to increase the numbers and improve the quality of individuals entering the workforce.**

The main features of this strategy are to:

- Understand and address the skills needs of the UK space industry
- Develop plans to improve the provision of advice on space-related careers
- Encourage and support the use of space as an inspiring context for learning across all age groups
- Develop wider outreach programmes to improve awareness of and engagement with the UK's space programme.

2 Background

The formation of the UK Space Agency was announced by the Government in early 2010 and it became operational as a 'shadow agency' from April 2010 with the aim of becoming a fully-functional executive agency of the Department for Business, Innovation and Skills from April 2011. Its corporate strategy will incorporate those goals of its predecessor, the British National Space Centre (BNSC) partnership, where these remain relevant and appropriate. These include the education and skills goals stated in the *UK Civil Space Strategy 2008-12*.

While the UK Space Agency has responsibility for all strategic decisions on the UK civil space programme, there are areas of overlap with other parts of government. On education issues it works closely with partners in the Department for Education (which is responsible for schools) and with the Department for Business, Innovation and Skills (which is responsible for Further and Higher Education as well as Science in Society). It also works with the Science and Technology Facilities Council (which has a Science in Society programme that encompasses space science and astronomy outreach) and with the European Space Agency (of which the UK is a member state and which has a large education programme).

In 2010 an industry-led team published the Space Innovation and Growth Strategy which covers the period 2010 to 2030. Recommendation 12 proposed that the space industry and the UK Space Agency "*should show exemplary and proactive support in championing initiatives aimed at addressing the STEM issues in our schools, colleges, universities and businesses.*" The Government accepted this recommendation and the UK Space Agency is now working with industry partners to implement the actions supporting it.

The UK has a range of formal and informal space-related education and outreach activities. Coordination of these various activities is important to help increase their impact and uptake, as well as to share best practice and address gaps in provision. This will be achieved mainly through the Space IGS Working Group on Education and through ESERO-UK (the European Space Education Resource Office).

Advice on space education policy is provided by the Space Education and Skills Working Group which is co-chaired by DfE and the UK Space Agency, and includes representatives of BIS, STFC and ESERO-UK.

3 Space for education

There is a widely recognised problem in encouraging interest in STEM subjects at school, college and at university level. Some recent improvements have been made, for example in numbers of students studying mathematics at A-level, but there is still much that needs to be done.¹

Several reviews² and much anecdotal evidence demonstrate that few subjects have as much impact as space to inspire interest in the young. For example, a 2009 survey³ demonstrated that 9% of children now want to become an astronaut (fourth, after 'famous footballer', 'famous popstar' and 'famous actor'), which is up from 4% (ninth) 25 years ago.

The UK Space Strategy states that we will "*seek to harness the existing diverse array of space-related education activities carried out by a variety of professional and enthusiast organisations across the UK. [...] The BNSC Partnership will work to exploit the potential of space to contribute to [the public understanding of science] using the expertise of its members and their network of contacts in academia and business. Together we will develop programmes to raise awareness of both the specific space issues and the importance of science in society.*"

¹ *Educating the next generation of scientists*, National Audit Office, November 2010

² *The Education and Skills Case for Space*, Spencer and Hulbert, June 2006

³ Survey carried out for Sky television, October 2009, sampled 3000 children by asking their parents what they wanted to do when they grow up.

Space provides a medium to support education across all age groups in both technical and non-technical subjects. **Thus the UK Space Agency education strategy should maximise the benefit and impact of space in education by optimising the 'space offer' to the needs of the education system** (taking account of regional variations as appropriate).

4 Education for space

The UK space sector now employs 24,900 people and has an annual turnover of £7.5bn.⁴ It supports a total of about 83,000 workers. It is one of the most highly skilled sectors of the economy: 57% of workers have a degree and output per worker is three times the national average. The sector has been growing at an accelerating pace (10.2% p.a. over the last two years, despite the difficult economic conditions) and is expected to grow to £14bn by 2020, and support some 115,000 jobs.⁵

Growth will be driven by the space industry's unique capacity to help address the global threat of climate change, pressure on natural resources, a growing world population and violent conflict. As explained in the *UK Civil Space Strategy 2008-12*, *'this continued growth depends on a steady supply of high quality scientists, engineers and technicians. Whilst UK Space activities attract good quality personnel, the domestic supply is limited and an increasing number are from overseas who bring welcome expertise.'*¹

In order to address this need, the UK Civil Space Strategy states that we will:

- Build a picture of the key skills and expertise that will be vital for a healthy space sector in the future
- Identify possible gaps in the skills base
- Establish how any supply gap can be filled
- Develop programmes aimed at promoting the key skills and tackling any gaps

In 2008, BNSC commissioned a report⁶ to characterise this skills shortage. This report identified several specific problems: *"the dominant need for (a) high level mechanical, electrical and software development engineering skills and (b) the capacity to apply these skills to complex projects as part of a commercial enterprise. Specifically it indicates that:*

1. *job vacancies in the sector are difficult to fill. Two-thirds of vacancies for experienced practitioners, and one-half of vacancies for graduates with applied degrees, are not filled at the first attempt*
2. *under 50% of graduates with a space-related qualification get a space-related job*
3. *new employees are missing skills that would help them to make a more positive contribution to the business in the initial months of employment*
4. *existing employees are missing skills that would make business more efficient and competitive"*

These findings are broadly in line with those of the CBI, who report that 70% of employers want action to improve the employability skills of school leavers and 81% want the same for graduates.⁷ Tackling these issues will contribute to the Government's aims in returning the economy to sustainable growth, as set out in its recent strategy document *Skills for Sustainable Growth*.⁸

To meet overall government objectives, barriers to growth of the space sector must be overcome. **Thus in order to counter the space industry's difficulties in securing sufficient, appropriately educated staff the UK Space Agency education strategy**

⁴ *The Size and Health of the UK Space Industry*, November 2010, UK Space Agency

⁵ *UK Space Innovation and Growth Strategy*, February 2010

⁶ *Space: The Skills Need*, Chas Bishop, Director of National Space Centre, November 2008.

⁷ *Ready to grow: business priorities for education and skills*, Confederation of British Industry, May 2010

⁸ *Skills for Sustainable Growth*, Department for Business, Innovation and Skills, November 2010

should aim to increase the numbers and improve the quality of individuals entering the workforce.

5 Objectives

In order to deliver these aims and taking account of the recommendations of the Space Innovation and Growth Strategy, the UK Space Agency will work with its partners in government, industry and elsewhere to:

- Continue to review and monitor the skills needed by the UK space industry and develop plans to address these needs
- Work with those responsible for the development of information, advice and guidance for all ages, to ensure that support and materials on careers in the space industry are easily accessible, including role models (mainly for younger pupils), work experience, internships and information on jobs (mainly for older pupils and students).
- Encourage and support the use of space as an inspiring context for learning across all age groups, but with emphasis on
 - supporting non-specialist primary teachers in the use of space in teaching
 - improving the quality and availability of teaching materials using space across the curriculum for primary and secondary schools and for colleges (mainly through ESERO-UK)
 - engaging pupils in STEM through the use of space and maintaining and developing the interest of the most enthusiastic students by providing suitable opportunities
- Develop and implement wider outreach programmes to improve awareness and engagement with the UK's space programme, in particular by organising a National Space Conference.

6 Analysis: the Skills Pipeline

The decision of an individual to take up any STEM-related career (or indeed to work in the space sector) is influenced by many experiences from early childhood onwards. And space-related learning activities may be used to improve education outcomes at all ages. Hence it is important to consider what interventions are appropriate for each age group and to identify the interests of the UK Space Agency and its partners at each stage.

6.1 Primary (5-11 years)

At this age, the main focus is on using space for education: space can be used to inspire many different learning activities across the curriculum and can help to demonstrate the excitement of STEM subjects. At this formative stage it is too early to identify students who will go on to careers in space, but it is likely that children at this age will be forming opinions that will influence their future career choices. Hence providing suitable role models for STEM-related careers will be valuable for this age group.

Since few primary school teachers are trained scientists, a key requirement is to support non-specialist teachers to give them confidence in teaching science.

Since there are some 25,000 primary schools, activities should aim to reach large numbers (through learning materials, access to space resources, and promotional activities) rather than focusing resources on a few students.

The main partner with responsibility for this age group is DfE. Since their remit is so wide and this is such an important target group for space, the UK Space Agency sees this as a key area on which to focus its resources. While resources and help for non-specialist teachers will be available through the new European Space Education Resource Office (ESERO-UK),

there will still be a need for activities directed at presenting role models to pupils and encouraging interest in space in primary schools.

6.2 Secondary (11-14 years)

Although all UK students in this age group study science, it is likely that most will have decided by this stage whether they see themselves following a STEM-related career. A few will already have a strong interest in space.

Key aims therefore should be to maintain an interest in STEM among all students and to help those with a strong interest in space by giving them access to good space-related learning resources and information regarding role models.

This may be achieved through assistance to teachers who want to use space in teaching, promotion of the value of space in learning and providing access to materials. There should also be direct contact with the most enthusiastic pupils through special activities such as competitions, conferences and other events.

The main partner with responsibility for this age group is DfE. STFC also takes a strong interest through its remit to increase understanding and engagement with STEM. The UK Space Agency's main contribution is to help identify and promote the many existing and new resources available to assist with teaching, by channelling this information to schools and colleges through the ESERO-UK networks and others.

6.3 Secondary (GCSE, 14-16 years)

As with the previous age group, all students study science, but some choose to do triple science at GCSE. At this stage students are encouraged to consider future career options in more depth.

Much the same approach applies as before, but there is a greater opportunity to assist the most enthusiastic pupils to maintain their interest in STEM subjects, and specifically space. This may be achieved through space camps, space schools and various classroom activities.

This age group is also mainly in the remit of DfE, with STFC also active. In addition to supporting the work of ESERO-UK, the main role for the UK Space Agency will be in enabling access to space careers advice, mostly through working with established providers of careers information, advice and guidance.

6.4 Secondary (A-level, 16-19)

This is the first point at which students studying STEM subjects have chosen to do so. It is therefore especially important to provide challenging resources to these students in order to maintain their interest.

Similar interventions as at younger age ranges are possible, but there is now a greater possibility of more exciting challenges – such as involvement in hardware projects. The smaller number of STEM students at this level should allow for the possibility of a deeper engagement with those demonstrating an interest in space. This may also involve space camps and space schools and could include participation in the annual UK Space Conference.

The main partner with responsibility for this age group is DfE (in schools) and BIS (in FE colleges). STFC also has an interest and ESERO-UK will be an active player. There is therefore less need for a high level of involvement from the UK Space Agency, although it has a role in supporting careers promotion in order to help improve the supply of skilled labour to the space sector.

6.5 Higher education

By this stage most students will have chosen the approximate direction of their careers. There will be little point in devoting large resources across the board, other than to encourage all students to maintain some engagement with STEM in general and space in particular. However, there is a need to ensure that those with a potential interest in a career in the space sector should be aware of the possibilities. It is also important that those with the greatest

interest do not feel abandoned simply because they are expected to be sufficiently self-motivated not to need any help.

In this age group, the principal focus will be using education for space – for example through engaging with employers and universities to ensure that UK graduates are acquiring the skills needed by the sector.

The main partner with responsibility for this age group is BIS. The main interest of the UK Space Agency in this age group will thus be to liaise with industry, universities and others on the suitability of courses, to promote careers opportunities among potential employers in the space sector and to enable access to key international space education opportunities such as the International Space University and the International Astronautics Congress. It will also engage with the student-run UKSEDS (UK Students for the Exploration and Development of Space) as a route to the most enthusiastic organised group of students. This will provide a source of student opinion and of ambassadors to the wider body of students. It will also help to facilitate access to hands-on activities for undergraduates and postgraduates, for example through its CubeSat programme and through promotion of ESA opportunities.

6.6 Informal education

There are many informal space education activities across the UK. The UK Space Agency's main role will be to encourage and promote the best of these. A funding scheme, 'Space for All', has been set up to facilitate this and the UK Space Agency web site will be used to promote relevant activities. The ESERO-UK network will conduct a review of existing activities and will, through its website, support providers to help them meet criteria to join the STEM Directories (www.stemdirectories.org.uk) which have a very broad take-up from schools and colleges.

7 Partners

This Strategy will be delivered by the UK Space Agency working with its partners. These include:

- Government and agencies (Department for Education, Department of Business, Innovation and Skills together with their agencies and the Research Councils – STFC and NERC in particular – and the European Space Agency),
- Space education and outreach organisations (in particular ESERO-UK, but including the National Space Centre and its Space Academy, as well as many regional organisations),
- National education bodies (such as the National Science Learning Centre and STEMNET),
- Representative groups (such as trade bodies, student groups, professional institutions, and teacher networks),
- The space sector (including companies and research groups in universities to help improve outreach, access to role models and support for educational initiatives).

8 Conclusion

This document presents the background, rationale and goals of the UK Space Agency's Education, Skills and Outreach Strategy.

It will be used to guide specific actions to be taken by the UK Space Agency and its delivery partners.

It will be updated as appropriate to take account of lessons learnt and wider policy developments.