

## **1.0 Space Academy overview**

The Space Academy is a partnership between the National Space Centre, the University of Leicester, University of Nottingham, Science Learning Centre East Midlands, STEMNET and *emda*. The National Space Centre is the lead organisation and many of the educational activities are held at the Centre itself. Other elements of the programme are held at the partner universities, and with industry organisations in the aerospace/space sector

### **1.1 Space Academy aims and objectives**

The Space Academy programme works simultaneously with pupils, educators and industry to:

**Enrich the learning experiences and educational outcomes of students** aged 9-19 with a new focus on those in the 14-19 age range. This is achieved by a range of curriculum-based intensive programmes that use the contexts of space and climate change to boost learners' engagement and understanding in a range of subject areas including the STEM subjects (sciences, technology, engineering and mathematics) as well as geography and environmental sciences.

The programme is aimed at both academic and vocational learning routes in the UK 14-19 curriculum, encompassing traditional academic programmes as well as the new vocational pathways. Learners are encouraged to access the various programmes successively as they progress through their educational career thus building continuity and further motivating them.

**Enhance the subject understanding and teaching of classroom teachers** through masterclasses, workshops, seminars, and conferences conducted by internationally-recognised experts in the fields of space sciences, climate change and education.

**Show learners how they can map out careers using science, technology, engineering and mathematics** by hosting careers fairs and industry visits to put them in direct contact with the industries that most need educational backgrounds in these STEM subjects.

### **1.2 Rationale for the Space Academy programme**

The uptake of STEM subjects studied through higher education or training is still dramatically low compared to 20 years ago. This drop in STEM subject participation is predicted to have detrimental effects on the UK economy and the global competitiveness of UK industry in a rapidly changing world. In a report to the UK Government in 2002 Sir Gareth Roberts outlined these concerns and recommended strategies to address the decline including better support and training for STEM teachers, improvements to school laboratories, a more appealing physical science curriculum and better starting salaries for STEM graduates.

The UK has a thriving space industry and world-leading expertise in space sciences and climate change modelling. Information gleaned from space satellite systems has been key to fully understanding the effects that climate change has already had on the environment and in trying to model future consequences regionally, nationally and internationally.

The UK has proven areas of excellence at the cutting edge of space technology and innovation. Space is a subject that often provokes inspiration and wonder in young people.

The Space Academy couples these in a programme that aims to help address the needs of business, industry and the country's future competitiveness in a global market.

### **1.3 Space Academy operating methodology**

- It is a sustained, progressive programme of curriculum support in STEM subjects. Students can access different support programmes in different subjects as they progress through the education system.
- The programme couples the inspirational contexts of space and climate change to enhance learning and engagement in curriculum subjects
- It works simultaneously with learners, educators and industry
- The programme is developed in conjunction with internationally recognised experts in space science, education and industry
- Dedicated university researchers are involved in the programme development and delivery working with teachers who have been assessed as outstanding practitioners
- Focused support for educators is provided through the partnership with the Science Learning Centre East Midlands

### **1.4 Students – formal and informal education**

The Space Academy programme provides progressive support for students of all abilities in a number of subject areas and uses two main approaches:

#### **1.41 Informal learning opportunities – “Challenger” and “e-missions”**

“Challenger” missions are simulated space missions initially developed in the US by the Challenger Centre for Space Science Education. The Challenger Centre at the National Space Centre is the only one in Europe and students participate in the role of Mission Controllers and as spacecraft crewmembers in purpose-built simulation facilities.

“e-missions” are videoconference class sessions in which contexts such as satellite monitoring of natural disasters are used for students to run real-time simulations, co-ordinated from the National Space Centre.

Both “Challenger” and “e-mission” components of the space Academy programme are well established, informal in terms of learning approach and are aimed at students in the 9-13 age range.

#### **1.42 Formal learning opportunities – Space Academy Masterclasses**

Masterclasses are defined as intensive, day-long learning experiences in which the contexts of space and climate change are used to create a “narrative” within which many elements of the subject curriculum under consideration are interwoven. This more formalised approach is used with students in the 14-19 age range.

An exemplar of the masterclass methodology is the 16-19 dedicated Physics masterclass “Away-Day to Mars” outlined below:

Narrative: The masterclass considers the challenges involved in sending an unmanned spacecraft to perform scientific observations on the surface of Mars. This leads on to scientific consideration of the challenges involved in future human exploration of Mars. The storyline includes the following elements

- Overview of scientific understanding of Mars through the ages
- Spacecraft launch from Earth
- Flight through interplanetary space including spacecraft power systems
- Entry into the Martian atmosphere, descent and landing
- Surface science experimental package
- Human survival on Mars

These elements are used as contexts for physics curriculum topics (age 16-19) including:

- Newtonian mechanics, including ballistics theory
- Ideal gas behaviour
- Electrical power systems
- Gravitational theory including the concept of escape velocity
- Theory of elliptical orbits including Hohmann transfer minimum energy solutions
- Fluid drag forces and modelling using kinetic theory and conservation of momentum
- The relationship between forces and fields
- The photoelectric effect and photon modelling of electromagnetic phenomena
- The nature of inverse square laws and application
- The exponential function and the modelling of capacitance, radioactive decay and pressure reduction in planetary atmospheres

During the masterclass a mixture of theory, practical work and mathematical modelling is used including the use of equipment not normally accessible to school students.

### **Masterclass subject range and development**

Masterclasses in physics for 14-16 age range students and 16-19 age range students have been piloted and evaluated. Masterclasses in chemistry, biology, geography, environmental science, applied science and mathematics are currently under development for piloting in 2008-09.

### **Masterclass development and delivery – the role of Space Academy Outreach Scientists and Space Academy Lead Educators**

The above roles are essential components of the masterclass development and delivery programme across all subject areas.

#### **Space Academy Outreach Researchers**

Space Academy Outreach Researchers are university scientists funded by the project who spend 25% of their time in active science research and 75% of their time working to develop and deliver masterclasses.

#### **Space Academy Lead Educators**

Space Academy Lead Educators are teachers who have been assessed by UK national assessment agencies as having outstanding teaching ability across a range of pupil ability and ages. They are seconded from their schools to work with the Space Academy project for a fixed number of days per academic year.

#### **The synergy of scientist and educator**

Researchers and teachers work together to ensure programmes under development are curriculum-focused and include contemporary science and up-to-date discoveries and information. The use of Lead Educators ensures that multiple learning styles are catered for in a programme to stretch students of all abilities. Both Researchers and Lead Educators deliver a given masterclass programme.

### **1.5 Science Educator Professional Development**

This component of the Space Academy programme is in conjunction with the Science Learning Centre East Midlands. The Science Learning Centre network is comprised of one National Centre and nine Regional centres whose purpose is to lead on the professional development of UK science teachers. An annual UK Space Conference for Science Teachers is held as part of the programme, providing extended residential opportunities for educators to enhance their subject knowledge and teaching pedagogy working with Outreach Scientists

and Lead Educators. STEM industry participants also work with educators to outline the requirements of STEM industries in terms of workforce supply issues.

### **1.6 STEM Careers support for students**

Annual Careers Conferences are held in which STEM Industry representatives host presentations and workshops for students in the 14-16 and 16-19 age range.

### **1.7 References**

Sir Gareth Roberts, "Set for Success" (HM Treasury 2002)