Background to the ISS Education Kit

The education of the European youth, in particular in the scientific disciplines, is an important theme for the European Space Agency (ESA). In fact, ESA has several education activities, aimed at students of all ages and their teachers. Part of the International Space Station (ISS) project, a specific ISS education programme has been defined, where development of educational material is one of the core activities.

The ISS Education Programme is an ESA initiative which is already supported by several organisations and exceptional individuals who want to make a difference in the world of education and who have joined the ISS Education Fund. More information about the ISS Education Programme and the ISS Education Fund are available on ESA's educational webpages (www.esa.int/spaceflight/education).

The development of this education kit goes back to 2001, when ESA organised a conference for European teachers, TEACH SPACE 2001. The main objective of the conference was for ESA to understand what could be done to support European educators in their important and challenging work. One of the conclusions of the conference was that teachers need simple, practical, and modular material that can be applied to their lessons and is based on existing European curricula.

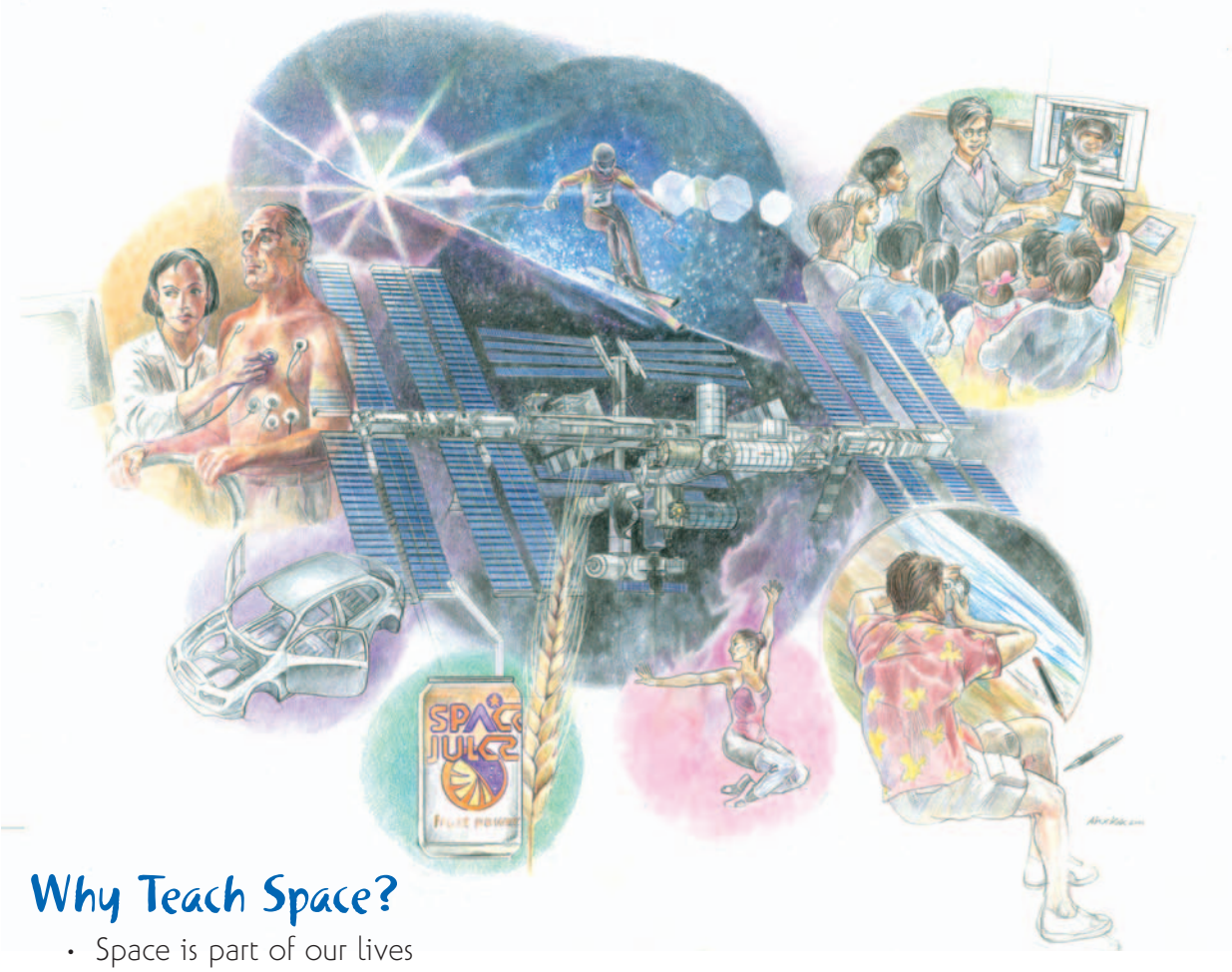
As a response to this, ESA developed, in cooperation with a group of 20 educators, a pilot version of the ISS Education Kit for secondary schools. The pilot version was ready in 2002 and sent to educators throughout Europe for testing and evaluation. Based on the feedback received, the kit has been revised and improved; in addition, six new units have been developed. This edition of the ISS Education Kit has been translated into all languages of ESA's Member States.

Target groups

The target groups for this ISS Education kit are teachers throughout Europe and their students, aged 12 – 15.

General objectives

- To introduce the International Space Station as a motivating and ideal tool for teaching.
- To increase the awareness and interest in science and technology research in space among the youth.
- To stimulate curiosity and creativity through active participation.
- To highlight the important contributions being made by space technology to the well-being of society.
- To focus on future, possible areas of space research and technology, as well as the importance of international cooperation and cross-cultural interaction.



Why Teach Space?

- Space is part of our lives
- Space is our future
- Space is fascinating
- Space-related topics are part of European curricula

Why teach topics related to the ISS?

The International Space Station represents an ideal tool for teaching.

The ISS is one of the largest, international, cooperative space adventures to date, and gives unique long-term research possibilities in weightless conditions in a wide range of disciplines. The science and technology research carried out on board the ISS is expected to provide us with important knowledge that will benefit people on Earth and make a foundation for further explorations.

All activities involved in building, working and living on board the ISS have many fascinating angles that can be applied to various subjects and skills taught in schools, such as:

- Mathematics
- Material Science
- Fluid Science
- History and cultural studies
- Environmental studies
- Creative writing and foreign language training
- Modelling related to artistic expression and technology
- Social skills (i.e. cooperation and teamwork)

How to use the ISS Education kit

The ISS Education kit is divided into five chapters:

1. What is the International Space Station
2. Building the International Space Station
3. Living on board the International Space Station
4. Working on board the International Space Station
5. Future Voyages

Each chapter includes a **general introduction** about the topic, followed by **exercise units**. The exercise units contain a variety of tasks with related explanations and background information. The level of difficulty varies and the teachers might have to adjust the content to the right level of their students. A set of **overhead projector colour transparencies** with illustrations supplement the text and exercises.

At the end of the kit there is a glossary with definitions of specific terms. These terms are highlighted in blue throughout the text. The glossary is intended to support teachers in their explanations of scientific phenomena and terms which may not be easily understood by their students. Only a key selection of terms in the glossary has been highlighted in the text, the glossary contains more entries than this selection. Keywords are highlighted in **bold**.

The kit includes **topics that already exist in European curricula** and the content is linked to topics taught in the classroom. As teachers across Europe will invariably have different teaching practices and curricula, the kit has been designed to be a reference tool and source of ideas for the teachers.

The kit can be used as an introduction to a topic, for more in-depth studies in a particular field of interest, or as extra stimulus for students. **Units can be copied** and handed out to the students, or adapted to suit specific projects or thematic studies. The content of each unit is independent of the others. Teachers can therefore use the whole kit or only parts of it .

The kit has an interdisciplinary approach that makes it relevant for a wide range of subjects. By including experiments and practical tasks, students will gain experience in carrying out scientific research: observing, analysing and recording data. On the following page, **a matrix shows the different subjects and topics represented** in the exercises. A list with references to relevant web sites has been made for further reading and ideas to related topics.

Teachers are encouraged to **send highlights** of the students' work, e.g. their best essays or designs, to the ISS Education Team. Up-dates, additional information and tools of relevance to the kit will be available through **ESA's educational web-pages** (*www.esa.int/education*).

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Matrix of subjects and topics represented in the exercise units of the kit

Exercise unit:	Subject	Topics represented in the exercise units
1.1.	Maths History Arts & Crafts Other topics	Volume, Surface area, Scale Exploration: Columbus Create a model of the Columbus Laboratory (materials, scaling etc.) Research – awareness of what research is and how it can help us
1.2.	Maths Science Geography Arts & Crafts	Degrees, Orbits (measuring circumferences, speed, time, distances) The Solar System Map-knowledge (north-south-east-west, latitudes and longitudes) Drawing ellipses
1.3	History/ Social science Language Geography Other topics	Space Station history (political aspects, worldwide collaboration) Writing tasks Map reading (world, flags) Career opportunities
1.4	Social Science Other topics Language Arts & Crafts	Contributions across Europe (link to local industry, career opportunities) Extract key words from a text, information search Design mission logo (symbols)
2.1.	Science	Newton's "Laws of Motion", friction, material science (temperatures, melting point) solid/ liquid/gaseous, mass/weight, escape velocity
2.2.	Foreign Language Language Other topics	Translating mission control centre guidelines Writing essays Teamwork, communication and cross-cultural interaction, spacewalk simulation
2.3	Science Arts & Crafts	Robotics Design of a robotic arm

3.1.	Science/Social Science Language Arts & Crafts Geography	Human needs, planning daily activities Writing tasks (diaries, interviews, articles) Creating a cartoon Map reading (Europe)
3.2.	Science Arts & Crafts	Water: studies in gravity and weightlessness Design a Personal Hygiene Kit/Bathroom Storage System
3.3	Science Environmental studies Maths/ Social science	Water consumption, water recycling (recycling processes, pH-level, filtration, sand filter) Carrying out a survey (consumption of water), use of water in different cultures
4.1.	Maths Science	Weight, mass, acceleration Gravity, force of attraction, free fall, friction, weightlessness
4.2.	Science Arts & Crafts	Chemical reaction (foam experiment), effects of gravity Design and construct a glovebox model
4.3	Science	Plants (what plants need to grow, growth processes in gravity / weightlessness, photo-synthesis, cell respiration) Planning, performing and evaluating an experiment
4.4	Science	Material science (how materials are affected by the environment, corrosion, degradation of materials, temperature, pressure, atomic oxygen, contamination, radiation) Planning, performing and evaluating an experiment