

## AN INTEGRATED APPROACH TO EDUCATIONAL ACTIVITIES ON EARTH OBSERVATION AT THE EUROPEAN SPACE AGENCY

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**RESUMEN:** Esta propuesta se basa en la iniciativa de integrar tres distintos proyectos educativos, que la Agencia Espacial Europea (ESA) está en la actualidad desarrollando individualmente, para promover la Observación de la Tierra desde el espacio como herramienta muy útil para los profesores (enseñanza) y estudiantes (aprendizaje). Esta idea de integración parte de la voluntad de optimizar los esfuerzos educativos que la ESA esta llevando a cabo en el marco de la utilización de los datos de sus satélites y del desarrollo tecnológico. Este proyecto quiere proporcionar a profesores y estudiantes la oportunidad de "manejar", a través de demostraciones prácticas, los distintos elementos de la cadena espacial, es decir la generación y transmisión de datos y su utilización en teledetección y Sistemas de Información Geográfico (S.I.G.). Se propone utilizar también el portal web para la escuela secundaria europea que la ESA esta desarrollando en el marco de un proyecto internacional de EURISY dedicado a la educación sobre las actividades espaciales. La novedad de la propuesta se fundamenta en que estudiantes europeos, finalizando sus estudios o bien realizando doctorados, impartirán esta clase de seminarios en países en vías de desarrollo, utilizando herramientas cedidas por la ESA y ayudados por el consejo de expertos de la ESA, así como de profesores locales.

**Palabras Clave:** Educación, Observación de la Tierra, Países en desarrollo, Teledetección, S.I.G.

**SUMMARY:** This proposal is based on the initiative of integrating three different educational projects that the European Space Agency (ESA) is developing to promote Earth Observation from space as a tool, very useful for professors (to teach) and students (to learn). This idea of integration comes from the wish of optimising educational efforts that ESA is carrying out in the framework of its satellite data exploitation and technology development. This project is aimed at providing professors and students with the opportunity of actually "touching", through practical demonstrations, the various elements of the space chain, namely data generation and transmission and its use in remote sensing and Geographic Information Systems (GIS). It is also planned to use the web portal for European secondary schools that ESA is implementing in the framework of an EURISY international project dedicated to education on space activities. The exciting part of the project is that European students doing their final studies or MSc courses will give seminars in developing countries, using tools provided by ESA and being supported by the advice of ESA experts, and also of local teachers respectively.

**Key Words:** Education, Earth Observation, Developing Countries, Remote Sensing, G.I.S

### INTRODUCTION

Since the first man in space (Yuri Gagarin in 1961) a global awareness about Space has evolved and today most young people are familiar with space activities and particularly with astronauts enterprises. However, there is still not enough understanding about the benefit for the human kind that investments in space can bring to daily life. For instance, awareness about the usefulness

of Earth Observation from space to monitor and better understand our environment is still very low.

At the same time, last decades have seen an increased public concern about the Earth, its environment and mankind's impact upon it. It is clear that Earth Observation from space is an instrumental tool in this context, as it can provide global and coherent information to monitor and better understand what is

going on in the Earth's environment (C. Readings, 1998). Hence, updated information about the environment is an essential basis for management and decision-making.

And when decisions on the environment are taken on the basis of this information, why not educate first about it current and even more future managers? Therefore, a proper education on this matter is of prime importance specifically for young generations.

In the above-mentioned context, aim of this paper is to present the idea of integrating various initiatives on the educational use of Earth Observation, which are being developed by European Space Agency (ESA) offices working in the field of education and outreach. Objective of this integration is to provide each of them with a wider scope and a common framework, with the additional benefit of enhancing the interest of individual results.

The three different educational projects carried out by ESA and considered in this proposal are presented in the following paragraphs.

#### **Teach & Track**

**Teach & Track** is an idea created in response to the challenge of educating people around the world about the potential benefits of space. This challenge was established at the UNISPACE III conference held in Vienna, 1999, entitled "Space Benefits for Humanity in the 21<sup>st</sup> Century". The United Nations General Assembly resolution for UNISPACE III confirmed "Member States determination that space be used for the benefit of all countries.... Educational programmes have to be set in place to facilitate local knowledge and expertise".

**Teach & Track** will involve European students travelling to developing countries with a small self-powering laptop and satellite Internet connection in their backpack. The mission of each travelling student is to teach the benefits of space technology to young people in developing countries, using the laptop and Internet connection as an educational tool. The Teach & Track initiative is seeking endorsement from UNESCO and sponsorship from industry. Several months of research into technology education in developing countries have been completed, the ideas and justification of the project developed and a student network supporting the project has been established.

Obviously, the very different environmental and life conditions and the well known dramatic difficulties in communication in developing regions will be taken into due account when the selection of the target communities will be carried out.

In fact, the project will start visiting schools primarily where this activity makes sense and has a sound perspective, also in terms of possible follow-up through

the contacts established, and indeed where technical problems, such as powering and internet connections are not an issue anymore.

#### **EURISY Web Portal**

**The European Earth Observation web portal for Secondary Schools** is an EURISY project and is being developed by a European team led by ESA. It implements the recommendations of a number of EURISY workshop on education about space. The project started at the end of 1998 and in 2001 will become operational and available to professors and students. Its basic mission statement is to raise awareness on Earth Observation (EO) as a tool for understanding Earth Processes and managing resources to enhance the welfare and quality of human life.

In practical terms, this web portal will put at disposal of registered secondary schools EO satellite data, EO glossary and documentation, and dedicated algorithms for image processing. Registered schools will be able to define and carry out their EO projects in support to curricula activities. Through this portal, they will also have the possibility to contact other registered schools and establish joint projects. The results of those projects will be entered into the dedicated project database, visible to and at disposal of any other registered school.

The implementation work of the EURISY EO web portal for schools is well advanced at ESRIN, the ESA centre in Frascati, Italy, and involves the co-operation of many institutions and value adding companies. In order to ensure that the portal will serve at best the needs of professors and students, one of the key members of the Implementation Team is a professor. In addition, school professors have prepared an important part of the material required to populate the portal, such as study cases. Finally, a limited number of selected schools are testing and validating the portal.

#### **KITEeye**

**KITEeye** is a project that aims to demonstrate satellite technology to schoolchildren. The initiative is multifaceted. An exciting and futuristic high altitude kite will be designed by Delft Technology University to break the world altitude record. Smaller versions of this kite will be fitted with remote sensing and/or meteorology equipment and used in demonstrations to the students. One of the Kite's functions is to act as a tool for environmental monitoring and surveillance, generating digital aerial photography from altitude.

It will use an advanced, highly efficient kite with Earth Observation equipment to provide in-situ remote sensing workshops for young people. Following some initial kite research and design by the students of TU

Delft University in The Netherlands, a contract is in place between ESTEC and Delft University for the development of the advanced kite of the KITEye initiative.

### WHAT IS THIS GLOBAL PROJECT ABOUT?

Purpose of this project is to combine complementary components of the above-mentioned three initiatives for educating on Earth Observation that ESA is carrying out, namely Teach and Track, KITEeye and the EURISY web-site.

The combination of the three initiatives will use the travel and hardware component of Teach and Track as a vehicle to bring the instructional tools of the EURISY web-portal and the demonstrational in-situ KITEeye workshops to young people in developing countries, specifically to teach about Earth Observation. The information obtained from the KITEeye workshops will be also used for comparing with the EURISY web-portal satellite data obtained through Internet connection with ESRIN.

This project is, in fact, intended to meet the overwhelming need that exists for this type of training in developing countries. Ending the necessary presentations, the teachers and students are shown how to:

- (i) understand how the selected methodologies (remote sensing and G.I.S. technology) can be used for integrated management of their environment
- (ii) elaborate generic system types in particular areas
- (iii) create a generic problem/opportunity structures and management actions/guidelines.

Specific objectives of the project are as follows:

- present the state-of-the-art of methodologies and tools for integrated system studies;
- provide insight in and practical experience with these methodologies and tools;
- initiate the establishment of contacts and networks between participants and ESA network;
- educate specifically in the context of the region, i.e. through the development of appropriate training materials for local use.

In order to establish the state of the art, disseminate results, understand and monitoring the region the Accompanying Measures will include necessary information to the regional teachers on concepts and topics like:

- i) Sustainable Management of the area integrity and of the ecosystem for future generations
- ii) optimised use of renewable resources and minimised use of non-renewable resources as the basis of economic efficiency

iii) impact of man-made ecosystem changes as the main issue for environmental management.

Key issues for achieving the objectives:

In promoting and enhancing contacts amongst the teachers of the region and between the students and the expert, European students will contribute to the further development and expansion of a human network with a positive return also to developing countries management.

### PROJECT IMPLEMENTATION

The project concept is based upon the aim of responding to education needs in developing countries.

Technological developments are being carried out within each individual initiative of this project.

Besides the above-mentioned implementation of the EURISY web-portal, in fact, the functions of the required lap-top must be developed for education. It is supposed to be able to gather Earth Observation images, or give access to the Internet, for instance for connecting to the web-portal at ESRIN.

Technical characteristics for the KITEeye are as follows:

- Platform (KITEeye),
- Altitude (usually up to 1000 m),
- Image characteristics (full colour, digital images, more than 1000 x 1000 pixels, depending upon specific camera used, JPG format),
- Image delivery (CD-ROM with digital images and list of positions).

In fact, recent developments of digital photocameras and hand-held GPS systems now offer a new and attractive option for rapid, cost-effective updating of maps, and monitoring and surveillance of the environment. The digital images can be combined in a mosaic or imported into a GIS. This type of surveys can be carried out below a cloud cover that would block satellite observations. Furthermore, these surveys can be made at any moment required, e.g. in case of calamities or disasters.

As far as the actual local programmes are concerned, the planned visits will entail:

- presentations in the morning,
- practical work sessions in the afternoon consisting in demos via internet connection to ESA/ESRIN servers (ESA proper and EURISY web-portal ones),
- evening presentations on subjects both of current interest on the region and students and teachers curiosities.

The proposed visit to each school or university aims at introducing EO to student and teachers and updating them on these matters. Therefore, a number of lecturers

from universities, government and industry will be involved, in a case-by-case basis.

The agenda will include the following elements:

- Earth Observation, its importance and role
- contribution of remote sensing technology
- current methods and tools for *in-situ* observation and investigation (including KITEye)
- state-of-the-art in modelling an area of study
- G.I.S. and their role
- integrated data processing
- Internet resources (including the EURISY web-portal)
- methods for forecast and simulation, and climate-related aspects
- planned observing systems
- social and economic aspects

## CONCLUSION

**Teach & Track** gives European students the opportunity to be involved in an educational outreach project. They will be able to teach Earth Observation and to demonstrate this technology first hand. When they return home to present the results of their trip, they will promote Educational Outreach. Before and after their trip, they will also be providing education to young people in their home country, using the portable lap-top and receiver station and they promote the European Earth Observation **web-portal** for Secondary Schools, giving them the possibility to compare that data with the aerial photography obtained with the **kite**.

This integrated project has therefore the potential for effective educational outreach. It will outreach to European students and to people in developing countries. It will outreach remote sensing and G.I.S. several regions

and also promoting European student involvement in space technology for beneficial use in their careers.

In order to make this project a reality, support is being sought from Governments, Universities and Industry.

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