

**UN/Austria/ESA Symposium  
on "Water for the World: Space Solutions for Water  
Management"**

**13-26 September 2004 - Graz, Austria**

*Use of space technologies in the  
management of the River Danube*

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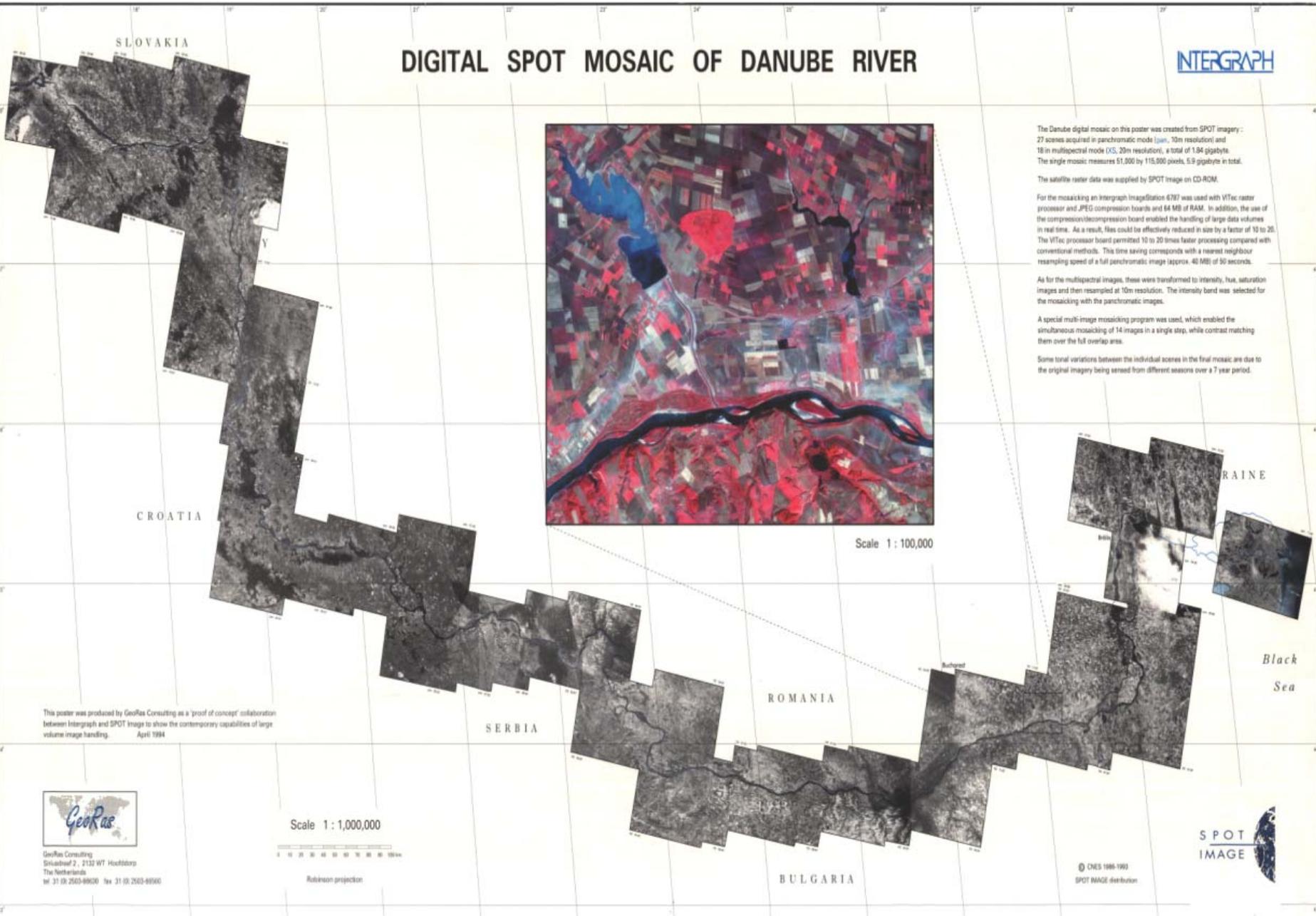
# The Danube

- The second **longest river in Europe** (after Volga) - flows 2,860 kilometers
- from southern Germany to Romania and the Black Sea.
- The river drains about **815,800 square kilometers of land**
- It has the **largest volume of flow of any European river**. Main tributaries :
- Inn, Drave, Tisza, Save, Morava, Siret, Olt, Prut
- The Danube begins at the merger of two small rivers in the Black Forest in Germany. It winds east through Germany and Austria and along part of the border between Slovakia and Hungary. The Danube curves south near Budapest, Hungary. It flows through Hungary, forming part of the border between Croatia and Yugoslavia. It turns east and flows across Yugoslavia, then forms part of the border between Yugoslavia and Romania and most of the border between Romania and Bulgaria. It flows north through Romania and splits into three branches before emptying into the Black Sea.
- Commercial ships and barges transport large amounts of freight on the Danube. They carry agricultural goods, chemicals, mineral ores, steel, and other products. About **35 major ports lie along the Danube**.



# DIGITAL SPOT MOSAIC OF DANUBE RIVER

INTERGRAPH



The Danube digital mosaic on this poster was created from SPOT imagery: 27 scenes acquired in panchromatic mode (pan, 10m resolution) and 18 in multispectral mode (XS, 20m resolution), a total of 1.94 gigabyte. The single mosaic measures 51,000 by 115,000 pixels, 5.9 gigabyte in total.

The satellite raster data was supplied by SPOT image on CD-ROM.

For the mosaicking Intergraph Imagerization 6707 was used with VTEC raster processor and JPEG compression boards and 64 MB of RAM. In addition, the use of the compression/decompression board enabled the handling of large data volumes in real time. As a result, files could be effectively reduced in size by a factor of 10 to 20. The VTEC processor board permitted 10 to 20 times faster processing compared with conventional methods. This time saving corresponds with a nearest neighbour resampling speed of a full panchromatic image (approx. 40 MB) of 50 seconds.

As for the multispectral images, these were transformed to intensity, hue, saturation images and then resampled at 10m resolution. The intensity band was selected for the mosaicking with the panchromatic images.

A special multi-image mosaicking program was used, which enabled the simultaneous mosaicking of 14 images in a single step, while contrast matching them over the full overlap area.

Some tonal variations between the individual scenes in the final mosaic are due to the original imagery being sensed from different seasons over a 7 year period.

This poster was produced by GeoRas Consulting as a 'proof of concept' collaboration between Intergraph and SPOT Image to show the contemporary capabilities of large volume image handling. April 1994



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Scale 1:1,000,000



Robinson projection

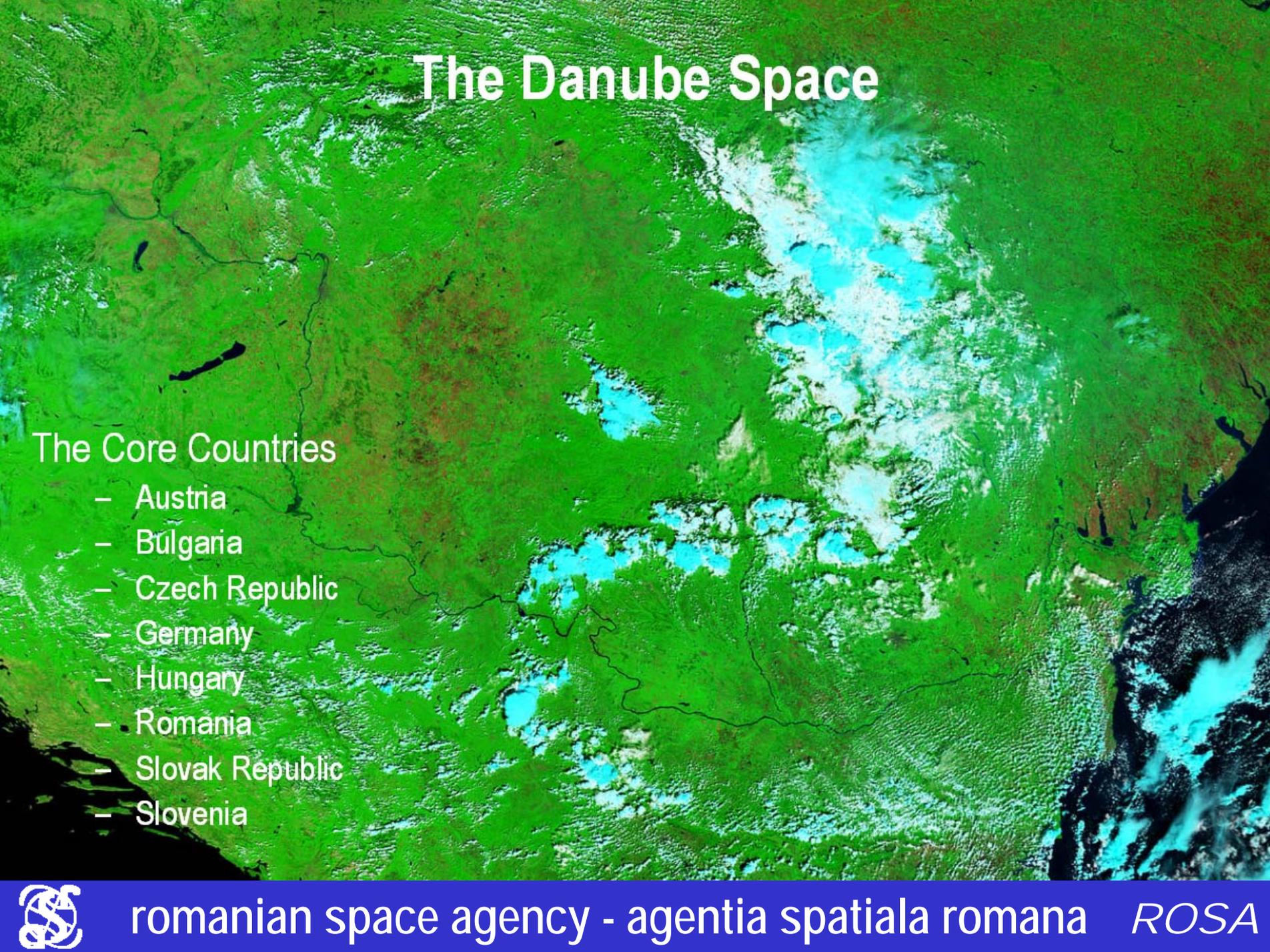
Scale 1:100,000

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SPOT IMAGE distribution

SPOT  
IMAGE



# The Danube Space

An aerial photograph of the Danube river basin, showing the river winding through a landscape of green and brown. A semi-transparent green overlay covers a large portion of the basin, indicating the 'Danube Space'. The Danube River is visible as a dark line winding through the landscape.

## The Core Countries

- Austria
- Bulgaria
- Czech Republic
- Germany
- Hungary
- Romania
- Slovak Republic
- Slovenia



# Space and the Danube

**Space applications could play a major role in the sustainable development of the Danube Basin region.**

**Tools as satellite imagery, navigation and positioning, telecommunications and their integration in geographic information systems bring positive effects to economic development, environmental management and societal integration.**

**Issues from the Danube Delta and Black Sea preservation, river satellite assisted navigation, disaster management and risk and traffic monitoring could be approached together by means of space technology towards with substantial benefits for the integration and development of this European region.**



# EURISY Conference

**The Danube and Europe: Integrated Space Applications  
in the Danube Basin, 23-25 June, Mamaia (Constanta) -  
Romania**

**Co-sponsored by:**

**Romanian Space Agency**

**United Nations Office for Outer Space Affairs**

**European Space Agency**



## Purpose (Objectives, Aims)

The Conference covered:

- scientific / technical definition on regional items identification and on how space technology could support their management,
- on-going and future space technology projects and initiatives in the region,
- trends and aspects of applications for the European scale projects, as GALILEO / EGNOS, GMES, ENVISAT, ARTES, EU Water Framework Initiative



# Three sessions + Posters

## 1. Integrated Space Applications to Water Resources Management

Pollution, Floods, Preservation of Natural Habitat . . .

## 2. Natural Resources Related Issues

Environmental Monitoring, Sharing of Water Resources, Climate Related Problems...

## 3. Human Security

Border Security, Telemedicine, Harbour Movement, Crime Prevention, Dangerous Goods Transport . . .



**A total of 58 participants attended the Conference and came from the following 10 countries: Austria, Azerbaijan, Bulgaria, France, Italy, Romania, Slovakia, Russian Federation, Ukraine and United States of America.**

**The International Commission for the Protection of the Danube river, ESA, the European Commission and the Office for Outer Space Affairs were also represented.**

**At the opening session of the Workshop, welcome addresses were made by representatives of ROSA, EURISY, ESA and the Office for Outer Space Affairs while keynote addresses came from ICPDR, ESA and ROSA. A total of 23 presentations were delivered in the above three thematic sessions and 14 posters were presented.**



# Highlights

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# **National Institute of Meteorology and Hydrology (NIMH), Romania**

## **“Flood Warning and Forecasting System Prototype for the Mures River basin in Romania”, by the National Institute of Meteorology and Hydrology (NIMH), Romania**

- Carried out a flood forecast system using as input data a Romanian model, weather forecast available in Romania and the ECMWF model used in the European Flood Forecasting System–EFFS project;
- Designed and built a GIS for the MURES basin corresponding to the flood forecasting model requirements and for the analyzing and dissemination of flood forecast results.

The flood warning and forecasting system prototype for the Mures river basin in Romania was tested in the National Hydrological Forecasting Centre of the National Institute of Hydrology and Water Management in Bucharest and it will be implemented in the Hydrological Service of the Romanian Water Administration;

Other products of the project (land cover/land use digital maps, satellite derived maps, image maps with integration of local GIS data, parameters derived from satellite images and GIS database, flood hazard maps for several probabilities of the maximum discharge occurrence) will be used in

- preparedness/warning actions, taken to insulate people or infrastructure
- recovery (after the flood) actions taken to re-building destroyed or damaged facilities.



# **United Nations- Office for Outer Space Affairs**

## **“International Programme - United Nations Programme on Space Applications”**

### **History of the Programme on Space Applications (PSA) Committee on the Peaceful Uses of Outer Space (COPUOS)**

- **Development of a fellowship programme for in-depth training**
- **Organization of workshops on advanced space applications and new system developments**
- **Stimulation of the growth of indigenous nuclei and an autonomous technological base**

### **UN/ESA Projects on the use of Remote Sensing Technology for sustainable Development**

- **Africa**
- **Asia**
- **Latin America**



# **Bureau de Recherches Geologiques et MiniPres - France**

## **“Risk-based Assessment and Management approaches for contaminated watersheds using very high spatial and spectral resolution imagery and GIS : example of the Witwatersrand gold field (South Africa)”**

### **Study area conditions:**

- **growing urban pressure, occupation of derelict lands**
- **water scarcity, contamination of surface and groundwater**
- **intense mining activity**
- **large watersheds composed of wetlands and artificial channels**

### **Using IKONOS, ASTER, LANDSAT TM AND HYPERION imagery**

**> Project driven by the Risk Assessment process, the best available strategy for dealing with the problems posed by land & watershed contamination**

### **> Project main outputs:**

- **a spatial imagery - based Risk Assessment Tool**
- **a decision-making tool (GIS) end users-oriented designed to help identifying priority zones where intervention is needed in order to keep risks within acceptable limits**



# **BULGARIA, ROMANIA, MOLDOVA & FAO “LAND COVER INVENTORY BY REMOTE SENSING IN THE LOWER DANUBE BASIN”**

## **LCCS - Land cover Classification System**

### **Projects in Bulgaria, Romania and Moldova**

- a harmonized and standardized collection of land cover data;**
- availability of land cover data for a wide range of applications and users;**
- comparison and correlation of land cover classes.**

**THE CO-OPERATION BETWEEN THE IMPLEMENTING AGENCIES CREATED A REAL NETWORK OF EXCELLENCE, IN FACT AN EXEMPLE TO BE FOLLOWED.**

**WHY NOT AN LCCS INTERPRETATION OF THE FULL DANUBE BASIN?**



**Royal Haskoning , Netherlands and World Water Forum**

**“Protection of wetlands of the Danube . A pilot project for  
Cama Dinu islets area”**

**Project focusing on ecological protection and restoration  
options for the Romanian - Bulgarian section of the lower  
Danube in European perspective**

**Realisation of a database, monitoring and inventory of flora  
and fauna in a test zone - the Cama Dinu islets area.**

**Implementation of the policy framework for the environmental  
management of the Danube river**

**Preservation of the Cama Dinu area as a pilot project**

**Protect or rehabilitate the valuable ecosystems of the Danube**



## **Environmental Monitoring Sustained by Ecotourism**

**Ecotourism as tool to evaluate and assist the anthropogenic changes of the Biosphere State.**

### **Primary goals**

- **determining the most important factors that influence the change of the state of some components of the natural ecosystems**
- **determining the observation indicators**
- **establishing the controlled parameters –linked to their dynamics, of the natural complexes**
- **optimization of the annual and periodic monitoring programme**

### **Conclusions**

**Ecological monitoring sustained by ecotourism is the solution for evaluation, forecast and control of the anthropogenic changes of the Biosphere State.**

**Unfortunately, no systematic data are available for the environments of the small and medium rivers in Romania. To form the databases, the concerned ecological projects must be realized.**



# Institute for the Protection and Security of the Citizen (IPSC) - Joint Research Centre “Monitoring the new European Union Borders”

The work presented was part of ISFEREA project (Information Support for Effective and Rapid External Action)

Methodological focus on integrated earth observation (EO) and GIS technologies in support to border monitoring activity and to border permeability assessment

## **Objectives of border monitoring activity**

- To improve the monitoring of migration flow,
- To enhance the exchange of migration statistics,
- The identification of key migration driving forces and hot spots for immigration on Europe's Eastern borders

## **Methodology**

- Existing statistics on migration flows and international migration rules will be integrated in a GIS containing socio-economic push-pull factors and physical border permeability map derived by satellite data processing and other cartographic sources. The system will be integrated using spatial fuzzy multicriteria approach in the frame of spatial decision support system methodologies.



# **TeleConsult Austria & ESA, The Netherlands Galileo and EGNOS for Waterway Transport – The GALEWAT Project**

**ESA-funded project (ARTES 5 program)**

**Aims:**

- Introducing EGNOS and Galileo into RIS (River Information Services)**
- Bridging EGNOS outages by retransmitting the information via AIS base stations**
- Analysis and validation of EGNOS performance with respect to requirements**
- Demonstrate the suitability of EGNOS augmented satellite navigation services for waterway transport**
- Development transition scenarios from today's RIS architecture towards the implementation of EGNOS and Galileo**

**Conclusions**

**The Europe-wide implementation of River Information Services is an important requirement to make transportation on inland waterways more competitive**

- Experiences gained in GALEWAT and MarGAL will give feedback on the applicability of new services and technologies for the waterway sector**
- Technical, administrative, and legal adaptations for advanced traffic information services all over Europe will be stimulated**



# Richmond, Virginia, United States

## “Telemedicine for Remote Areas”

### Telemedicine Capabilities

1. Internet Access
2. Consultations
3. Data Mining
4. Limited Video Conferencing
5. Multimedia Production
6. Coordination of Care

For the first time in Romania a real mobile telemedicine demonstration during a trip in a remote area of the Danube Delta

During the demonstration session Prof. Ronald Merrell, MD, (affiliated to Virginia Commonwealth University and NASA) acted as the on-site physician consulting a member of the ship crew supposed to be in a critical health state. Real time echographic images were transmitted and there was a videoconference tele-consulting with Tony Hangan, MD, situated at the Constantza District Emergency Hospital, via satellite data connection.



# Final recommendations

1. An integrated information system for Danube Basin natural resources, environmental monitoring and risk preventing using space technologies;
2. A Danube Basin water related risk management and environmental protection project. It will consist of several pilot projects that formed and performed by the countries in the Danube Basin area. The objectives of these pilot projects are set according to their own needs for the benefit of their own countries. According to the lesson's learned from our past experience in running projects, finance and authority are the two major issues for sustaining a project. So we discussed strategies for handling both issues. Basically, on the finance issue, each country is responsible for their own funding, so it is important to choose project which benefits their own country;
3. A network of institutions organizations from the Danube riparian countries, specialized in space applications and oriented to Danube specific issues.

## Sources of funding:

- European Commission RTD FP 6, priorities 1-4 from Aeronautics and Space with an emphasize on 1.4.2 area, GMES;
- ESA programmes;
- The countries involved.



**The Romanian Space Agency (ROSA), as the national space programs leading institution and international representative of Romania in major space related organizations and agreements, is developing and planning applications of space technology to risk and disaster management with a view to the specific national and regional items.**

**Projects and studies on specific natural disasters as flood, earthquakes and landslides, together with actions towards increasing security to environmental and human risk generating factors, are developed by ROSA centers and the affiliated institutes, universities and companies on a wide thematic and international basis.**

**ROSA can undertake for the start-up phase the co-ordination of a Danube River and Basin Network of representative organizations**



<http://www.rosa.ro>

