



# Integrated Applications Programme (IAP)

**European Interparliamentary Space Conference**  
**Bucharest Oct. 25th 2010**  
**Prof. A. Ginati, ESA**



European Space Agency

- **Introduction**
- **Integrated Applications Promotion (IAP)**
- **Illustrative Examples of Projects**
- **Satellite AIS Initiative**
- **Conclusion**

## The goal :

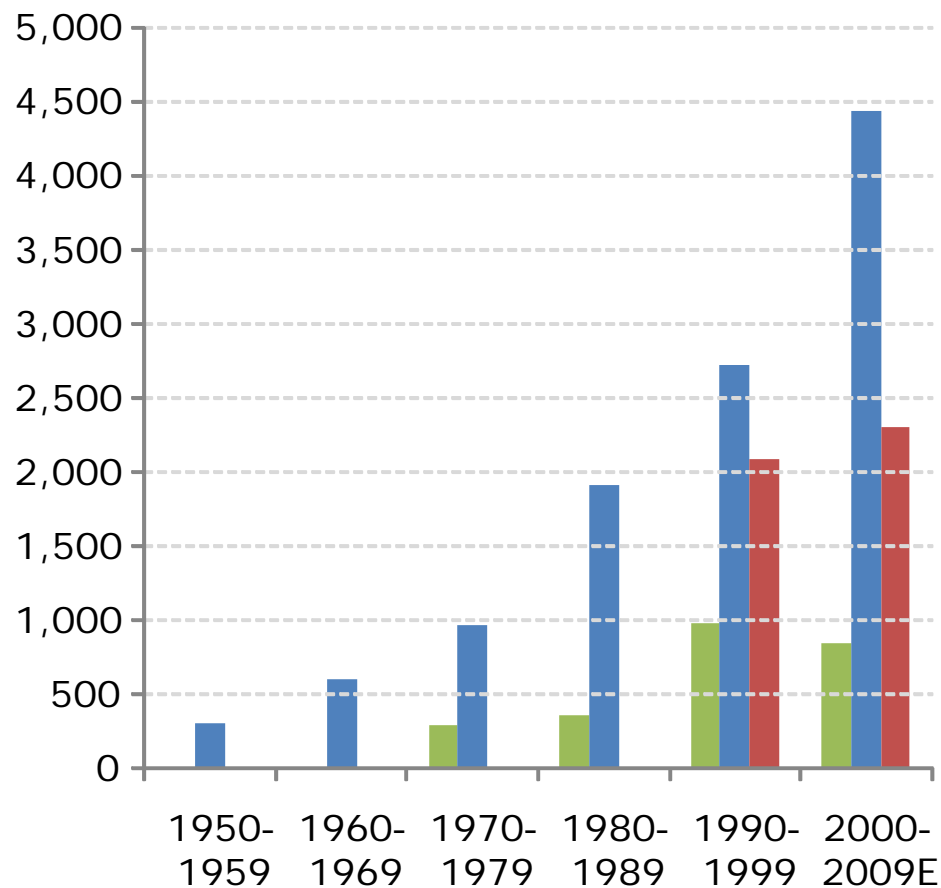
Foster **new utilization** of **existing space** capacity and **capability** through the development, in close **partnership** with **end-users**, and with the required stakeholders of **integrated** (different space and non space technologies) applications projects which **demonstrate** a potential for **sustainable services**.

Addressing global challenges in different thematic areas: **Space 4**  
Health, Development, Transport, Security, Safety, Energy,  
Agriculture, Economy, Knowledge, Innovation, ...

**Climate => Energy / Health**

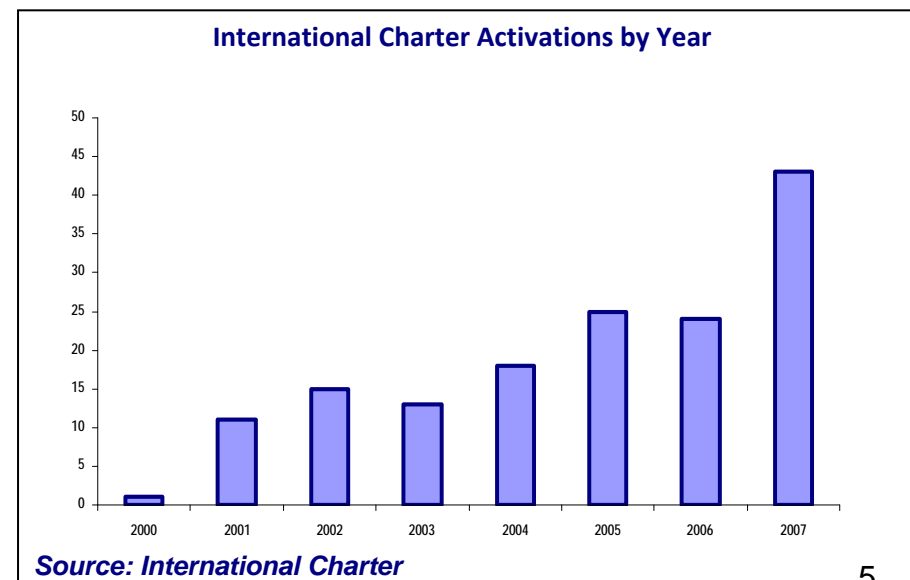
- Awareness & innovations
- **Time to market** critical (limited R&D)
- “Open” and “Thematic **Calls**” are based on:
  - Expert opinion from the IAP **Advisory Committee** (IAPAC)
  - A web communities portal gateway, **KM & sharing**
  - A network of **ambassador platforms** across Europe and..  
(**Vienna**, Harwell, N, Addis Ababa, Fi, F, E...)
- Requirement / **Partnership**
- Feasibility Studies toward **Sustainability**
- Demonstration Projects toward **Pre-operation**
- Space 4 Entrepreneurship: **EIB, Innovation Fund**

An increasing impact of disasters per decade:



Source: ISDR, Euroconsult estimates

- Fast growing number of disasters reported in the different world regions
- Over 2 billion people impacted
- Economic damage over \$500 billion

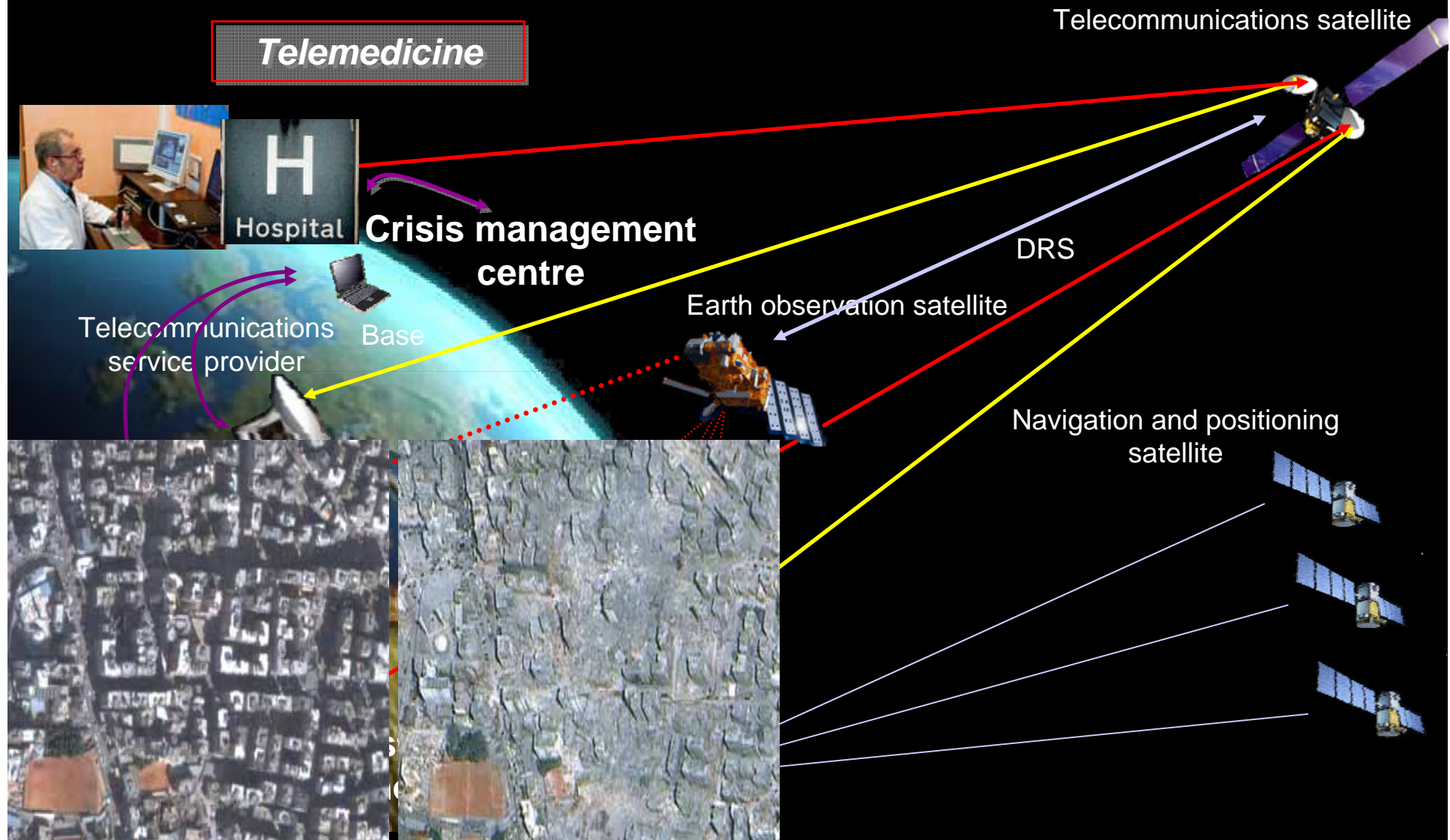




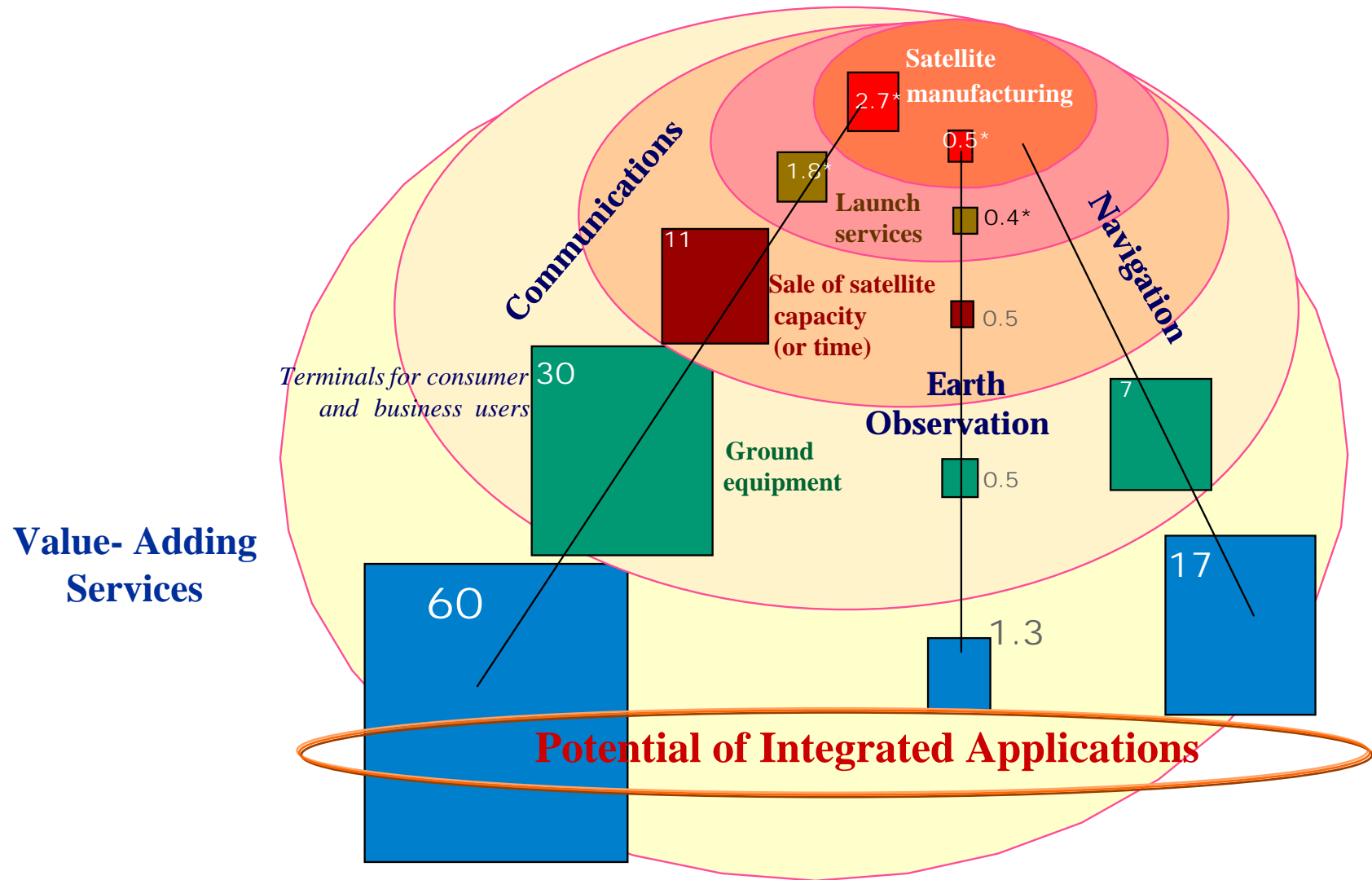


# Integrated Applications

## Example: "Service-Buy" Model



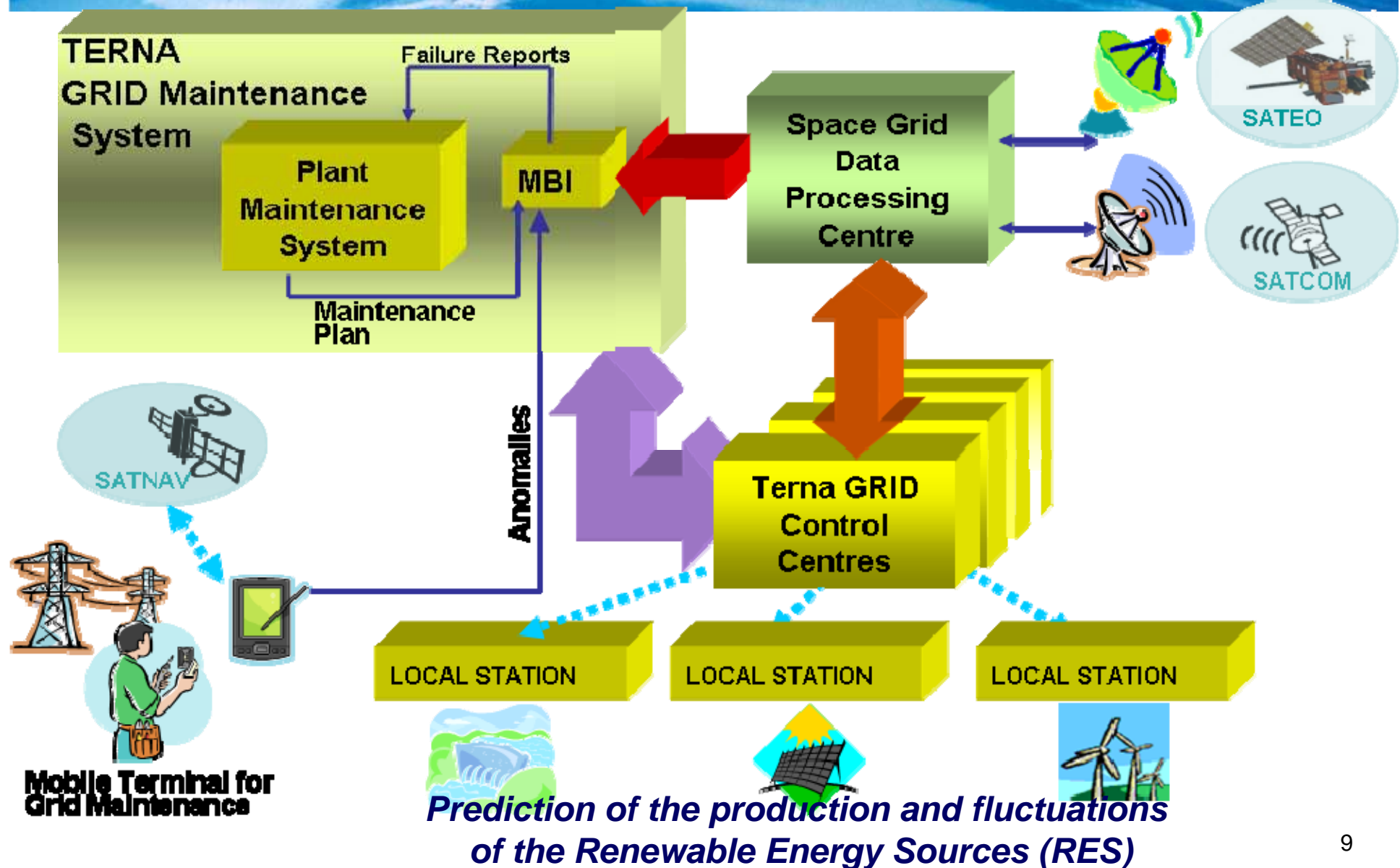
# The three value chains in commercial satellite applications



Values for the year 2009 in billions of € (Satcom)

- ***Space for Safety / Transport***
  - Flight Safety: NL, B (D, F) - Air Forces (Airlines / Airports)
  - Satellite AIS System for Maritime Security: EMSA & DG-MARE
  - Transport of Hazardous materials (SSMART): AREVA
  - Integrating Space Assets for UK Civil Resilience: British Cabinet Office
  - Satellite Systems, Operations and IA for UAS :EDA
- ***Space for Health (thematic website: [www.esa.int/health](http://www.esa.int/health))***
  - Health in Peacekeeping Missions : G, F, I ,E MoDs
  - Private medical insurance and assistance : Europ Assistance
  - Aero-telemedicine System : BMI & I SOS
- ***Space for Knowledge/Development***
  - Telemedicine / Infrastructure in Africa: DG-DEV / EIB
  - Peace Building and Damage Assessments: (e.g. DG RELEX)
- ***Space for Energy***
  - Power grid management : TERNA
  - Nuclear site monitoring (e.g. Chernobyl): IAEA







*Integrated Application Promotion*

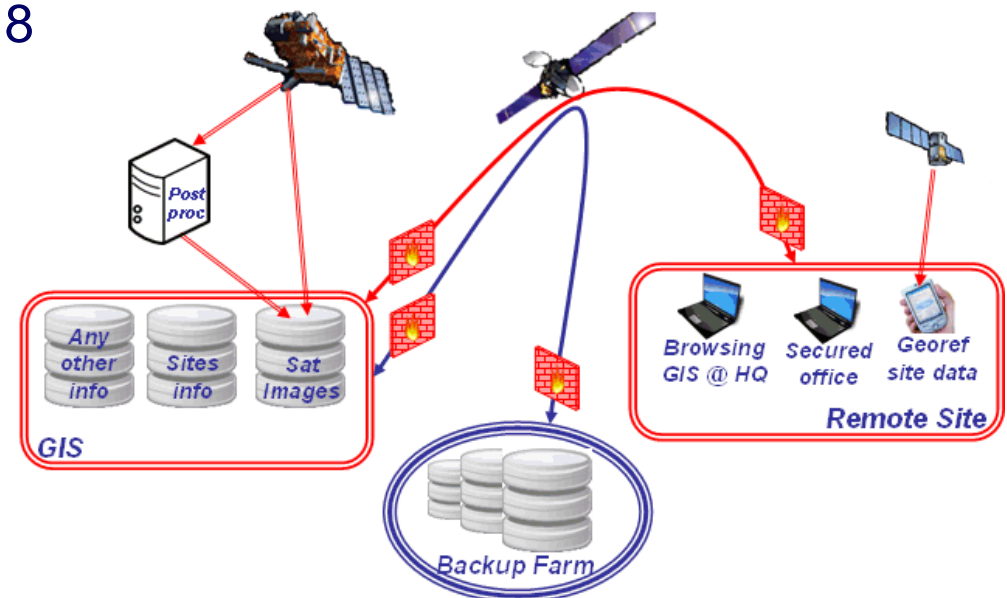
- IAEA is the world's nuclear inspectorate, with more than four decades of verification experience
- Inspectors work to verify that safeguarded nuclear material and facilities.

*Nuclear Safeguard and Verification*



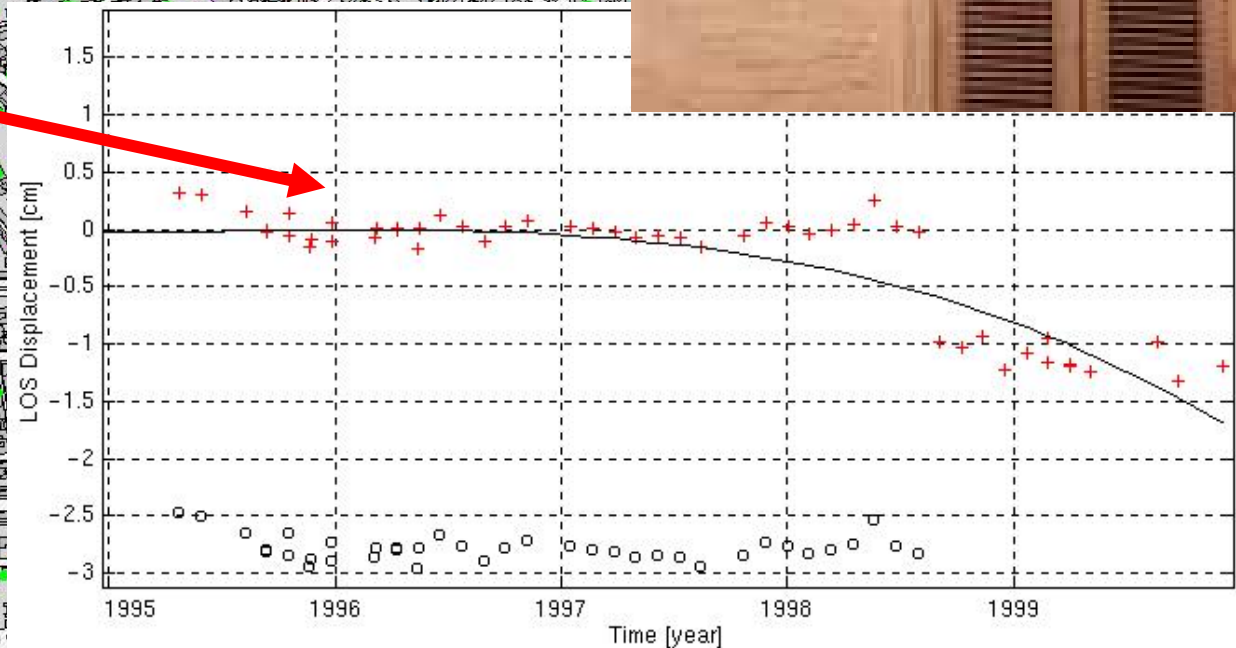
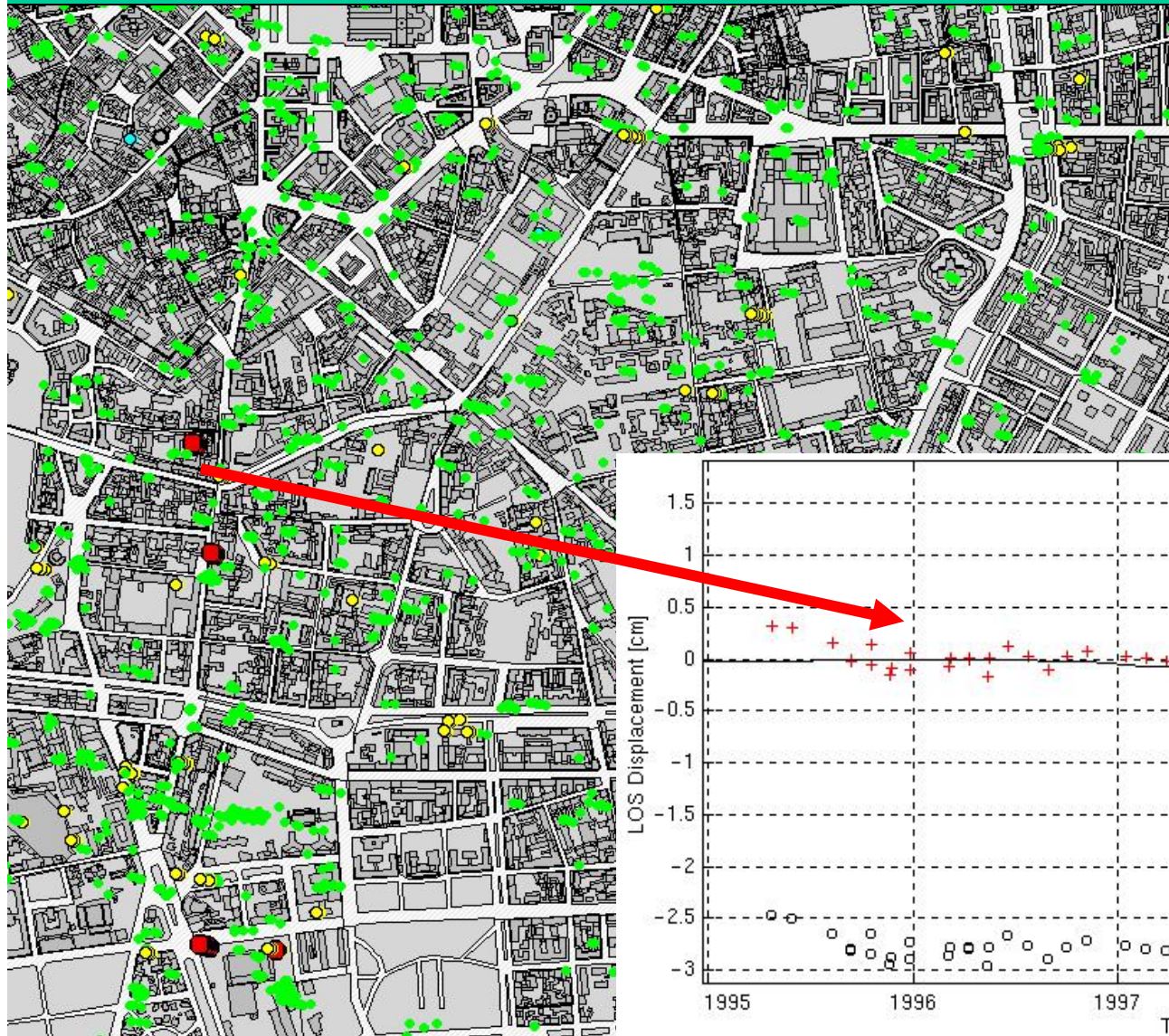
# Integrated Satellite-Based IAEA Safeguard Services

- **IAEA needs:**
  - Connect all Nuclear Power Plants to IAEA Headquarters
  - Monitor critical assets
  - Secure Data acquisition & processing in near real and real-time (confidentiality is a must)
  - Support on-site Inspections
- Pre operational Demo activity in key sites of 4 countries (Brazil, Hungary, Armenia, Ukraine) Next 8 sites follows.
- IAEA wish an operational solution to integrate up to 400 sites.
- Letter received by ESA DG with request to enlarge cooperation
- Space assets involved
  - Satcom, -Nav, EO





*Structural Damage seen from Space – ERS  
SAR sees  
permanent ‘scatterer’ sink suddenly by  
about 1 cm*

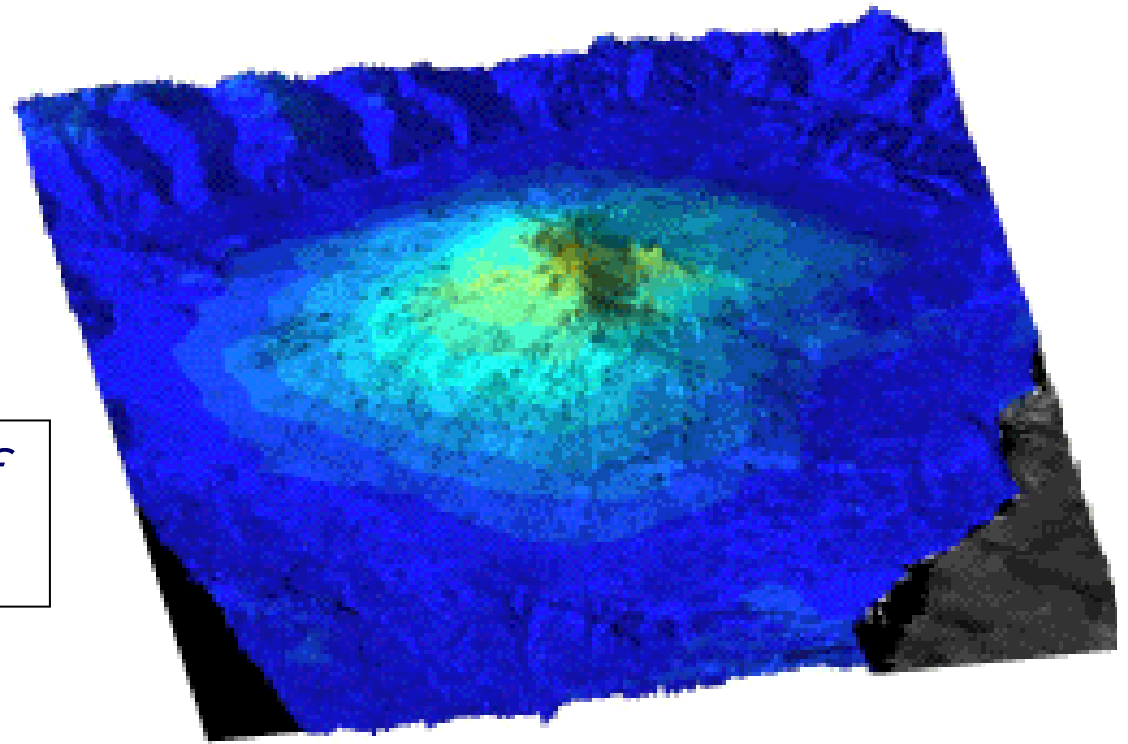








## *The Breathing of ETNA*





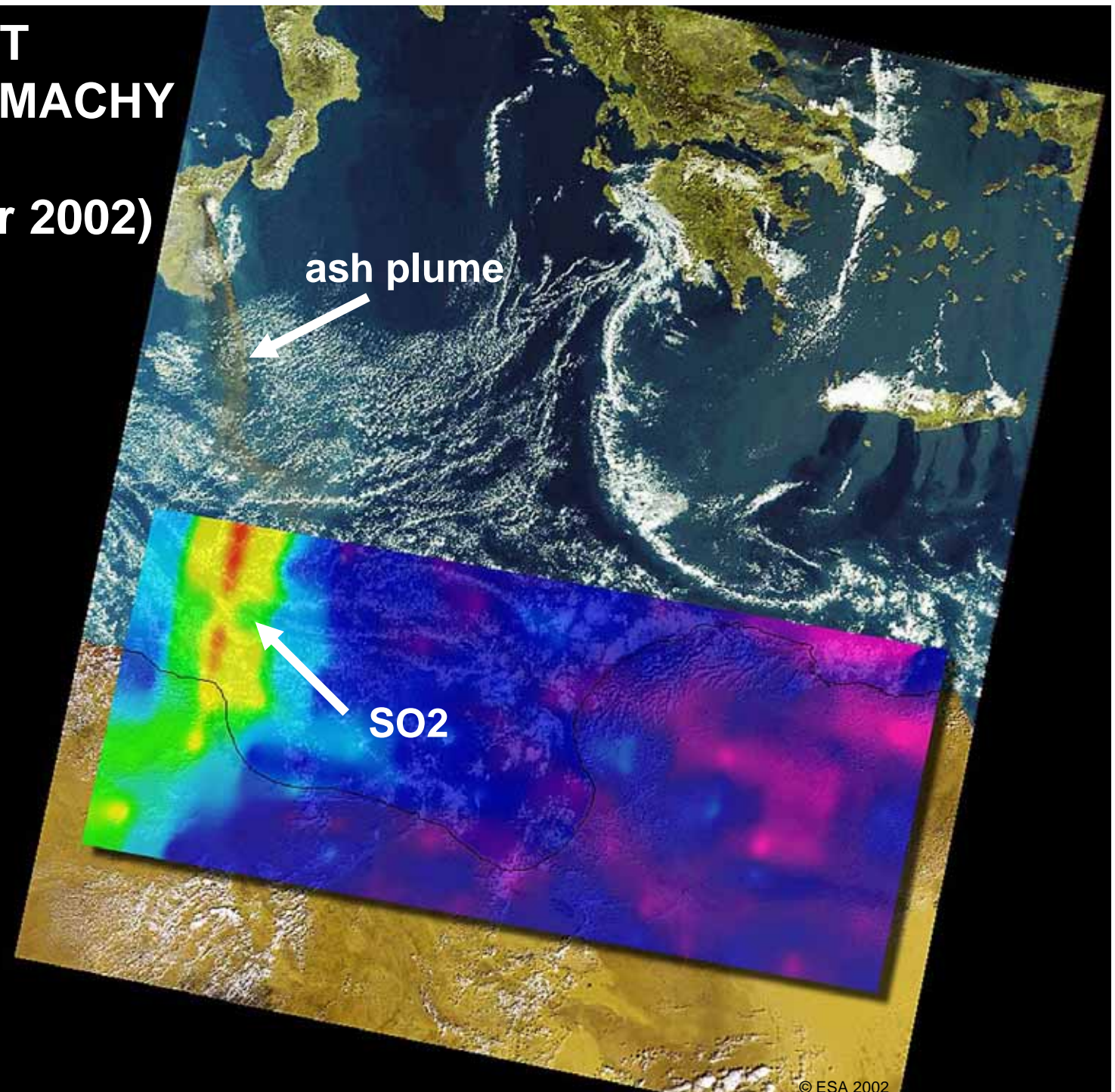
*Integrated Application Promotion*

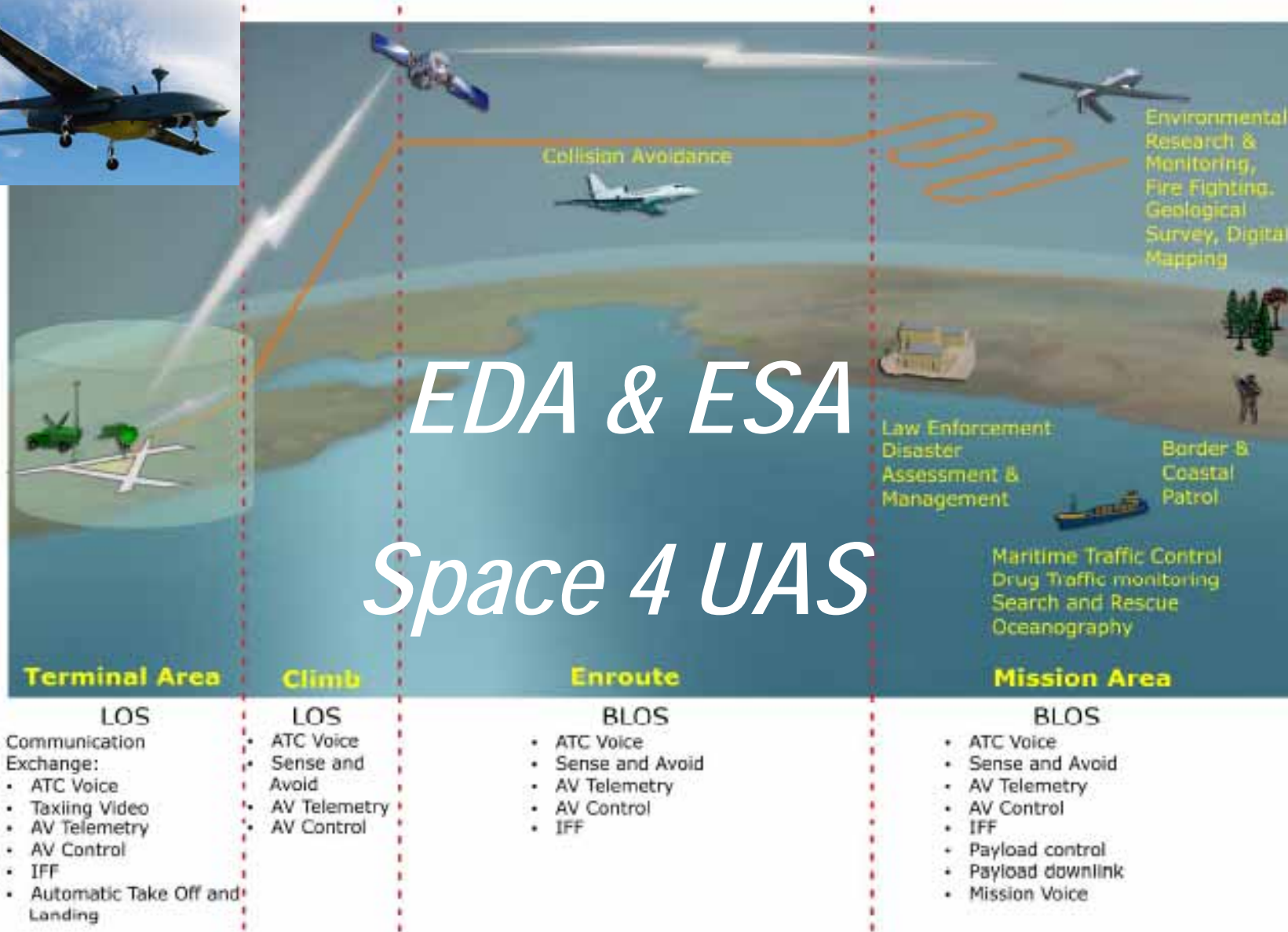
*Volcanic ash cloud monitoring*



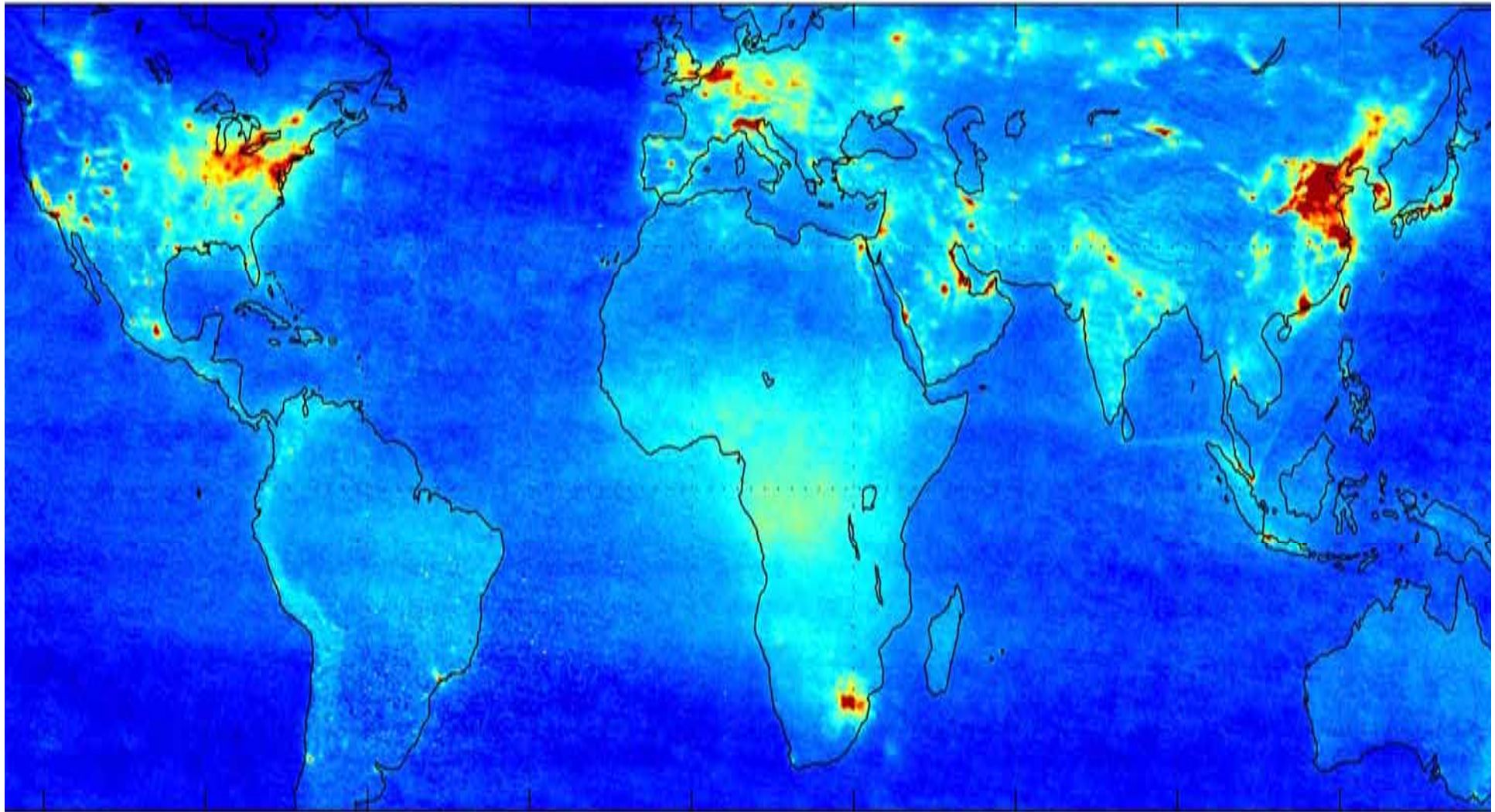
**ENVISAT  
MERIS + SCIAMACHY**

**Etna (October 2002)**





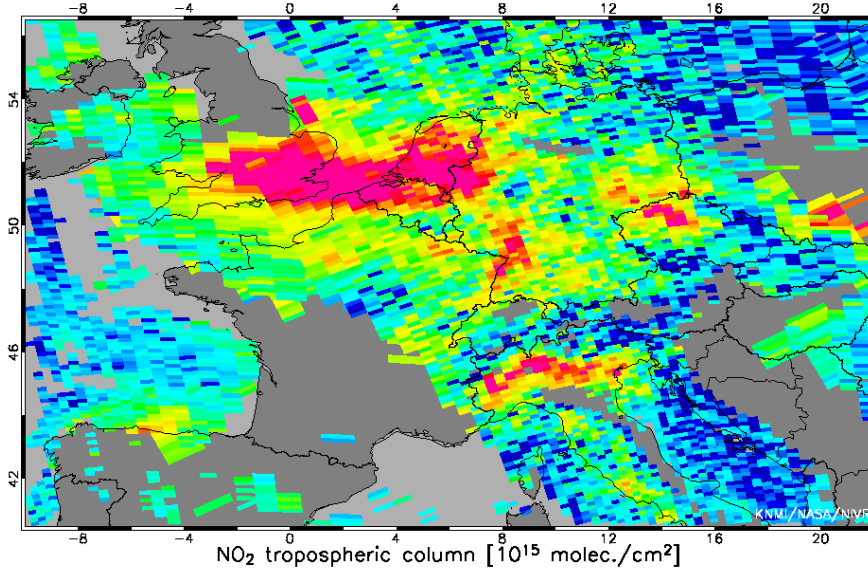






OMI mean tropospheric NO<sub>2</sub> 15 Oct 2005

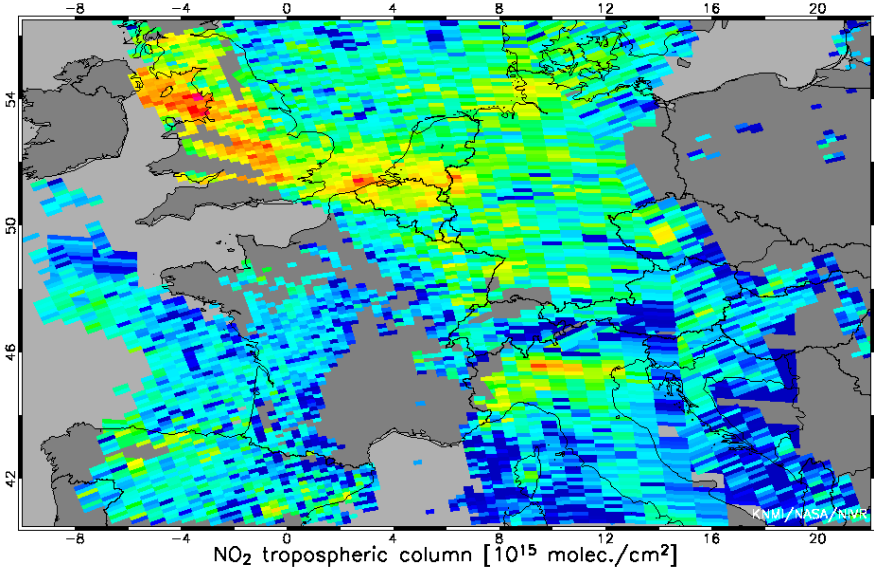
KNMI/NASA/NIVR



Saturday  
15 october

OMI mean tropospheric NO<sub>2</sub> 16 Oct 2005

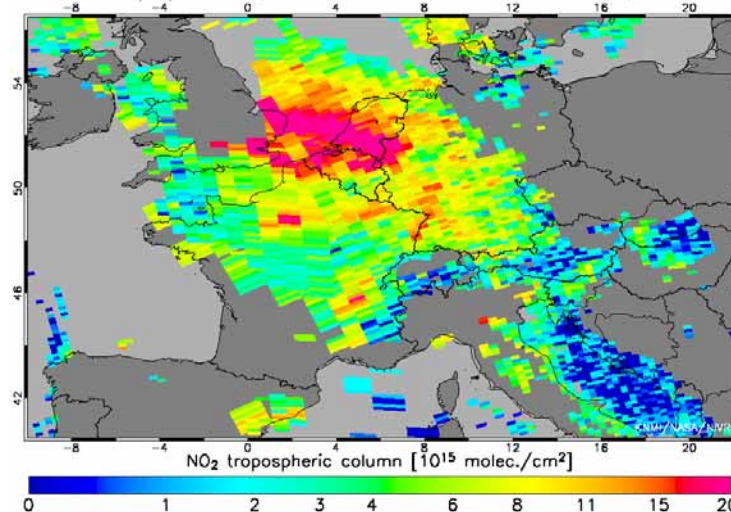
KNMI/NASA/NIVR



Sunday  
16 october

OMI mean tropospheric NO<sub>2</sub> 17 Oct 2005

KNMI/NASA/NIVR



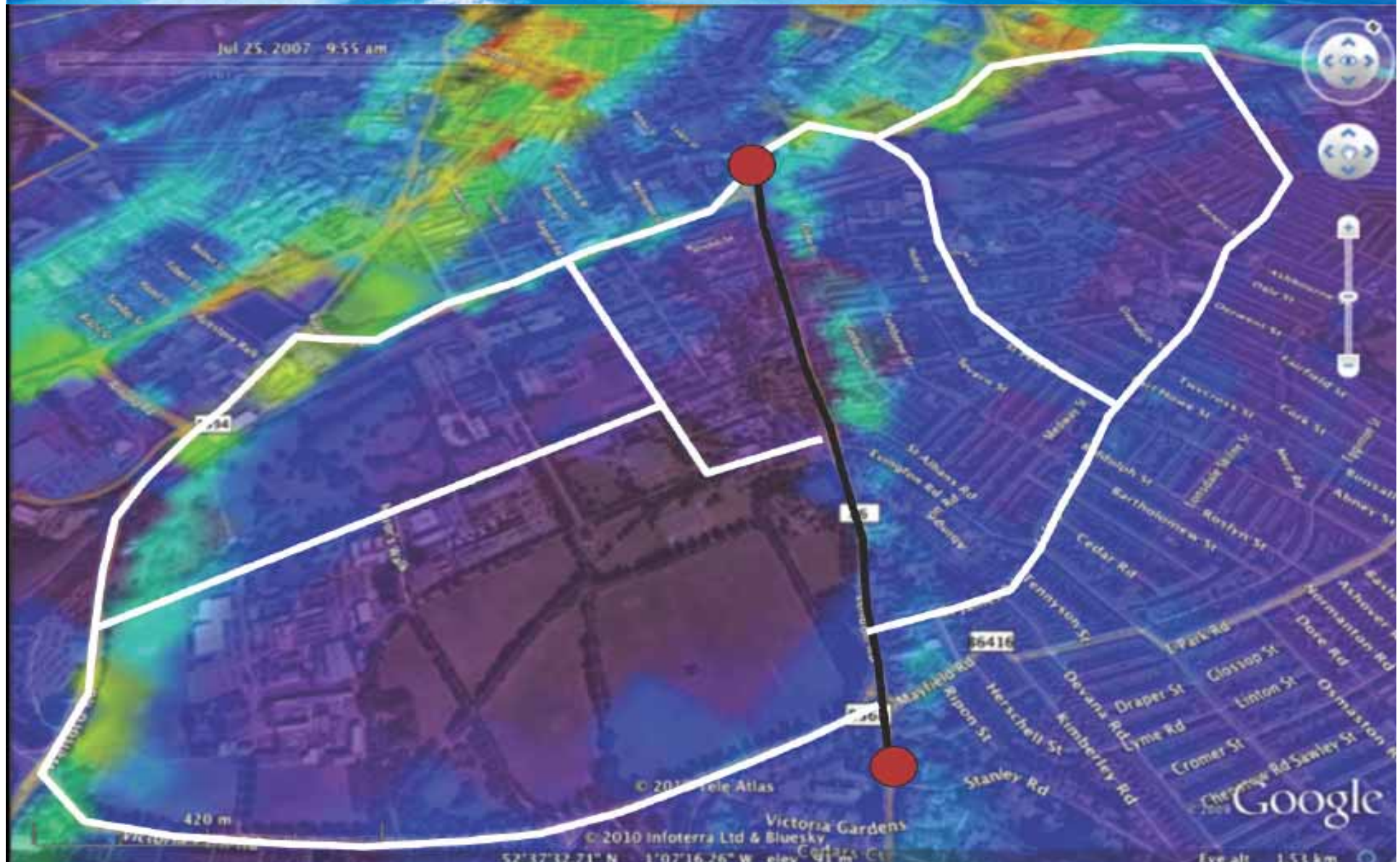
Monday 17 october

Credits: KNMI, NASA, NIVR

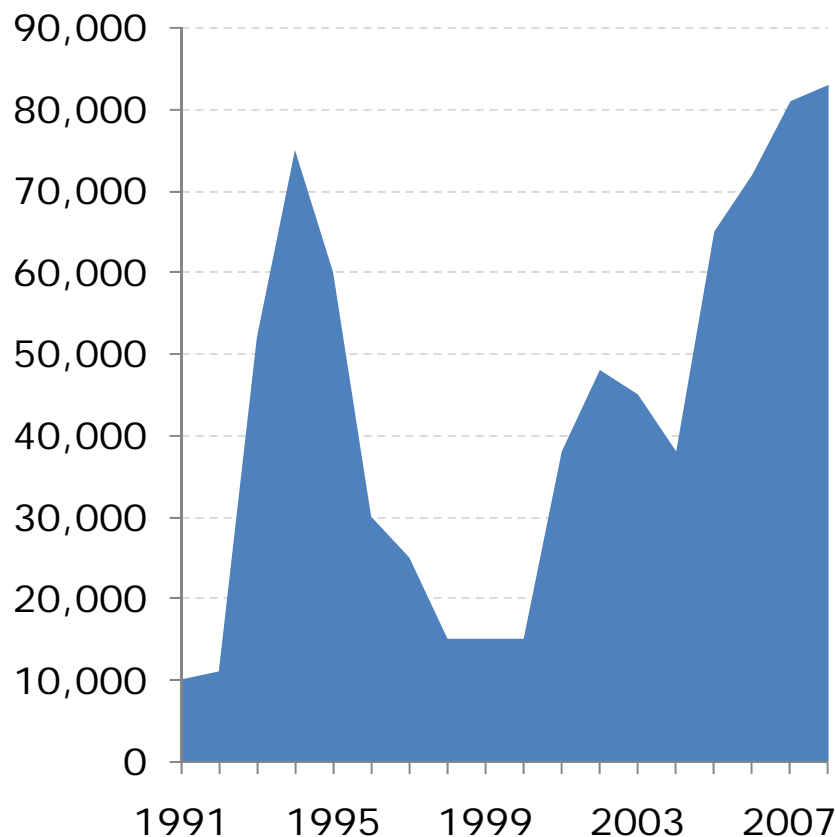




# *ITRAQ - Integrated TRaffic management and Air Quality control in cities*



**Uniformed personnel in UN peacekeeping operations**



Source: UN

- Political instability in a number of geographical areas has resulted in an increasing number of multilateral government operations for peacekeeping and security
- Increasing costs of peacekeeping information in recent years:
  - 1993: \$3.6 billion
  - 1998: \$1 billion
  - 2001: \$3 billion
  - 2004: \$2.8 billion
  - 2006: \$5.03 billion
  - 2008: \$6.8 billion
  - 2009: \$7.1 billion





# *T4MOD - Medical support in peacekeeping missions*

**Consultation, second opinion, training**



**Remote guiding**



**Image-based diagnosis**



## **Project objectives:**

**Telemedicine system capable to support remote assisted services (echography for F MoD, neurosurgery for D MoD) through an interoperable IP overlay satellite network**

## **Medical Fields of interest:**

**dermatology, ophthalmology, microbiology, haematology, orthopaedics, traumatology, anatomopathology, radiology (X-Ray / CT scan, US)**

**Remote manipulation**



**Remote maintenance**






*Example EC / EIB / ESA*

*Space 4 > Africa > in Space*

**Countries with a critical shortage of health workers  
(doctors, nurses and midwives)**

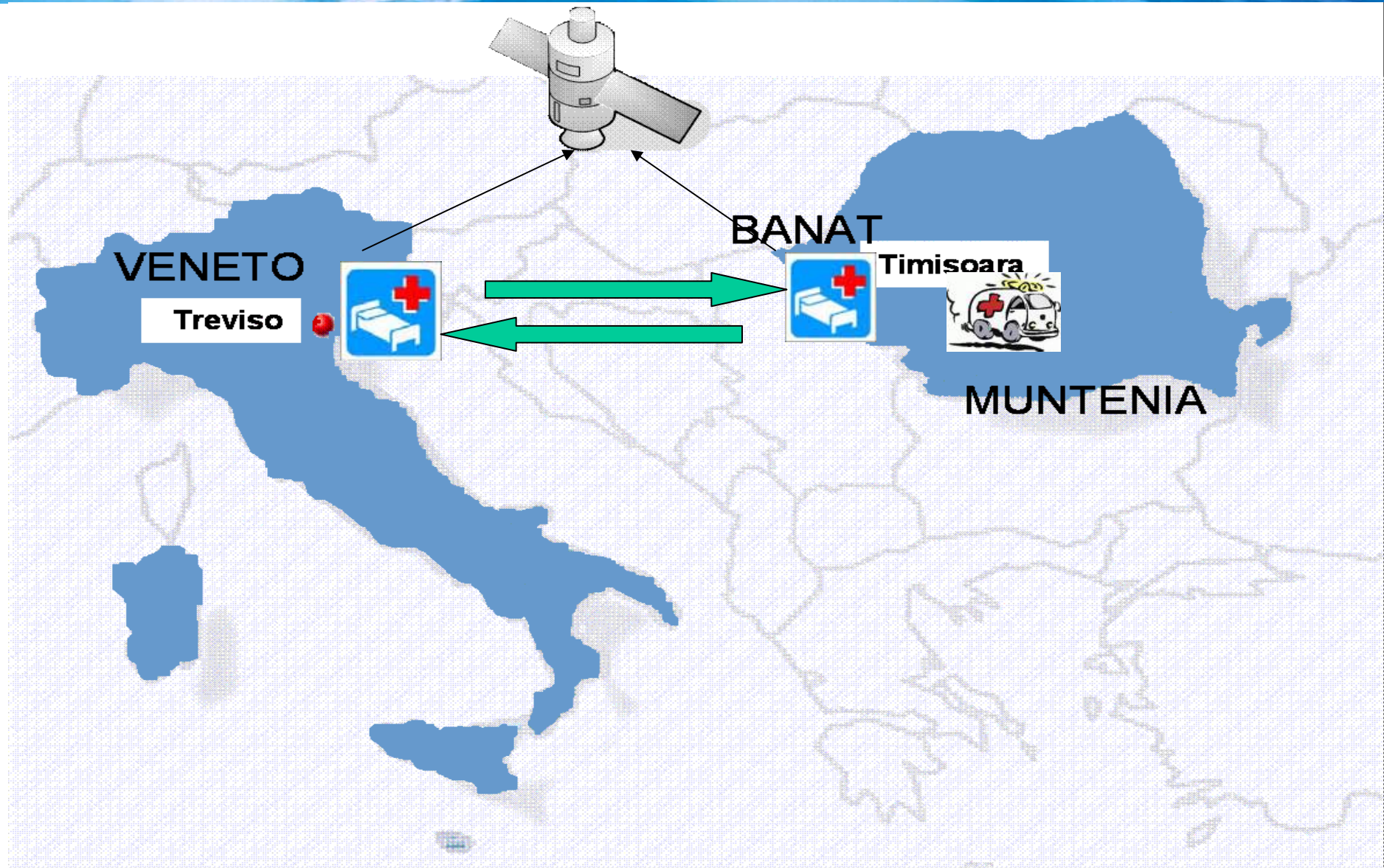
**Programme for the Development of  
Satellite-Enhanced Telemedicine and  
eHealth Services in Sub-Saharan  
Africa**

A world map with countries colored in two shades of orange. Darker orange indicates countries with a critical shortage of health workers, while lighter orange indicates countries without. Sub-Saharan African countries are predominantly dark orange. A legend at the bottom right clarifies the color coding.

■ Countries with critical shortage  
■ Countries without critical shortage

**Millennium Development Goals (MDGs) and counteracting Health workforce crisis**









# *SATO - Safer Tourism*



- Every year between **700-1000 people died** during long duration flights (>6 h) due to medical reasons
- Each day **1- 1.5 planes** are landing in emergency conditions for medical reasons the statistic data on these landings showed that **45% can be avoided** if a single **electrocardiogram** could be transmitted from the plane to an emergency medical department in an **hospital**;
- The cost of such re-routings is about **80K€**.
- Increase flights duration, A380, **15 hours non stop**
- **Increase number** of passengers will increase with the new capacities of the planes





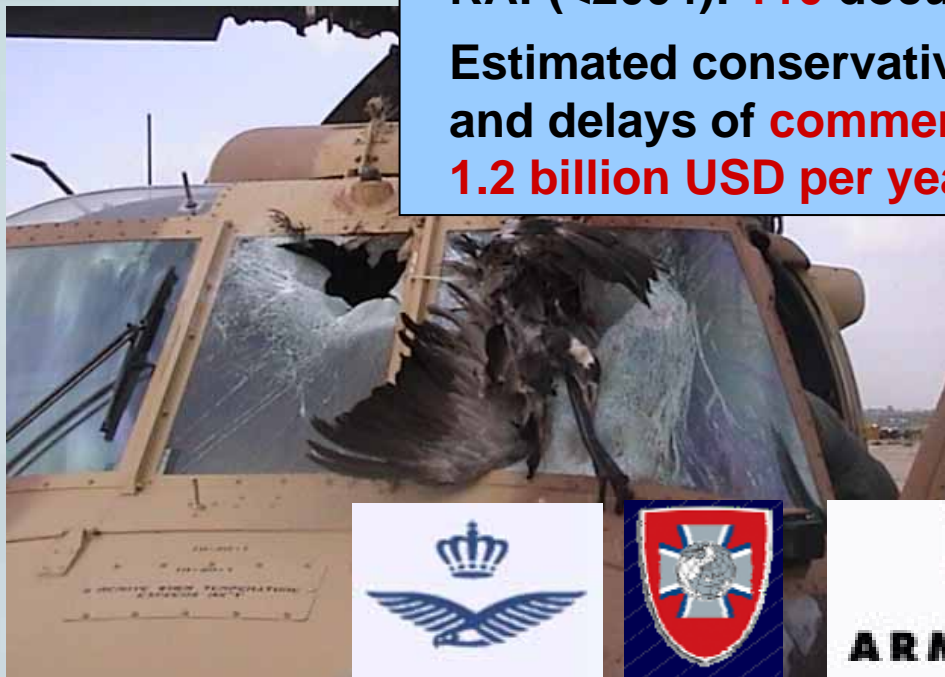
# *Integrated Application Promotion*

## *VOYAGE – Telemedicine on Board of Airplanes*





GAF (1997-2004): **360** collisions strikes/year  
 FAF (1998-2005): **320** collisions strikes/year  
 RAF(<2004): **110** documented serious accidents  
 Estimated conservative cost due to damage  
 and delays of **commercial** aircraft worldwide  
**1.2 billion USD per year**







July 15 1996 a Belgian C-130 crashed at Eindhoven Air Base due to a bird strike. 34 people were killed and 7 people were seriously injured.





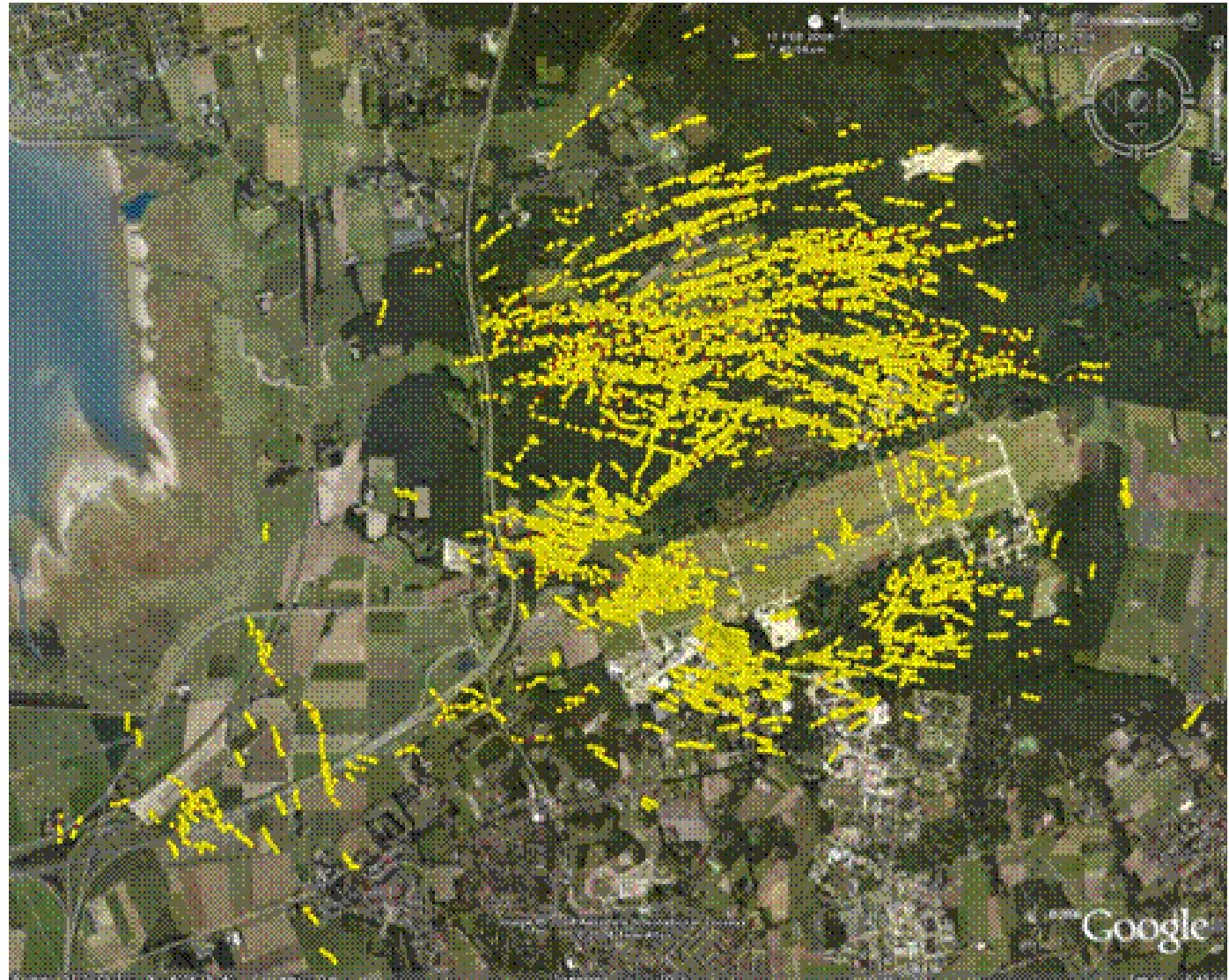
## *FlySafe Intermediate Results*

**“It’s just to let you all know that FlySafe is really able to do spectacular things”**

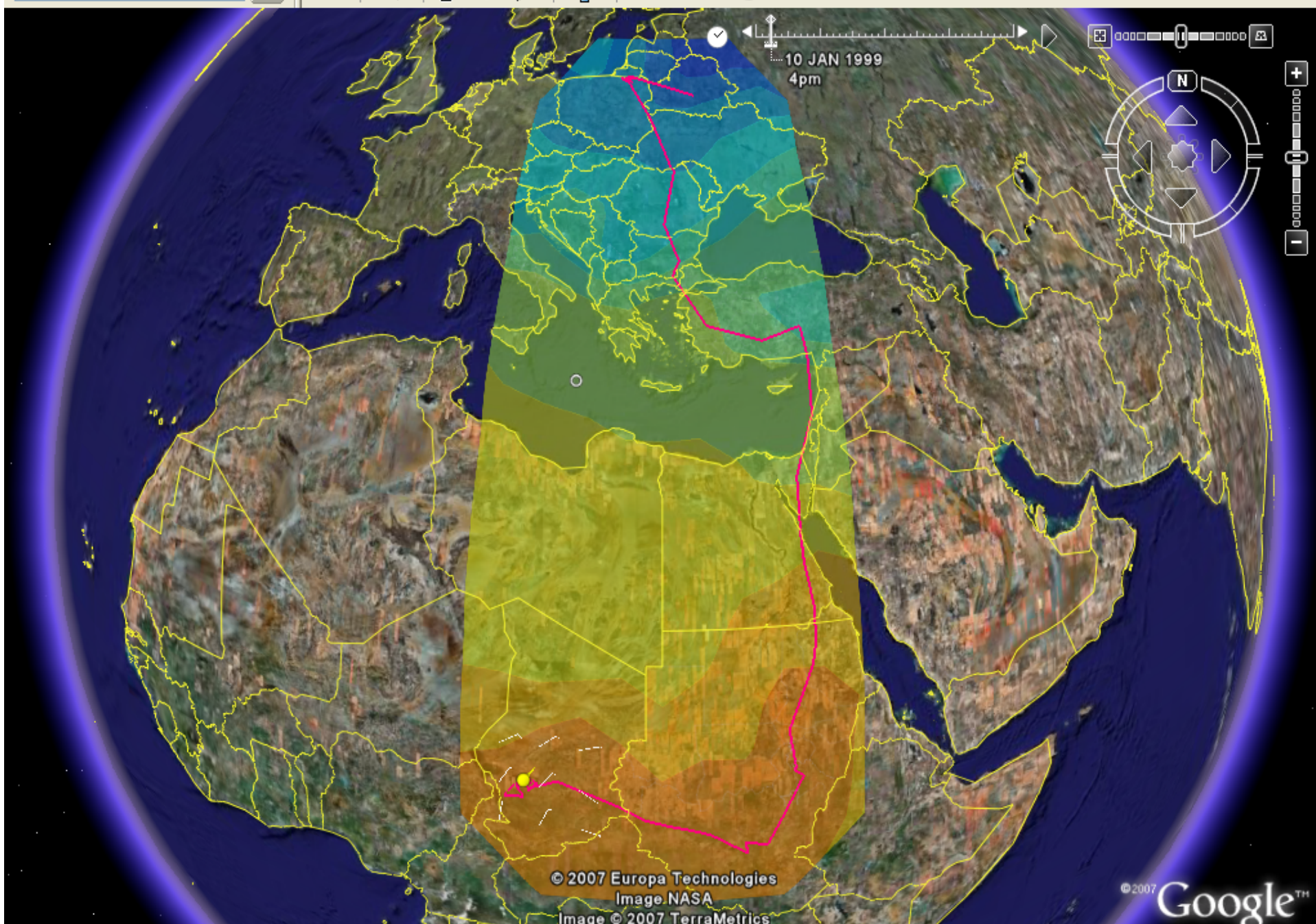
Example: Gulls  
movement  
Woensdrecht  
Airbase, NL

Night of  
Feb.20th  
2008

(photo RNLAF).









# FLYSAFE Web Service

The FlySafe Bird Avoidance Model - Microsoft Internet Explorer

File Edit View Favorites Tools Help



Address <http://public.flysafe.sara.nl/bambas/migration/index.php?radar=glons&subwindow=nw>

Web Search Bookmarks Settings Get IE8 now! Translate Page Mail My Yahoo! Answers Games Anti-Spy



The FlySafe  
Bird Avoidance Model

European Space Agency

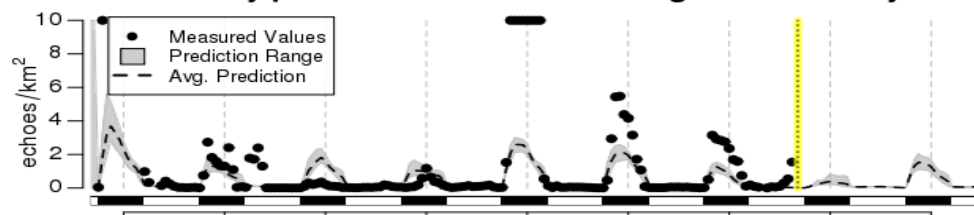
ESA Home Migration Spatial Models More information Legal Disclaimer

## Welcome to the FlySafe bird migration prediction module

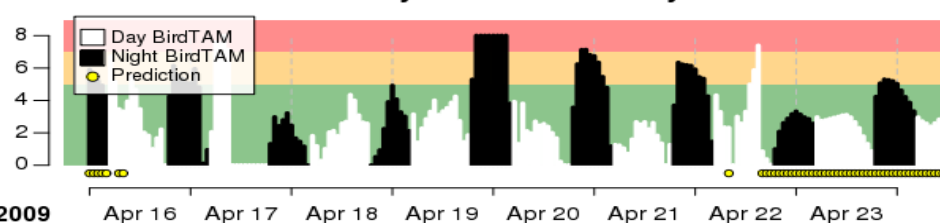
This page provides a 72-hour forecast of bird migration intensity for the **Central Belgium** location. The predictions are provided in two formats. The **Hourly predicted and measured migration intensity** plot shows the measured bird density values in bird echoes/km<sup>2</sup> (black dots) as well as the mean predicted bird density (dashed line) and prediction range (gray). The prediction range is produced by an ensemble forecast of ~50 models. The **Hourly BirdTAM Intensity** plot shows the bird densities converted to BirdTAM warning levels for pilots from seven days in the past and three days into the future. If the measured value is available, the BirdTAM intensity reflects that measured value. If no measurement is available, the mean bird migration density prediction is used (indicated by small yellow circle).

These predictions are made using the European Centre for Medium Range Weather Forecast Deterministic Model. The most important weather variables in the predictions are visualized in the plots on the right. Wind speed and direction at multiple pressure heights in the top plot. The tails point in the direction FROM which the wind is coming, and the barbs indicate the speed of the wind. Following plots are surface pressure (hPa), hourly precipitation (mm) as well as the percentage of cloud cover. Cloud cover is given in both a **lower** and **total** component. The final plot provides temperature (deg).

### Hourly predicted and measured migration intensity



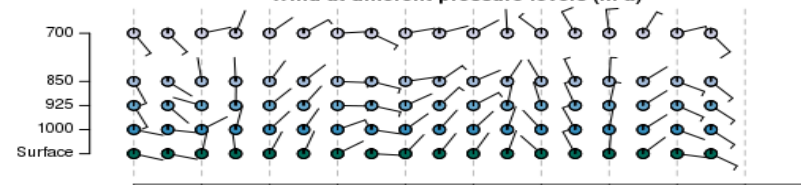
### Hourly BirdTAM Intensity



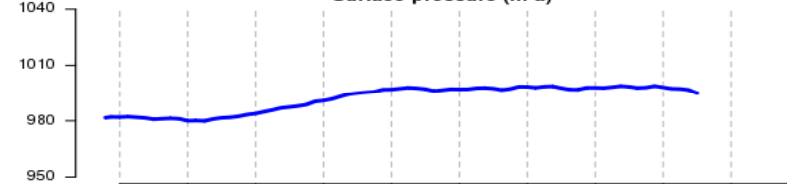
2009 Apr 16 Apr 17 Apr 18 Apr 19 Apr 20 Apr 21 Apr 22 Apr 23

Location: Central Belgium, Last modified: Wed Apr 22 2009, 6:18 pm, Next run: Wed Apr 22 2009, 6:48 pm

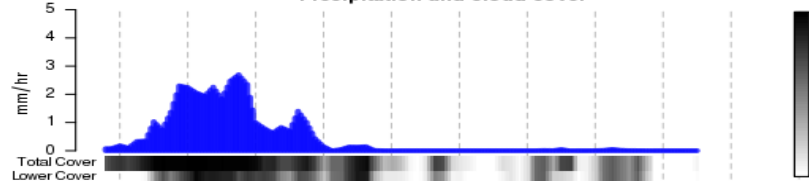
### Wind at different pressure levels (hPa)



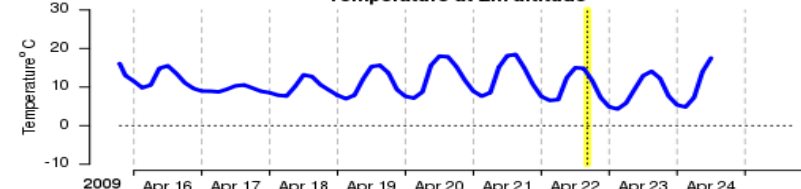
### Surface pressure (hPa)



### Precipitation and cloud cover



### Temperature at 2m altitude



Last modified: Wed Apr 22 2009, 6:17 pm, Next run: Wed Apr 22 2009, 6:47 pm



vle







Hudson river (New York – 15/01/09)  
(simulation)

Hudson River





# *Improvements Needed for the Local Situation*

## *Anticipation of Birds Crossing the Airport*



BAA Heathrow



Amsterdam  
Airport Schiphol



Manchester  
Airport



# *Users and Application Driven European Satellite AIS Mission*

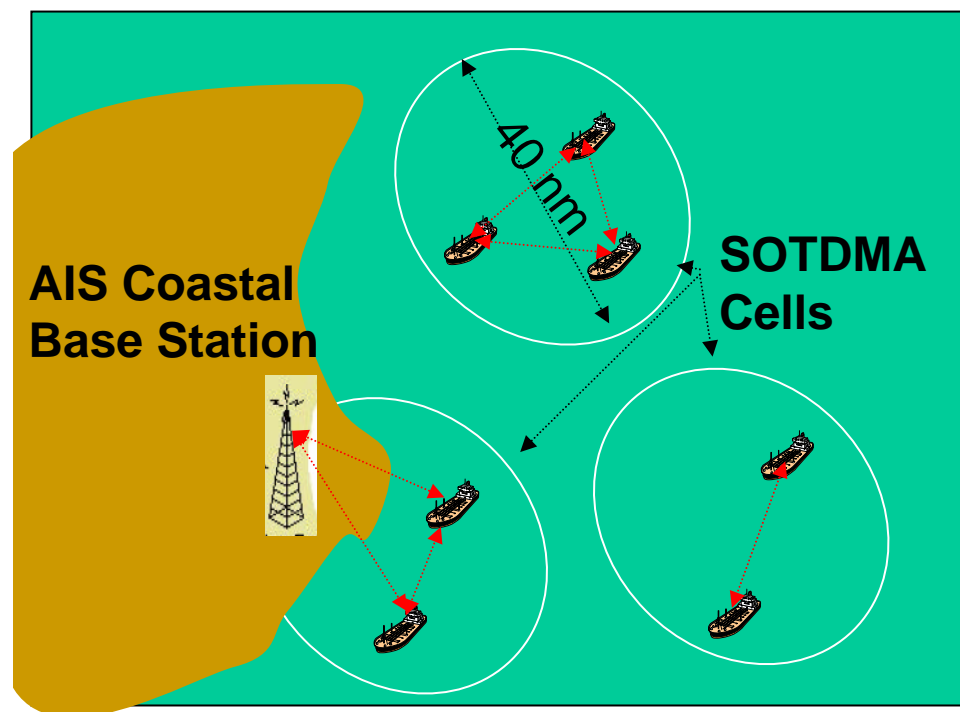


Source: [www.garcon.com](http://www.garcon.com), International Salvage Union, 2003



- The **Automatic Identification System (AIS)** is communication system provides **identification and location** information to vessels and shore stations
- Aim of **exchanging data** (position, identification, course and speed).
- This allows vessels to anticipate and thus **avoid collisions** in the sea by means of a continuous traffic monitoring with several navigation aids
- AIS also offers important **ship monitoring** services to coastal guards or search and rescue organizations.

The system is based on the broadcasting of fixed length digital messages using the Time Division Multiple Access (TDMA)



## AIS message fields

Start buffer	Training sequence	Star flag	Data	FCS	End flag	End-buffer
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## *Satellite-based AIS for maritime*

*related policies*

*DG-MARE / ESA*

*Joint*

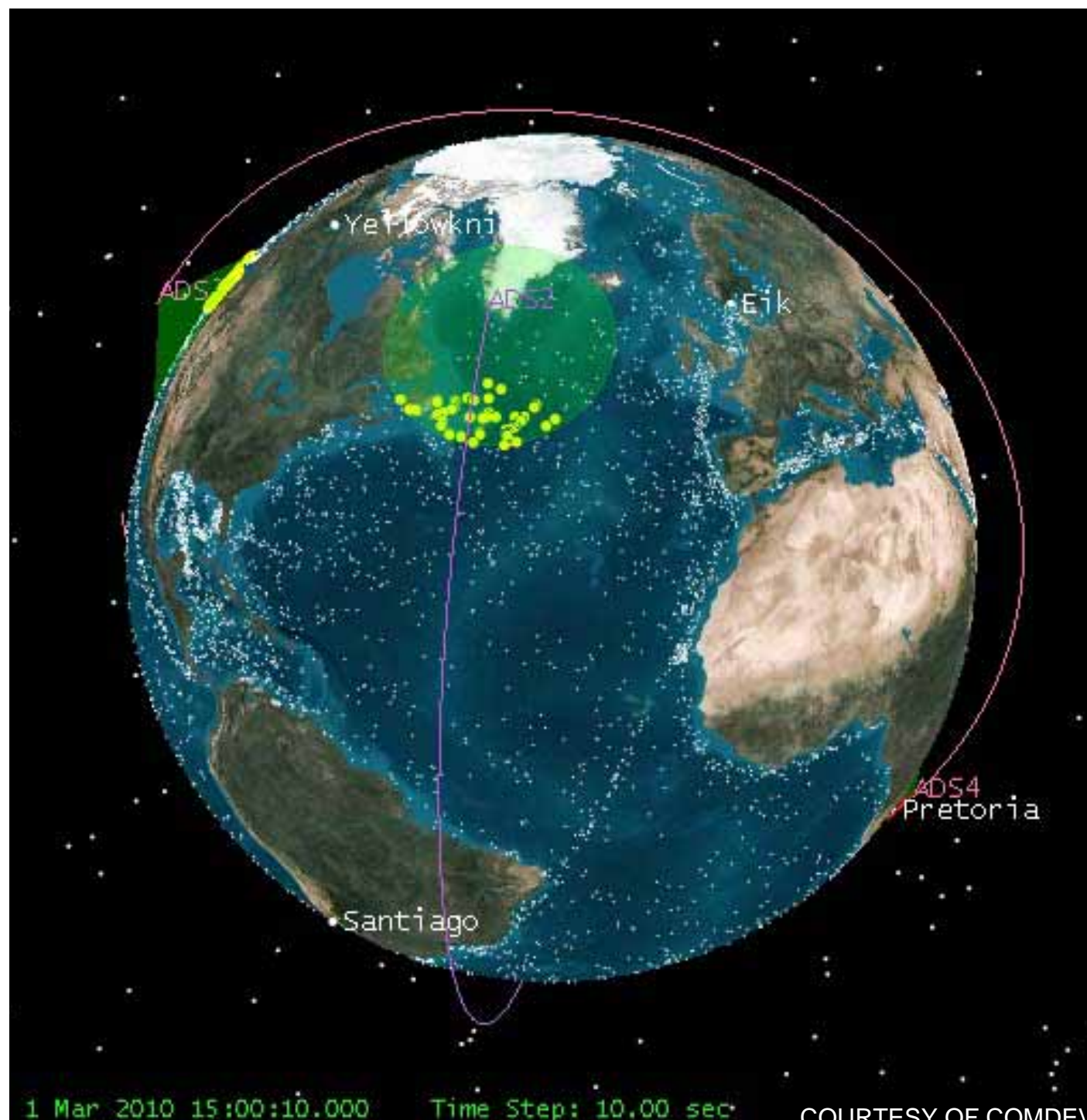
*Action Team*

*&*

*European*

*Steering group:*

*EC DGs ( Mare, ENV,  
TREN, JLS, INFSO,  
TAXUD, ENTR, JRC)  
FRONTEX, EDA,  
EMSA, ESA*



Number of AIS class A vessels  
(> 300 gross tonnage, ferries, etc.) 64.000

Number of AIS class B vessels > 500.000

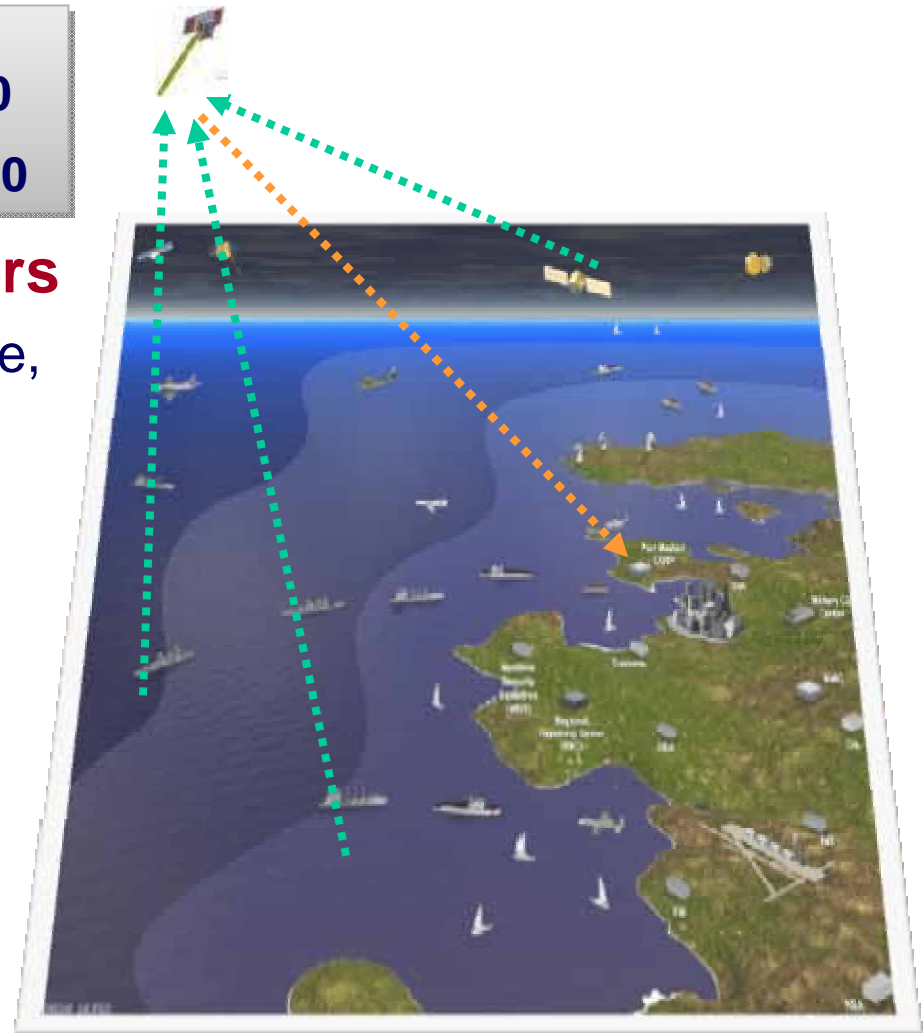
- **Governmental and public users**

- Maritime offices (e.g. Customs, Police, Military, National administrations)
- Traffic management
- Search and Rescue
- Ship agents
- Ship owners
- Shipping companies
- Logistics

**Worldwide maritime traffic:**

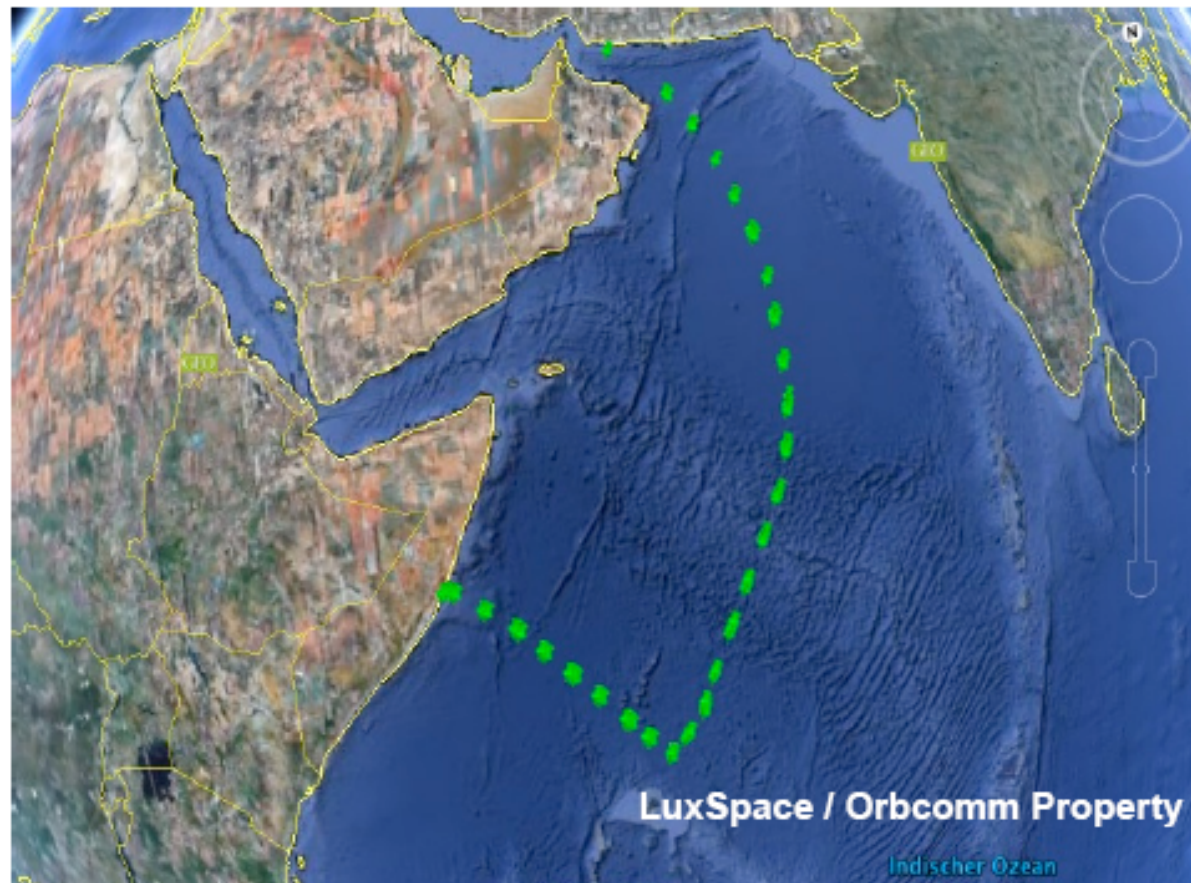
**64.000 ships in 2010, 85.000**

**ships in 2021, >100.000 in 2029**





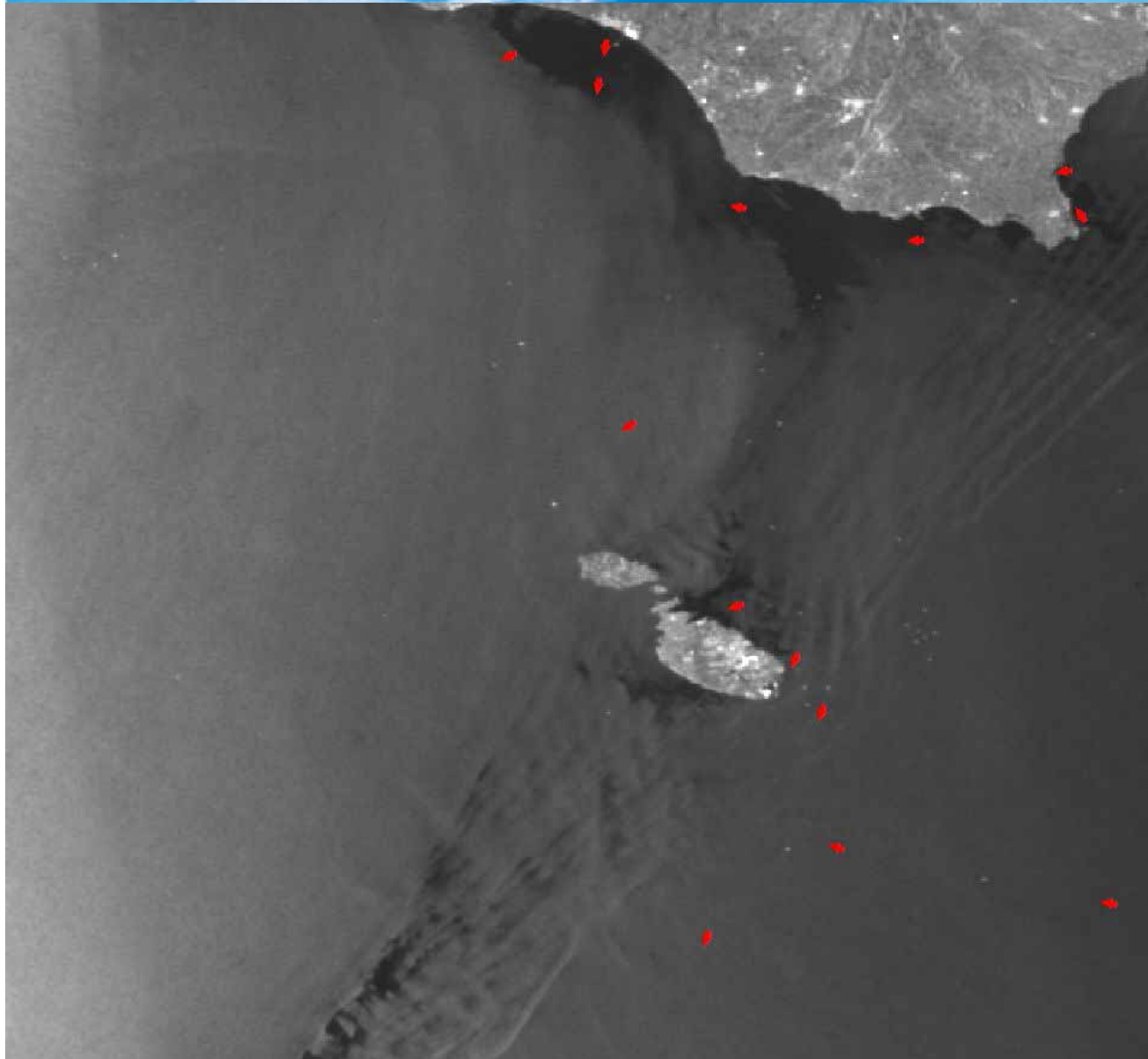
## „POMPEI”



Ship was hijacked 700 nm off Somalia coast and 100 nm from destination (Port Victoria / Seychelle Islands)

- Request of DG MARE based on information demand of Belgium Crisis Centre, having lost the vessel POMPEI and asking for latest position at 14:00 on April 21, 2009
- Delivery of latest vessel position by LuxSpace at 16:00 (captured at 7:00 of the same day)
- Request for vessel track of the past days at 19:00 of 21 April
- First information available at 22:00 on 21 April
- Second information with final anchor place (4:56) on April 22 at 23:00





SAR detected ships

SAR ships & AIS tracks

Correlation SAR & AIS

Remaining  
uncorrelated ships

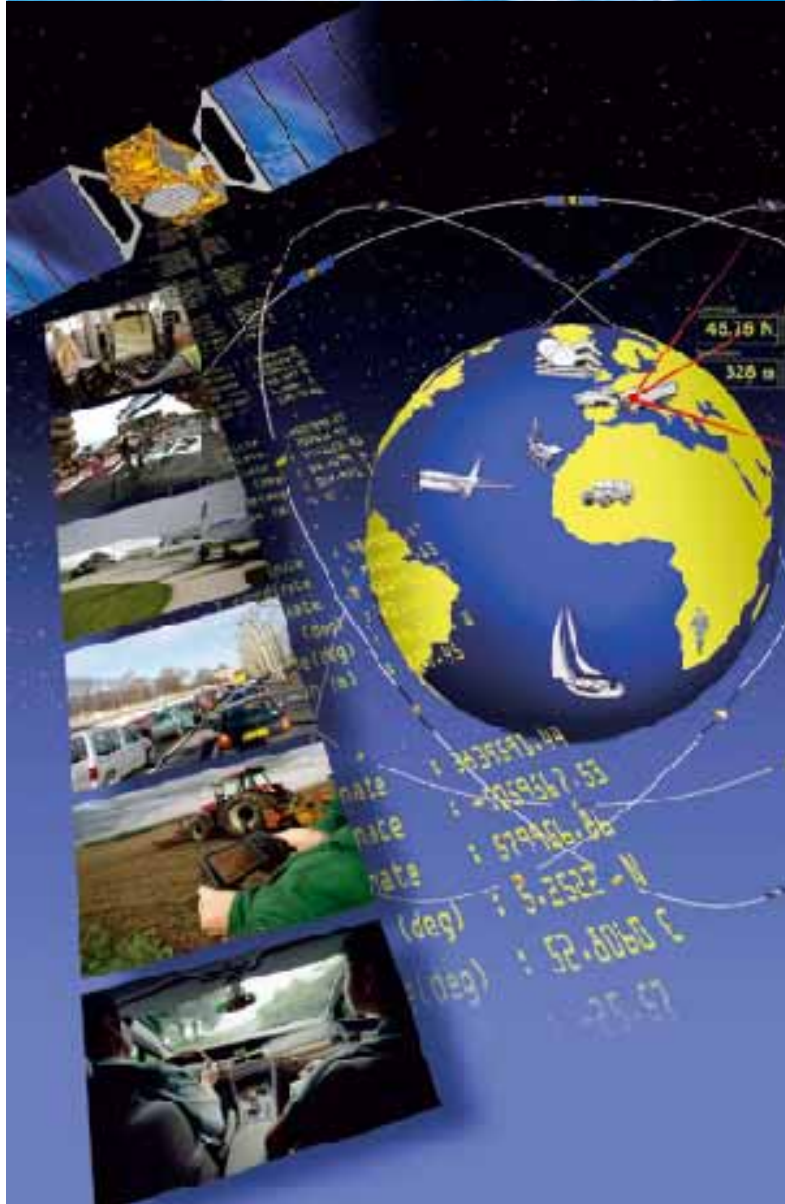




- The **IAP initiative** is an opportunity for ESA and Europe to demonstrate and promote the **added-value of Space** in support of Member States, European public policies and citizens in various new domains, **beyond current individual space programmes**.
- The IAP initiative is an opportunity for European & Canadian **operators and Industry** to exploit their expertise for the purpose of new initiatives and to identify **new lines of business** in various fields.
- Integrated Applications Promotion (IAP) programme **support economic prosperity** in variety of thematic areas:

## **Space is the Limit**





**Open Call, June 15<sup>th</sup>  
2009, IAP web portal:**  
<http://iap.esa.int>

***Thank you!***