ESA New Integrated Applications Promotion (IAP) Programme

4th UN- Spider International Workshop
on Disaster Management and Space Technology
Oct. 12th 2010, Bonn

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European Space Agency (ESA)

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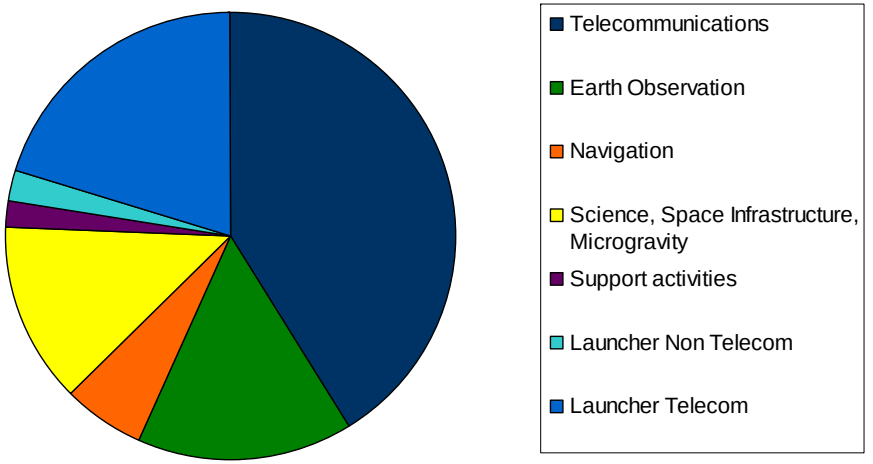
*** ARTES: Advanced Research on Telecommunication Satellite Systems**

The scope of ESA's Telecomunications and Integrated Applications Programme

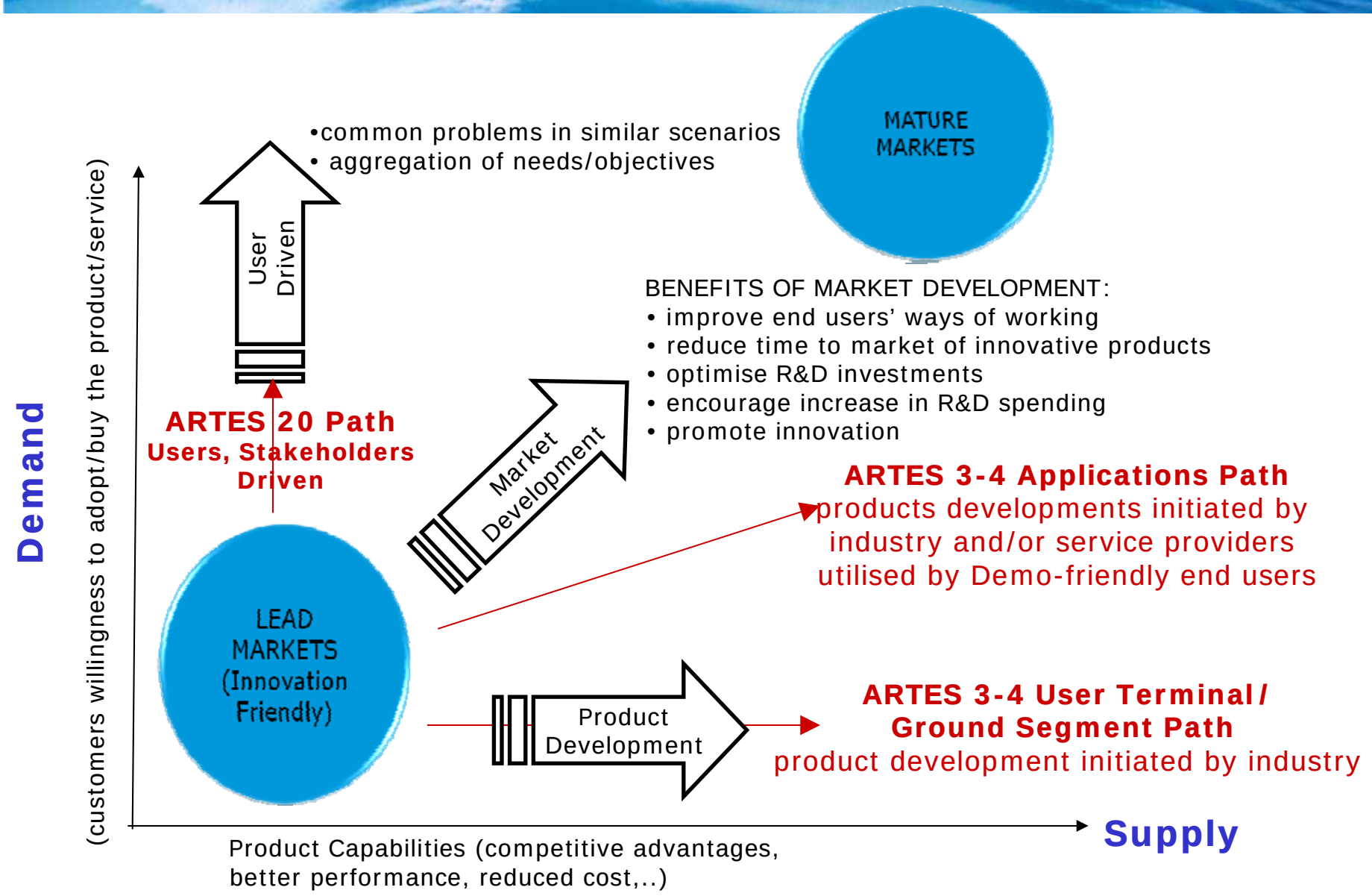
- Telecommunications is by far the most mature of Space applications.
- 60% of the European industry turnover is derived from producing or launching telecommunications satellites.



ESA's ARTES programme has a two-fold purpose:

- To enhance the competitiveness of Industry by means of Research Development and Innovation of Satcom products, services and applications.
- To contribute to the resolution of problems that affect the European Institutions and the European society at large; to support the implementation of the European policies and society;

ARTES programme elements approach
Demand-Supply



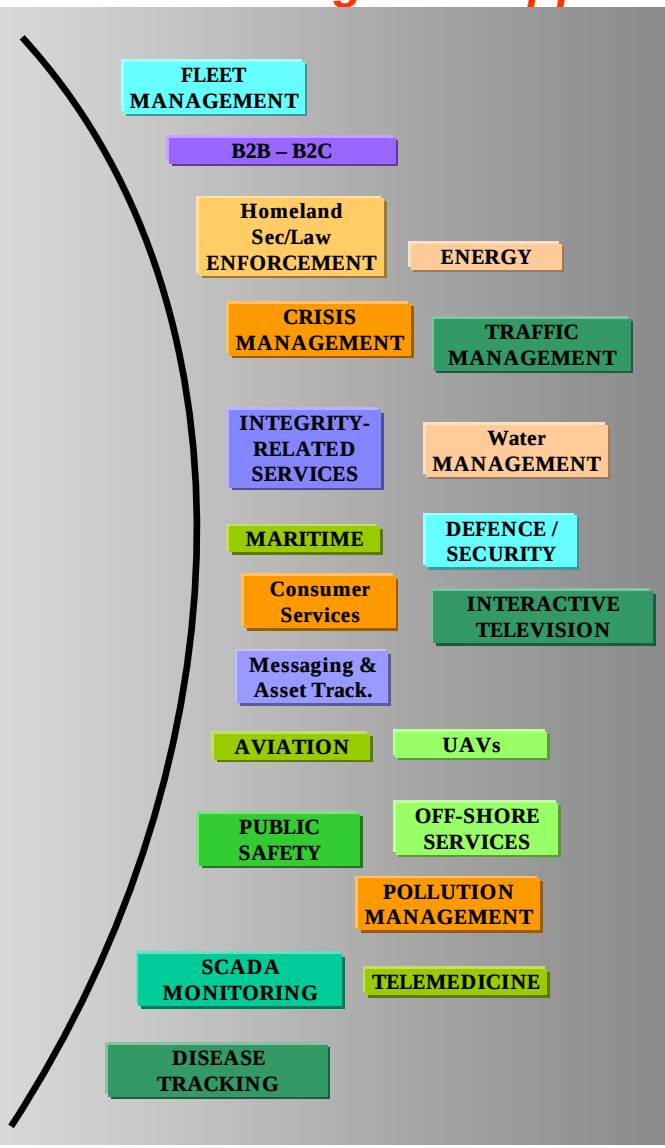
The goal :

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, …

Integrated Applications

Technological → ← *Technology Enabled Applications* → ← **Integrated Applications** →



Integrated Applications provide a systematic user driven approach to:

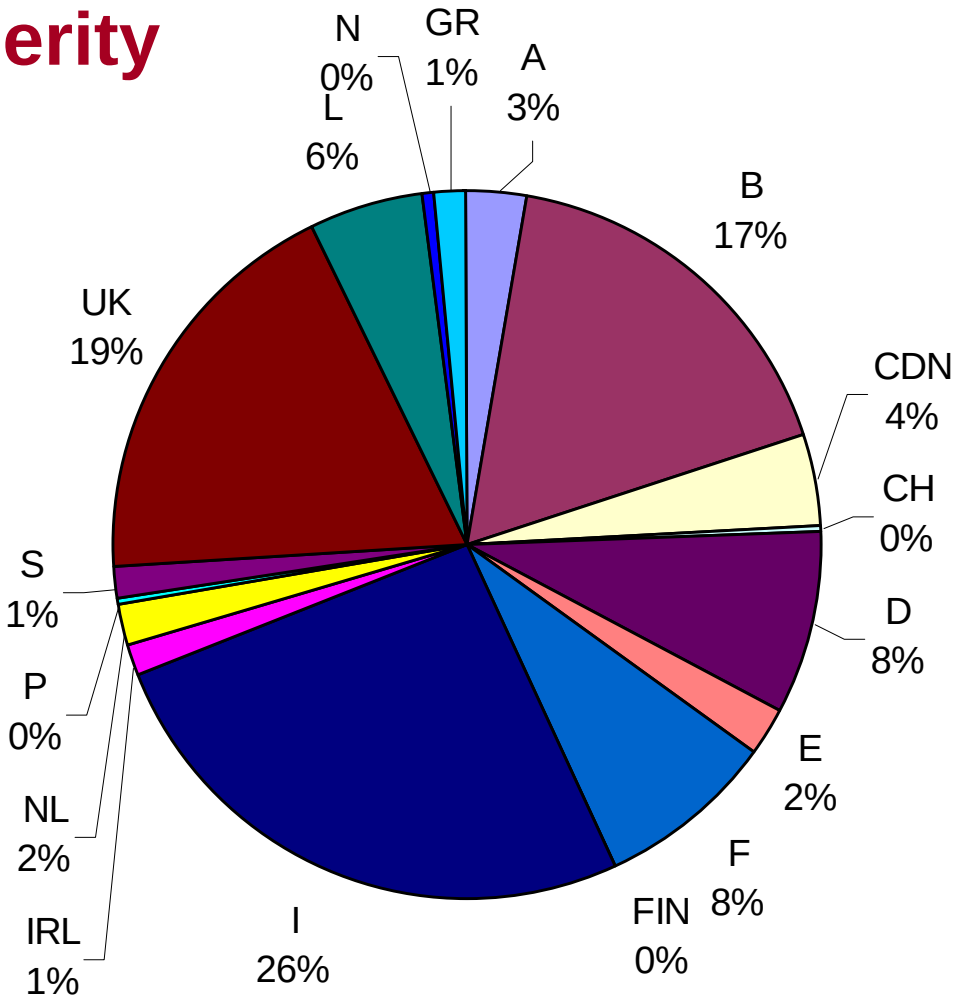
- **Find the way into markets not well explored**
- **Provide added-value by taking advantage of multiple technologies (space & terrestrial)**
- **Overcome existing gaps/deficiencies in currently used solutions**
- **Provide cost-affordable sustaiable solutions to a variety of users**
- **Identify missing technologies / Missions demanded by user/service provider communities**

Huge potential not sufficiently exploited yet.

Support economic prosperity

- 161 contracts,
- 130 MEUR contract value,
- period: 1997-2009

- 60% of the projects contracted to Small and Medium Enterprises
- 50% of the projects contracted to new entrant into ESA Telecom



The eight thematic areas of ARTES 3-4 Applications

Telemedicine/ Medical Education

- 29 Projects
- 22.8 MEUR (ESA part)

Satcom Networks Systems & Services

- 38 Projects
- 34.5MEUR (ESA part)

B2B / B2C

- 36 Projects
- 45.8 MEUR (ESA part)

Location Based Satcom Services

- 13 Projects
- 3.9 MEUR (ESA part)

Disaster Relief/ Emergency Management

- 9 Projects
- 3.3 MEUR (ESA part)

Community Information Services & Capacity Building

- 15 Projects
- 7.3 MEUR (ESA part)

Distance Learning

- 11 Projects
- 6.3 MEUR (ESA part)

e-Government

- 2 Projects
- 2.0 MEUR (ESA part)

The three value chains in commercial satellite applications

2009 Telecom

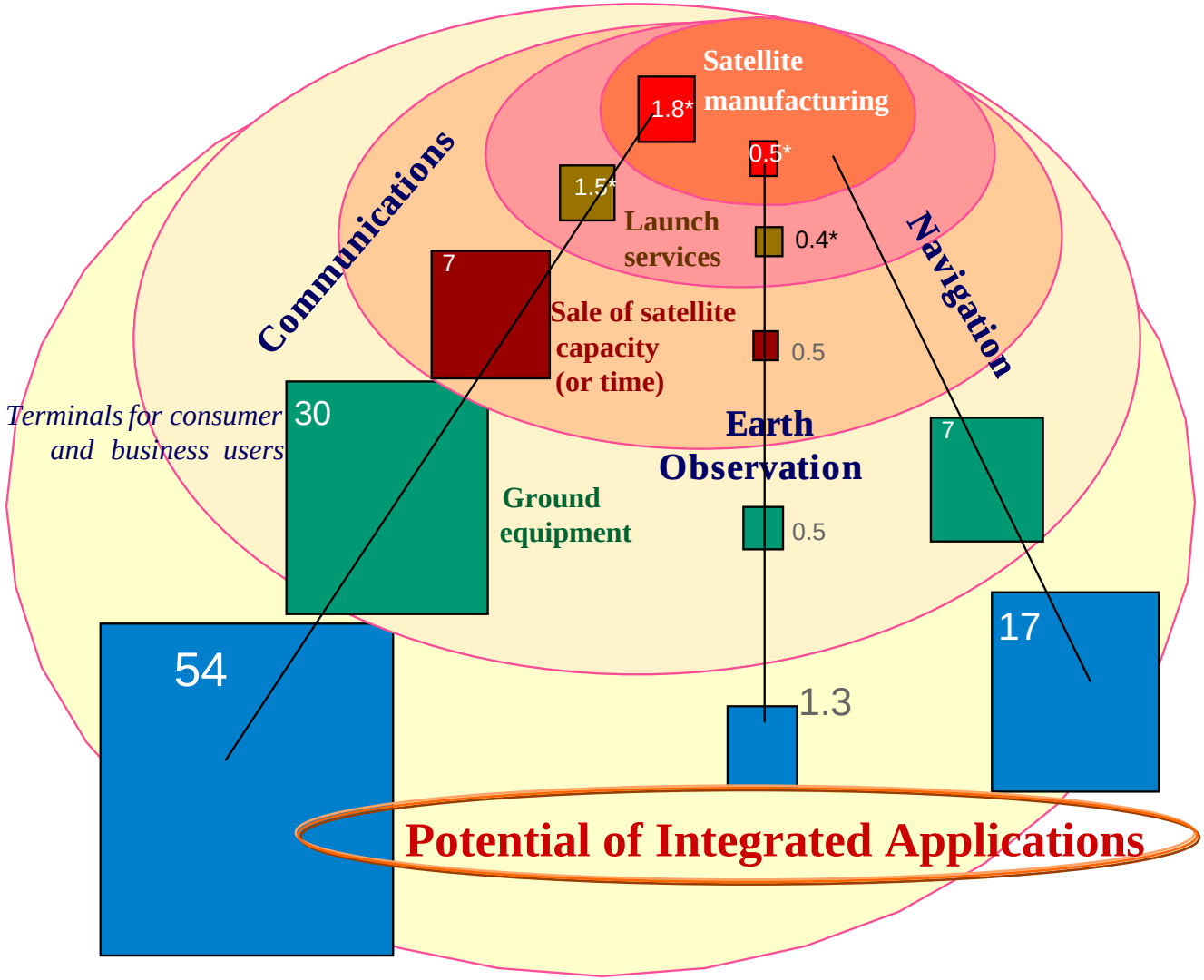
2.7

1.8

11.5

20-30

60



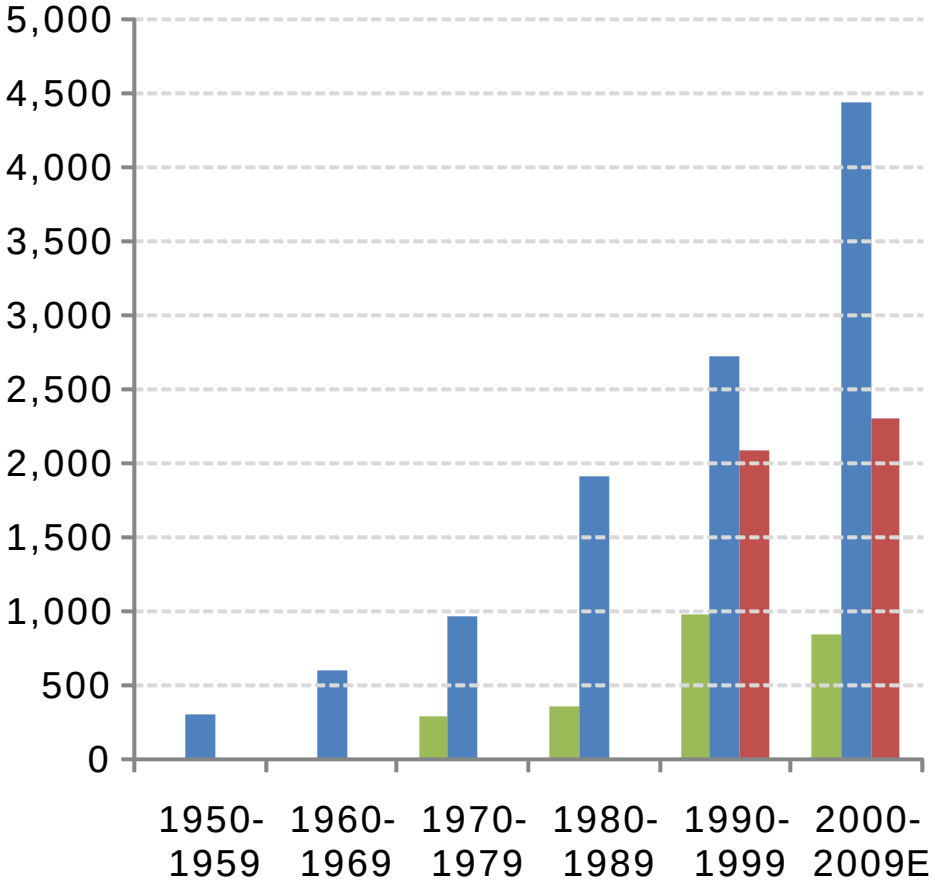
Value- Adding Services

Values for the year 2005 in billions of €

COURTESY OF Euroconsult

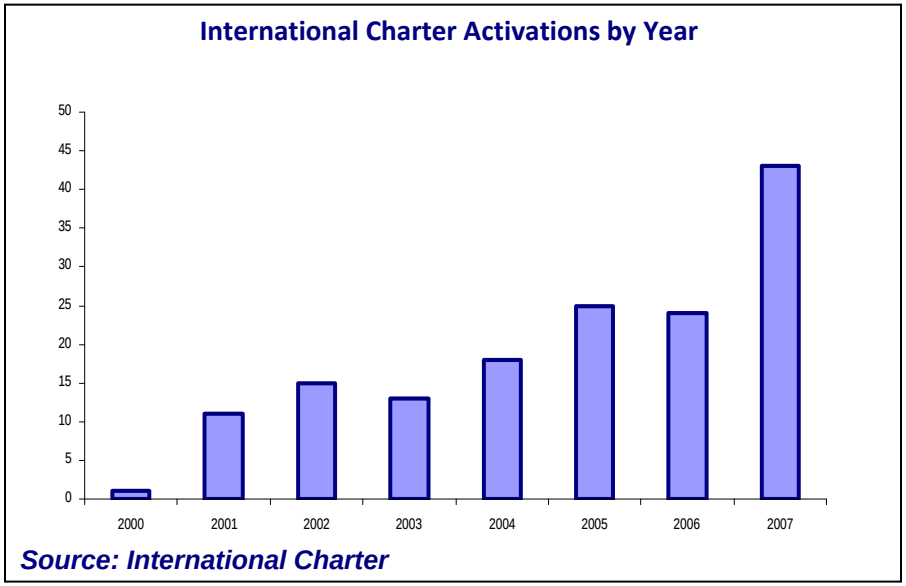
Disaster prevention & recovery
Sector overview and primary stakes

An increasing impact of disasters per decade:

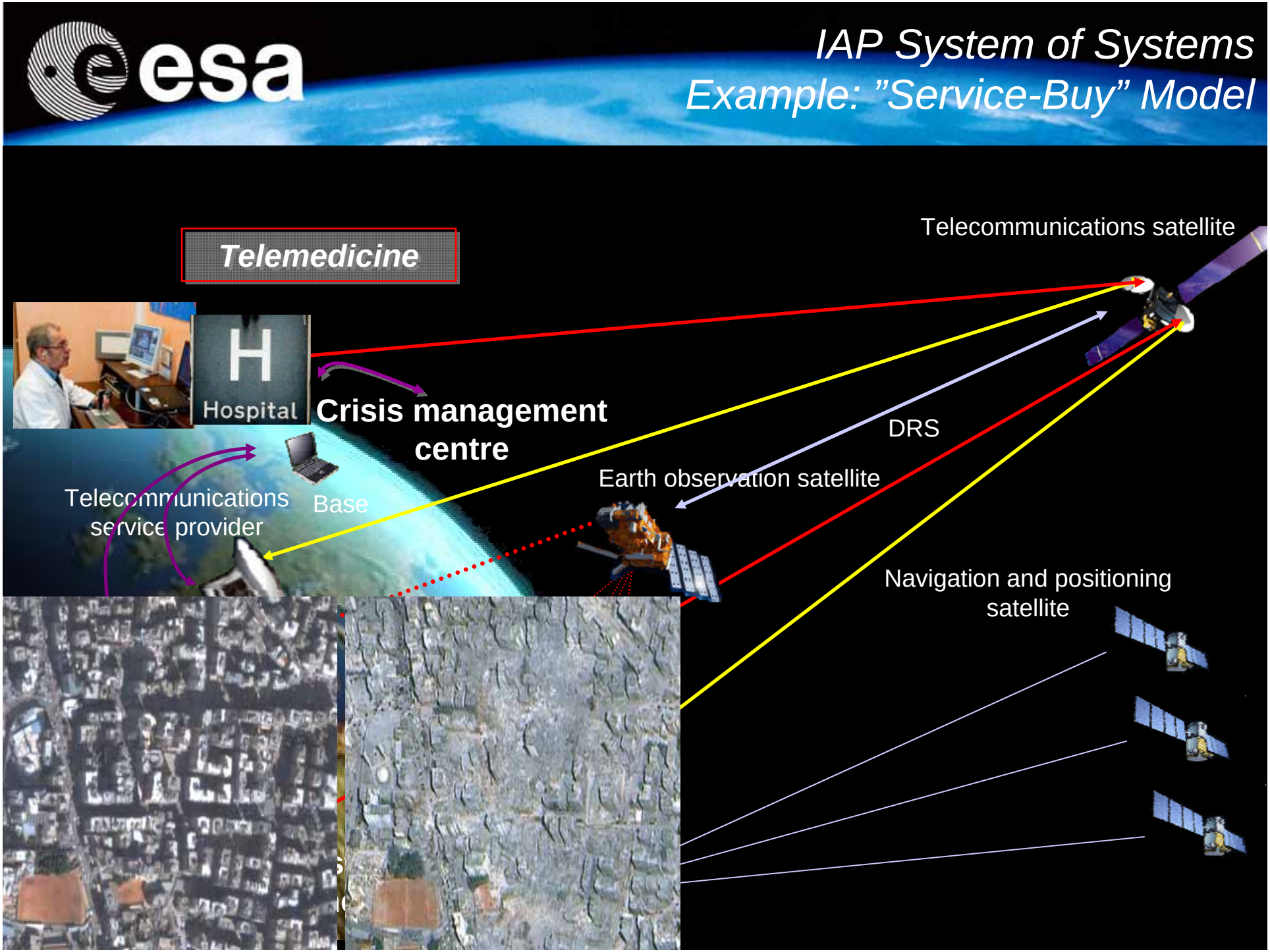


Source: ISDR, Euroconsult estimates

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



IAP System of Systems
Example: "Service-Buy" Model



Emergency Response : Current Status (DG-RELEX)

- **Lack of Providers who can give affordable and ready-to-deploy solutions**

  Commercial solutions target mass-market

- **Lack of Coverage (global/regional) for some available solutions**

  Currently offered solutions might not be available in all crisis areas

- **Lack of Synergy or interoperable tools amongst different organizations**

  Proprietary standards limit the interoperability

- **Lack of Robust solutions/tools suitable for crisis environment**

  Commercial tools not always suitable for crisis

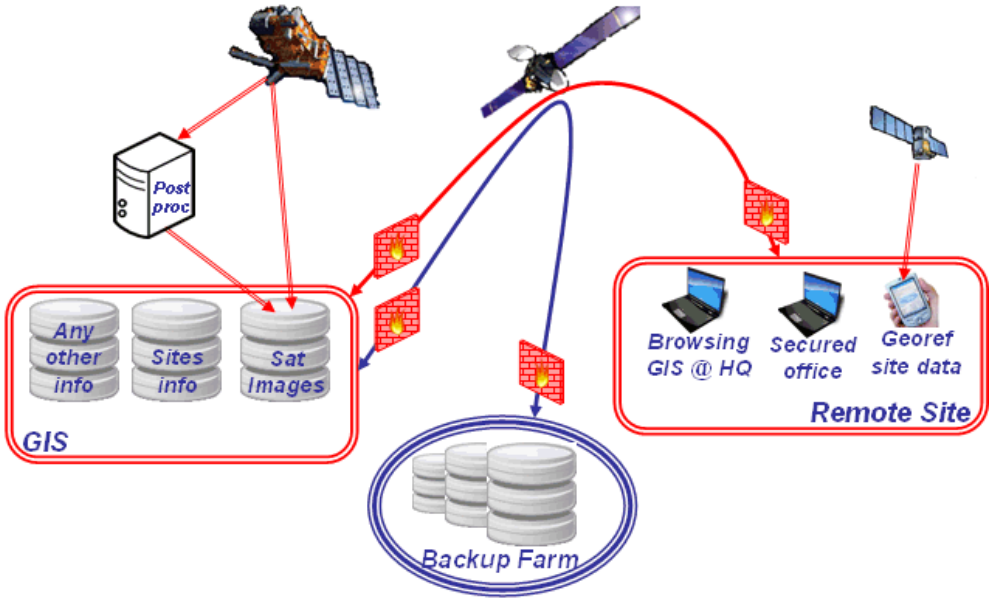
IAP Projects & Partnership

- *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: UK Cabinet Office
  - Satellite Systems, Operations and IA for UAS :EDA
- *Space for Health* (thematic website: 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


esa
IAEA
International Atomic Energy Agency
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

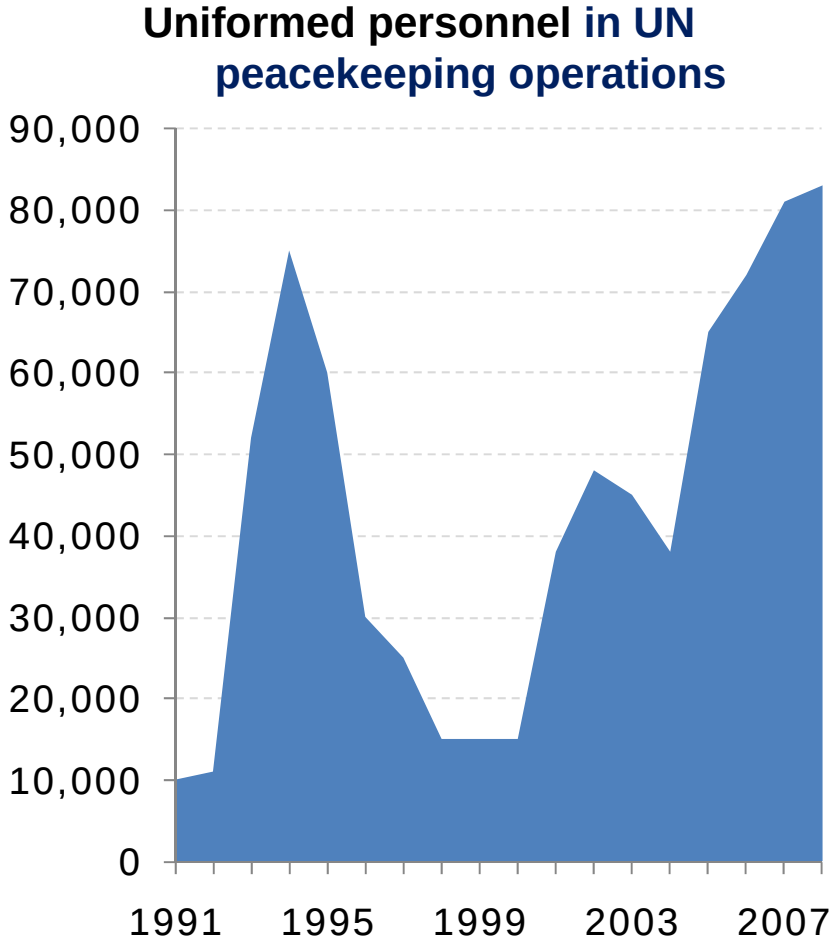
Integrated Satellite-Based IAEA Safeguard Services

- 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 for secure and reliable communications (fixed and mobile).
  - GIS, to acquire information on the areas of interest and prepare specific plants



IAP- Multi-Satellite Network

Peace Building & Emergency Response



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

COURTESY OF Euroconsult

T4MOD - Medical support in peacekeeping missions

Consultation, second opinion, training

Remote guiding

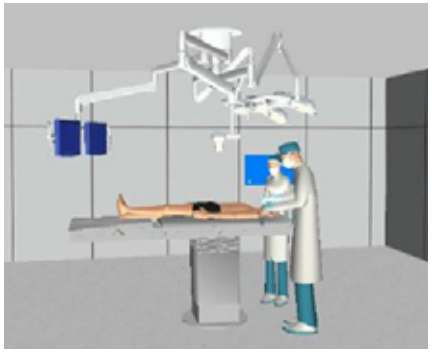


Image-based diagnosis

Project objectives:

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

Remote manipulation

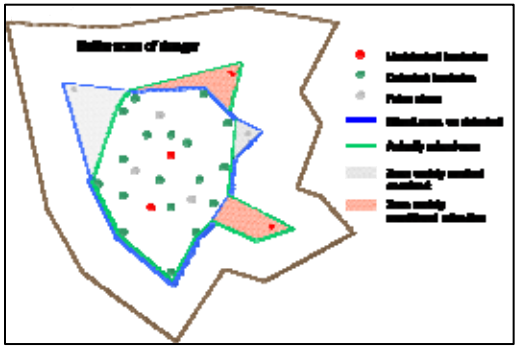
Remote maintenance

Medical Fields of interest:

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

Landmine Detection Support Service
Theme: Safety

- **Background:**
  - The UN estimates that approximately 110 million land mines are presently scattered in about 70 countries;
  - Mines claim between 15,000 and 20,000 new victims in countries that suffered war recently.
  - Resources (arable land, infrastructure, water, etc) located within areas suspected of mine contamination cannot be exploited



- **Objective of the Feasibility Study:**
  - investigation of the added value of space assets to improve planning & efficiency of existing de-mining procedures by integrating space services with aerial offset sensing.
  - Study includes:
    - consolidation of user requirements
    - state-of-the-art review
    - concept definition
    - system and service design
    - viability analysis
    - roadmap for demonstration project

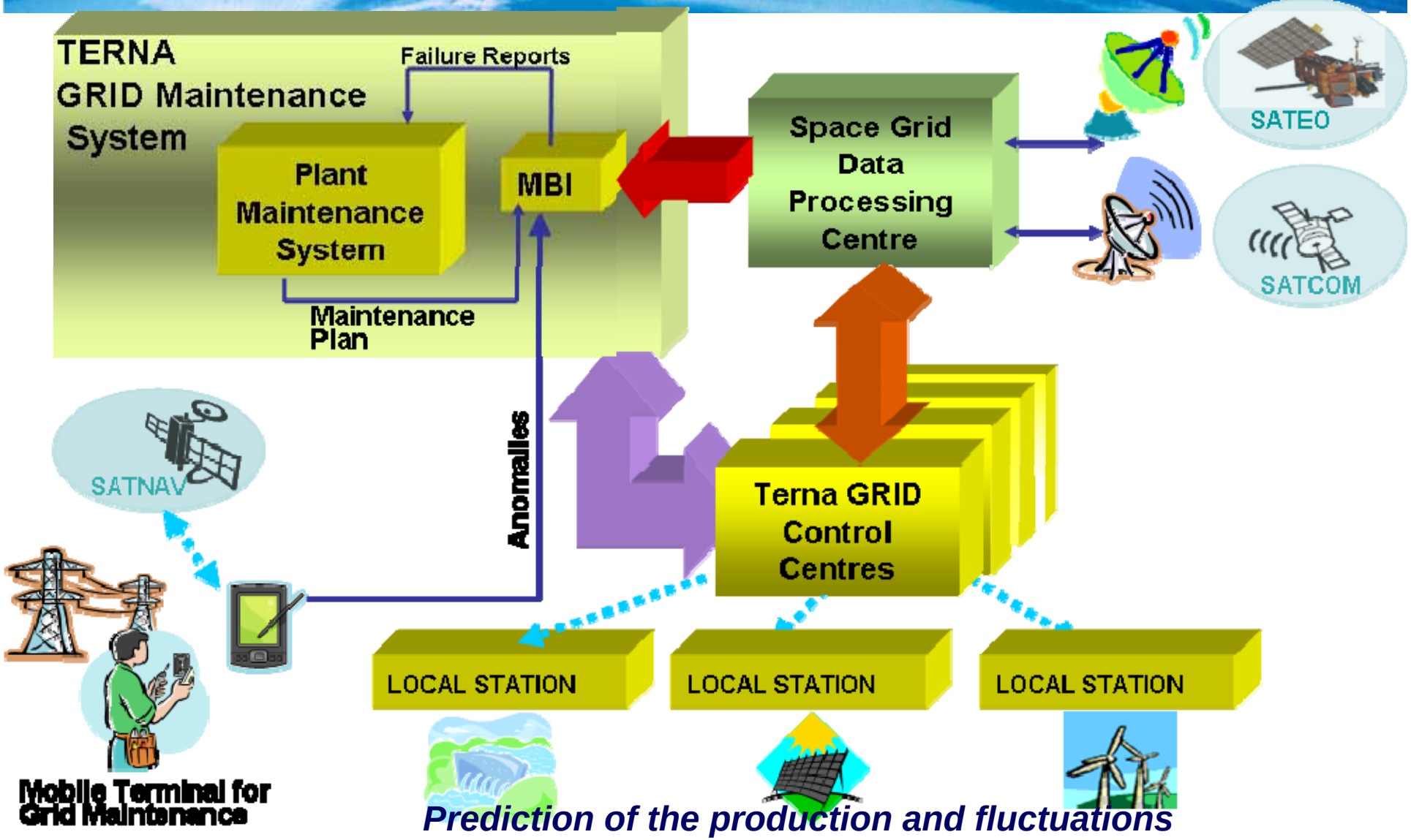
- **Background:**
  - UAS (Unmanned Aerial Systems) steadily become more important for e.g. surveillance tasks
  - Until now, UAS have only been deployed routinely in segregated airspace because of safety reasons
  - The safe and secure integration into "non-segregated airspace" is still a challenge
    - Technology is not proven
    - Regulation is missing
    - Little practice and experience

IAI Heron UAV in flight

- **Objective of the Feasibility Study:**
  - Investigate the technical and economical feasibility of UAS services in non-segregated airspace supported by space systems for:
    - Command & Control, Sense & Avoid, Air Traffic Control
    - Operational service provision (UAV Payload data transmission, e.g. camera, radar, etc.)
  - Simulations and demo project preparation specifically in the civil domain: pipeline monitoring

SpaceGrid Architecture

Theme: Energy **User:** TERNA (I)



Prediction of the production and fluctuations of the Renewable Energy Sources (RES)

Flight Safety

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

ARMÉE DE L'AIR

DEFENCE
PEACE OUR PRIORITY

Birds and Flight Safety

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.

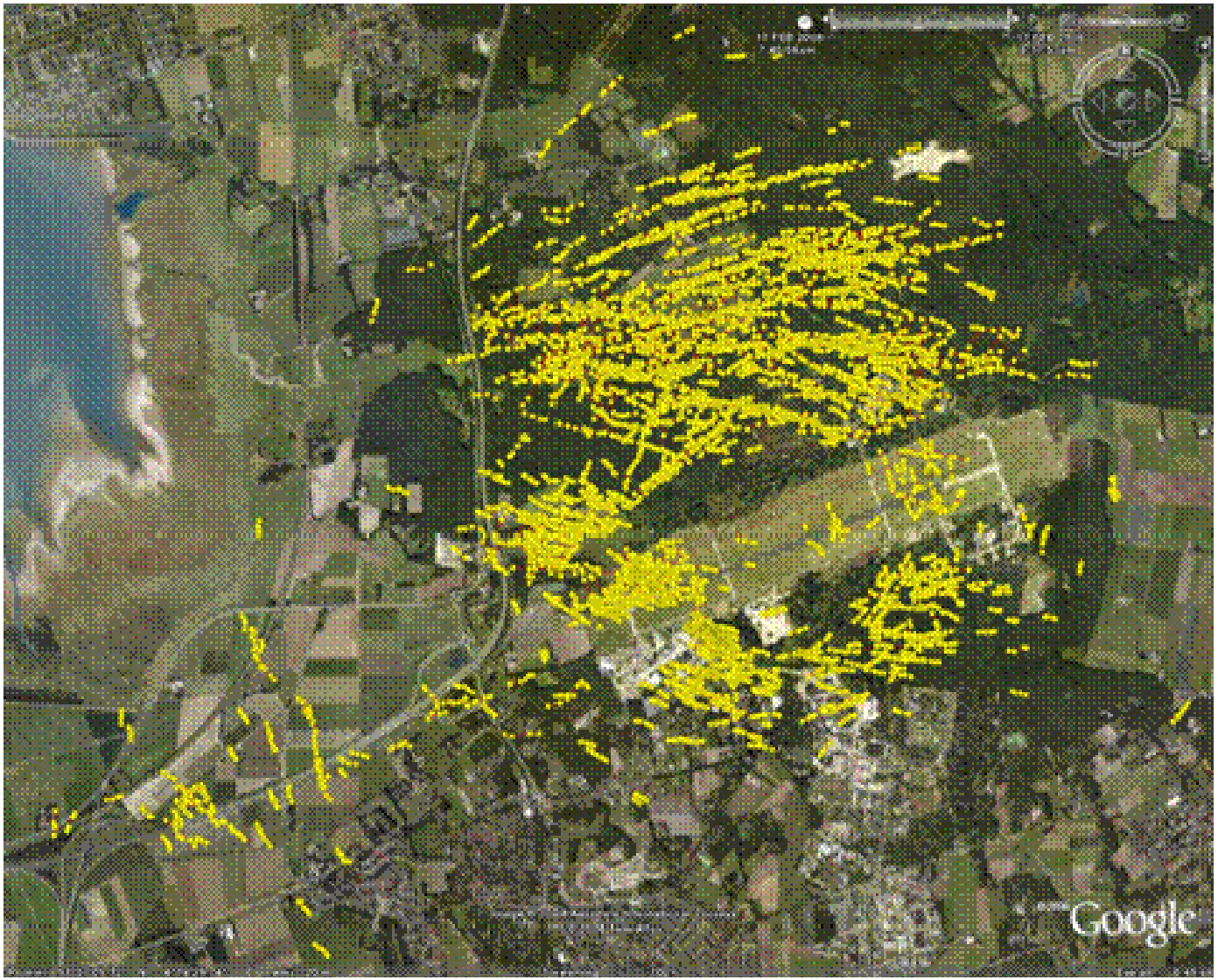
FlySafe Intermediate Results

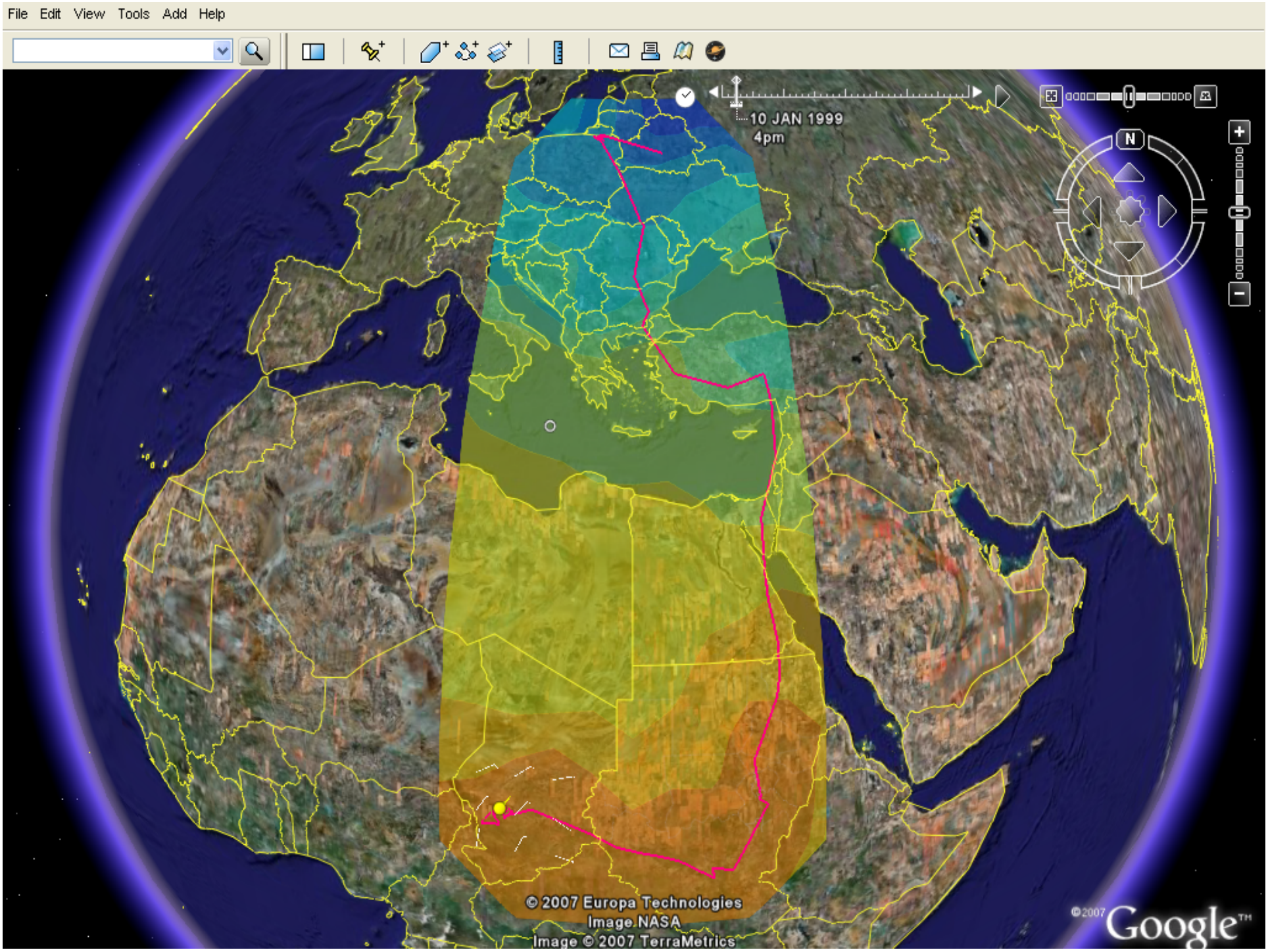
"It's just to let you all know that FlySafe is really able to do spectacular things"

Example: Gulls movement Woensdrecht Airbase, NL

Night of Feb.20th 2008

(photo RNLAF).

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FLYSAFE Web Service

The FlySafe Bird Avoidance Model - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites

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

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esa **The FlySafe Bird Avoidance Model**

European Space Agency

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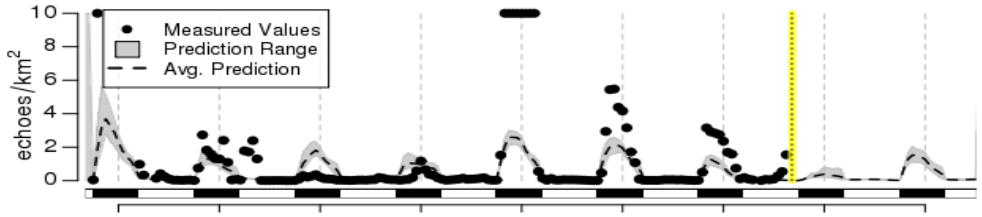
Welcome to the FlySafe bird migration prediction module

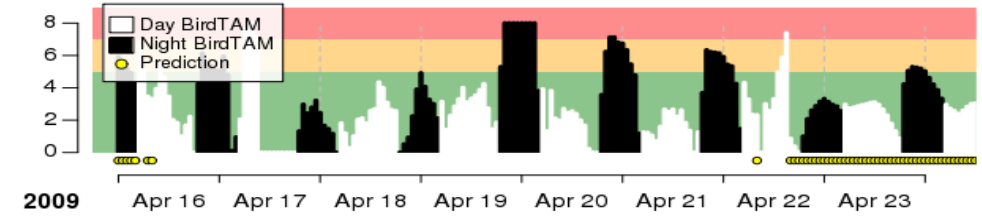
This page provides a 72-hour forecast of bird migration intensity for the **Central Belgium** location. The predictions are provided in two formats. The **Hourly predicted and measured migration intensity** plot shows the measured bird density values in bird echoes/km^2 (black dots) as well as the mean 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

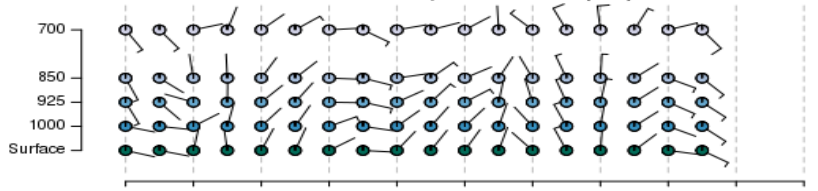


Hourly BirdTAM Intensity

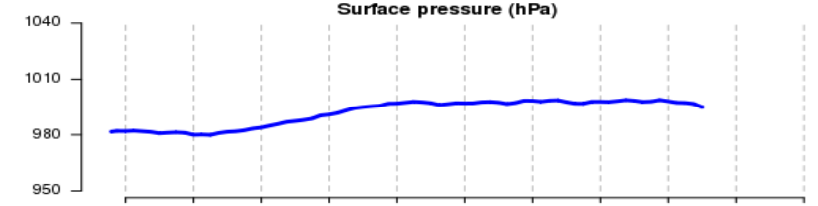


Location: Central Belgium,Last modified: Wed Apr 22 2009, 6:18 pm,Next run: Wed Apr 22 2009, 6:48 pm

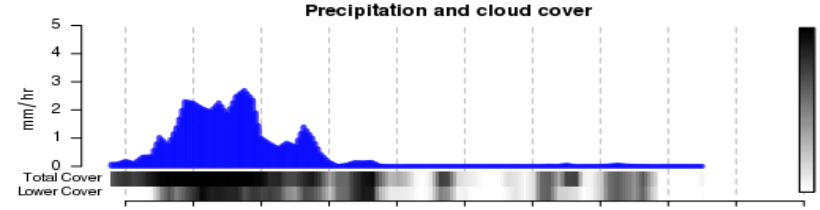
Wind at different pressure levels (hPa)



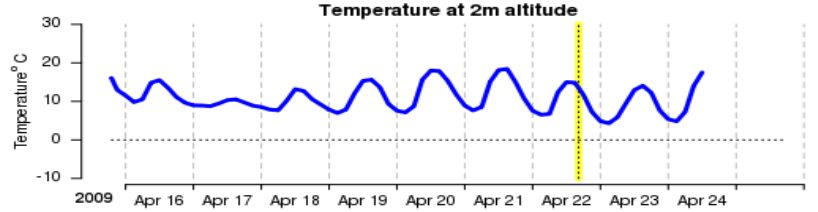
Surface pressure (hPa)



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

Koninklijke Luchtmacht

sara

Hudson river (New York – 15/01/09)

Hudson River

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

Improvements Needed for the Local Situation

Anticipation of Birds Crossing the Airport

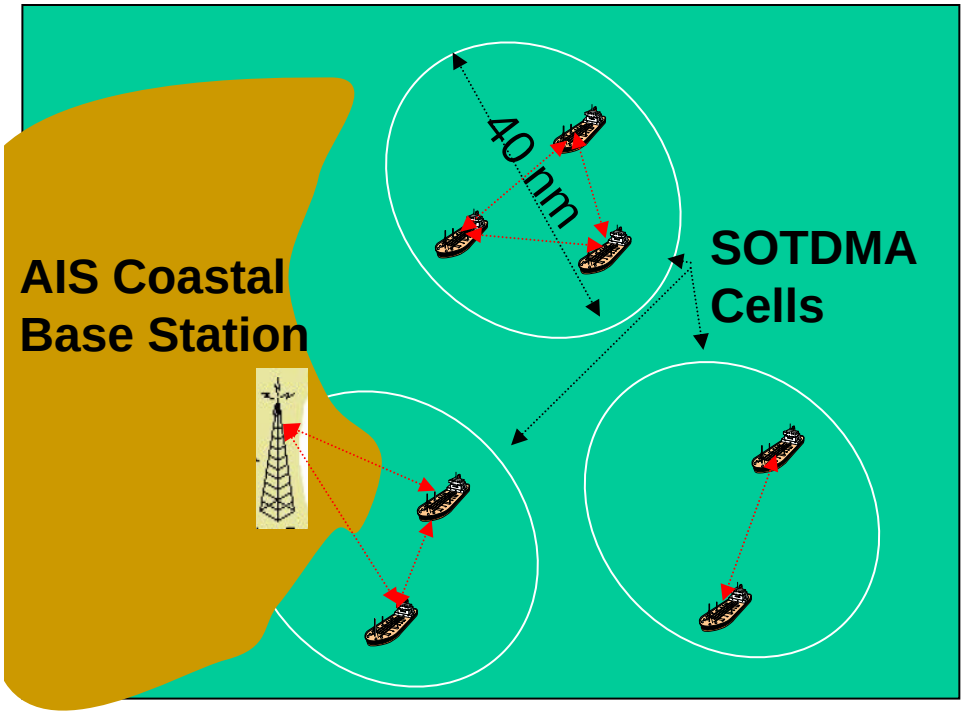
Users and Application Driven European Satellite AIS Mission

Sources: Law Offices of Countryman & McDaniel/CargoLaw.com, International Salvage Union, 2003

What is AIS?

- 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.

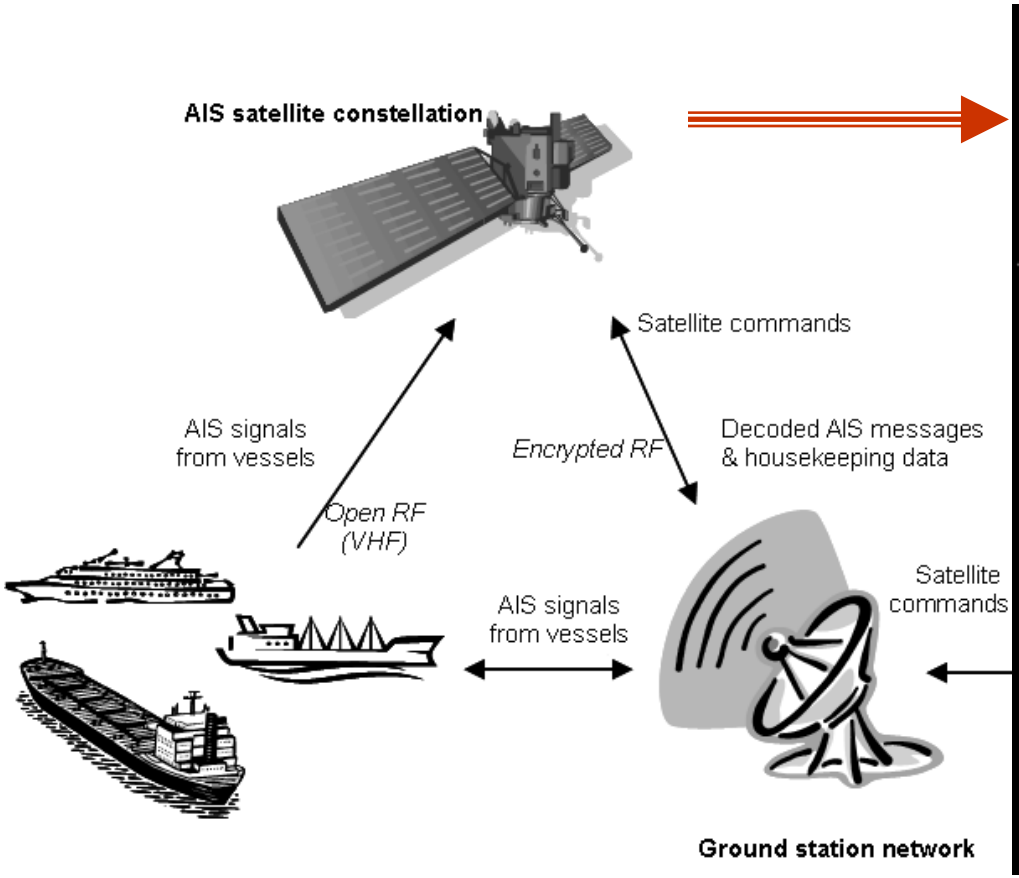
The system is based on the broadcasting of fixed length digital messages using the Time Division Multiple Access (TDMA)

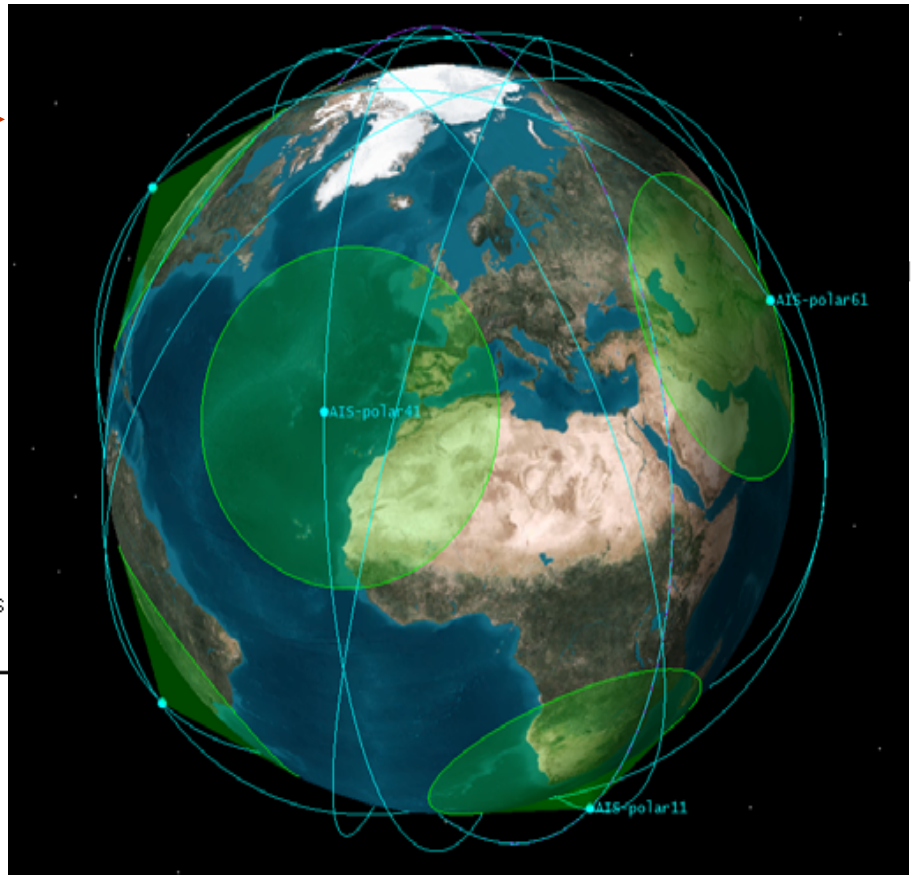


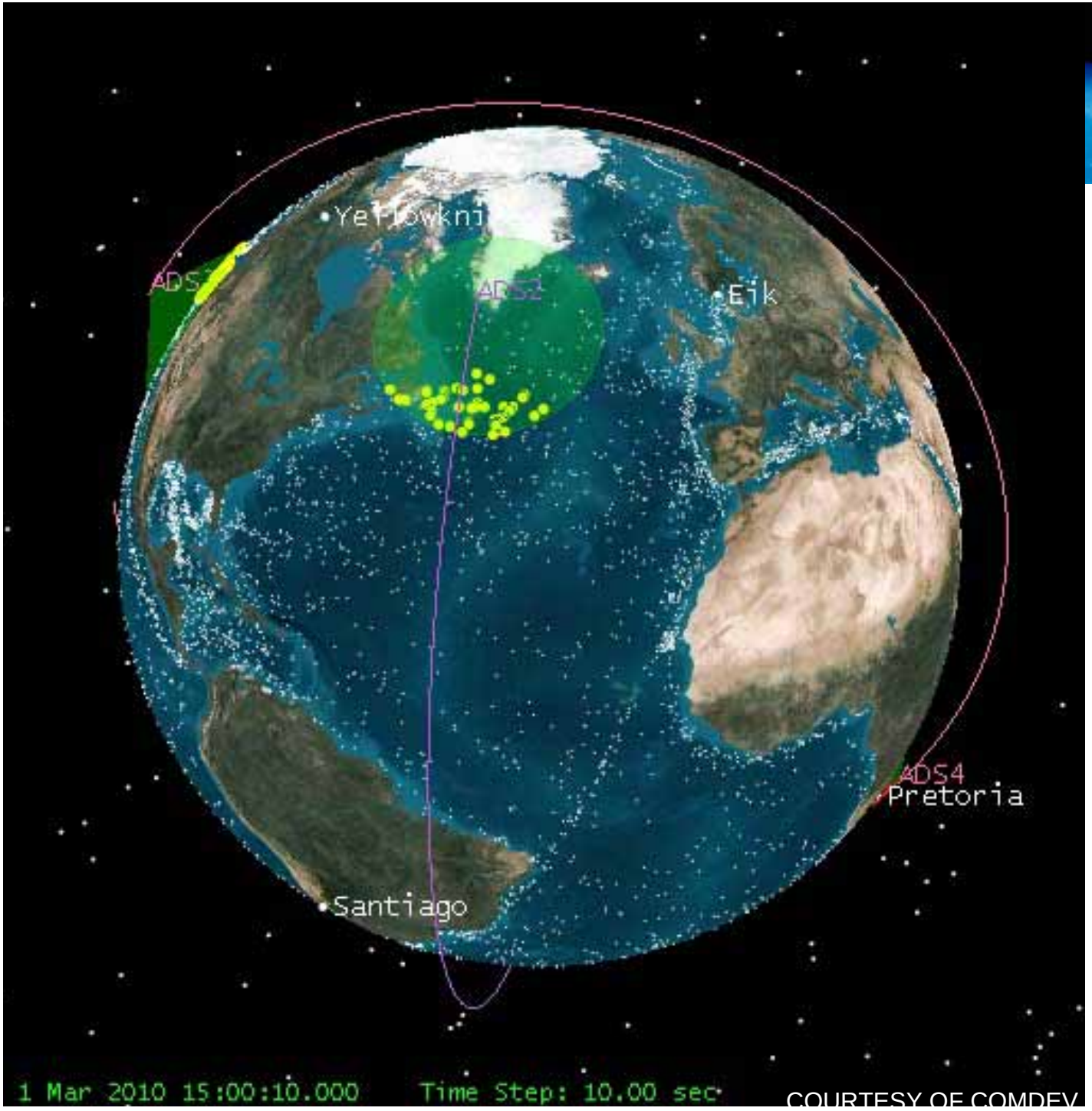
AIS message fields

Start buffer	Training sequence	Star flag	Data	FCS	End flag	End-buffer

AIS signal detection from space







Satellite-based AIS for maritime

related policies

DG-MARE / ESA

Joint

Action Team

&

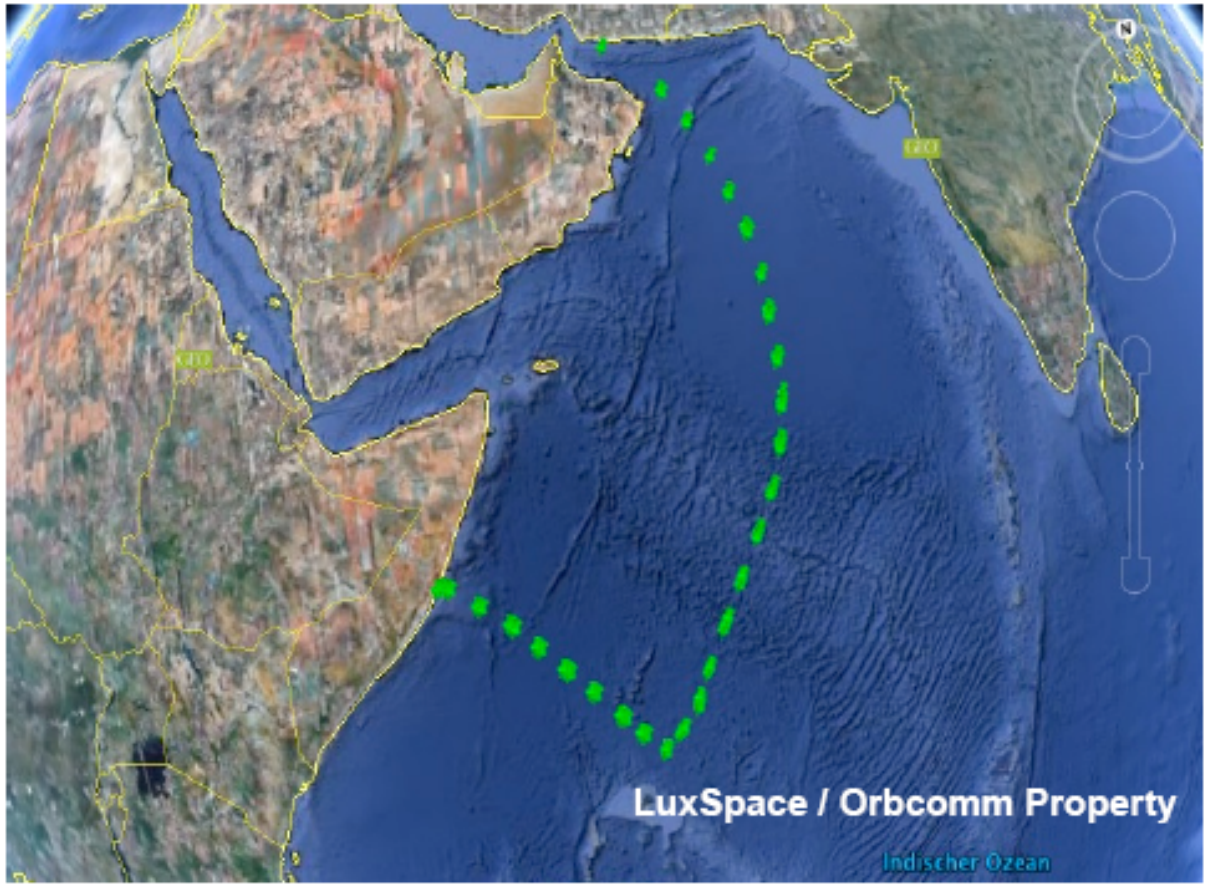
European

Steering group:

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

Tracking Pirates

„POMPEI"

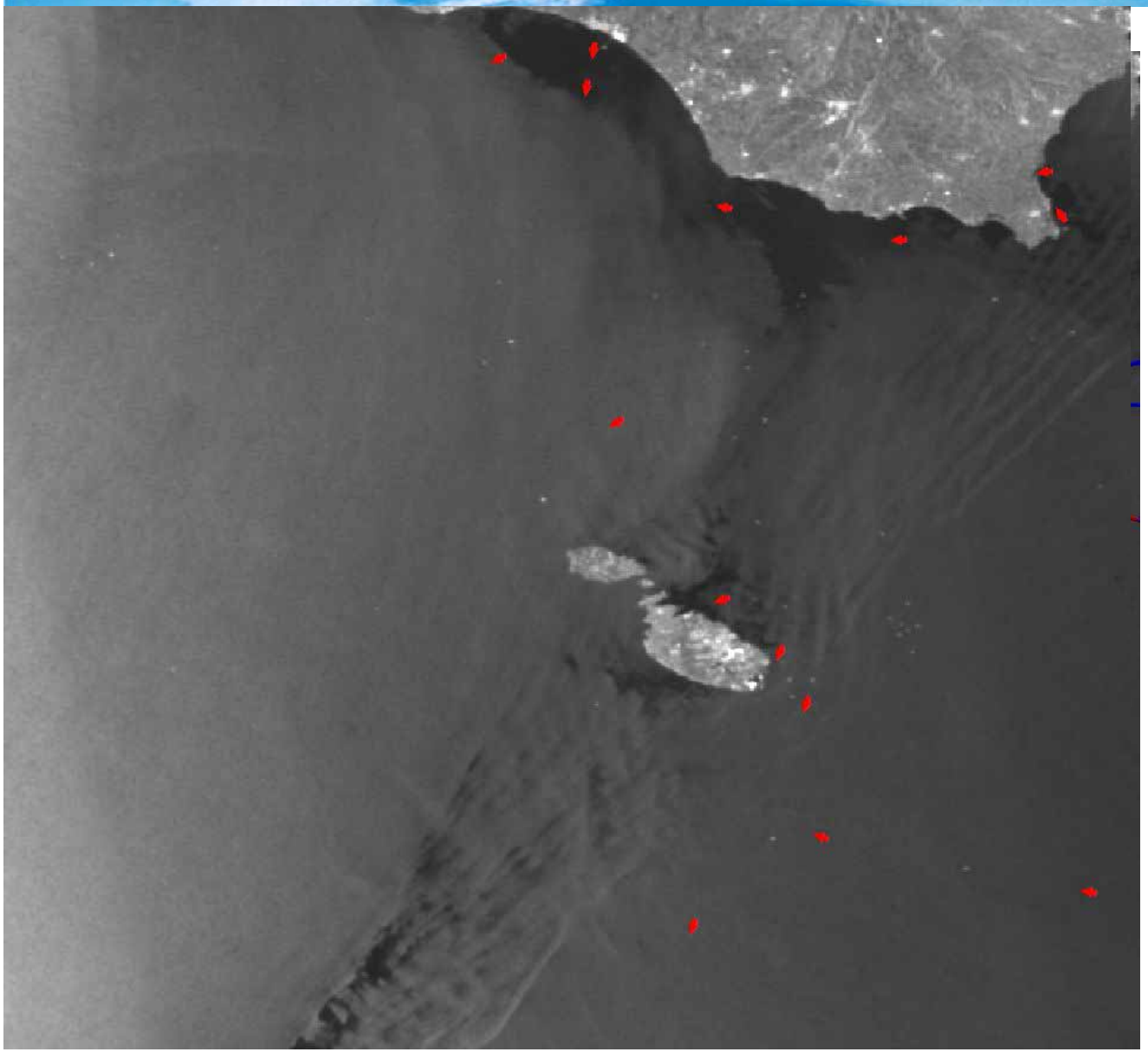


Ship was hijacked 700 nm off Somalia coast and 100 nm from destination (Port Victoria / Seychelle Islands)

- 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

COURTESY OF IUXSPACE

Integrated Application EO, Nav & Telecom



SAR detected ships

SAR ships & AIS tracks

Correlation SAR & AIS

Remaining uncorrelated ships

Lisbon Jan 22nd 2010

Meeting Participants

EMSA MARITIME DELEGATIONS

- Belgium
- Bulgaria
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Ireland
- Latvia
- Norway
- Luxembourg
- Poland
- Portugal
- Romania
- Spain
- Sweden
- The Netherlands

ESA JCB DELEGATIONS

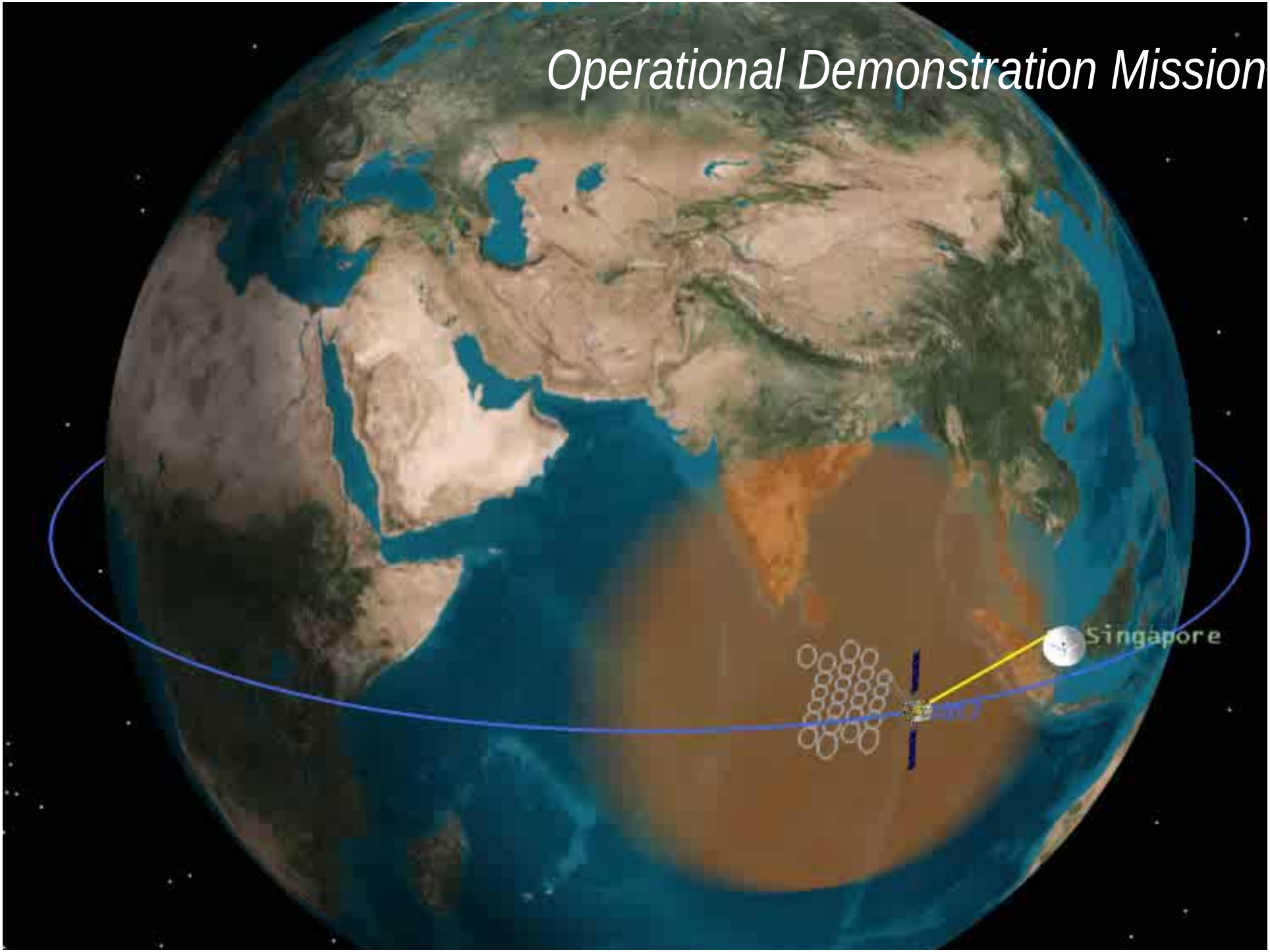
- Belgium
- Canada
- France
- Germany
- Norway
- Luxembourg
- UK
- The Netherlands

DG MARE
DG TREN

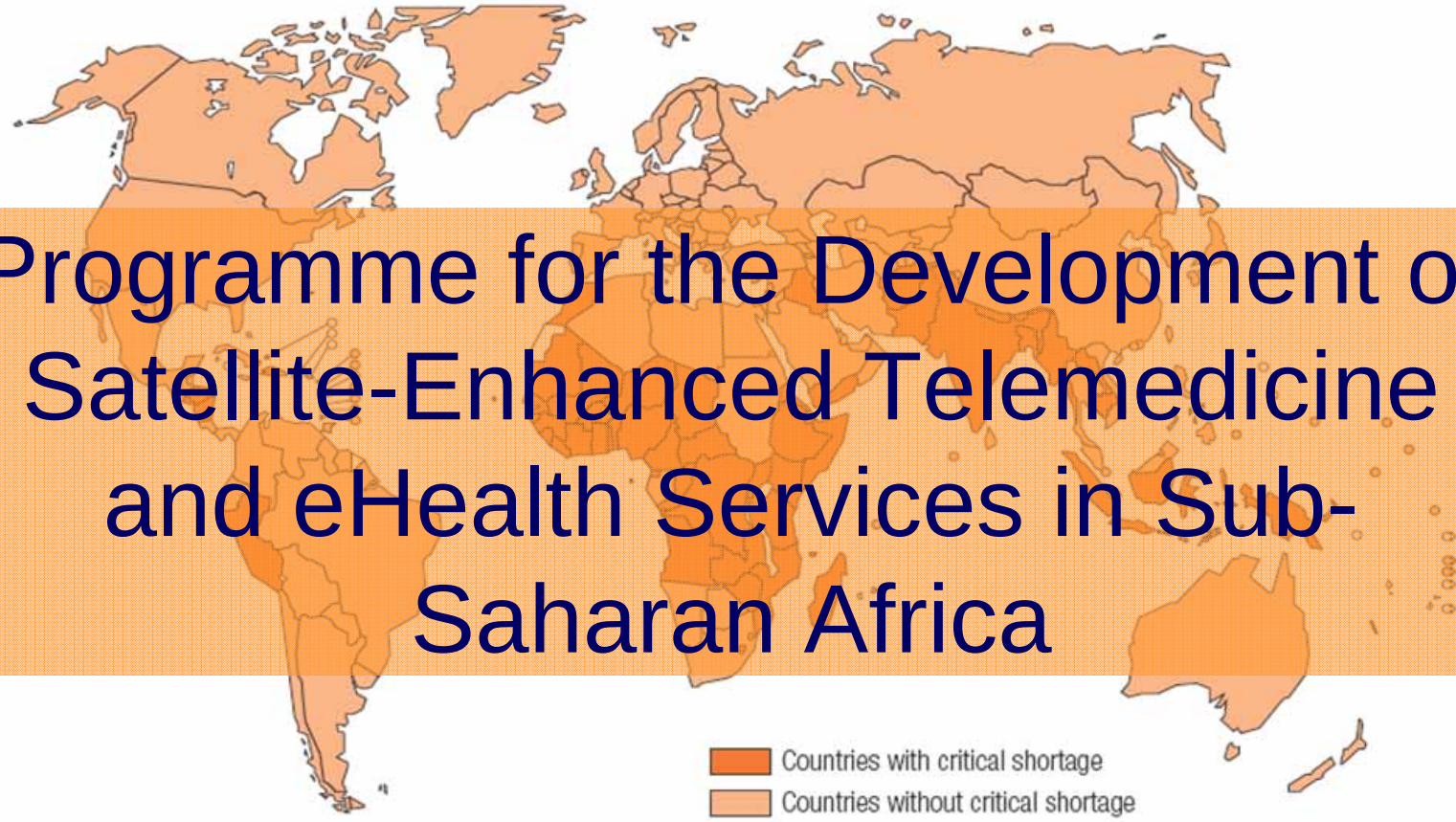
Wanted to come, but could not attend


Groenland
Canada
Feroe. Island
Northern N.Atlantic server
North Sea
AIS server
HELCOM
AIS server
Mediterranean
AIS server
Satellite AIS
server
&
SafeSeaNet
Server
EMSA
EMSA
1st SAT- AIS Space Node in the SafeSeaNet Server

Operational Demonstration Mission



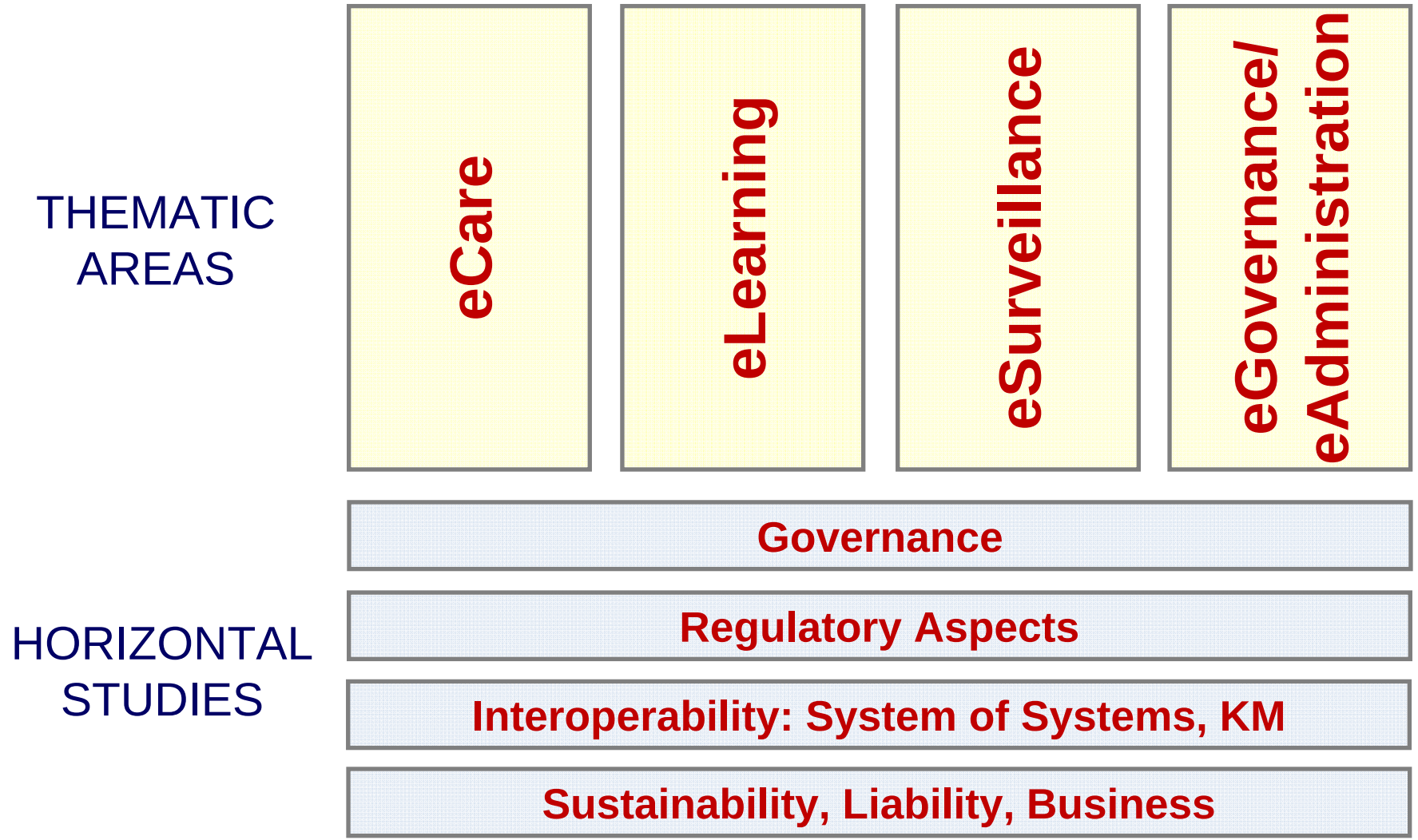
Countries with a critical shortage of health workers (doctors, nurses, midwives) & infrastructure



(World Health Report 2006)

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

Programme Structure



Programme Objective

This programme has been endorsed by the Steering Committee of the European and African Union Partnership on Infrastructure, and comprise horizontal studies and thematic areas projects:

Horizontal Studies:

1. *Governance*, to identify and propose a suitable governance model to manage the infrastructure;
2. *Regulatory aspects*, to analyse and assess the existing regulations and related authorities relevant to the implementation of telemedicine services;
3. *System of system*, to investigate the technical interoperability;
4. *Liability/sustainability*, to develop suitable economic models for long-term sustainability of the satellite-enhanced eHealth infrastructure.

Thematic areas projects (follow-on):

1. *eCare*, to develop new, sustainable telemedicine services for improved delivery of healthcare;
2. *eLearning*, to develop new, sustainable eLearning services for enhancement of health workers education;
3. *eSurveillance*, to develop new, sustainable services for disease surveillance in sub-Saharan Africa;
4. *eGovernance/Administration*, to develop new, sustainable management services supporting the governance of sub-Saharan African healthcare systems.

Key challenges where Integrated Applications can contribute:

- **Increase automation and distant management**
- **Optimize logistics & resources due to budget constraints**
- **Optimize reactivity in case of emergency**
- **Provide to local units more autonomous capacity of management and decision**
- **Guarantee security of personnel and sensitive equipment (Blue Forces)**
- **Optimize the usage of UAVs**



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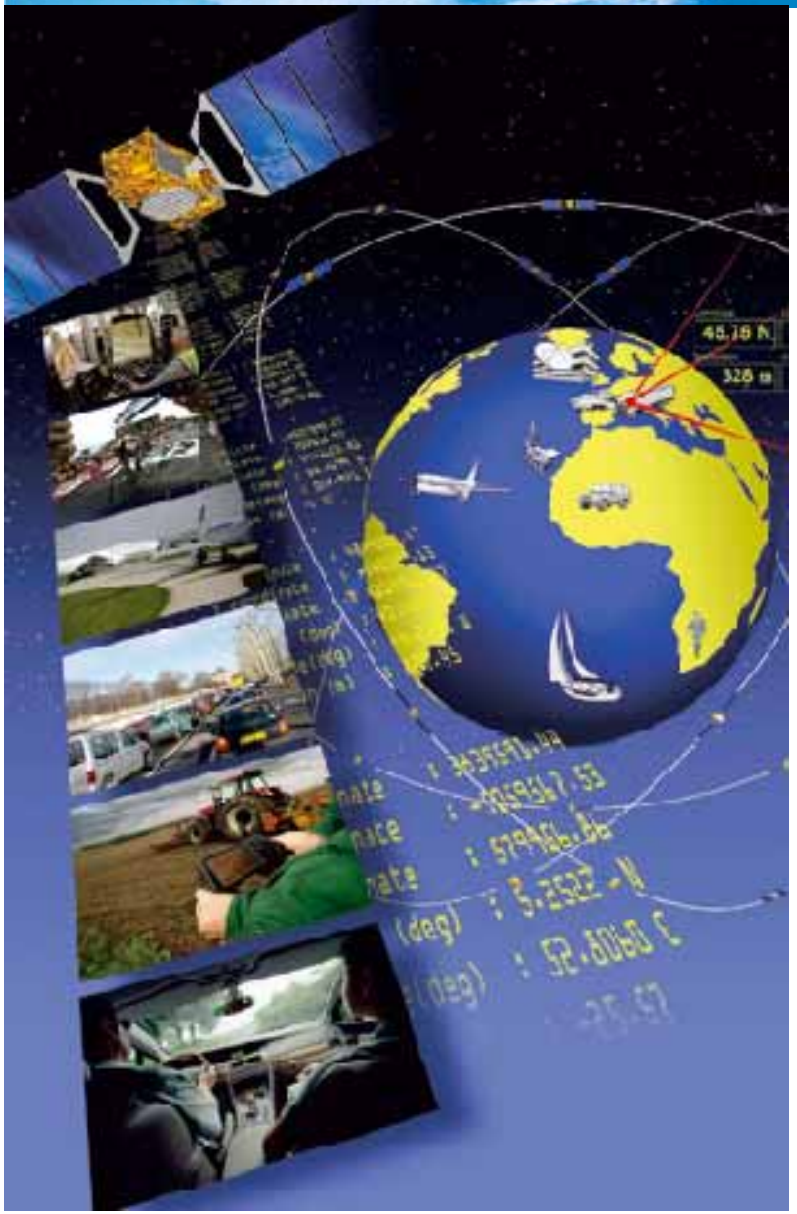

Open Call, June 15th 2009, IAP web portal: http://iap.esa.int

Thank you!