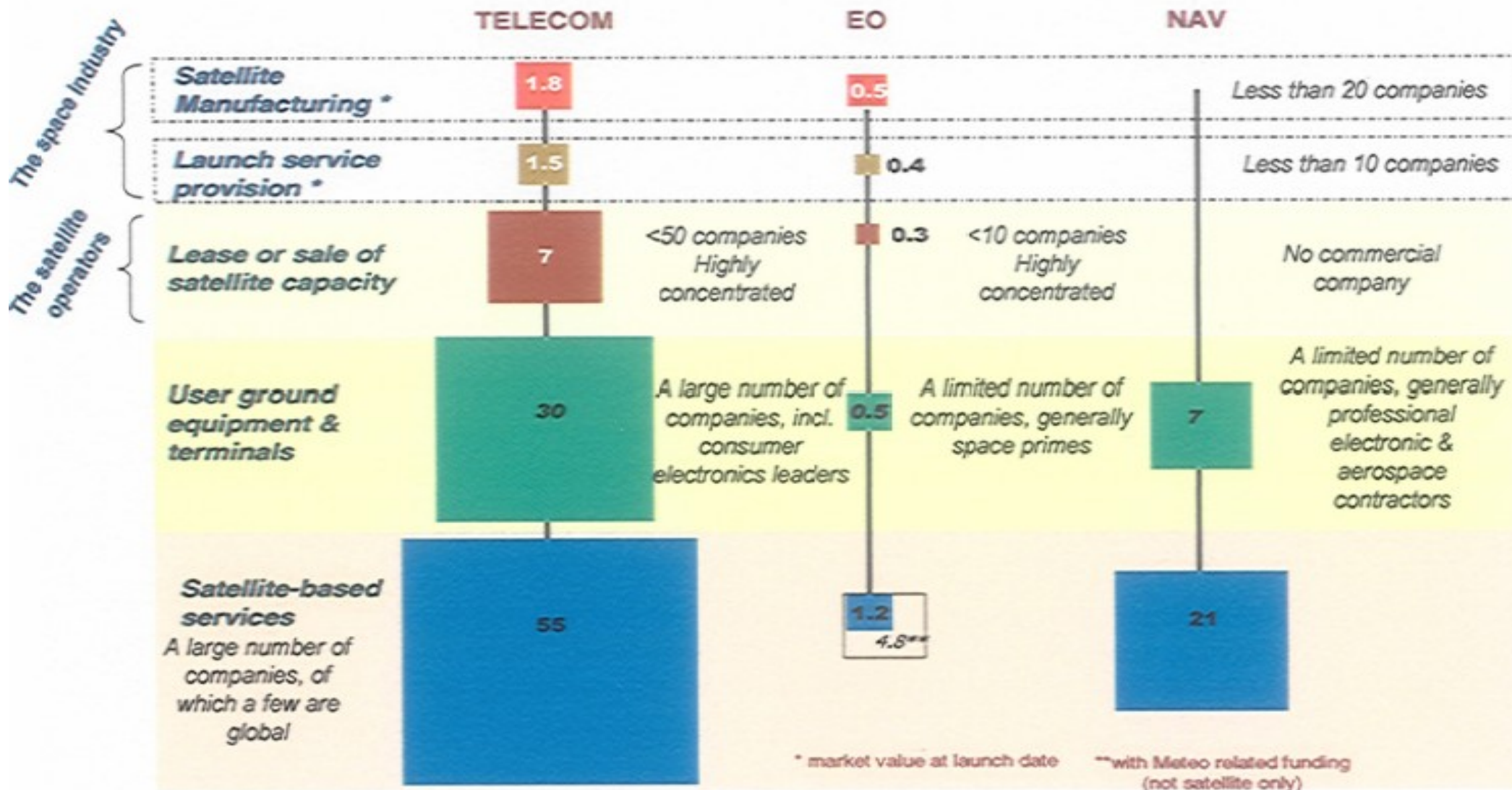# Opportunities and Challenges of E-Health and Telemedicine via satellite

P.Mancini Ph.D.

ESA

• Estimated global revenues of the Downstream Value-Adding Sectors of space applications were **90 Billions Euro in 2003** and expected to grow to **300 Billions Euro by 2010**

• Estimated global revenues of the Upstream space sectors were **10 Billions Euro in 2003** and expected to grow to **31 Billions Euro in 2010**

The 3 value chains in commercial satellite applications in 2005 (€ in billions)

	TELECOM	EO	NAV
The space industry			
Satellite Manufacturing *	1.8	0.5	Less than 20 companies
Launch service provision *	1.5	0.4	Less than 10 companies
The satellite operators			
Lease or sale of satellite capacity	7	0.3 — <10 companies Highly concentrated	No commercial company
	<50 companies Highly concentrated		
User ground equipment & terminals	30 — A large number of companies, incl. consumer electronics leaders	0.5 — A limited number of companies, generally space primes	7 — A limited number of companies, generally professional electronic & aerospace contractors
Satellite-based services — A large number of companies, of which a few are global	55	1.2 / 4.8**	21

* market value at launch date

** with Meteo related funding (not satellite only)

Telemedicine via satellite transition phase:

• Creation of a European expert group to advice ESA on the actions to be promoted in the telemedicine field

• User driven, user co-funding for service sustainability, promotion of a transition phase

• Three demonstrations were deemed eligible for the transition phase by the expert group:

• Health Early Warning

• Management of Medical Emergency for commercial aviation

• Interconnectivity for Healthcare Services and Professional Medical Education bridging communities in Eastern and Western Europe

• The transition phase shall demonstrate the user capacity in co-funding and in teaming up with other stakeholders of the relevant service value chains

- Airlines, Health institutions, health service providers involved technically and financially (namely: Air France, British Airways, Alitalia, bmi, Samu de France, Guy's and St Thomas' Hospital, Galliera Hospital Genoa, Healthcare U.L.S.S. 9 Treviso, Swiss Center for international Health, Vilnius Hospital (Lithuania), Nice University Hospital, Hospital Cruz Roja Ceuta (Spain),Tartu University Hospital (Estonia), Nicosia General Hospital (Cyprus), Remote Diagnostic Technologies Ltd, Vermon Sa, Kell, Medes, Instituto de Salud Carlos III , Institut de Veille Sanitaire, INSA Portuguese National Institute of Health, …..

- The above stakeholders teaming up with traditional space industry actors

- World Health Organization key partner in the overall initiative

Among current biological threats

- Avian Influenza
  - Since 2003: 235 cases, 137 deaths (WHO, 8/08/2006)
  - Increasing geographical spread in animals, increasing number of species affected…
- Current or emerging and re-emerging diseases
  - Global challenges for AIDS, Tuberculosis, Malaria, and many others
  - Environmental/climate changes influence microbial geographical distribution, persistence and transmission mode and can cause spread of local or species-specific diseases
  - On average, one new human disease per year, of which 75% is from animal origin
  - Diseases can re-emerge after containment if the reservoir of the virus still exists (Ebola, SARS)
  - Chikungunya in La Réunion island:
    - since March 2005 - More than 266 000 cases (InVS, 3/08/2006).
- Bioterrorism
  - Anthrax (US, 2001)

+ Risk of epidemiological crises after natural or man-made disasters

Need for an Outbreak Management System to prevent, predict and organize an optimized response.

- Network of experts, decision-makers

- Tools:

  – To prevent or predict the outbreak

  – To issue early warning

  – To optimize the resources and the intervention to limit the extension of the crisis

Added value of satellite communications for health early warning in remote, isolate or prone to natural or man-made disaster areas.

Access to communication from any place in the world especially remote areas or areas with difficult access.

- Data collection for electronic surveillance and early alert
  - Geolocalisation of events related to the outbreak of epidemics (monitoring of movement of birds, localization of areas at risks…)
- Communication for management of biological crisis.
  - Satellite connectivity between experts, decision-making centers and coordination centers on the site of the crisis.
  - Access to Internet from remote areas or mobile field units
  - Satellite communications for mobile field units.
- Post disaster monitoring for data collection.

To develop and demonstrate the <u>added value of various satellite communication services</u> for all the phases of a biological crisis including prevention, early warning and crisis management.

Specifications based on a close collaboration with end-users, in particular WHO and ECDC.

Development of a European Outbreak management system:

- Interoperable

- Implementing existing standards

- Based on well recognized open source technologies.

  ➢ To provide a standard tool usable by the maximum number of end-users.

Objective:

- To validate the development with end-users.

Different types of demonstrations:

- End-to-end case of early warning at the onset of an epidemic based on a post disaster scenario.
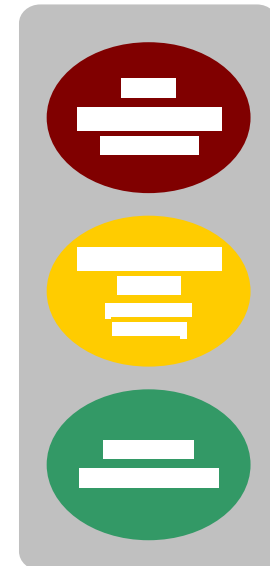
- Itinerant and On-demand demonstrations

- **Inclusion of a scenario on the avian flu risk defined with experts from WHO.**

- **Evaluation of SAFE solution for radiological risks.**

- **Others to be defined, all over Europe, <u>on demand of users</u>.**

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HEWS objective is: *the development, integration, deployment and validation of a pilot* **Satcom based service** *with the purpose of predicting and monitoring communicable diseases from the outbreak and spreading point of view and of supporting response to alert and emergency situation including vertical and horizontal communication.*

HEWS will act as a **monitoring** and **surveillance** system in the scope of Public Health, with the added capabilities of supporting Early Response and Reaction activities.

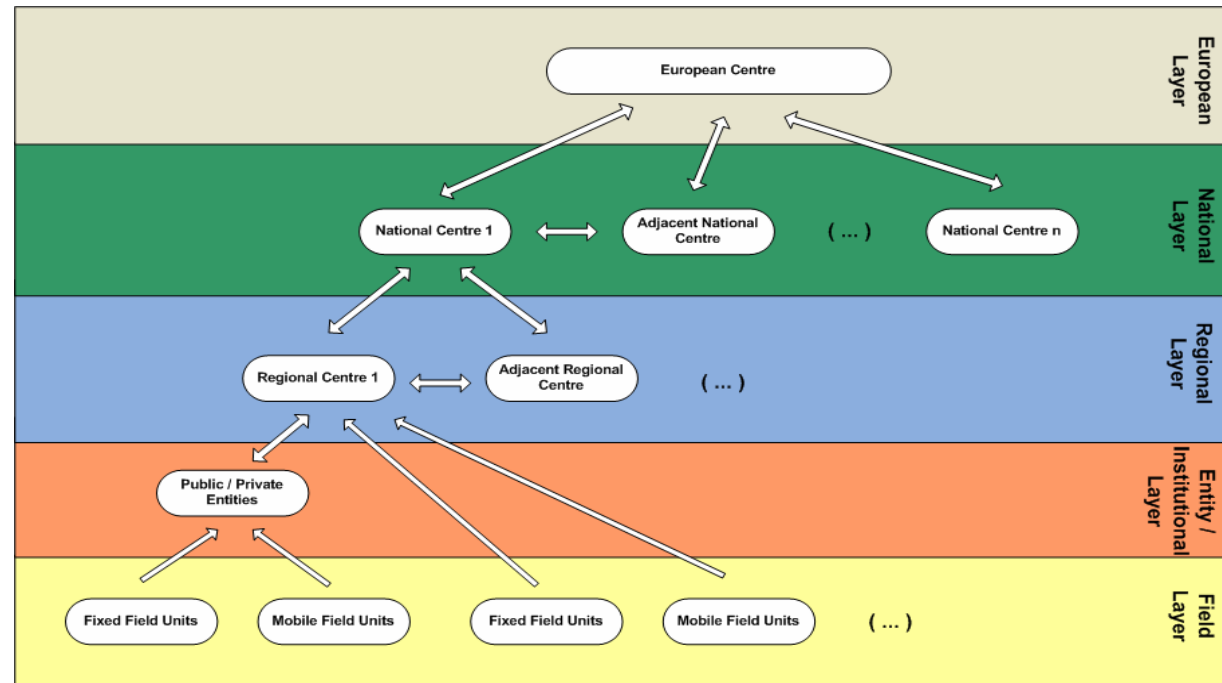HEWS will be operated in three different levels of monitoring depending on the Public Health risks.

Final objective is to validate the system proposed through the **functional operational testing** in two scenarios that will include all the critical point of operability, flexibility and scalability.

HEWS primary task is the **exchange and analysis** of health-related information between public and private entities, fixed warning and monitoring systems, field units and mobile labs, regional and national centres. Different locations, cultures, behaviour patterns and languages are issues that will be covered to empower the **European-wide implementation**.

The development of the **HEWS** should cover the following main points:

• **Interoperability** and low cost of the different components

• **Standard** data communication and architecture (extendable for new situations and scenarios)

• **Security** and redundancy of the gathered and analysed information

• Robust and intelligent **disaster management**

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Avian Flu/ Flu Epidemics/ Pandemic Flu

WHO Level 3 / Who Level 6 in Portugal

• **HEWS** comprises a field unit with laboratory analyses capabilities;

• **HEWS** will geo-refer epidemiological events to support response plan definition;

• **HEWS** will assure real time information in different locations to all actors and will dispatch work instructions;

Heat Waves

10 days Heat Wave in Portalegre (interior district of Portugal)

• **HEWS** have registries of key individuals and community representatives;

• **HEWS** will offer satcom based communications to isolated areas (both individuals and local authorities);

• **HEWS** will broadcast information relating Heat Waves to help individuals during the occurrence of the wave;

Marburg and Cholera Virus in Africa

Two suspect cases of Marburg fever; A nurse from a small village falls ill.

• **HEWS** will offer communication services to villages health structures (satcom based);

• **HEWS** will gather, analyse, disseminate and store epidemiological reports on a daily basis;

• **HEWS** will geo-refer epidemiological events to support response plan definition;
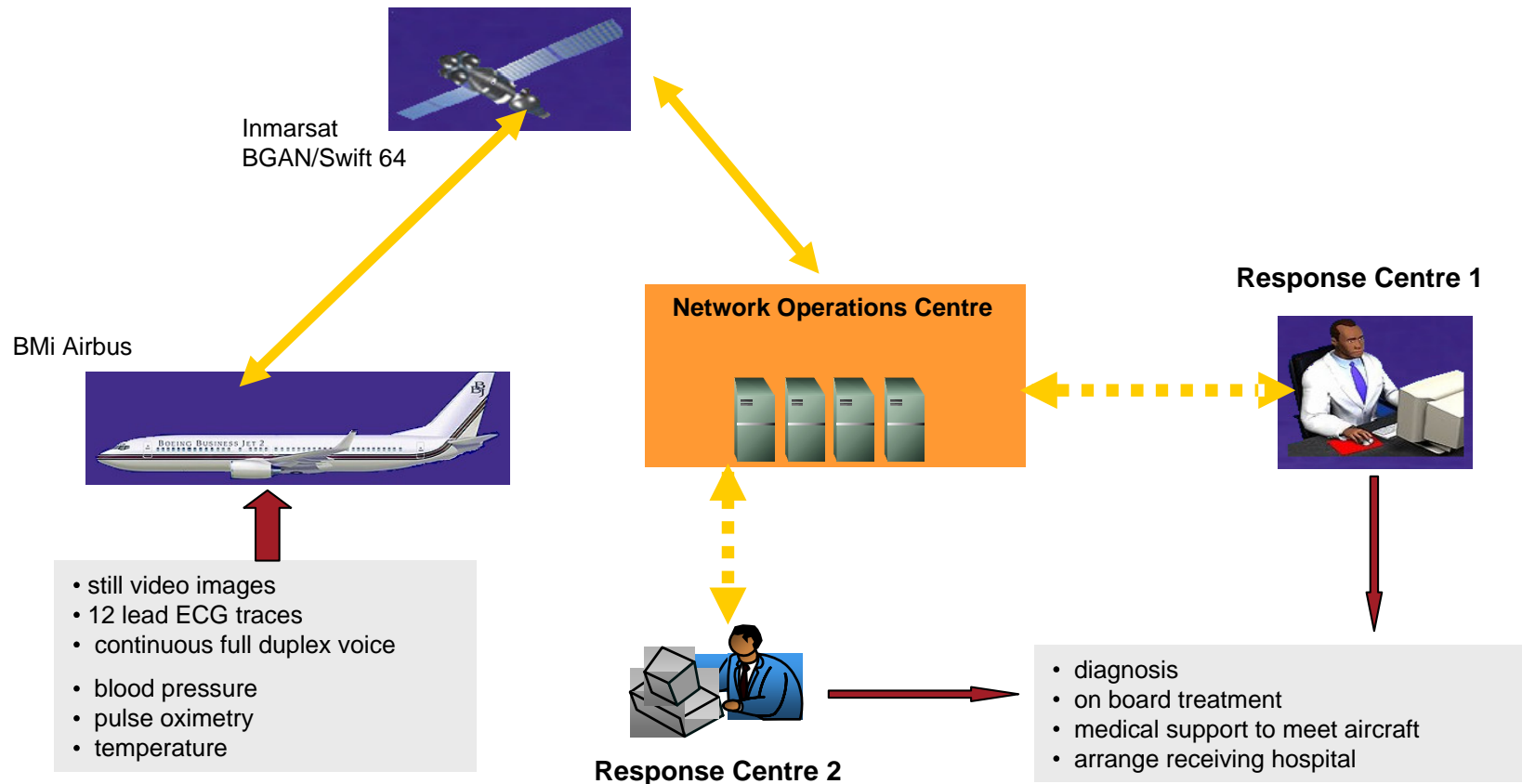
Biochemical Terrorist Attack

Aerosol spread of Anthrax spores over Lisbon downtown or Sarin multiple site attack.

• **HEWS** will assess risk and support crisis response activities;

• **HEWS** will assure real time information in different locations to all actors;

• **HEWS** will dispatch work instructions to different hospitals and health centres.

The issue:

Every year in all world airlines between 700 and 1000 people die during long duration flights (i.e. more than 6 hours) due to medical reasons; each day between 1 and 1.5 planes are landing in emergency conditions for medical reasons; the cost of such re-routings is about 80000 €. Statistical data on these landings shows that 45% can be avoided if a single electrocardiogram could be transmitted from the plane to an emergency medical department in a hospital. Furthermore the travel durations are getting longer i.e. the next A380 planes (more than 15 hours non stop); the number of passengers will increase with the new capacities of the planes.
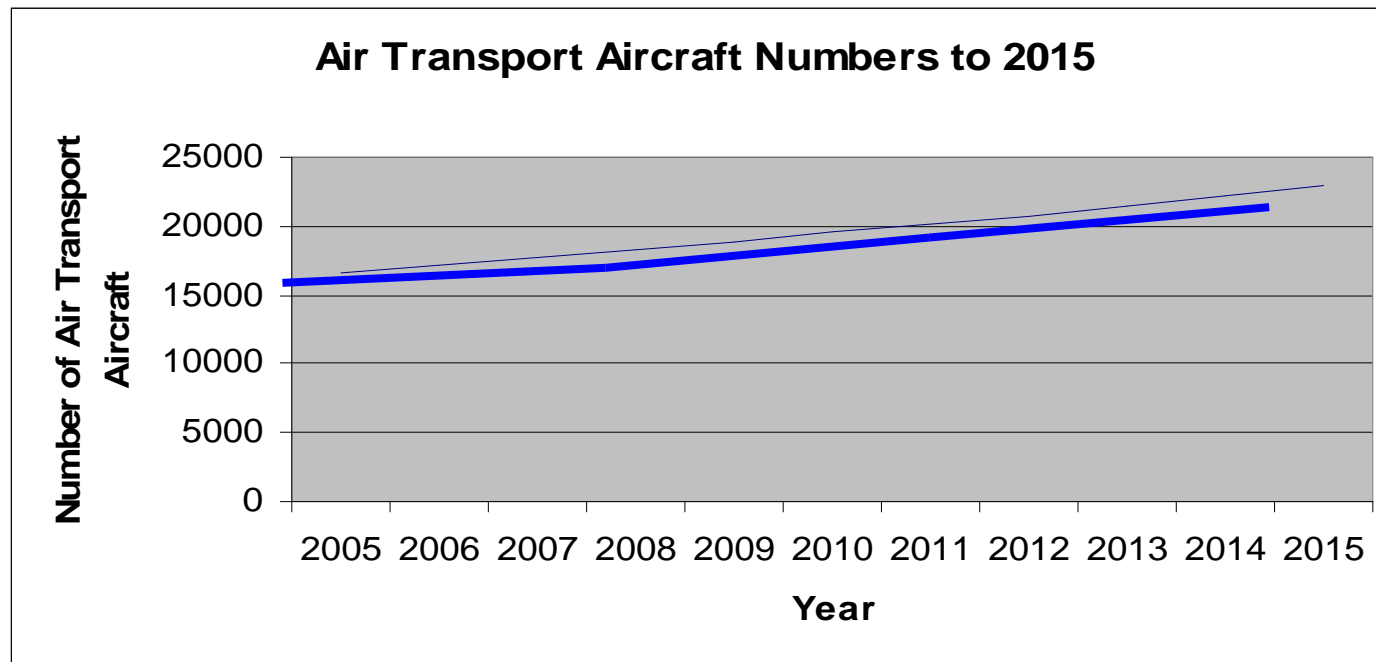
Proposed Aero-telemedicine System:

Inmarsat
BGAN/Swift 64

Network Operations Centre

Response Centre 1

BMi Airbus

• still video images
• 12 lead ECG traces
• continuous full duplex voice

• blood pressure
• pulse oximetry
• temperature

Response Centre 2

• diagnosis
• on board treatment
• medical support to meet aircraft
• arrange receiving hospital

The aim of the system is to determine if the medical condition of the passenger is serious enough to cause a diversion
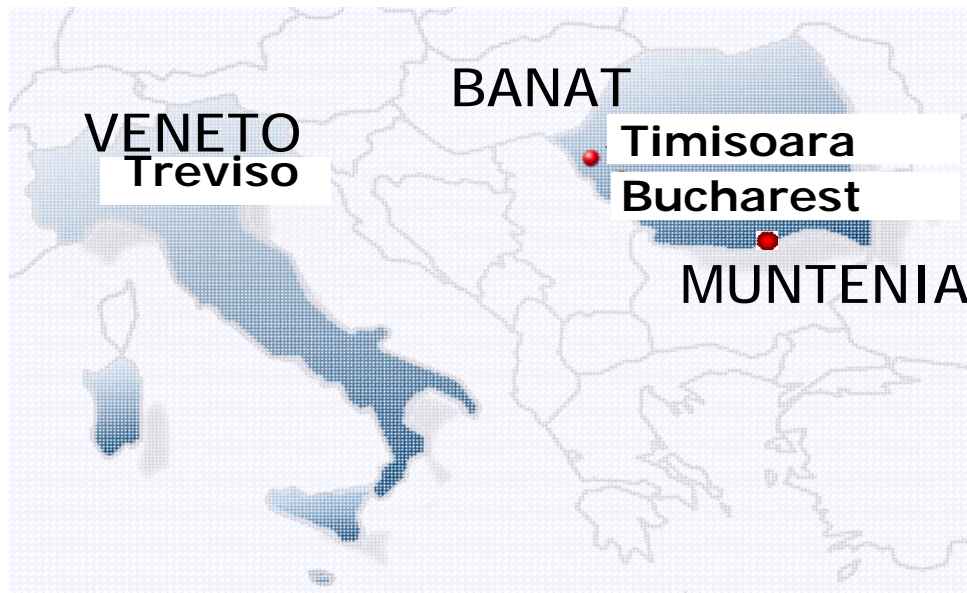
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Commercialisation

Business case: avoid cost of unnecessary medical diversion
Target market: commercial aviation fitted with cabin satcom capability
(legacy narrowband, current and future broadband)
Product: Manufacturing the on-board equipment and work with airlines
to develop the end to end service

Air Transport Aircraft Numbers to 2015

In Romania over two thousand businessmen from Veneto Region have in the last decade created hundreds of companies where over ten thousand Italians and over a hundred thousand Romanians work. Many of these Italian workers moved to Romania with their families while others spend only part of their time there.

The highest concentration of Italian companies in Romania is found in the area of **Banat** (above all in the Timis Region and particularly in Timisoara) with about **3.500** Italian **companies**, and in **Bucharest** with **2.500 companies.**

Through the Project it will be possible to:

• Promote synergies between different healthcare structures and training systems, cultures and working environments between Italy and Romania (which will become part of the E.U. in 2007);

• Promote the integration and sustainability of ICT in daily healthcare provision and medical/nursing training;

• Analyse the potential of a satellite platform in healthcare, with a view to ESA's future dedicated telemedicine via satellite programme.
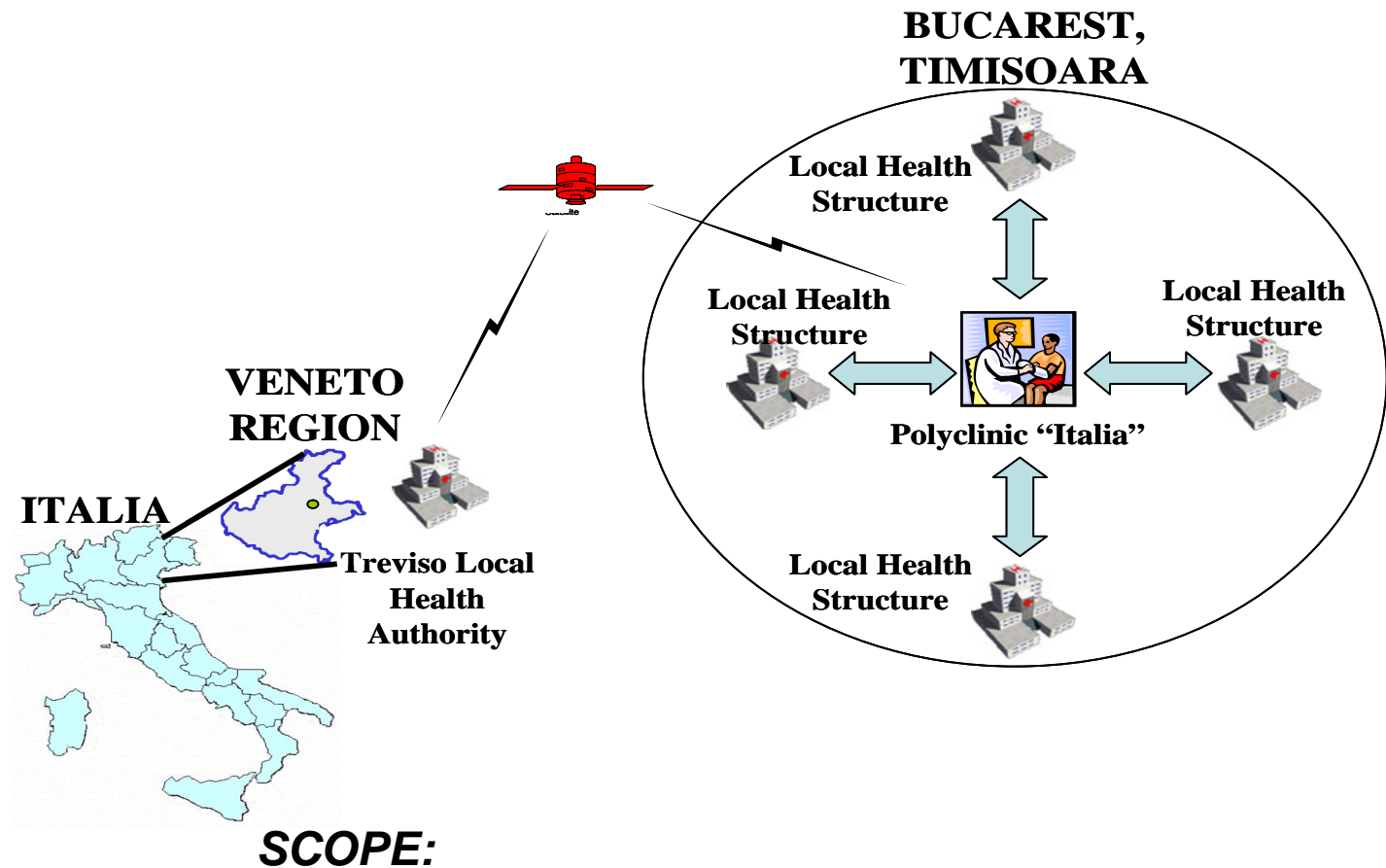
Identification of a low-complexity, low-cost model for clinical data transmission.

The Romanian prototype implementation will benefit from some favourable context conditions:

- *An Italian community which is large enough for trial purposes.*

- *The possibility to experiment both modes of data transmission (i.e. by terrestrial infrastructure or by satellite), and, consequently, to compare them also from the economic sustainability point of view.*

Interconnectivity for Healthcare Services and Professional Medical Education bridging communities in Eastern and Western Europe

SERVICES:

- Telecounselling
- Teleradiology
- Telelaboratory
- Epidemiology
- E-learning

BUCAREST, TIMISOARA

Local Health Structure

Local Health Structure

Local Health Structure

Polyclinic "Italia"

Local Health Structure

VENETO REGION

ITALIA

Treviso Local Health Authority

SCOPE:

TO SUPPLY HIGH QUALITY HEALTHCARE ASSISTANCE

(REGARDLESS OF THE GEOGRAPHICAL POSITION)

THANKS TO THE USE OF TELEMEDICINE

Telemedicine initiative for Africa

A task force (Telemed Task Force, TTF) composed by the relevant African Organizations, WHO, EC and ESA has been set up to identify a framework of appropriate actions for a telemedicine programme in the sub-Saharan African region.

The TTF activities are supported by a study of satellite based system architecture of interest at country/region/pan-African level.

The TTF will investigate where (which geographical areas) and why (assessment of the social benefits deriving from the utilisation of this technology with respect to the present situation) the use of telemedicine via satellite services could improve the existing health sector.

The final report of the TTF for sub-Saharan Africa will be presented to the African Ministers in order to support the overall political decision making process.
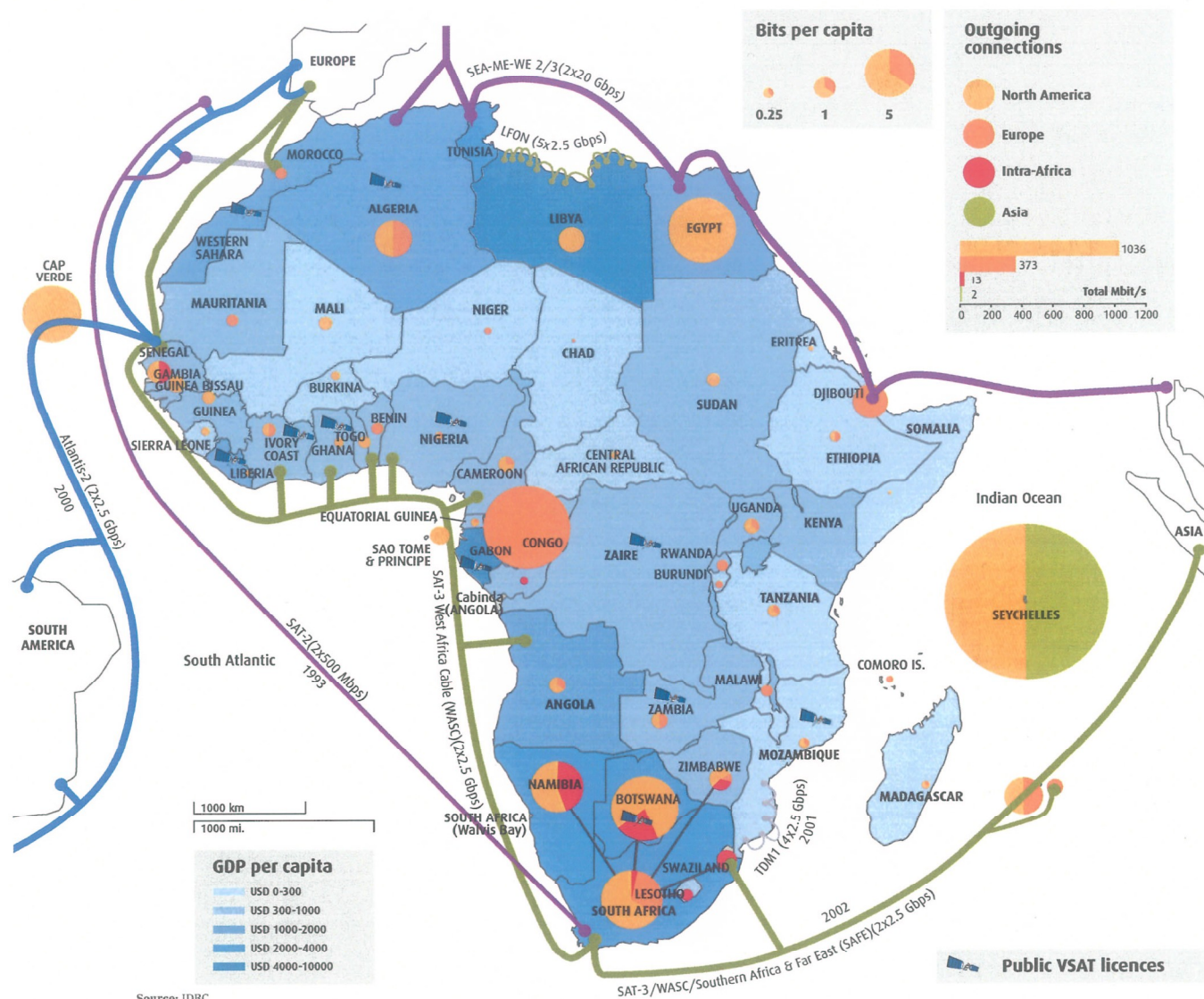
Furthermore the European Commission approved on the 13th of July 2006, the Communication to the Council and the European Parliament (i.e. Interconnecting Africa: the EU-Africa Partnership on Infrastructure, SEC (2006) 896, SEC (2006) 983) to support and initiate programmes that facilitate interconnectivity at continental level. EU will support Africa's efforts to identify and address missing links in existing networks, harmonise transport policies, develop integrated water management, develop cross-border and regional energy infrastructure and promote efforts to bridge the digital divide.

Facts and Figures for Sub-Saharan Africa *(Excluding South Africa)*

INDICATORS	YEAR	RESULTS
Population	2003	647 M
GDP per capita (USD)	2002	342
Urban pop (%)	2003	36
Iliteracy (% of population age 15+)	2003	35
Gross promary enrollment (% of school age population)	2003	87
Main telephone lines (%)	2003	0,96
Residential main lines (% households)	2002	3,5
Mobile cellular subscribers (%)	2003	2,78
- % Prepaid (mobile)	2003	91,2
- % Population coverage (mobile)	2003	47,6
Effective teledensity fixed+mobile (%)	2003	2,68
Personal computers (%)	2003	0,75
Internet users (%)	2003	0,7
Television sets (per 1000 people)	2001	60
Radios (per 1000 people)	2001	198

Source : ITU African Telecommunication indicators 2004
World Bank Development indicators

Connectivity in Africa

Source: IDRC

ESA IS SETTING UP THE NECESSARY STEPS
TO GENERATE A EUROPEAN USER DRIVEN APPLICATION
PROGRAMME TO DEVELOP SATELLITE BASED SERVICES
TO TACKLE THE CHALLENGES
OF OUR MODERN SOCIETY