

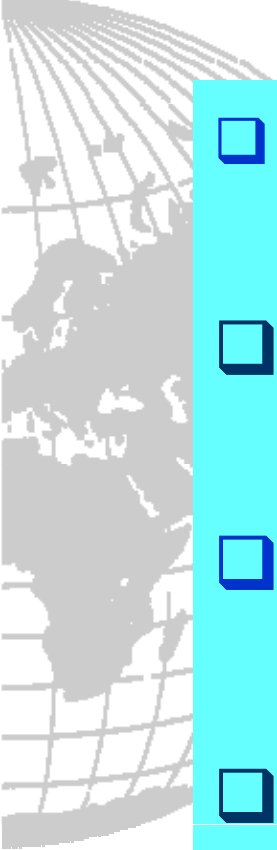


# Advanced ICT Infrastructures for Emergency Scenarios



**Prof. Marina Ruggieri**  
University Roma Tor Vergata  
Faculty of Engineering - DIE  
Director, CTIF\_Italy  
[ruggieri@uniroma2.it](mailto:ruggieri@uniroma2.it)

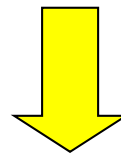
## OUTLINE

- 
- ☐ Elements of an Advanced Infrastructure
  - ☐ The Center for TeleInfrastructure (CTIF)
  - ☐ Activities for Emergencies @ CTIF\_Italy
  - ☐ References



# Elements of an Advanced Infrastructure

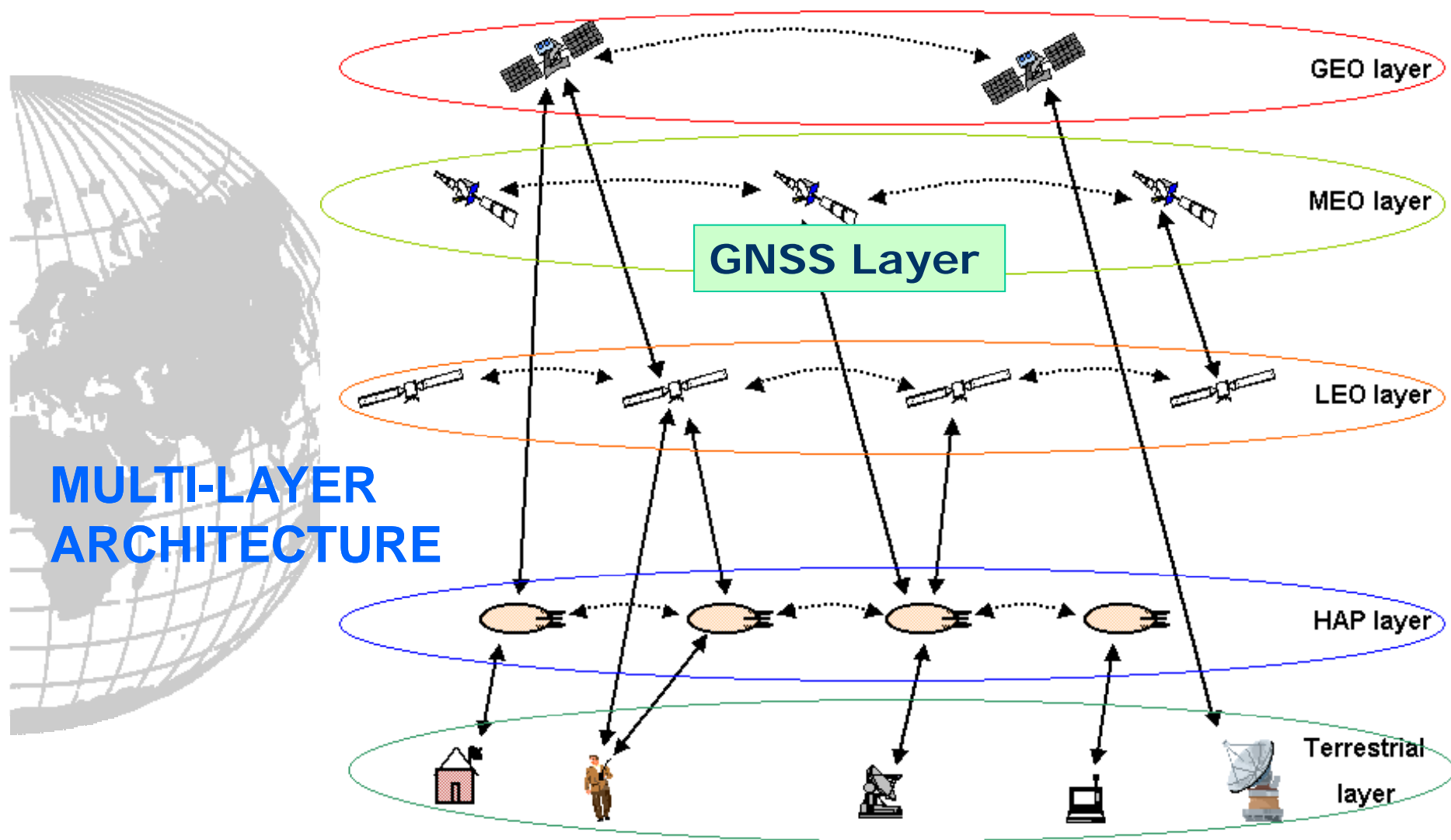
- 
- ☐ **Earth Monitoring (Planet Health, Protection and Security )**
  - ☐ **Navigation (GALILEO, GPS III)**



**Telecommunications is the glue of the tissue**



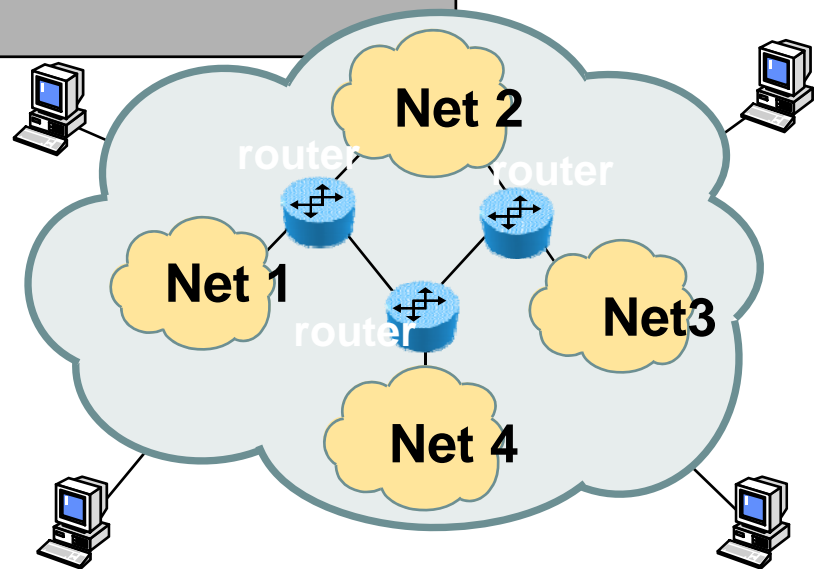
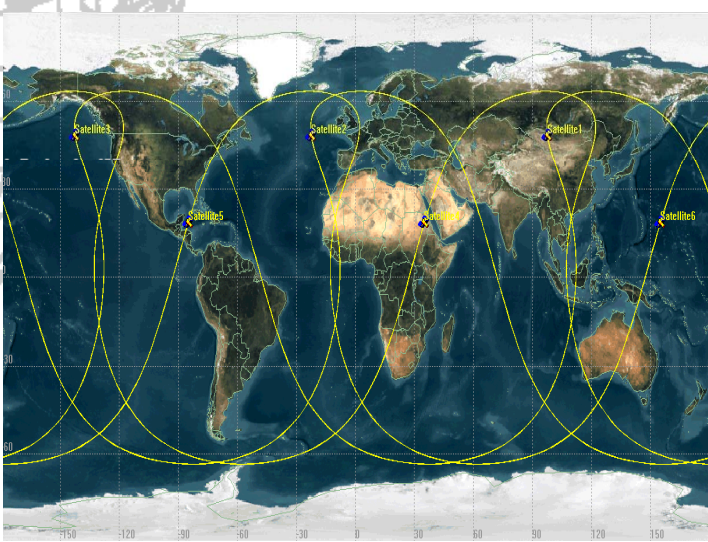
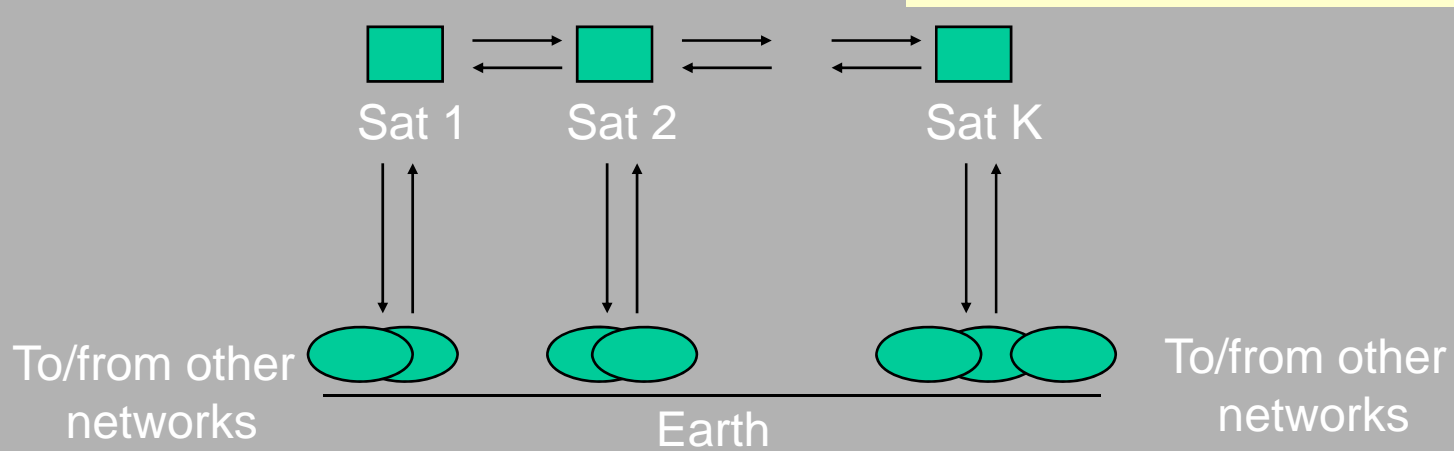
- 
- ☐ **User Terminals**
  - ☐ **Technologies**
  - ☐ **Service Integration**  
**(NavCom, ObsComNav, ObsNav)**
  - ☐ **Service Integration**  
**in mobility and wireless applications**

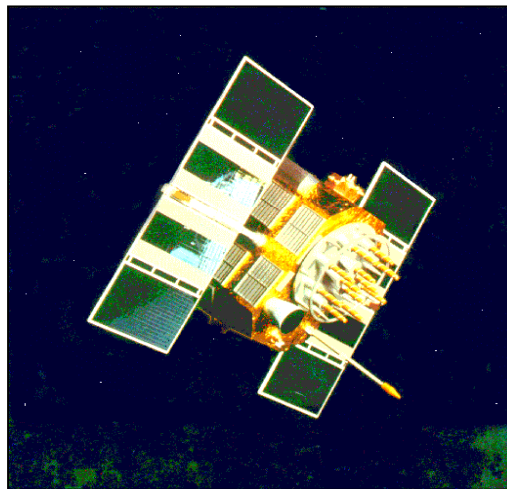
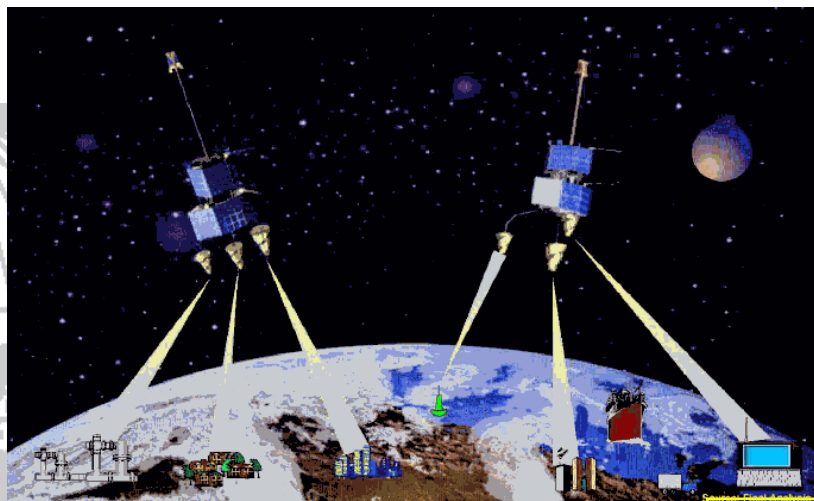


## Each layer is heterogeneous in terms of:

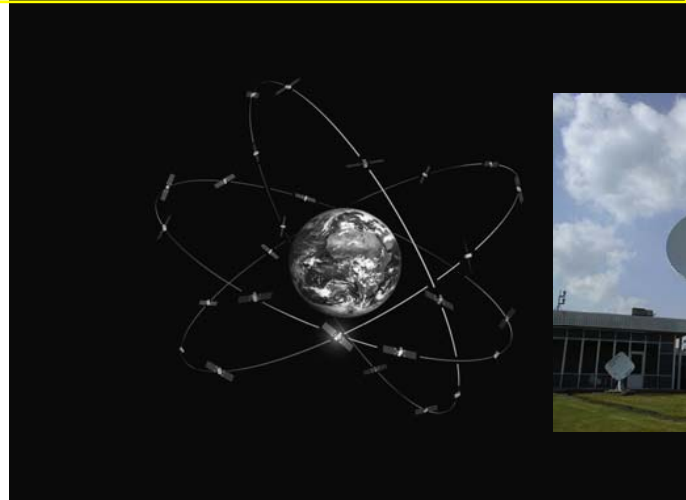
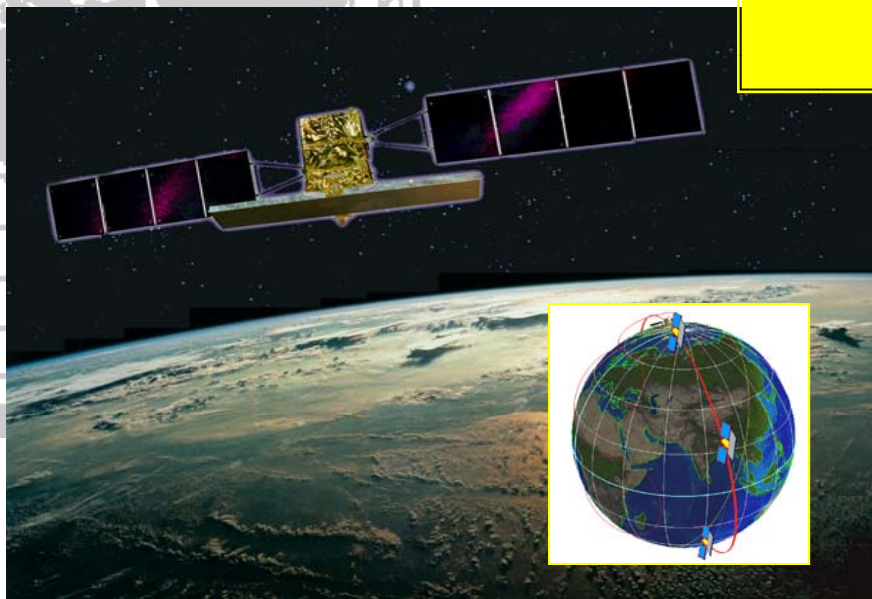
- 
- ☐ frequency ranges
  - ☐ technologies
  - ☐ intra-layer features
  - ☐ cross-layer issues
  - ☐ deployment time and cost
  - ☐ design and modelling issues

## Satellite-Based Networking

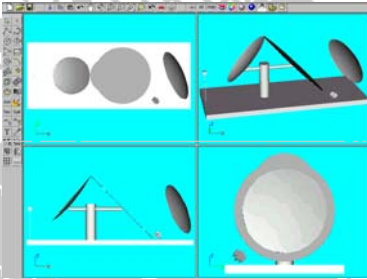




**NAV - EO - COM**



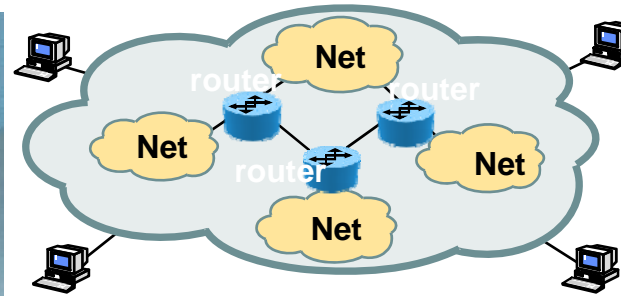
## DESIGN



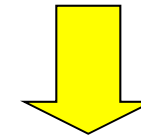
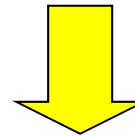
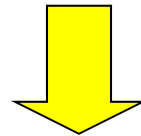
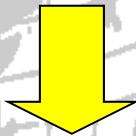
## TECHNOLOGY



## NETWORKING



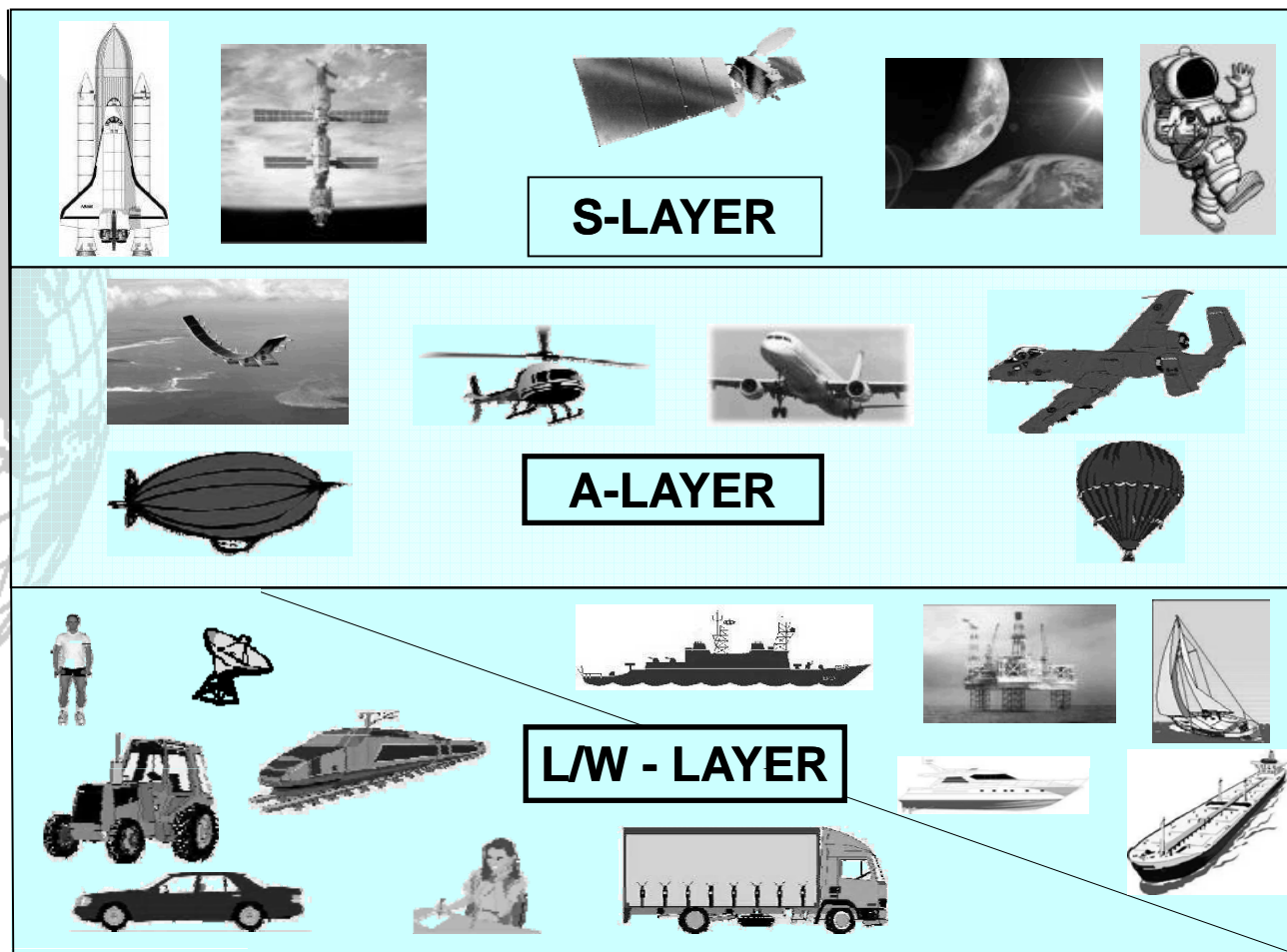
## CHALLENGE

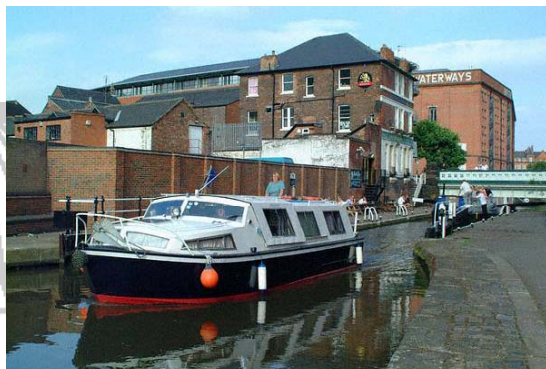


**Necessary ingredients for the *Integration-concept*  
(*I-concept*)**



## NavCom Integrated Architectures

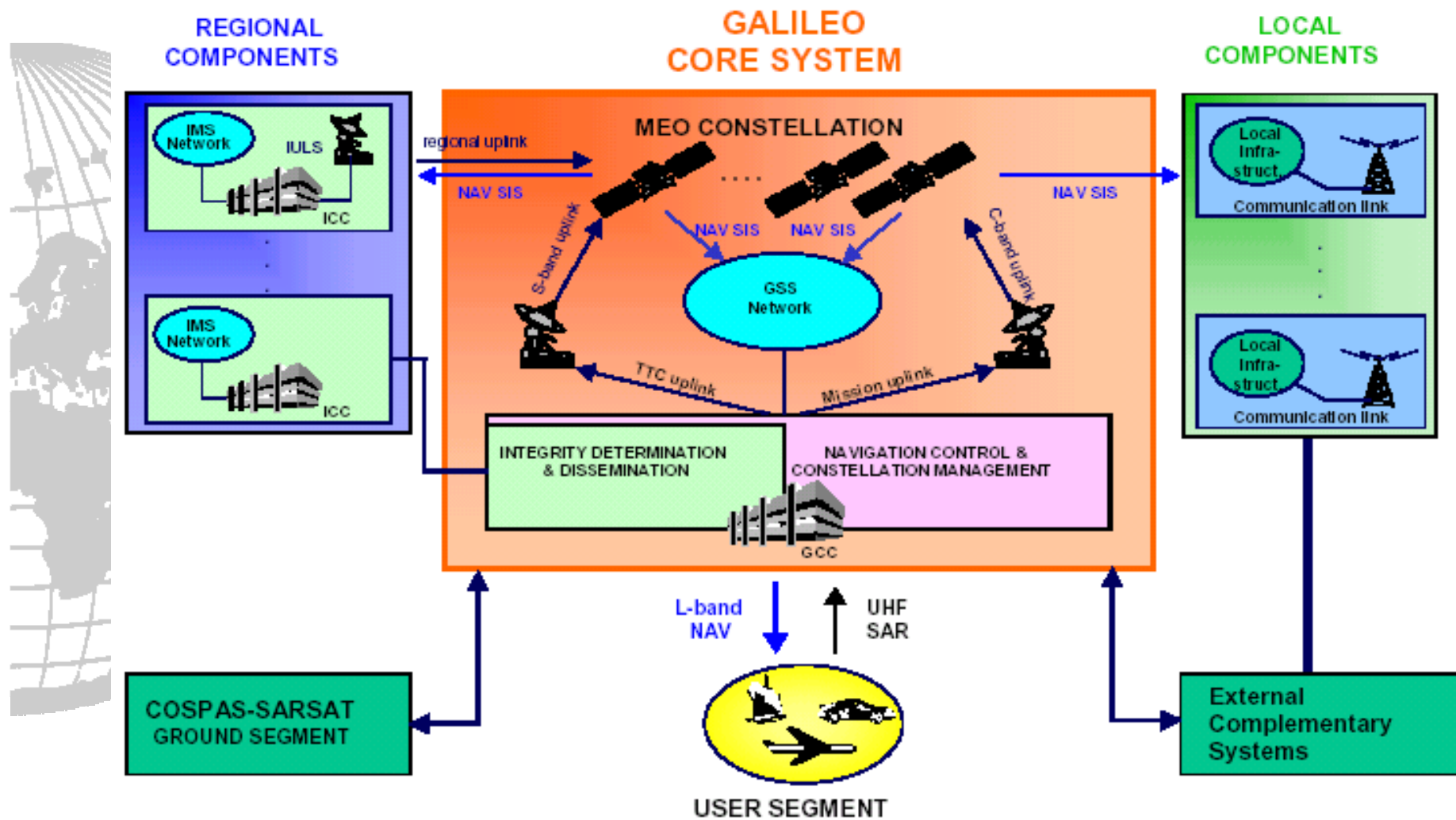


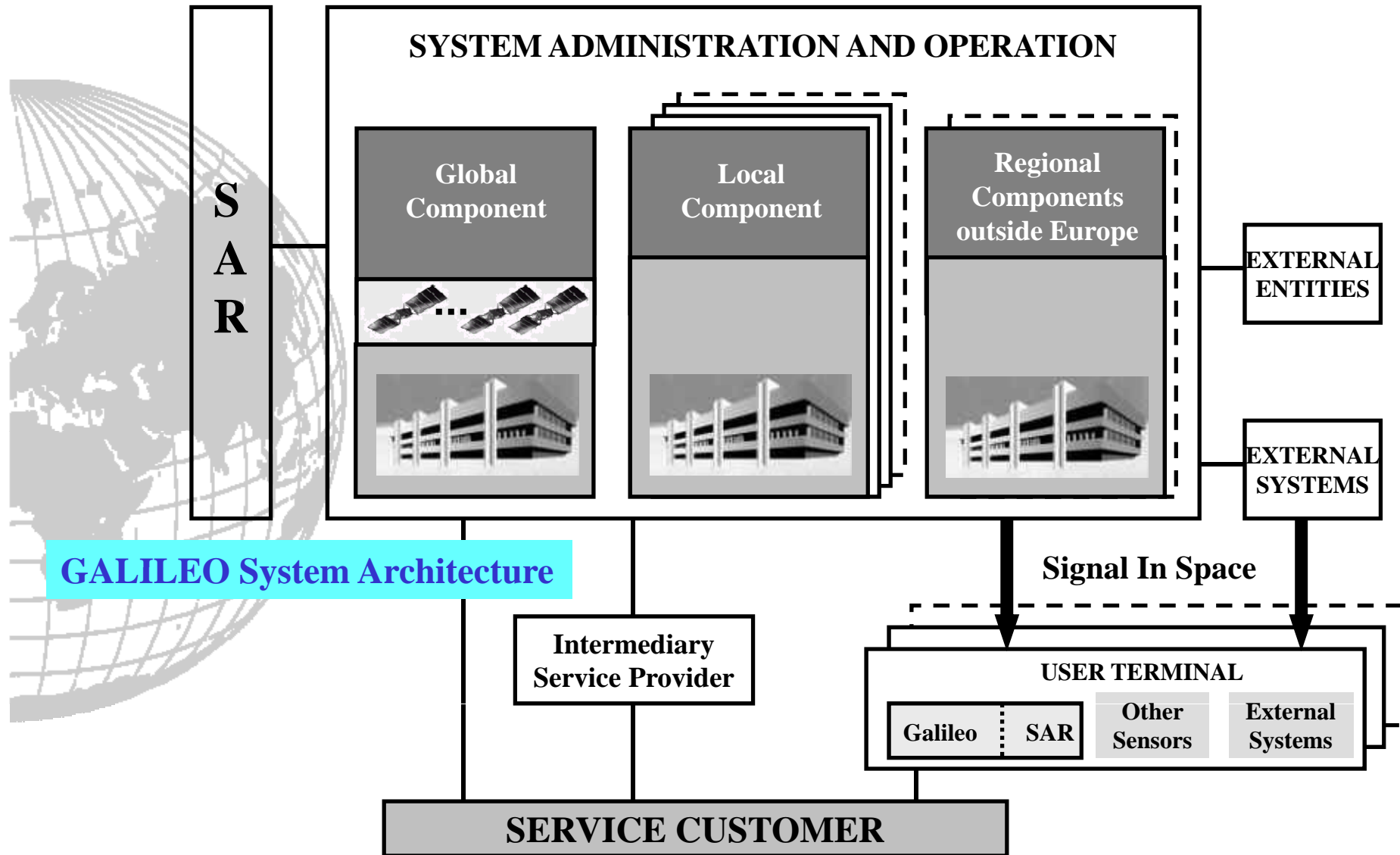


## GALILEO

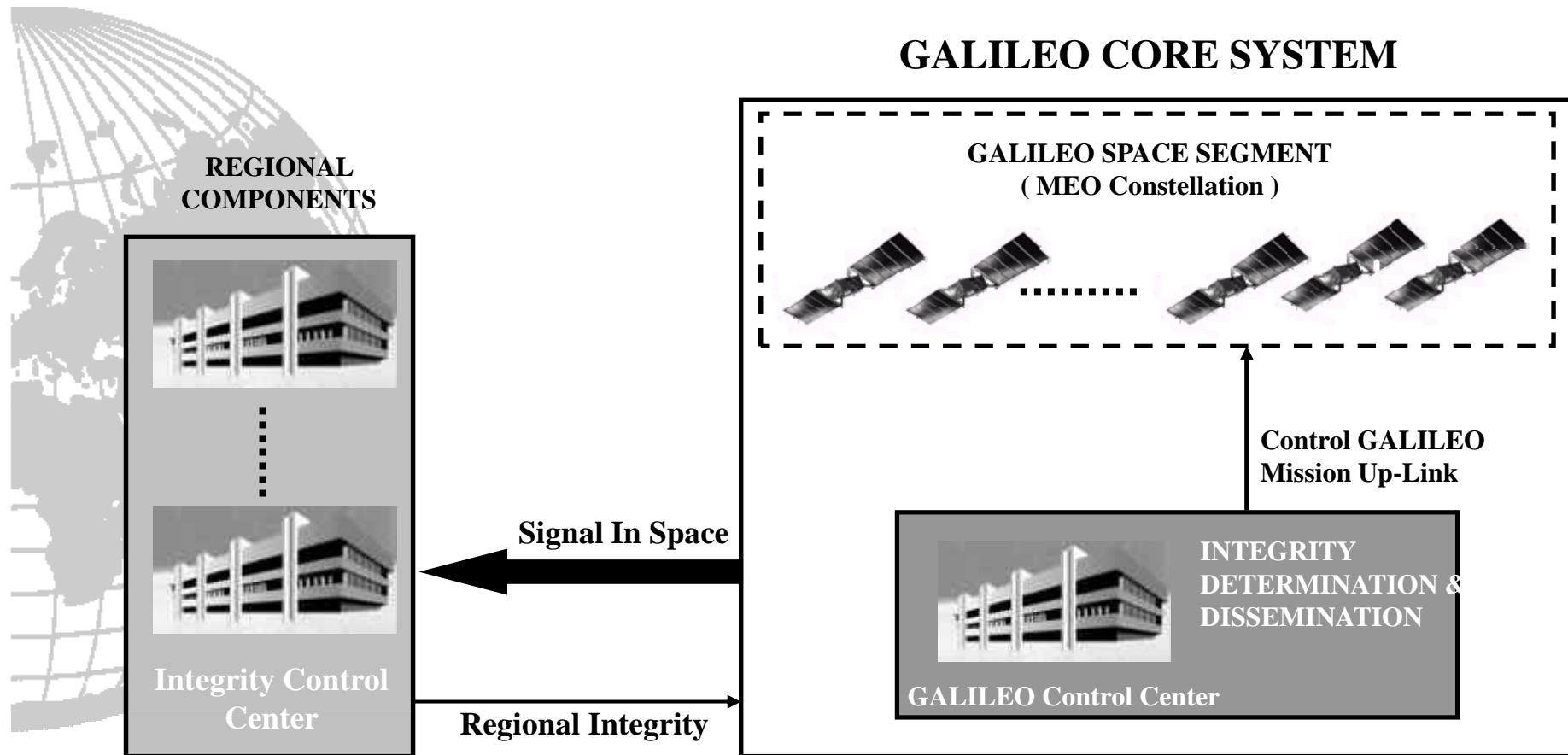




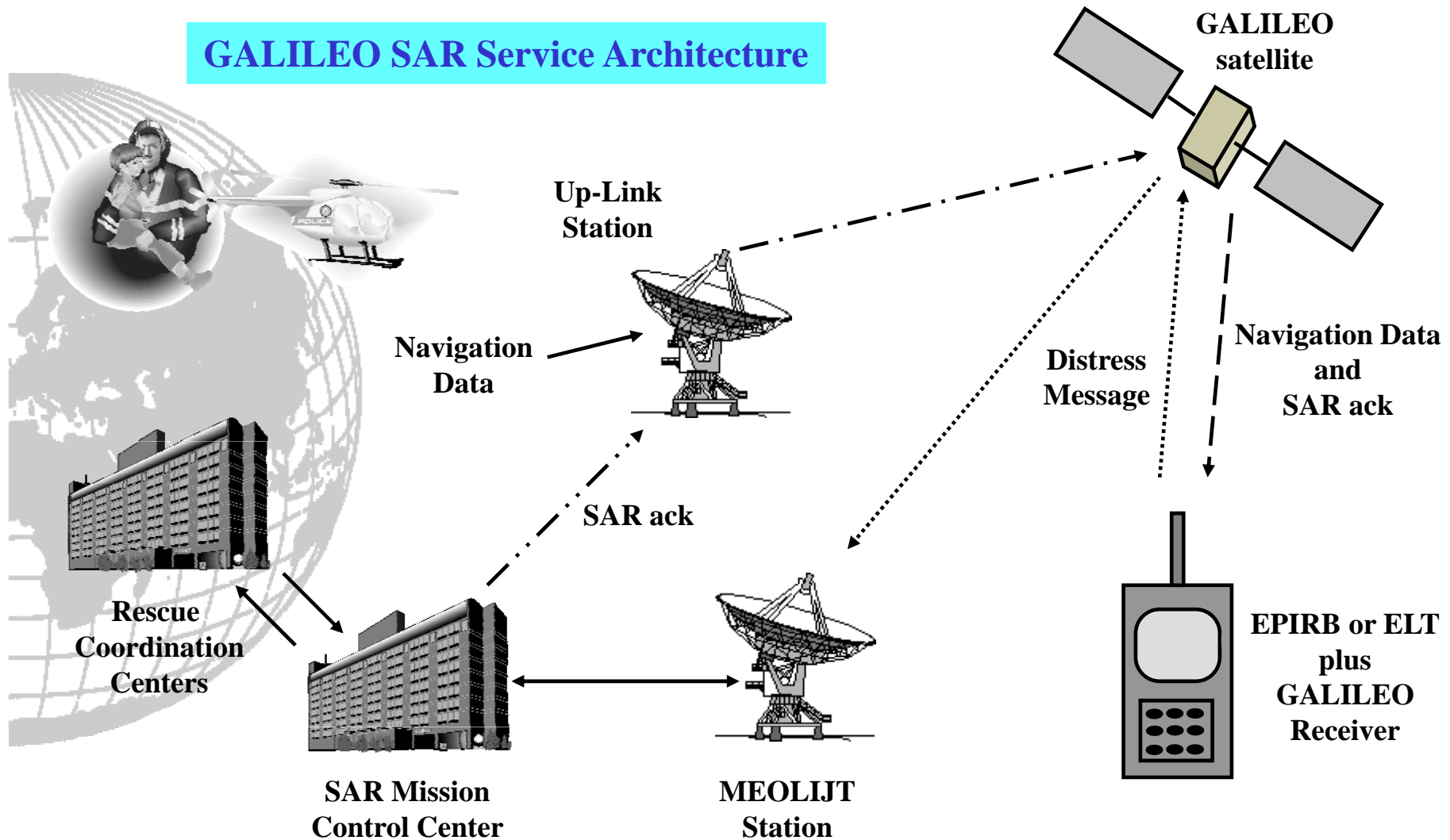




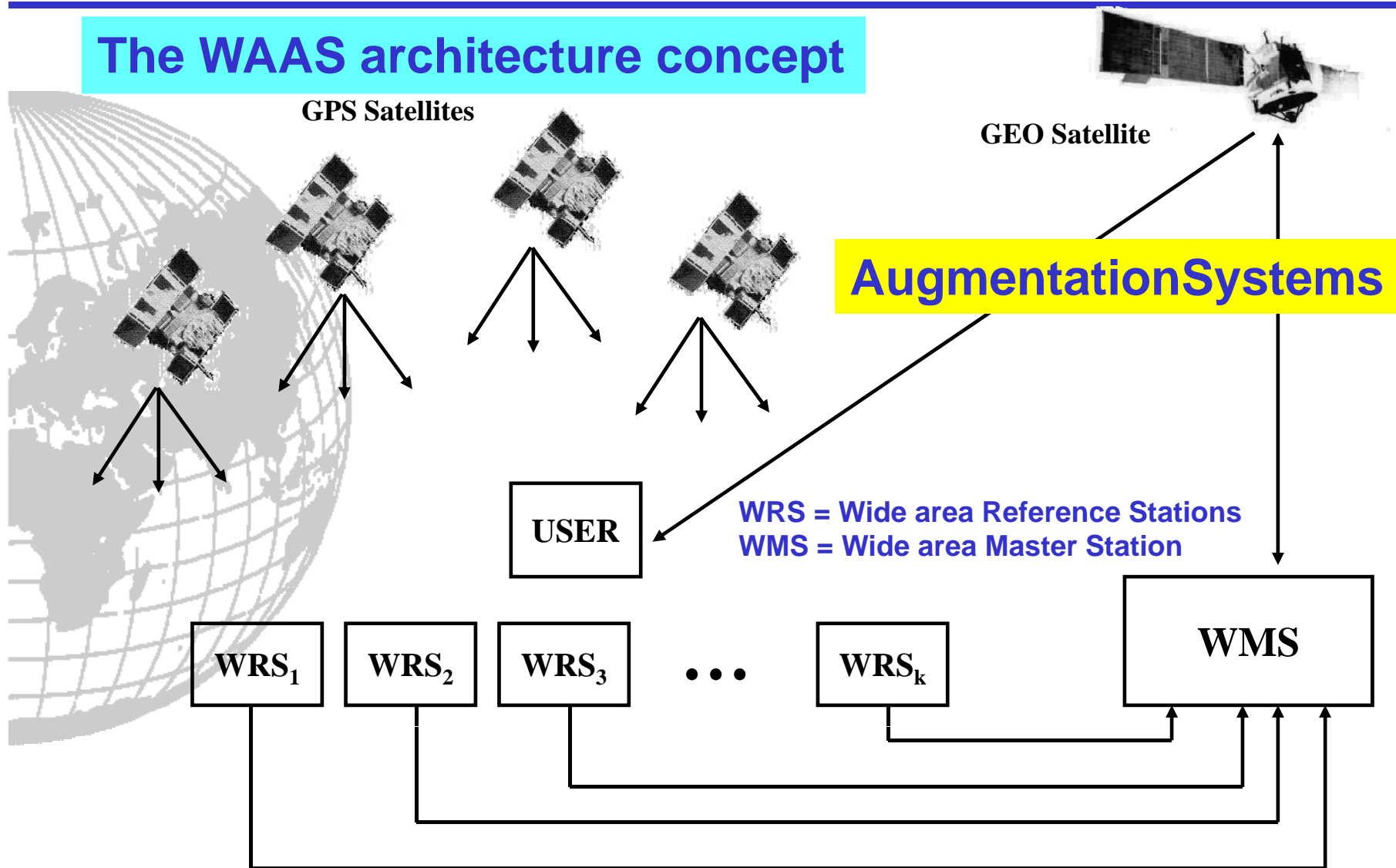
## GALILEO CORE SYSTEM

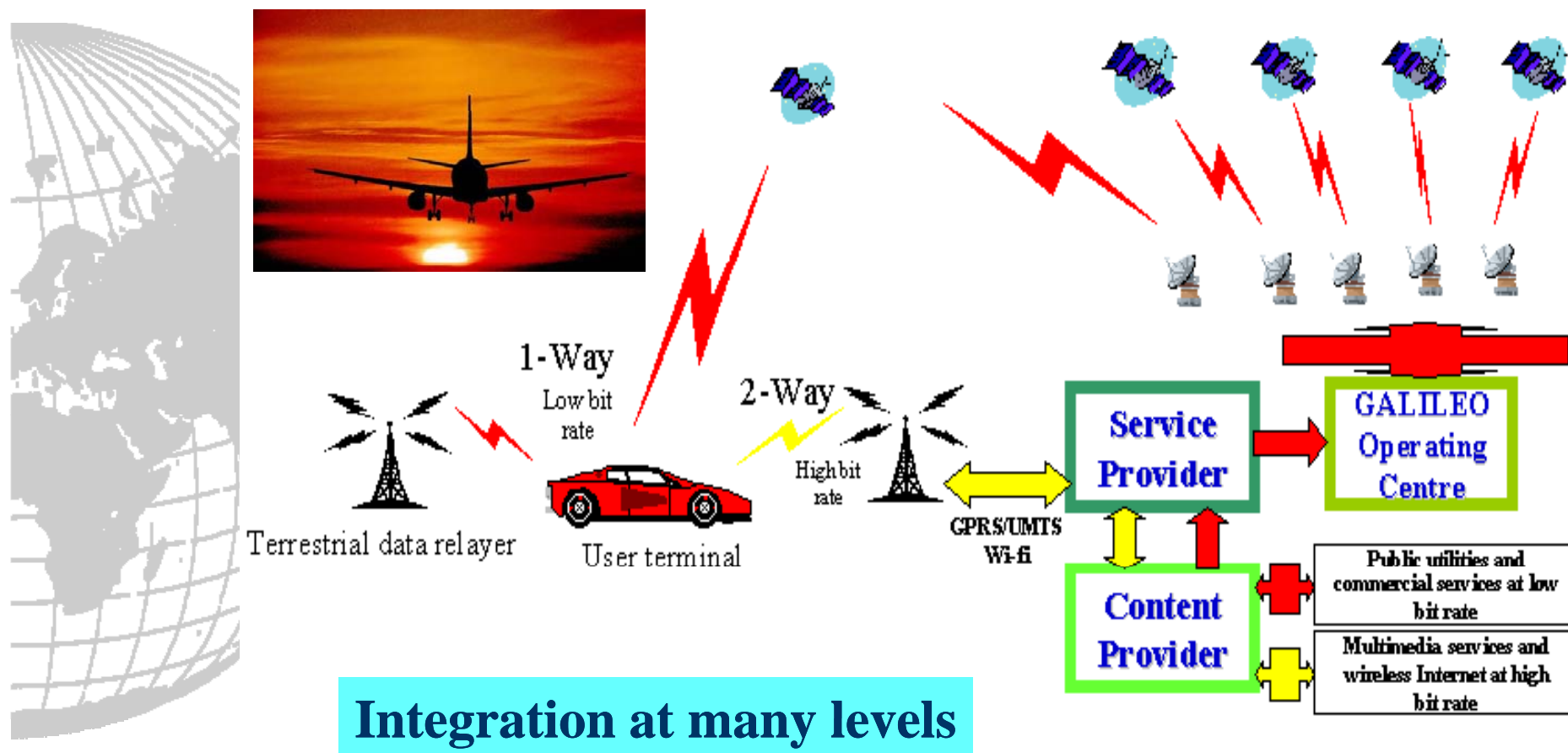


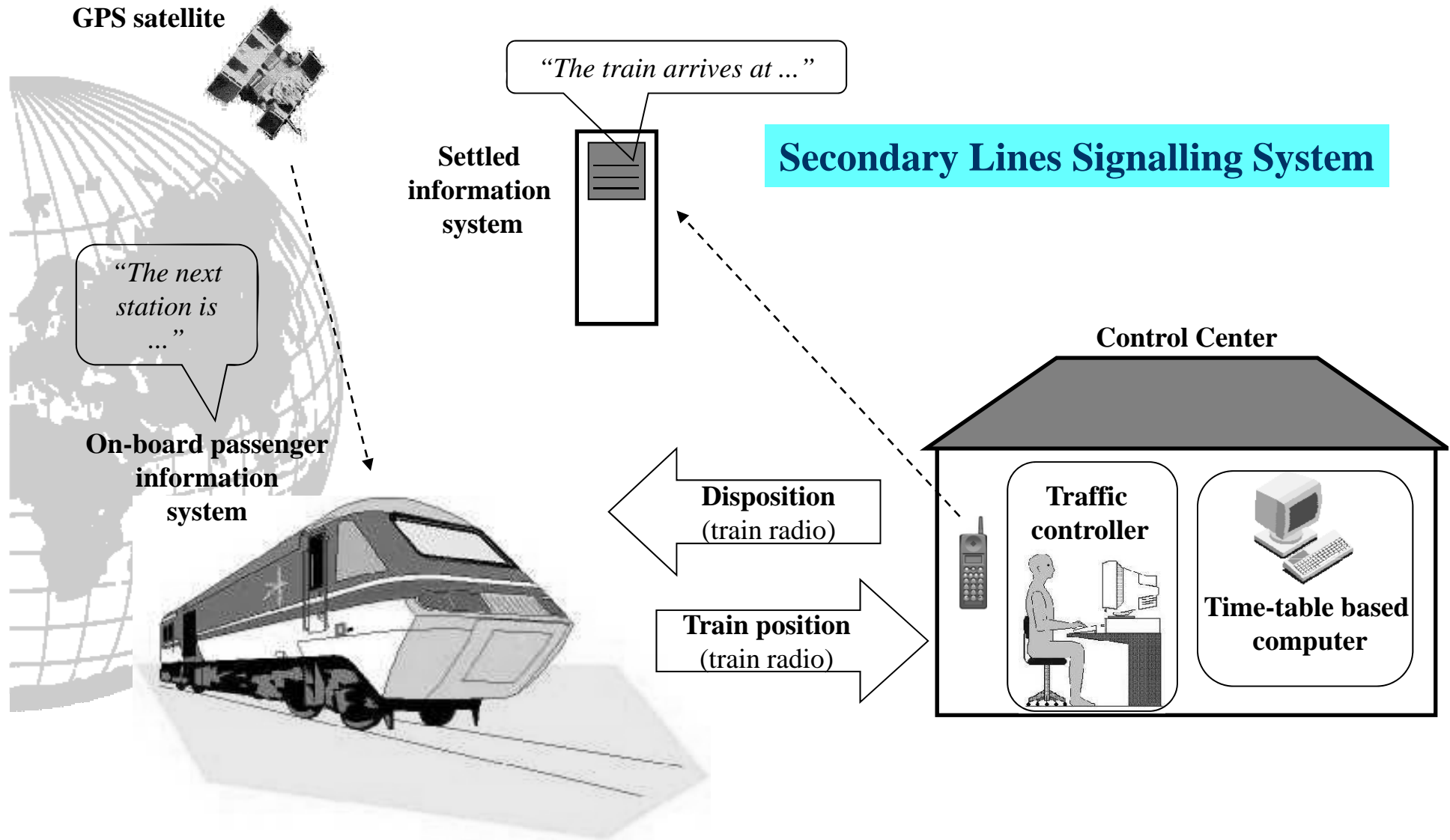
## GALILEO SAR Service Architecture



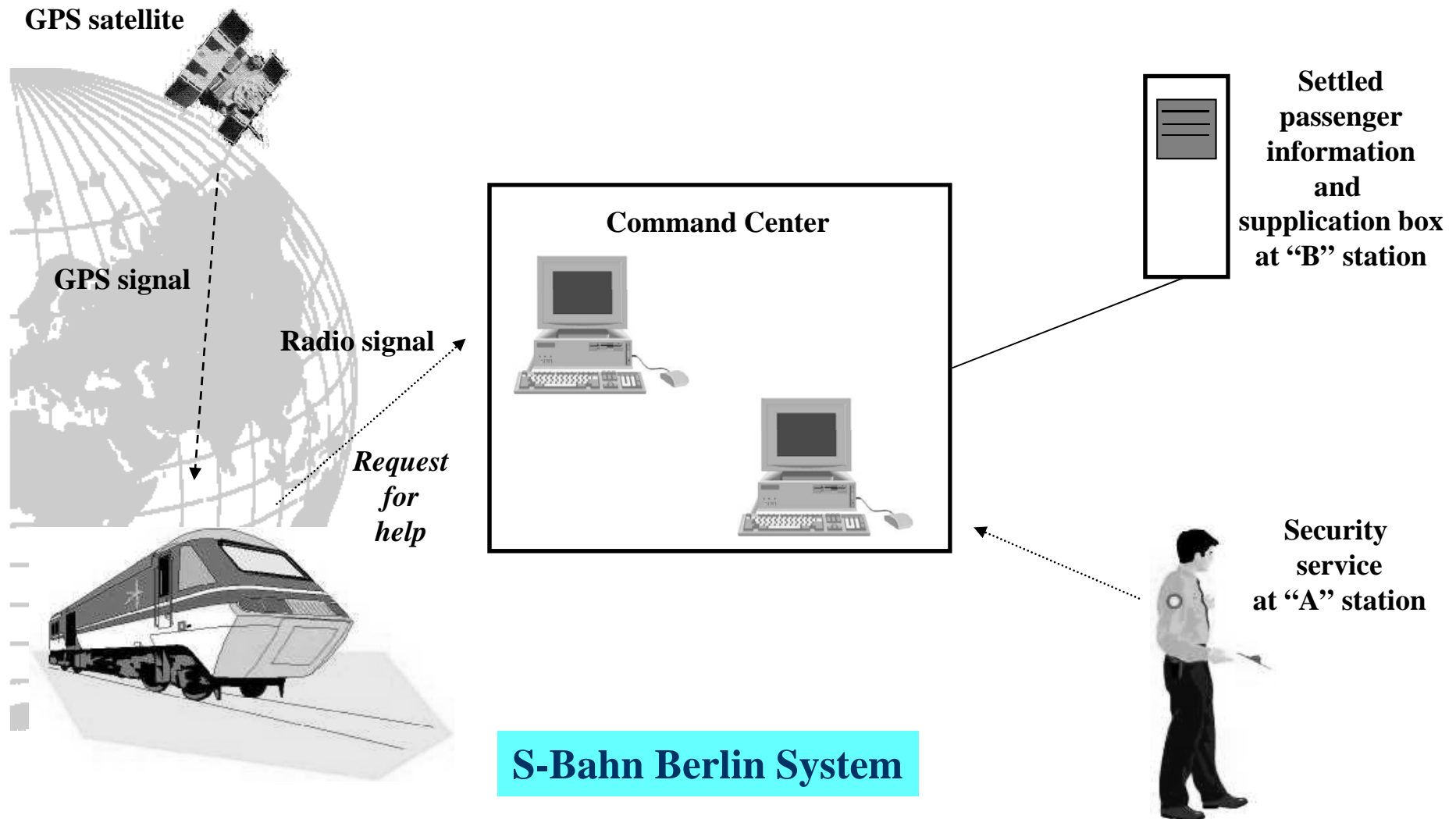
## The WAAS architecture concept



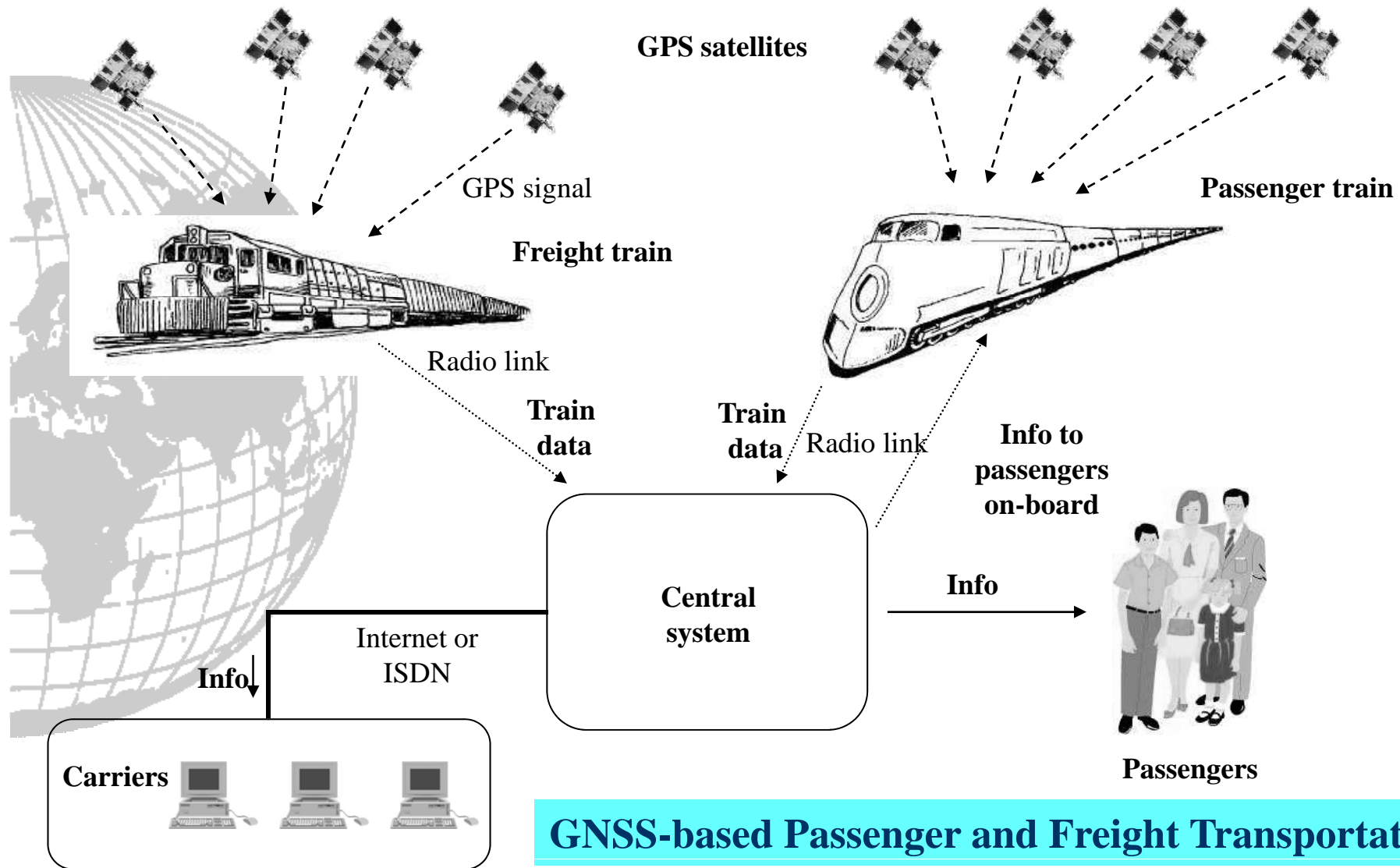




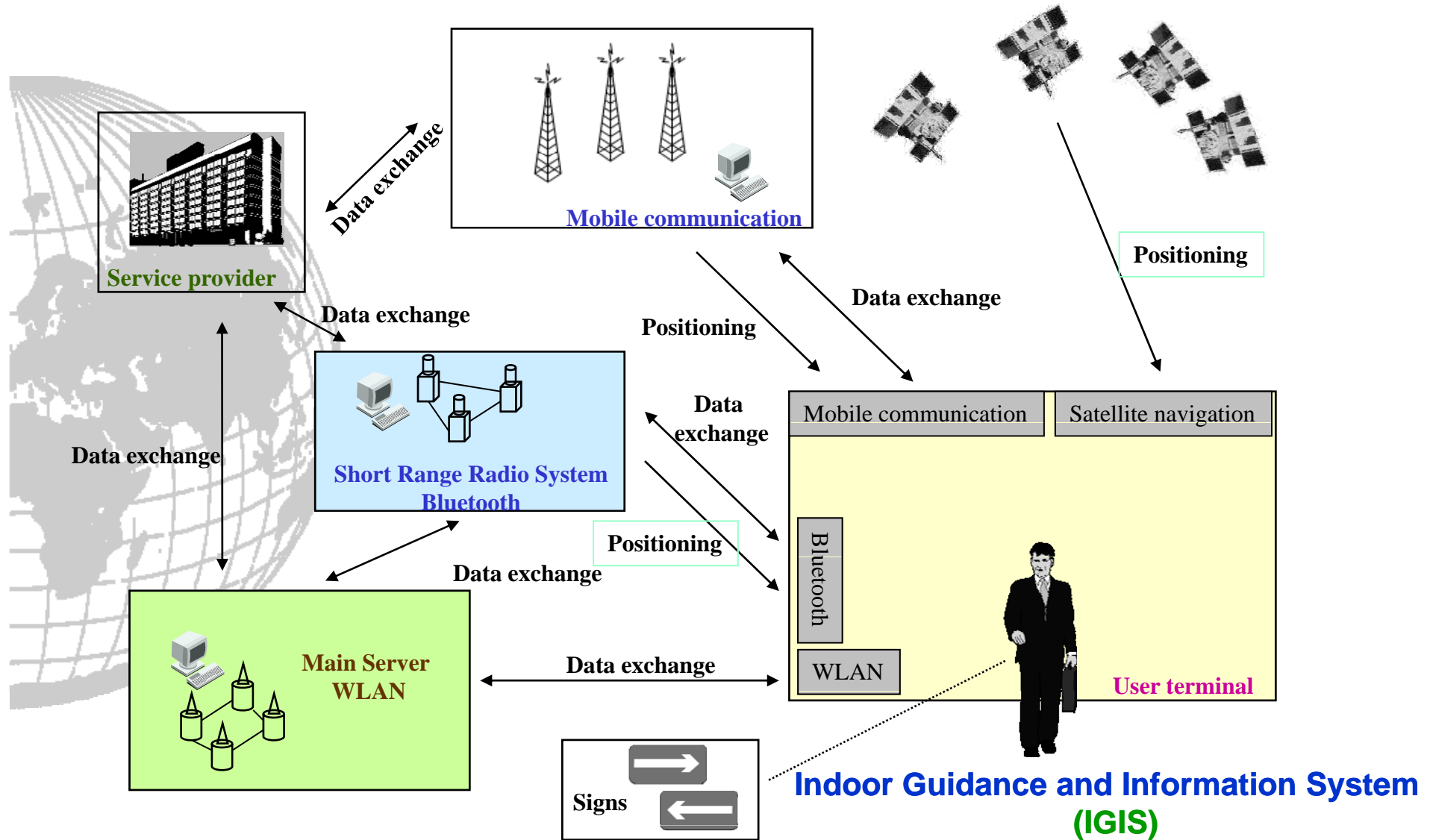




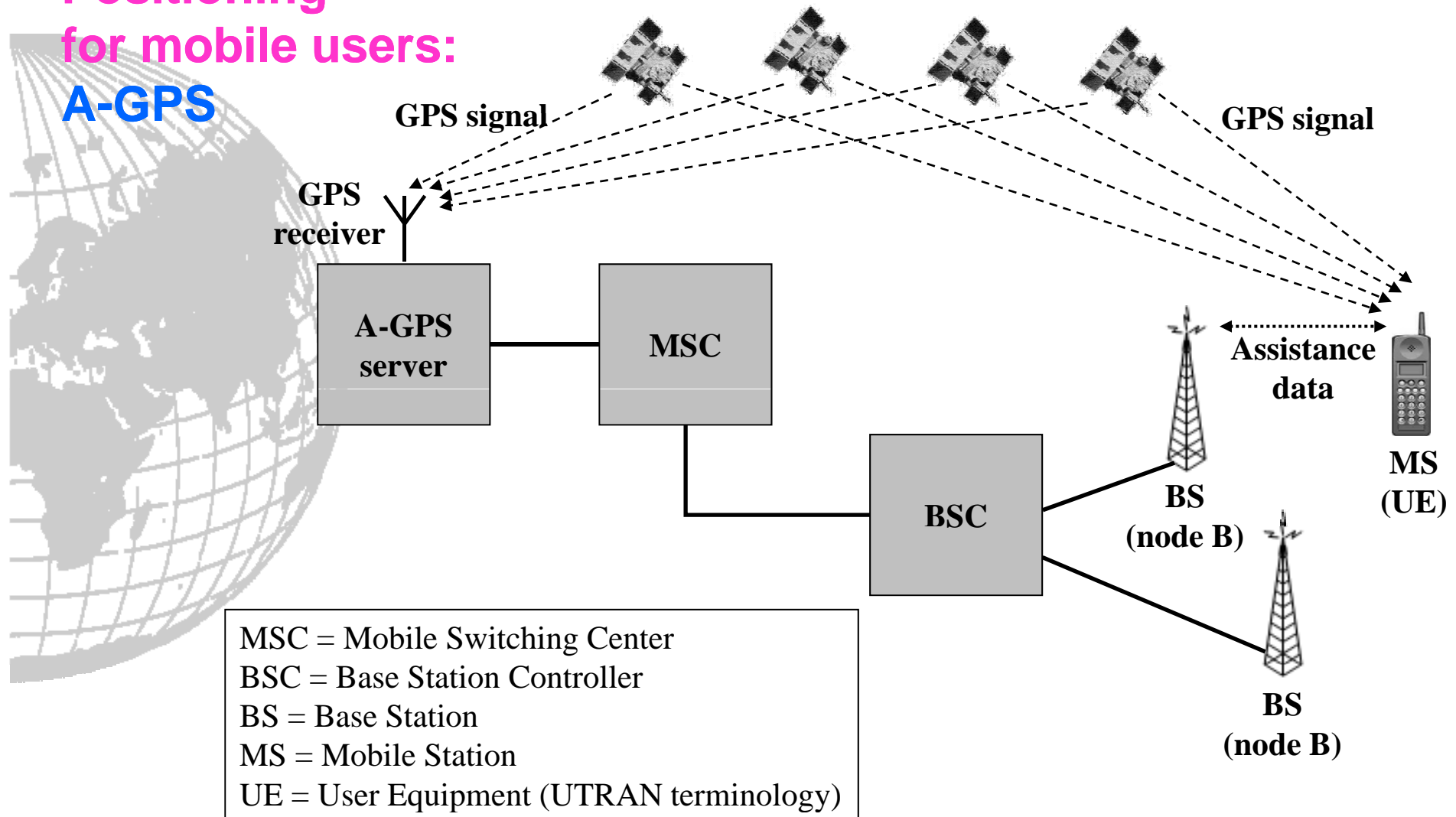




## GNSS-based Passenger and Freight Transportation



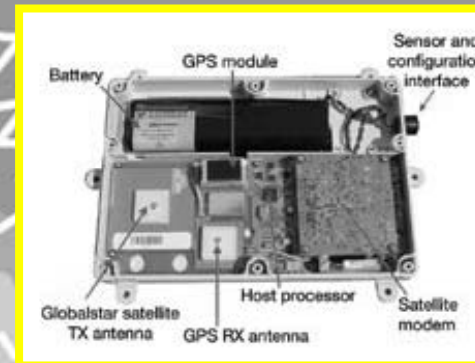
## Positioning for mobile users: **A-GPS**



## Integration of GNSS with *satcom* networks:

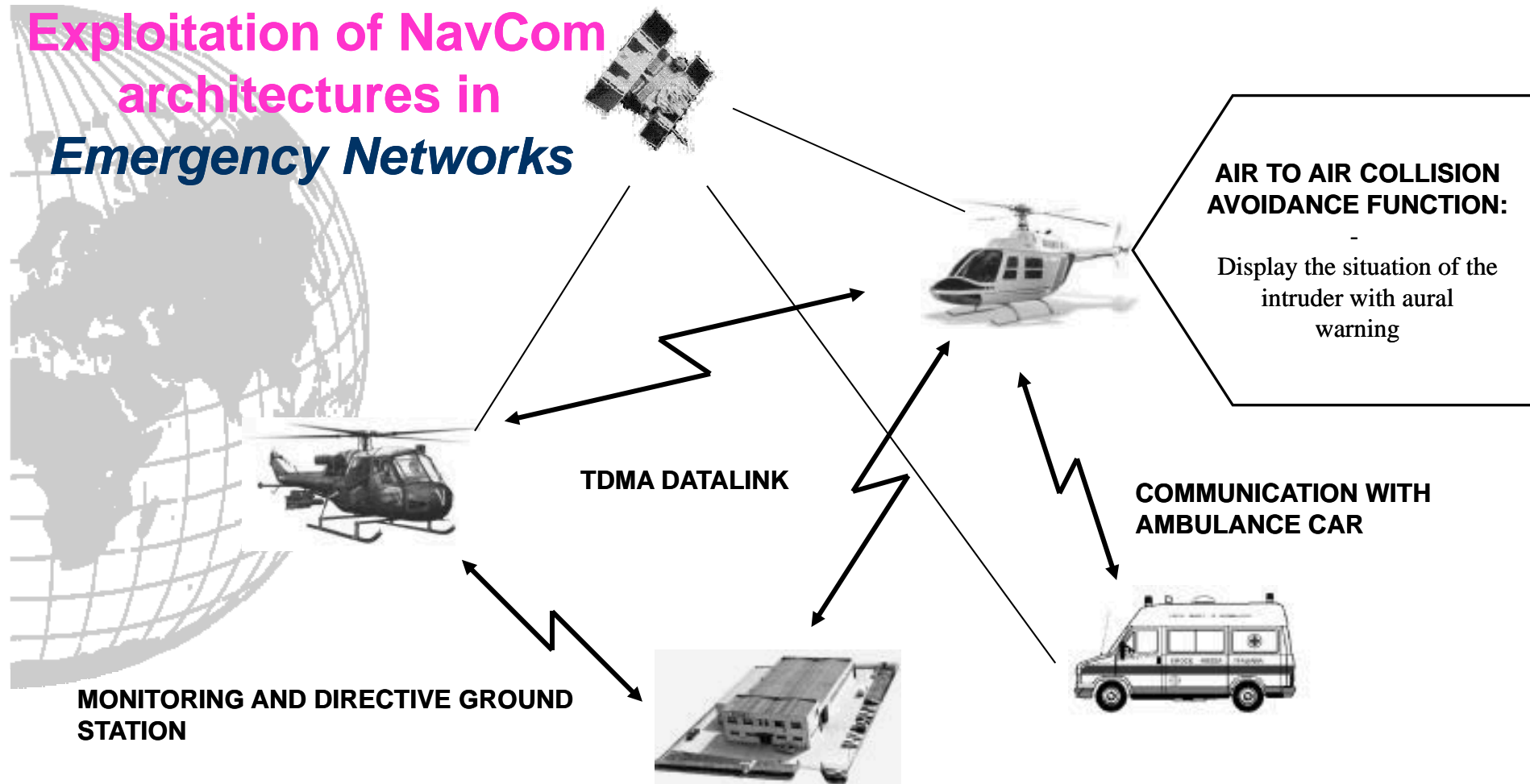
- ☐ Inmarsat
- ☐ Iridium
- ☐ Globalstar
- ☐ Thuraya
- ☐ QZSS

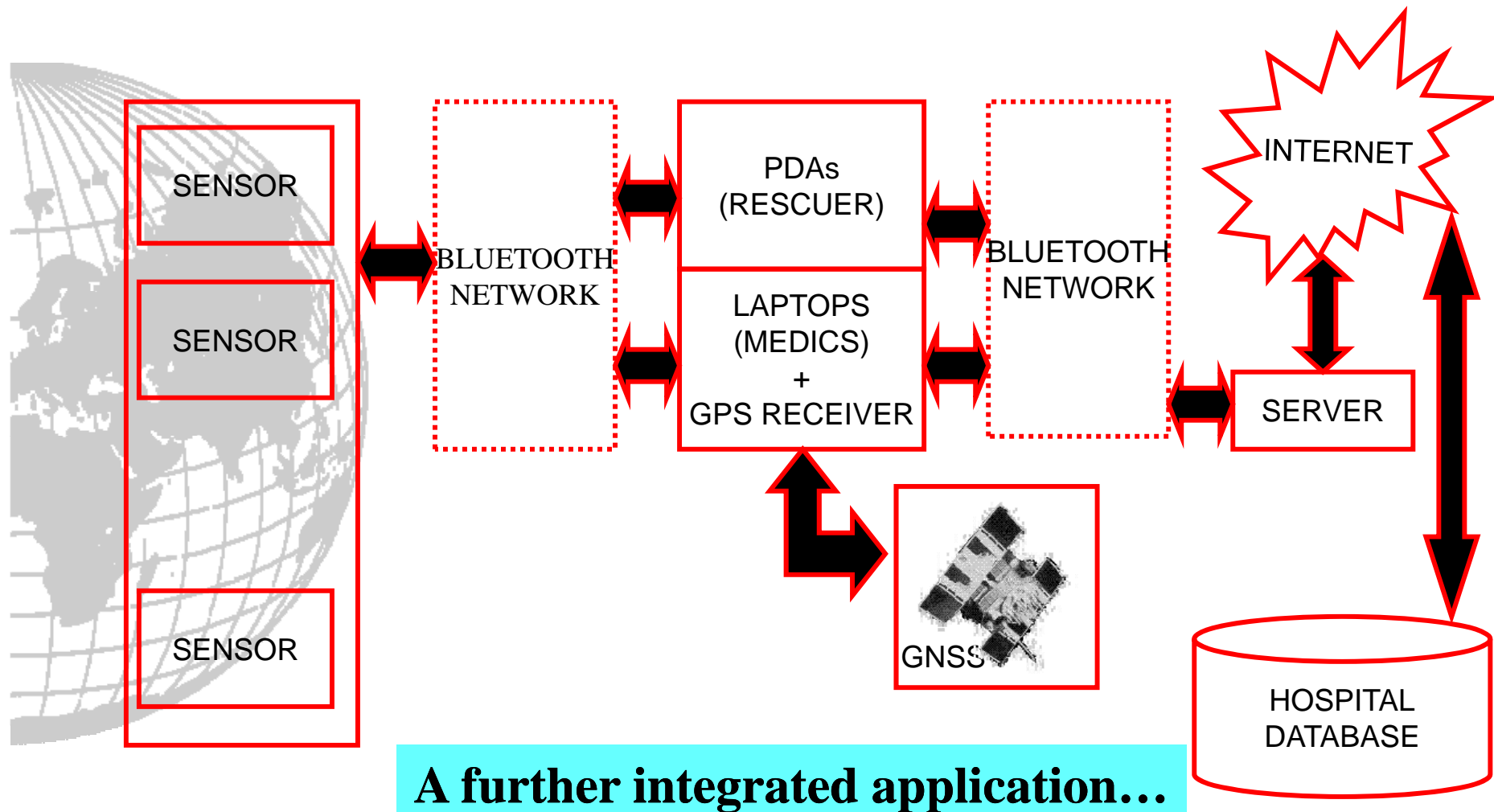
Thuraya  
Satellite  
Coverage

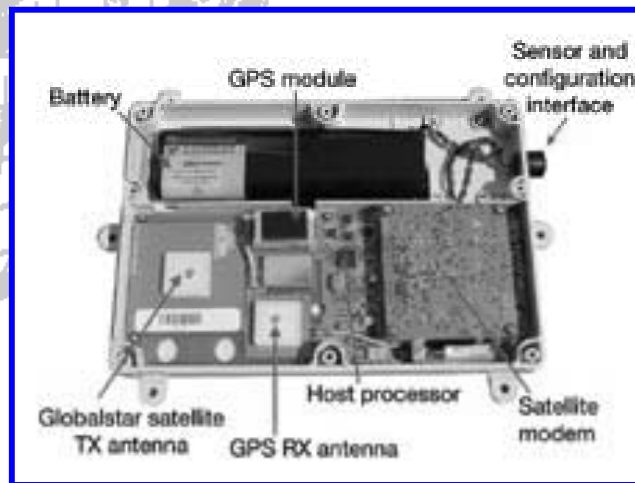


## GPS POSITION INFORMATION

# Exploitation of NavCom architectures in Emergency Networks







## Integration at User Terminals



## Examples of WAAS avionics receivers



**Certified UPSAT**



**Certified Chelton**



**SFAR approved Capstone**

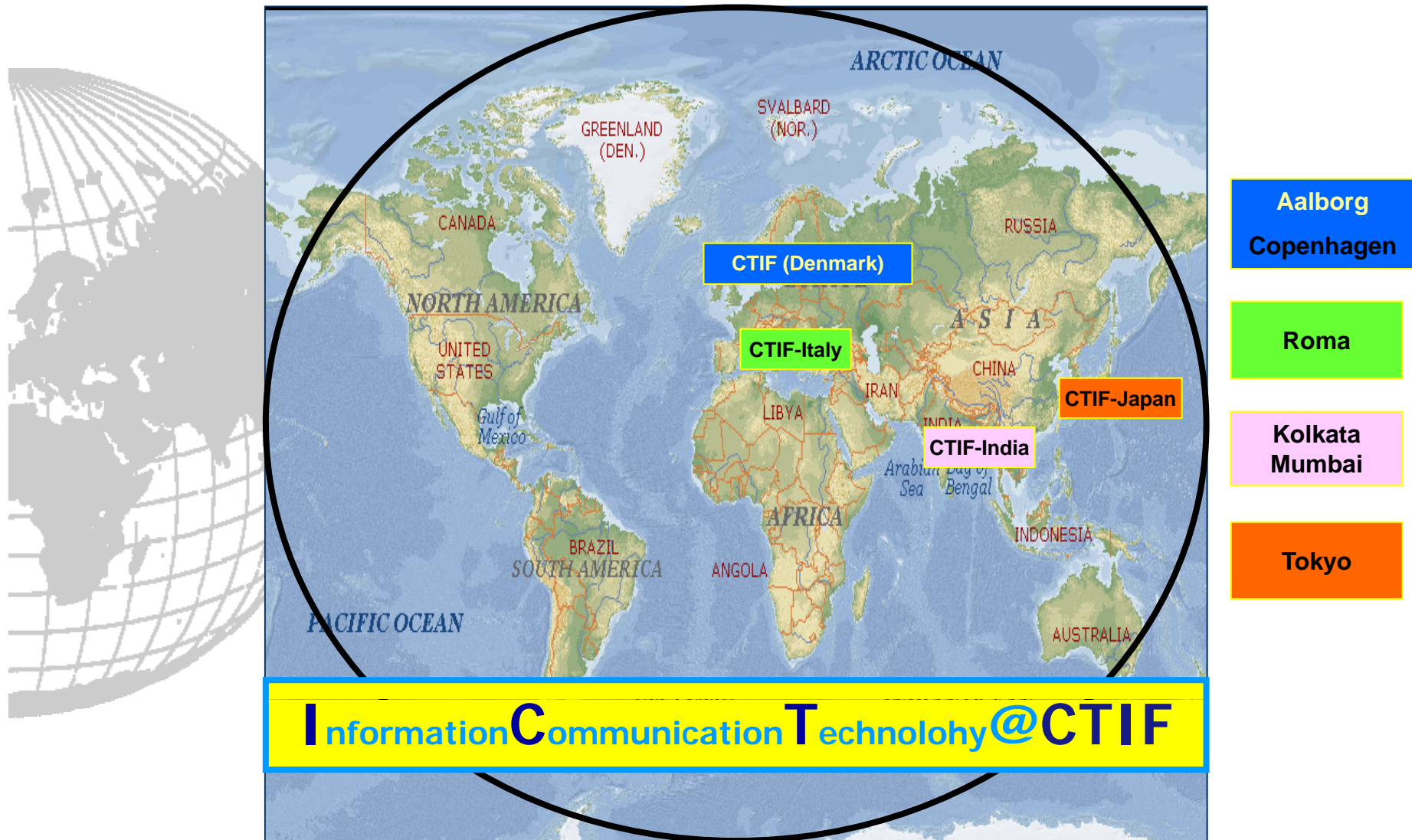




## Other Applications



# The Center for TeleInfrastructure (CTIF)



## CTIF\_Headquarter



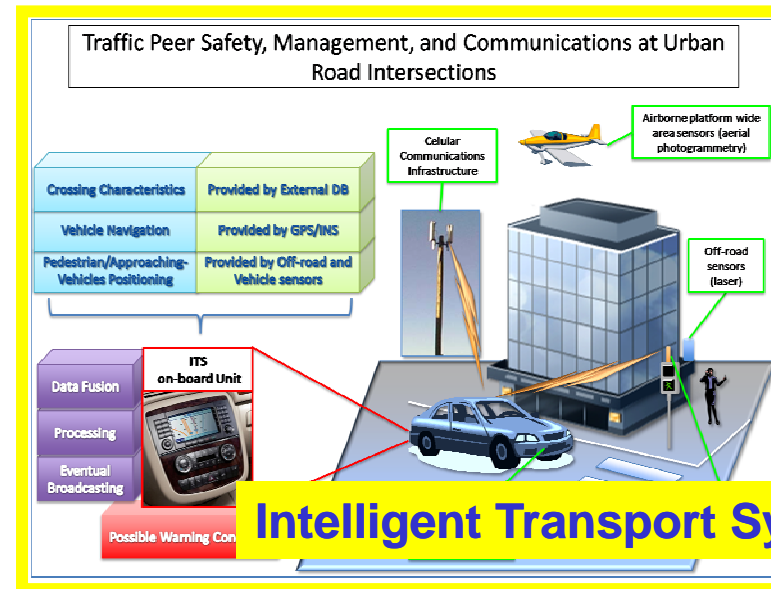
**Aalborg University**



**CTIF\_Headquarter:**  
another premise  
in Ballerup - Copenhagen



## CTIF\_Japan



## Intelligent Transport Systems

is located in the Yokosuka Research Park (YRP), 60 km south Tokyo.



## CTIF\_India



**Kolkata University**



## CTIF\_Italy @University Roma Tor Vergata



## CTIF\_Italy Field of Interest

### Wireless communications :

- Future Broadband Communications
- Radio Networking and Security
- Satellite Communications & Integration with terrestrial
- Short-Range Communications
- Medical Applications

### Aerospace Systems (Telecom, GNSS, Earth Observation):

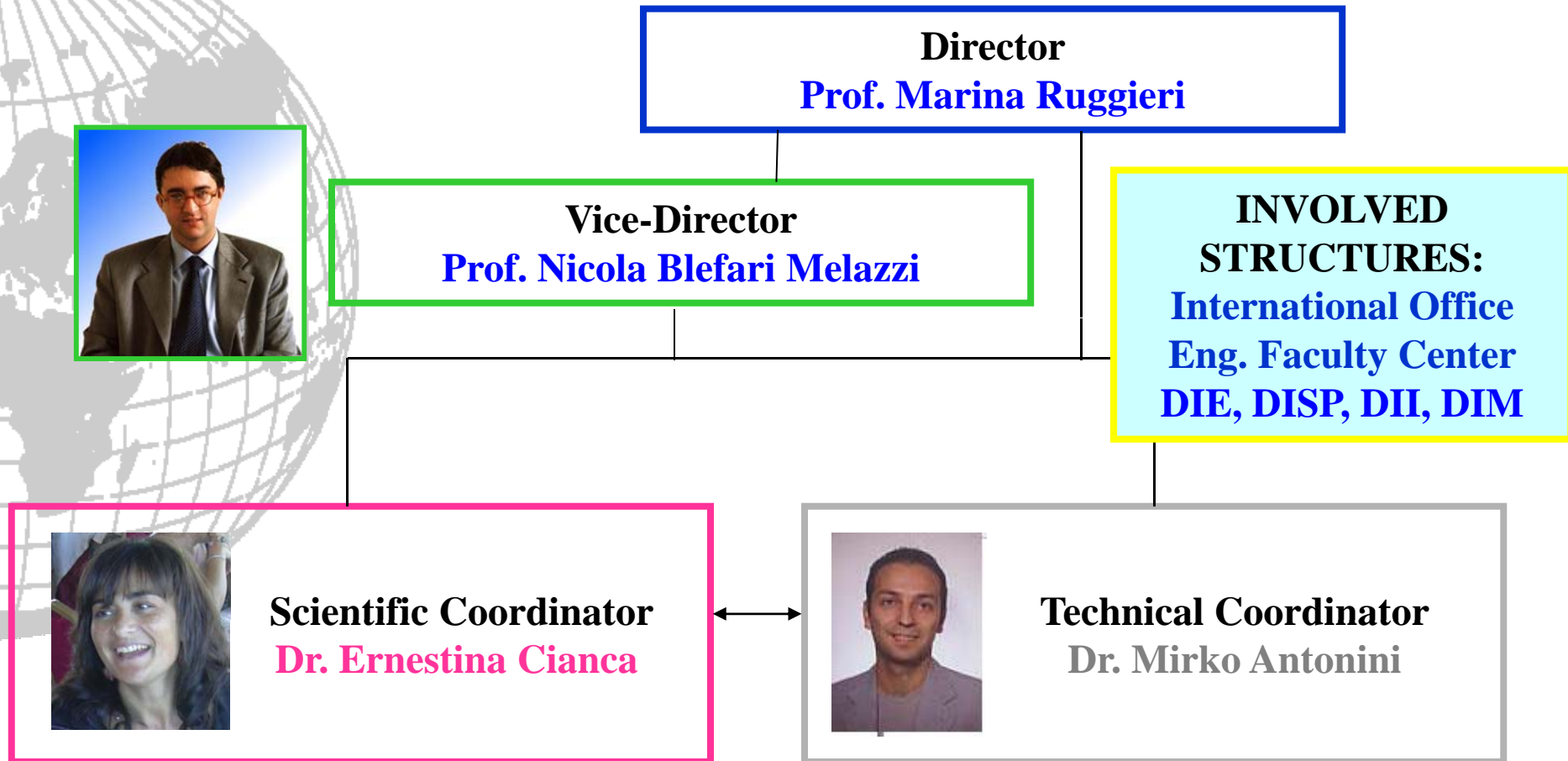
- Satellites, HAPs, Constellations, Formations
- Architectures, payloads, components
- Software
- Receivers
- Applications and services (including dual use)
- Experimental trials
- Data analysis

### ICT for Quality of Life

- Biotechnology
- Energy
- Earthquakes

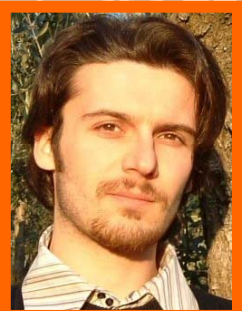


## CTIF\_Italy Premises: @University Roma Tor Vergata

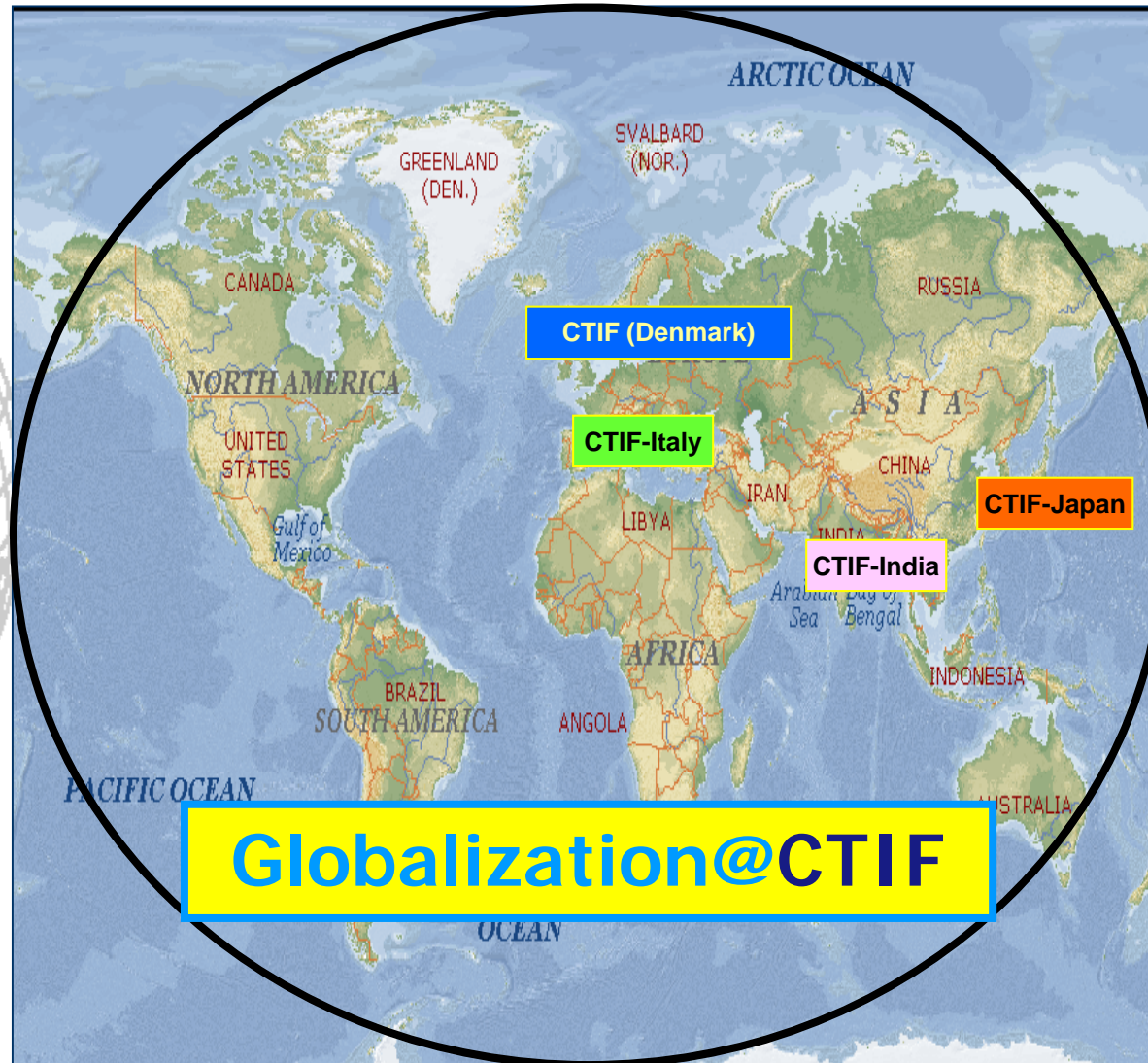




**Dr. Mauro De Sanctis**



**Dr. Tommaso Rossi**



**Aalborg  
Copenhagen**

**Tokyo**

## Industry & CTiF\_Italy

- ☐ **Conceivment of applications (C)**
- ☐ **Experimental trials (C)**
- ☐ **Technological development (I)**
- ☐ **Achievement of user terminal cost and performance effectiveness (I)**

<http://ctif.uniroma2.it/cms>



CTIF Italy - Welcome - Mozilla Firefox

File Modifica Visualizza Cronologia Segnalibri Strumenti ?

http://ctif.uniroma2.it/cms/

Come iniziare Ultime notizie

CTIF Italy Centro per le TeleInfrastrutture Center for TeleInfrastruktur

search

24 October 2007 | 1:02:19

HOME TEAM PUBLICATIONS PROJECTS PARTNERS ASSOCIATIONS LINKS CONTACTS

Login

CTIF-ITALY

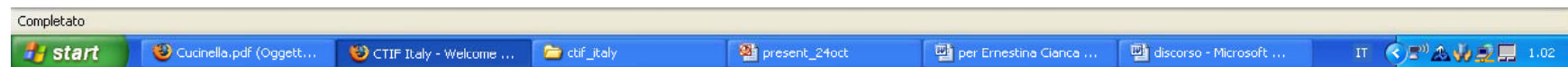
Username:

Password:

Private Area

In the development plan of the Danish CTIF, Italy is the only other selected European site. In fact, further branches will be opened in USA, India, and Indonesia. The important implications of the signed MoA frame the on-going activities between Italy and Denmark in a new dimension of coherence and synergic effort for the achievement of higher and higher future goals. This exciting page to be written in the history of the cooperation between Italy and Denmark stimulates the proposal of novel initiatives where the heritage, experience, capability and international contacts of the two countries can be merged and exchanged for the common aim of shaping a bright future in the complex and challenging road towards Excellence.

## Activities for Emergencies @ CTIF\_Italy



Completato

start

Cucinella.pdf (Oggett...

CTIF Italy - Welcome ...

ctif\_italy

present\_24oct

per Ernestina Cianca ...

discorso - Microsoft ...

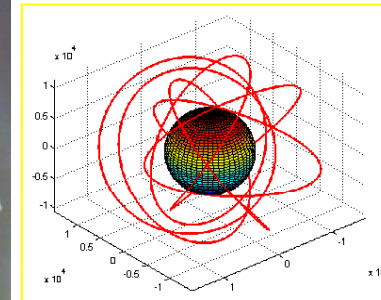
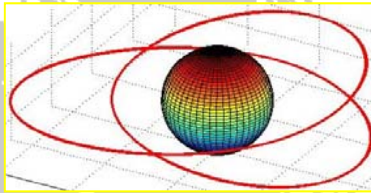
IT

1.02

----- Bressanone, 2 luglio 2010 ----- M. Ruggieri -----



## An International Environment for System Integration

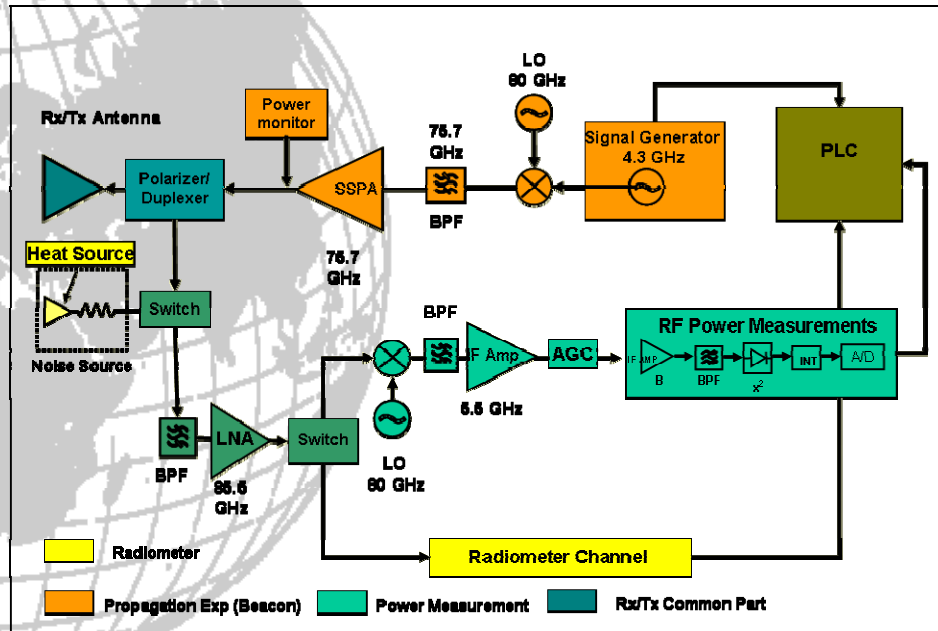


Texas  
A&M, USA



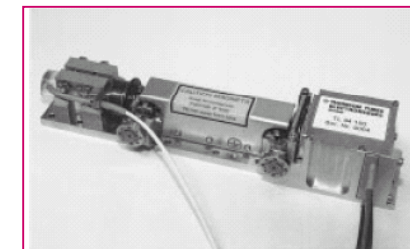
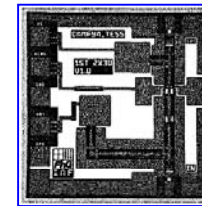
# W-Band Experiments

(75-110 GHz)



Early Experiment of terrestrial link in W-band

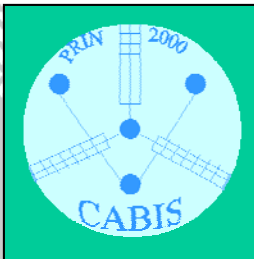
Heritage: the DAVID Mission





# Advanced Integrated Systems

PRIN 2000



Integration of terrestrial and **satellite** communications

PRIN 2002



Integration of terrestrial/satellite/**HAP** communications

PRIN 2005

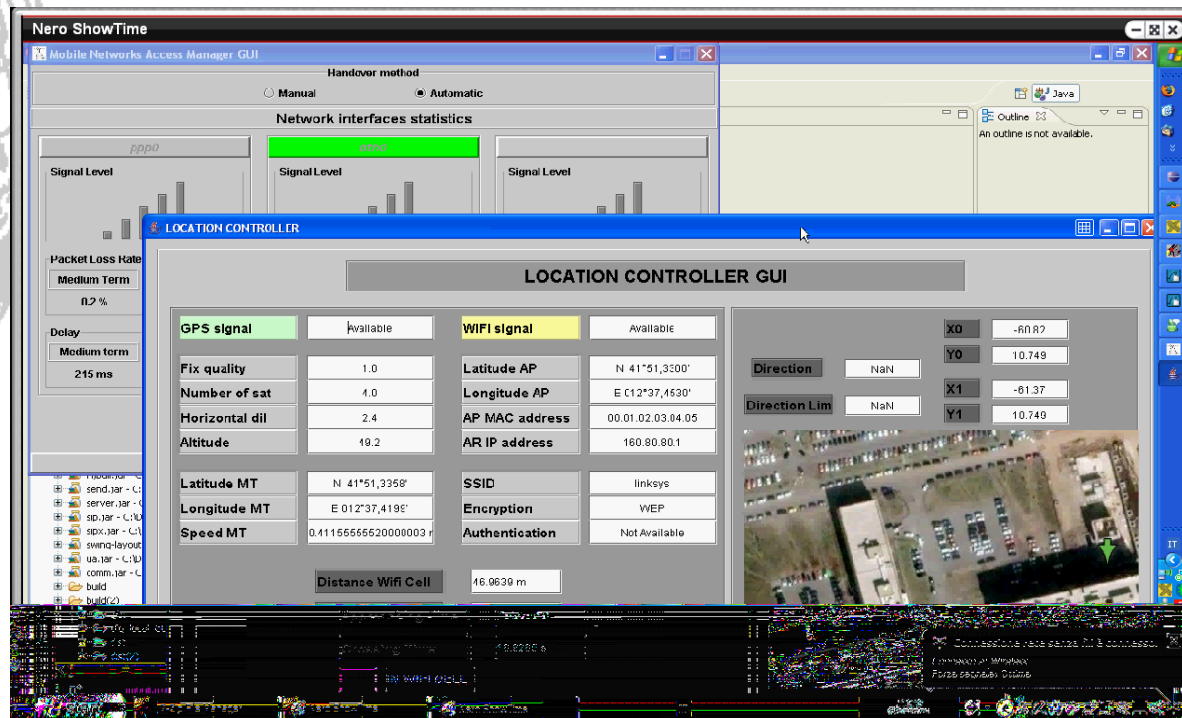


Integration of **navigation** and communications

# Advanced Integrated Systems

## ICONA (Integrated COMMunications and NAvigation):

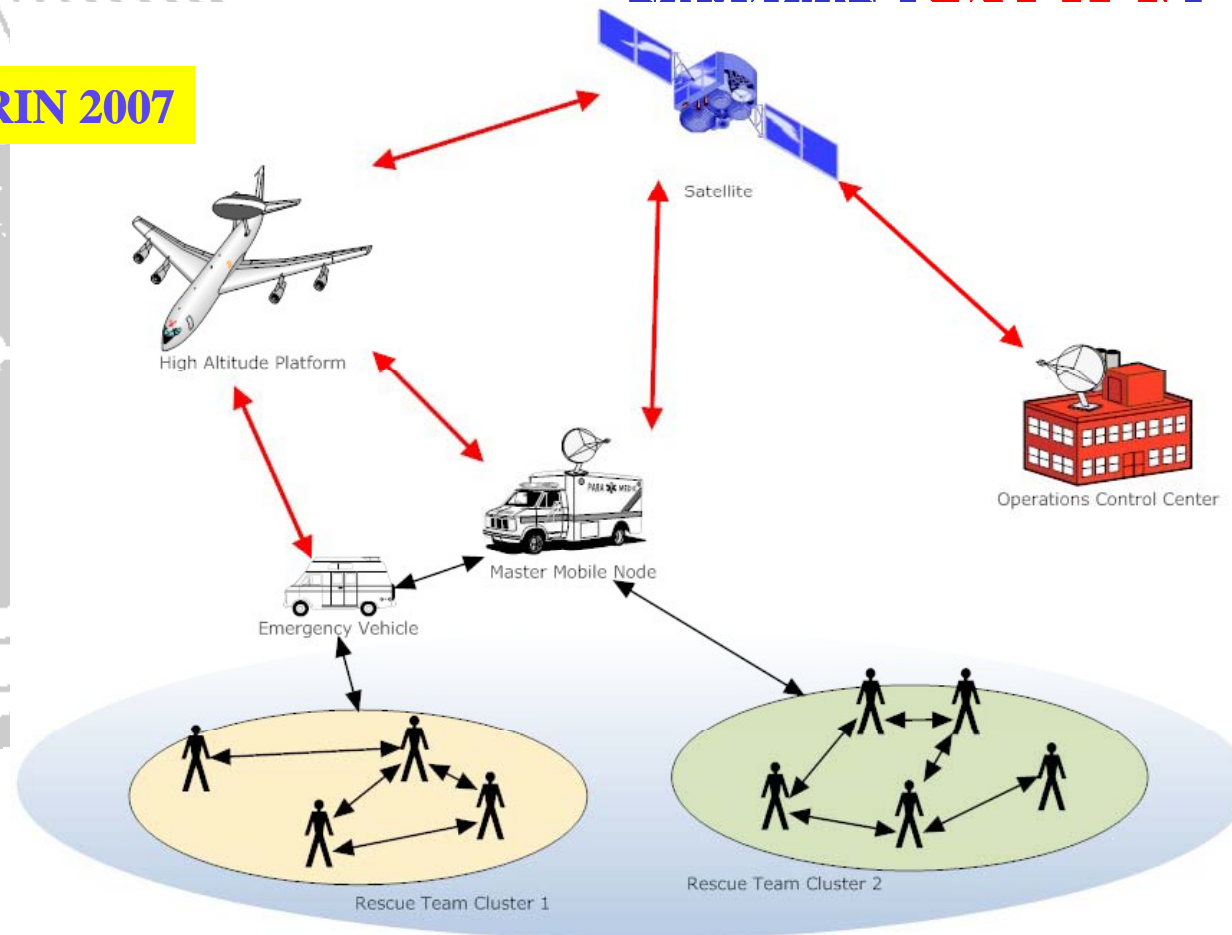
(National funding) : Situation and location aware design solutions over heterogeneous wireless networks, where the information of the location and situation is used to guarantee an optimized inter-system Radio Resource Management and Mobility management



# Advanced Integrated Systems

## Satellite-Assisted Localization and Communication systems for Emergency services (SATICE)

PRIN 2007



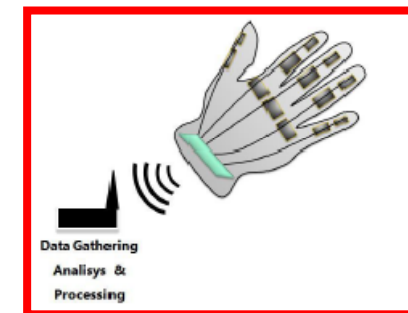
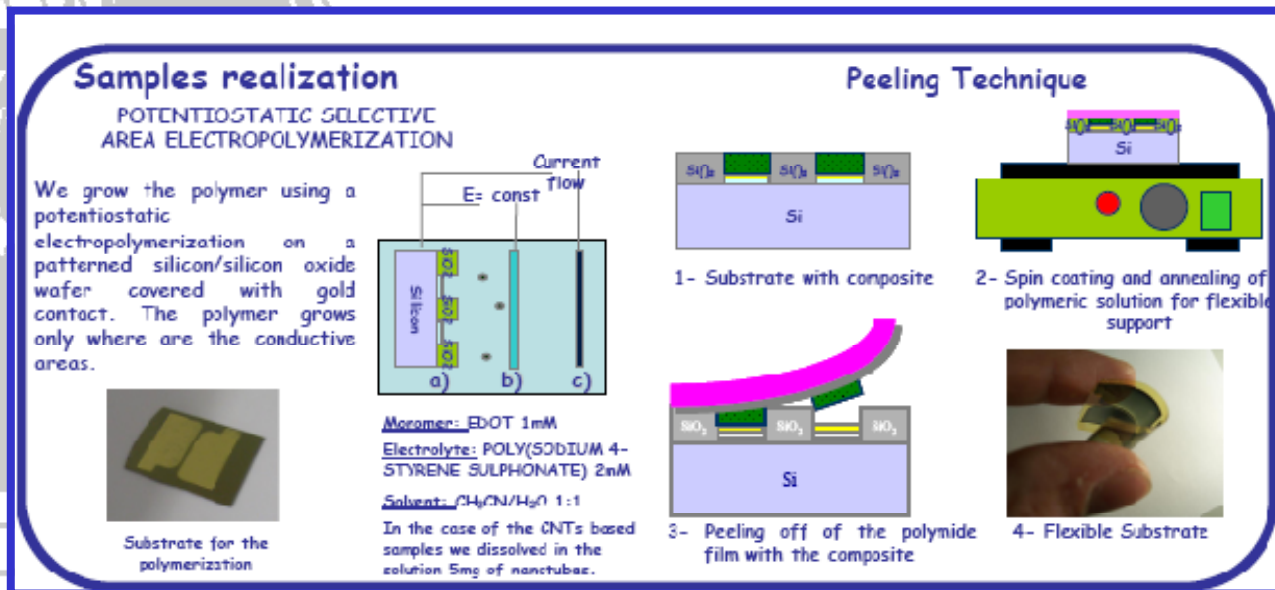
Integrated Reconfigurable NAV/COM device with **SDR** and **CR** technologies in a Sat-HAP-ground network

Incident Area Network (IAN) for optimal user aggregation of context, location and environmental information

# Medical Applications

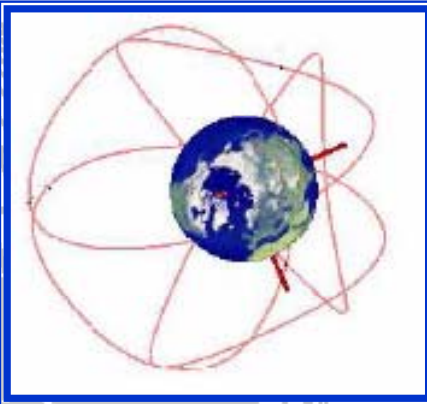
## DCMC (Disturbo Controllo Motorio Cardio-Respiratorio)

Control of movements by studying them in some special conditions.



Realization of a goniometric glove for hand posture obtained with the vulcanization of the sensors in a textile material that is controlled using a wireless system

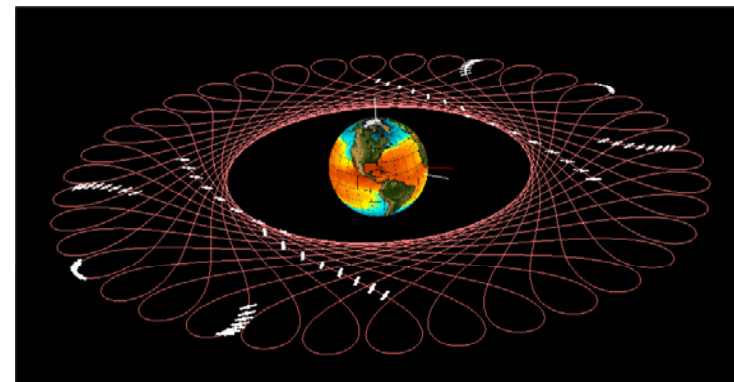
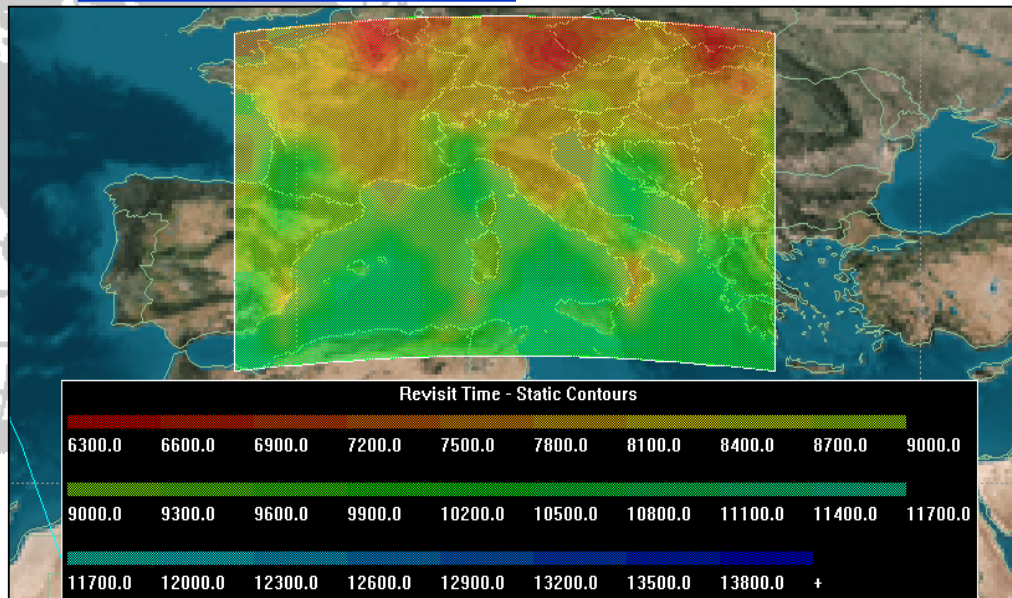
## NEW CONSTELLATIONS



### FLORAD

Micro-satellite **F**lower Constellation of millimeter-wave

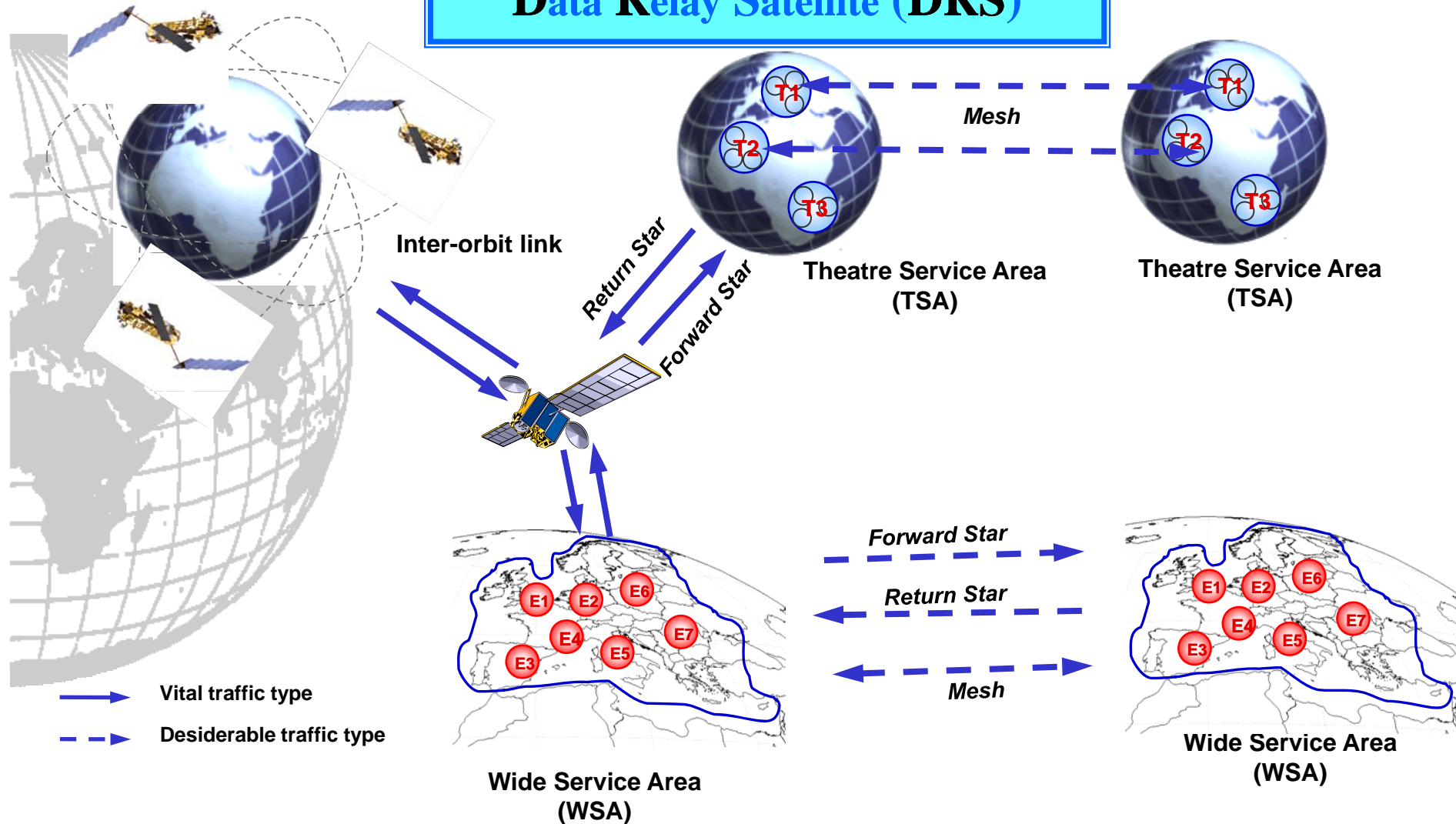
**R**adiometers for the Earth and space Observation at regional scale (ASI Contract)



Flower vs Walker  
Constellation  
Performance Analysis



## Data Relay Satellite (DRS)

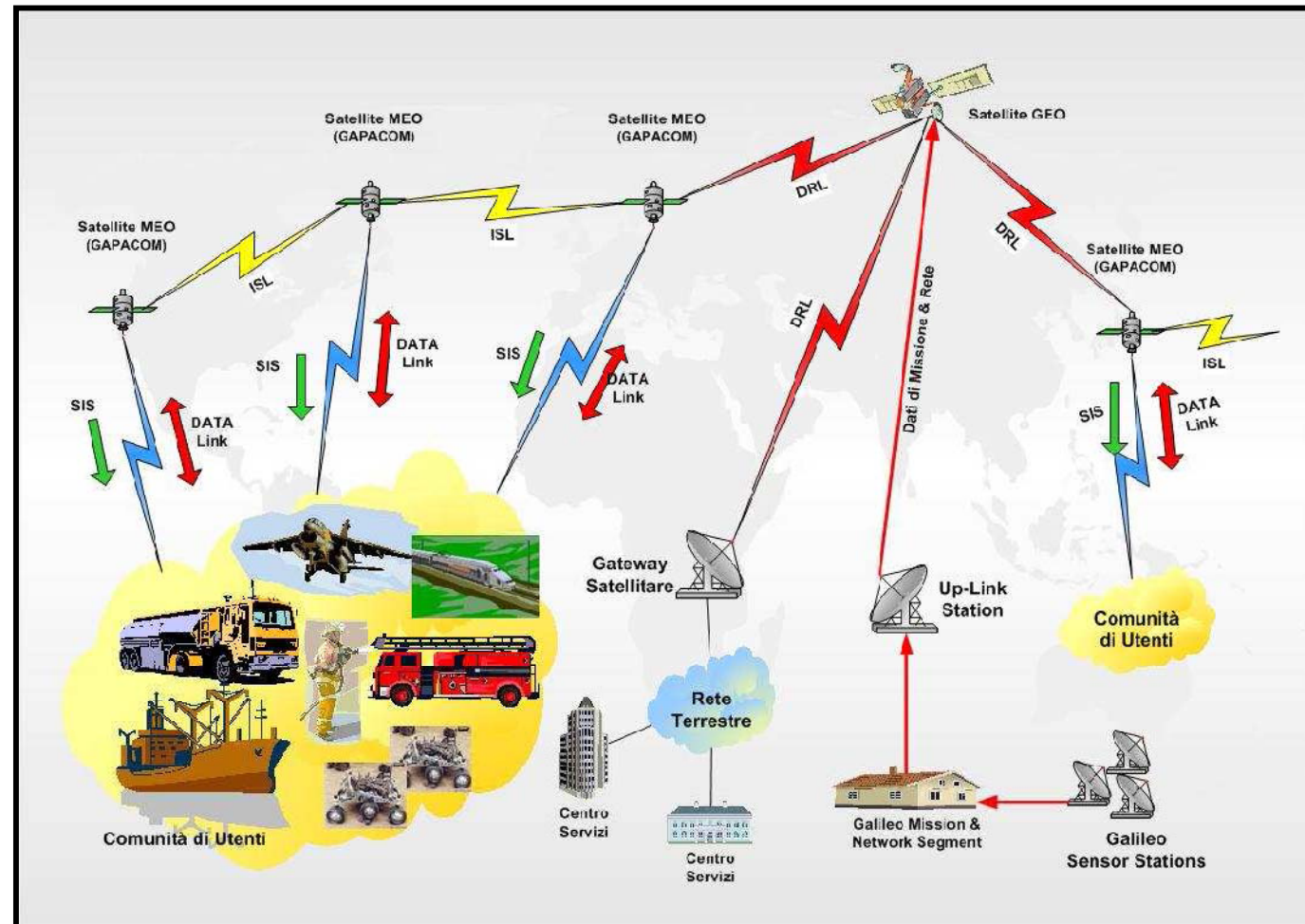




## GNSS-based Architectures and Services



**GAPACOM**  
 satellite/terrestrial  
 system based on the  
 study of an innovative  
 NAVCOM payload  
 to be embarked on  
 GALILEO satellites

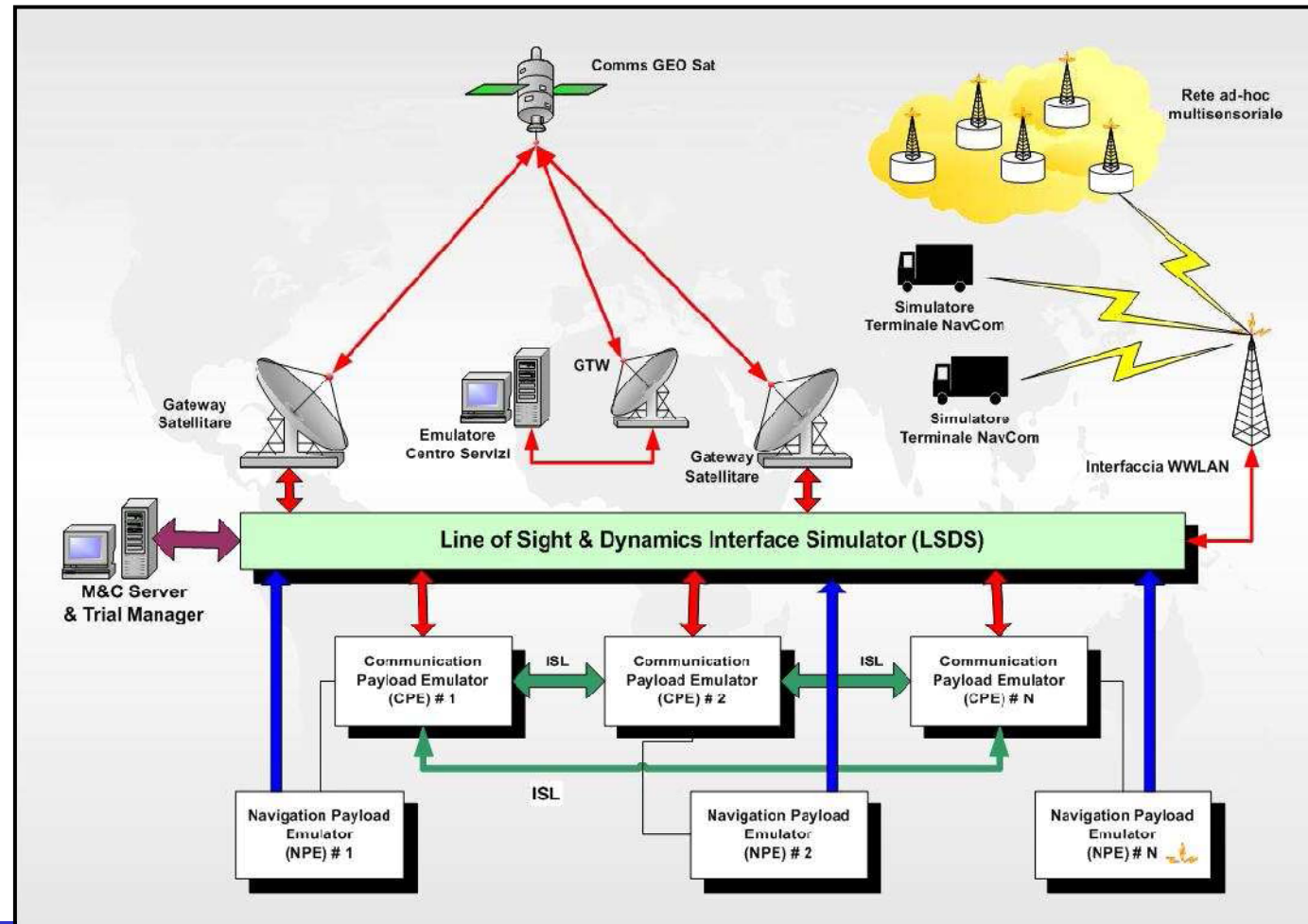


## GNSS-based Architectures and Services

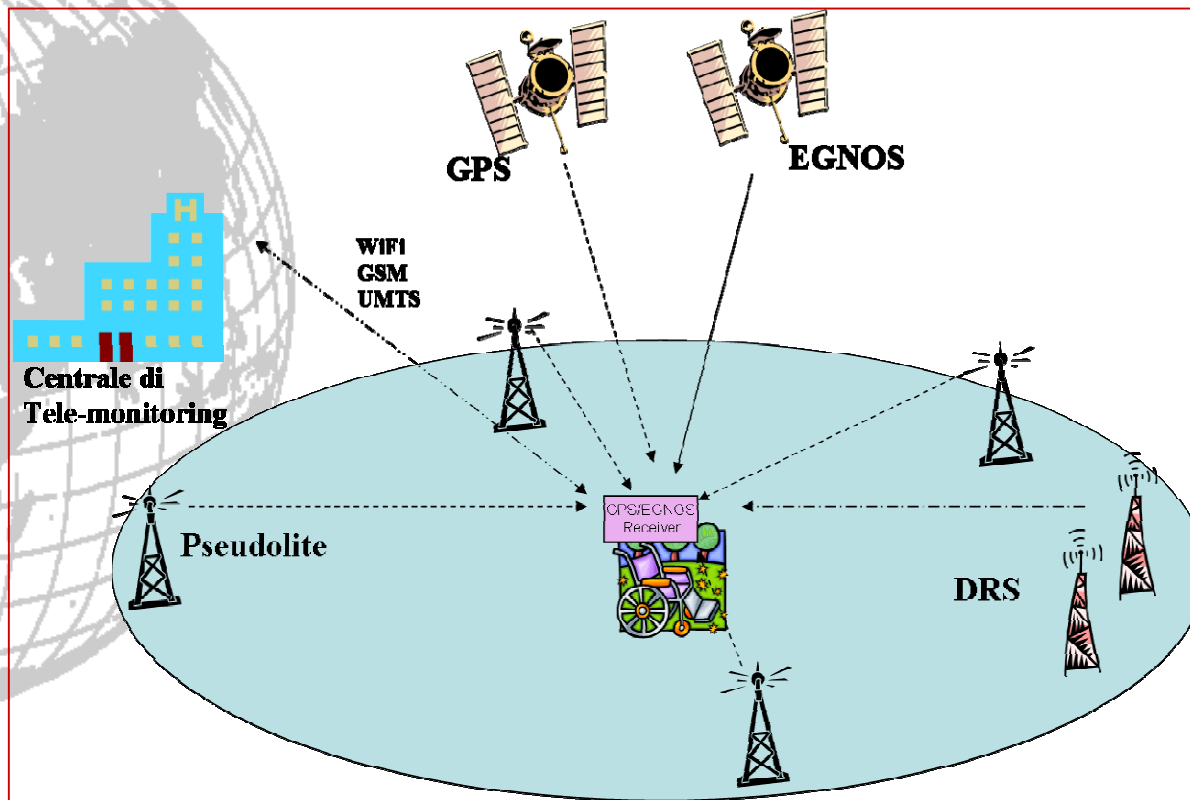


**GAPACOM**

validates a communications and navigation system based on the GALILEO constellation for AeroNavCom applications

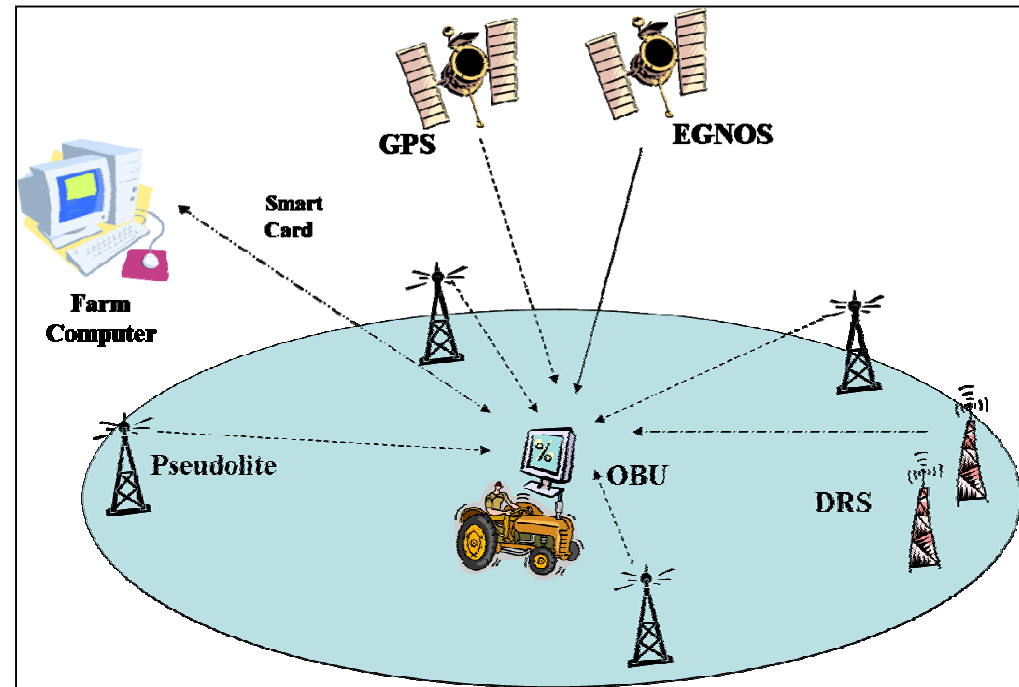
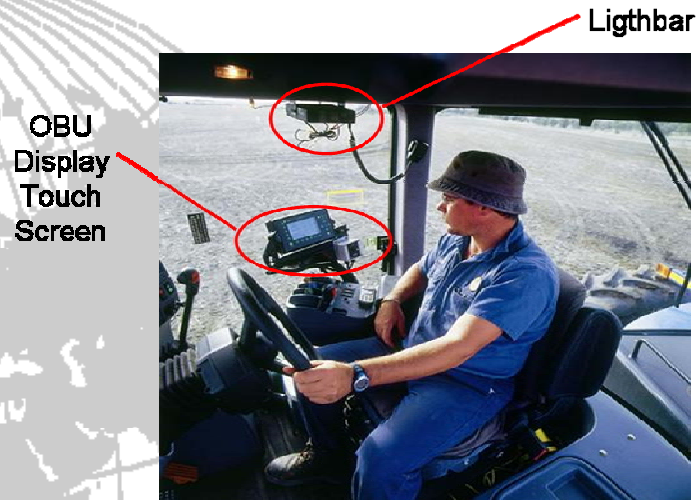


## GNSS-based Architectures and Services



**Health  
Engineering**

## GALILEO TEST RANGE: Application Prototypes



**Precision Agriculture**

**ALPHASAT TDP#5 (Technology Demonstration Programme#5) is a Q/V band payload that will be embarked on the AlphaSAT satellite (ESA), whose objective is to:**

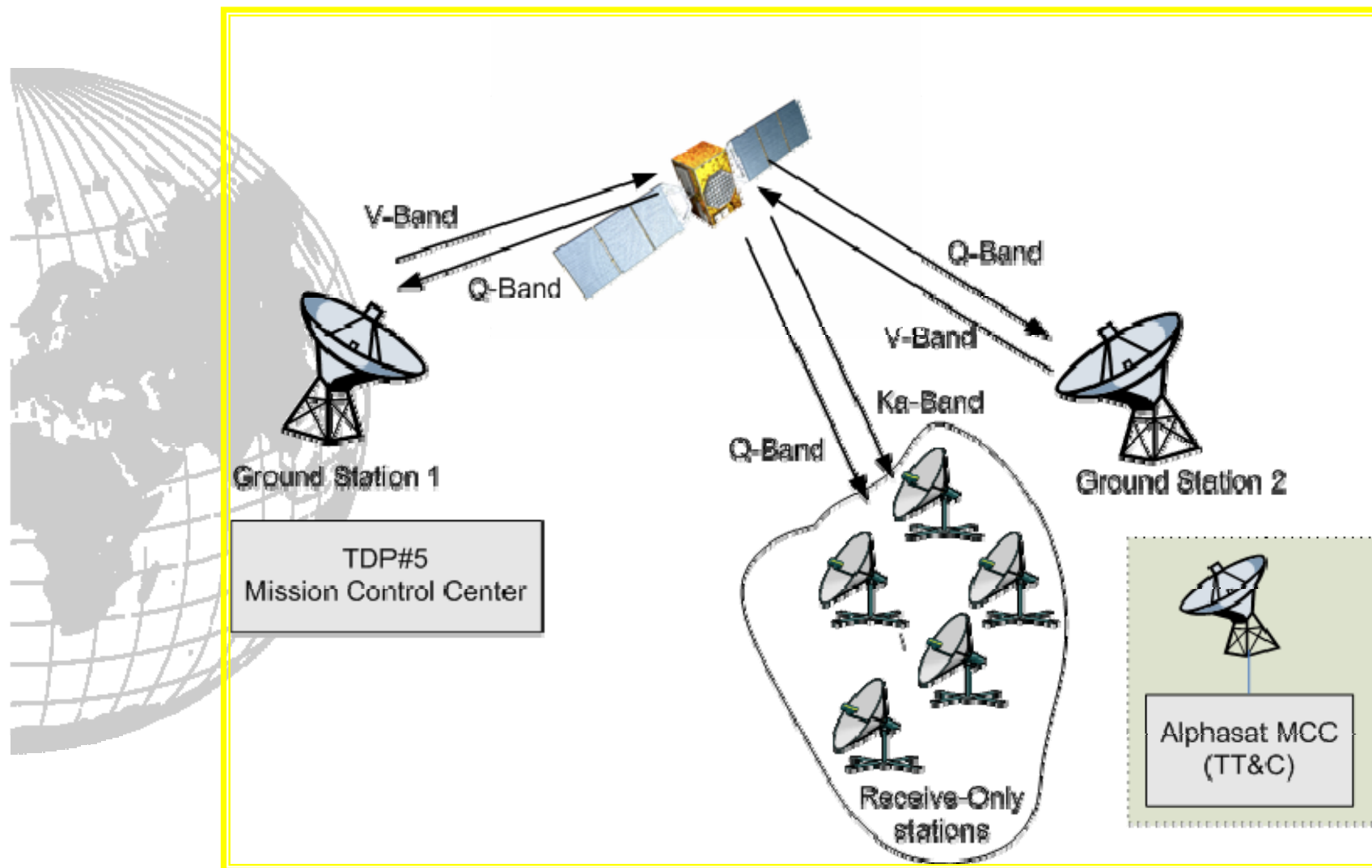
Improve the knowledge of propagation impairments at Q/V band which is instrumental in the design of satellite communication systems adopting adaptive techniques, e.g. ACM, on-board antenna pattern re-configurability, up- and down-link power control. In particular, a better characterization of 2nd-order statistics is currently required to better exploit the characteristics of the new interference and fading mitigation schemes, like the one just mentioned (ACM, adaptive on-board power reconfiguration, up-link power control, site diversity).

**Test the technologies required for implementing modern communications payloads in Q/V band.**

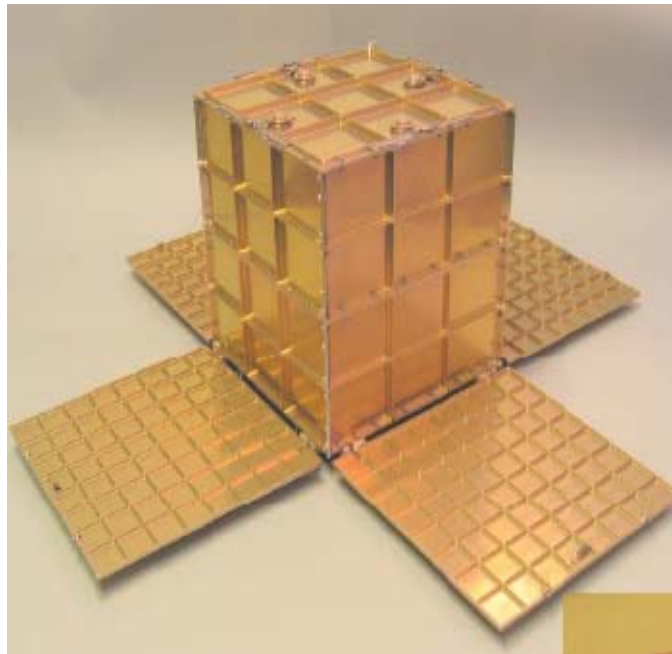
**space to earth in Q band region: 37.5 ÷ 43.5 GHz** (selected centre channels frequencies 37.9 and 38.1 GHz).

**earth to space in V band region: 47.2 ÷ 50.2 GHz** (selected centre channels frequencies 47.9 and 48.1 GHz).





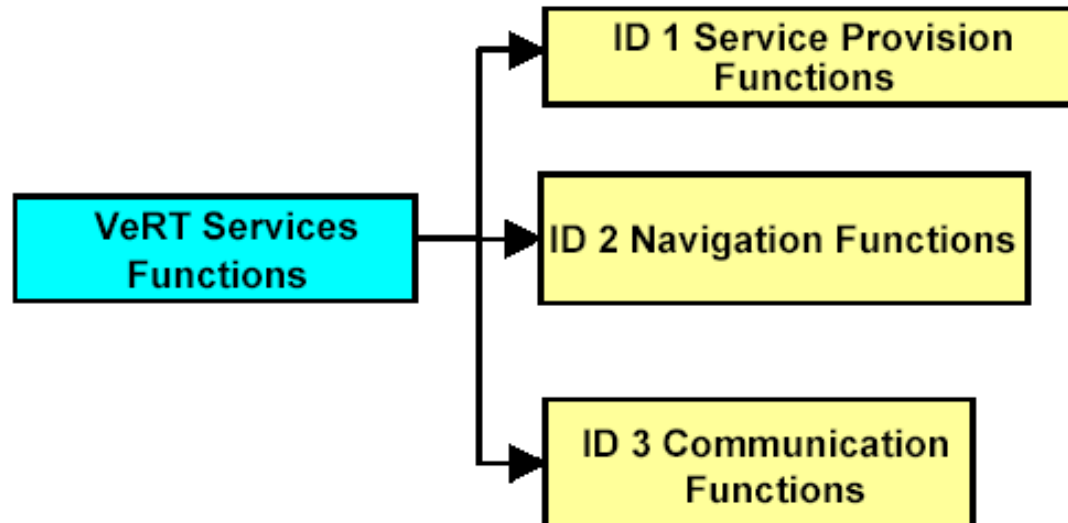
## Nanosatellites



Weight < 30 kg



High Speed Multilane free flow system



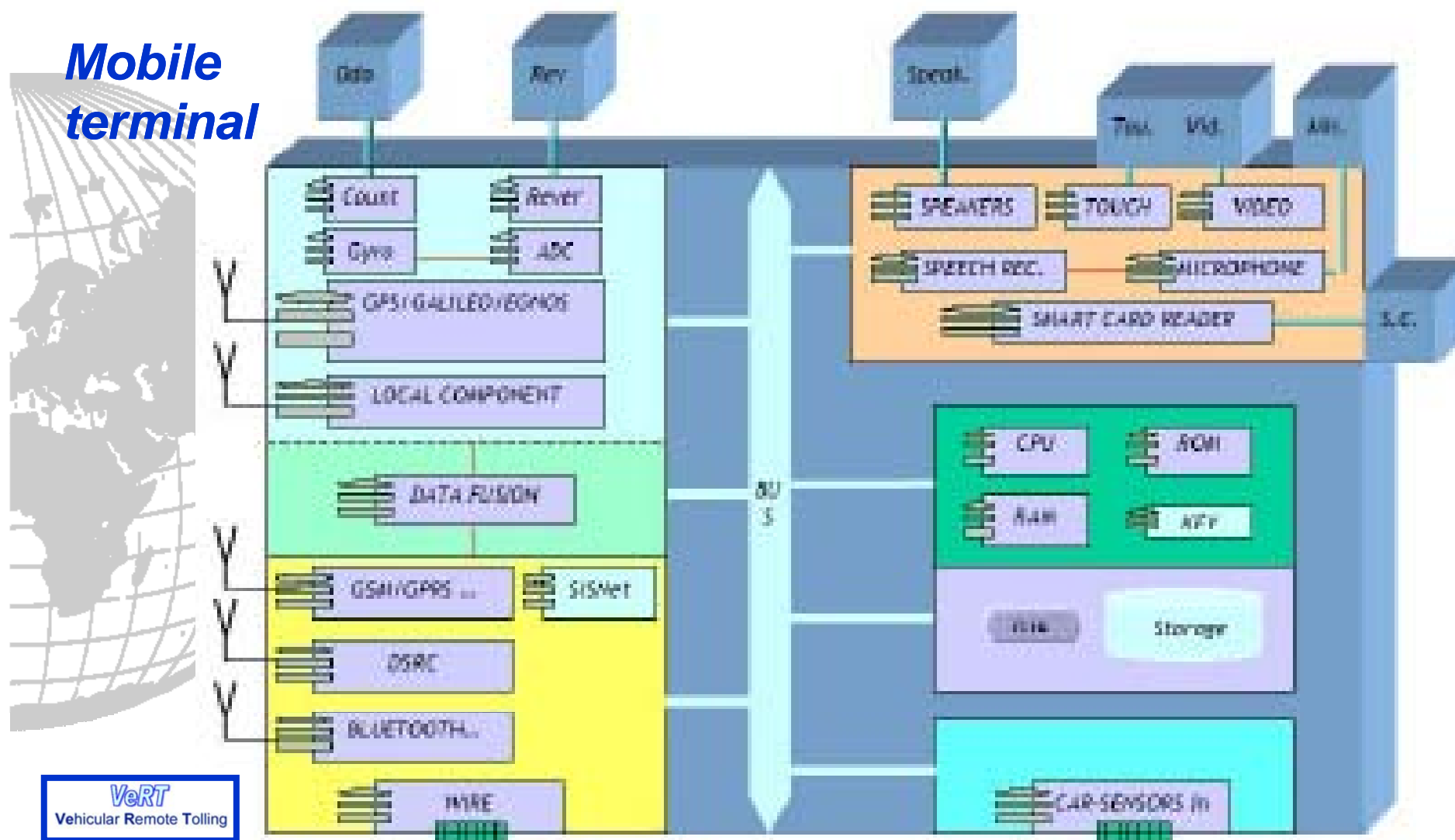
*Integrated service provision*



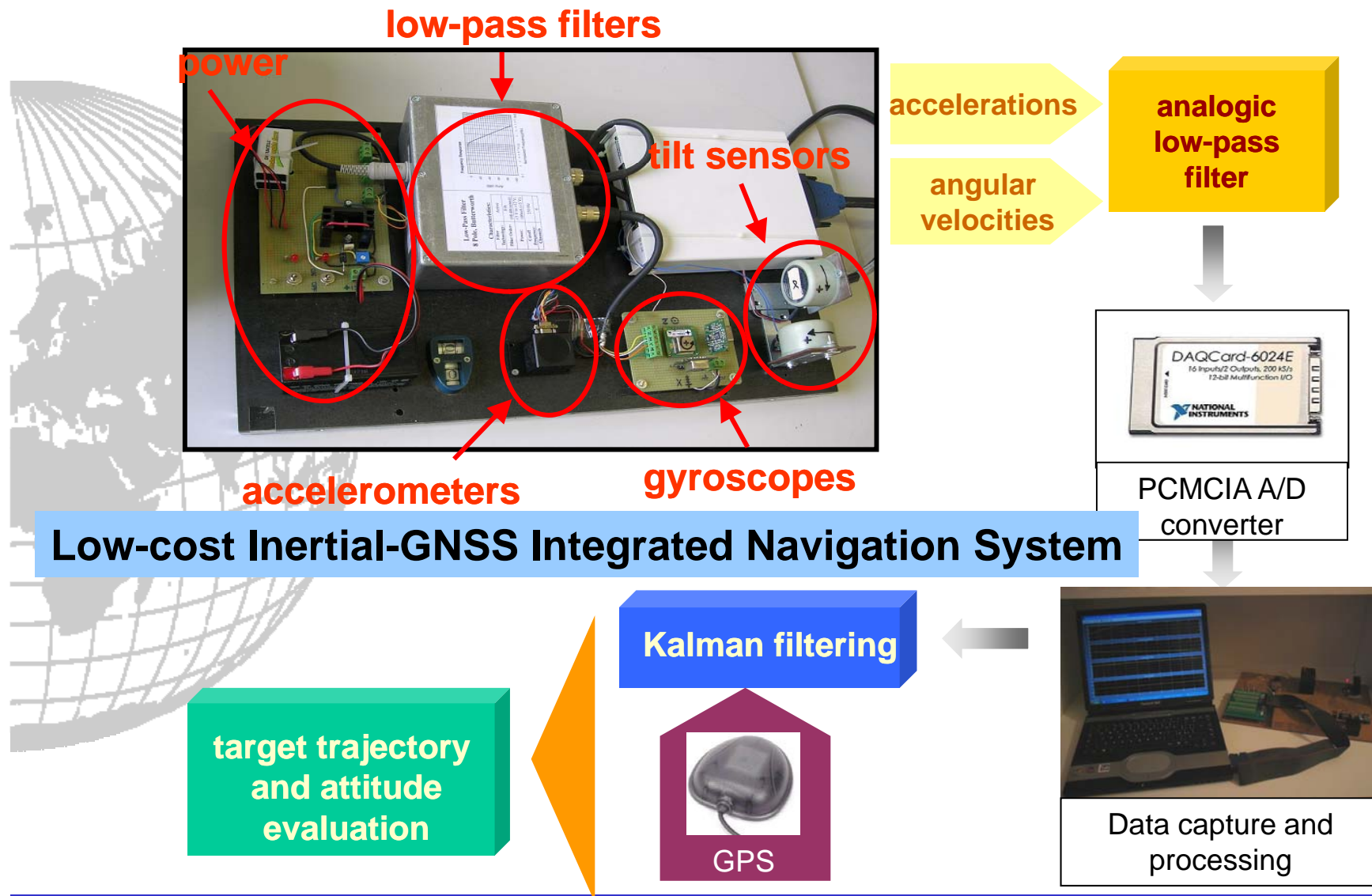
*Integrated network*



## Mobile terminal

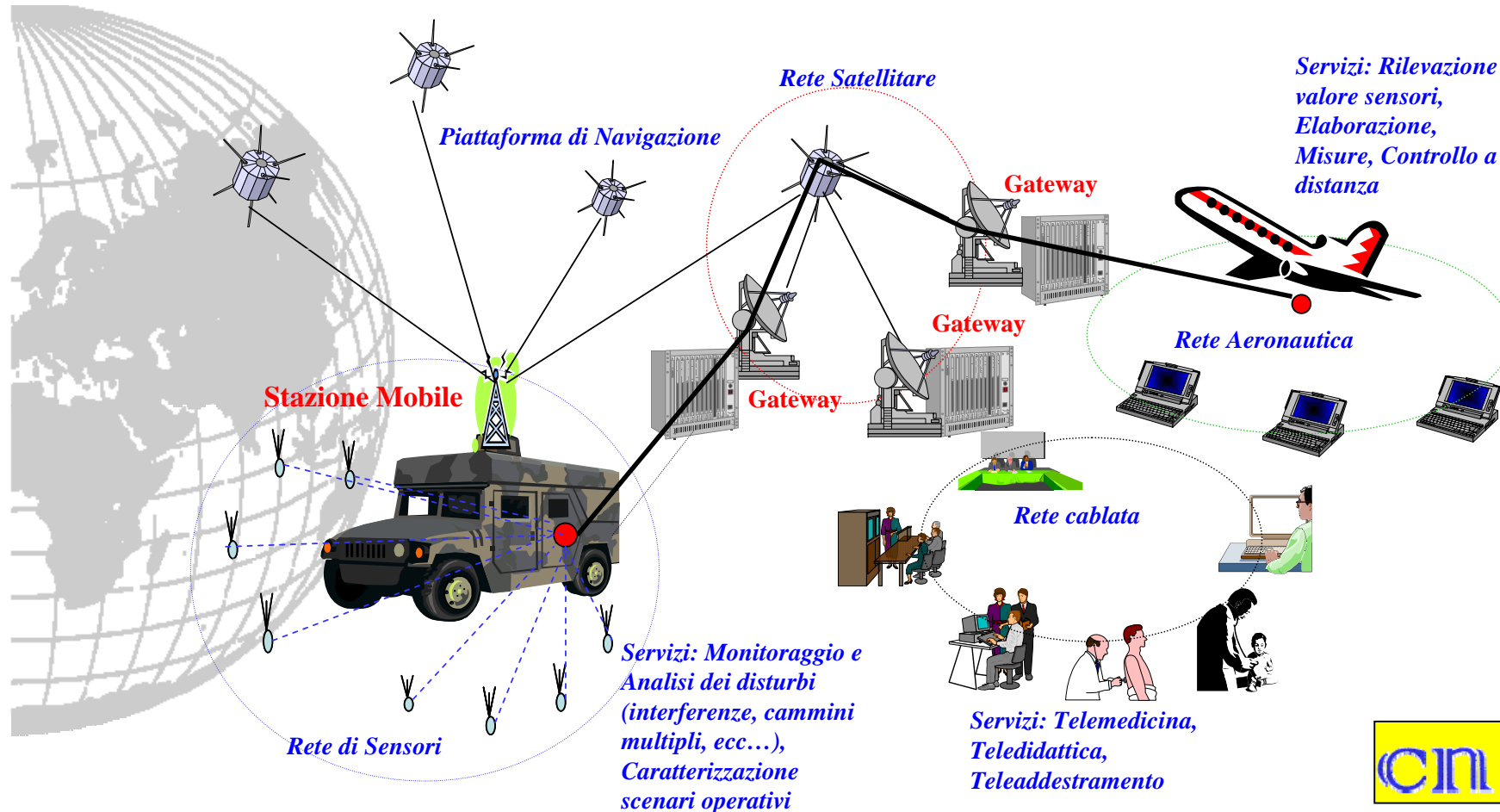


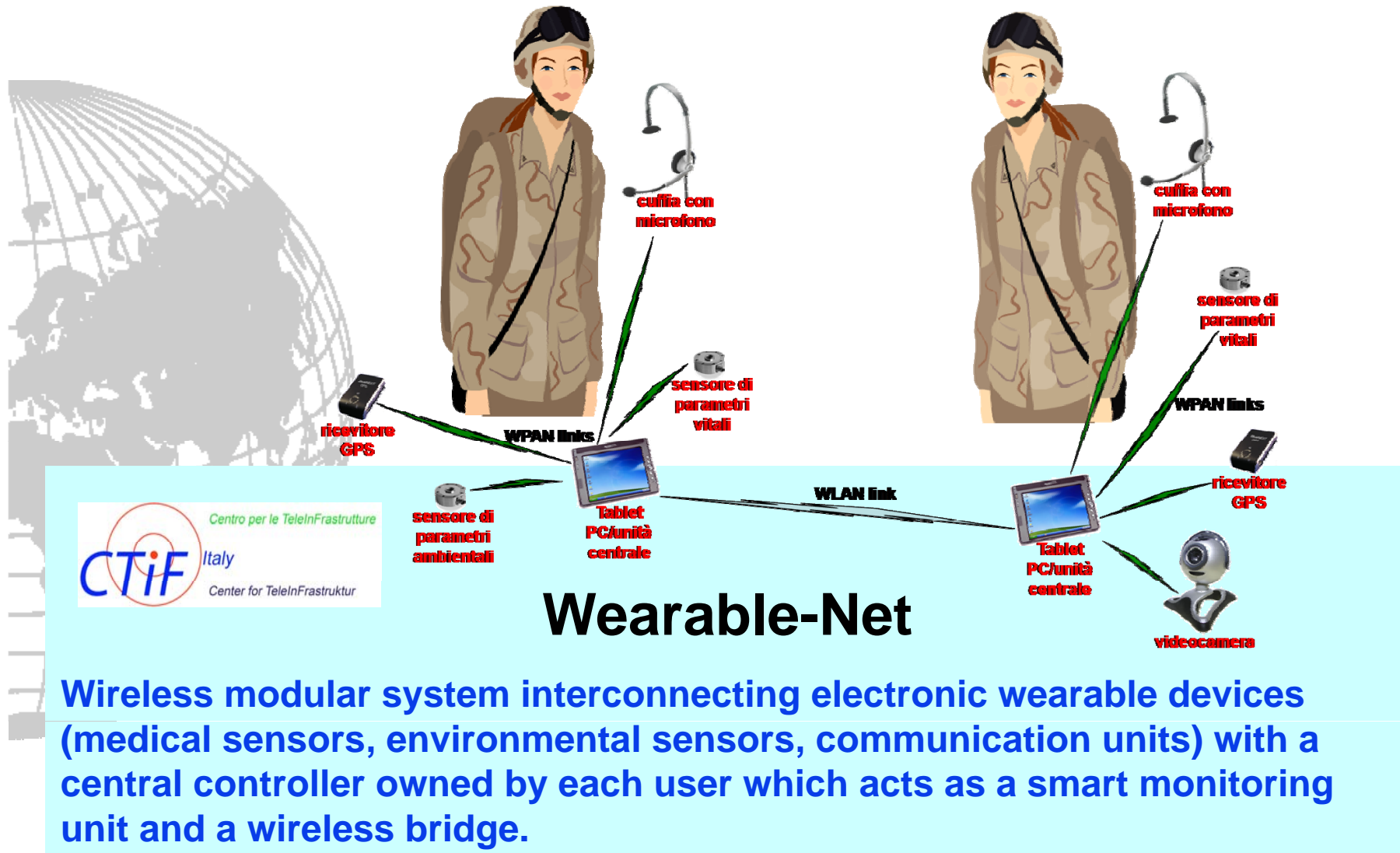
**VeRT**  
 Vehicular Remote Tolling





# AMUSE - Advanced MULTiservice and positioning Satellite nEtwork





**Wearable  
Bend Sensor**



**ZigBee  
Modul  
e**



**Visualization  
and  
Monitoring**

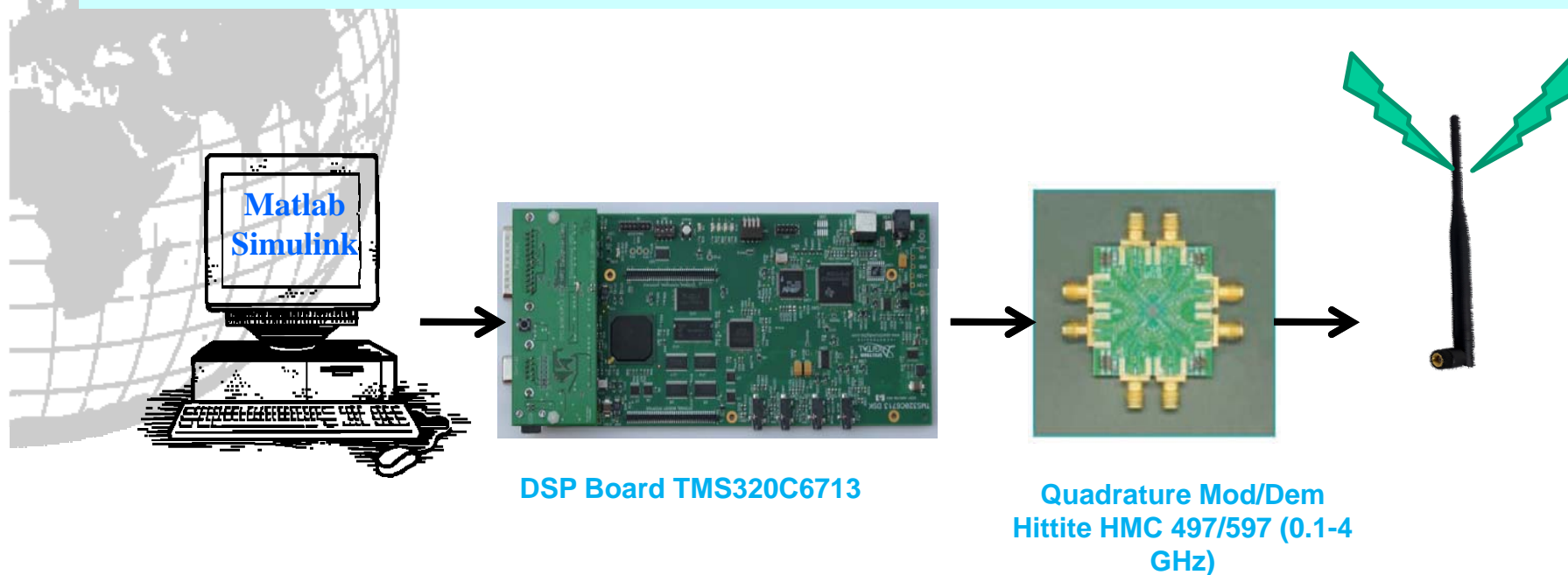


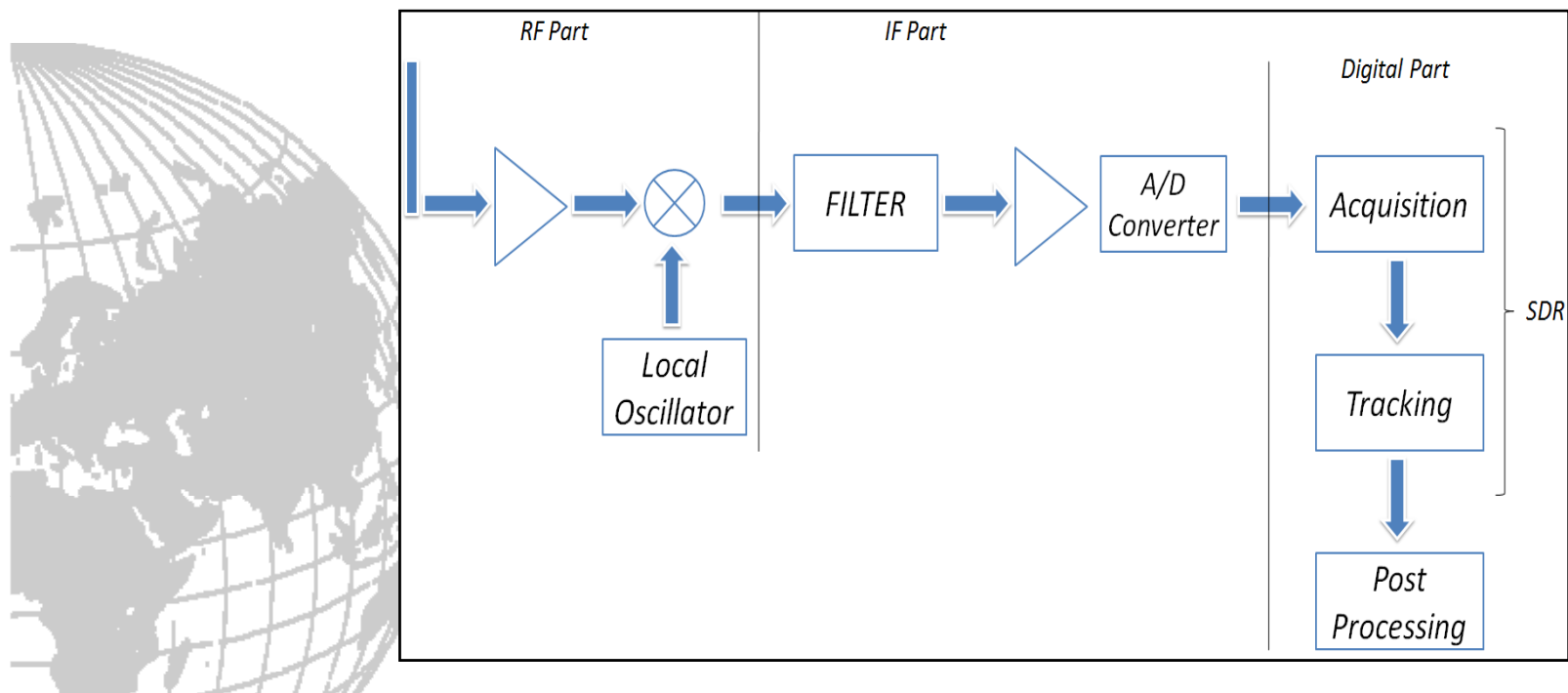
## V-Glove

Wireless glove that allows to deliver messages based on hand gesture; optimization and test of communication parameters.

# SDR

## for tactical communications





## GNSS SDR receiver



# W-Pencils

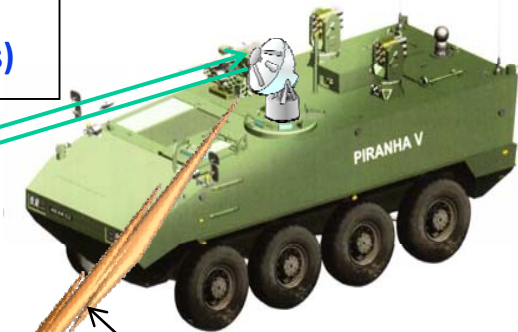


W-band Transportable User Terminal  
(used for operation and soldiers  
health/status data gathering)

High data-rate bidirectional  
W-band Pencil-beam (few kms)

Short-range soldiers  
health/status data

Theatre of Operation

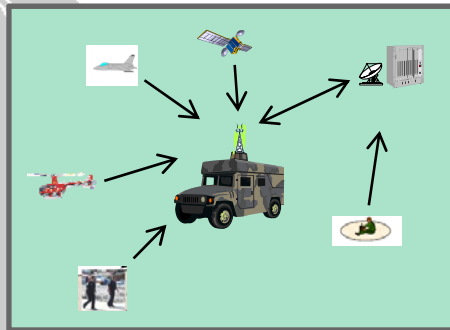


Jamming signals do not  
affect UWB radio link



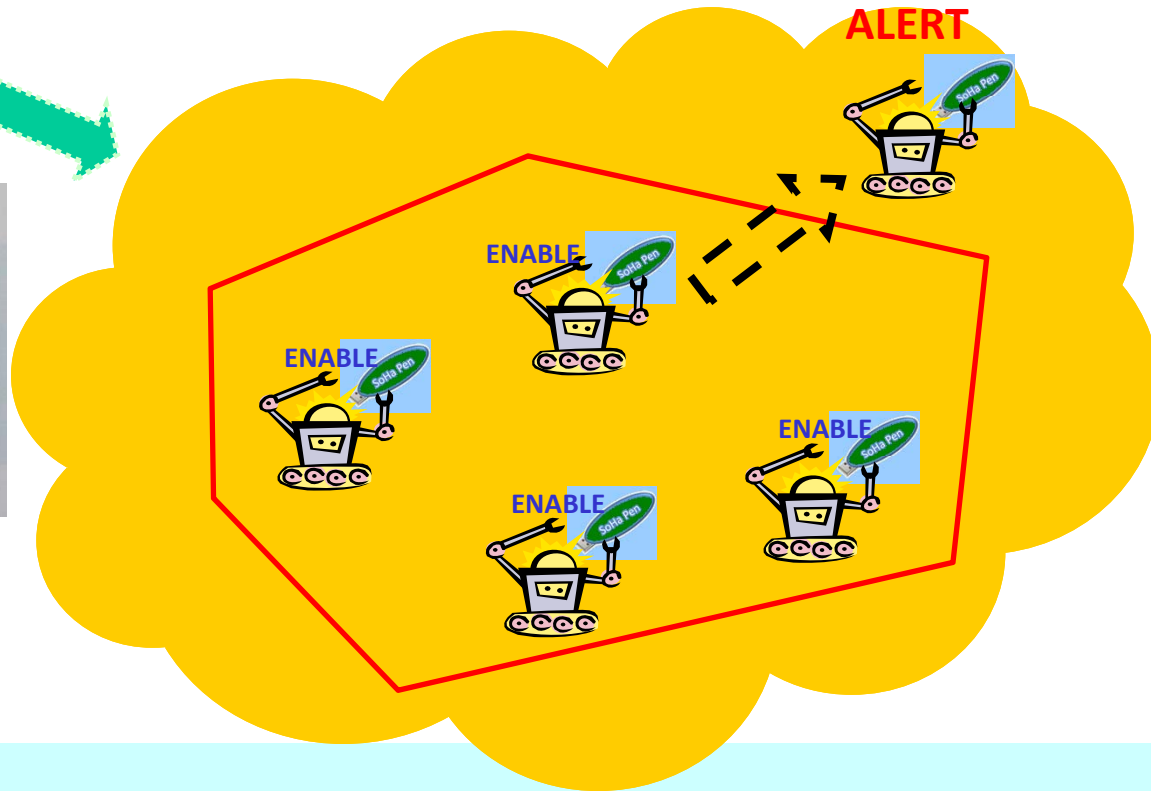
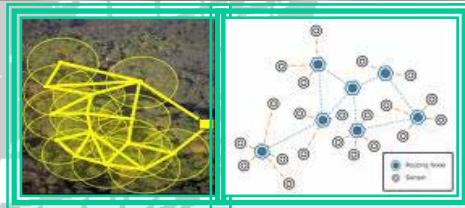
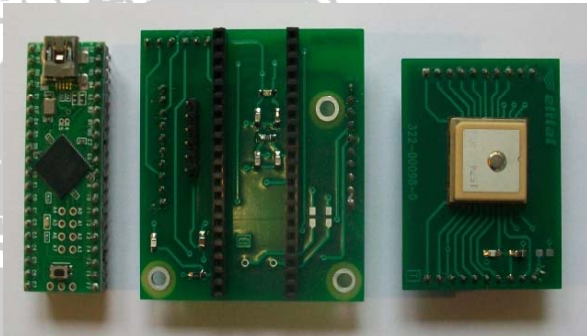
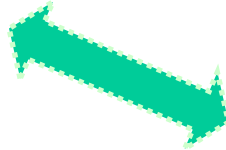
## ICT for Energy Security

Protection of electric facilities against terroristic attacks; security of sensitive data related to oil and gas potential sites against cyber-spying

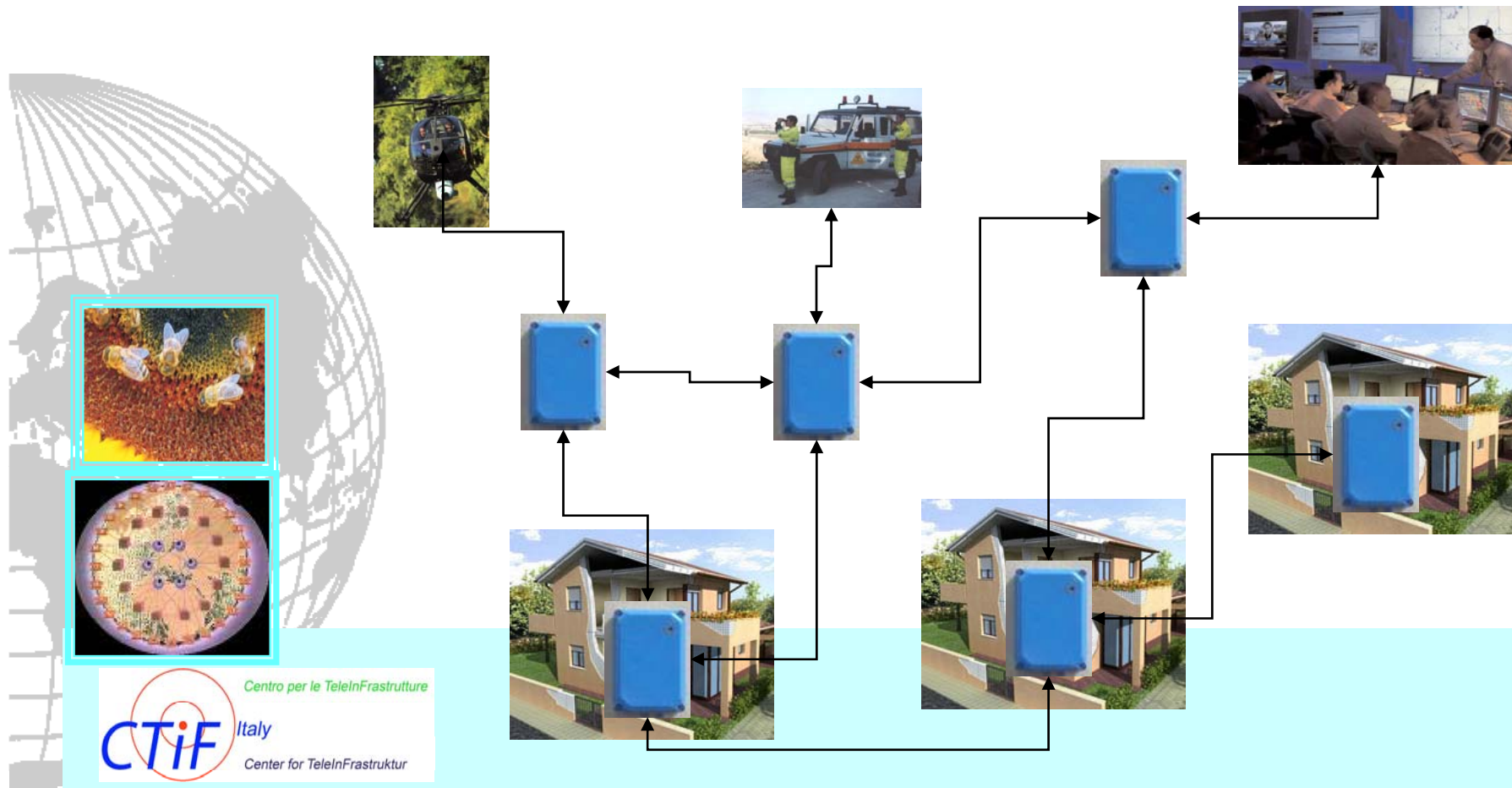


## **Sixen (*anti-roadside bombs*)**

**Multi-sensor / multi-platform integrated system for IED detection and counter measures (unattended sensor payload; proving-ground-based expert system)**

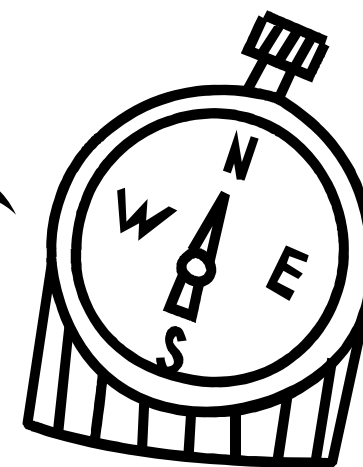


## Swarm-Enabler/Disabler



**Swarm-based architectures for Earthquake prediction/early warning/management.**





## Seaport applications

Satellite compass; access control; logistics



UNIVERSITA' degli STUDI di ROMA  
TOR VERGATA

Master  
in Sistemi Avanzati di Comunicazione  
e Navigazione Satellitare  
[www.masterspazio.it](http://www.masterspazio.it)



**University M.Sc (second level)**  
**Cermet Quality Certification UNI EN ISA 9004:2000**  
**VII Edition (2009-10)**

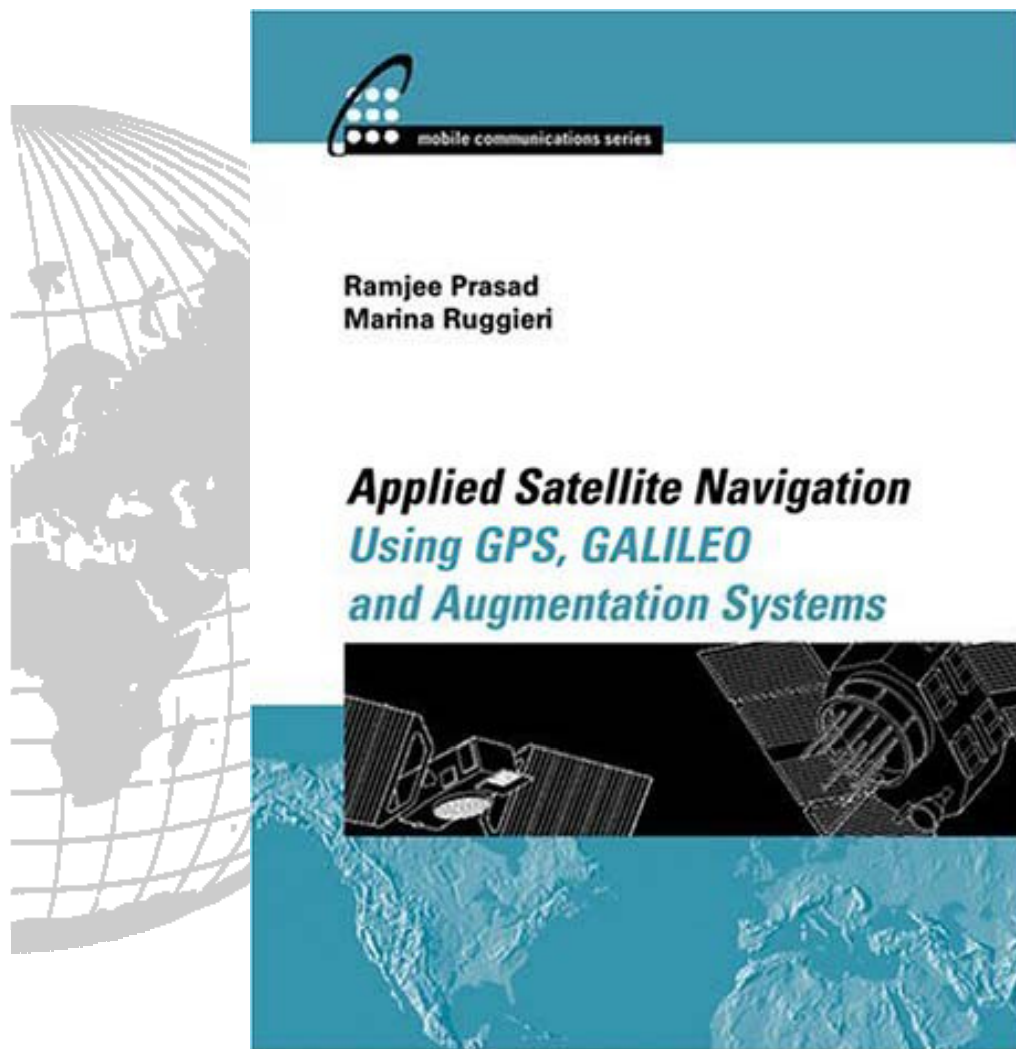


## References



**Publisher: Artech House**  
**year: 2003**

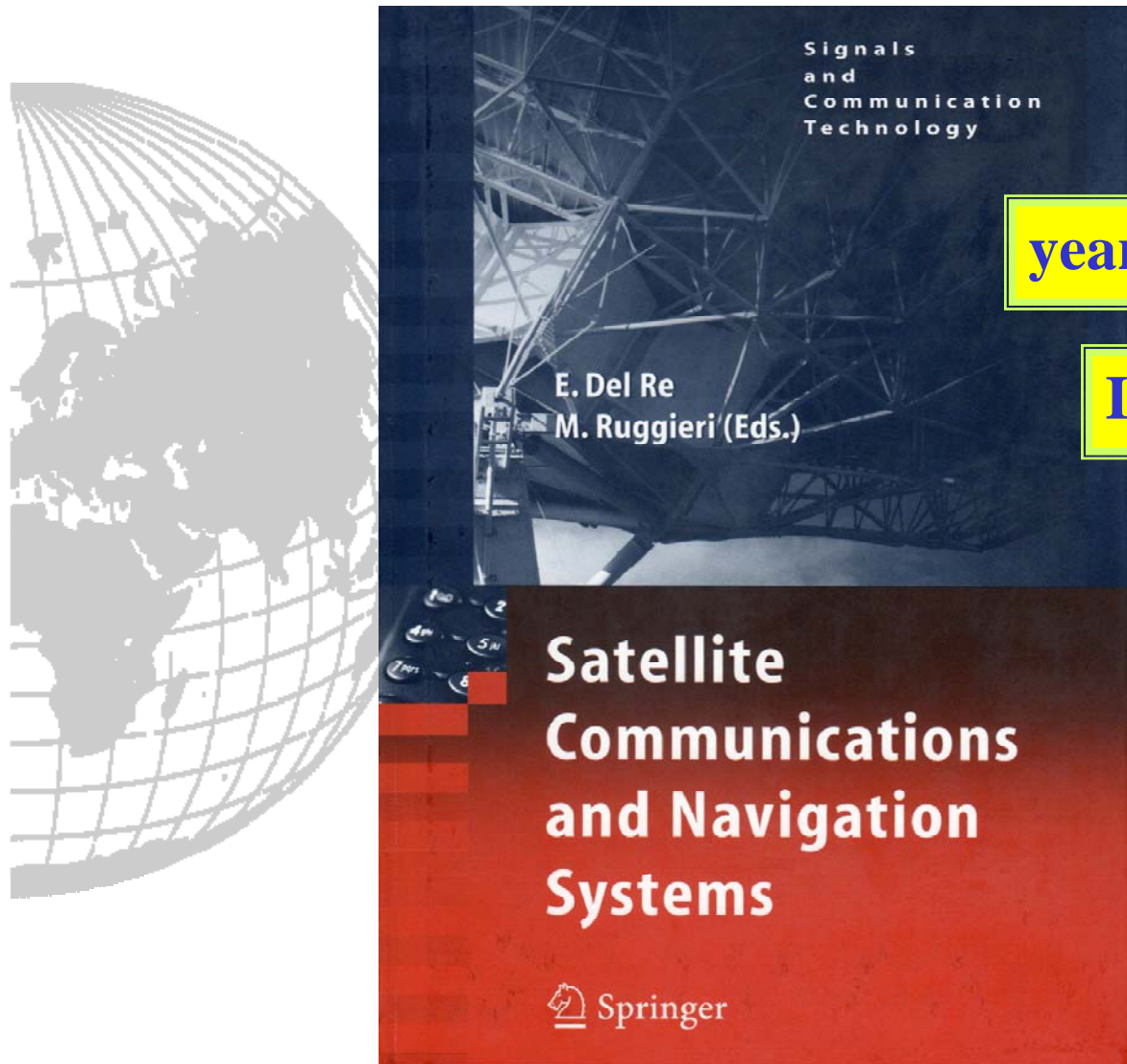
**ISBN 1-58053-352-3**



**Publisher: Artech House  
year: 2005**

**ISBN 1-58053-814-2**





**year: 2008**

**ISBN 978-0-387-47522-6**

**year 2008**

**ISBN: 978-87-92329-04-2**

**[www.riverpublishers.com](http://www.riverpublishers.com)**

**[Customer.Care@riverpublishers.com](mailto:Customer.Care@riverpublishers.com)**

River Publishers Series in Communications

## Aerospace Technologies and Applications for Dual Use

A New World of  
Defense and Commercial in  
21st Century Security

Editors

General Pietro Finocchio

Prof. Ramjee Prasad

Prof. Marina Ruggieri



**River Publishers**



# Thank you

**For questions :**  
**[ruggieri@uniroma2.it](mailto:ruggieri@uniroma2.it)**