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# PSCE Forum General Assembly

November, the 30<sup>th</sup> 2011

- SATCOM recent and future techniques  
Interest for Public Safety users

*Ph. Boutry (Astrium Satellites)*



All the space you need



# Content of the presentation

- The presentation is focused on.
  - Current evolution of the satellite communication techniques. New solutions (evolution toward Ka, multi-beam solutions, new antennas and payloads).
  - Overview of the trend in satcom (new spectrum bands, hybrid/integrated architectures, adhoc networks).
  - How such evolutions could interest Public Safety users (impact on services provided, on performances, integrated terrestrial/satellite).

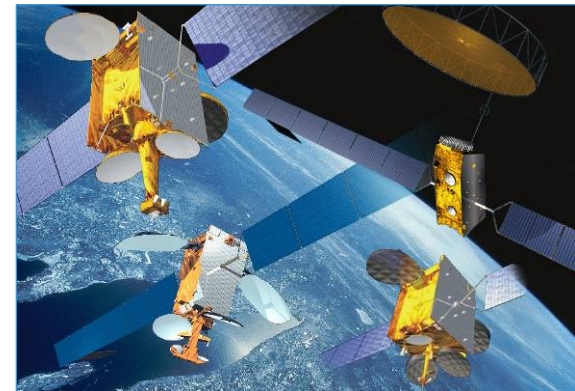
# Astrium and EADS

- Astrium is the space division of European Aeronautic Defence and Space Company (EADS), a global leader in aerospace and defence
  - €45.8 billion sales, 118,000 people
  - 70 production sites, principally in France, Germany, Spain, UK and USA but also subsidiaries in Europe and worldwide including ... Poland



# Telecommunications Satellites

- **Complete satellite communications system capability**
  - Spacecraft and payload design, manufacture, test, launch and operations
  - End-to-end communications system infrastructures
  - Civil and military telecom systems
- **A partner of confidence for major operators worldwide**
  - 45-year experience in satellite manufacturing
  - Prime for over 90 GEO communications satellites
  - Product range covering all mission needs
  - Efficient industrial organisation
- **A market leader**
  - Established on challenging commercial market, ca. 25% market share
  - Eurostar E3000 best selling
  - At the forefront of innovation





# How satcoms are perceived by PS users

## ■ What they are complaining about

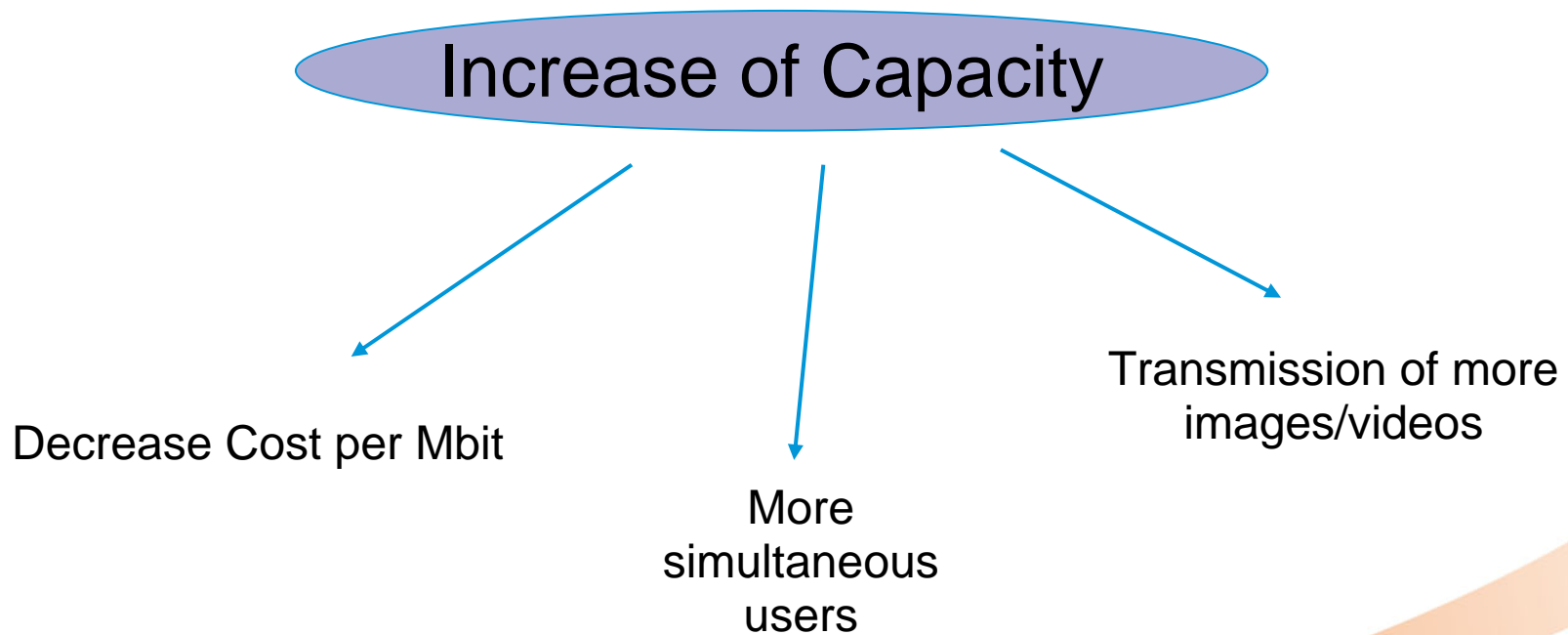
- Limited capacity
- Capacity not available immediately when needed
- Missing functions (PTT)
- Dedicated equipment/terminal required
- Specific training required
- Too expensive – not affordable for PS organisations

But ...

## ■ What they recognised

- Only available telecom solution during/after disasters
- Independent of nationally “controlled” coms networks
- Available nearly everywhere (isolated regions)
- Capacity to provide secure coms
- Could be discrete
- Broadcast on widespread areas

# Which evolutions on Satcom are expected



# Which evolutions on Satcom are expected

How to increase Capacity

## **Migrate to higher frequencies**

→ **More spectrum**

Today : C/Ku → Ka

Tomorrow : Q/V bands

The day after : Optics

## **Better usage of spectrum**

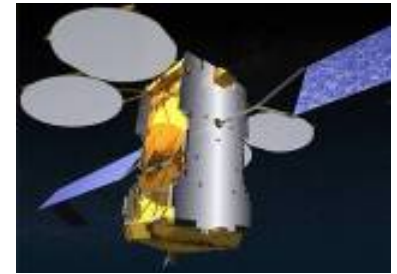
Today : Global coverage → Multi-beam techniques

Tomorrow : Integrated terrestrial/satellite networks

# SatCom : Recent achievements

## Higher frequency spectrum

- Migration of services towards higher frequency bands
- Opening of new services in Ka-band for commercial and military usages
- Ka payload integrated in new Ku satellite (e.g. Astra 3B)



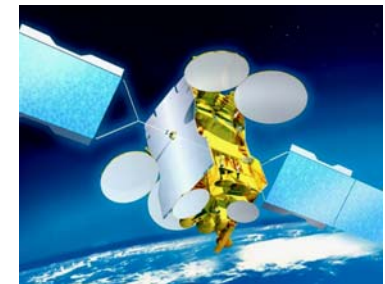
*Ka-Sat*

## Multibeam concepts

- Large number of small beams
- Maximum frequency re-use
- e.g. Eutelsat Ka-Sat : 1st high throughput spacecraft
- A factor 35 of gain in communication capacity



*Ka-Sat coverage*



*Astra 3B*

## Higher flexibility

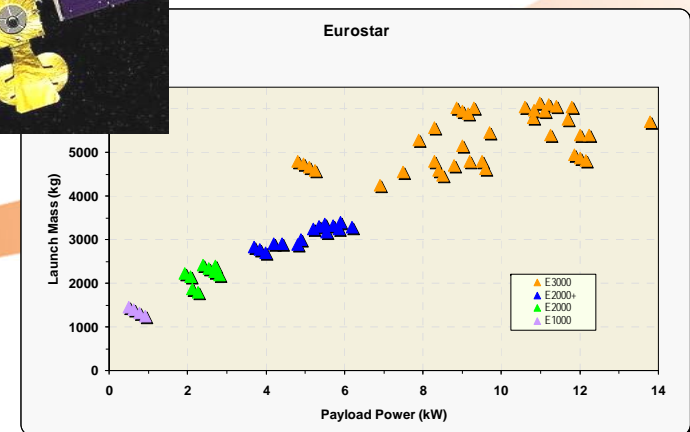
- New concepts to dynamically adapt frequency bands
- e.g. Hylas1: flexible payload in Ku/Ka
- GEO and LEO complementarity



*Hylas 1*

## Satellites' performance evolution

- Increased platform capacity (mass, power, ...)
- Antennas design and accommodation
- Integrated payload components



All the space you need



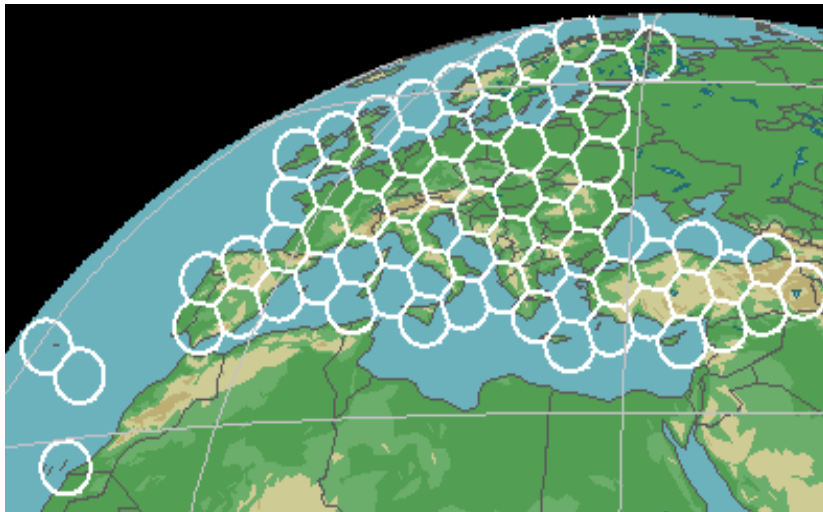
# Satellite System Concepts – frequency re-use

- Multispot beams enable an efficient management of available spectrum.

- System capacity, number of beams, beamwidth, number of cells, size of cells, available bandwidth ... => achieve the best spectral efficiency.

0.5 ° (72 beams)

0.4 ° (100 beams)

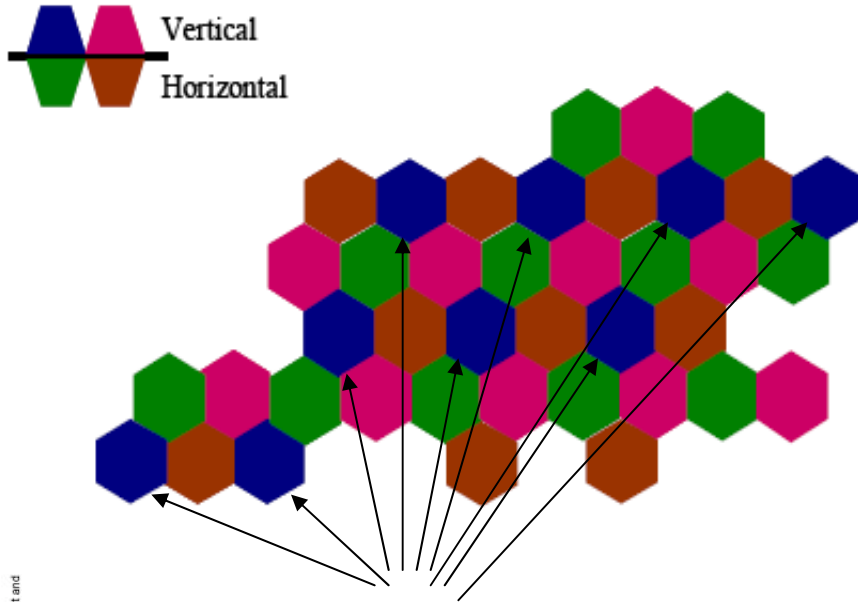


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# Satellite System Concepts – frequency re-use

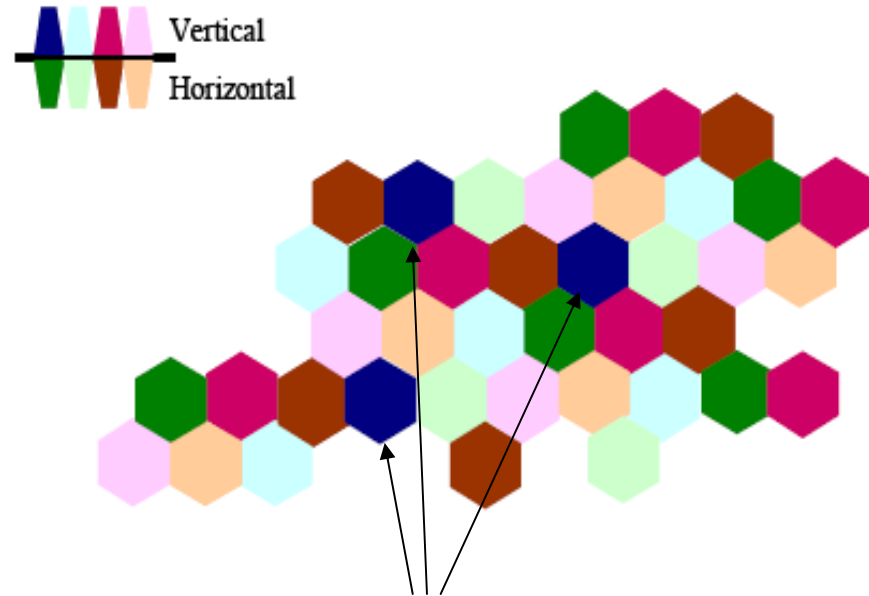
- Frequency re-use pattern

4-colour pattern



Blue colour interfering beams

8-colour pattern



Blue colour interfering beams

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This document and

# SatCom : recent achievements (cont'd)

## ■ Mobile satellite systems

- Inmarsat 4 follow on → Alphasat I-XL
- Use of Ka band also for mobile → Inmarsat GlobalExpress
- Hand-held terminals → bi mode Terrestrial/satellite terminals (Elektrobit, Solaris)



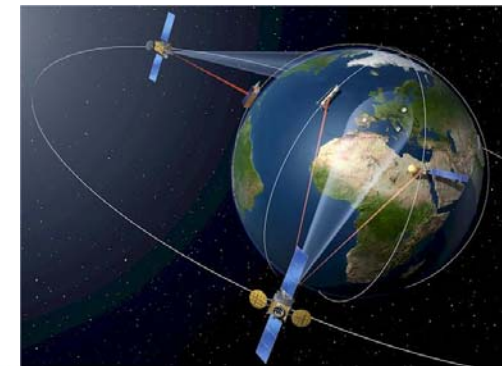
*Alphasat I-XL*



*Terrestrial terminal (EB)*

## ■ Data relay satellite

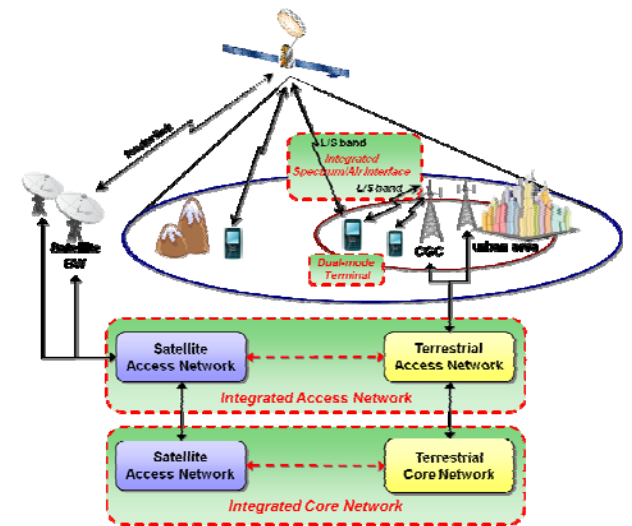
- EDRS decided
- First optical terminal integrated in EB9B (Eutelsat)
- To drastically reduce the satellite image delivery to user



*Système E-DRS*

# What are the trends ...

- **Evolution toward high capacity**
  - Increase of services in Ka band
  - Opportunities to use higher frequency bands
    - Q/V but also optical bands
    - Optical feeder links
  - Path towards very high throughput satellite
    - (>100 Gbps and Terabits)
- **Integrated terrestrial/satellite systems**
  - Seamless integration of satellite and terrestrial networks
  - e.g. Usage of the S-band with CGC concept
- **Innovative concepts**
  - Adhoc communication → Monet study
  - On-board routing
  - Beam forming technics
- **Satellite platforms' next generation**
  - Development of an European high power platform : Alphabus
  - Preparation of new generation of Industry satellite platforms (e.g. Astrium Eurostar and TAS Spacebus)



# Alhabus



- **The large, high power European platform**
  - A new step in satellite capacity and efficiency
  - Up to 22 kW payload DC power capability
  - Large accommodation (up to 230 TWTAs, 12 antennas)
- **Available on the commercial market**
  - Fully qualified
  - Large flight heritage from legacy programmes
  - Spacecraft ground delivery within typ. 30-32 months
- **First spacecraft in integration**
  - Protoflight service module developed by Astrium and TAS, completed and qualified
  - First satellite Alphasat I-XL under integration by Astrium for Inmarsat, on track for delivery in 2012



Alhabus PFM

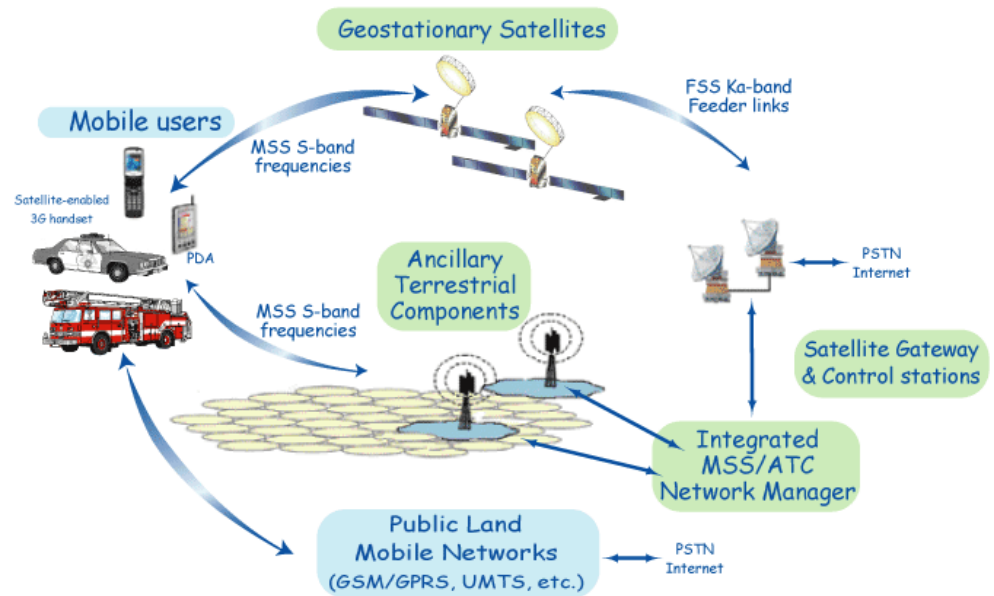


Alphasat I-XL



# A dedicated infrastructure for Public Safety users

- Some characteristics of a communication system for PPDR missions
  - Integrated terrestrial/satellite system
  - Associate Mobile Services for global coverage (com with/between FR) and spot mobile (Ka band) for high capacity hot spots (link with control center)
  - Opportunity to use the S-band
  - A minimum dedicated capacity to guarantee priority of use for PS
  - A governance through a PPP (Public Private Partnership) approach



# How to improve the Satcom services to Users

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PS User

Satcom Industry

- **identified limitations**
  - Limited capacity
  - Capacity not available immediately when needed
  - Missing functions (PTT)
  - Dedicated equipment/terminal required
  - Specific training required
  - Too expensive – not affordable for PS organisations

Define frame contracts

Synthesize user need

Mutualise the demand

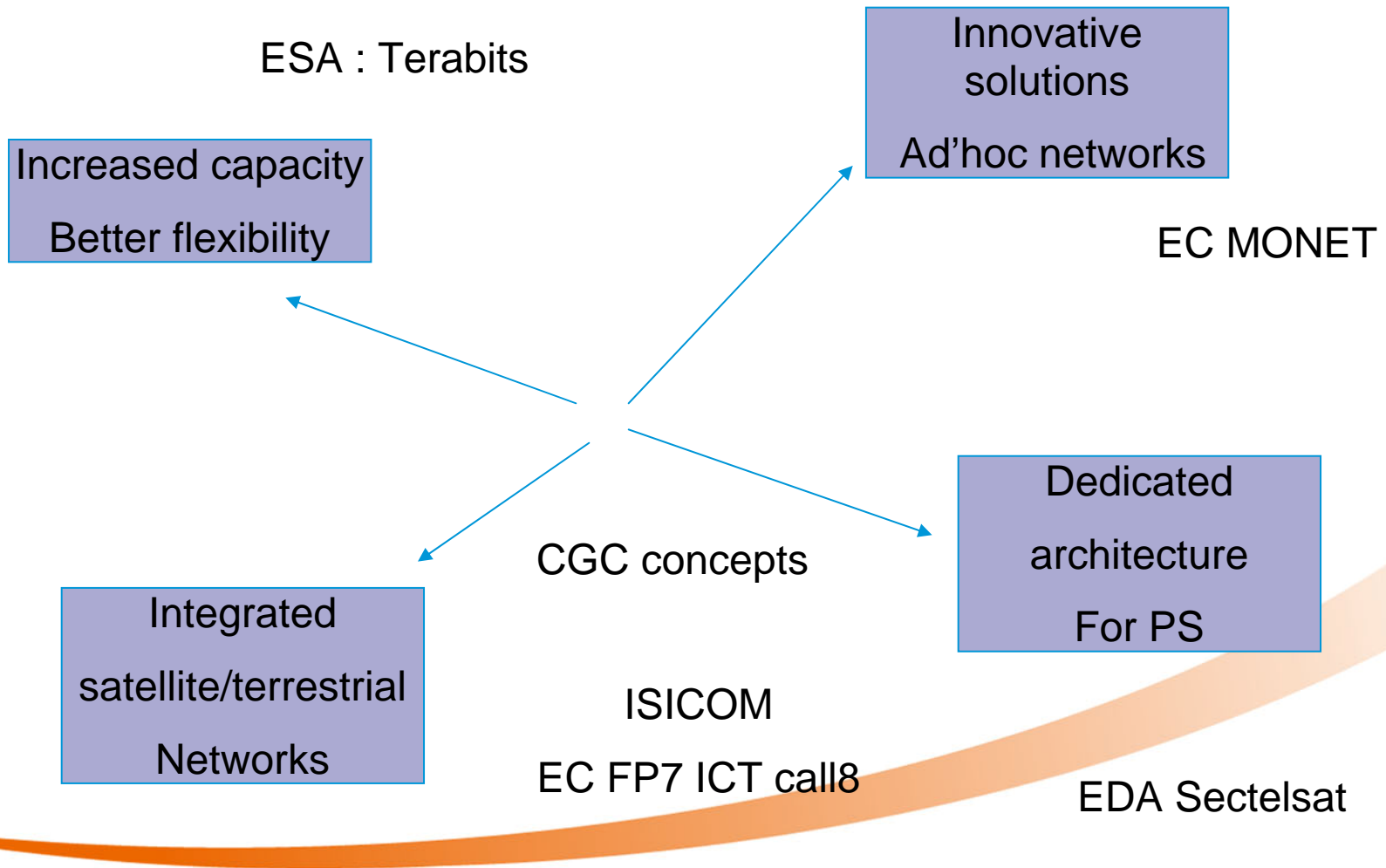
New innovative solutions

Dedicated infra and services

Bi-mode terminals

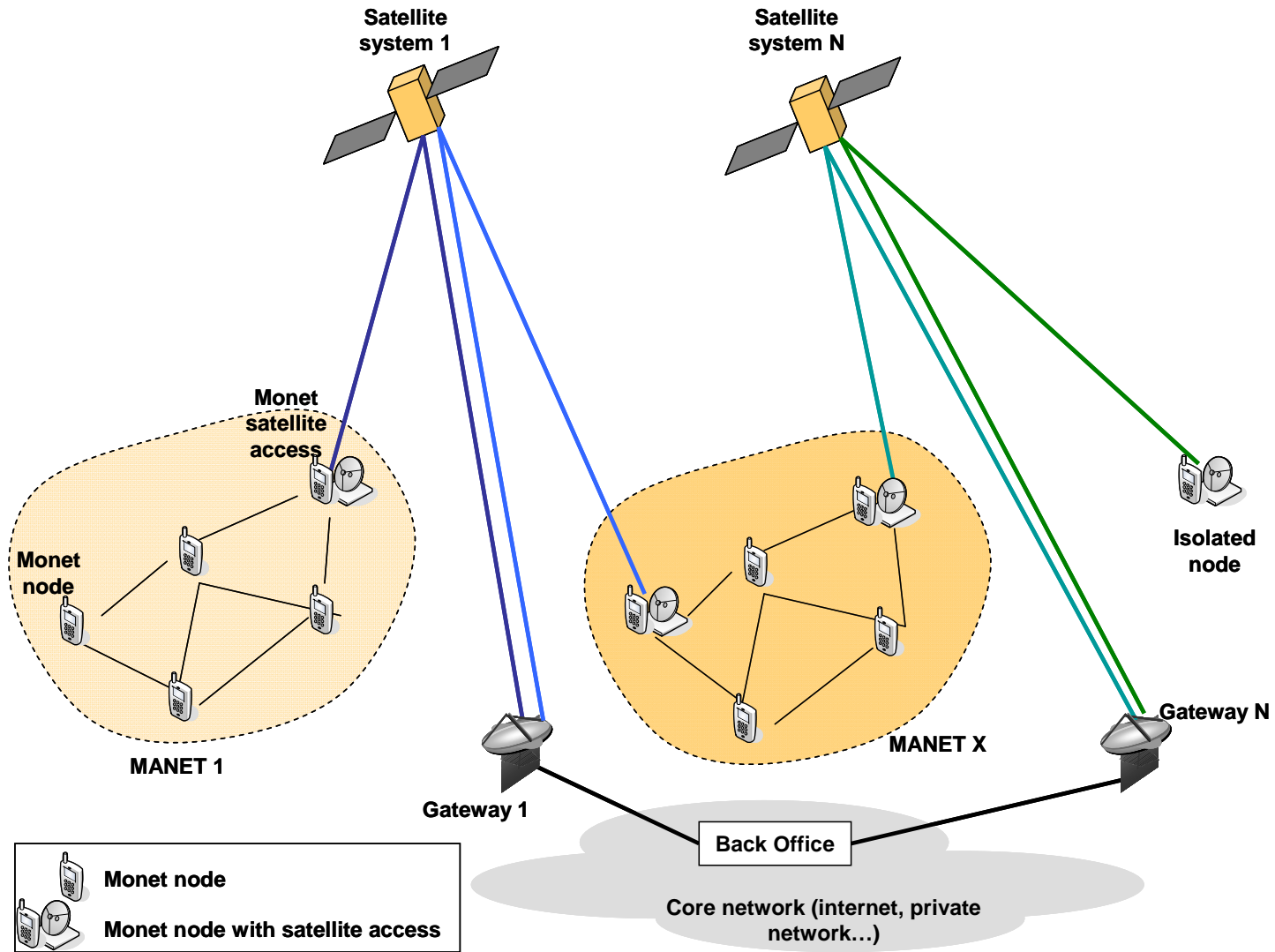
Integrated Satellite/terrestrial networks

# Evolutions and trends – importance of EU research → just some examples



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# MONET project on ad'hoc communications



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November 2011 - 17

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