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CENTRE NATIONAL D'ETUDES SPATIALES

GLOBAL FORUM
Shaping the Future
2006

DIGITAL CONVERGENCE

Towards a more competitive, mobile and inclusive knowledge-based information society

Session 1: Ubiquitous Infrastructure

THE SATELLITE OFFER

TRENDS AND MID TERM PERSPECTIVES

Bernard MATHIEU

Head of Radio Communications Programmes

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Content

- **Satellite Communications**
- **Satellite Navigation**

The Satcom Business Value Chain

According to Euroconsult

- **Satellites + Launch services**

Equipment goods & services

$ 2.36 Billion + $ 1.43 Billion

- **Satellite operation**

Capacity provision

$ 7.6 Billion

- **Satellite service provision**

TV Channels (DTH,TVHD)
Dedicated bandwidth
Internet traffic
VSAT private networks

$ 80 Billion

DTH Platforms : $ 55 Billion

To offer a complete set of final services to end users:
TV programs, Internet content, Telephony, Data transmission...

Satcom solutions: Strength & Weakness

- Unique capability for Broadcast and Push services
- Wide coverage & universal service capability: national, regional, global
- Seamless integration and good complementarity with terrestrial networks
- Ability to bridge the increasing digital divide

But:

- Current satellite channel cost still too high for Broadband access
- Rather high Capex and time needed for development of new & innovative solutions
- Strong competition with terrestrial Broadband network solutions: DSL, WiMax,…

Satcom Trends & Perspectives

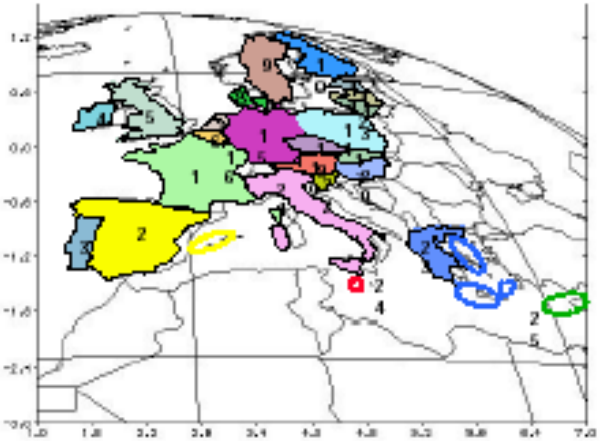
Fixed Satellite Services

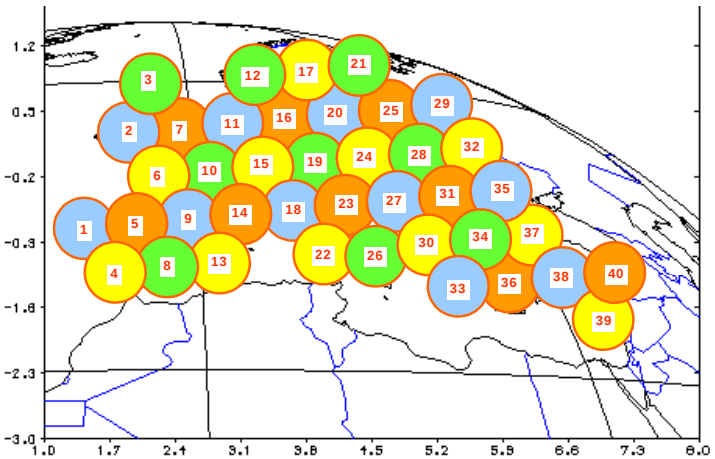
- Replenishment and extension of existing systems (C and Ku band),
- Operators enlarge their satellite fleets, develop to the maximum their orbital positions, take advantage of the economies of scale brought about by larger and larger satellites,
- As a consequence the need for flexibility and reconfigurability of satellite payloads increases,
- Operators requires shorter production time and reduced costs

Satcom Trends & Perspectives

Broadband Access Systems

- Implementation of multibeam broadband access systems since 2005: Wildblue, IPStar, …
- Other operators are considering full Ka Band multispot beam systems (in some case for local TV distribution): Direct TV, SES Americom AMC 17





New cycle of growth expected with multibeam Ka Band satellite systems using standards (DVD-RCS/DVB-S2, Docsis)

Example of European multibeam coverage: AGORA

Satcom Trends & Perspectives

Mobile Systems (1/2)

- Development of new generation of Inmarsat IV with BGAN platforms and services for maritime, aeronautical and land mobile applications,

- Success of Radio Broadcast to mobiles in the USA,

- Definition & deployment of new systems mainly for digital mobile broadcasting (S-DMB):
  MBSat (Japan), TVMSL(Europe),

Eutelsat and SES Global will exploit and market jointly the first European S-DMB space infrastructure on board W2A Eutelsat satellite to be launched early 2009

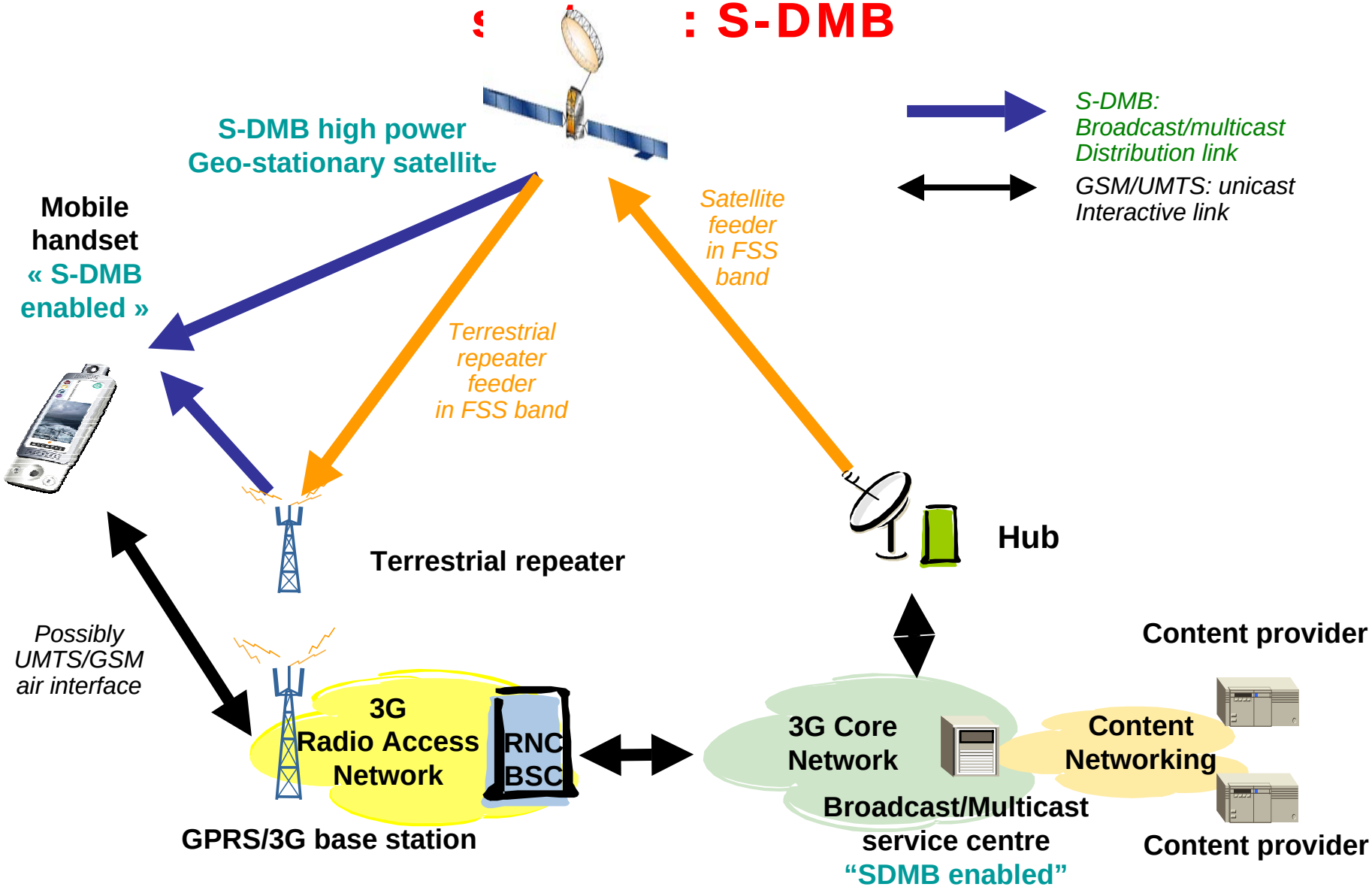
Satcom Trends & Perspectives

Mobile Systems (2/2)

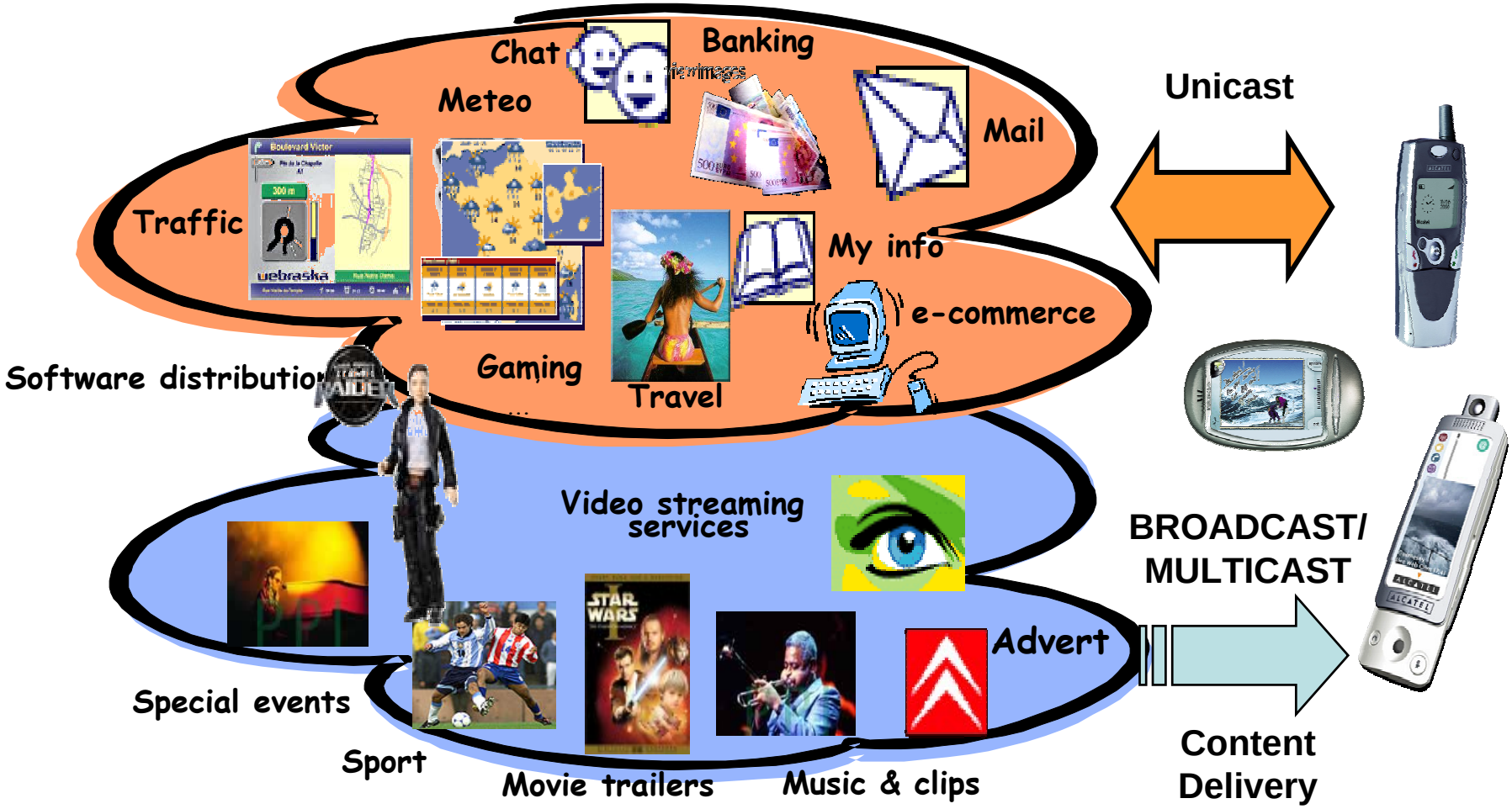
- Satellite Data Link System for air/ground communications in complement to terrestrial VHF systems for Air Traffic Management

- New other applications:
  - Internet access for high speed trains,
  - Civil Protection, ,
  - Location based services & applications by using combined satellite positionning and timing systems (GPS, EGNOS, Galileo) and satellite or terrestrial communication systems

Mobile TV through an hybrid satellite / terrestrial s : S-DMB



S-DMB typical applications – Broadcast / Multicast services, with a natural complement with unicast mobile networks applications

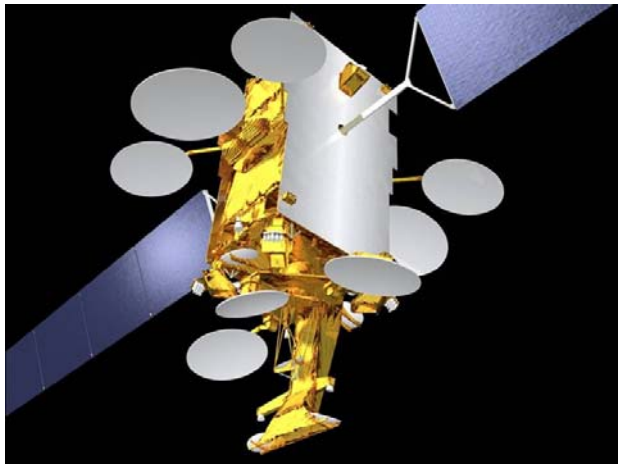


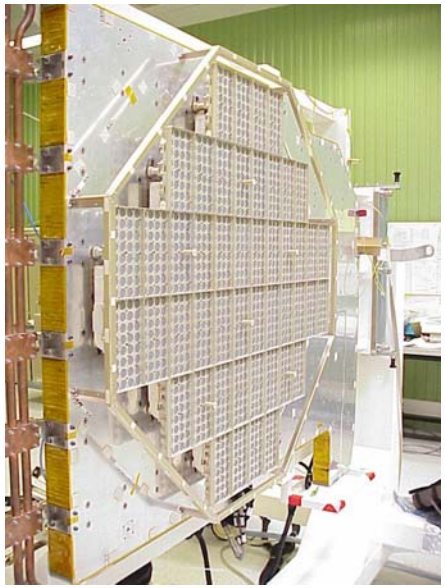
Satcom: Key Technology Trends

- High capacity GEO platforms:

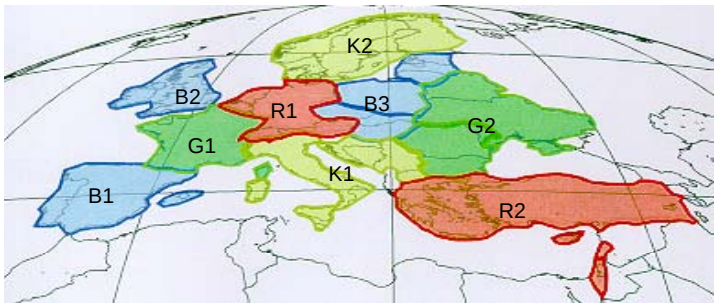
  European Alphabus:

  1Ton/18 KW payload capacity

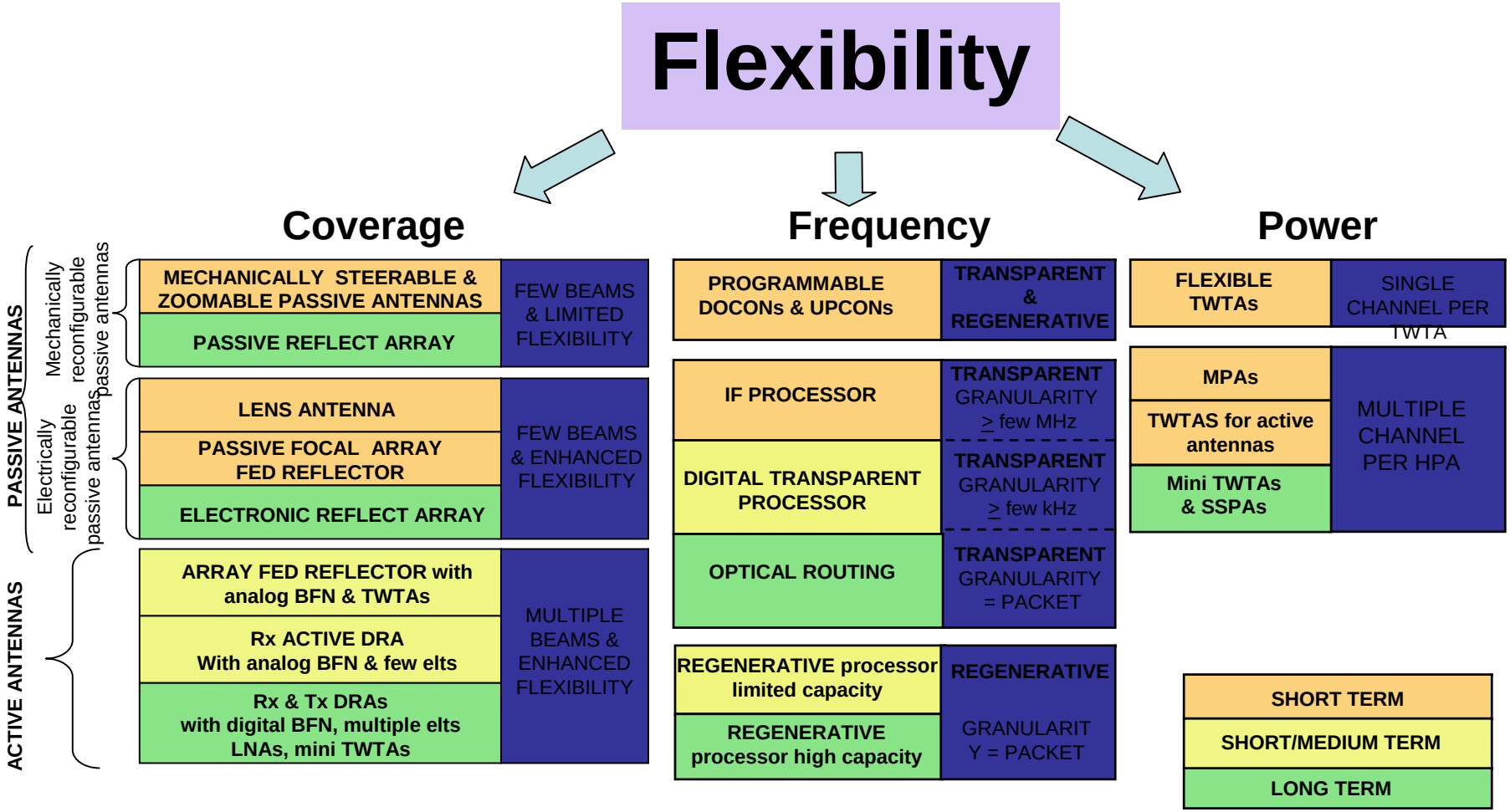




- Flexibility of next generation payloads (antenna & repeater)
  - **Coverage, Frequency, Power allocation**
  - **Channelisation & beam to channel allocation**
  - **Polarisation**

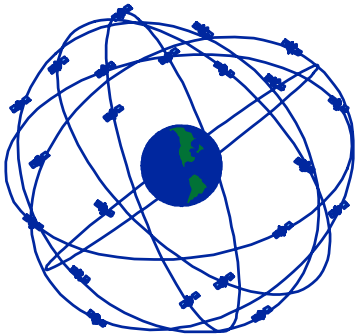


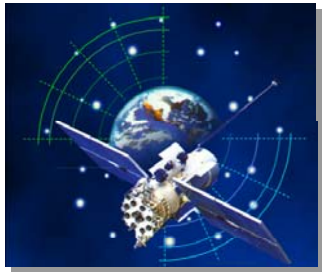
Flexibility of next generation Payloads



According to AAS

Satellite Navigation Systems



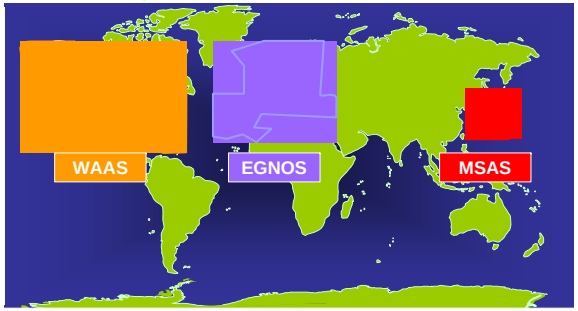


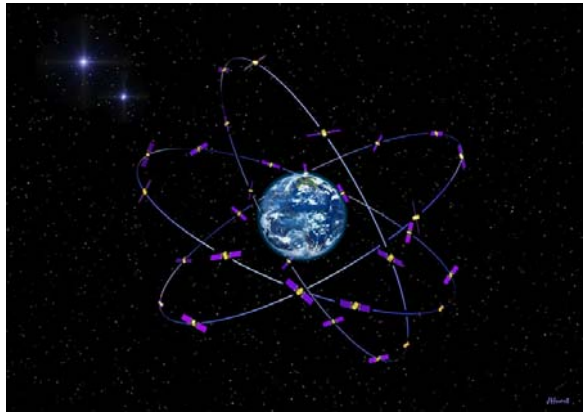
Today:

GPS and GLONASS

and

the augmentations to GPS





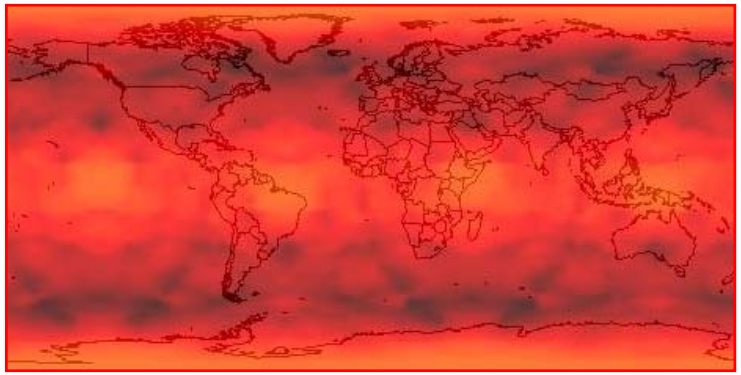
Galileo Constellation

Tomorrow:

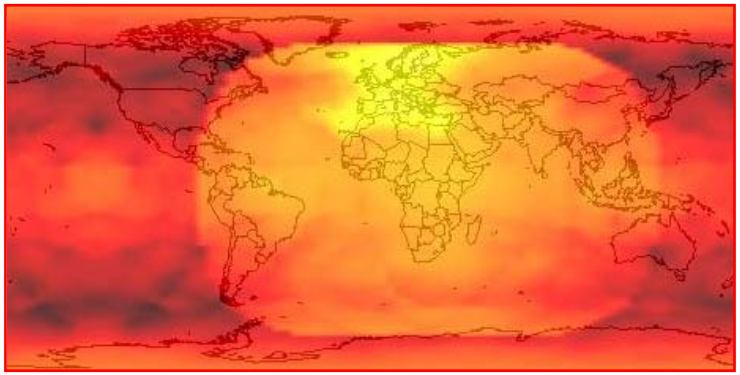
GPS + GALILEO + GLONASS + …

A huge applications market

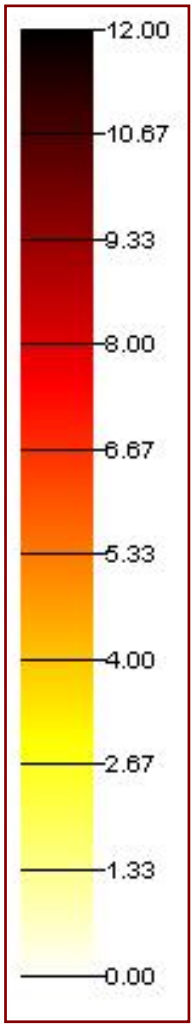
Combined Performances : GPS - EGNOS - GALILEO



GPS (Current)



GPS + EGNOS



GPS + EGNOS + GALILEO

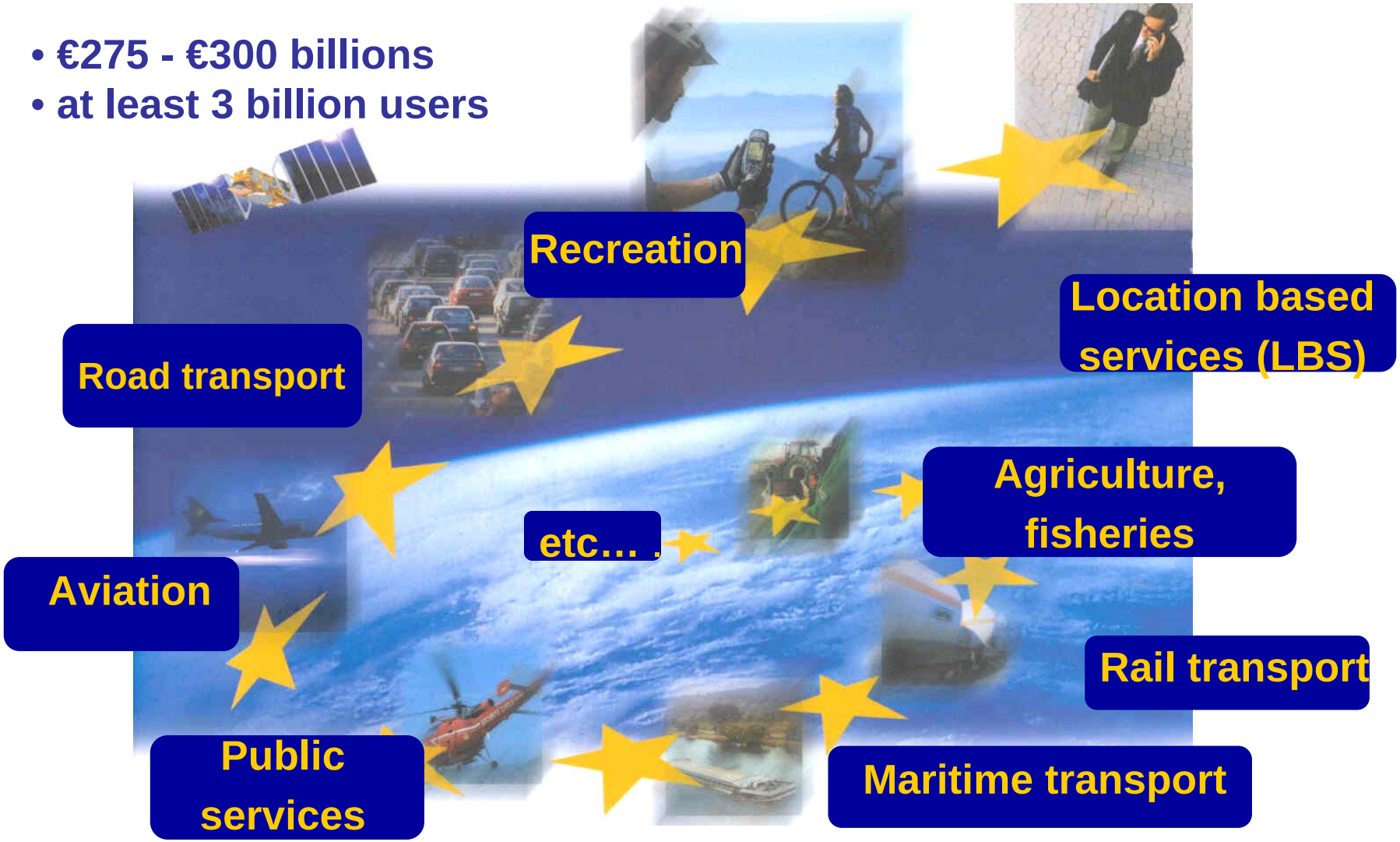
Horizontal positioning accuracy (95%)

A universe of services and applications

According to E.C.

In 2020, Worlwide Market

- €275 - €300 billions
- at least 3 billion users

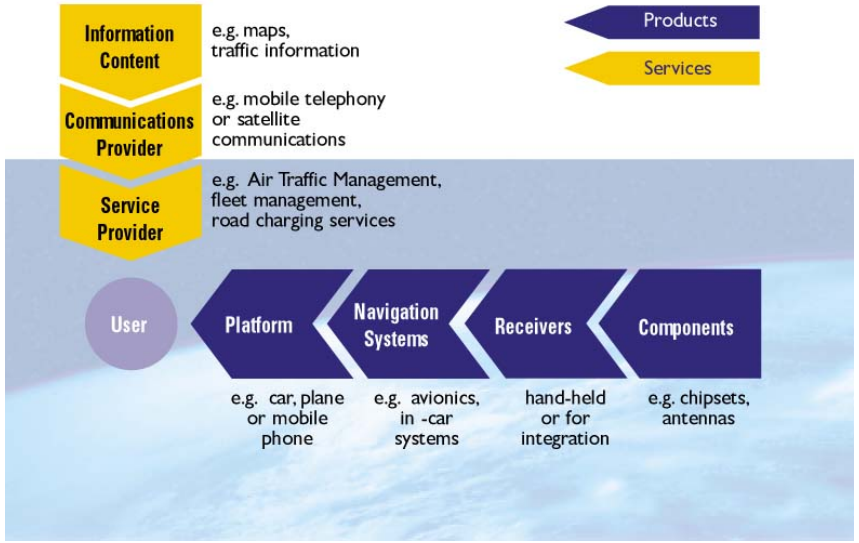


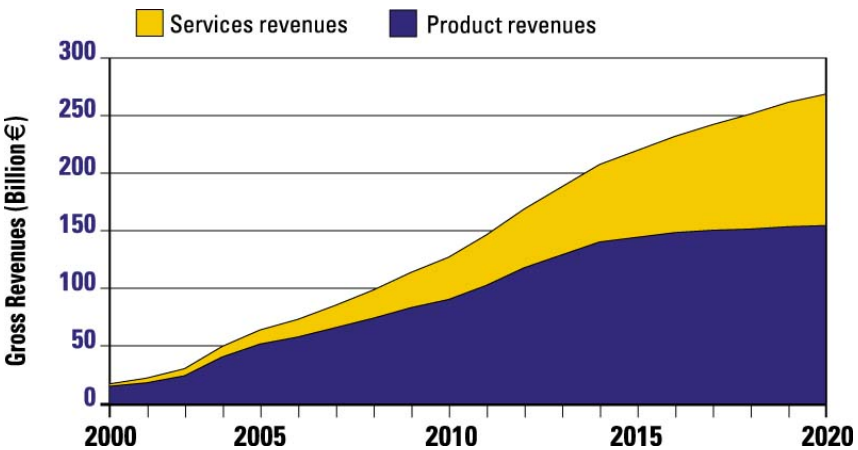
Products & Services

According to E.C.

In 2020, Worlwide Market

- **€275 - €300 billions**
- **at least 3 billion users**





Thank you for your attention

Questions ?

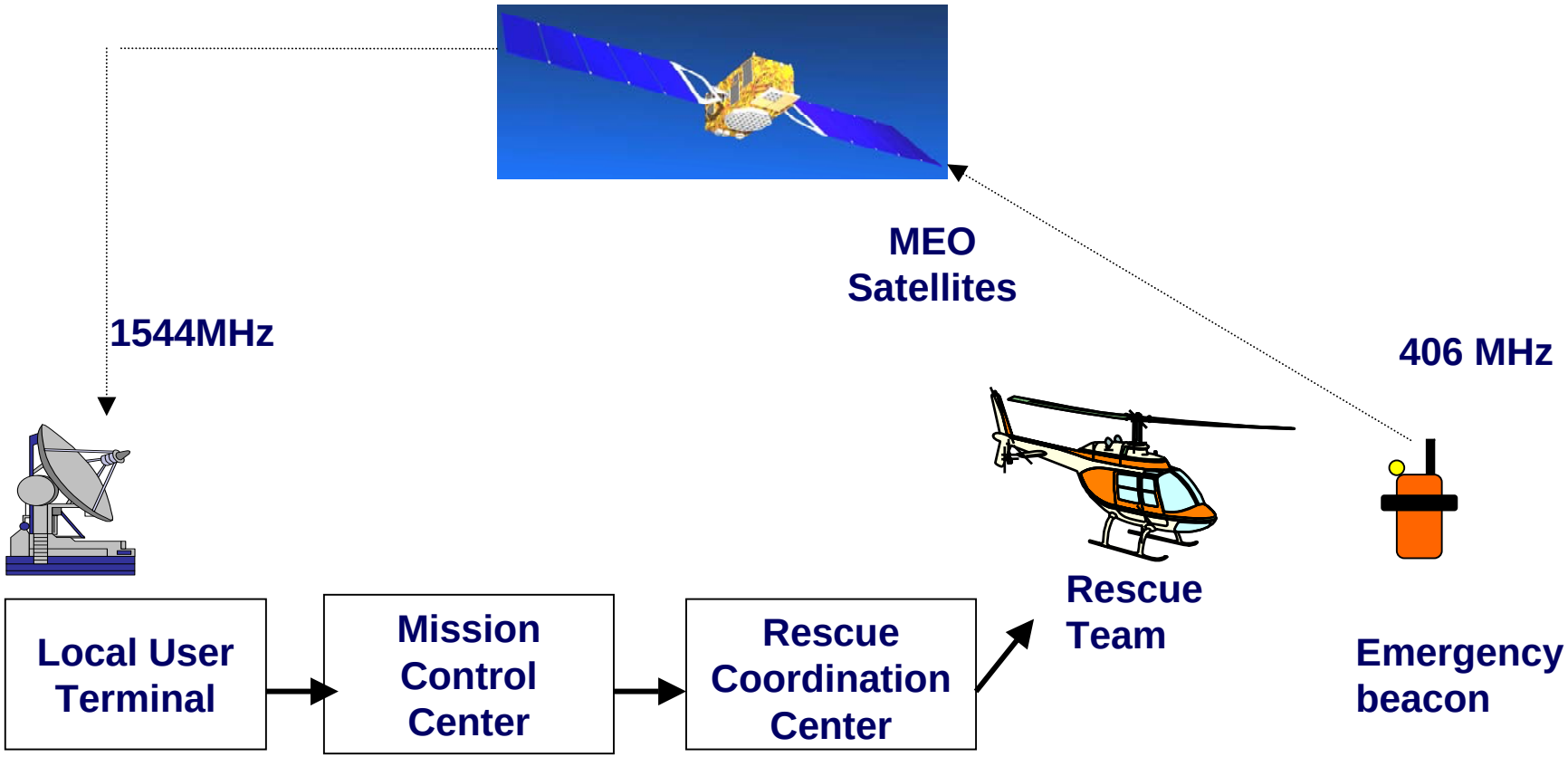
bernard.mathieu@cnes.fr

Galileo Reference Services

December ’04 Transport Council approved 5 services:

Navigation	**Open Access**	**Free to air; Mass market; Simple positioning and timing**	
	Safety of Life	**Open Service + Integrity and Authentication of signal**	
	Commercial	**Encrypted; High accuracy; Guaranteed service**	
	Public Regulated	**Encrypted; Integrity; Continuous availability**	
SAR	**Search and Rescue**	**Near real-time; Precise; Return link feasible**	

SAR/Galileo Description



Open service - positioning

Carriers	Single Frequency (L1)	Dual Frequency (L1+E5)
Ionospheric correction	Based on simple model	Based on dual-frequency measurements
Coverage	Global	
Accuracy (95%)	H: 15 m V: 35 m	H: 4 m V: 8m
Availability	99.8 %	

Safety of Life service (SoL)

SoL = Open Service + Integrity

Safety of Life service (SoL)

SoL = Open Service + Integrity

Carriers		Three Frequencies	
Ionospheric correction		Based on dual-frequency measurements	
Coverage		Global	
		Time Critical level	Non-time critical level
Accuracy (95%)		H: 4 m V: 8 m	H: 220 m
Availability of accuracy		99.8 %	
Integrity	Alarm Limit	H: 12 V 20 m	H: 556 m
	Time-To-Alarm	6 seconds	10 seconds
	Integrity risk	3.5×10^{-7} / 150 s	10^{-7}/hour
Continuity Risk		10^{-5}/15 s	10^{-4}/hour – 10^{-8}/hour
Certification/Liability		Yes	
Availability of integrity		99.5%	

As For Open service

Integrity

Public Regulated Service

Carriers		Dual-Frequency (E6 and L1)
Ionospheric correction		Based on dual-frequency measurements
Coverage		Global
Accuracy (95%)		H: 6.5 m V: 12 m
Integrity	Alarm Limit	H:20-V:35
	Time-To-Alarm	10 s
	Integrity risk	3.5×10^{-7}/150 sec *(Under evaluation)*
Continuity Risk		10^{-5}/15 s
Timing Accuracy w.r.t. UTC/TAI		100 nsec
Availability		99.8 %

Search and Rescue service

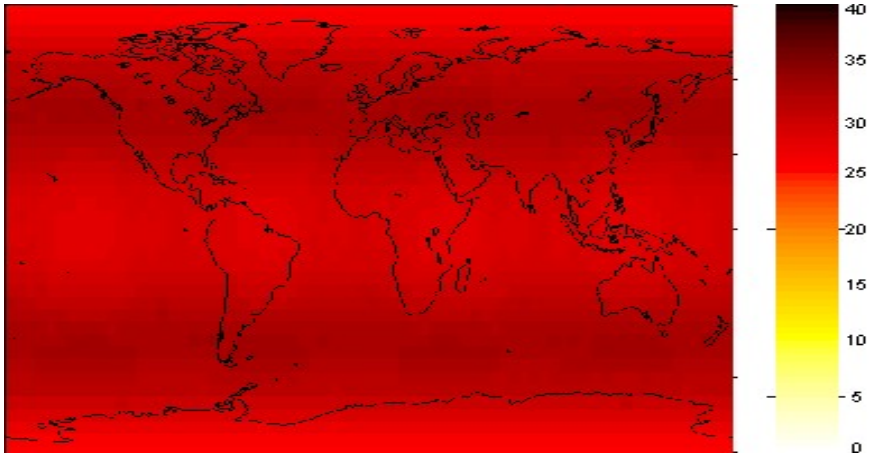
Capacity	Each satellite capable to relay signals from 150 simultaneous active beacons
Forward System Latency Time	Communications from beacon to SAR ground stations less than 10 min
Quality of Service	Bit Error rate < 10^{-5} for communication between beacon to SAR ground station
Acknowledgement Data Rate	6 messages of 100 bits each per minute
Availability	> 99.8%

- **Agreement that GPS/SAR, GLONASS/SAR and Galileo/SAR be interoperable**

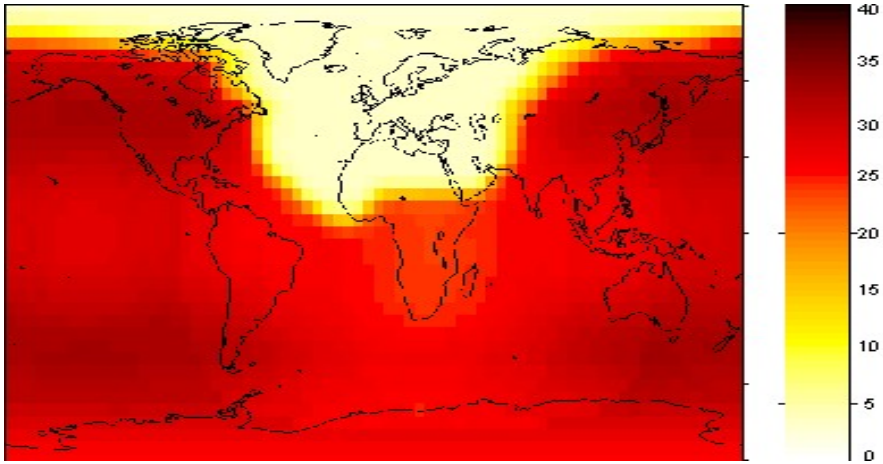
⇒ **SAR ground station can receive alerts from any of the three systems**

Combined Performances : GPS - EGNOS - GALILEO

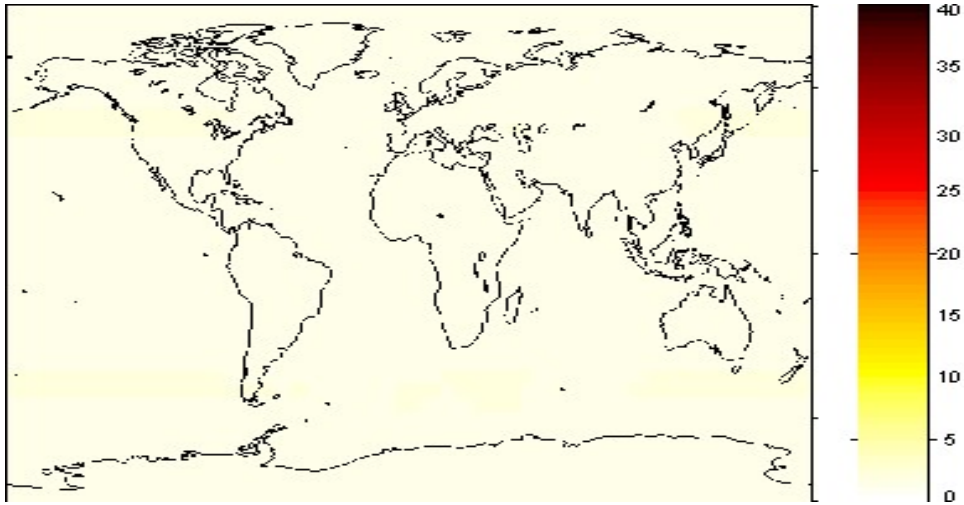
GPS (current)



GPS + EGNOS



GPS+EGNOS+Galileo



Horizontal positioning accuracy (95%)