

# GALILEO and R&D at UNIVERSITY

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Information Day - First Call for Proposals - Galileo

# Personal Introduction

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## Recent Professional Activities

- 2002 – 2005: Staff member at the European Space Agency, RadioNavigation Section.
- 2006 – onwards: Associate professor at Universitat Autònoma de Barcelona. Initiator and responsible of the SPCOMNAV group.

## Education

- MSc and PhD in Telecommunications Engineering, Universitat Politècnica de Catalunya, 1996, 2000.
- MBA, IESE, 2002.

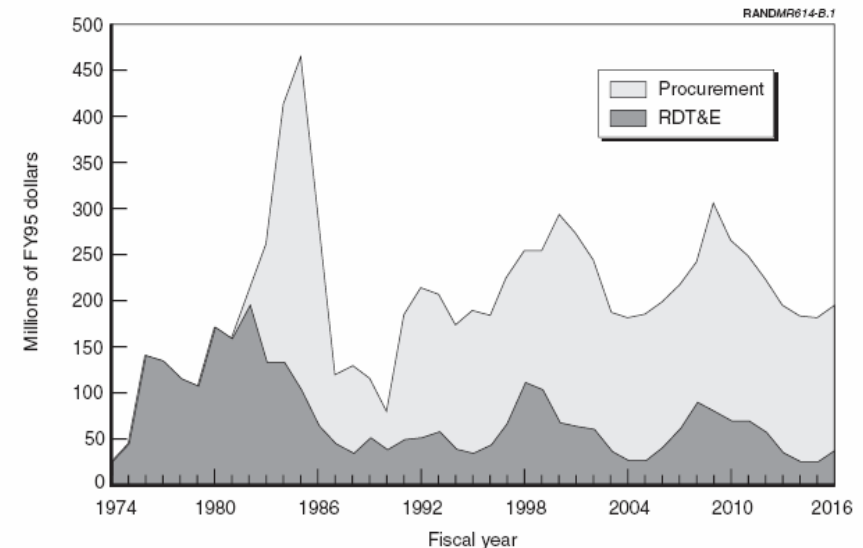
## Recent projects

- Platform for Indoor Positioning, ESA
- Automatic Traffic Management of UAV, CENIT

# The Long History of GPS (I)

There is a very long R&D trajectory underlying the current state of GPS:

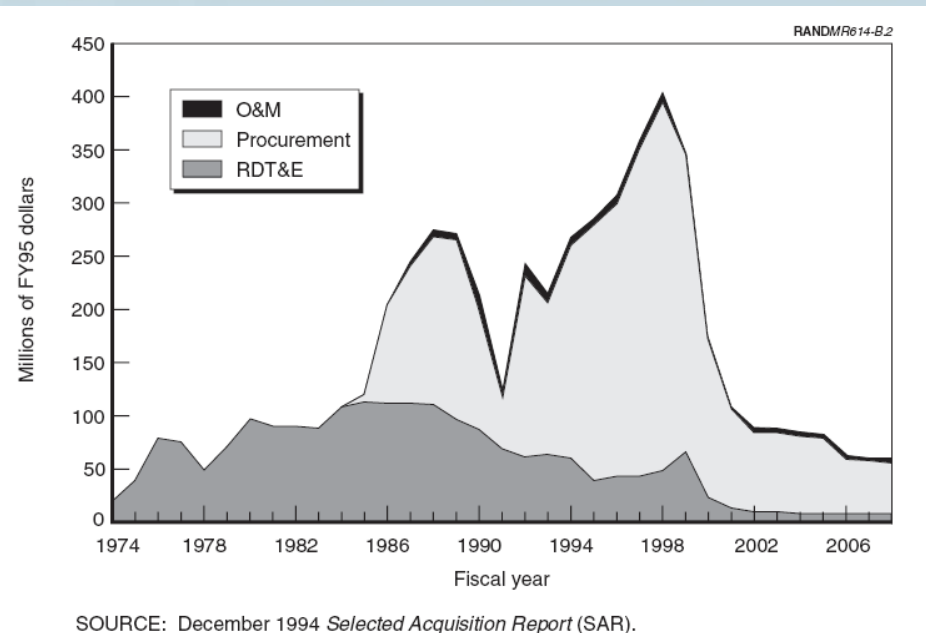
- 1963: Aerospace Corporation launches a study on navigation using a space system.
- 1964: Timation satellite system: experimentation on high-stability clocks and time-transfer capability.
- 1968: L vs. C band study, design of signal structure.
- 1974: First GPS satellite launched (GLOVE equivalent, 1974-1979)
- 1987: DoT assumes *responsibility* for civil use.
- 1990: Trimble's Initial Public Offering
- 1993: Initial Operational Capability (IOC)
- 1995: Full Operational Capability (FOC)



SOURCE: December 1994 Selected Acquisition Report (SAR).

GPS Satellite Costs over Time

# The Long History of GPS (II)

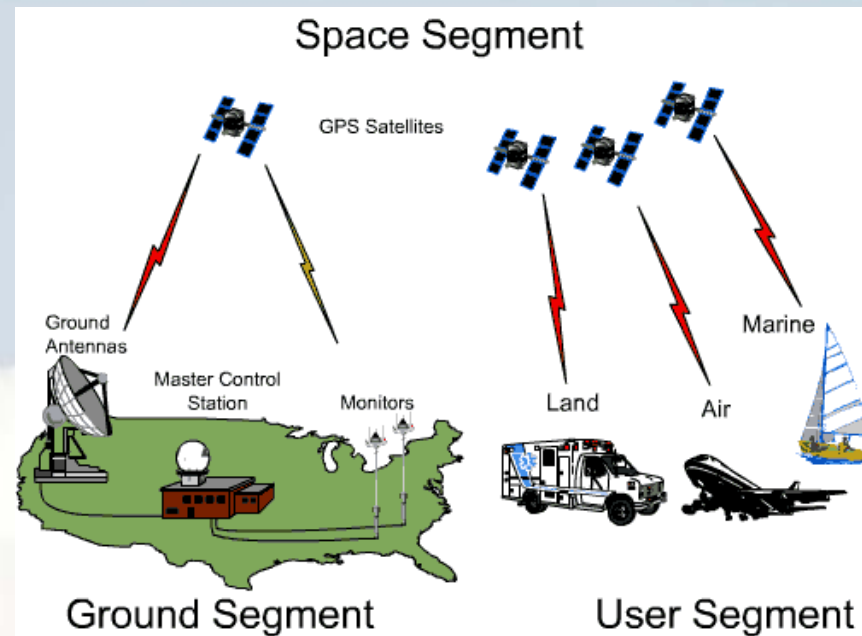


GPS User Equipment Costs over Time

- Breakthroughs cannot be planned, *by definition*. But, the correct conditions for them happening can be planned, indeed:
- Vision, a long-term goal.
- Continuous and stable push, investment.
- To generate **knowledge, technology** and **know-how**.

# Complex Systems

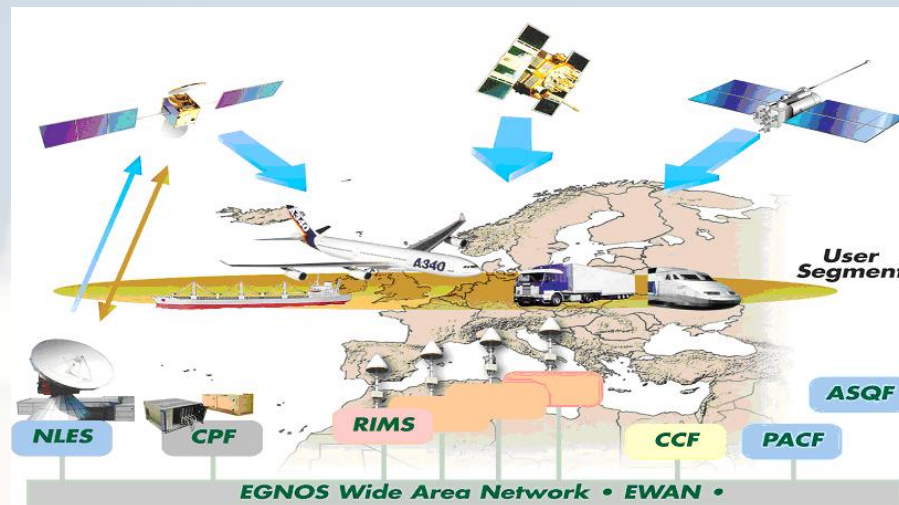
- ... and a lot of **knowledge**, **technology** and **know-how** needs to be generated because GNSS are complex systems: space, ground and user segments.



- Moreover, performance improvement is a persistent goal.
- **Applications** is the reason for meeting here. System development and applications cross-fertilize, but most applications arise from profit opportunities in the short term. In a properly regulated market, private initiative will exploit them.

# The European Way

- We are in the way of generating the knowledge, technology and know-how towards building a state-of-the-art GNSS, and creating and exploiting the possible applications.
- Late start, but fast advance: EGNOS, GSTB, GIOVE, competitive receiver manufacturers, cutting-edge R&D.
- Experience in all three segments plus applications.



- Nevertheless, the learning path is long and has to be walked. The experience of others shows the direction, but *evil is in the details*. Everyone's own experience needs to be acquired.

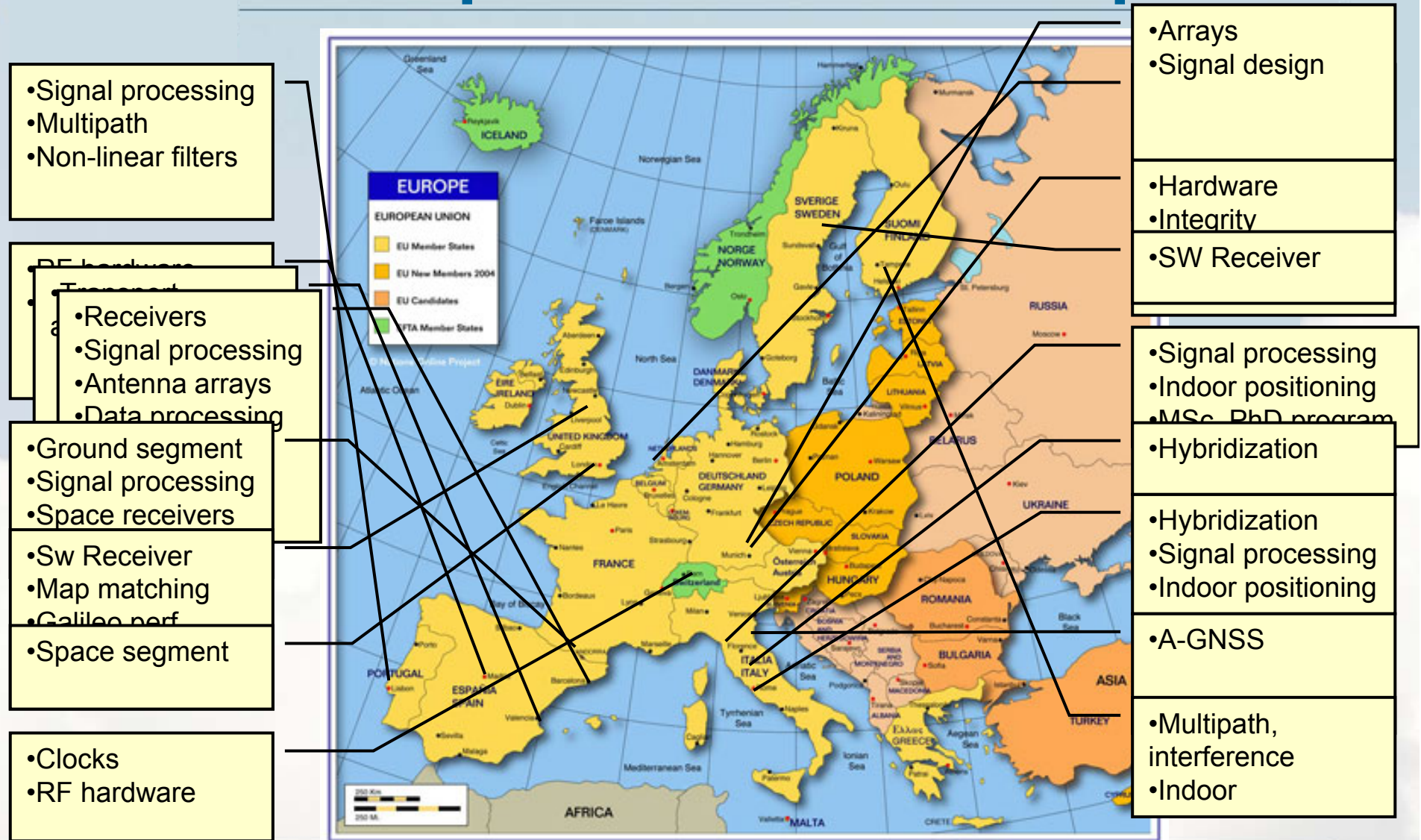
# EC – GSA Support

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- To create the continuous and stable push for the development and exploitation of GNSS.
- From an academic point of view,
  - **KNOWLEDGE** is
    - generated (Research)
    - shared (networking)
    - formalized (publications)
    - passed (teaching)
  - **TECHNOLOGY** is
    - transferred (Development, industry-university cooperation)
- Many Areas of the FP7 Galileo Programme fit in these objectives:
  - Area 7.4.1.3 Scientific Applications
  - Area 7.4.1.7 New and innovative applications and services
  - Area 7.4.3.1 Receivers
  - Area 7.4.3.2 Customised user terminal
  - Area 7.4.4.1 User needs and mission evolution
  - Area 7.4.4.2 Space and ground segment evolution



# European R&D Landscape





# Strengths and Weaknesses

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- ☑ Internationally recognized
  - ☑ 50% worldwide volume
  - ☑ Geographically distributed
  - ☑ All areas of expertise covered
  - ☑ Young active and innovative teams
  - ☑ Student support
  - ☑ Early involvement in applied research projects
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- ☒ Small teams
  - ☒ GNSS is in most cases a diversification opportunity
  - ☒ Universities participation in FP6: 4%
  - ☒ Non-GNSS background
  - ☒ Limited opportunities of high-level training, bias towards other degrees
  - ☒ Main conference and journal outside Europe
  - ☒ No equivalent to ION

# Opportunities and Threats

- ☑ To contribute to the design and development of a new system, with market potential.
- ☑ To foster the so desired entrepreneurship and spin-offs creation at universities.
- ☑ Strengthen the links between university and industry, ensuring a sufficient level of R&D private fun in the future (*durable integration*).
- ☑ To bring that 50% volume to a global dimension by
- ☑ competing globally and facilitating Europe-wide collaboration.
- ☑ Plenty of R&D topics:
  - new environments, applications and requirements
  - new signals
  - new hybridization possibilities
  - new technologies, from nano to quantum
  - etc.
- ☒ Further duplication of efforts
- ☒ Further fragmentation due to fierce internal competition
- ☒ Remain with the low university participation in FP (4%)
- ☒ Fallback to traditional R&D areas
- ☒ GNSS in being included in the agenda of other NoEs.

# Network of Excellence

- Instrument introduced in FP6:

NoE are designed to strengthen scientific and technological excellence on a particular research topic through the durable integration of the research capacities of the participants. They aim to overcome the fragmentation of European research by:

- \* gathering the critical mass of resources
- \* gathering the expertise needed to provide European leadership

- Over 170 NoEs have been created.
- Revisited and continued in FP7.
- In FP7, the number of NoEs has been substantially cut back in the first calls, with only 17 Networks being funded, as compared to 101 in FP6.
- Network of Excellence should be implemented provided that:
  - research capacity is fragmented in the (thematic) area being considered;
  - this fragmentation prevents Europe from being competitive at international level in that area;
  - the proposed integration of research capacity is likely to lead to higher scientific excellence and more efficient use of resources.

# The Case for a GNSS NoE

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- Research is specially fragmented
- Provide a common ground under the different sources of funding (with different objectives as well)
- GNSS are intrinsically multidisciplinary systems
- Successful applications will probably come from multidisciplinary teams
- Costly tools and testbeds
- Need for a medium-term support
- Creation of European think-tanks (e.g. Mitre corporation, Aerospace corporation ...)
- Support to international negotiations and regulation.
- Contribute to a consolidated long-term vision of the research and technological trends in GNSS

# NoE Activities

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- Joint Programme of Activities
  - Steering Board
  - Advisory Board; participation of all stakeholders
- Integration of distributed expertise
  - Personnel Exchange
  - Workshops and Conference
  - Summer School
  - Creation of common curricula
  - Development of largest platforms or testbeds
- Jointly Executed Research
  - Provide a pool of expertise for training and consultancy
  - Standardization
- Spreading of Excellence
  - Research and tutorial papers
  - Books
  - Training activities with long-term perspective

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# THANK YOU

Gonzalo Seco Granados  
Madrid, November 22, 2007