



# SATELLITE NAVIGATION APPLICATIONS

REALIZING THE **AMBITIONS** OF EU2020



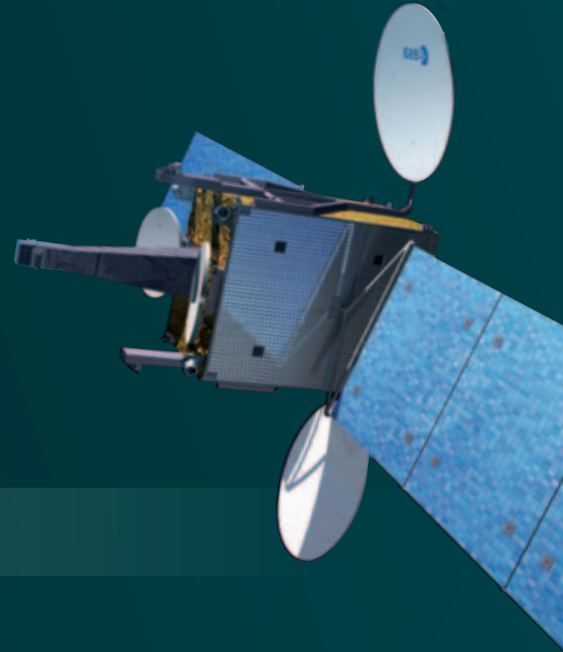


The present Position Paper is consecutive to the European Parliament Resolution of 7 June 2011 on Transport applications of Global Navigation Satellite Systems, and coincides with the preparation of the Common Strategic Framework and future “Horizon 2020” programme for research and innovation.

This paper will detail how **GNSS<sup>1</sup> applications** can act to **take up EU challenges** and to **reach EU2020 ambitions**. It will reiterate the necessity to make EU public funding accessible to satellite navigation applications Research and Development and states the budget required. It identifies the critical **GNSS technologies, applications and services** that will be boosted by EU public funding and provides a set of **recommendations** for the preparation of “**Horizon 2020**” in the GNSS R&D domain.

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<sup>1</sup> GNSS or satellite navigation application means application of satellite navigation, positioning and timing.



## LINE TO TAKE

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- > TO ENFORCE THE EUROPEAN PARLIAMENT RESOLUTION OF 7 JUNE 2011 ON TRANSPORT APPLICATIONS OF GLOBAL NAVIGATION SATELLITE SYSTEMS

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- > TO FOSTER EUROPEAN KNOWLEDGE & KNOW-HOW TO REACH EXCELLENCE IN THE GNSS FIELD

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- > TO GUARANTEE THE USE OF GALILEO AND EGNOS BY SECURING SUBSTANTIAL EU PUBLIC INVESTMENTS NOW IN THEIR APPLICATIONS DEVELOPMENT

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- > TO DRAMATICALLY AND QUICKLY INCREASE THE LEVEL OF EU PUBLIC FUNDING IN GNSS APPLICATIONS R&D TO A MINIMUM OF EUR 100-200 M PER YEAR TO OPTIMIZE EU BENEFITS AND NOT MISS THE WINDOW OF OPPORTUNITY FOR EUROPE

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- > TO SUPPORT THE EUROPEAN INDUSTRY IN INVESTING AND DEVELOPING CRITICAL GNSS TECHNOLOGIES, APPLICATIONS AND SERVICES

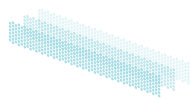
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# I. CHALLENGES & AMBITIONS FOR EUROPE

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The 21<sup>st</sup> century is the scene of a number of new societal challenges, all mutually dependent, these include: health, environment (pollution and climate change), agriculture, ageing population, security of citizen and consumer, public and civil protection, safe and efficient transport and mobility, citizen rescue, land management, energy (supply, security and efficiency), full employment, new consumer and citizens services, high-tech industry, business security, connected Europe, globalization, EU knowledge and know-how management and protection.

All these challenges actually have a common denominator: the economic health of Europe, namely growth, competitiveness and job creation in Europe. Along the same lines, the European Union has established the Europe 2020 strategy for a *Smart, Sustainable and inclusive growth*. The ambition for Europe is thus to deliver growth: *“developing an economy based on knowledge and innovation, promoting a more resource efficient, greener and more competitive economy, fostering a high-employment economy delivering social and territorial cohesion”*.

The role of European Institutions in the growth process is especially decisive at a time when all organizations are struggling to borrow, spend and invest due to the current economic situation. The need to provide stimulus to the economy and to ensure the competitiveness and return on investment in Europe is more important than ever.

Among the ‘growth-enhancing items’ identified in the EU2020 strategy, R&D and Innovation are part of the headline priorities: *“3% of the EU’s GDP should be invested in R&D”* is one of the five EU headline targets. The European Commission also put forward the “Innovation Union” flagship initiative *“to improve framework conditions and access to finance for research and innovation so as to ensure that innovative ideas can be turned into products and services that create growth and jobs”*.

Given the EU budgetary restrictions, as stated in the EU2020 strategy, the financial framework needs *“to be devised to maximize impact, ensure efficiency and EU value added”*.

This is the reason why the budget of the European Union must be carefully invested in research and innovation areas which have both a strong growth potential, and secondly, satisfy the political, societal and economic interest of Europe.

The domain of satellite navigation applications, becoming one of the pillars of 21-century society, offers a splendid opportunity among the most promising ones!



- ▶ **MOBILITY:** Navigation, road tolling and charging, Location Based Services, multi-modal transport services...
- ▶ **TRANSPORT:** Safety and efficiency increase for aviation, maritime and inland waterways, rail, road transport...

## SOME KEY GNSS APPLICATIONS



### TRANSPORT

Safety and efficiency increase for aviation, maritime and inland waterways, rail, road transport...

### ENVIRONMENT PROTECTION

Support to ecologic driving, support to car parking, waste control, low cost sensors for landscape monitoring, Land monitoring and Land Administration through Surveying and Mapping...

### HEALTH

Tracking and Tracing of medical goods, assistance to elderly and disabled people...

### AGRICULTURE

Precision Agriculture (steering guidance, farm logistics), Livestock management...

### MOBILITY

Navigation, road tolling and charging, Location Based Services, multi-modal transport services...

### SECURITY AND SAFETY

Pay As You Drive insurance, law enforcement, protection of IPRs, secure asset and person tracking, Unmanned Vehicles, integration of GNSS/SATCOM/GMES for civil security services, Customs and Freight monitoring...

### TIMING & NETWORKS

Synchronization of smart grids, telecommunications, banking and DVB networks...

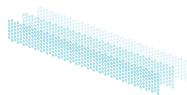


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## II. THE NECESSITY OF EU PUBLIC FUNDING FOR GNSS APPLICATIONS R&D

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### 1. EU public funding is necessary for Europe to reach excellence, be competitive in a global market and expect future commercial and societal benefits



GNSS Navigation, Location and Timing technology is fast becoming a mature commodity, but major improvements are however still required.

Without EU public support, such as the Framework Programmes for R&D, GNSS development will continue to follow the purely economic approach from industry, i.e. maximizing return on investment rather than technology innovation. Industries will naturally look to combine COTS<sup>2</sup> sensors and functions with minimal effort on R&D rather than improving the GNSS technologies ability to meet their evolving needs.

This approach jeopardizes both European Excellence in the GNSS field and the future take-up of European GNSS infrastructure.

**Need to foster European Knowledge & Know-how to reach Excellence in the GNSS field to maximize competitiveness, growth and job creation in Europe**

The commercial approach will place the American GNSS “GPS” as a standard, which constitutes a major risk for Galileo and for the EU economy as a whole as it would continue to rely on a GNSS service that it has no control of.

Therefore, EU public funding, through EU Programmes such as FPs, CIP and later Horizon 2020, is essential to ensure the use of European infrastructures and the generation of benefits for Europe. This will give the means to the EU industry to get a better share of the global GNSS downstream market. It is a question of business, growth, employment, return of EU investment in the European GNSS programmes. As an example, it is important to notice that most non-aviation applications of the EGNOS infrastructure exist solely from the stimulation of FP6 and FP7 projects.

Finally, the virtuous circle of EU public funding through EU Programmes also has to be underlined: through these programmes, SMEs, large companies, Academia and research Institutes from EU countries and wider can meet and work together. To link people and brains stimulate creativity and is a perfect springboard for new ideas and market opportunities.

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<sup>2</sup> Commercial Off-The-Shelf



A lack of public support for R&D effort would significantly limit the potential of innovation and growth as well as European ambitions in GNSS.

It is worth stressing at this stage the huge risk of the absence of FP7 GNSS applications R&D budget until 2014 – the dedicated FP7 budget being exhausted due to extensive cuts leaving only EUR 100 million in the GNSS FP7 budget line, instead of the EUR 350 million consented at the outset.

The European Parliament Resolution of 7 June 2011 on “Transport applications of Global Navigation Satellite Systems – short- and medium term EU policy”<sup>3</sup> however revives hope among European downstream Research and Innovation actors<sup>4</sup>.

Among other things, the European Parliament “calls on the Commission to ensure that the EUR 100 m likely to be underspent in payment appropriation for research within the Seventh Framework Programme is made available for the development of GNSS applications.” ▶▶▶

**Need substantial EU public funding to be invested by now in GNSS applications R&D with the prerequisite to make use of Galileo and EGNOS**



<sup>3</sup> [European Parliament Resolution of 7 June 2011 on “Transport applications of Global Navigation Satellite Systems – short- and medium term EU policy”](#)

<sup>4</sup> Please see GS related Press Release [“New Hope for European GNSS Downstream Industry Development”](#)



- ▶ **ENVIRONMENT PROTECTION:** Support to ecologic driving, support to car parking, waste control, low cost sensors for landscape monitoring, Land monitoring and Land Administration through Surveying and Mapping...
- ▶ **AGRICULTURE:** Precision Agriculture (steering guidance, farm logistics), Livestock management...



## 2. GNSS applications constitute one of the most promising markets for Europe

GNSS-based positioning/timing technologies and services must be part of the long-term growth priorities of the European Union. As being part of the solutions to the next generation of challenges<sup>5</sup>, GNSS technology can indeed contribute strongly to all major EU policies.

**GNSS-based location/timing technologies and services can contribute to meeting all major EU challenges**

Furthermore, as already stressed during the Galileo Services Manifesto<sup>6</sup> awareness campaign, GNSS applications and services development can bring about both immediate benefits, namely creation of new industrial activities in Europe and, with them, hundreds of thousands of jobs, as well as enhancing the day to day life and wellbeing of Europe's citizens – the core vocation of GNSS applications is fully in line with the Lisbon Treaty.

Besides, GNSS applications and services is one of the most promising sectors in terms of European growth. The global GNSS market amounted indeed to around EUR 130 billion in 2010 and is expected to reach around EUR 240 billion by 2020.

**EU Budget would have a significant catalytic effect in GNSS field**

This corresponds to a substantial growth rate of +11% per year<sup>7</sup>.

EU public funds invested in GNSS applications R&D would have a significant catalytic effect on the enabled GNSS market development, thus maximizing the efficiency of EU budget. Indeed, with only a small part of EU budget being dedicated towards GNSS applications R&D the EU would see an important and decisive impact on the GNSS market on one hand, and on the other hand would generate a snowball effect fertilizing further applications and domains with GNSS technology.

**EUR 1 invested by Europe in GNSS application R&D generates about EUR 100 of European turnover<sup>8</sup>**

The 2010 FP7 budget for GNSS R&D amounted to EUR 30.5 million. Assuming that EU27 Member States together made a similar contribution at national level and that two-thirds of investments in GNSS R&D come from the private sectors, the total EU investment in GNSS applications R&D rose around EUR 180 million in 2010 – private and public sectors.

Considering also that the EU Gross Domestic Product of GNSS applications and services amounted to around EUR 26 billion in 2010, thus, by only considering orders of magnitude, the rate 'EU GNSS GDP / Investment in GNSS applications R&D' corresponds to a 100-factor (and close to a 1000-factor regarding FP7 investments).

<sup>5</sup> EU logistics, EU electronic car/road systems, EU CO<sub>2</sub> reduction, EU congestion, EU security, EU training/education, EU internal market development, EU digital agenda, EU elderly support, EU new social media, Integration EU GNSS/SATCOM/GMES system/services, EU Space infrastructure tax system...

<sup>6</sup> Galileo Services [Manifesto for a More Committed Europe towards the Development of GNSS Applications](#)

<sup>7</sup> GSA GNSS Market Study, October 2010

<sup>8</sup> Figures to be considered as orders of magnitude

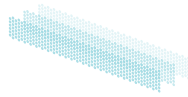






- ▶ **SECURITY AND SAFETY:** *Pay As You Drive insurance, law enforcement, protection of IPRs, secure asset and person tracking, Unmanned Vehicles, integration of GNSS/SATCOM/GMES for civil security services, Customs and Freight monitoring...*
- ▶ **HEALTH:** *Tracking and Tracing of medical goods, assistance to elderly and disabled people...*

### III. EU PUBLIC FUNDING LEVEL REQUIRED FOR MAXIMIZING THE BENEFITS FOR EUROPE



As stressed in the EU2020 strategy, “*R&D spending in Europe is below 2% [of GDP], compared to 2.6% in the US and 3.4% in Japan*”. The Barcelona targets as well as the national targets specify that the financing of R&D should be broken down between public and private sectors in the ratio of one-third public to two-thirds private<sup>9</sup>.

In 2011 the EU public investment in GNSS applications R&D is expected to be up to 0.1% of EU GNSS GDP which is well below the required threshold. It is worth noticing that if the FP7 budget dedicated to GNSS applications R&D is not restored, this rate will come very close to zero until 2014.

**Strong Need to dramatically increase the EU public fund for GNSS application R&D**

According to the Barcelona and Europe 2020 targets, the level of EU contribution to investments in GNSS applications R&D can also be computed – computation performed for 2010 and 2020 (cf. figures page 10).

**To ensure EU benefits would require a yearly EU public support to GNSS applications research growing from EUR 100 m in 2011 to EUR 200 m in 2021**

Increased levels of investment would enable Europe to assure its position in the GNSS downstream market, by boosting the current 20%-EU market share of this market to reach the usual 33% of other High-Tech sectors. Such a 13-point increase of the European market share would represent in 2020 the creation of more than 400 000 additional jobs<sup>10</sup>. ▶▶▶

<sup>9</sup> Cf. “A more research-intensive and integrated European Research Area - Science, Technology and Competitiveness key figures report 2008/2009”, EC DG-RTD, EUR 23608 EN

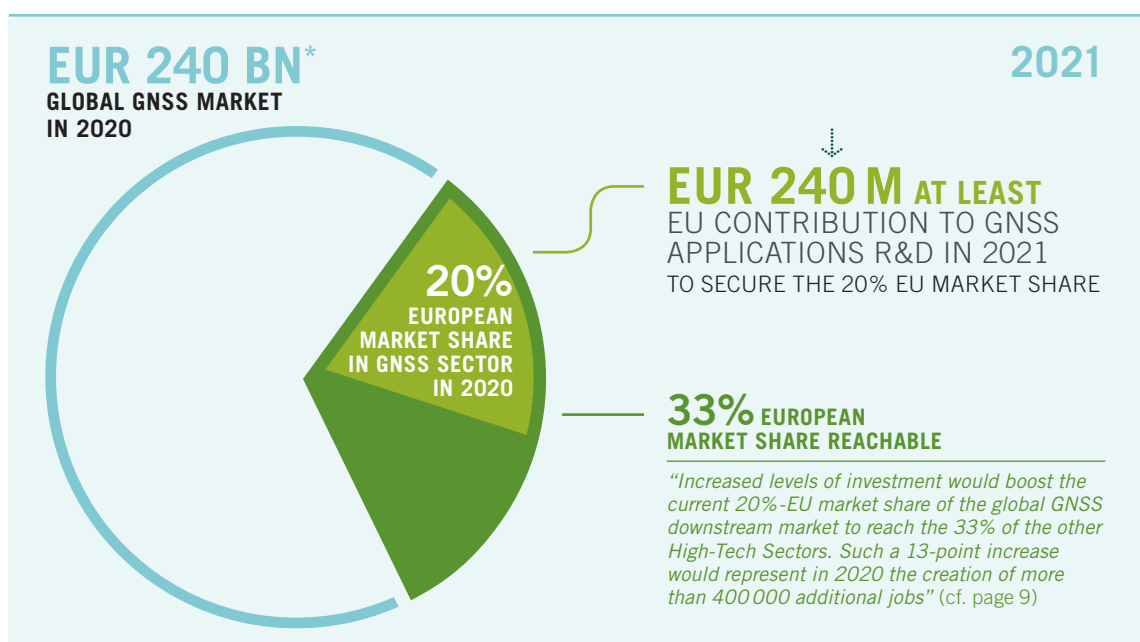
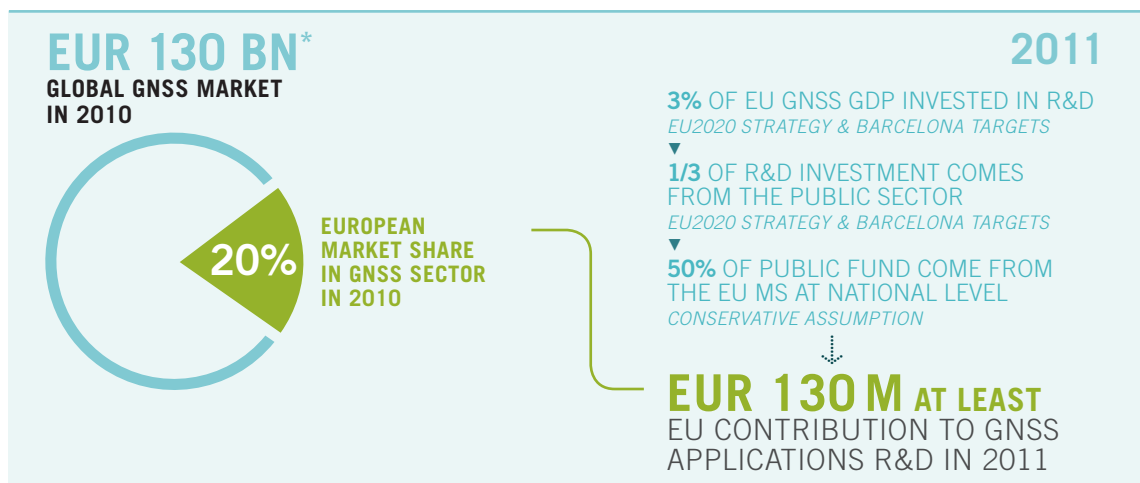
<sup>10</sup> by assuming the average annual man cost at EUR 75 000

►►► It is also important to note that, contrary to countries like the US, China or Russia, the EU lacks a large military applications R&D programme, which helps to underpin the investments of companies in commercial and civil applications.

Given European investments in other sectors<sup>11</sup> and investment of other continents in GNSS application R&D<sup>12</sup>, a level of EU public investment rising between EUR 100 million and EUR 200 million per year is an essential investment.

<sup>11</sup> Several EUR 100s m are wisely invested by Europe every year to support the development of Internet applications  
<sup>12</sup> According to EC estimates, US public funded programs reach between EUR 200 m and EUR 500 m per year

## MINIMUM LEVEL OF EU PUBLIC FUND REQUIRED FOR GNSS APPLICATIONS R&D FROM 2011 TO 2021



\* GSA estimates



## IV. THE CRITICAL GNSS TECHNOLOGIES, APPLICATIONS & SERVICES

With new infrastructures imminent, such as Galileo, or in expansion, like EGNOS, the GNSS downstream market is a truly burgeoning market, right at the beginning of its growth phase. GNSS performances improvement and hybridization will offer a plethora of new opportunities ensuring job creation as well as European citizens' well-being. Improved GNSS technology will enable its integration in new systems and its use in an innovative way.

European GNSS downstream industry has already acquired significant knowledge and expertise in GNSS technology and services and needs support to further develop user segment and cutting-edge applications, and reach Excellence in the GNSS field.

**The main challenges of GNSS-based services at user level for the forthcoming years are reliability, robustness, security, and high performance**

Some demanding applications requirements are not satisfied yet:

- **Integrity, confidence, reliability, robustness and security:** e.g. protection against interferences/jamming, spoofing and multipaths enabling automation; authentication; liability/safety/governmental critical services;
- **Availability:** e.g. constrained environment, GNSS coverage, indoor;

- **Continuity:** e.g. enabling seamless indoor/outdoor services;
- **High accuracy:** e.g. enabling scientific and professional applications, such as cadastre or Advanced Driver Assistance Systems applications.

R&D effort is therefore still required and will focus on achieving the best combination through suitable hybridisation techniques and design of advanced integrity algorithms considering/given application specific constraints – whether in terms of positioning/timing performances or cost – of:

- **GNSS signals and services** (GPS, Galileo, Glonass, Compass, SBAS, GBAS, pseudolites...)
- **Positioning Sensors and ICT, Information and Communication Technologies** (3G/4G/LTE, Wi-Fi, RFID, DAB/DVB, Radar, odometer, clock, gyroscope, accelerometer, magnetic compass (MEMS)...) )

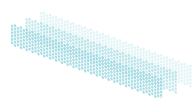
In general, the development of a reliable *Ubiquitous Positioning System*, assuring continuity from indoor to outdoor, is one of the main R&D priorities for allowing a real penetration of Galileo into the positioning market.

It is worth stressing the R&D activities actually impact on many domains: e.g. multi-constellation GBAS and combined GPS/Galileo/SBAS for aviation, new or improved road telematic services, freight and train management, ship docking support, fast fix and continuous availability of Location Based Services, automation for agriculture, internet of things, integration with social media, sub-microsecond synchronization, etc.



► **TIMING & NETWORKS:** Synchronization of smart grids, telecommunications, banking and DVB networks...

## V. CRUCIAL IMPORTANCE OF USERS' INVOLVEMENT IN EU PROJECTS



The lack of user acceptance of GNSS technology is a major barrier that must be overcome to ensure business success. To address this issue the user has to be aware of real opportunities offered by incoming GNSS services the EU is going to promote, by having a clear understanding of costs, benefits, financial savings, advantages and drawbacks – e.g. privacy infringements – coming from the introduction of a new GNSS service.

Communication can show to the user that GNSS has not to be considered as a bonus/optional technology but as a technology with a real potential for revolutionizing citizens life.

**Pilot Projects are particularly relevant awareness and stimulation tools to favour the penetration of GNSS technology in professional and governmental services**

### IMPACT OF USERS' INVOLVEMENT IN EU PROJECTS

- > USER ACCEPTANCE OF GNSS TECHNOLOGY, APPLICATIONS AND SERVICES
- > BETTER UPTAKE OF THE GNSS TECHNOLOGY
- > STIMULATION OF THE GNSS DOWNSTREAM MARKET

Professional and governmental users are often reluctant to introduce innovative tools in their workflow, due to the need of changing their well-established internal rules and procedures, often based on legacy systems. The monetary benefits for stakeholders introduced by new GNSS solutions – e.g. less fuel consumption, improved working efficiency, data security – and better working conditions for final operators can be efficiently demonstrated in an operative context.

## HORIZON 2020

# THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION

## “GALILEO SERVICES” RECOMMENDATIONS FOR HORIZON 2020 ACTIVITIES IN THE GNSS DOMAIN

Galileo Services provides a list of Recommendations for “Horizon 2020” to support GNSS applications Research and Innovation in Europe, to tackle societal challenges, to achieve excellence, to encourage industry take up and to create industrial leadership so as to generate sustainable economic growth, new jobs and to optimize the use of EU GNSS systems funded by EU public money.

### 1. GNSS technologies and services

- > To support European Industry in investing and developing critical technologies, applications and services based on ultimate user requirements, namely security, reliability, robustness and high performance
- > To pursue Research aiming at improving GNSS performances, mainly multi-constellation multi-sensor receiver\*
- > To encourage the emergence of innovative ideas, whatever the domain is, through very open calls for proposals

### 2. Enabling Activities to support market penetration and development

- > The necessity of adequate value added content (e.g. high precision or indoor digital maps) must not be forgotten to leverage the development of applications

- > Usual enabling activities must be pursued :
  - Market analyses and business cases, with a focus on new uses of GNSS
  - Promotion and awareness activities
  - Standardization in relevant domains
  - Support for Certification process for safety/security critical application
  - Demonstrations and Operative Pilot Projects, focusing on implementation of GNSS solution tightly integrated in the real operative user workflow, involving all value chain actors
  - Utilize European industry locomotives, as well as the innovation capacity of SMEs, in the various domains to penetrate markets and to spin off new business opportunities
- > International cooperation must be carefully established by: favoring EU industry interests within bilateral discussions between EU and non-EU countries, involving non-EU partners only providing either opportunities for market penetration beyond the EU boundaries or specific skills and/or technology not available in Europe, and setting up adequate IPRs policy.



\* Please refer to the related part for further details



### 3. Other support activities from European Institutions

- > Expectations from massive procurement from the public sector as well as regulations would also radically boost private investment in GNSS technology. Such tools are widely exploited in America, Russia and Asia.
- > Regional and national procurement plans would benefit to be coordinated at EU level.
- > A close dialogue has been established between the European Institutions and GNSS downstream industry, represented by Galileo Services, in the last years. In this frame crucial issues such as licensing rules, Intellectual Property Rights policy or international cooperation can be discussed. This initiative must be pursued and even reinforced.

## LINE TO TAKE

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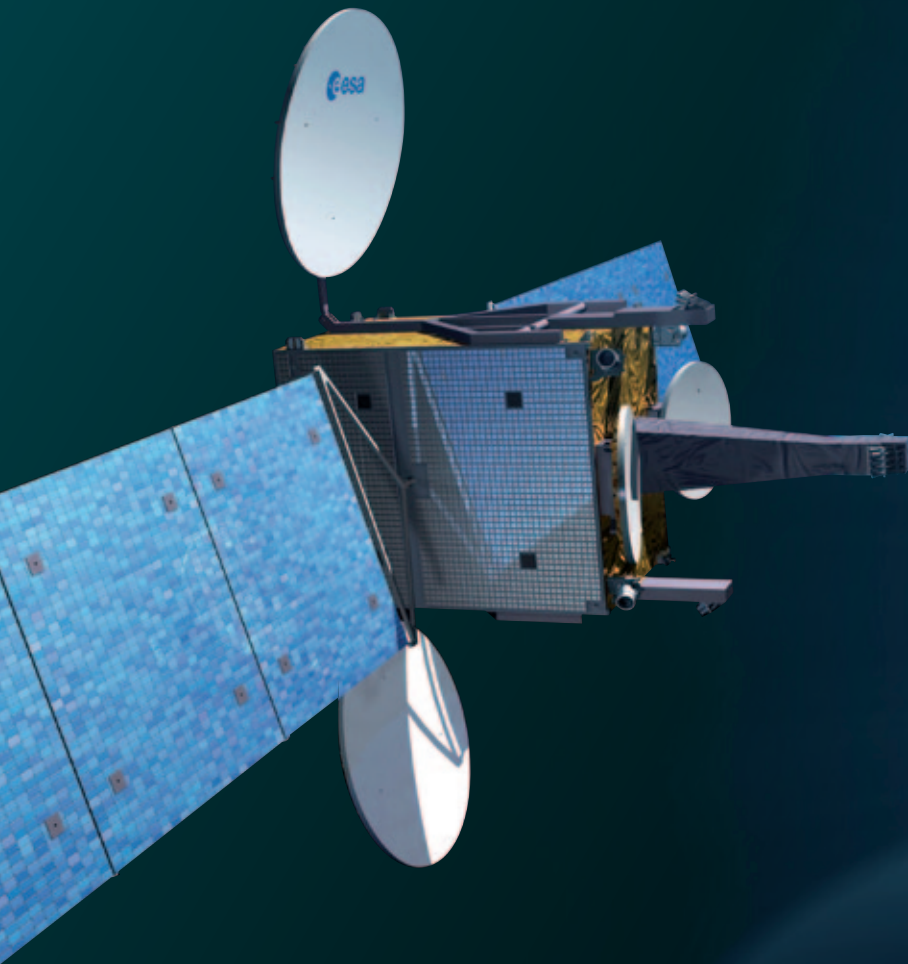
- > **TO ENFORCE** the European Parliament Resolution of 7 June 2011 on Transport applications of Global Navigation Satellite Systems
- > **TO FOSTER** European Knowledge & Know-how to reach Excellence in the GNSS field
- > **TO GUARANTEE** the use of Galileo and EGNOS by securing substantial EU public investments now in their applications development
- > **TO DRAMATICALLY AND QUICKLY INCREASE** the level of EU public funding in GNSS applications R&D to a minimum of EUR 100-200 m per year to optimize EU benefits and not miss the window of opportunity for Europe
- > **TO SUPPORT** the European Industry in investing and developing critical GNSS technologies, applications and services



## ABOUT GALILEO SERVICES

Galileo Services is a non-profit organization founded in 2002 as a major partner for the Galileo programme and GNSS application development. Having merged with OREGIN (the Organisation of European GNSS Industry of equipment and services) in 2009, Galileo Services network represents now more than 180 member organisations (from Europe, North America and Asia) ranging from SMEs to large companies.

The organization's mission is to support and assist the Programme implementation and to stimulate GNSS downstream technology and business development (terminals, applications and services) as well as contribute to partnerships, advertise EU Industry competencies all over the world, support on-need EU institutions and express industry views.



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