



# GNSS MARKET REPORT

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GSA GNSS Market Report – Issue 1



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## Methodology and sources of information

This market report has been produced using the GSA's\* market monitoring and forecasting process. The underlying forecasting model is based on advanced econometric techniques. An extensive set of variables is used to model scenarios based on key assumptions. These assumptions are cross-checked through an iterative process involving renowned experts in key areas of each market segment. In addition, a consistency check is performed for each segment by comparing the model's results with the most recent market research reports from independent sources. Nevertheless, due to the inherent uncertainties in long term forecasting, a margin of error is unavoidable.

The model makes use of publicly available information including the following sources: Eurostat, US National Transportation Statistics, International Road Assessment Programme (iRAP), United Nations public information, International Telecommunication Union (ITU), Nations Online, Boeing, Airbus, Federal Aviation Administration, Flight Insight, and the Food and Agriculture Organisation (FAO).

## Disclaimer

The information provided in this report is based on the GSA's best estimates and forecasts at the time of publication\*\*. Although the GSA has taken the utmost care in checking the reasonableness of assumptions and results with the support of industry experts, the GSA cannot guarantee the accuracy of the information presented and hence does not take any responsibility in the further use made of the content of this report.

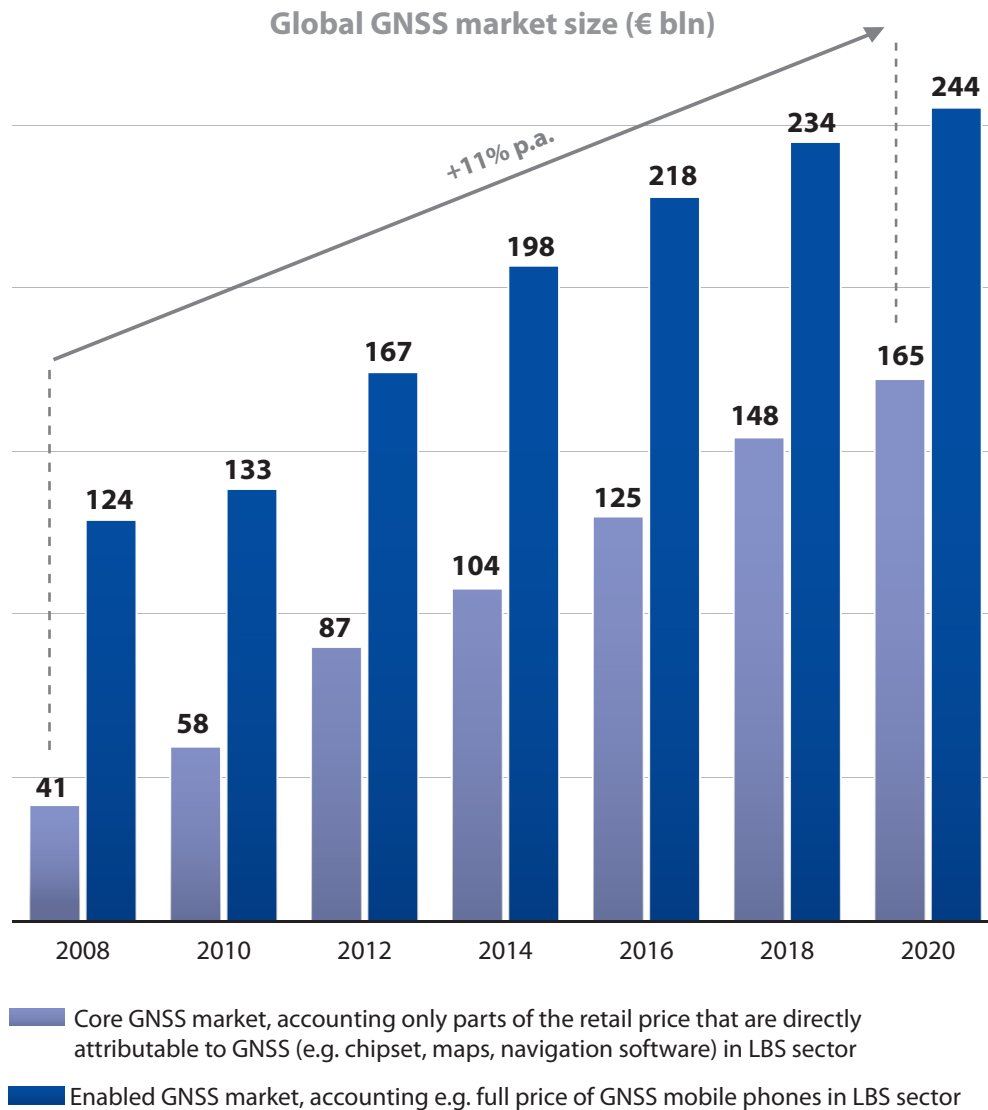
## Feedback and further information

We are looking forward to receive any comments and feedback. If you have any questions regarding this report, please contact GSA market development at: [market@gsa.europa.eu](mailto:market@gsa.europa.eu)

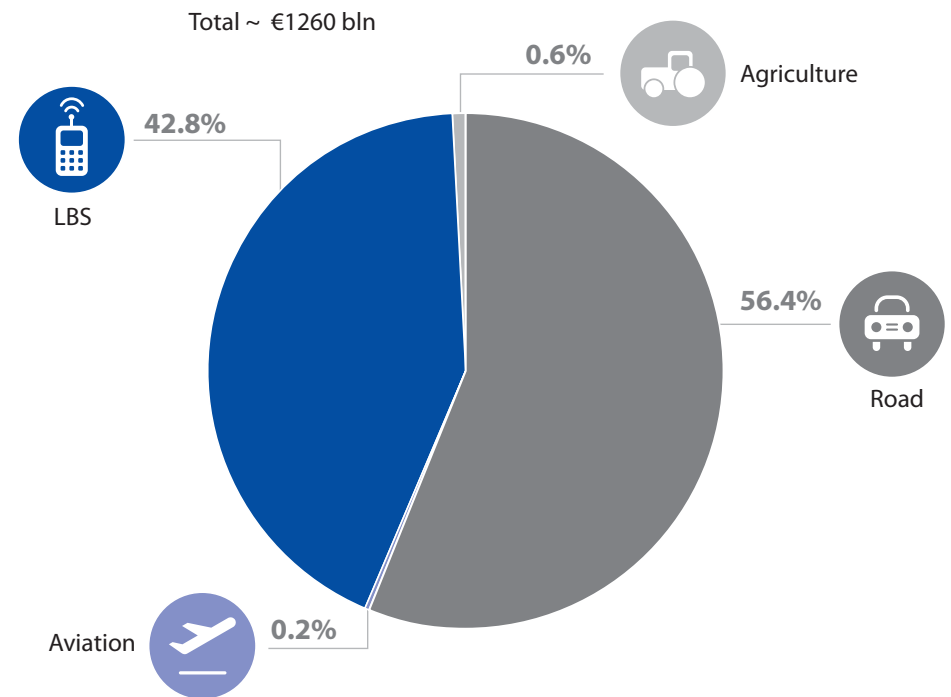
\* **About the GSA:** The European GNSS Agency (GSA) is an agency of the European Union. One of its missions is to support the European Commission in promoting the market exploitation of Galileo and EGNOS, keeping Europe at the forefront of the satellite navigation sector.

\*\* **Previous reports:** In the past GSA has communicated various market forecasts through different channels including GSA's own website and conference presentations. The current publication is based on the latest and most comprehensive analyses and takes into account the most recent trends and the most recent information with respect to the Galileo deployment. In addition the period analysed has been extended until 2030 and market definition has been clarified.

## The market for GNSS will grow significantly over the next decade



Global core GNSS market by segment (cumulated revenues 2010-2020)



- ▶ The worldwide GNSS market is growing fast and revenues are expected to increase at a 11% CAGR over the next decade.
- ▶ The total enabled GNSS market size in 2020 is estimated at €244 bln, the core global GNSS market is estimated at €165 bln.
- ▶ LBS and Road will be the market sectors with the highest revenue generation.

## Market definitions

### GNSS market

- ▶ The GNSS market is the market of products and services using GNSS based positioning and navigation as a significant enabler.
- ▶ When assessing the size of the market for multi-purpose products like mobile phones, a correction factor is taken into account to reflect only the (retail) value of the parts related to positioning and navigation, for example:
  - ▶ **PND:** 100% of retail value as GNSS is the key enabler;
  - ▶ **GNSS-enabled phone:** For the core market, only the value of chipsets, maps and navigation software is counted. For the enabled market, the full retail value of the phone is counted;
  - ▶ **Subscription to a GNSS-enabled location based service** such as local search: 100% of retail value;
  - ▶ **Precision agriculture system:** only the retail value of the GNSS receivers, the maps and the navigation software is counted.

### GNSS core market vs. enabled market

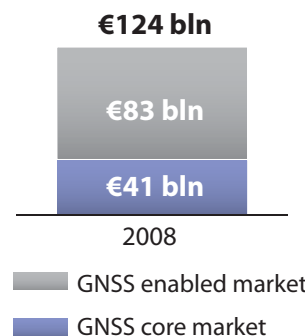
The **core market** include only the parts of the retail value of the product and services that are attributable to GNSS, e.g. chipset, maps, navigation software.

The **enabled market** includes the full retail value of the GNSS-enabled platform, e.g. in LBS full price of the mobile phone.

*\* not included in all exhibits*

*\*\* includes non-EU European countries*

### Global GNSS market size



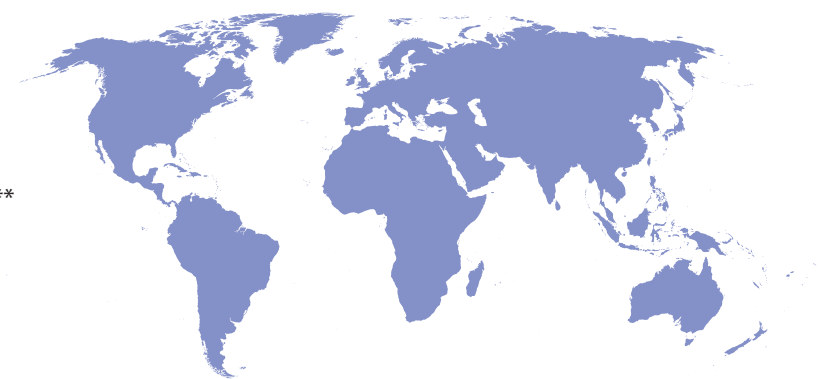
### Four market segments covered

The following segments have been selected as they represent the largest volume of users and/or public benefits.

- ▶ **Road:** including PND and in-vehicle systems
- ▶ **LBS:** including GNSS-enabled mobile phones and services
- ▶ **Agriculture:** including low and high technology
- ▶ **Aviation:** including GNSS devices for commercial and general aviation

### Global geographic coverage

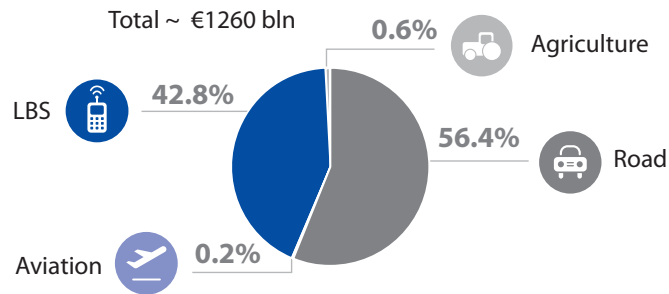
- ▶ European Union (EU-27)
- ▶ North America
- ▶ China\*
- ▶ Japan\*
- ▶ Rest of the world\*\*



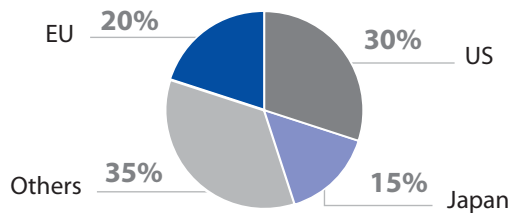
# Global: Core GNSS market to reach €165 bln in 10 years

- ▶ GNSS device shipments will grow on average 10% per year over the next decade reaching 1.1 bln shipments by 2020.
- ▶ Despite significant growth since 2006, significant untapped potential remains. The overall worldwide GNSS revenues for civil applications are expected to grow on average by 11% per year reaching €165 bln in 2020 (core market), of which €32 bln is generated in the EU.
- ▶ LBS and Road will be the market sectors with the highest revenue generation.

## Core GNSS market by segment (cumulated revenues 2010-2020)

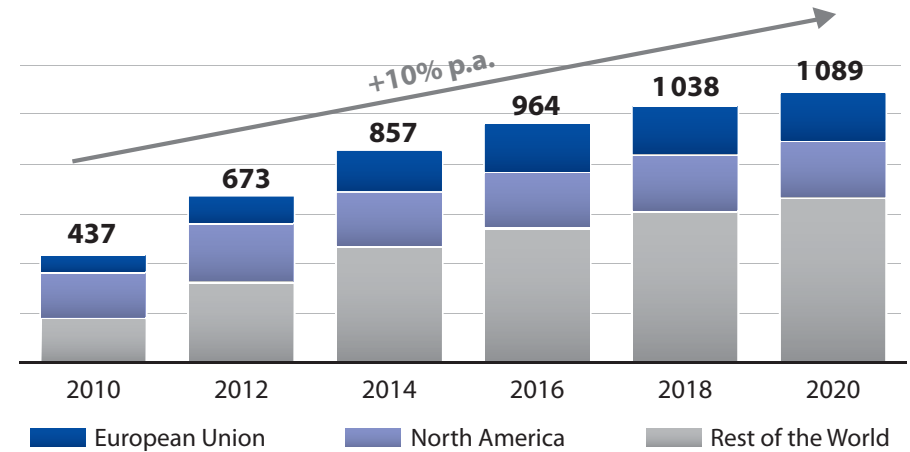


## GNSS market share by companies' origin (2009)\*

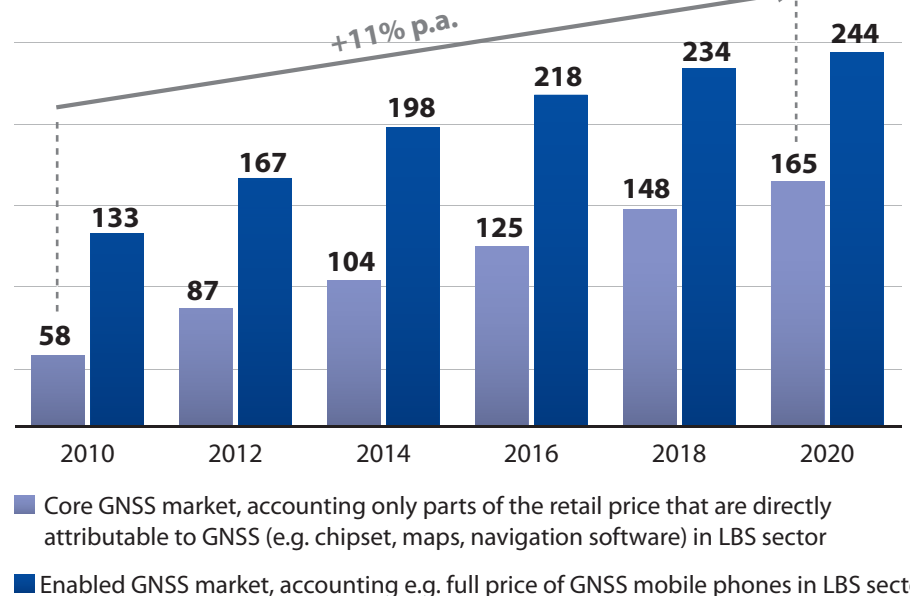


\*This analysis is based on the turnover of the top 15 of companies involved in GNSS.

## Shipments of GNSS devices worldwide (mln units)



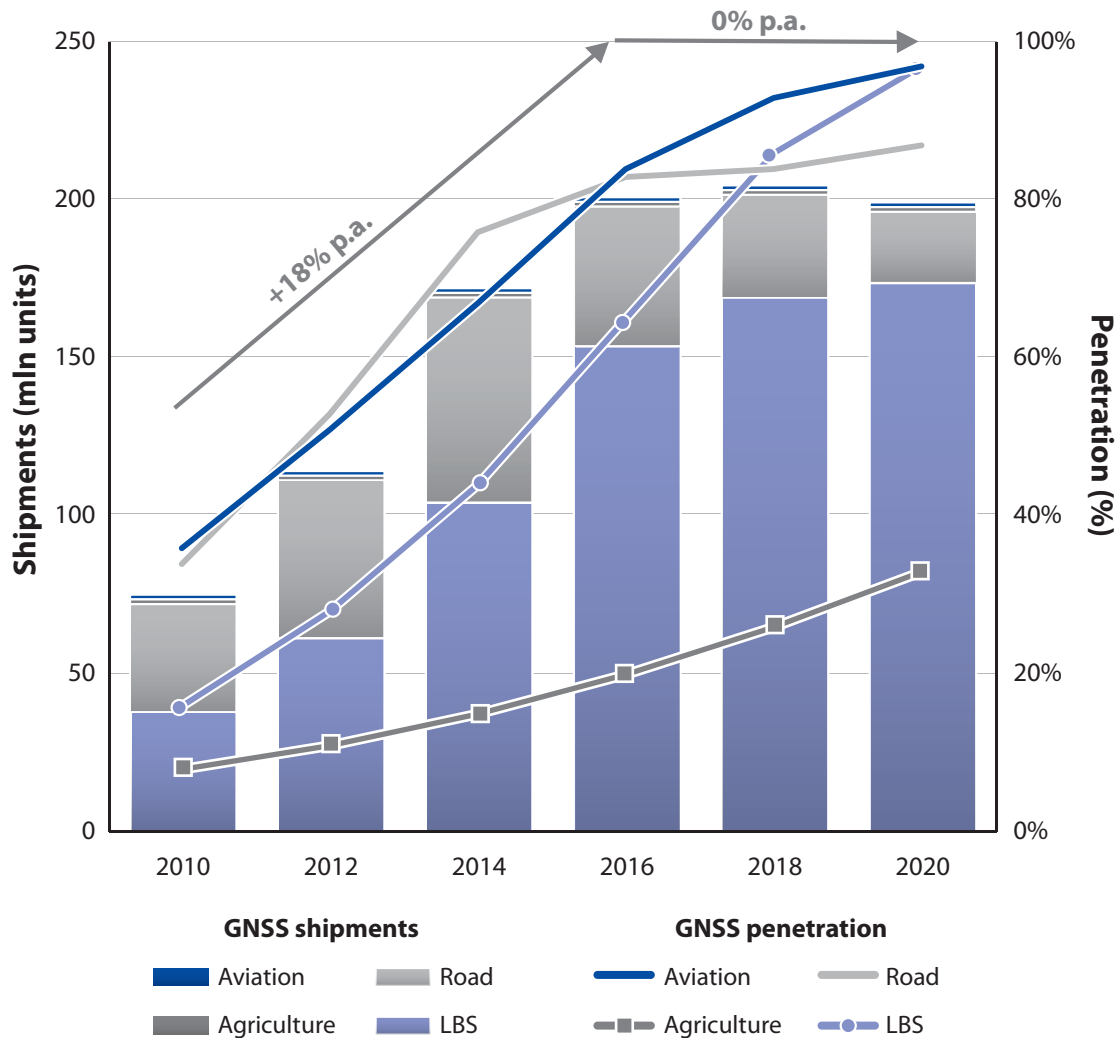
## Global GNSS market size (€ bln)



- Core GNSS market, accounting only parts of the retail price that are directly attributable to GNSS (e.g. chipset, maps, navigation software) in LBS sector
- Enabled GNSS market, accounting e.g. full price of GNSS mobile phones in LBS sector

# EU: 200 mln GNSS devices shipped every year by 2016

EU shipments (mln units) and EU penetration (%) of GNSS devices



- ▶ GNSS-enabled device sales in the EU will continue to increase over the next 6 years at a CAGR of 18% and will plateau at about 200 mln annual shipments in 2016.
- ▶ LBS handset sales make up the majority of GNSS device sales, about 174 mln in 2020 up from 38 mln in 2010. Over the same period, penetration will increase from below 20% to nearly 100%.
- ▶ Road GNSS shipments are expected to peak at 65 mln in 2014 after which shipments start to decline, cannibalised by smartphones used as navigation devices. Penetration will grow from 34% to almost 90%.
- ▶ In aviation and agriculture, unit shipments are much lower due to a much smaller addressable market. In the aviation sector an increase in GNSS penetration from 36% in 2010 to 97% in 2020 is expected while GNSS penetration in agriculture is expected to reach 33% in 2020, up from 16% in 2010.

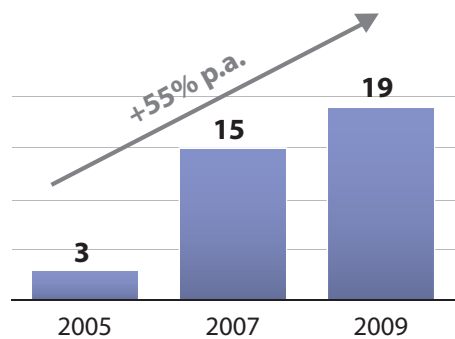


## Road: more than navigation

### Car navigation

Car navigation is currently the main application of GNSS. GNSS data combined with electronic maps allow positioning and guidance of the road user. PND sales have enjoyed fast growth over the last 4 years: 76% per year worldwide, 55% in the EU.

EU PND shipments (mln units)



PNDs are especially popular in the EU, while Japanese and US consumers favour in-vehicle systems and consumers in emerging markets like China often favour mobile phone-based navigation systems.



### Fleet management and logistics



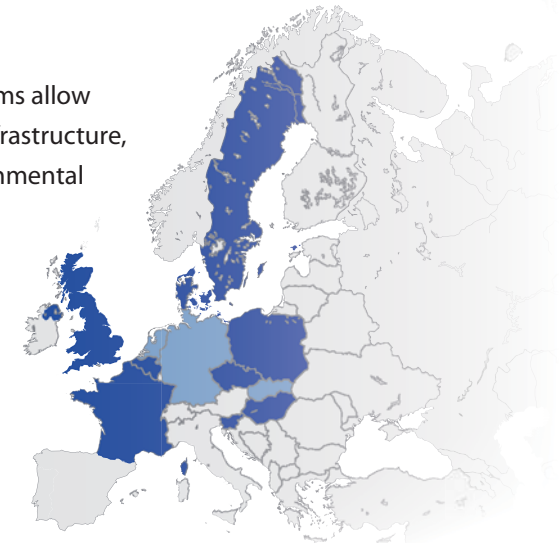
GNSS-based fleet management systems are used to locate vehicles (e.g. trucks, buses, police cars, taxis) in order to optimise resource management, reduce travel time, increase security and reduce fuel consumption.

In 2009 the number of vehicles equipped with fleet management and vehicle tracking systems was 6 mln in North America and roughly 5 mln in the EU. Beyond vehicles, containers are increasingly being equipped with GNSS-enabled devices.

### Road User Charging

GNSS-based toll collection systems allow more efficient use of the road infrastructure, reducing both traffic and environmental effects.

In 2009, 3 EU countries have already decided to use GNSS for toll collection in the future and 9 are evaluating it.



- GNSS adopted /decision taken
- GNSS under evaluation

### Adoption of GNSS based toll collection systems in the EU

### Emergency call

In-vehicle emergency call systems allow the emergency services to remotely locate vehicles in a difficult situation, resulting from a collision, etc.

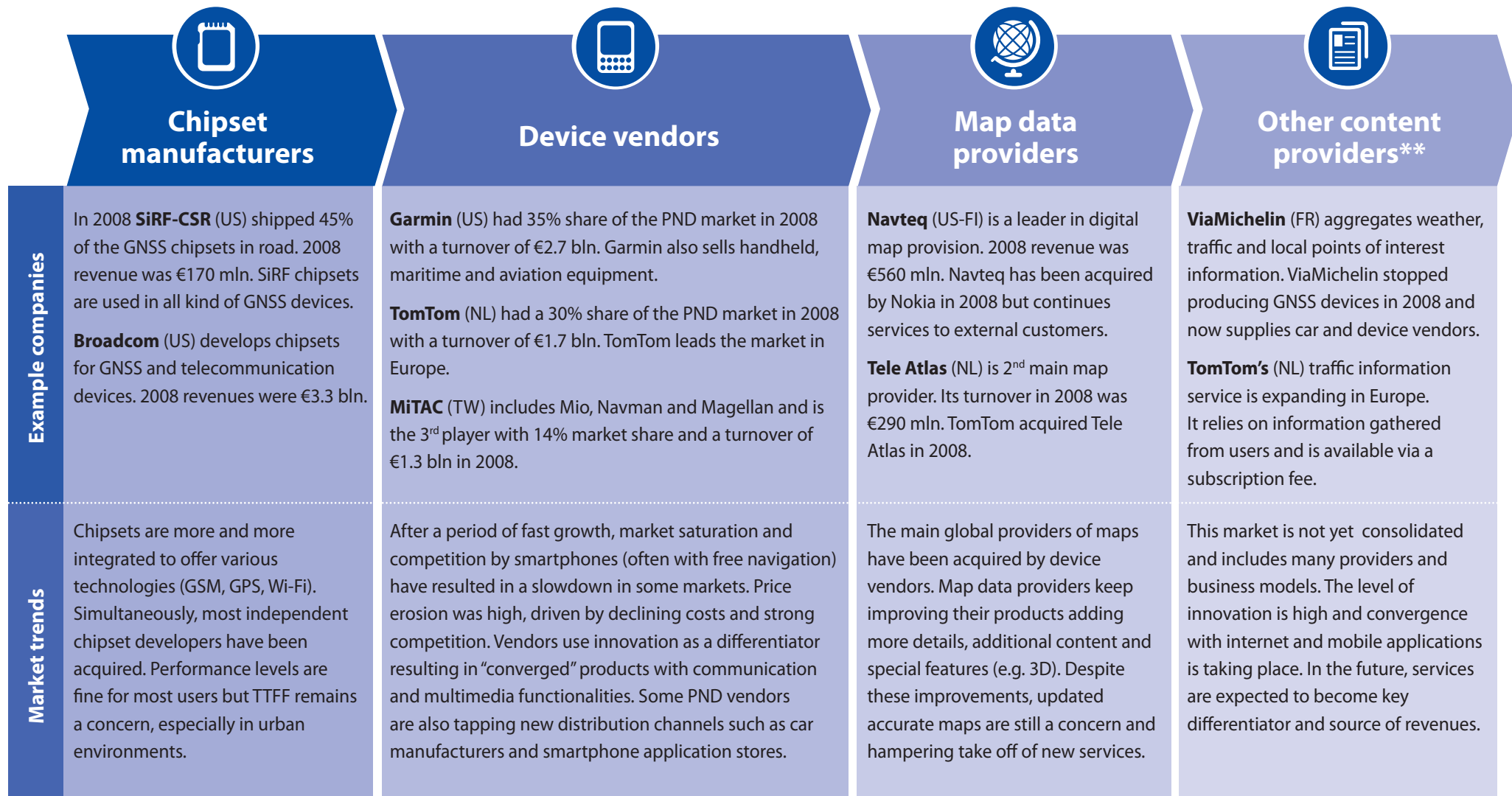


The European "eCall" programme foresees that all new cars manufactured in the EU in the next few years will be equipped with an emergency call system. In 2009, 15 EU Member States have signed the eCall Memorandum of Understanding.





## PND value chain\*: increasing importance of content



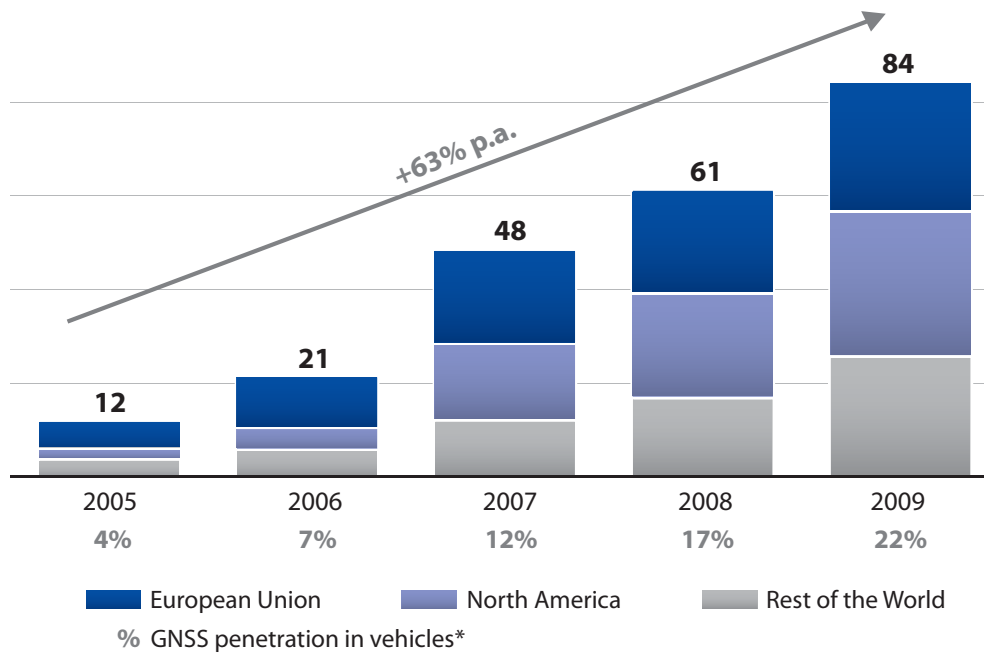
\* PND has been chosen as an example. Value chain for in-vehicle devices or applications like Road User Charging follows a different pattern.

\*\* includes traffic, weather, point of interest information

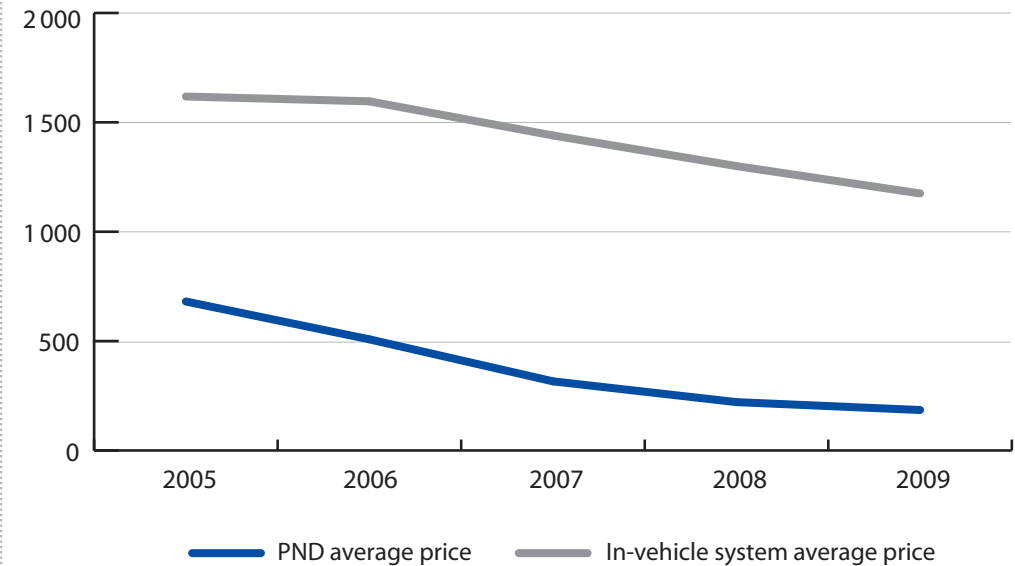


## Explosive market growth and strong price erosion

Worldwide shipments of GNSS devices in road sector (mln units)



Average price per device (€)



### Analysis of the market evolution

- ▶ GNSS consumer market for road applications has exploded in the past 5 years adding over 63% per year in terms of shipments.
- ▶ As a result, in 2009 almost 30% of road vehicles in the EU have a GNSS device on board, 22% worldwide. This high penetration resulting from navigation systems can represent an opportunity for other applications (e.g. road tolling, Advanced Driver Assistance Systems).
- ▶ Simultaneously significant price erosion has taken place, especially for PND where the average price per device declined from over €600 to under €200 in 5 years.

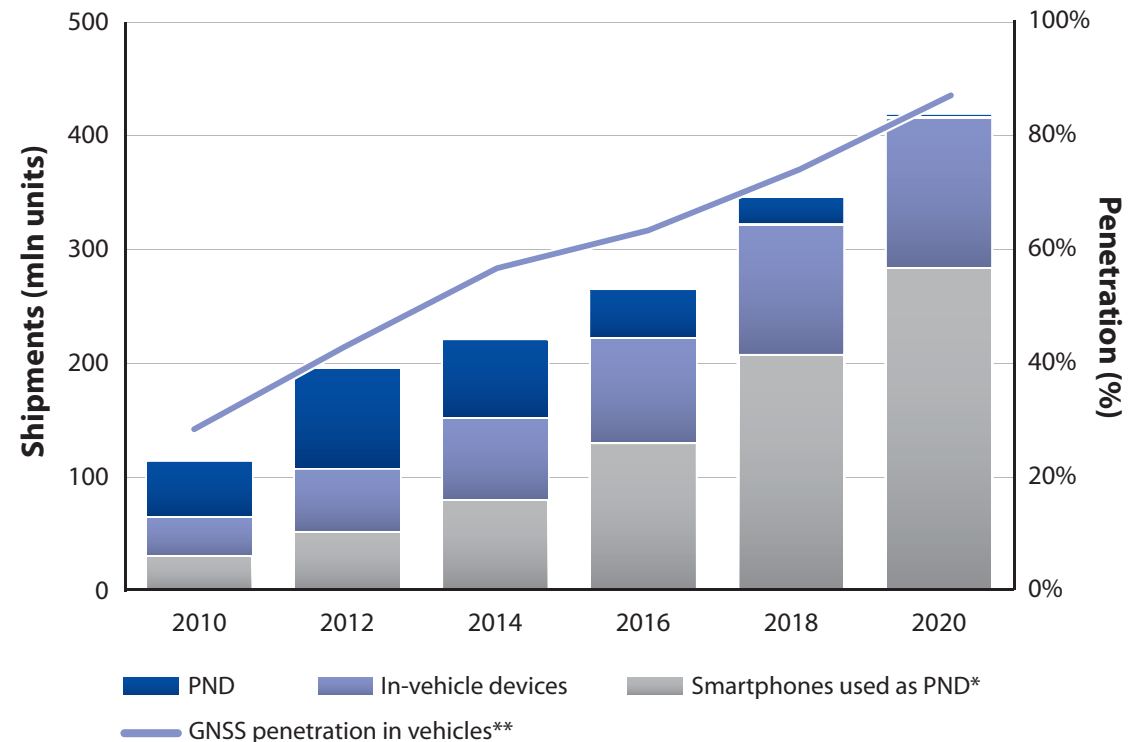
\*The penetration represents the percentage of vehicles in use which have a GNSS device.



## By 2020, the majority of vehicles will be equipped with a navigation device

Driver	Assumption
Stock of vehicles	Global CAGR of 4.7%
GNSS device penetration	S-Curve based on the past mobile phone market evolution
Substitution of dedicated devices by smartphones	24% by 2015 48% by 2020

Worldwide shipments (mln units) and penetration (%) of installed base of GNSS devices in road sector



- ▶ Combined GNSS penetration worldwide (including smartphones used as PND) will reach 87% by 2020 from 28% today while shipments will exceed 400 mln.
- ▶ PND sales have substantially grown in recent years and are expected to peak in 2013. After this peak, shipments of PND are expected to decline while shipments of factory-installed in-vehicle navigation systems and the adoption of GNSS-enabled mobiles for turn-by-turn navigation will continue to increase.

\* Smartphones used as PND are a subset of GNSS equipped smartphones in LBS market segment and counted only once in the global market size.

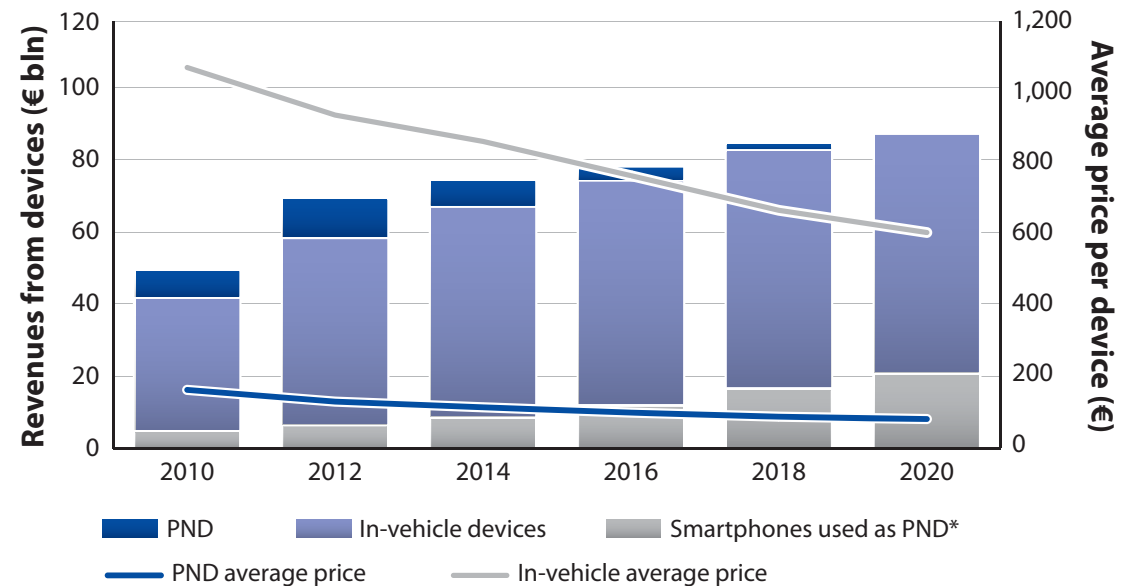
\*\* The penetration represents the percentage of vehicles in use which have a GNSS device.



## GNSS revenues from devices to consolidate from 2014

Driver	Assumption
PND price	7% annual price decrease
In-vehicle device price	6% annual price decrease
GNSS penetration	High penetration of GNSS limits growth area in pure device sales

Global GNSS market size (€ bln) and device prices (€) in road sector



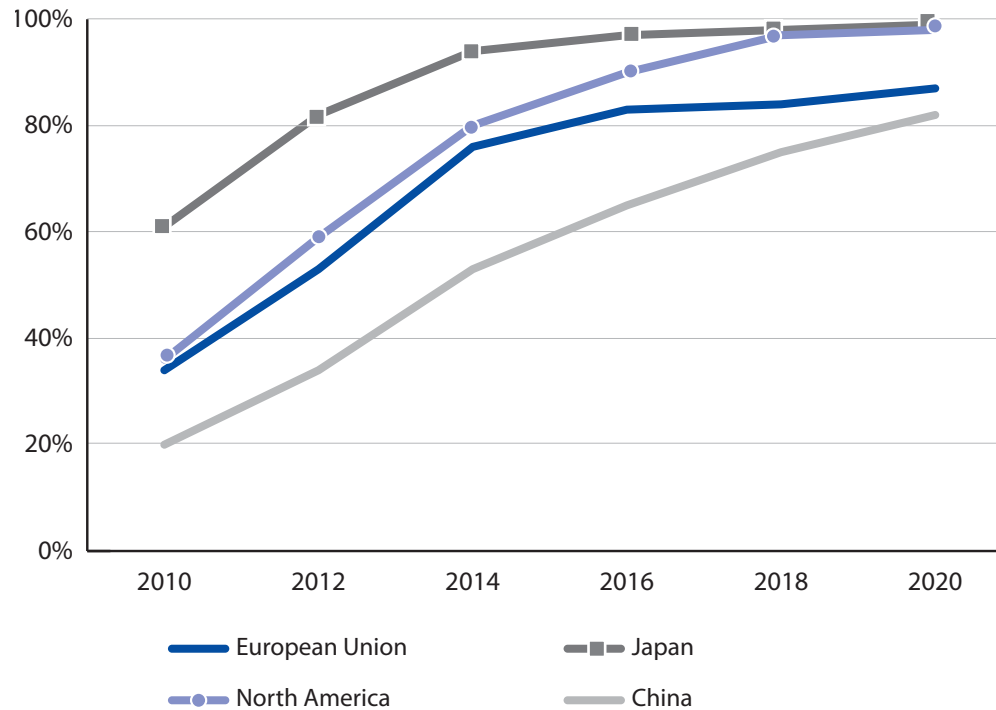
- ▶ Prices for PND are expected to decrease from €150 in 2010 to €70 in 2020 (-7% CAGR). Prices of in-vehicle systems (in-car platform for cooperative systems and advanced services) will decrease from €1070 in 2010 to €600 in 2020 (-6% CAGR).
- ▶ Total GNSS road segment revenues will increase rapidly from €49 bln in 2010 to €74 bln in 2014 driven by the increase in device sales. From 2014 onwards, the effect of decreasing prices will cause revenue growth to slow. In 2020 estimated global device revenues in the road sector are €87 bln.
- ▶ Services based on cooperative systems such as advanced services for safety, assistance to the driver and active traffic management — as well as new and innovative information and entertainment services — will provide an important additional source of growth (not modelled in the scope of this report).

\* Smartphones used as PND are a subset of GNSS equipped smartphones in LBS market segment and counted only once in the global market size.



## Fastest growth observed in RoW, EU penetration to saturate by 2018

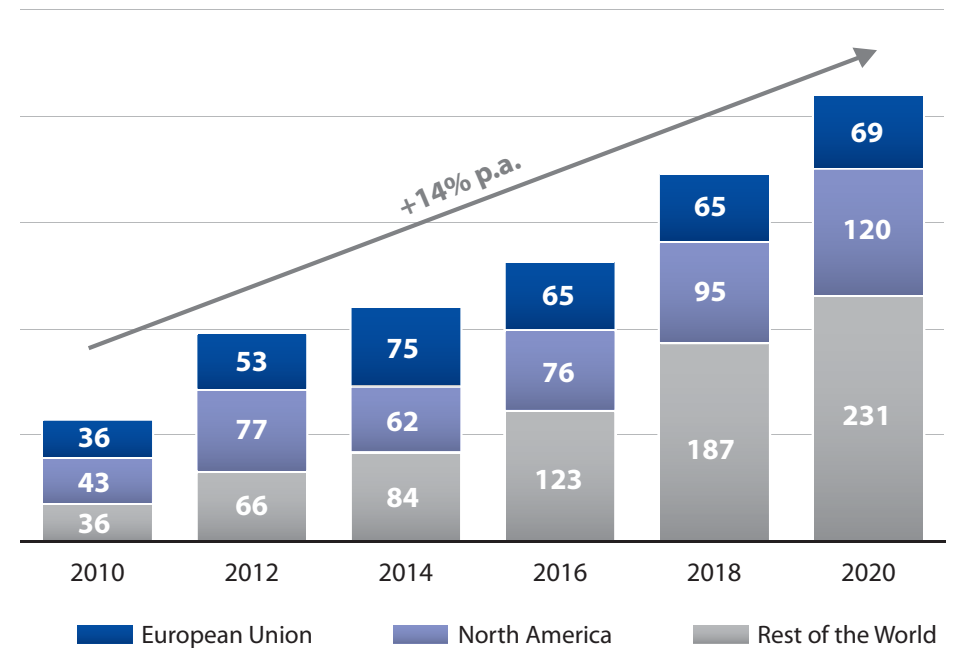
GNSS penetration in road sector (%)



### GNSS penetration in road sector by region

Penetration of GNSS in road sector will exceed 50% in the European Union already in 2012 and will continue to grow up to 87% in 2020. The Japanese and North American markets will reach almost 100% penetration from 2015 and 2018 respectively.

Shipments of GNSS devices in road sector\* (mln units)



### GNSS devices shipments in road sector by region

Shipments of GNSS devices in the road sector are expected to grow in all regions with an average of 14% to reach 69 mln units in the EU (CAGR 7%), 120 mln in North America (CAGR 11%) and 231 mln in the rest of the world (CAGR 20%).

\* includes the subset of smartphones used as PND, however these devices are counted only once in the global market size.



## Mobile LBS are taking off as progress is being made in different areas

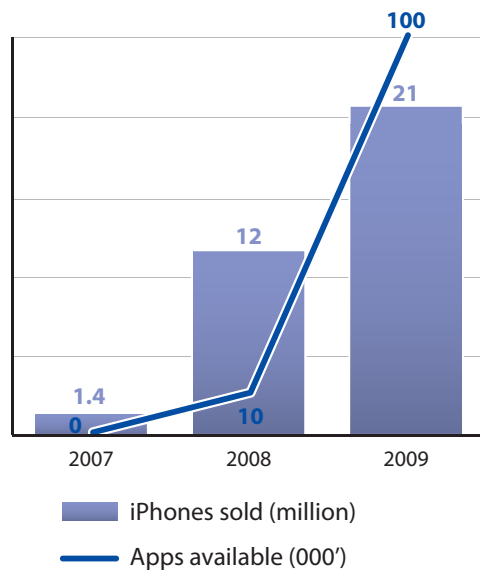
### More and more mobile phones with GNSS inside



### Application stores provide a viable business model

#### Apple example\*

- ▶ >200,000 apps
- ▶ >5 bln downloads
- ▶ \$1.4 bln revenues
- ▶ Driving iPhone sales
- ▶ Increasing mobile traffic
- ▶ Similar concepts developed by competitors



\* Similar concepts by Google, Nokia, RIM.

### Increasing consumer and developer awareness

- ▶ All major mobile phone operating system vendors provide API with location functions.
- ▶ In the UK, France and Germany 5 out of 10 best selling iPhone's applications in 2009 are related to navigation or are location based applications.
- ▶ 30% of Android developer's contest winners used location in their application.
- ▶ Nokia experienced 7 mln downloads of its map software in the 3 months after offering free navigation.



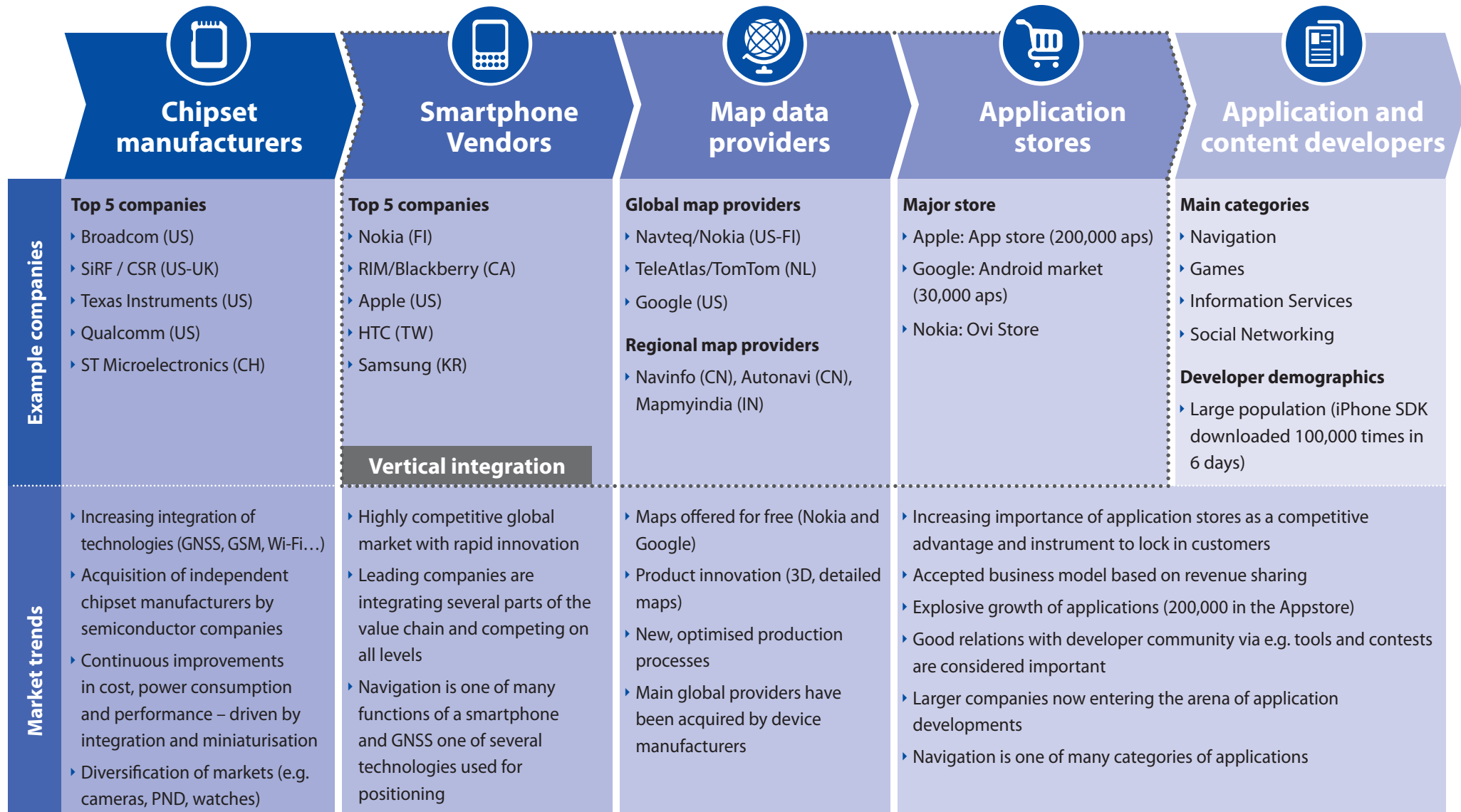
### Improvement in navigation performance

Leading smartphones display a host of technologies to improve position performance:

- ▶ Assisted-GPS to reduce Time To First Fix
- ▶ Magnetic compass
- ▶ Highly sensitive GNSS chipset
- ▶ Wi-Fi, cellular and hybrid positioning as back-up
- ▶ Motion sensors and gyroscopes for tilt
- ▶ Map matching for road use

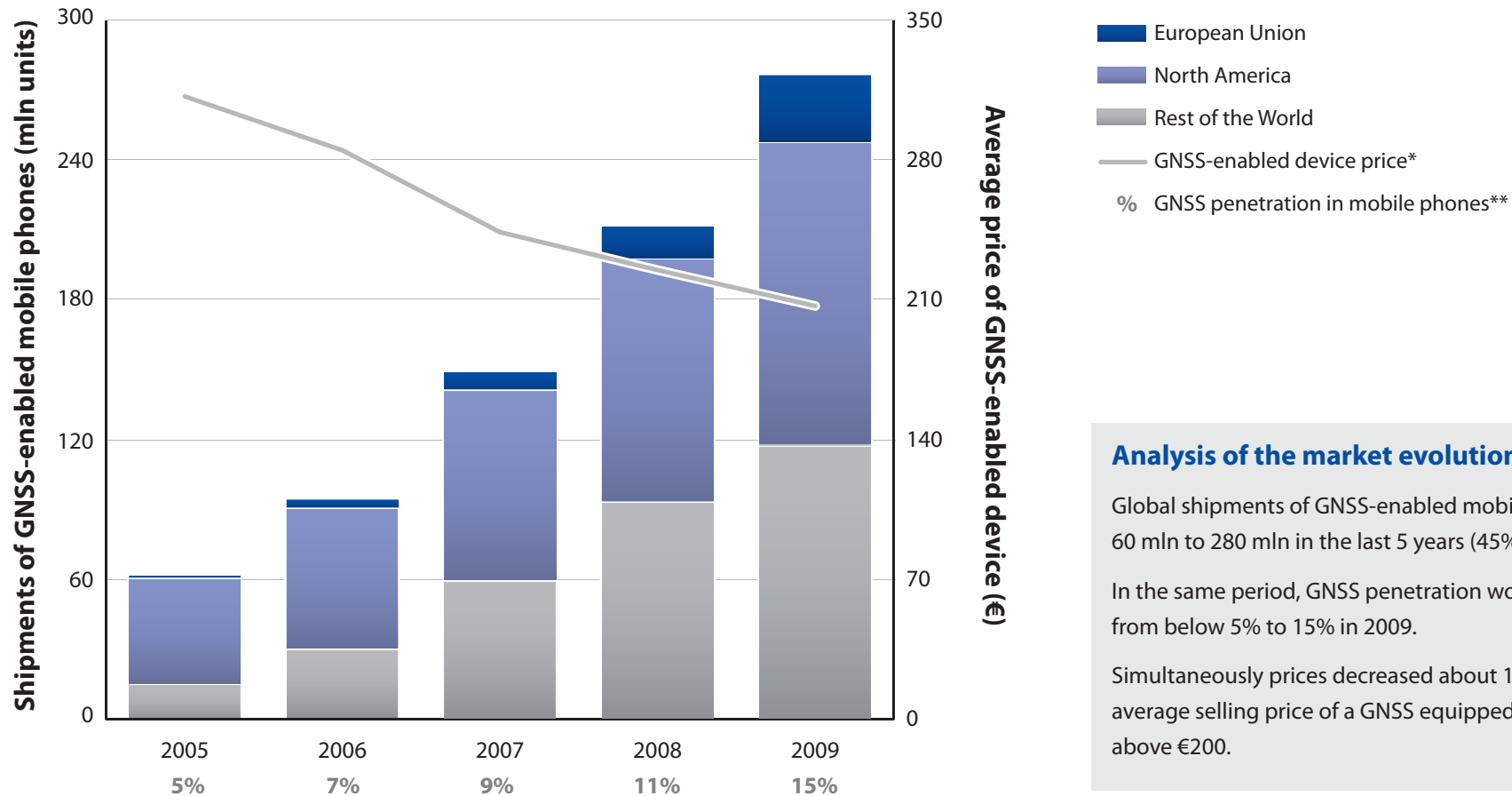


## LBS value chain: vertical integration by leading smartphone vendors





## GNSS penetration in mobile phones reached 15% in 2009



### Analysis of the market evolution

Global shipments of GNSS-enabled mobile phones increased from 60 mln to 280 mln in the last 5 years (45% CAGR).

In the same period, GNSS penetration worldwide has increased from below 5% to 15% in 2009.

Simultaneously prices decreased about 10% annually. In 2009 the average selling price of a GNSS equipped mobile phone was just above €200.

\* Only a fraction of this price is used to estimate the revenues attributable to GNSS.

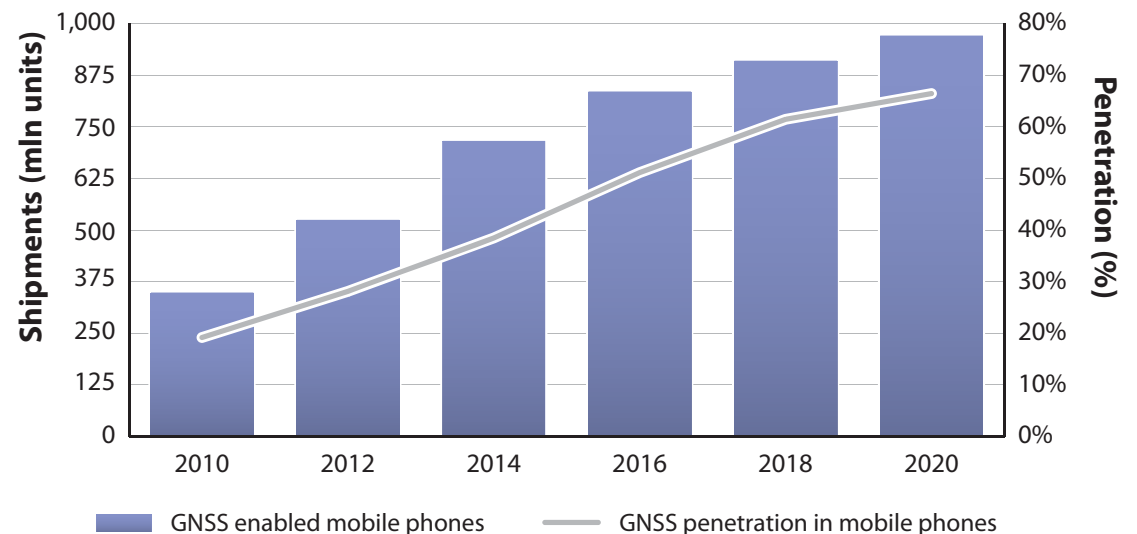
\*\* The penetration represents the percentage of mobile phones in use which are GNSS-enabled.





## Almost 1 billion GNSS-enabled mobile phones shipped every year in 2020

Shipments of GNSS-enabled mobile phones (mln units) and penetration of GNSS in mobile phones (%) worldwide



Driver	Assumption
Population growth	Annual growth of 1%
GNSS penetration	By 2020, more than 65% GNSS penetration in mobile phones worldwide
Device diffusion	Based on market forecasts of replacement cycle

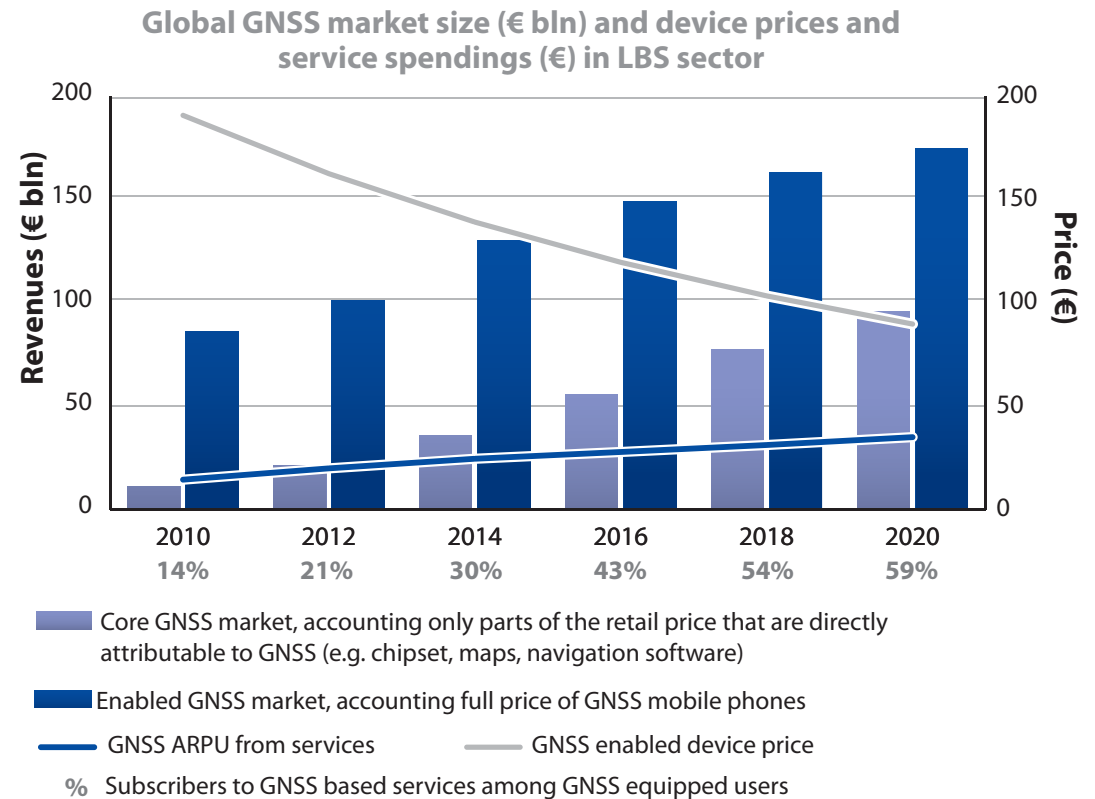
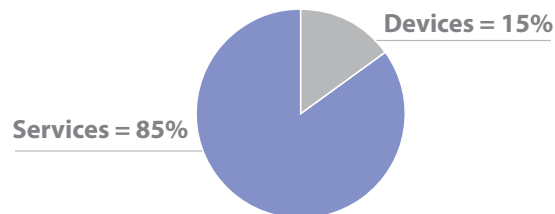
- ▶ Shipments of GNSS-enabled smartphones, PDA and mobile handsets are expected to increase from 350 mln to almost 1bln (11% CAGR) over the next decade.
- ▶ By 2020 the penetration of GNSS-enabled mobile phones will have reached 65%. This growth is expected to slow down after 2020 as the markets in most countries will be mature.
- ▶ These developments are driven by increasing attractiveness and increasing affordability of LBS devices.
  - ▶ Attractiveness: Besides navigation, new applications and services such as vulnerable people tracking, mobile commerce and location-based games are becoming prevalent.
  - ▶ Affordability: Price erosion and reduced power consumption of GNSS chipsets thanks to integration and miniaturisation make it easier and cheaper to integrate GNSS in mobile phones.



## Value-added services will drive revenues in the global LBS market

Driver	Assumption
Location based service subscribers	22% in 2015 43% in 2020
ARPU	9% CAGR 2010-2020
GNSS-enabled device price	From €190 in 2010 to €90 in 2020

Distribution of revenues Devices vs. Services  
(% of cumulated value 2010-2020)

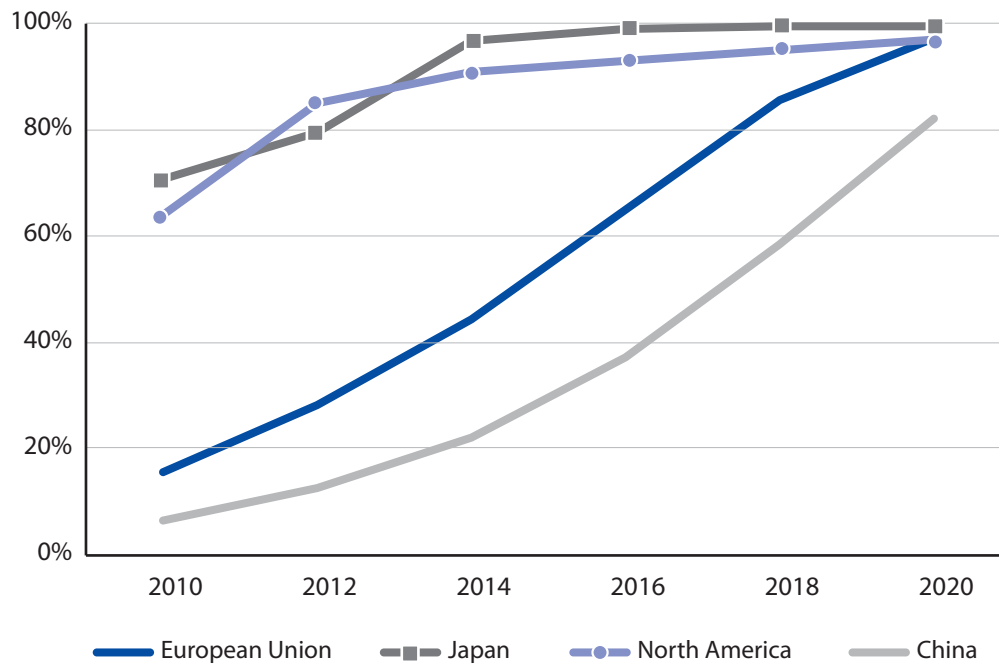


- ▶ Total annual core GNSS revenues in LBS are expected to grow between 2010 and 2020 from €12 bln to €96bn (24% CAGR). More than 85% of cumulated revenues during the period are from GNSS based services, the remainder coming from devices sales.
- ▶ ARPU from GNSS based services will grow at an average of 9% per year during the next decade. Average revenues will increase as new personal location-based services are developed, such as people tracking, mobile commerce and location-based games. Device prices on the other hand will decline from an average of €190 in 2010 to €90 in 2020 (-7% CAGR).
- ▶ The growth of revenues is also driven by the increased penetration of GNSS in mobile handsets (reaching 65% by 2020) and the larger base of mobile users (+11% from 2010 to 2020).



## EU to experience significant growth

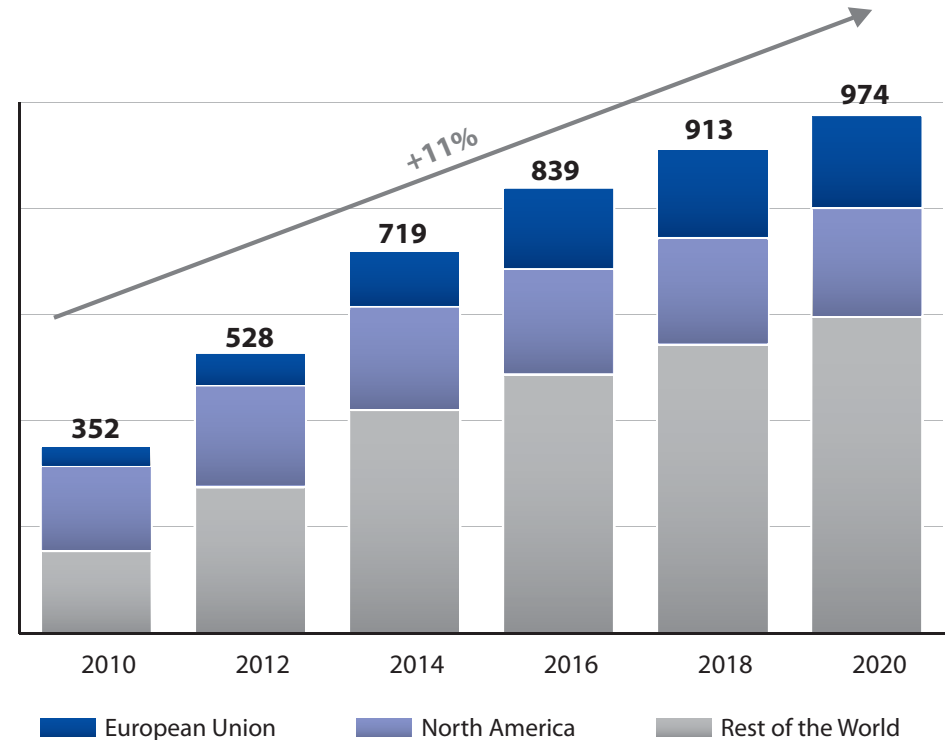
GNSS penetration in mobile phones (%)



### GNSS penetration by region

Penetration in 2010 is much higher in North America and Japan driven by early availability of GNSS-enabled phones. The gap is expected to decline as penetration of GNSS in mobile phones will already exceed 50% in the European Union in 2015 and will continue to grow up to 97% in 2020. At this time, the penetration of GNSS in mobile phones will reach 97% in North America, almost 100% in Japan and 82% in China.

Shipments of GNSS-enabled mobile phones (mln units)



### GNSS-enabled mobile phone shipments by region

Shipments of GNSS-enabled smartphones are expected to grow in all regions by an average of 11% per year and reach 175 mln units in the European Union (CAGR 16%), 205 mln in North America (CAGR 3%) and almost 600 mln in the rest of the world (CAGR 14%).



## GNSS devices increasingly relevant for aviation

### Commercial Aviation (CA) and General Aviation (GA)



Commercial aviation involves scheduled commercial passenger and cargo flights. Most commercial aviation aircraft have GNSS integrated in their avionics and usually feature two receivers.

General aviation covers a wide range of activities such as leisure, business, surveillance, etc. and usually involves smaller sized aircraft.

In general aviation GNSS equipped aircraft have a stand-alone device with panel mounted display. For these, GNSS deployment is quicker, easier and cheaper than for large aircraft with a separate FMS.

### Use of GNSS in Aviation

Traditionally, radio navigation systems near airports, combined with inertial systems which keep track of the plane's location are used. GNSS-based navigation has the potential to greatly complement these systems for en-route navigation at all altitudes and for airport approaches.

However, in order to match the accuracy, integrity and availability of integrity of existing infrastructure based on Instrument Landing Systems (ILS) CAT II and CAT III, additional ground-based augmentation systems are required near the runways.

Users requirements in the aviation market are differentiated between CA and GA and evolve slowly due to heavy regulation and safety concerns and due to the long life cycle of aircraft (>20 years).

*\* Delays, Diversions and Cancellations*

### Benefits of SBAS, the case for EGNOS

The aviation market requires the highest possible robustness and integrity. SBAS systems improve the accuracy and integrity of GNSS via a network of ground stations that take measurements of GNSS and broadcast information messages to users via satellite. The US WAAS system is an SBAS developed by the US FAA.



EGNOS, the European SBAS, is set to be certified for civil aviation in 2010. Its enhanced vertical precision and integrity will improve safety, efficiency and accessibility.

EGNOS enables:

- ▶ Reduced occurrence of Controlled Flight into Terrain by 75%.
- ▶ Decision altitudes for landing similar to ILS CAT I, reducing costly DDC\* without the need for airport infrastructure.
- ▶ Curved approaches and continuous descent paths, which can reduce noise and emissions.

### Opportunity for GNSS

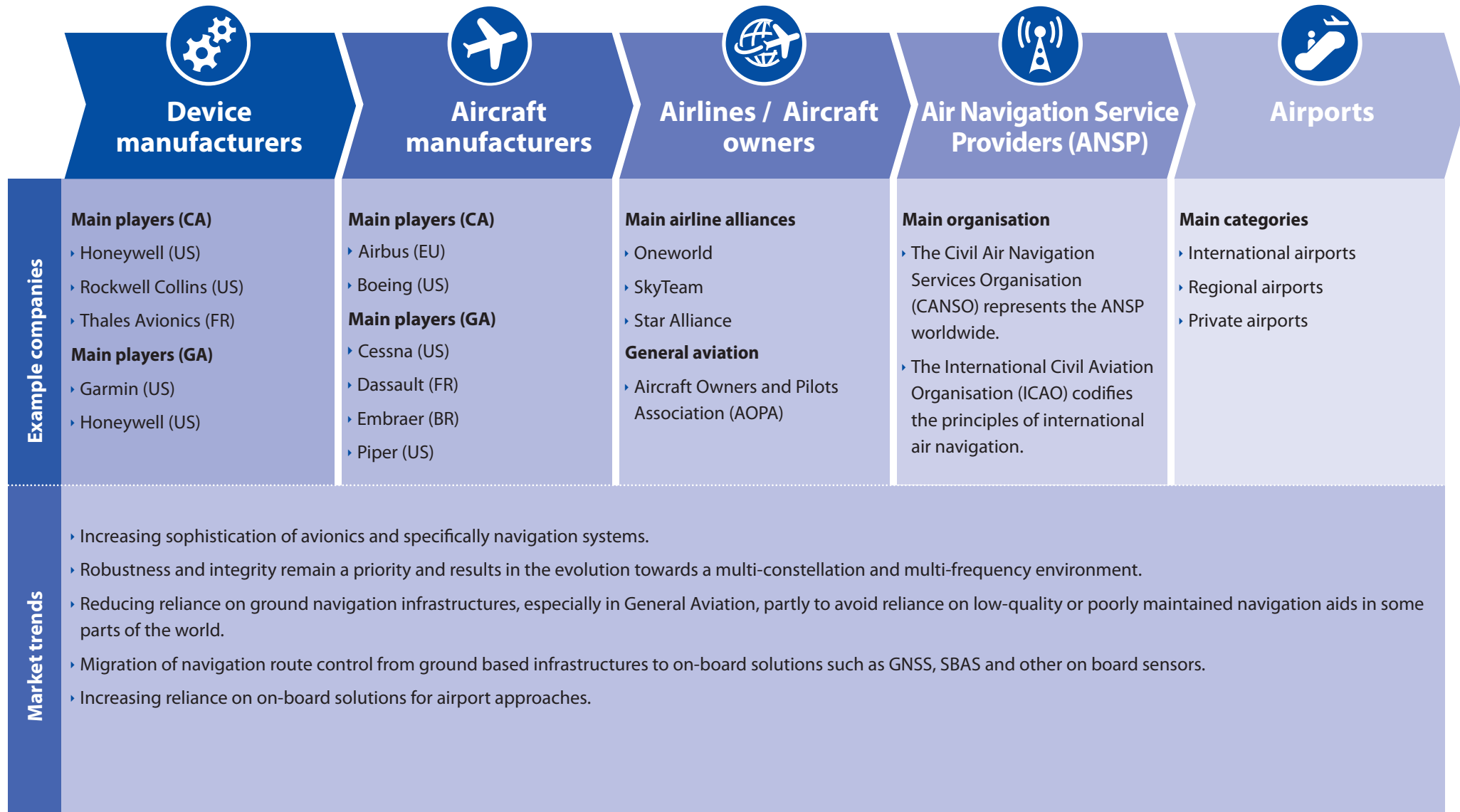
GNSS overcomes many of the deficiencies in today's air traffic infrastructure thanks to its accurate, continuous, all-weather positioning. This is especially relevant for GA which often use smaller airports.



The Single European Sky ATM Research (SESAR) programme defines in its 2020 navigation baseline that the primary means for aircraft positioning should be GNSS for all flight phases using a minimum of two dual frequency satellite constellations or augmentation systems (including SBAS). Today all new commercial aircraft are equipped with GNSS devices. GNSS will eventually be widely used throughout the world.



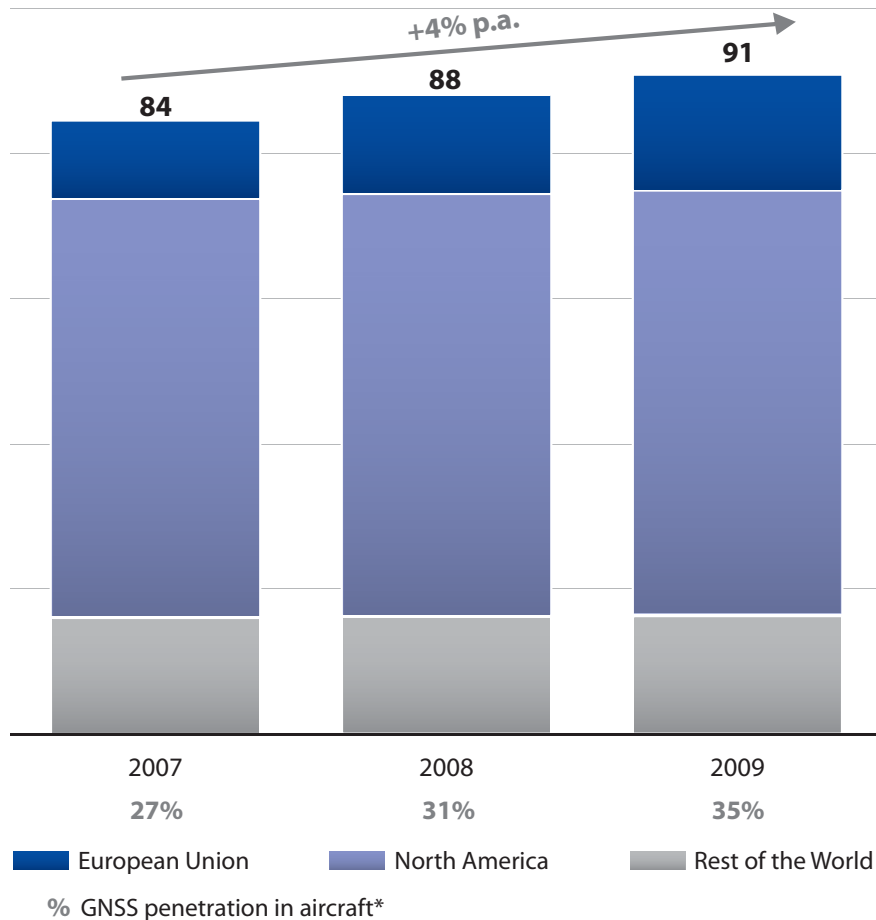
## Aviation value chain: increasing reliance on on-board solutions





## GNSS penetration increased to 35% in 2009

Shipments of GNSS devices in aviation sector (000' units)



### Analysis of the market evolution

Shipments of GNSS devices are dependent on the sales of new aircraft which have grown moderately over the last 3 years. However the aviation industry remains sensitive to the overall economy.

Over the same period, GNSS penetration in new aircraft has increased while retrofitting of GNSS to existing aircraft also contribute to the increase of penetration from 27% to 35%.

Shipments of GNSS devices have reached 91,000 units in 2009, of which more than 65% were sold in North America. Most of these are sold in general aviation where North America has a much larger installed base.

Future uptake of GNSS is expected to increase, driven by regulation on the one hand, and by the availability of SBAS and multi constellation GNSS and their associated procedures on the other hand.

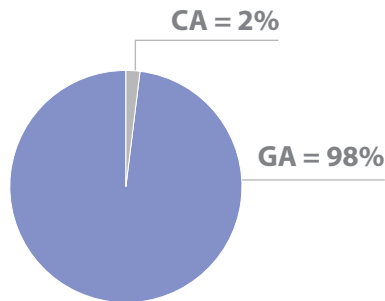
\* The penetration represents the percentage of aircraft in use which have a GNSS device.



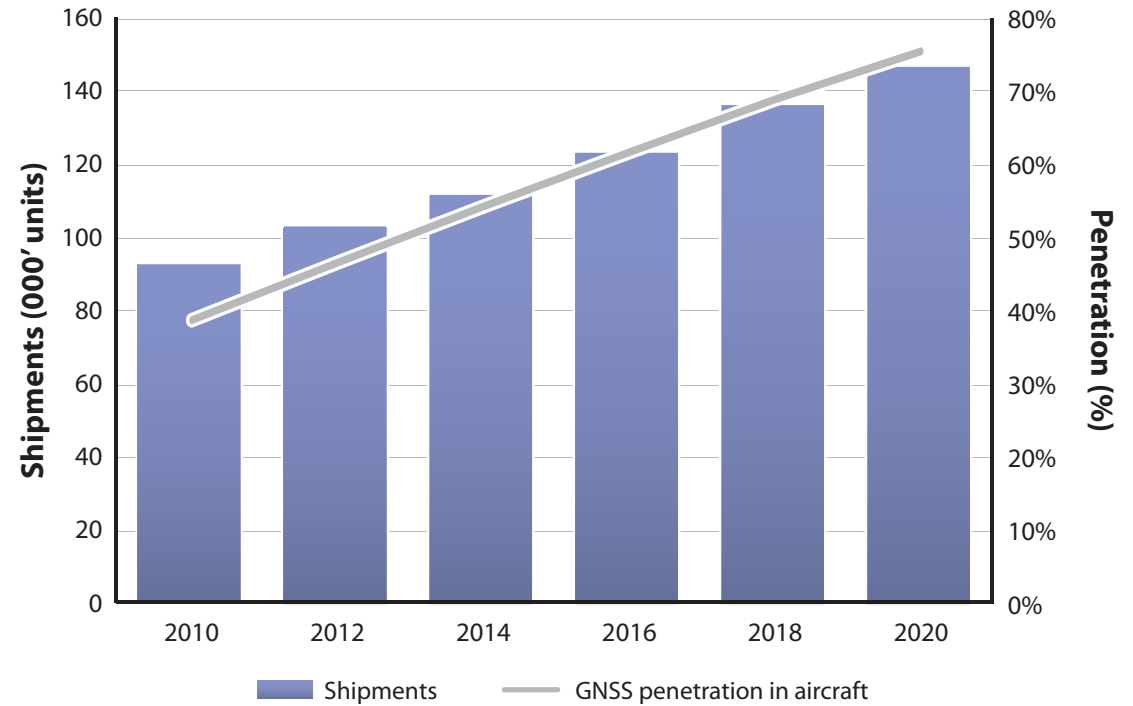
# GNSS penetration is expected to reach 75% of aircraft by 2020

Driver	Assumptions
General aviation fleet	1% growth 2010-2020 93% of total fleet in 2010
Retrofitting (CA and GA – IFR)	1% of aircraft stock
GA – VFR life cycle	4 years
SESAR regulation (Europe)	100% GNSS penetration expected by 2020

Distribution CA vs. GA (% of shipments)



Shipments (000' units) and penetration (%) of GNSS devices worldwide in aviation sector

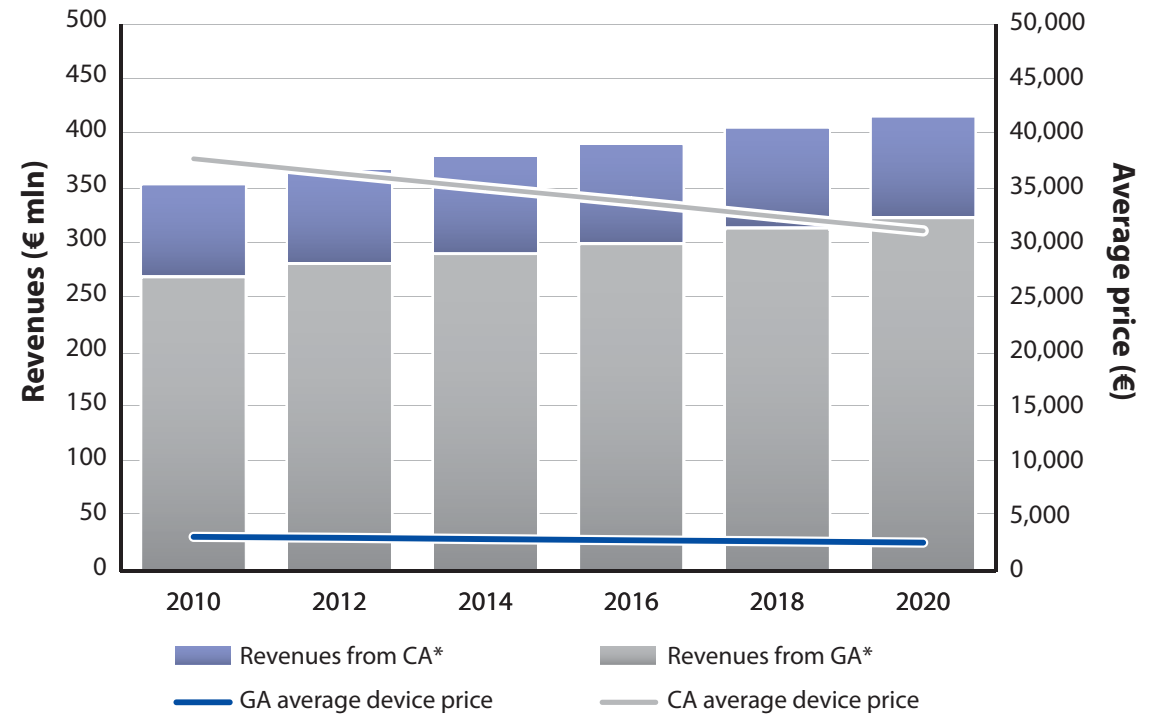


- ▶ Over the next decade, GNSS penetration is expected to rapidly increase from 38% in 2010 to 75% by 2020.
- ▶ Shipments increase, from 94,000 to 147,000 (CAGR 4%).
- ▶ Device sales for general aviation aircraft will account for about 98% of the total.



## Revenues from GNSS in aviation will reach €415 mln in 2020

Global GNSS market size (€ mln) and device prices (€) in aviation sector



Driver	Assumptions
GNSS penetration	58% by 2015 75% by 2020
Distribution VFR/IFR in GA	74% VFR 26% IFR
Average GNSS receiver price 2010-2020	CA – €34,000** GA – €2,900

- ▶ Total cumulated revenues from GNSS in the aviation sector for the period 2010-2020 will be €4.2 bln. Large aircraft will account for 19% of total revenues, regional aircrafts for 5% and general aviation for 76%.
- ▶ In commercial aviation average price of Flight Management System including GNSS receivers are expected to fall from €37,000 in 2010 to €31,000 in 2020 while average prices of GNSS devices in general aviation will decline from €3,200 in 2010 to €2,000 in 2020, corresponding to a 2% annual price erosion.

\* from sales of devices

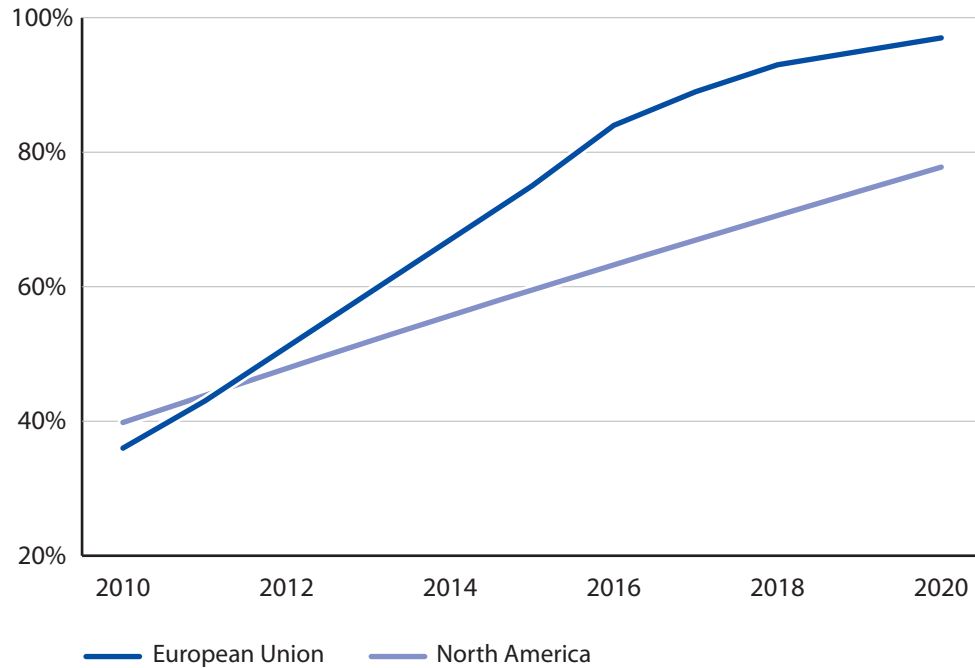
\*\* price of Flight Management System including GNSS receiver





## Strongest growth is expected in the EU

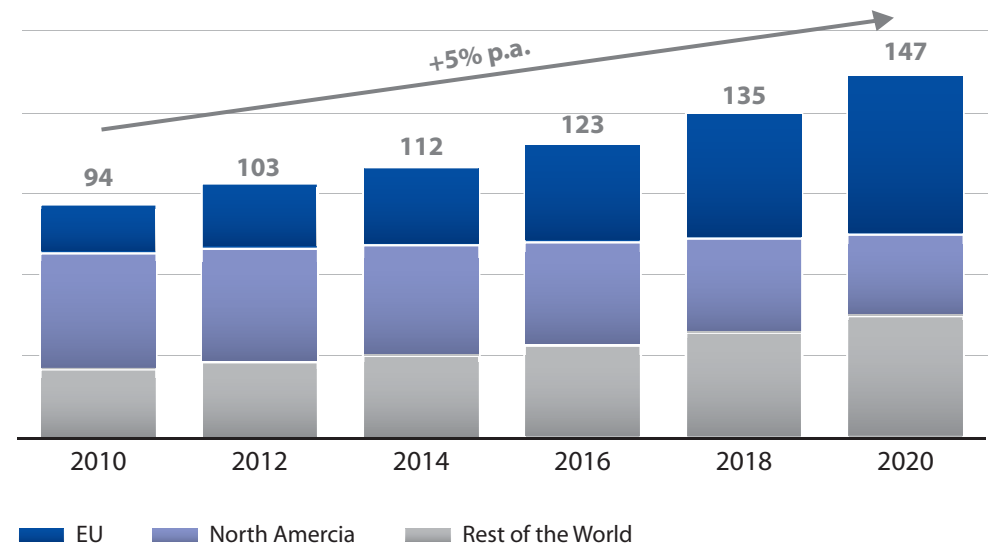
GNSS penetration in aircraft (%)



### GNSS penetration by region

Penetration of GNSS in aviation will already exceed 70% in the European Union in 2015, growing to 97% by 2020 driven by the SESAR programme. In North America, penetration of GNSS in aircraft will reach 78% by 2020.

Shipments of GNSS devices in aviation sector (000' units)



### GNSS device shipments in aviation by region

Shipments of GNSS receivers in the aviation sector are expected to grow in all regions to reach 42,000 units in the European Union (CAGR 14%), 61,000 in North America (CAGR 1%) and 44,000 in the rest of the world (CAGR 5%). Despite the EU displaying faster growth in penetration, the higher installed base of aircraft in North America results in the highest volumes being shipped there.

## EGNOS receiver share in agriculture is 50% in the EU

### Low technology solutions

Low technology GNSS solutions are used for low-value crop cultivation (e.g. cereals), low accuracy operations (e.g. fertilising, reaping) and for agro-logistic applications (e.g. land parcel identification, field measurement).



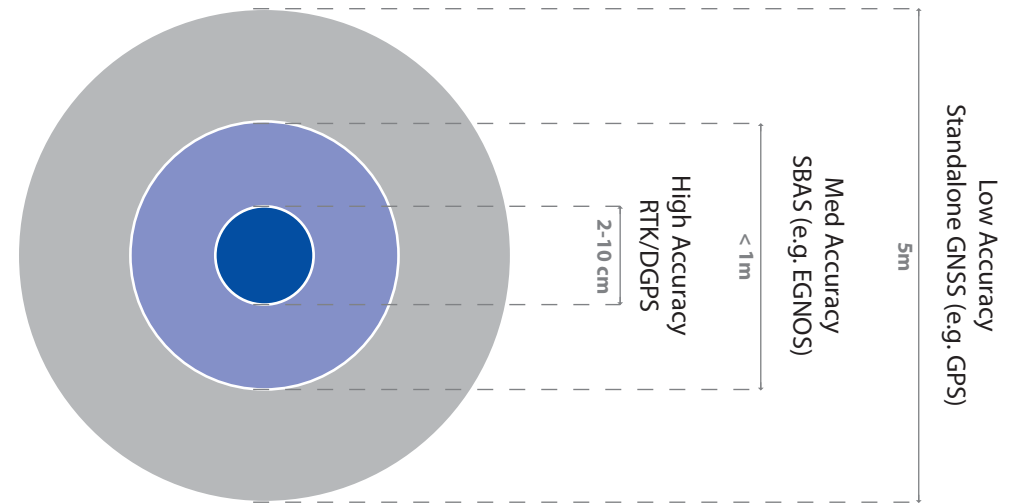
Most techniques rely on standard GNSS receivers complemented by free satellite based augmentation services such as WAAS in the US and EGNOS in Europe. The level of accuracy achieved is below 1 meter.

### High technology solutions

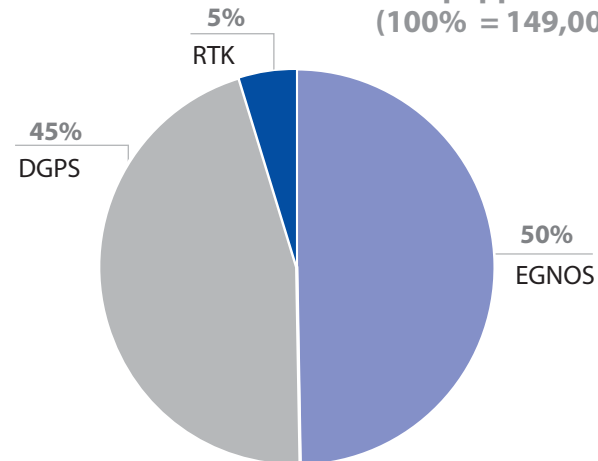
High technology GNSS solutions are more costly and mostly used for high-value crop cultivation (e.g. potatoes and vegetables) or precision operations (sowing and transplanting). In organic agriculture, herbicides can be substituted by mechanical treatment.

More advanced positioning technologies, such as local and regional Real Time Kinematics (RTK) systems or commercial satellite based augmentation services (e.g. Omnistar, StarFire) are used. The levels of accuracy achieved are in the range of 2 to 10 cm.

### The different levels of accuracy by GNSS technology



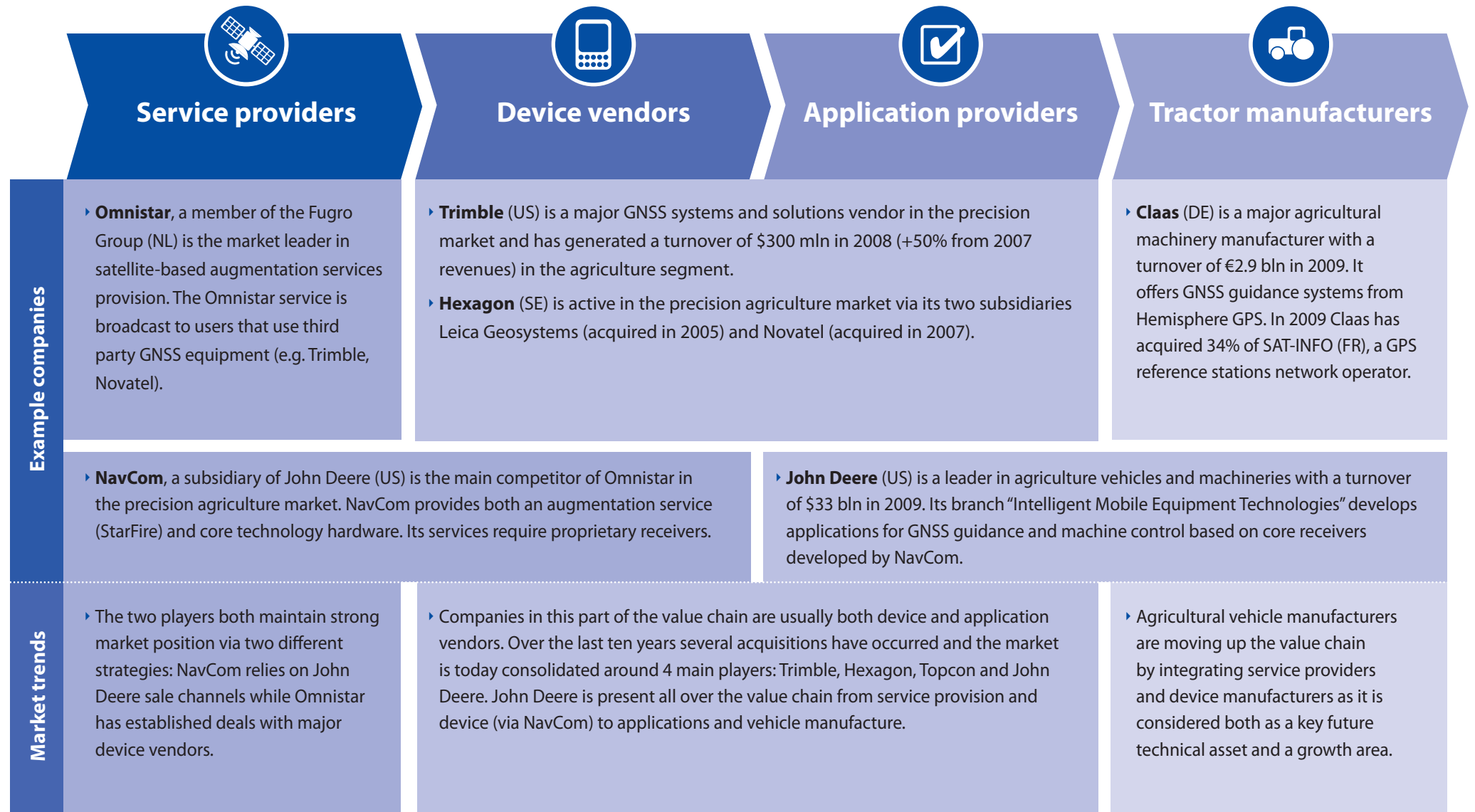
### Installed base of GNSS equipped tractors in 2009 in the EU (100% = 149,000)



EGNOS leads the market in the EU with 50% share in installed base of GNSS equipped tractors.



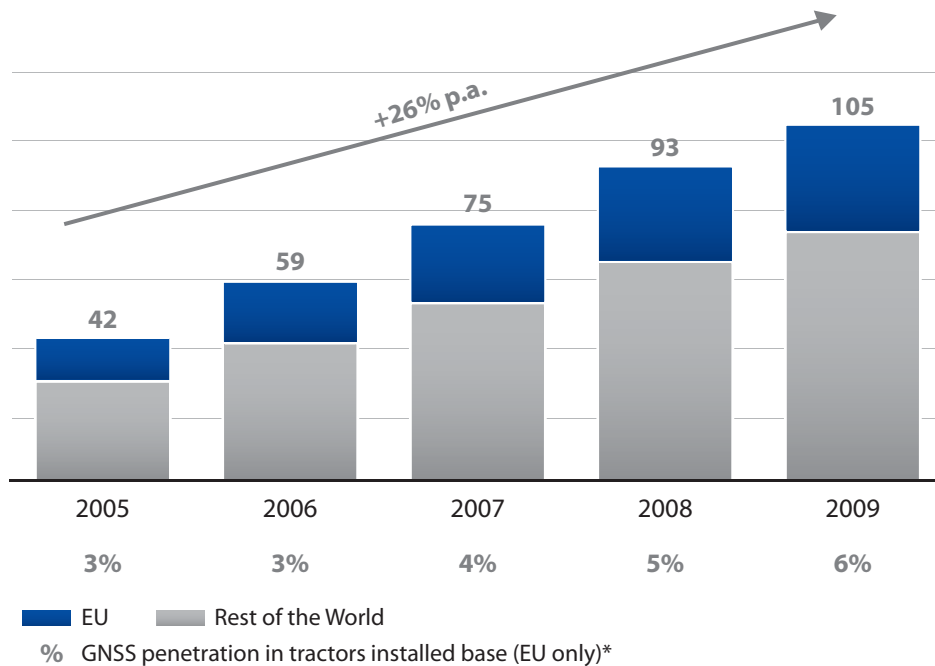
# Agriculture value chain: Various business models and levels of integration in the value chain



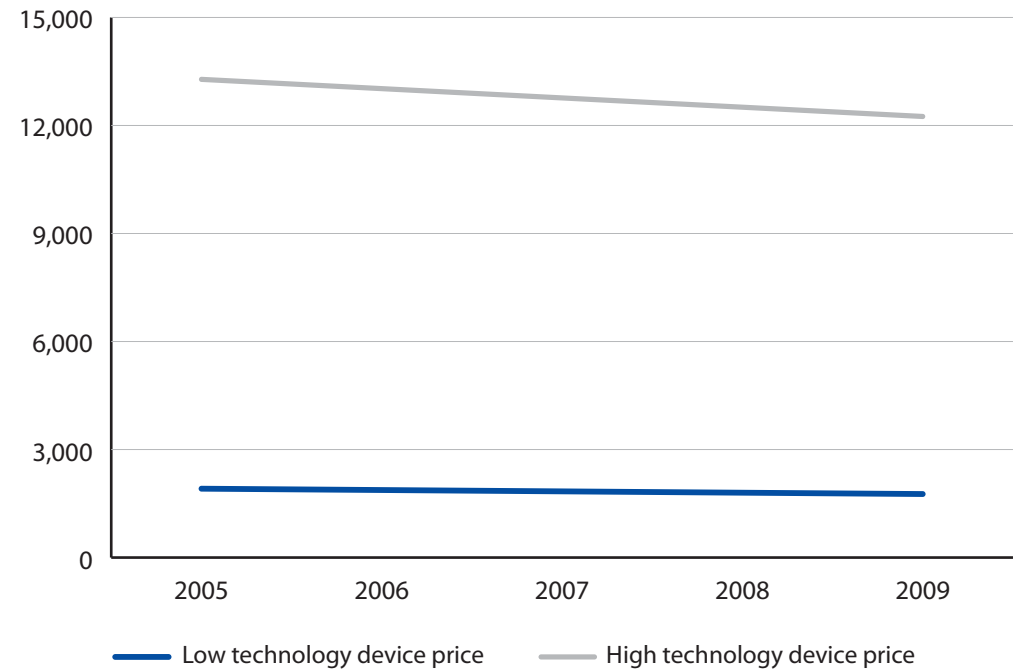


## Shipments have more than doubled in the EU over the last 5 years

Shipments of GNSS devices in agriculture sector ('000 units)



Average price per device (€)



### Analysis of the market evolution

- Within the last 5 years the GNSS market for agriculture has grown significantly, from 42,000 to 105,000 annual shipments (26% CAGR).
- In parallel prices of equipment have gone down slightly, notwithstanding increasing functionality such as the availability of EGNOS, increasing the accuracy of systems at a very low cost. The price of high technology devices has declined from €13,000 to €12,000 while the price of low technology devices declined from €1,900 to €1,800.
- Awareness of the benefits of precision agriculture in the farming community has increased.

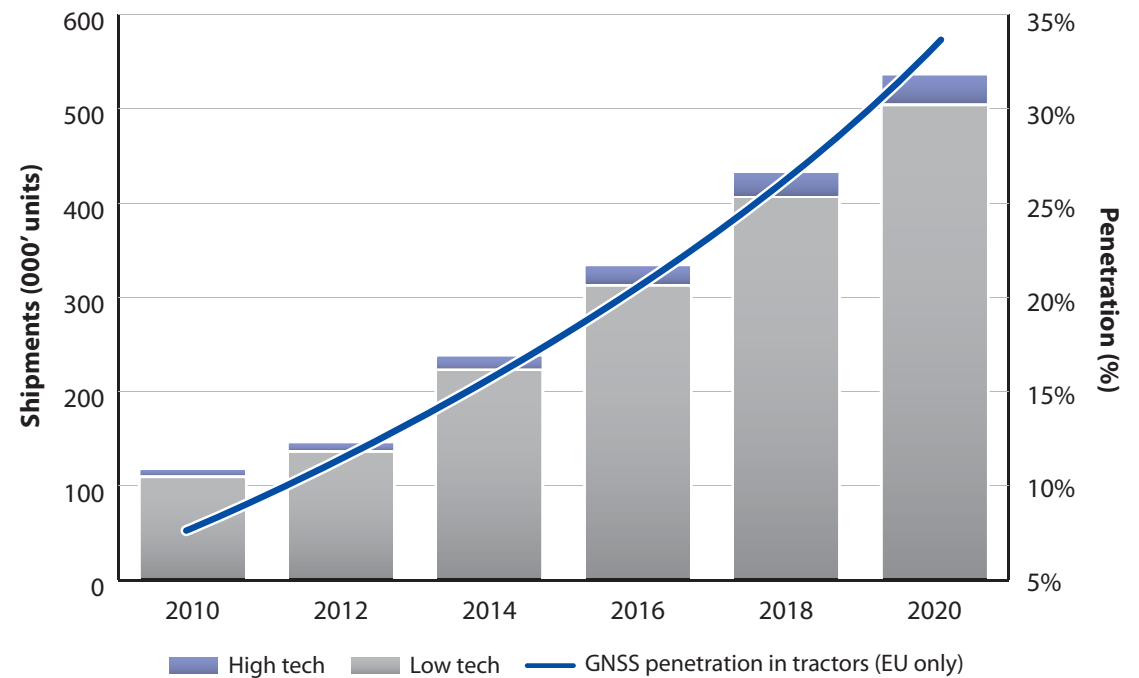
\* The penetration represents the percentage of tractors in use which have a GNSS device.



## Increasing penetration of GNSS in tractors

Shipments (000' units) and penetration (%) of installed base of GNSS devices worldwide in agriculture sector

Driver	Assumptions
Addressable market	High power tractors Farms larger than 50 ha
GNSS penetration in new tractors	EU: 8% in 2009 US: 12% in 2009
Retrofitting	4% of all tractors in 2009 CAGR 12%



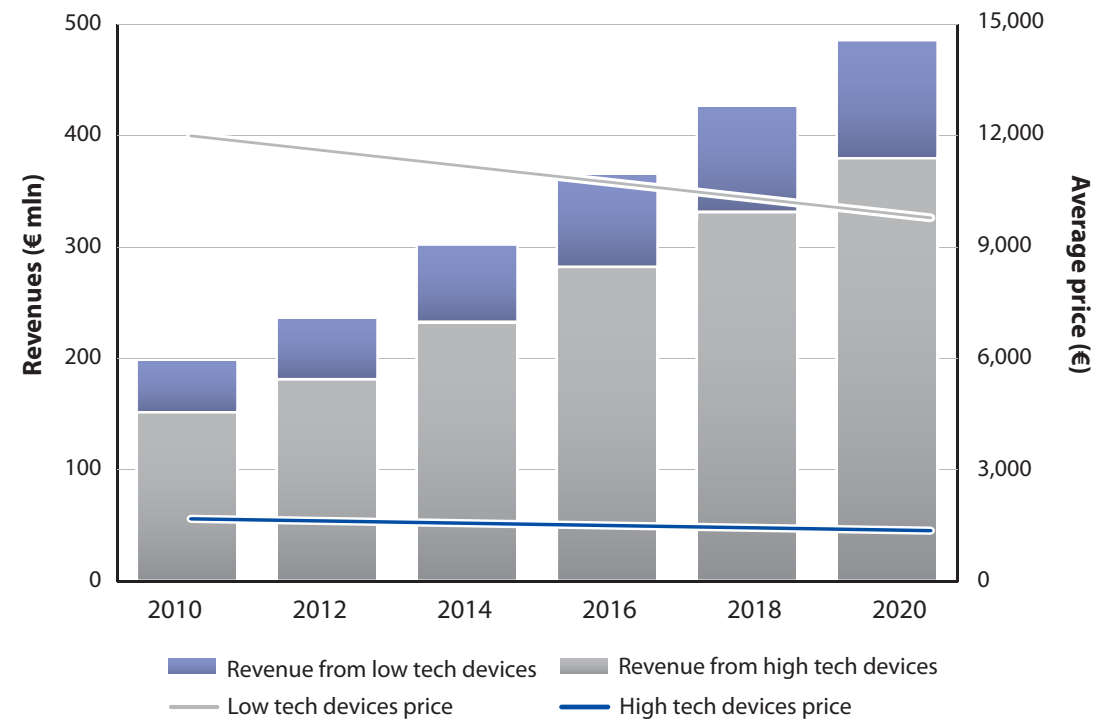
- ▶ GNSS penetration in tractors will reach 33% in EU in 2020.
- ▶ Between 2010 and 2020, GNSS device sales are expected to grow at an average rate of 16%. Annual shipments of GNSS devices for the agriculture sector are estimated to some 530,000 units in 2020.
- ▶ Low technology devices (using e.g. EGNOS or WAAS) will dominate the market accounting for 93% of total sales.



## GNSS revenues\* in agriculture expected to reach almost €500 mln in 2020

Driver	Assumptions
GNSS penetration in tractors	18% by 2015 33% by 2020
Share devices (2020)	Low technology 94% High technology 6%
Average device price (2020)	Low technology - €1,400 High technology - €9,800
Share of device price attributable to GNSS	Low technology - 80% High technology - 50%

Global GNSS market size (€ mln) and device prices (€) in agriculture sector



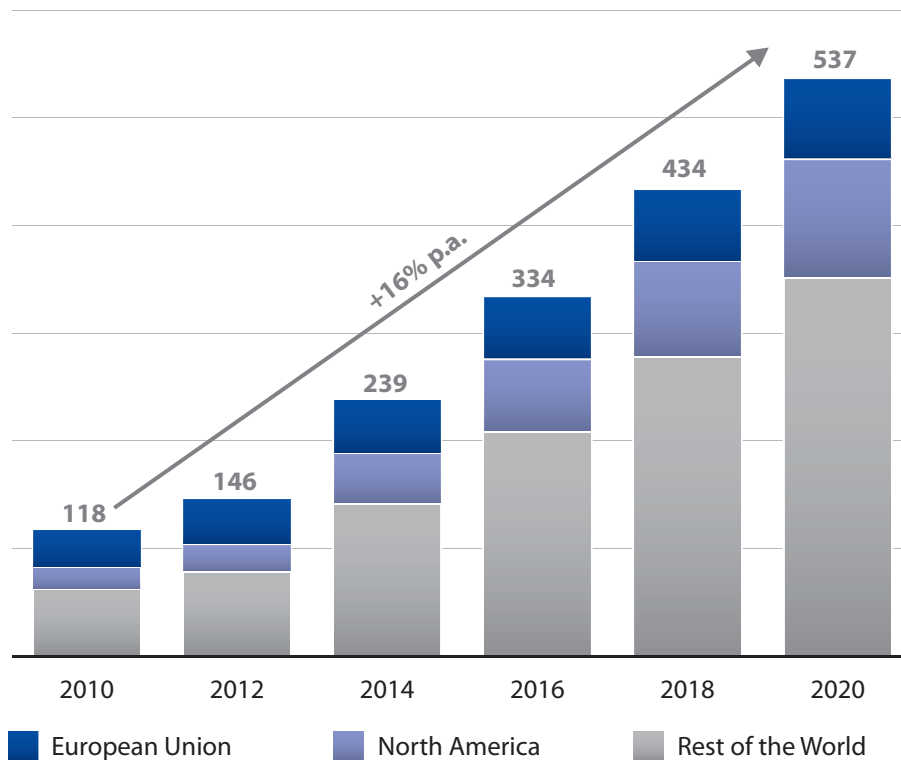
- ▶ Worldwide agriculture revenues will increase over the next decade driven by the increase in device sales from €198 mln in 2010 to €486 mln in 2020 (9% CAGR). 77% of these revenues derive from low technology devices, a proportion that remains fairly stable over time.
- ▶ The price of devices is expected to decrease by 2% each year. The price of low technology devices will fall from €12,000 in 2010 to €1,400 in 2020 while prices for high technology devices will decrease from €1,700 in 2010 to €9,800 in 2020.

\* Revenues from sales of devices. Revenues from services are not represented here.



## Agriculture market 2010-2020 by region

Shipments of GNSS devices in agriculture sector (000' units)



### GNSS device shipments in agriculture by region

Annual shipments of GNSS devices in the agriculture sector are expected to grow in all regions to reach 75,000 units by 2020 in the European Union (CAGR 8%), 110,000 units in North America (CAGR 18%) and 350,000 units in the rest of the world (CAGR 19%).

Increased sales are mainly driven by the growth of the fleet and the higher penetration of GNSS in new tractors. Retrofitting is not a main driver.

<b>API</b>	Application Programming Interface	<b>GPS</b>	Global Positioning System
<b>APV</b>	Approach with Vertical Guidance	<b>IFR</b>	Instrument Flight Rules
<b>ADAS</b>	Advanced Driver Assistance Systems	<b>IOC</b>	Initial Operational Capacity (of Galileo)
<b>ARPU</b>	Average Revenue Per User (annually)	<b>LBS</b>	Location Based Services
<b>ASP</b>	Average Selling Price	<b>p.a.</b>	Per Annum (per year)
<b>ATM</b>	Air Traffic Management	<b>PDA</b>	Personal Digital Assistant
<b>AWU</b>	Annual Work Unit	<b>PND</b>	Personal Navigation Device
<b>CA</b>	Commercial Aviation	<b>POI</b>	Point Of Interest
<b>CAGR</b>	Compound Annual Growth Rate	<b>ROW</b>	Rest of the World
<b>CAT</b>	Category	<b>RTK</b>	Real Time Kinematic
<b>CS</b>	Commercial Service (of Galileo)	<b>RUC</b>	Road User Charging
<b>DDC</b>	Delays, Diversions and Cancellations	<b>SBAS</b>	Satellite Based Augmentation System
<b>DGPS</b>	Differential GPS	<b>SDK</b>	Software Development Kit
<b>EC</b>	European Commission	<b>SESAR</b>	Single European Sky ATM Research
<b>EGNOS</b>	European Geostationary Navigation Overlay Service	<b>TTFF</b>	Time To First Fix
<b>ESA</b>	European Space Agency	<b>VAT</b>	Value Added Tax
<b>EU</b>	European Union	<b>VFR</b>	Visual Flight Rules
<b>GA</b>	General Aviation	<b>WAAS</b>	Wide Area Augmentation System
<b>GNSS</b>	Global Navigation Satellite System	<b>Wi-Fi</b>	Wireless Fidelity (a common wireless networking technology)
<b>GSA</b>	European GNSS Agency		



## The Galileo and EGNOS programmes

### Galileo



Galileo will be Europe's own Global Navigation Satellite System (GNSS), providing highly accurate, guaranteed global positioning services under civilian control. It will be interoperable with the US GPS and the Russian Glonass, two other global satellite navigation systems in operation.

Galileo will open up new and exciting prospects for economic growth. It will benefit citizens, businesses and governments throughout the EU and beyond.

### The European Commission



The European Commission, mainly through its Directorate General for Enterprise and Industry, is the programme manager of Galileo.

The Full Operational Capability phase of the Galileo programme is managed by the European Commission and is fully funded by the European Union. The Commission and the European Space Agency (ESA) have signed a delegation agreement under which ESA acts as design and procurement agent on behalf of the Commission.

The European Commission is also promoting the use of EGNOS and Galileo by end-users and decision makers alike in order to foster the development of cutting-edge GNSS applications and user services and devices.

### EGNOS



EGNOS is Europe's first venture into satellite navigation. It increases the accuracy of the GPS position and provides information on its reliability, making it suitable for safety-critical applications.

Consisting of three geostationary satellites and a network of ground stations, EGNOS achieves its aim by transmitting a signal containing information on the reliability and accuracy of the positioning signals sent out by GPS. It allows users in Europe and beyond to determine their position to within about 1 metre.

### The European GNSS Agency (GSA)



The European GNSS Agency (GSA) is the authority formed by the European Union to accomplish specific tasks related to the European GNSS programmes. Its current mission is to:

- ▶ ensure the security accreditation of the systems and the operation of the Galileo security centre;
- ▶ contribute to the preparation of the commercialisation of the systems, laying the foundations for the economic sustainability and maximising the economic, social and public benefits;
- ▶ accomplish other tasks entrusted to it by the Commission, such as the promotion of applications and services and managing the R&D programmes on satellite navigation.



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