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NORWEGIAN COASTAL ADMINISTRATION

GNSS Market report

PNT Advisory Group 15

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GNSS MARKET REPORT

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Almost 4 billion GNSS devices used worldwide, with all regions experiencing growth

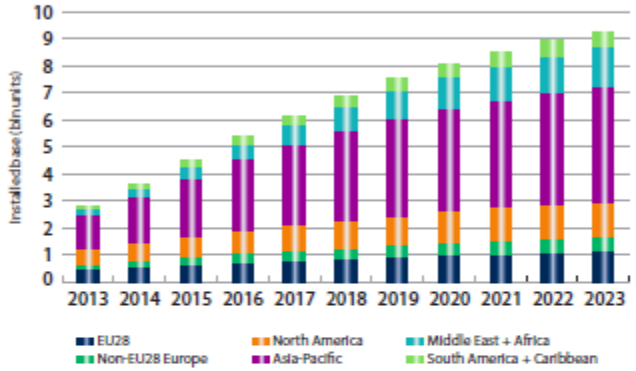
GNSS is used around the globe, with **3.6 bln GNSS devices in use in 2014**. By 2019, this is forecasted to increase to over 7 bln – for an average of one device per person on the planet.

Smartphones continue to dominate (3.08 bln in 2014), being the most popular platform to access Location-Based Services, followed by devices used for road applications (0.26 bln). Other devices may be less numerous, but billions of passengers, professionals, consumers and citizens worldwide benefit from their application in efficient and safe transport networks, in productive and sustainable agriculture, surveying, and critical infrastructures.

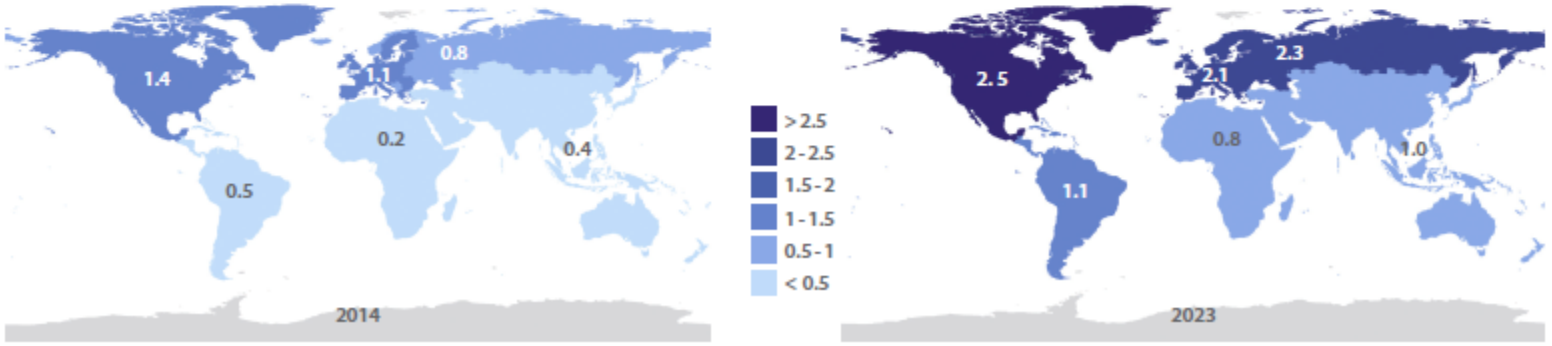
At the regional level, the installed base in the mature regions of EU28 and North America will grow steadily (8% p.a.) through 2023. **The primary region of global market growth will be Asia-Pacific**, which is forecasted to grow 11% p.a. from 1.7 bln in 2014 to 4.2 bln devices in 2023 – more than the EU and North America combined. The Middle East and Africa will grow at the fastest rate (19% p.a.), but starting from a low base.

As a result, the 'digital divide' is forecasted to narrow. Although there is significant regional variation in GNSS penetration in terms of devices per capita, the up-take of smartphones in emerging regions will change the situation in almost every corner of the world.

Installed base of GNSS devices by region



GNSS devices per capita: 2014 and 2023



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New GSA analysis of receiver capabilities proves that multi-constellation is becoming a standard feature in today's user equipment

This year the GSA conducted an **independent analysis of the GNSS capabilities** of the main chipset and receiver manufacturers. This analysis is focused on a selection of the global top 31 companies* (by market segment consistent with the list in respective value chains) and a review of their publicly available technical documentation on the product portfolio. In principle, only manufacturers with more than 1% global market share by market segment were included.

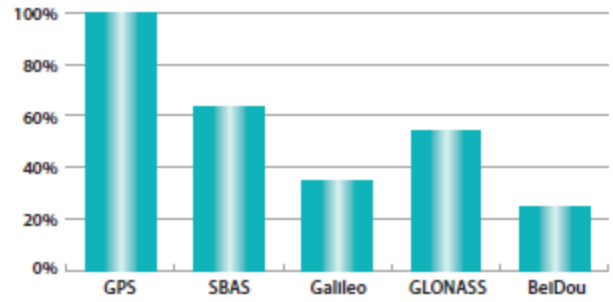
The analysis assesses the capabilities of **more than 300 receivers, chipsets and modules** currently available on the market**. The parameters researched include such technical information specifications as GNSS core constellation capabilities, SBAS constellation capabilities and the market segments to which the manufacturers sell their products.

In the presented results, each device is weighted equally, regardless of whether it is a chipset or a receiver and no matter what its sales volume. The results should therefore be interpreted not as the split of constellations utilised by end users, but rather the split of constellations available in manufacturers' offerings. As some receiver models are used in more than one market segment, it is impossible to have a direct match between general analysis charts and segment charts.

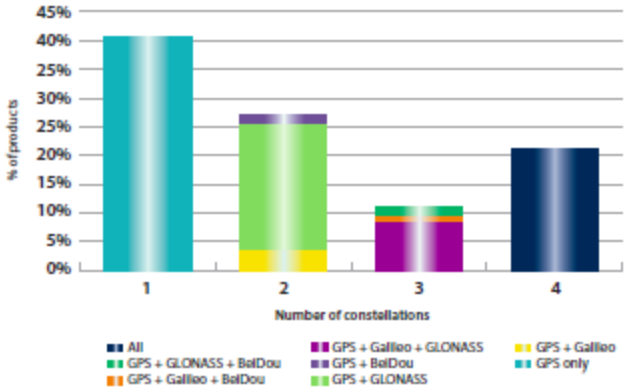
The **"Capability of GNSS devices"** chart shows the percentage of available receivers capable of tracking the SBAS, GPS, Galileo, GLONASS and BeiDou constellations. GPS is naturally present in all devices, followed by GLONASS. Galileo and BeiDou are progressively adopted by the leading manufacturers. In some cases, the full capability of GNSS receivers (chipsets/modules) is not necessarily used in the products/devices (e.g. SBAS capability in LBS segment).

The **"Supported constellation by receivers"** chart shows the percentage of available receivers capable of tracking signals from one GNSS (i.e. GPS only), two GNSS (i.e. GPS + Galileo, GPS + GLONASS, GPS + BeiDou), three GNSS (i.e. GPS + Galileo + GLONASS, GPS + Galileo + BeiDou, GPS + GLONASS + BeiDou) or tracking signals from all constellations at the same time. The percentages add up to 100%. We can conclude that almost 60% of all available receivers, chipsets and modules are supporting a minimum of two constellations, showing that multi-constellation is becoming a standard feature across all market segments.

Capability of GNSS receivers – All segments



Supported constellations by receivers – All segments



* Analysed manufacturers: CSR, Furuno, Hemisphere GNSS, Japan Radio Co., Leica Geosystems AG, Mediatek, NavCom Technology, Nottingham Scientific Ltd, NovAtel, Orolia, Septentrio, STMicroelectronics, Topcon, Trimble, U-blox, Avidyne, Broadcom, Esterline, Garmin, Honeywell, Infineon, Intel, John Deere, Kongsberg, Omnicom, Qualcomm, Rockwell Collins, SkyTraq Technology, Texas Instruments, THALES Avionics, Universal Aviation.

** Please note that the capability of GNSS devices presented in Market Report Issue 3 cannot be compared with the ones from the current edition due to different group of manufacturers used in the analysis.

The added value of multi-GNSS receivers led the IMO to invest in developing new performance standards

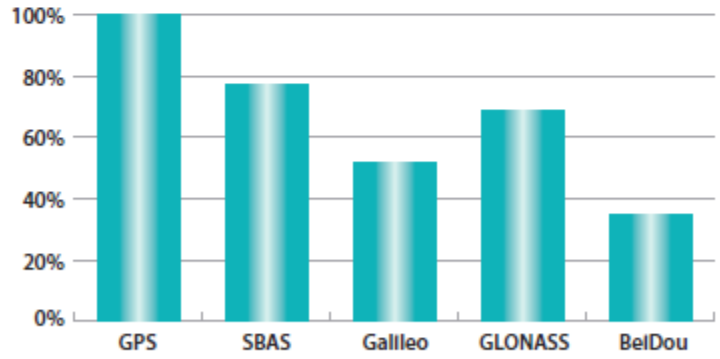
GNSS has become the primary means of navigation in many Maritime applications. The International Maritime Organization (IMO) has set **operational performance requirements for GNSS** to be recognized as World-Wide Radio Navigation Systems (WWRNS). These requirements are used as a benchmark to assess the performance of the potential core systems and their augmentations. They are expressed in the maritime context in terms of accuracy, coverage, availability, continuity and integrity warnings.

The ability to concurrently receive GNSS and augmentation signals from multiple satellites belonging to different constellations allows receivers to have a higher probability of acquiring a greater number of satellites at any single point in time. Consequently, navigation performances will be greatly improved, enhancing the users' experience and increasing the possibility for GNSS receivers to meet IMO performance standards.

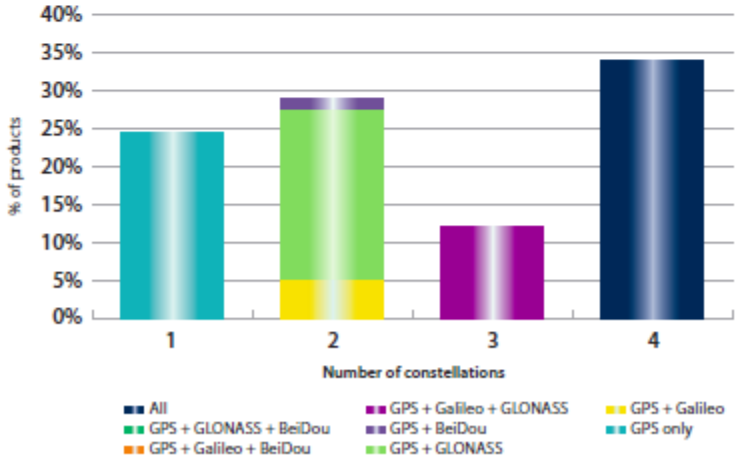
In order to ease the introduction of multi-GNSS receivers into the Maritime segment, **the IMO "Maritime Safety Committee 90" introduced the need to develop new performance standards for navigation receivers**. These new standards will enable full use of the availability, continuity and integrity, as well as increased accuracy, thanks to a combination of multi-constellation GNSS and terrestrial and augmentation systems. To this extent, the IMO "Sub-Committee on Safety of Navigation, Radio Communications and Search & Rescue" is charged with developing "Performance Standards For Multi-System Shipborne Navigation Receivers". The status of the initiative is advanced and such standards are expected to be provided in the course of 2015.

Anticipating the provision of standards, the **adoption of multi-constellation in user equipment has already started**. The charts below show the penetration of SBAS and the four global GNSS systems in the current maritime GNSS devices' offering*. Around 75% of all devices have implemented at least two constellations (see chart on the right). The most popular system, after GPS, is GLONASS, supported by regulatory measures taken by the Russian Federation. Galileo and BeiDou are increasingly present, and more than 30% of receivers are capable of processing all constellations simultaneously.

Capability of GNSS receivers – Maritime segment



Supported constellations by receivers – Maritime segment



* For the methodology applied to the charts please go to page 15 of the Report.

IMO - International Maritime Organisation -

MSC 95 (Maritime Safety Committee) June 2015

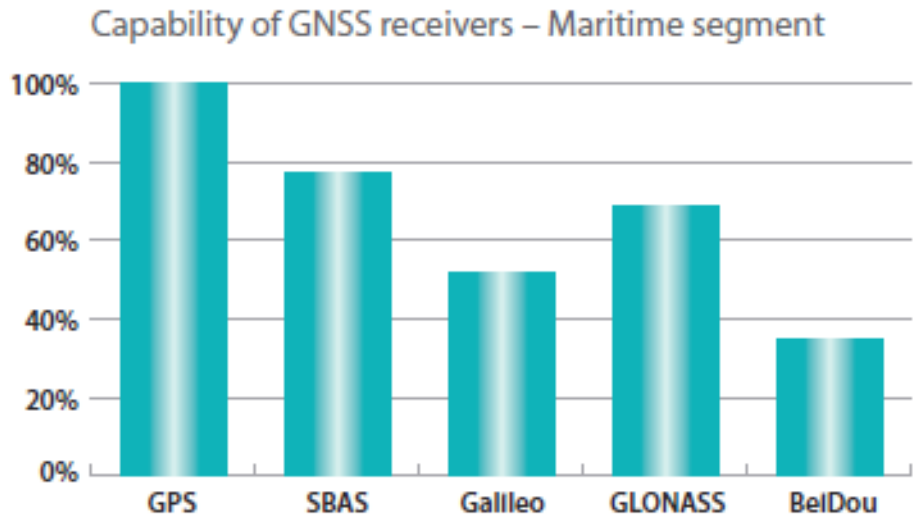
New draft standard approved:

”Performance Standards for Multi System Shipborne Radionavigation Receivers”

adds to:

- Resolution MSC.112(73) Shipborne Global Positioning System (**GPS**) receives equipment
- Resolution MSC.113(73) Performance standards for shipborne **GLONASS** receives equipment
- Resolution MSC.114(73) Standards for shipborne **DGPS** and **DGLONASS** maritime radio beacon receiver equipment
- Resolution MSC.115(73) Standards for shipborne combined **GPS-GLONASS** receiver equipment
- Resolution MSC.233(82) ADOPTION OF THE PERFORMANCE STANDARDS FOR SHIPBORNE **GALILEO** RECEIVER EQUIPMENT
- Resolution MSC.379(93) PERFORMANCE STANDARDS FOR SHIPBORNE **BEIDOU** SATELLITE NAVIGATION SYSTEM (BDS) RECEIVER EQUIPMENT

GNSS Market report cont'd



* For the methodology applied to the charts please go to page 15 of the Report.

EGNOS for Maritime Users?

- IALA DGPS ”Global” network provides
  - Increased accuracy
  - Integrity

- EGNOS / SBAS provides
  - Increased accuracy
  - Integrity?

- The GSA is currently studying whether EGNOS v3 can provide integrity for Maritime Users
  - Outreach to identify user needs
  - IMO performance requirements vs ICAO performance requirements
  - Receiver standardisation
  - Identify regulatory and technical steps required






Global maritime traffic is increasing and Europe's ports and inland waterways are becoming ever more congested. This growth requires new solutions to improve efficiency, safety and minimise the impact of maritime traffic on the environment.

Accurate and reliable positioning are key elements for a range of satellite systems capable of streamlining port operations, improving safety and protecting maritime environments. New satellite based systems that can substantially reduce response times in case of an emergency are also being deployed.

Two European programmes, EGNOS and Galileo, serve as the backbone for a wide-range of solutions tailored to **navigation at sea and in inland waterways of commercial and leisure vessels, search and rescue activities, port operations and environmental protection.**

" Be it for fisheries, yachting, passenger or freight, **maritime transport relies on satellite technology.**

By contributing to a safer, more efficient and more sustainable maritime sector, EGNOS and, in the near future, Galileo, are making a real difference. "

How can EGNOS and Galileo make a difference?

NAVIGATION

Satellite-based systems have fundamentally changed maritime navigation. Vessels ranging from small sailing boats to super tankers now have systems on board that rely on satellites for positioning. EGNOS, and soon Galileo, can make navigation more **accurate, reliable** and **available**.

Many systems installed on leisure craft already integrate EGNOS corrections. The resulting precise positioning, especially in tight waters, makes navigation easier and safer. On rivers and other inland waterways, EGNOS already complements existing ground-based systems.

The deployment of Galileo will further enhance positioning accuracy by adding additional satellites to the currently available constellations.

SEARCH AND RESCUE

In case of an emergency at sea, **time is of the essence** and **first response is critical.**

Galileo, in combination with other GNSS systems, will make a meaningful difference by offering:

- Faster alert localisation and message detection
- A more precise localisation of the distress beacon
- Higher availability
- Global multi-satellite coverage

Galileo will complement the existing network of satellites tasked to receive and transmit distress signals. This will greatly decrease response times, which now can take over an hour as one waits for a satellite to be in line of sight and able to pick up the distress signal. Galileo will also offer a return link confirming the distress signal was received – which has proven to drastically improve the chances of survival.

PORT OPERATIONS

Many ports are congested and require systems to ensure efficient operations whilst guaranteeing safety. Furthermore, the increase in the size of cargo ships has led to the need for extremely accurate manoeuvring.

One solution is EGNOS-based portable pilot units that provide increased confidence and accuracy in the vessel's positioning. Accurate positioning enhances the precision of Vessel Traffic Monitoring and Information Systems (VTMIS), which manage vessel movements and increase both efficiency and safety.

Once deployed, Galileo will further improve both availability and accuracy.

ENVIRONMENTAL PROTECTIONS

Maritime environments are often vulnerable and require protection. Galileo is the foundation for a range of new solutions designed to protect delicate marine environments, reduce fuel consumption and enable more efficient enforcement of environmental protection measures.

Improved accuracy can facilitate the development of tools that promote sustainable fishery, and the guaranteed positioning offered by Galileo will enable more efficient enforcement. This guaranteed position can also serve as the basis for systems designed to protect vulnerable maritime areas such as marine parks. More so, research is currently underway to combine accurate positioning and meteorological data that has the potential to turn all vessels into small weather stations.

The European **G**lobal Navigation **S**atellite System **A**gency (GSA) has published the ”GNSS Market Report” on:

http://www.gsa.europa.eu/market/market-report

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