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# XXVI FIG CONGRESS

8-11 May 2018, İstanbul



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# GNSS Positioning: From High-end to Mass-market

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## GNSS/RNSS in a Nutshell: Operational Status

	Healthy SV	Orbiting SV	As of	Source
GPS	31	32	23/04/2018	NAVCEN* <sup>1</sup>
GLONASS	23	25	23/04/2018	Information Analysis Centre* <sup>2</sup>
Galileo	14	18	23/04/2018	European GNSS Service Centre* <sup>3</sup>
BeiDou	15	28	22/04/2018	Information Analysis Centre* <sup>2</sup>
QZSS	4	4	23/03/2018	QZ-vision* <sup>4</sup>
IRNSS	8	8	23/03/2018	Indian Space Research Organisation* <sup>5</sup>
	<b>95</b>	<b>115</b>		

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\*1: <http://navcen.uscg.gov/?Do=constellationStatus>

\*2: <https://www.glonass-iac.ru/en/>

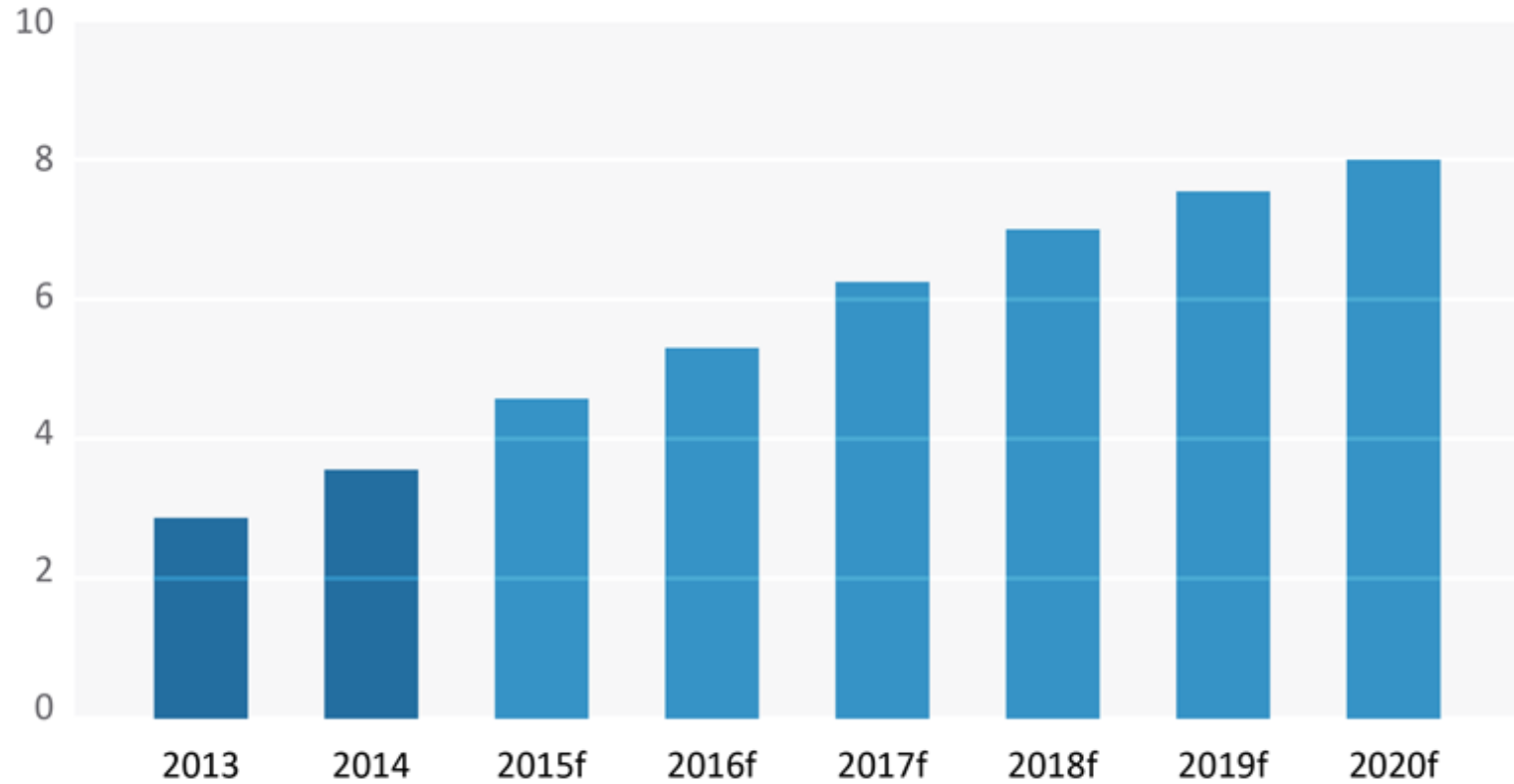
\*3: <https://www.gsc-europa.eu/system-status/Constellation-Information>

\*4: <http://qzss.go.jp/en/index.html>

\*5: <https://www.isro.gov.in/spacecraft/list-of-navigation-satellites>



## 8 billion navigation devices in the world by 2020



Source:  
European Commission (2017)

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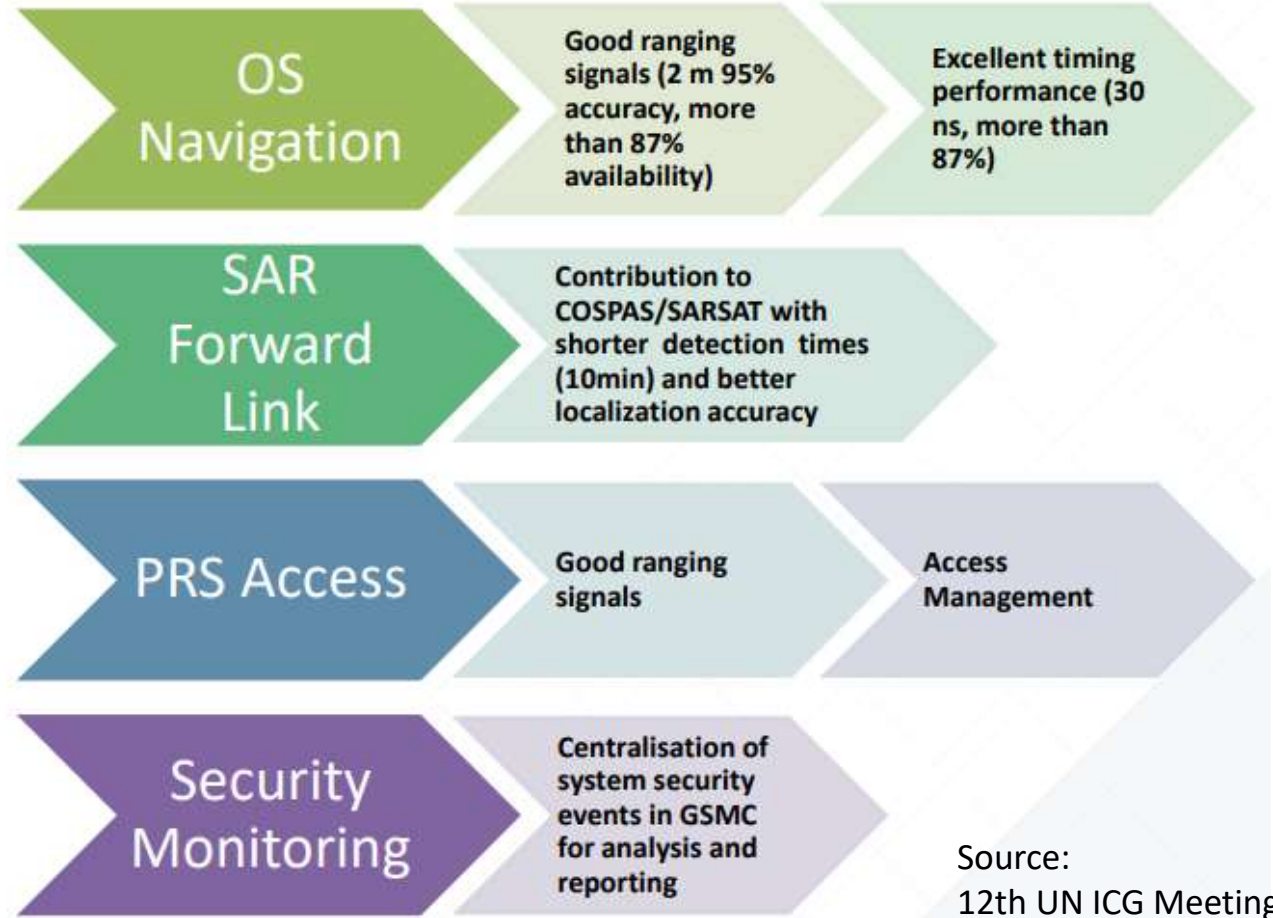






# Galileo and EGNOS

## What services are offered?



Source:  
12th UN ICG Meeting (2017)

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# Galileo and EGNOS Commercial Service



★ Programme decision taken : **High Accuracy and Authentication.**



★ Authentication will be based on a

★ **Navigation Message Authentication:**

★ Integrated in the E1 OS. Aimed at consumer users and offered for free. Already prototyped and under testing



★ **Commercial Service Authentication:** based on the E6 Spreading Code Encryption.

★ **High Accuracy** will be based on PPP transmission in E6B.



★ Gradual implementation between **2018 and 2020**

Source:  
12th UN ICG Meeting (2017)

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# QZSS

What services are offered?



## Functional capability:

1. GPS Complementary
2. GNSS Augmentation
  - Sub-meter Level Augmentation Service (SLAS)
  - **Centimeter Level Augmentation Service (CLAS)**
  - SBAS transmission
  - Public Regulated Service
3. Messaging Service
  - Satellite Report for Disaster and Crisis Management

Source:  
12th UN ICG Meeting (2017)

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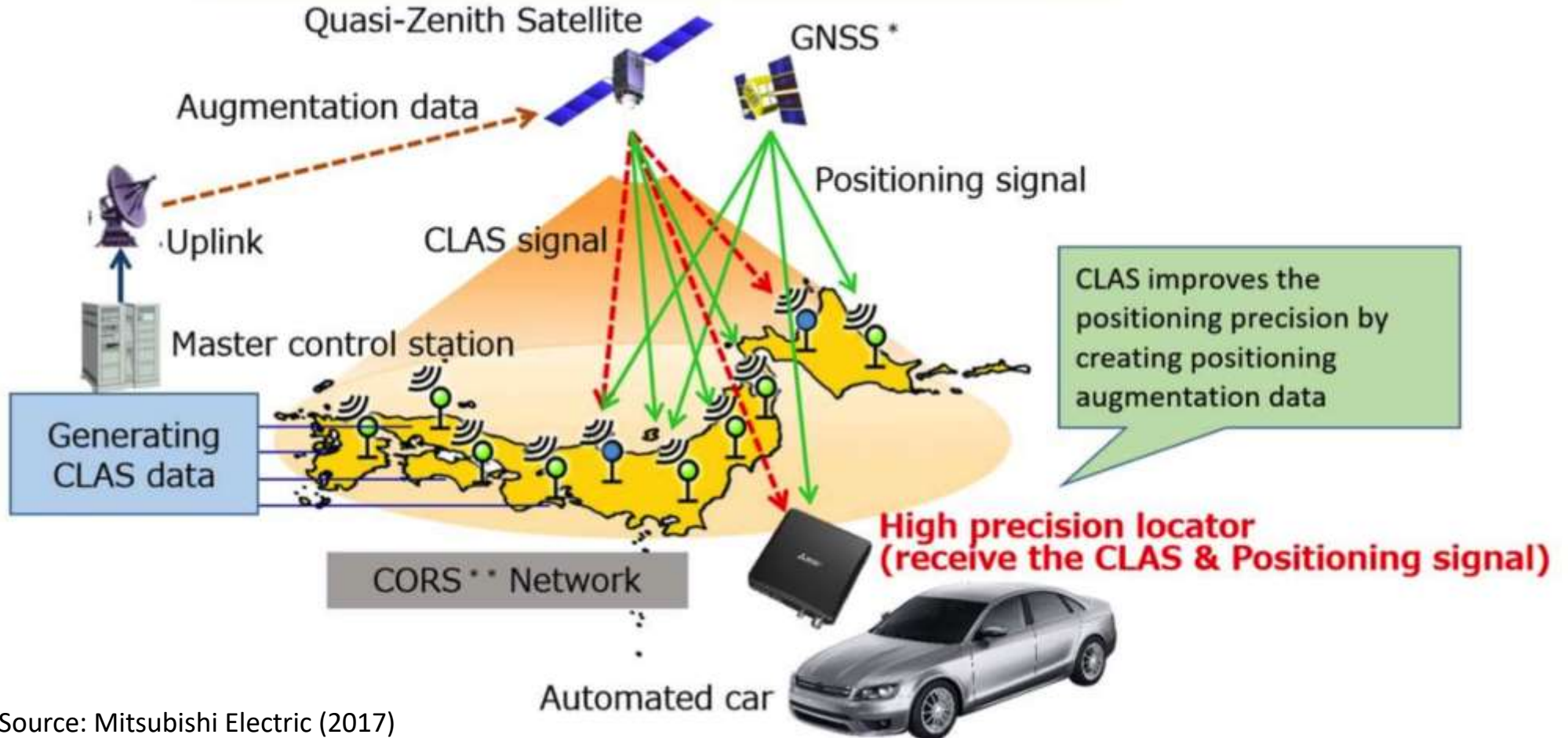
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Source: Mitsubishi Electric (2017)

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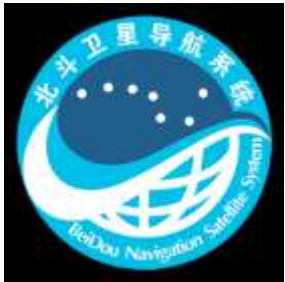
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# BeiDou

## Planning of services



Service type	Service area	Nominal Specification	Remarks
RNSS	Global	Positioning accuracy < 10m Timing accuracy < 20ns Velocity accuracy < 0.2m/s	In the Asia-Pacific region, services are improved by the GEO and IGSO satellites Timing accuracy < 10ns Velocity accuracy < 0.1m/s
short message communication services	China and the surrounding areas	Regional communication ability < 1000 Chinese characters per time	RDSS, GEO satellites
	Global	Trial communication ability < 40 Chinese characters per time	Communication + RNSS, MEO satellites

Source:  
12th UN ICG Meeting (2017)



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# GLONASS

What services are offered?



Source:  
 12th UN ICG Meeting (2017)

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# Moore's Law

Everything gets better and better

Accuracy 

Cost 

Size 



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## Broadcom Dual-frequency Chip



- Processing of satellite signals in both L1/E1 and L5/E5 frequency bands providing higher level of location accuracy
- Incorporates new low power GNSS radio and dual-core ARM® CM4-CM0 sensor hub
- More than 50% lower power consumption compared to previous generation GNSS receiver
- Delivers high quality raw GNSS measurements for both code and carrier phase enabling advanced location-based applications

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Investor press releases | 08 August 2017

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# Bosch, Geo++, Mitsubishi Electric and u-blox to establish joint venture Sapcorda Services to bring high precision GNSS positioning services to Mass Markets

Bosch, Geo++, Mitsubishi Electric and u-blox today announced the creation of Sapcorda Services GmbH, a joint venture that will bring high precision GNSS positioning services to mass market applications

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News Releases

## Global Positioning Augmentation Service Corporation (GPAS) Newly Established for Commercialization of Centimeter-level High-precision Satellite Positioning Service

Jun. 14, 2017 [News Releases](#) [Organization Announcement](#)

Hitachi Zosen Corporation, Development Bank of Japan, DENSO Corporation, Japan Radio Co., Ltd., and Hitachi Automotive Systems, Ltd. today announced that they will establish a new company named Global Positioning Augmentation Service Corporation (GPAS) on June 15, 2017 in the form of a joint investment.

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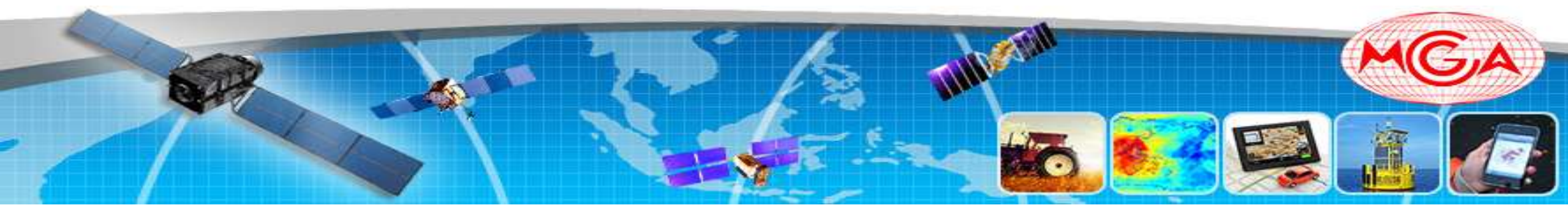
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# 10<sup>th</sup> Multi-GNSS Asia (MGA) Conference



RMIT University  
Melbourne, Australia

23-25 October 2018

<https://2018.mgaconference.com.au/>