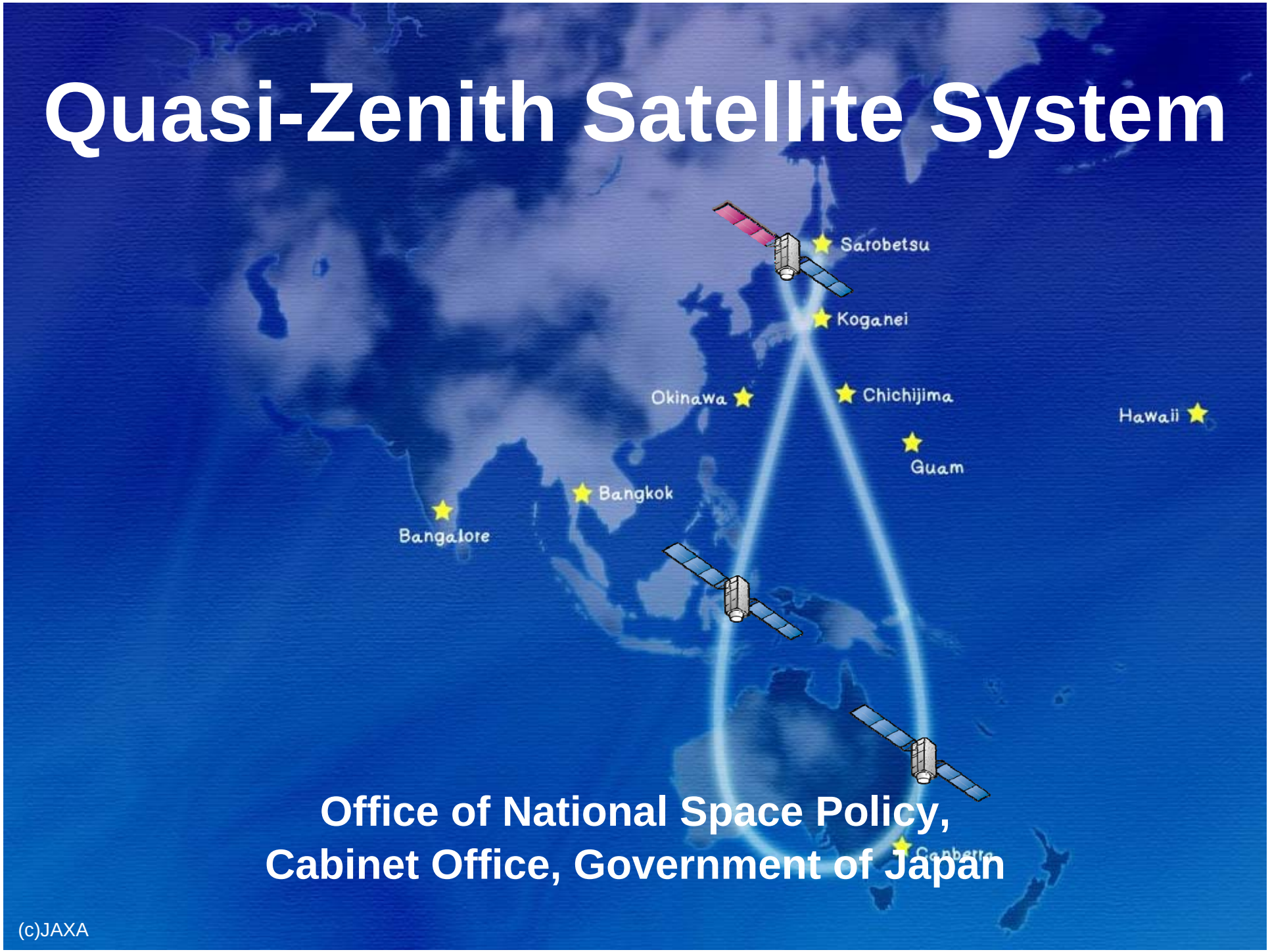
Quasi-Zenith Satellite System



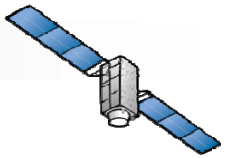
Office of National Space Policy,
Cabinet Office, Government of Japan

Quasi-Zenith Satellite System

- ***Functional Capability:***
  - GNSS Complementary
  - GNSS Augmentation
  - Messaging Service
- ***Coverage:*** Asia and Pacific region
- ***Signals:***
  - L1C/A, L1C, L2C and L5
  - L1S (L1-SAIF) on 1575.42 MHz
  - L6 (LEX) on 1278.75MHz
- ***First QZSS satellite "MICHIBIKI"***

- ***Four satellites constellation shall be established and the service will start in 2018.***

Timeline of QZSS (planned)



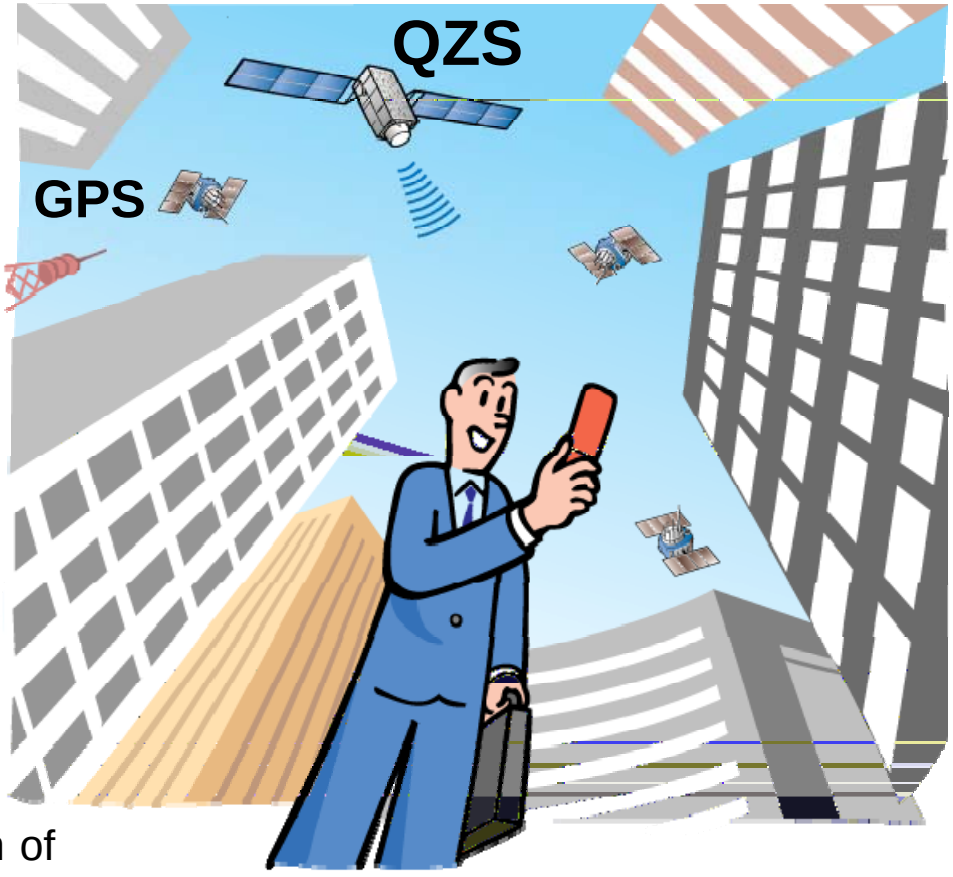
FY	2012	2013	------	2016	2017	2018	2019	------	------	2031	2032	
		Development (~6 years)										
						Operation (15 years)						

QZSS Functional Capability 1

GPS Complementary

QZSS improves positioning availability time

Navigation signals L1-C/A, L1C, L2C, and L5 sent from high elevation will improve the time percentage of positioning availability from 90 % (GPS only) to 99.8 % * (GPS + QZSS.)

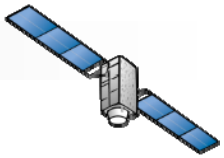


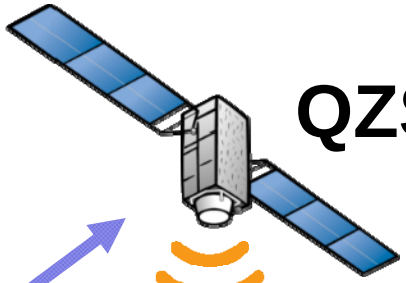
* The time percentage that the position dilution of precision (PDOP) is less than 6 when a satellite whose elevation angle is 20 degrees or over is used for positioning calculation.

QZSS Functional Capability 2

GPS Augmentation

QZSS improves positioning accuracy and reliability



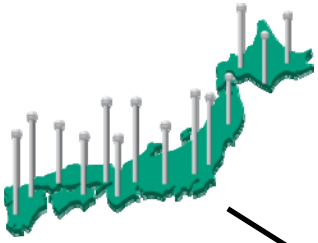


Navigation Signal

GPS Galileo GLONASS

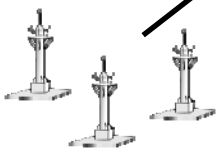
Navigation Signal and Augmentation Data

Ground Segment



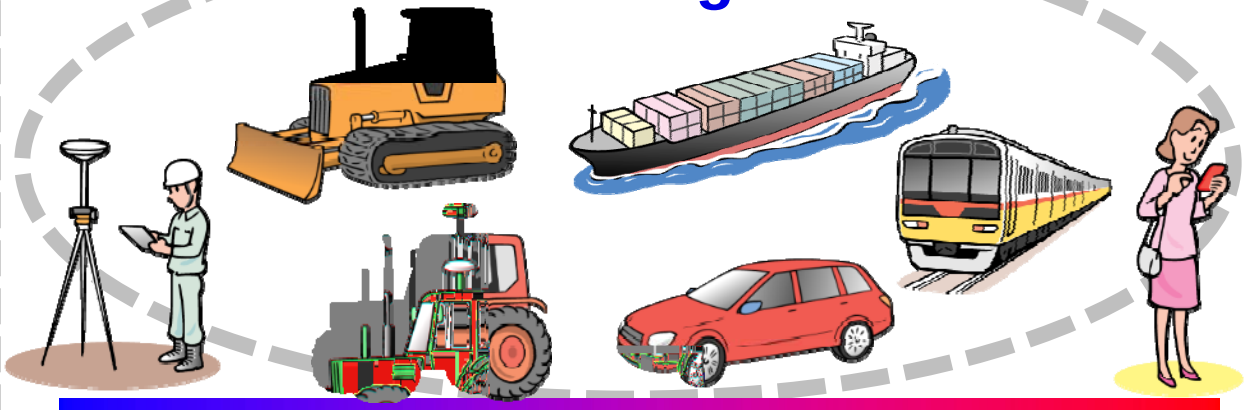
GNSS Earth Observation Network

Augmentation Data Generation



Global Monitoring Stations

User Segment



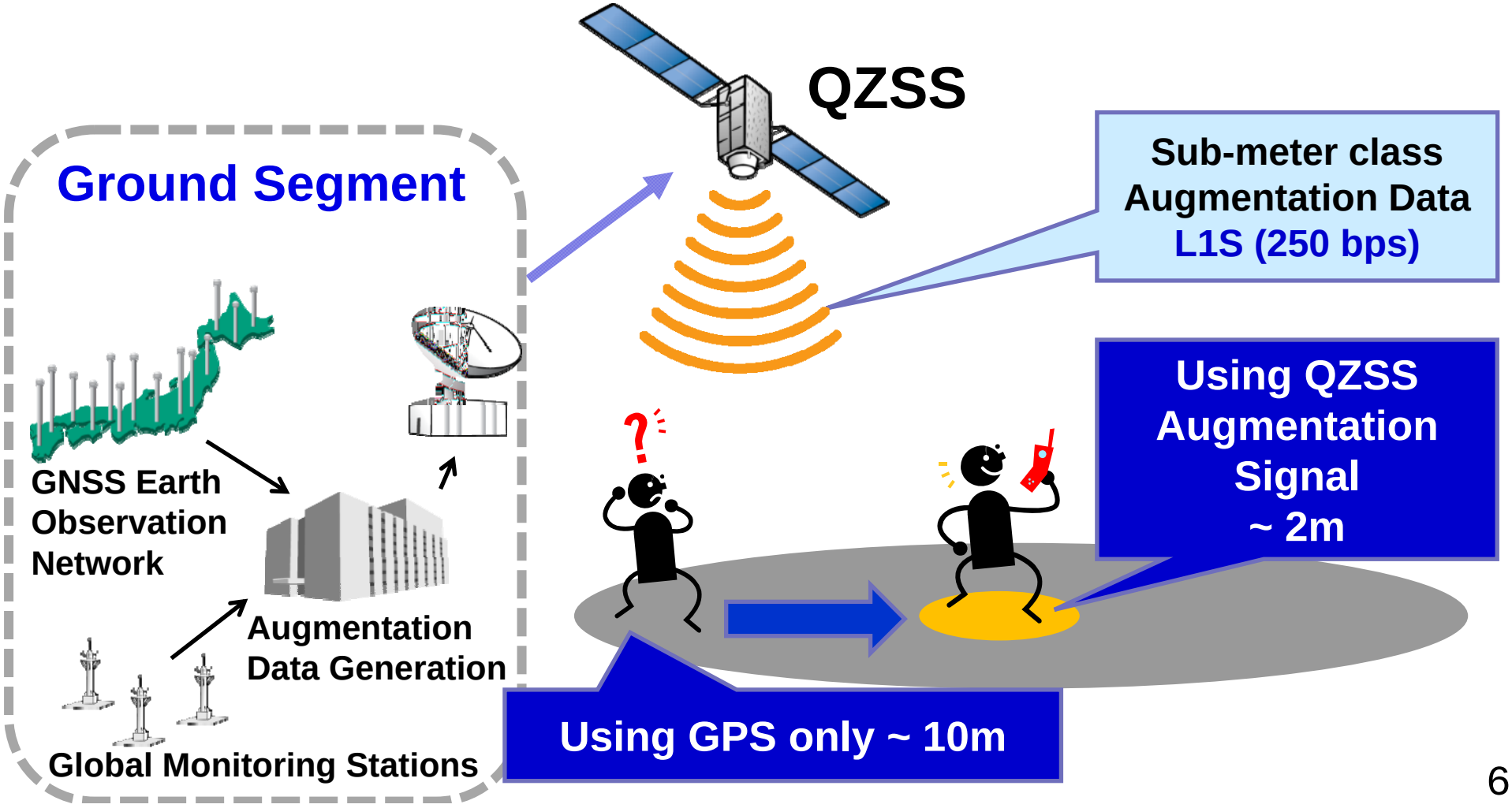
L6 L1S

centimeter (accuracy) sub-meter

QZSS Functional Capability 2

GPS Augmentation

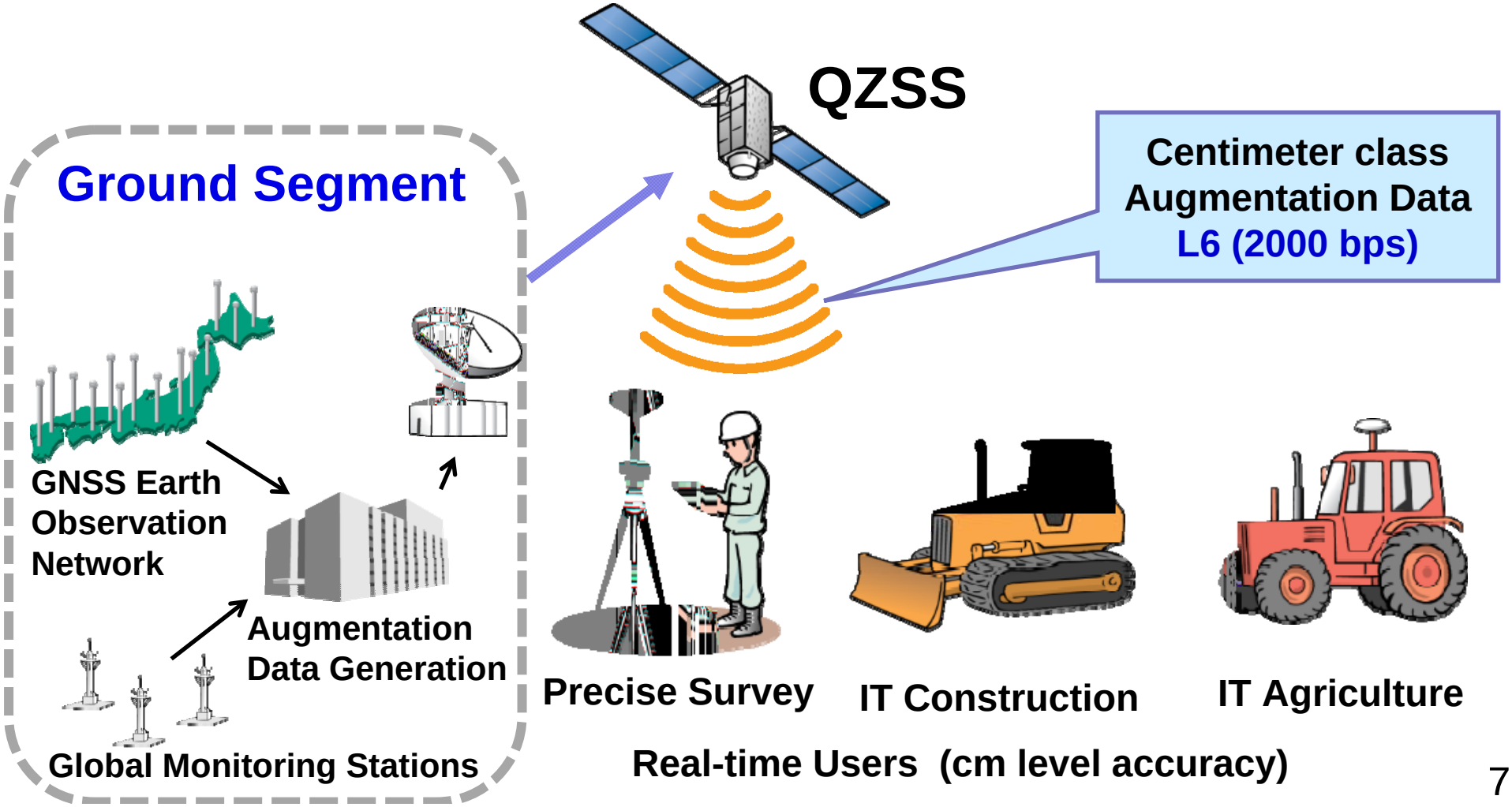
Sub-meter Class Augmentation



QZSS Functional Capability 2

GPS Augmentation

Centimeter Class Augmentation

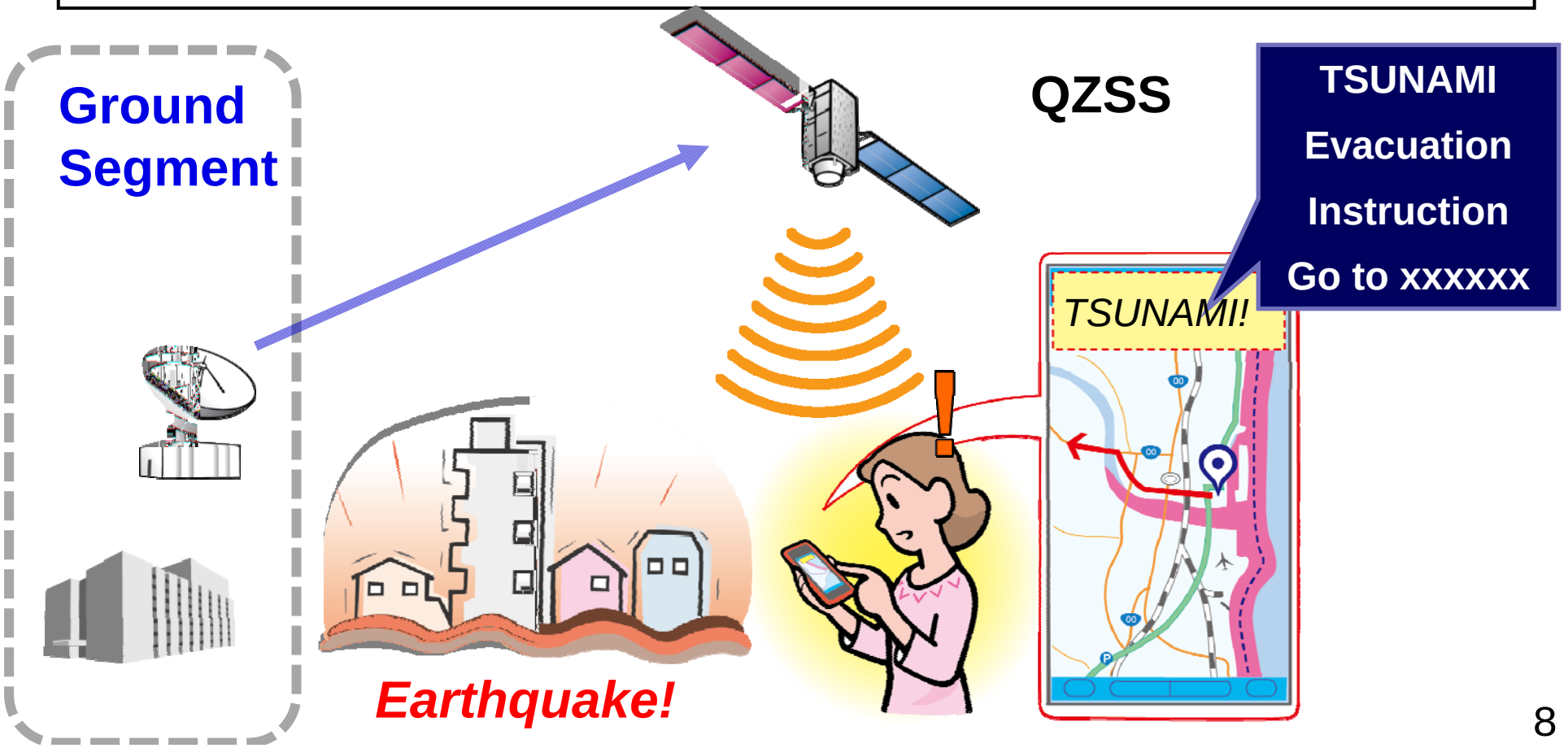


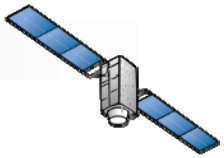
QZSS Functional Capability 3

Messaging Service

QZSS can send short messages

•QZSS can send short messages such as emergency warnings simultaneously to everyone with a mobile phone.





QZSS Update

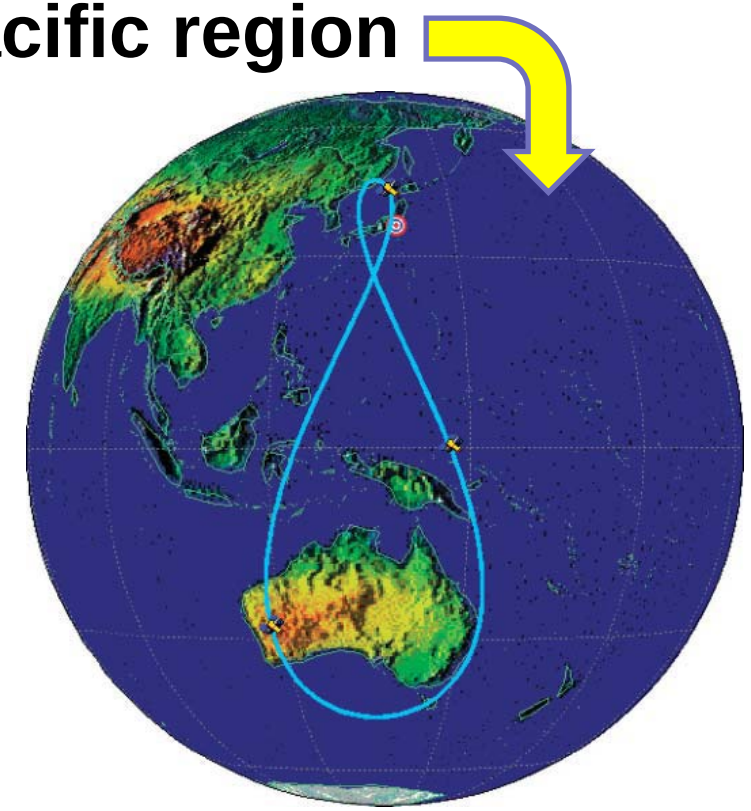
- ***Basic policy on the implementation of the operational QZSS project*** *(Cabinet Decision on September 30, 2011)*
  - The Government of Japan has decided to accelerate the deployment of the operational QZSS as expeditiously as possible.
- ***Verification of QZS-1 MICHIBIKI***
  - Technical Verification by JAXA
  - Application Verification by private companies

Basic policy on the implementation of the operational QZSS project (1)

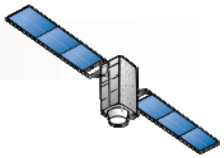
Cabinet Decision on September 30, 2011

The QZSS will contribute to

- **Welfare of the Asia and Pacific region**
- **Broad range of security including the improvement the capacity to respond to natural disasters**



QZSS Satellite Ground Track



Basic policy on the implementation of the operational QZSS project (2)

Cabinet Decision on September 30, 2011

- **GOJ has decided to accelerate the deployment of the operational QZSS as expeditiously as possible.**
- **Four satellites constellation shall be established by the late 2010s.**
- **In the future, seven satellites constellation shall be completed to enable sustainable positioning.**
- **The Cabinet Office shall develop, deploy and operate the operational QZSS, based on the achievement of the first QZSS satellite MICHIBIKI, and shall submit a budget request to cover relevant cost.**
- **Legal amendments shall be made in order for the Cabinet Office to fulfill such a role in time for budget implementation.**

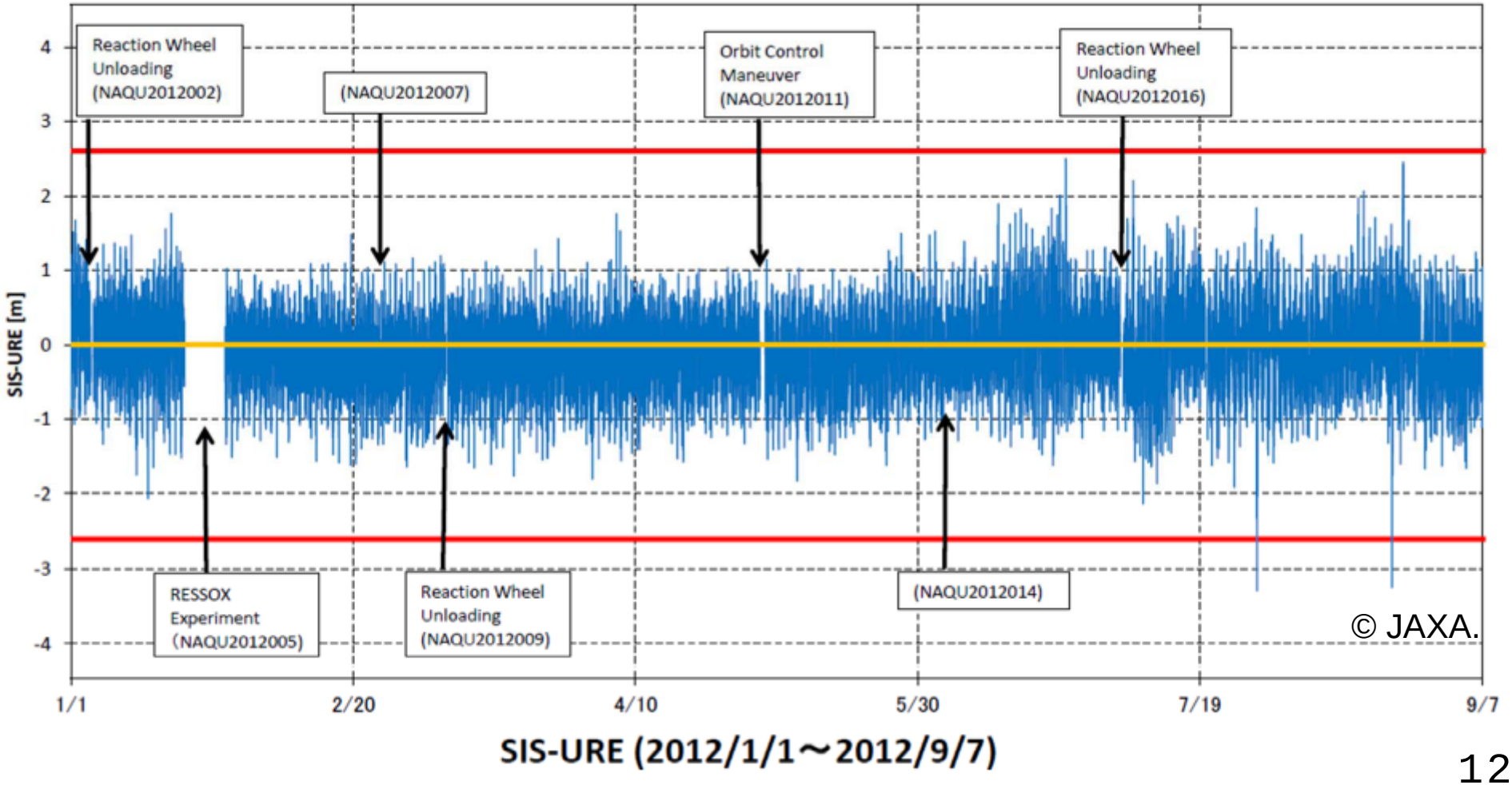
QZSS Technical Verification of QZS-1 MICHIBIKI

Accuracy : Signal-in-space User Range Error (SIS-URE)

MICHIBIKI SIS-URE meets its specification, within +/- 2.6m (95%).

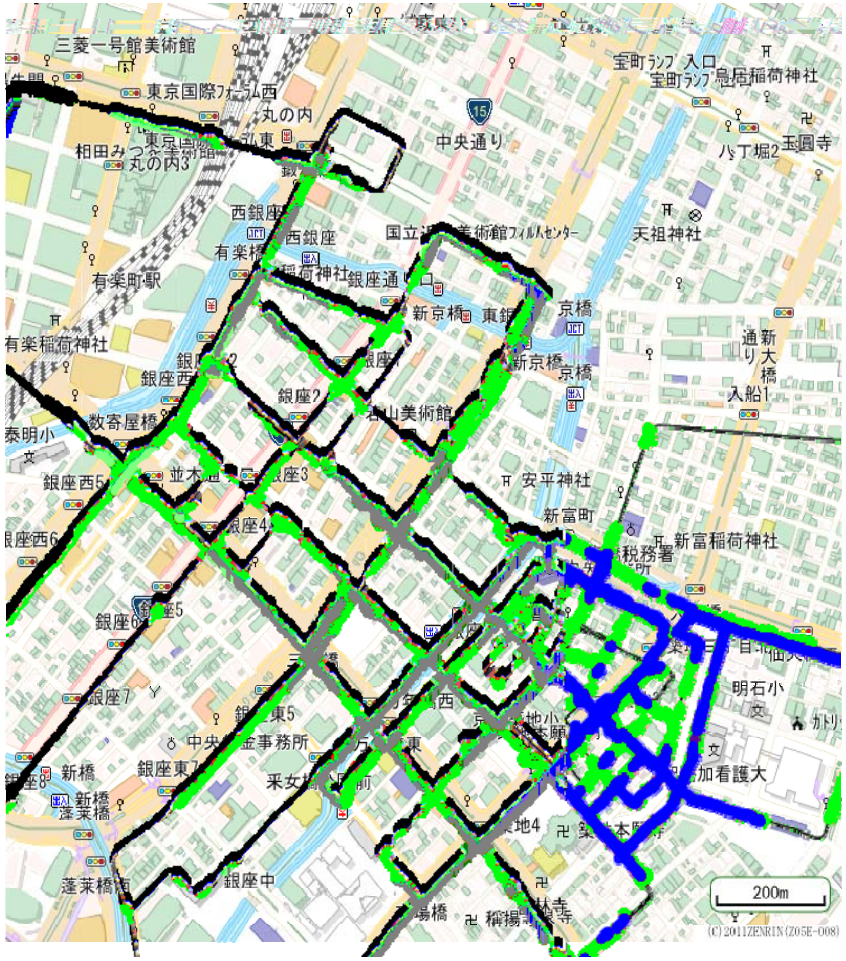
Its SIS-URE(RMS) is about 40cm & less than that of GPS's target, about 90cm*.

(*refer to GPS Program Update to CGSIC 2011)



QZSS Technical Verification of QZS-1 MICHIBIKI

Availability Improvement in Ginza, Tokyo (Feb. 19, 2011)



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Date of Observation: 2011/2/19
250 minutes driving observation data during 6:00-12:30 obtained under JAXA-Melco joint research experiment

Single Frequency DGPS positioning Availability

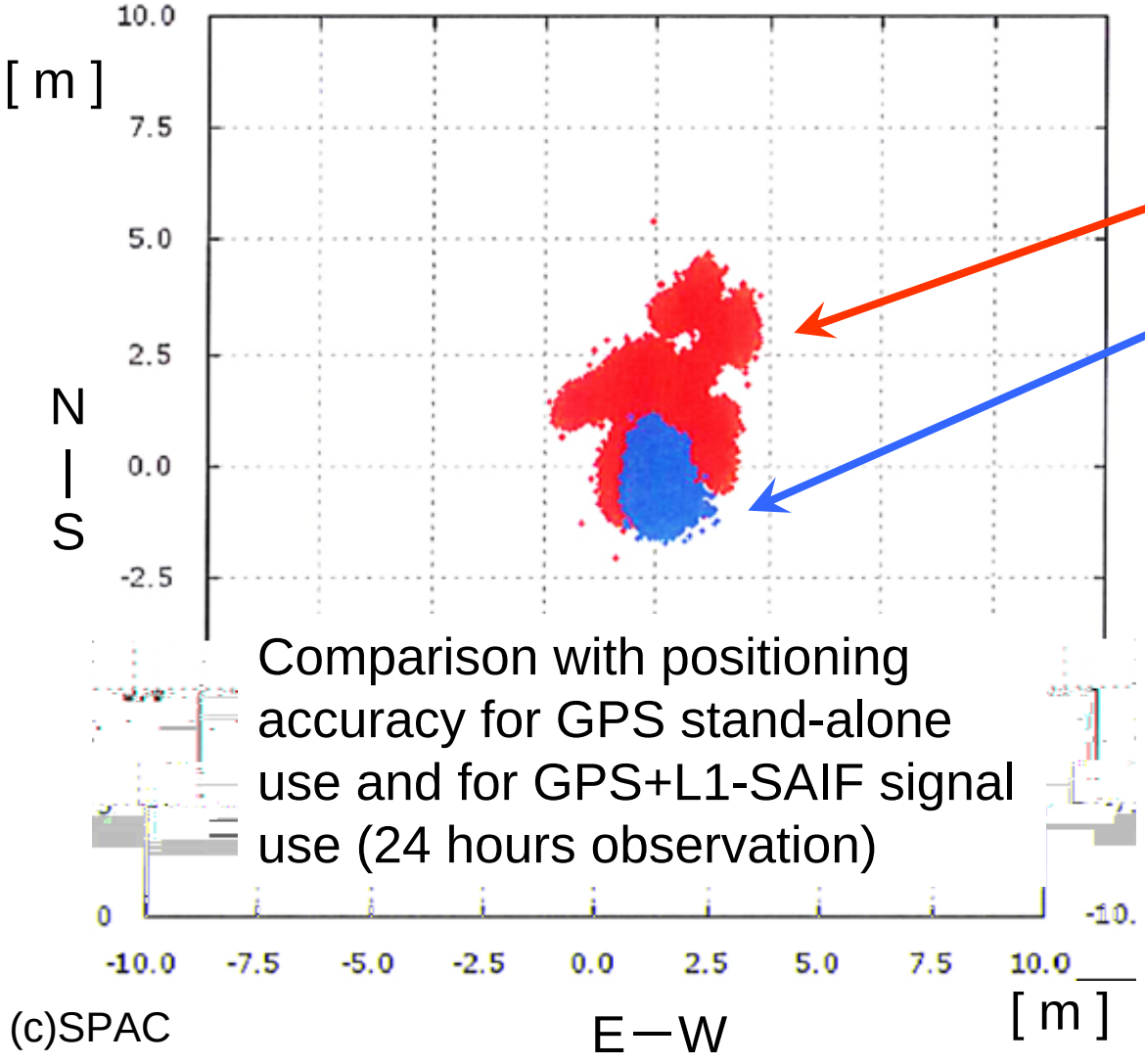
GPS: 39.5%

GPS+QZSS: 69.1%

— Reference route
● Positioning result of GPS stand-alone use
● Positioning result of GPS+QZSS combination use

QZSS Technical Verification of QZS-1 MICHIBIKI

Accuracy Improvement using augmentation signal L1-SAIF from MICHIBIKI



Comparison with positioning accuracy for GPS stand-alone use and for GPS+L1-SAIF signal use (24 hours observation)

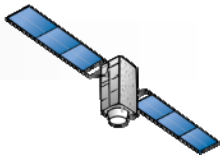
Positioning Error(RMS)

Horizontal	
GPS Only	1.56m
GPS+ L1-SAIF	0.46m

Vertical	
GPS Only	3.85m
GPS+ L1-SAIF	0.57m

* Observation Point
GPS-based control station in Kawagoe, Japan, 5/3/2011

* SAIF : Submeter-class Augmentation with Integrity Function, conformable to SBAS signal



Master Plan of QZSS

- **The Cabinet Office shall develop, deploy and operate QZSS.**
- **Four satellites constellation shall be established and the service will start in 2018.**
- **The four satellites constellation will consist of three QZSs (IGSOs) and one GEO satellite.**
- **In the future, seven satellites constellation shall be completed to enable sustainable positioning.**