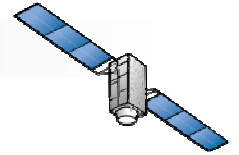


# Quasi-Zenith Satellite System



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

# System Overview



- **Functional Capability:**

- GNSS Complementary
- GNSS Augmentation
- Messaging Service

- **Coverage:** Asia and Pacific region

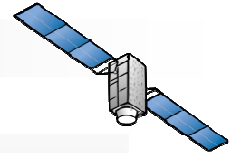
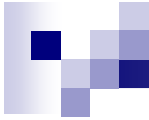
- **Signals(QZS-1):**

- 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 & the service will start in 2018.**





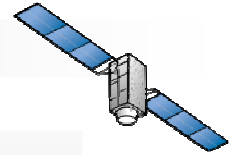
# Timeline of System Development

(Planned)

FY	2012	2013	2014	2015	2016	2017	2018	-----	2032
Over All		<b>Development (~6 years)</b>					<b>Operation (15 years)</b>		
Satellite System		Design		Test		Launch			
		Manufacturing							
Ground System		Design		Test					
		Manufacturing							

Functional Capability 1

# GPS Complementary



## **QZSS improves positioning availability time**

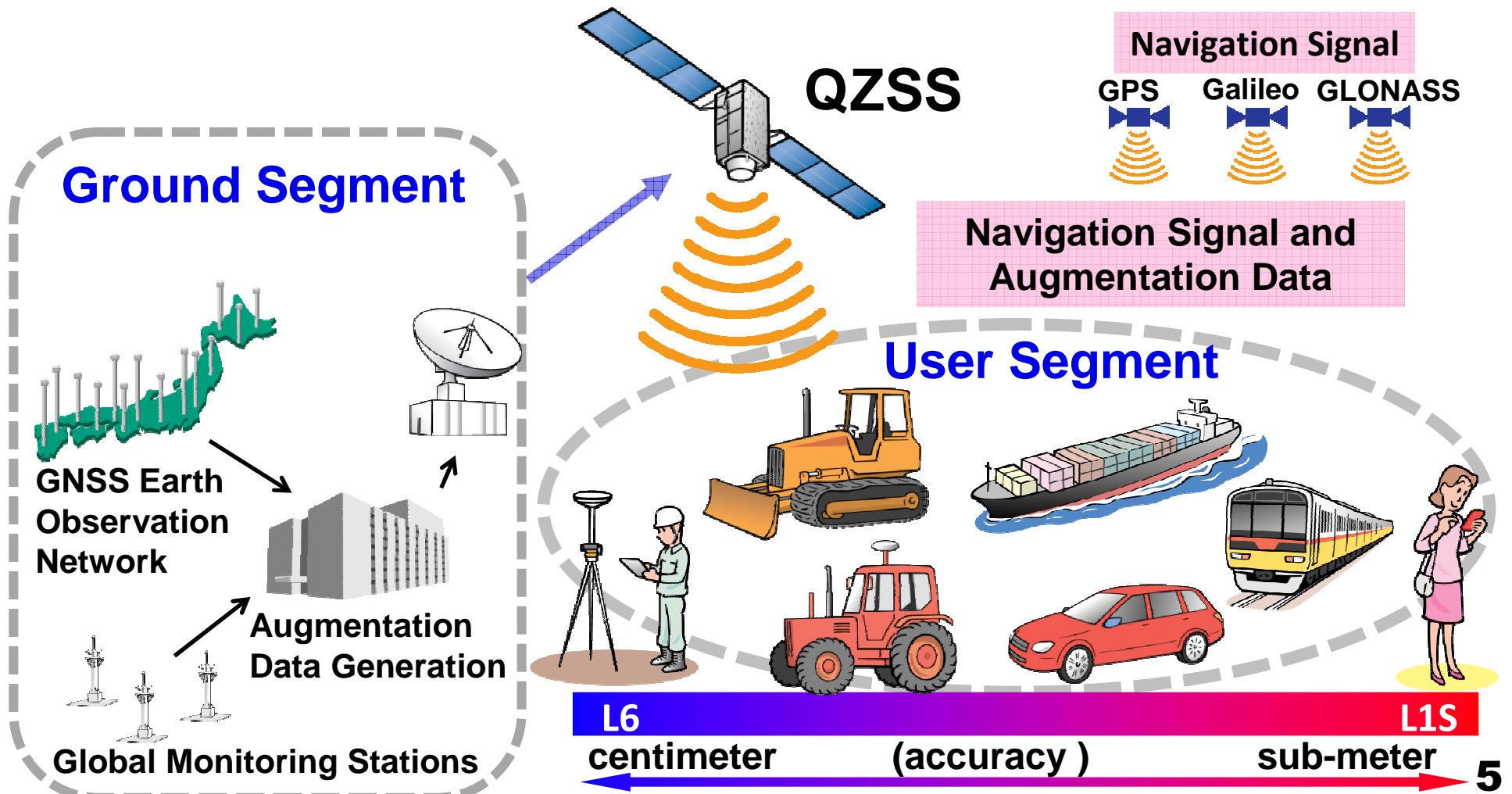
Navigation signals L1-C/A, L1C, L2C, and L5 sent from high elevation will improve the time percentage of positioning availability.



Functional Capability 2

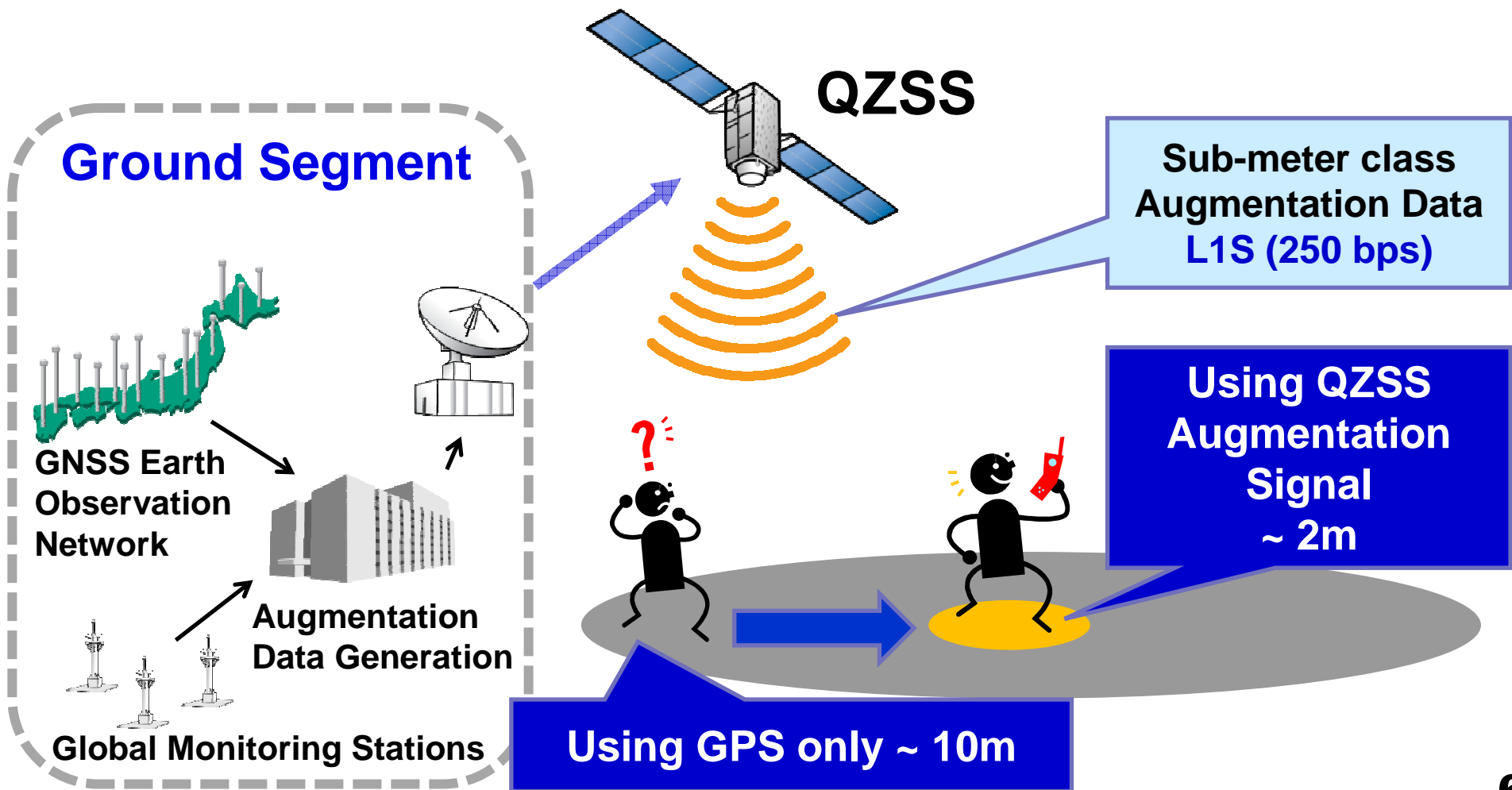
# GPS Augmentation

QZSS improves **positioning accuracy and reliability**

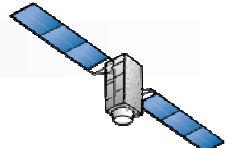


*Functional Capability 2* **GPS Augmentation**

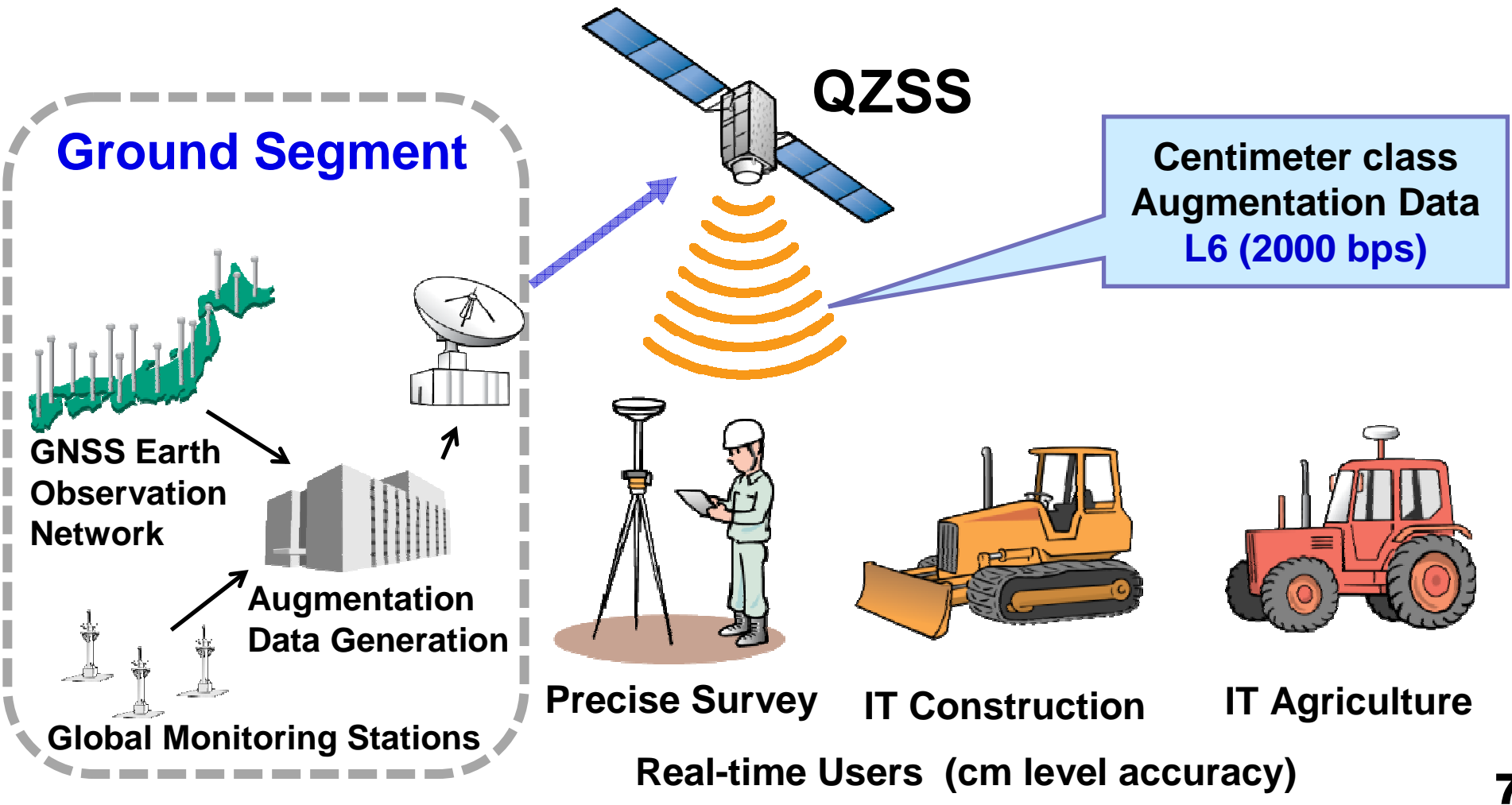
**Sub-meter Class Augmentation**



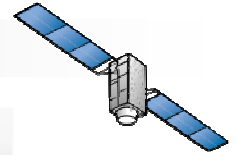
*Functional Capability 2* **GPS Augmentation**



**Centimeter Class Augmentation**

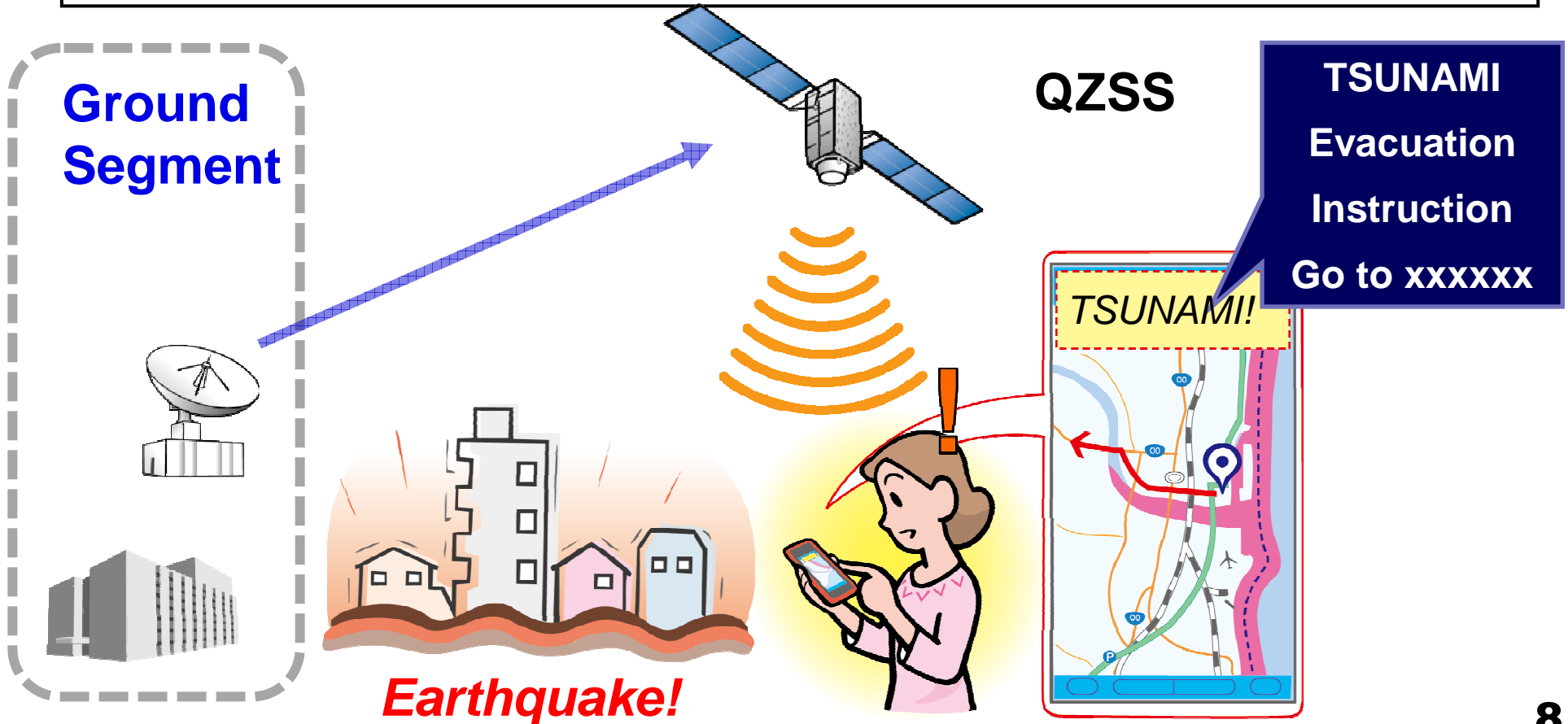


# Functional Capability 3 **Messaging Service**



## **QZSS can send short messages**

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





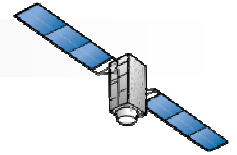


# **QZSS Update**

- ***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
- ***Overall System Outline***

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

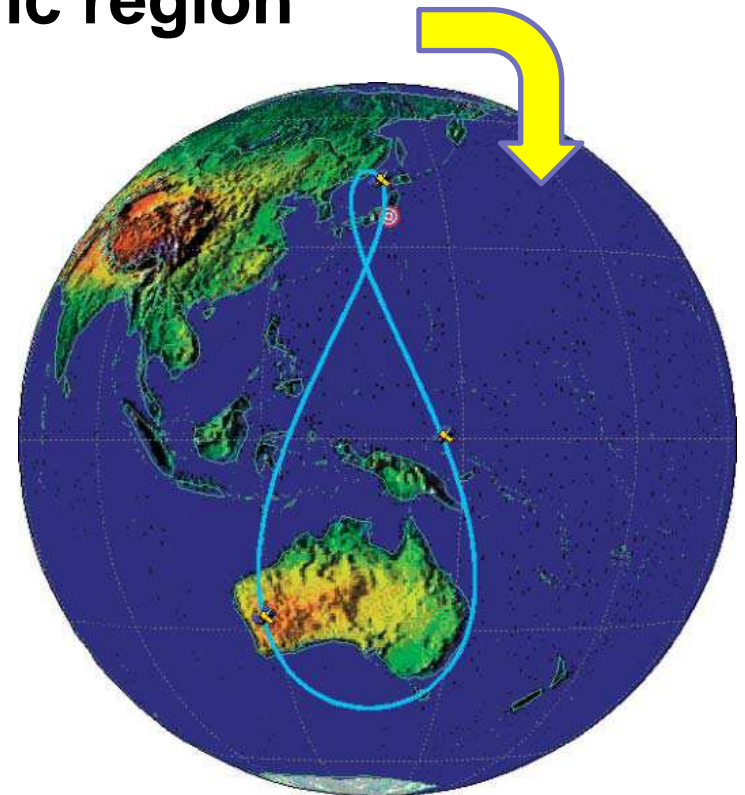
*Cabinet Decision on September 30, 2011*



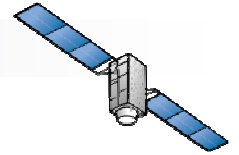
**The QZSS will contribute to**

- **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**



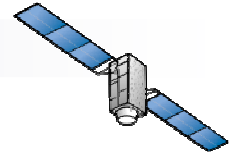
## ***Basic policy on the implementation of the operational QZSS project (2)***

*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.**

**The QZSS is regarded as one of the most important projects in the Japan's New Basic Plan on Space Policy. (January 25, 2013)**

## QZSS Technical Verification of QZS-1 MICHIBIKI

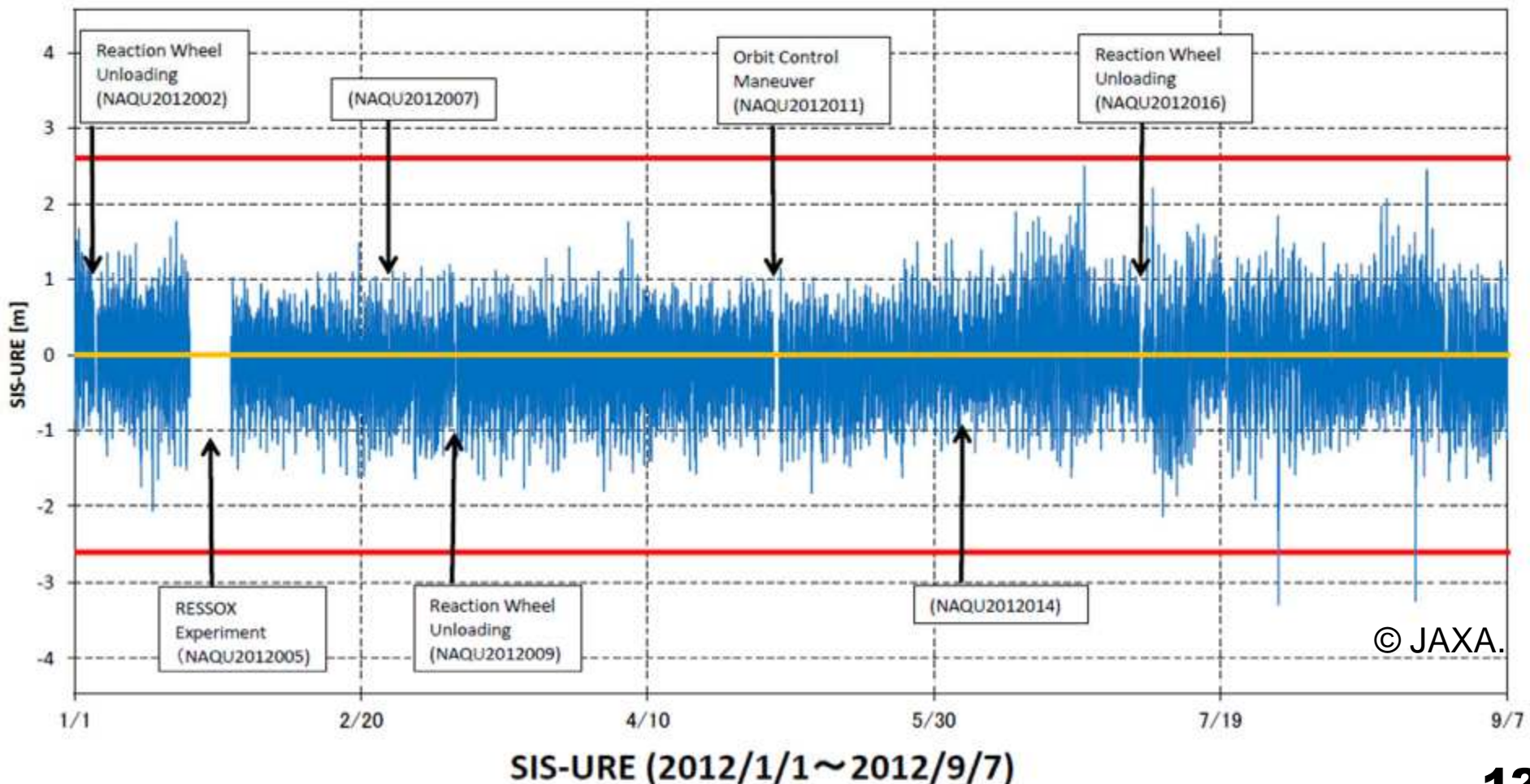


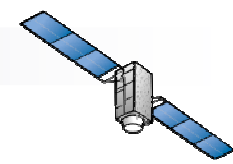
### Accuracy : Signal-in-space User Range Error (SIS-URE)

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\*.

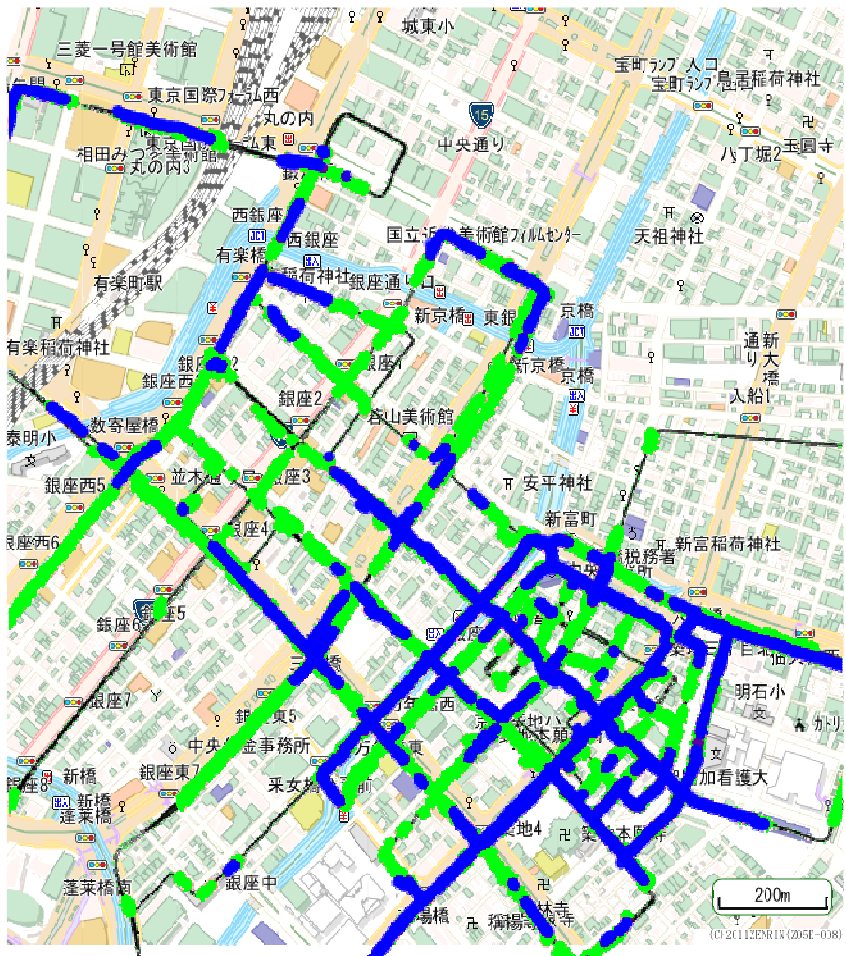
(\*refer to GPS Program Update to CGSIC 2011)





# QZSS Technical Verification of QZS-1 MICHIBIKI

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



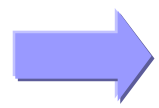
© 2011ZENRIN (Z05E-008)

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

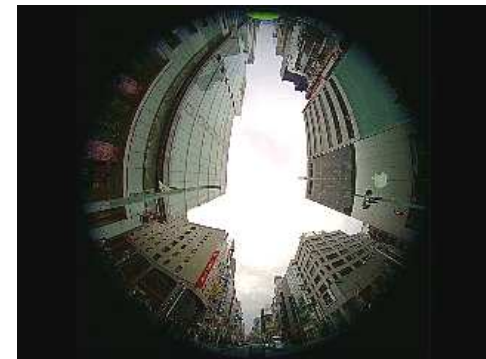
Date of Observation: 2011/2/19  
 250 minutes driving observation data during 6:00-12:30 obtained under JAXA-Melco joint research experiment

Single Frequency DGPS positioning  
 Availability

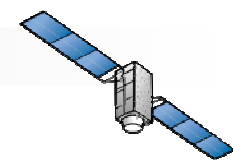
**GPS: 39.5%**



**GPS+QZSS: 69.1%**

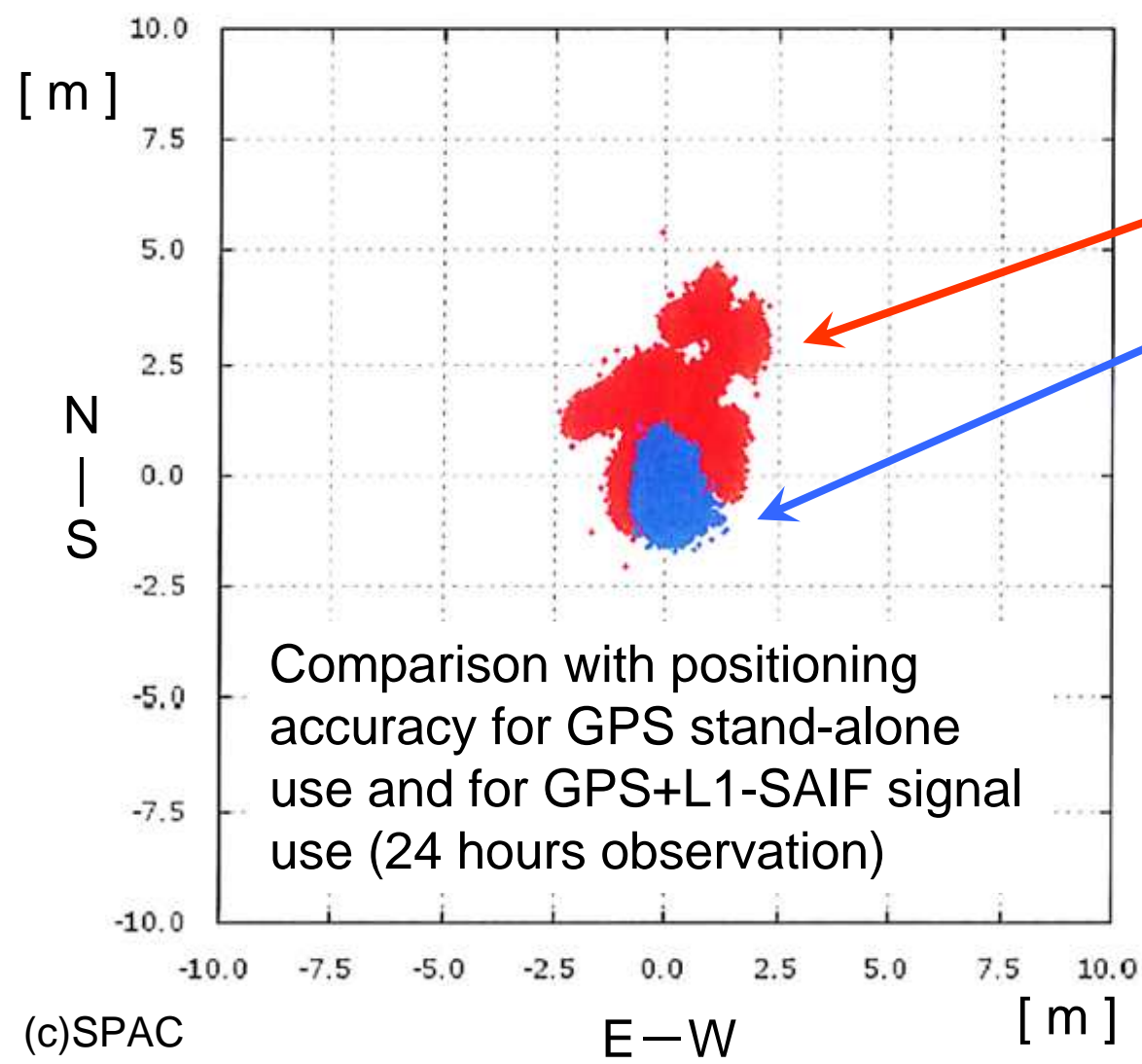


© JAXA.



# QZSS Technical Verification of QZS-1 MICHIBIKI

## Accuracy Improvement using augmentation signal L1-SAIF from MICHIBIKI



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



# Summary

- **The Cabinet Office** shall develop, deploy and operate QZSS.
- **Four satellites orbit constellation** shall be established and the service will start **in 2018**.
- The four satellites constellation will consist of **three QZOs (IGSOs) and one GEO satellite**.
- To enhance **the utilization of QZSS would be beneficial** and Japan would actively cooperate with related members for various issues.