



Project Overview of The Quasi-Zenith Satellite System

25 September 2017

QZS System Services Inc. (QSS)

NEC Corporation



1. Project/System Overview and Program Status

2. Mission of the QZSS

3. Recent Demonstration results of the QZSS

4. The QZSS Expansion Activities for Asia-Oceania Countries

Summary

1. System Overview



Functional Capability:

GPS 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

(L1Sb will be added as SBAS from 2020' s)



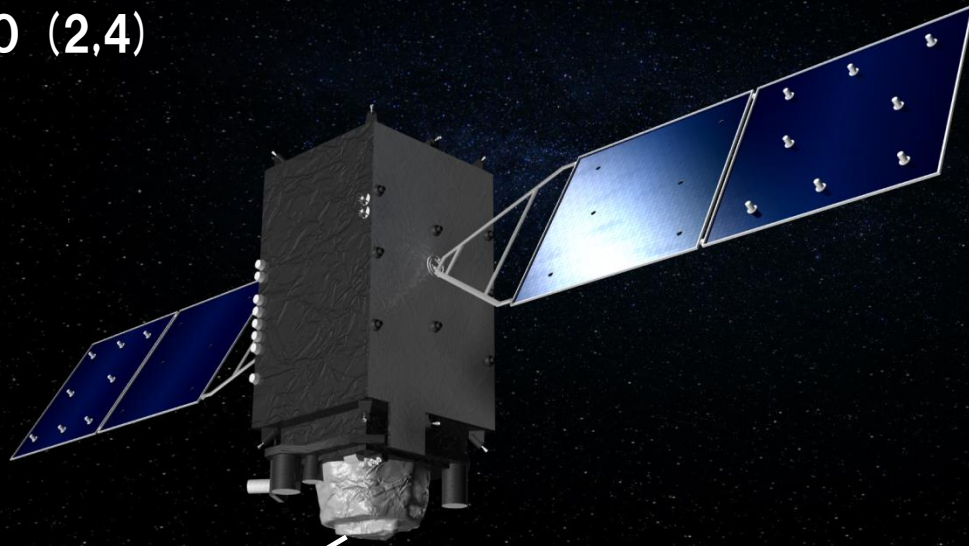
(Today) 1st QZSS satellite “MICHIBIKI”

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

QZSS Satellite (s) Overview



QZO (2,4)



L-band Antenna

Launch Vehicle : H-IIA
Mass Dry/Launch : 1.6t/4.0t
Lifetime : 15years+

Orbit Parameter	Nominal Allocation
Semimajor Axis (A)	42164km
Eccentricity(e)	0.075
Inclination (i)	41 degree
Argument of Perigee (w)	270 degree
RAAN (Ω)	Block I_Q: 117 degree Block II_Q: 117 \pm 130 degree
Central Longitude (λ)	136 degree

RAAN: Right Ascension of the Ascending Node

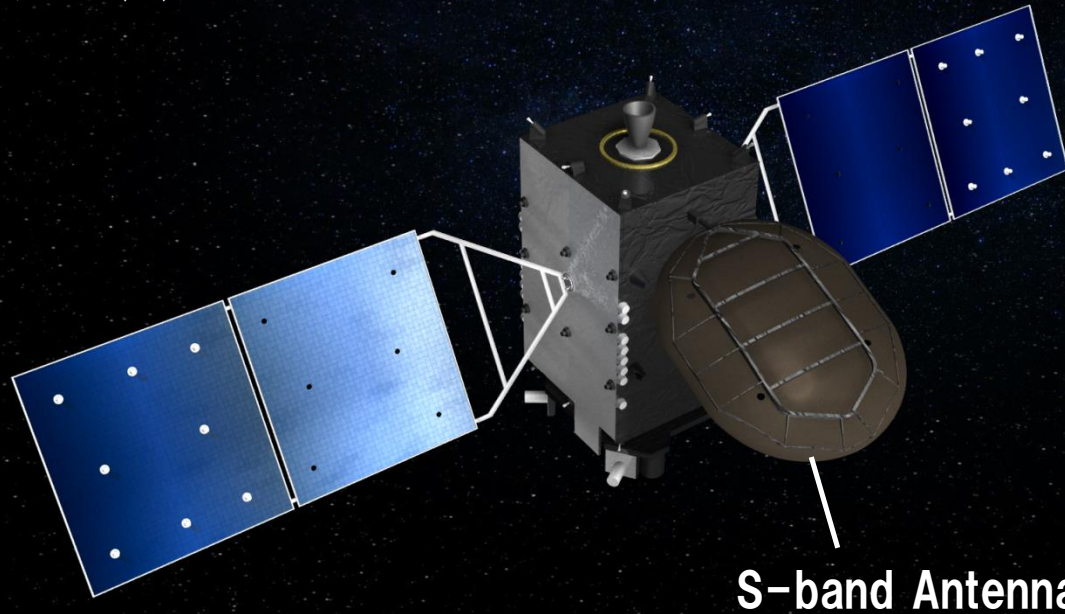


No.2 QZS Launch
1st of June, 2017
TANEGASGIMA
Launch Site

QZSS Satellite (s) Overview



QGO (3)



Launch Vehicle : H-IIA
Mass Dry/Launch : 1.8t/4.7t
Lifetime : 15years+

Orbit Parameter	Nominal Allocation
Longitude	E 127
Latitude	0



No.3 QZS Launch
19st of August, 2017
TANEGASGIMA
Launch Site

QZSS Master Ground Station

http://www.mlit.go.jp/koku/15_bf_000367.html



**QZSS Control Center
Kobe,**

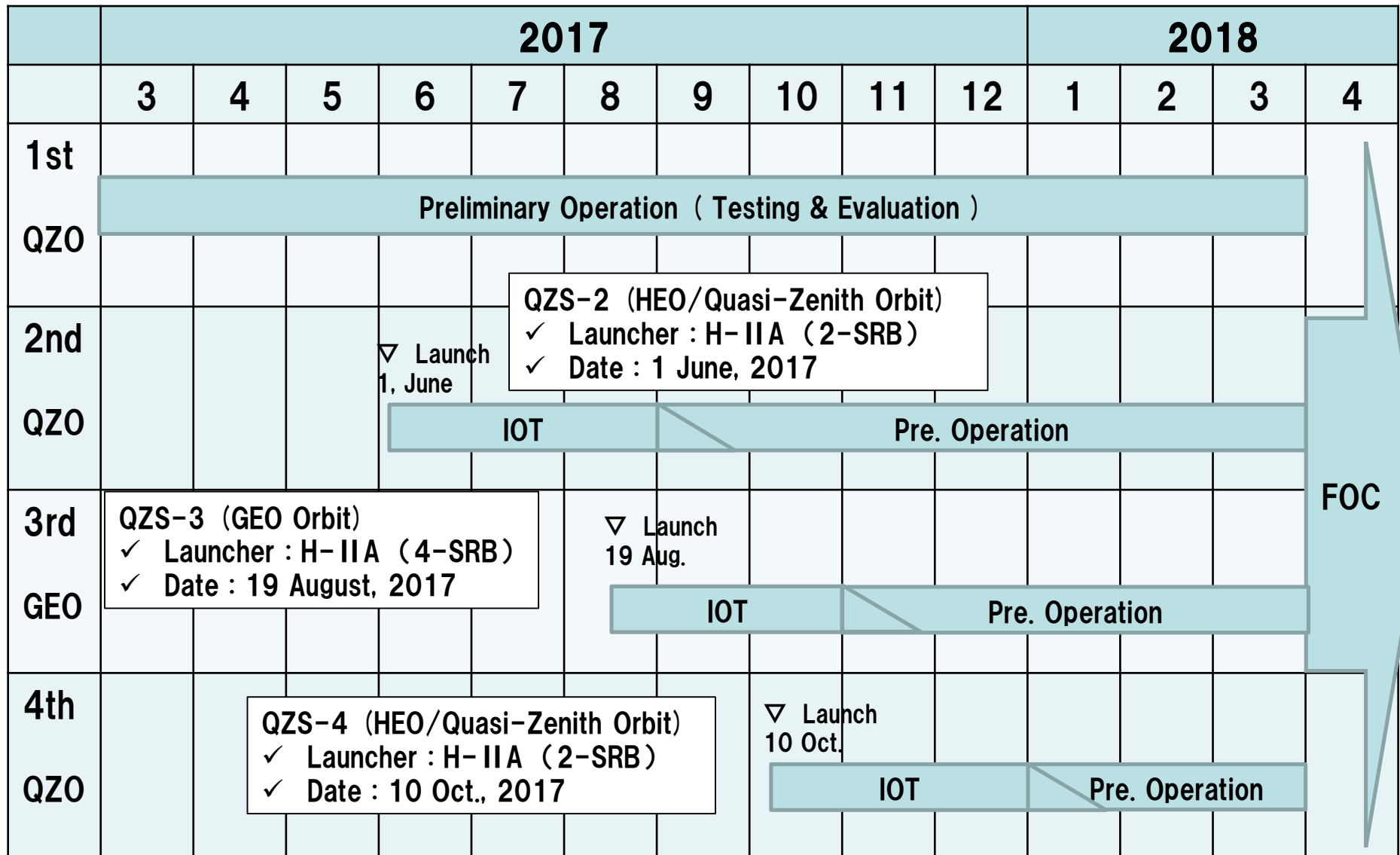
**QZSS Control Center
Hitachi-Ohta,**



- ✓ **Two-Ground Station (Control Center) is available from the end of 2016.**
- ✓ **Initial Operation will be started from 2018.**

http://www.mlit.go.jp/koku/15_bf_000367.htm

QZSS Program Schedule (Detail)



QZSS Overview



Japan Region

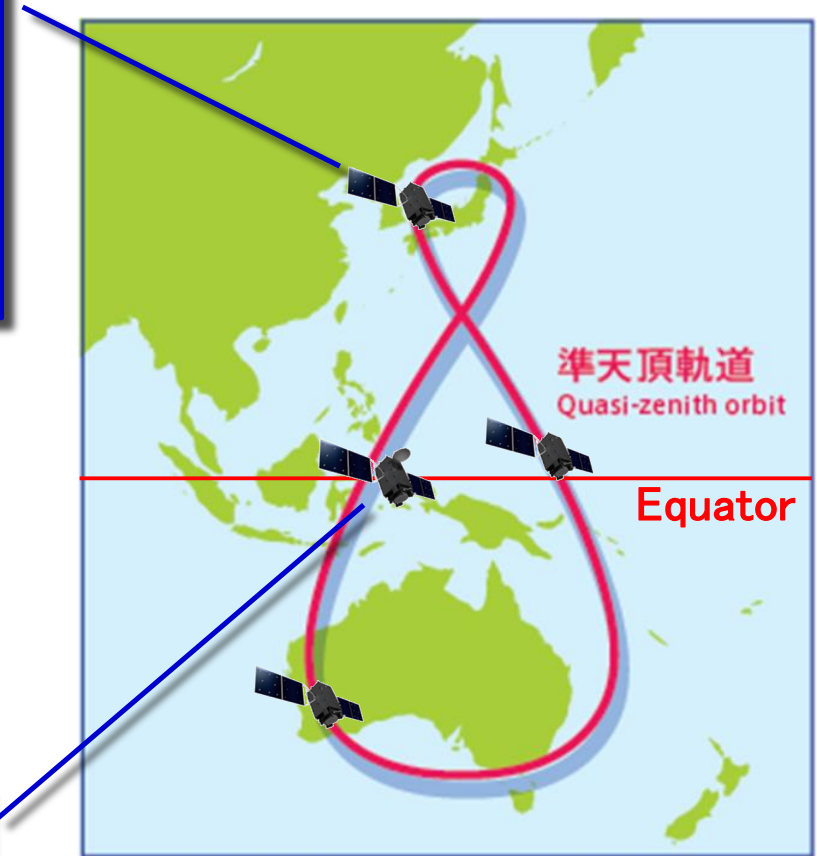
- Over 20 degrees elevation
More than 2-QZS are available
- Over 60 degrees elevation
1 QZS is available

Functional Capability:

GPS Complementary
GNSS Augmentation
Messaging Service

Coverage: Asia and Pacific region

1 Geostationary satellite



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



2. Mission of the QZSS

2. Mission of QZSS



QZSS provides positioning– related service and messaging service.

Positioning– related service

① Satellite Positioning Service

The service to provide the same as GPS satellites in spite of urban area or mountain area.

② Sub–meter Level Augmentation Service

The service to provide accurate positioning around 2–3 meters. (※)

③ Centimeter Level Augmentation Service

The service to provide highly accurate positioning around 10 centimeters.(※)

※ Ionosphere disturbance (fluctuations) , multipath and others will affect the accuracy.

④ Positioning Technology Verification Service

The service to provide an application demonstration for new positioning technology.

Messaging Service

⑤ Satellite Report for Disaster and Crisis Management (DC Report)

The service to provide users in the field with disaster management and rescue .

②, ③, ⑤ :These services are under investigation for overseas users.



2. Mission of QZSS

QZSS provides positioning– related service and messaging service.

Positioning– related service

**Performance Standard (PS–QZSS) and
Interface Specification (IS–QZSS)
will be released in the website**

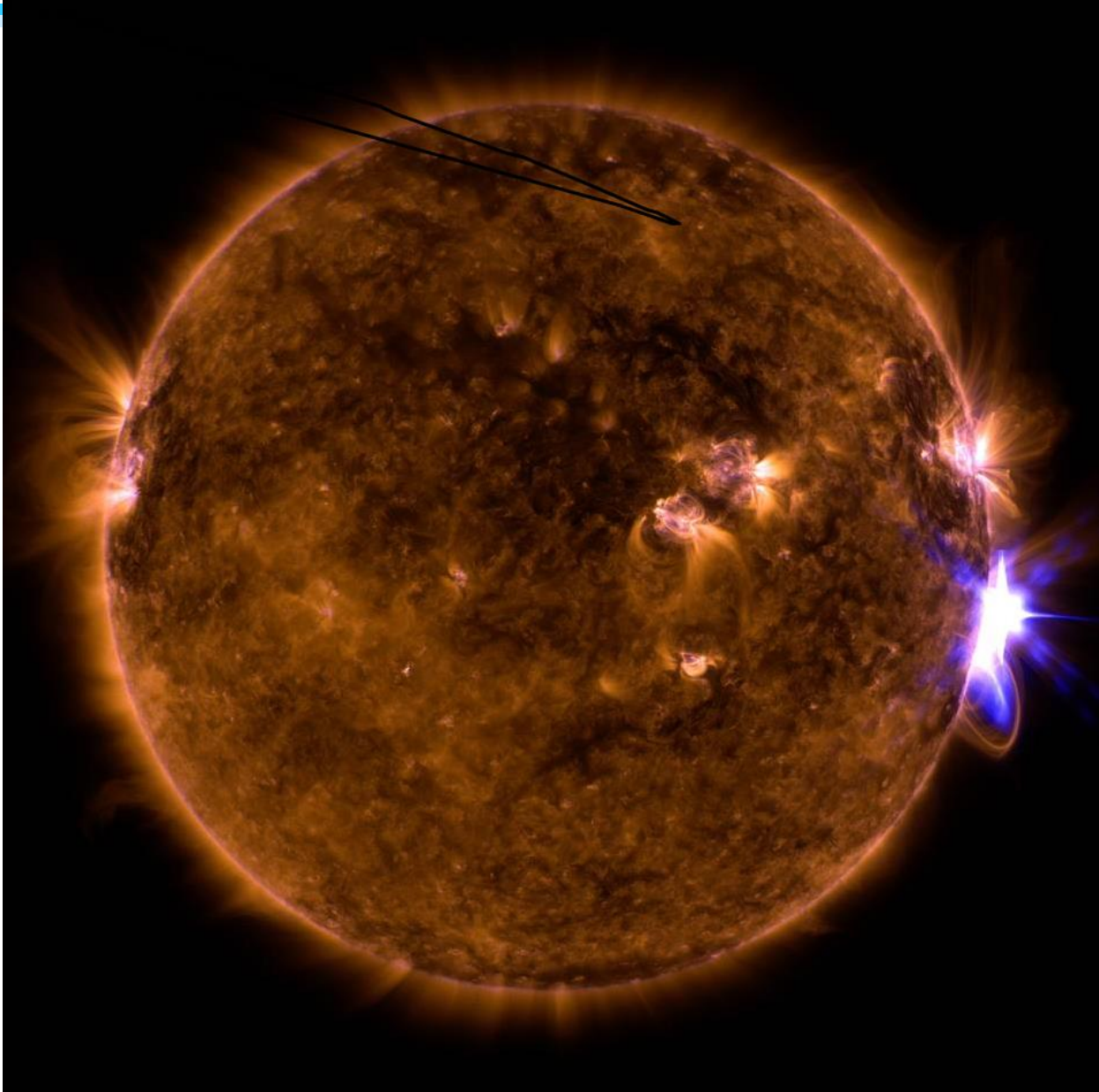
<http://qzss.go.jp/en/technical/ps-is-qzss/ps-is-qzss.html>

②, ③, ⑤ : These services are under investigation for overseas users.

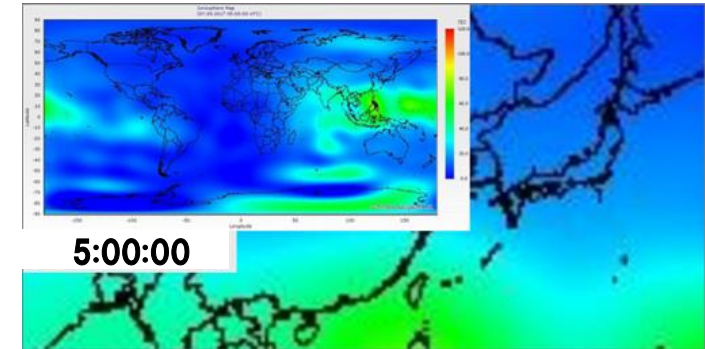
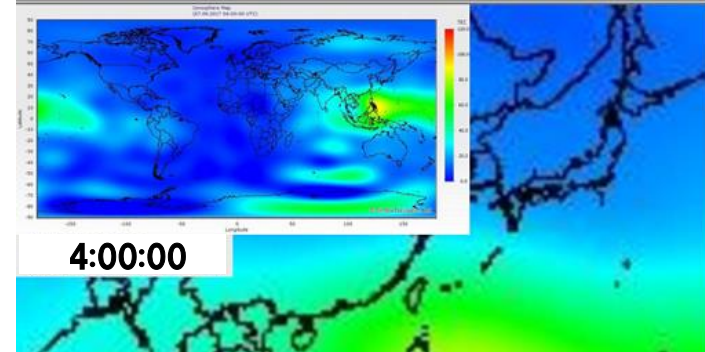
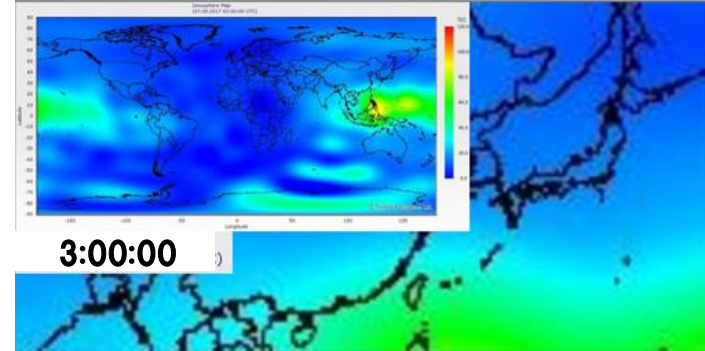
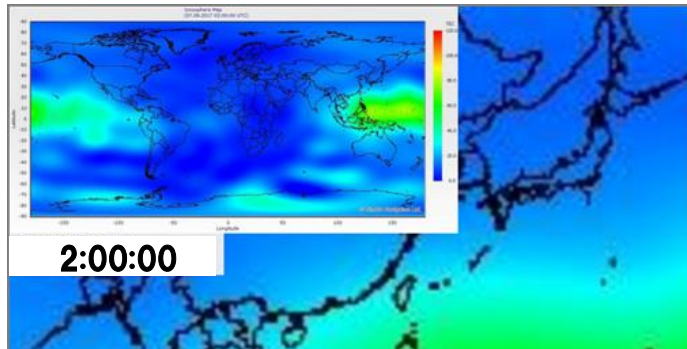
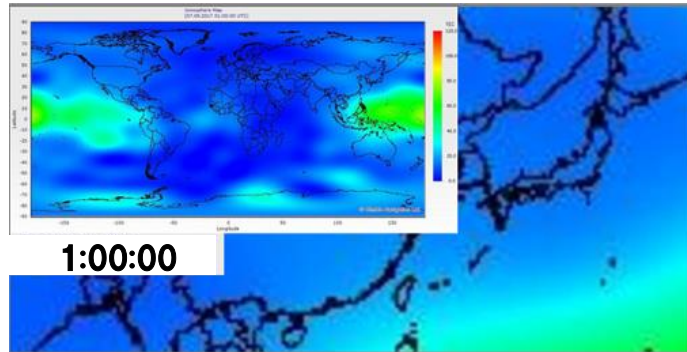
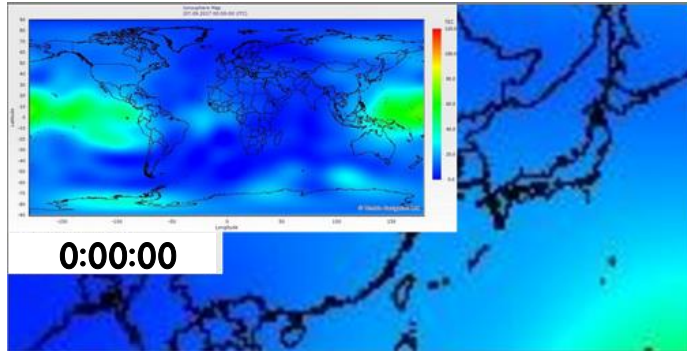


3. Recent Demonstration results of the QZSS

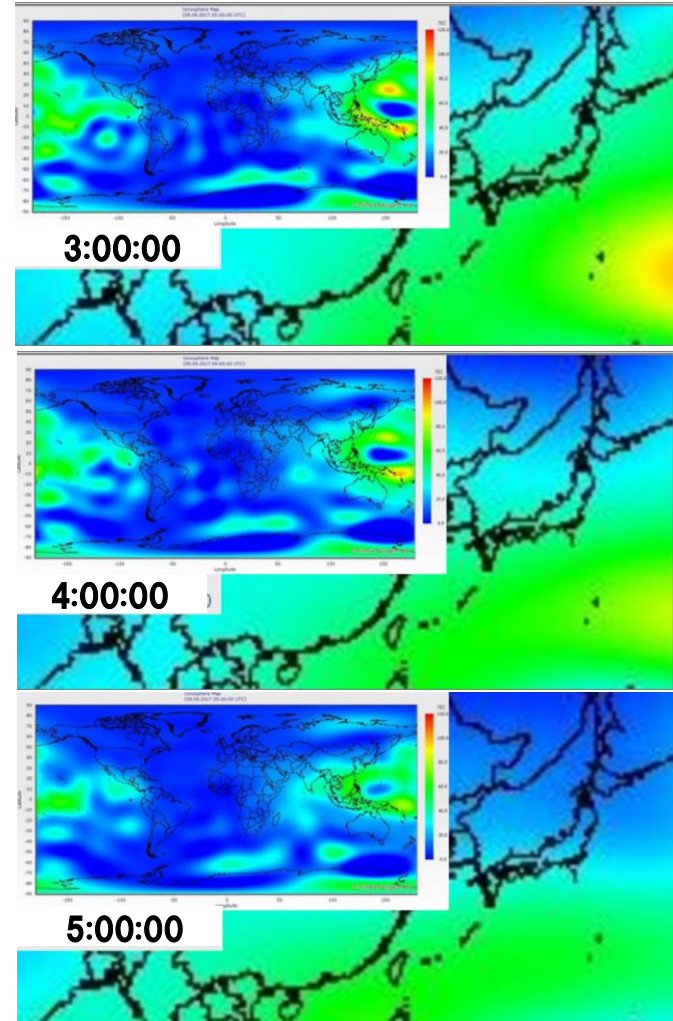
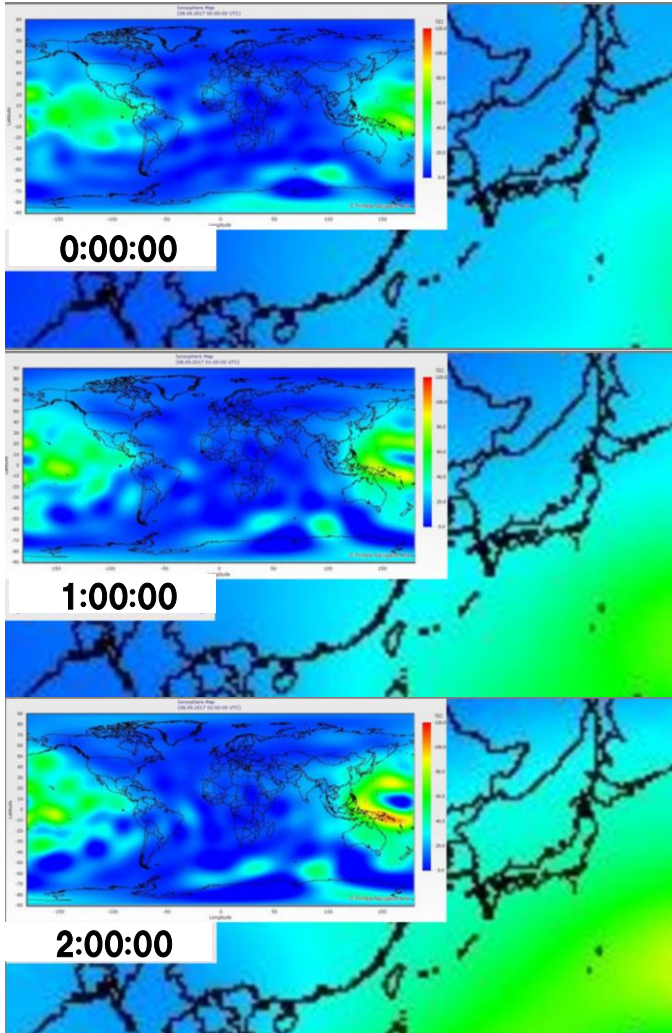
Sun Flare on 8th, September



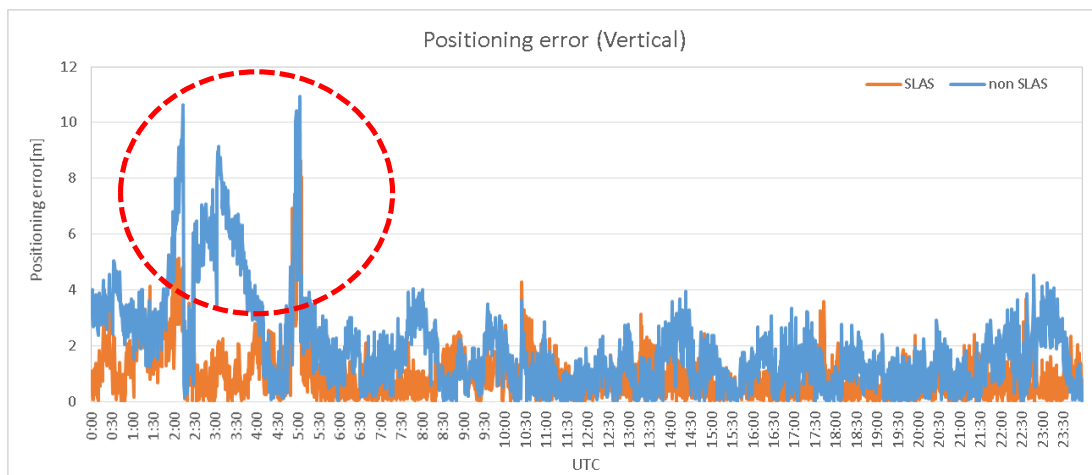
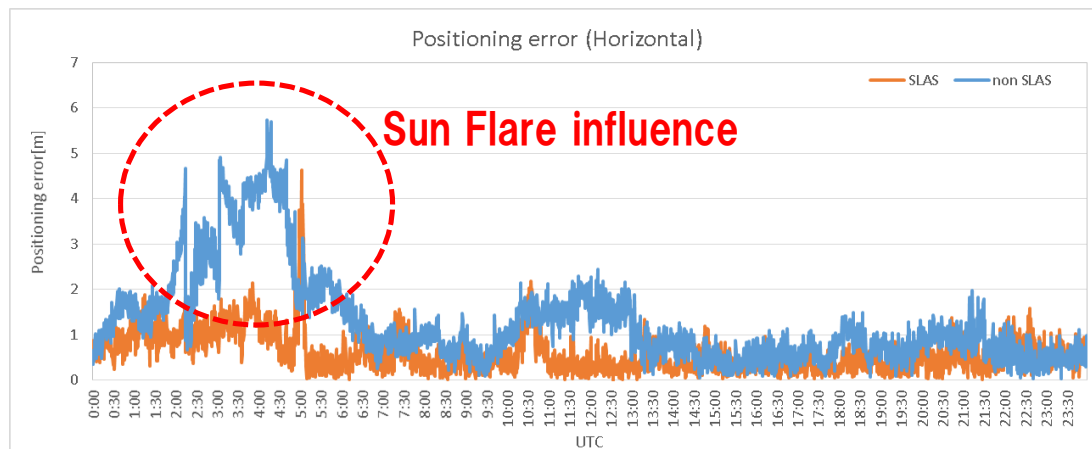
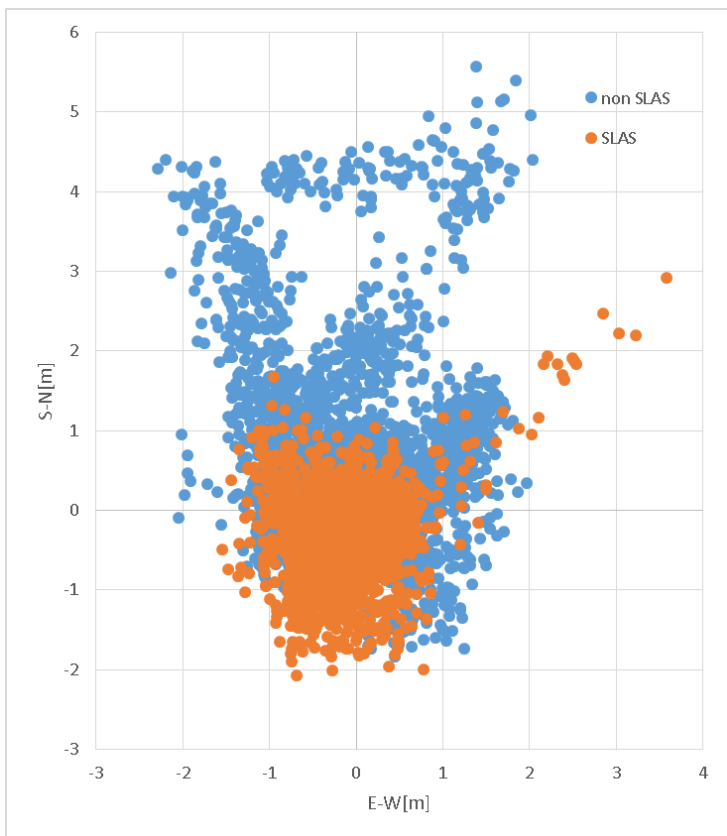
Ionosphere Map, 7th September



Ionosphere Map, 8th September



Positioning results, 8th September



	Horizontal		Vertical	
	SLAS	Non SLAS	SLAS	Non SLAS
Average	0.6	1.28	0.95	1.89
σ	1.03	2.29	1.88	3.6
2σ	1.46	3.3	2.82	5.31

Place : TOKYO,
Receiver : TRIMBLE NetR9
Antenna : TPSCR.G5 GSI
Elevation : Mask : 20°



4. International Activities (Asia-Oceania Countries)

QZSS Expansion Activities (in Asian Countries)



Preparation of GNSS reference station (Development of satellite positioning and experiment environment)

Chulalongkorn Univ(Bangkok)



Univ. of Philippine (Diliman)



Indonesia Univ. (Jakarta)



Joint Experiment, Demonstration

QZSS Positioning in Urban City (Hanoi/Vietnam)

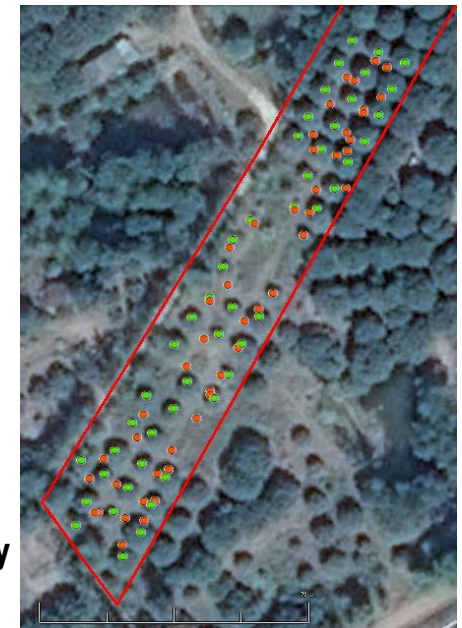
Demonstration Set-up



Bus Driving (Quezon/Philippine)



Management of orchards fused with remote sensing technology (AIT/PASCO)



9th Multi-GNSS Asia (MGA) Conference



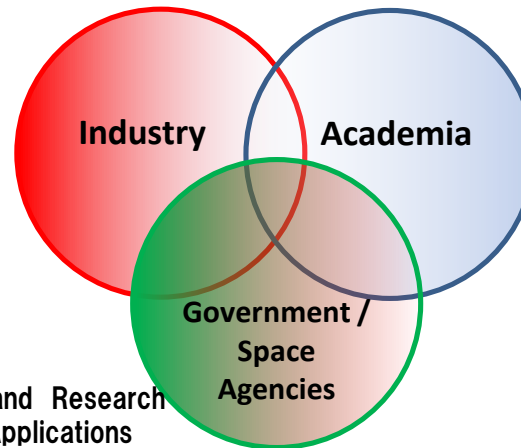
9-11 October 2017,
@ AYANA Midplaza Jakarta
in Jakarta, Republic of Indonesia

Participation free
No registration fee



Scope

- Industry–Academia–Governmental Cooperation
- Discussion on potential solutions for Indonesia
- B-to-B matching
- Open forum for multi-GNSS



Disaster Mitigation



Precise Positioning



ITS



LBS



Program

- Opening Ceremony
- Plenary Session (GNSS Update)
- Latest Trends in Multi-GNSS Technology and Research
- Multi-GNSS Industrial Developments and Applications
- Multi-GNSS Applications in Indonesia and in Asia-Pacific Regions
 - Precise Positioning
 - Disaster Mitigation / Management
 - Intelligent Transportation System
 - Location Based Services
 - Others (Space Weather, etc.)
- Students and Young Professional Forum
- MGA Annual Activities Report
- Exhibition / Demo / Poster

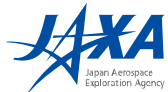


8th MGA Conference @ Manila, Philippines

“Next Generation Multi-GNSS Resilient Solutions For Sustainable Development”

Register on MGA website: www.multignss.asia

Co-organized by



QZSS Services

Supported by





KYOTO, JAPAN
DECEMBER 2017

12th Meeting of the International Committee
on Global Navigation Satellite Systems

Please visit
<http://icg12.jp/>

KYOTO, JAPAN

2017

December 2-7

Cabinet Office, Government of Japan

Summary



- ✓ **Based on the decision of the GOJ, the deployment of the operational QZSS is underway.**
 - **4 satellites constellation shall be established by the 2018JFY.**
 - **Necessary equipment (satellite, ground station and others) are currently in development.**
 - **GOJ has decided to up-grade the QZSS to 7-satellite constellation in 2020' s.**

- ✓ **Verification, assessment and many demonstration of the QZSS have been conducted.**

Thank you for your attention.

**For more information, please visit our web site
<http://qzss.go.jp/en/>**



- **A large circle illustrated “Q” as Quasi-Zenith Satellite System**
- **Green and blue circle composes 8 shapes; the coverage area of QZSS and they are represented earth and satellite.**
- **Blue line symbolized precise positioning information as well as enlargement of brand new service to society.**
- **Color of green stands for environment and safety, and blue stands for space and technology.**

Positioning Signal of QZSS (as of Sept. 2015)



Positioning Signal of QZSS						
Not only positioning complementation signal, but satellite orbit, time, and ionosphere correction information will be also transmitted as augment information.						
				1 st Satellite	2 nd -4 th Satellite	
				QZO	QZO	GEO
L1C/A	1575.42 MHz	Positioning	complement GPS	○	○	○
L1C		Positioning	complement GPS	○	○	○
L1S		Augmentation (SLAS)		○	○	○
		Message Service		○	○	○
L2C	1227.60 MHz	Positioning	complement GPS	○	○	○
L5	1176.45 MHz	Positioning	complement GPS	○	○	○
L5S		Augmentation Experimental Use		—	○	○
L6	1278.75 MHz	Augmentation (CLAS)		○	○	○
L1Sb	1575.42	Augmentation	SBAS	—	—	○

SBAS Service will be available from the beginning of 2020' s.

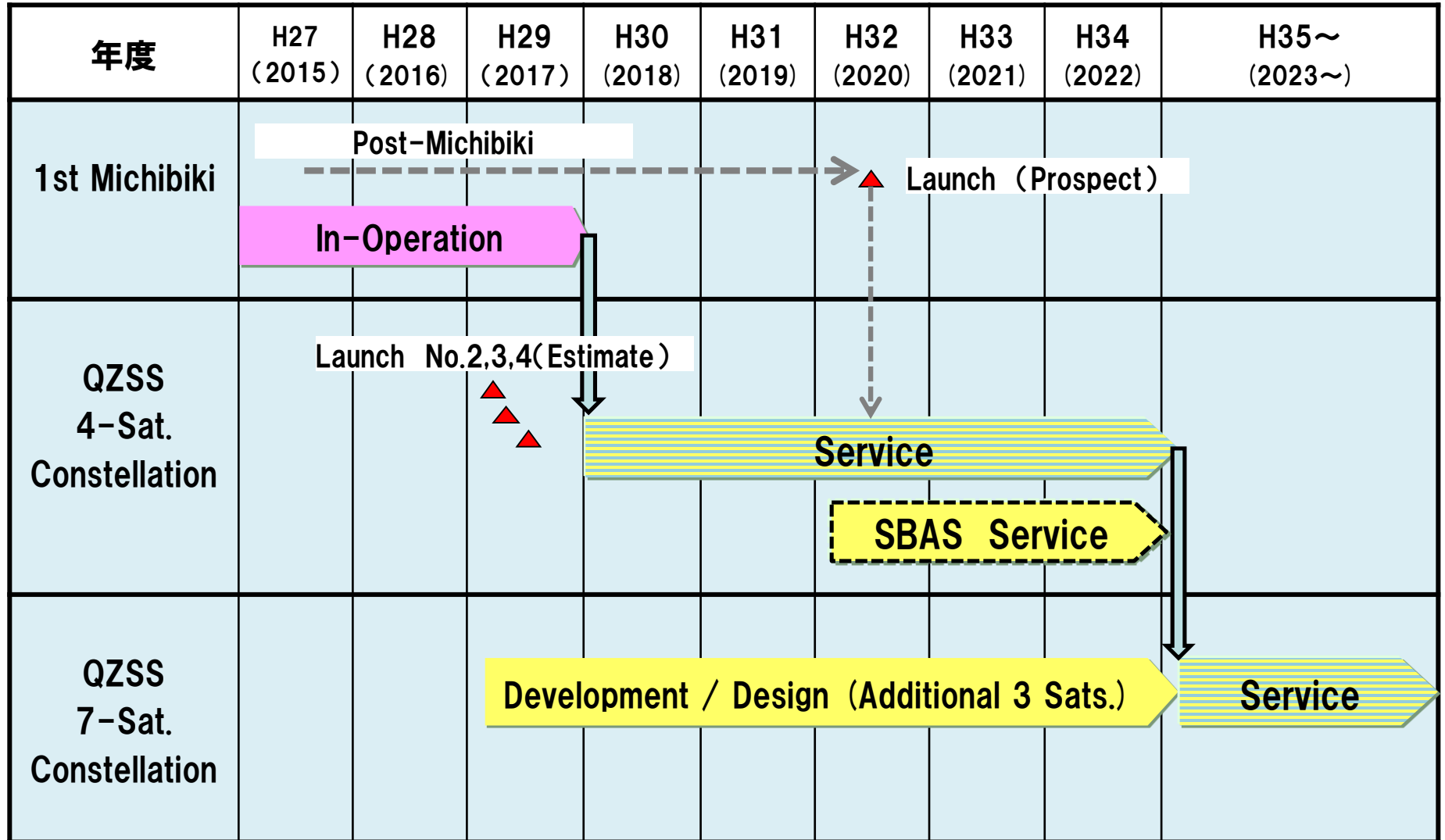
QZSS TTC & Monitor Station



- ✓ All of TTC monitor stations will be founded by the end of 2016.
- ✓ Initial Operation will be started from 2018.



QZSS Program Schedule



SBAS Service will be available from 2020's under Ministry of Land, Infrastructure, Transport and Tourism jurisdiction.