Contents

- *Introduction*
  - *QZSS program*
  - *Concept of QZSS*
  - *User Benefits of QZSS*
- *System description*
  - *Space Segment*
  - *Ground Segment*
  - *Navigation Payload on QZS-1*
  - *Planned Signals*
  - *QZSS orbit and Clock estimation analyses*
- *Current Development Status*
  - *Space Segment*
  - *Ground Segment*
  - *Site survey for MS*
  - *Development Schedule*
- *Summary*

Introduction
QZSS program

- **Japan is promoting research and development of the Quasi-Zenith Satellite System (QZSS), which is a regional satellite navigation system aiming at the GPS compliment and augmentation over Japan.**
- **The Japanese government decided to promote the QZSS program on the following step by step approach. (March 31, 2006)**
  - **Single mission: Navigation**
  - **Step by step development:**

    First step; Only one satellite will be launched in summer 2010

    Technical validation and application demonstration

    Second Step; 2nd and 3rd satellites launch in several years after 1st satellite launch

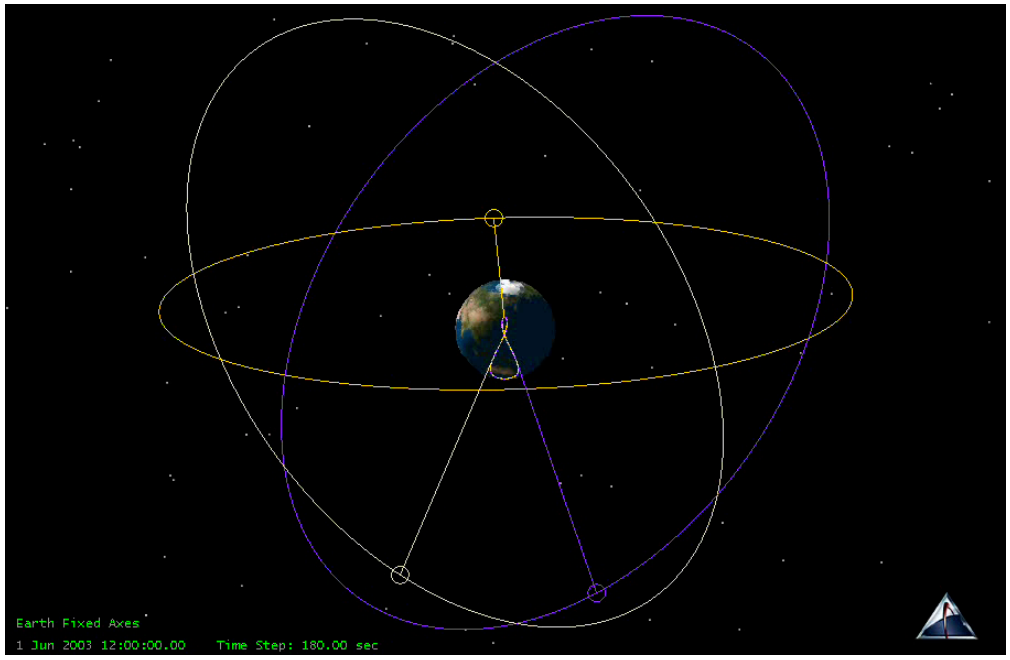
    System operation will be demonstrated.
- **Some national institutes of Japan participate in the QZSS project for the 1st satellite.**
  JAXA is taking charge of development of satellite bus system, navigation payload, ground system and operation for 1st satellite.

Introduction

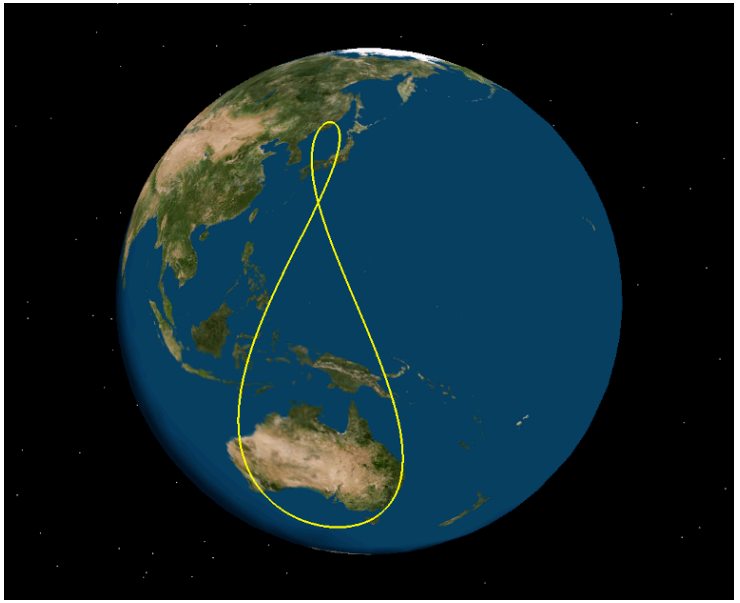
Concept of the QZSS

- *Three satellites are in elliptical and inclined orbits in different orbital planes to pass over the same ground track.*
- *QZSS is designed so that at least one satellite out of three satellites exists near zenith over Japan.*

(a=42,164km, e=0.06-0.09, i=39-47deg, Ω= 120deg apart)



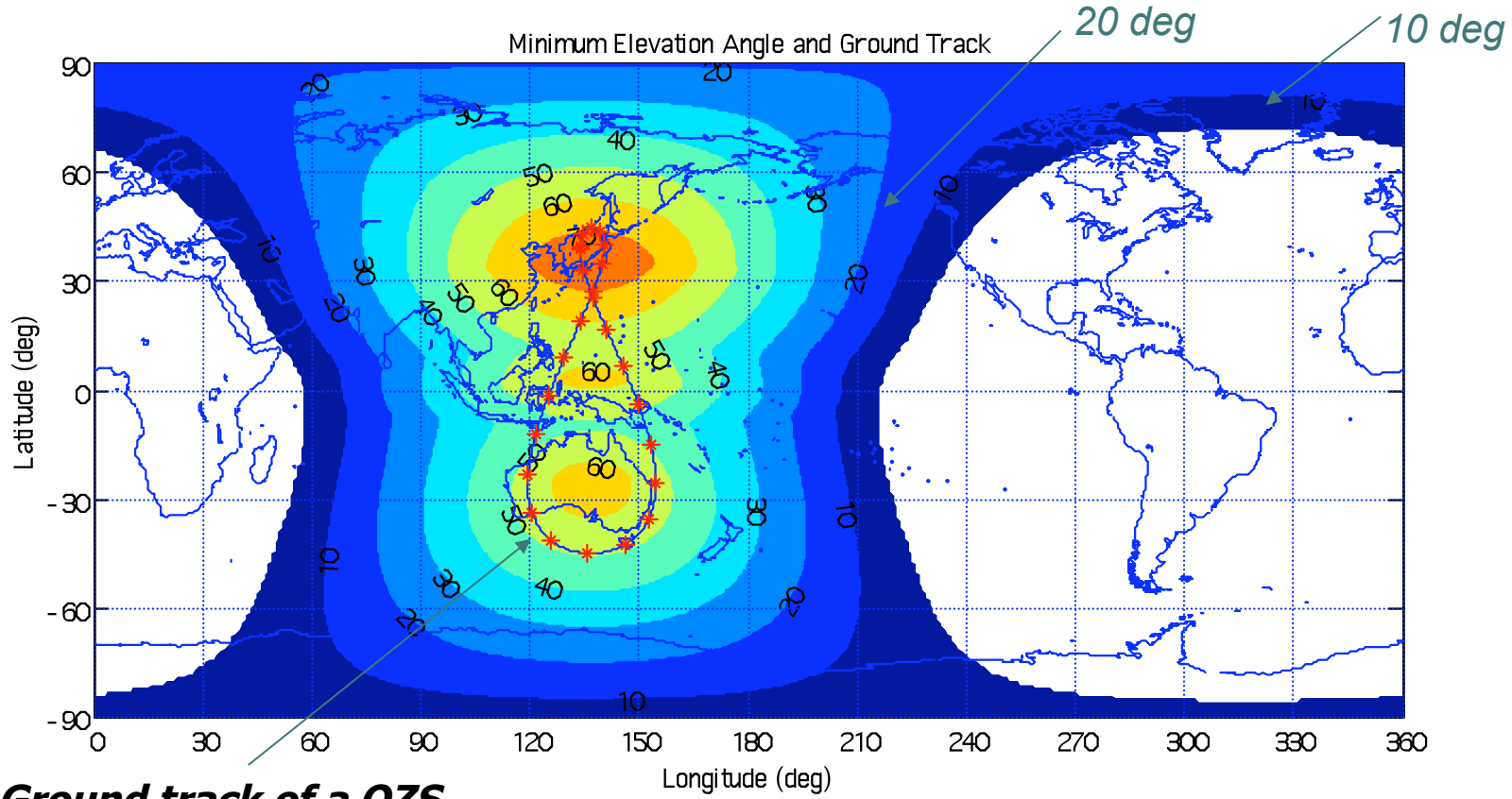
QZSS orbit constellation



QZSS Ground Track

Introduction

Concept of the QZSS



Ground track of a QZS

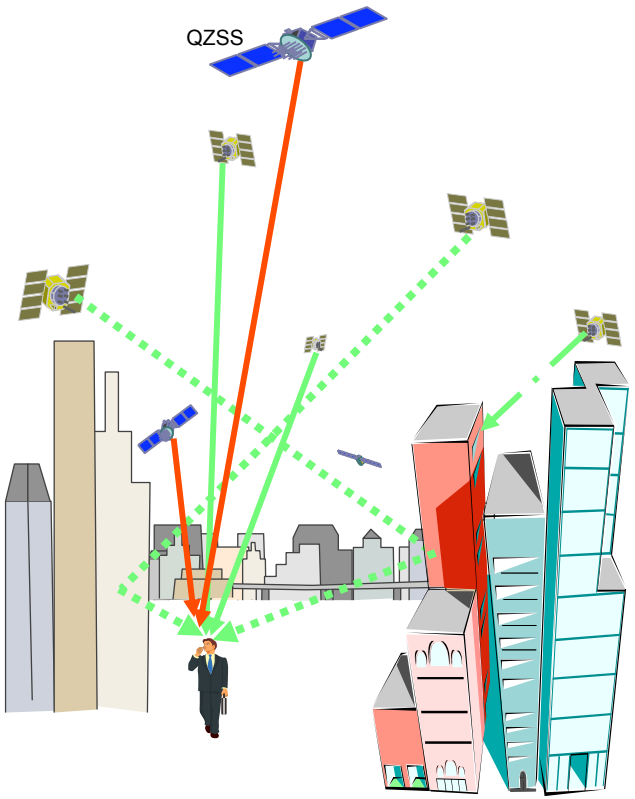
Minimum Elevation Contour for 3 QZS over 24 hours

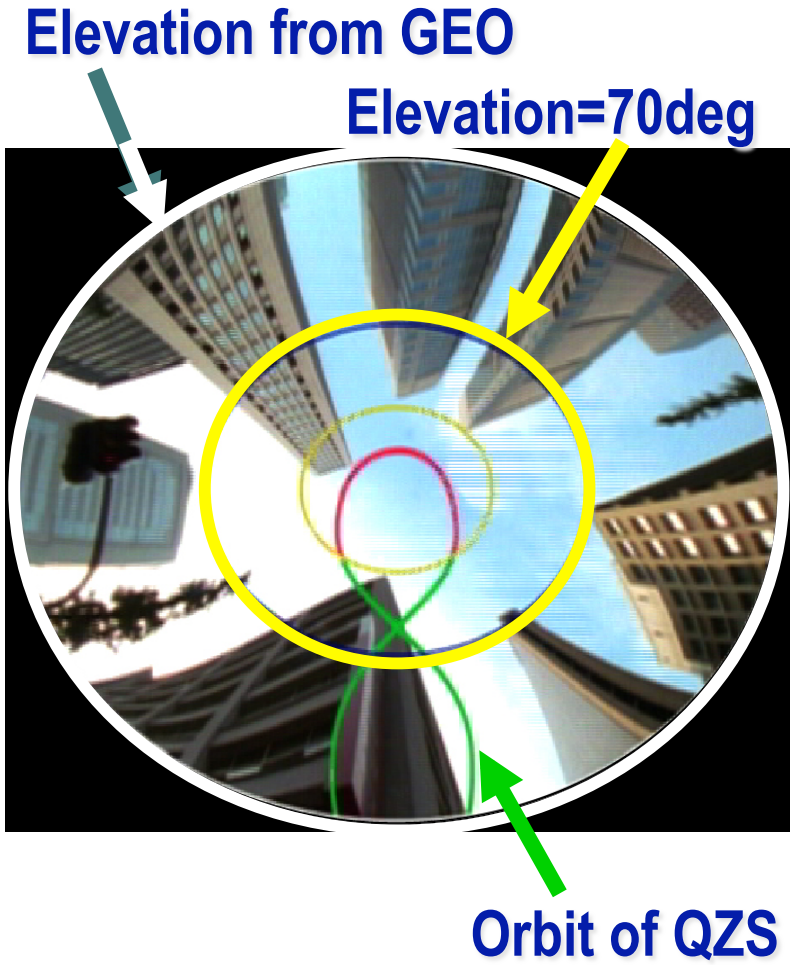
** for maximum elevation of visible satellites*

Introduction

User Benefits of QZSS (1/2)

- *QZSS can provide a seamless service from high elevation angle.*
- *Increasing the availability of PNT services in downtown and mountainous areas.*

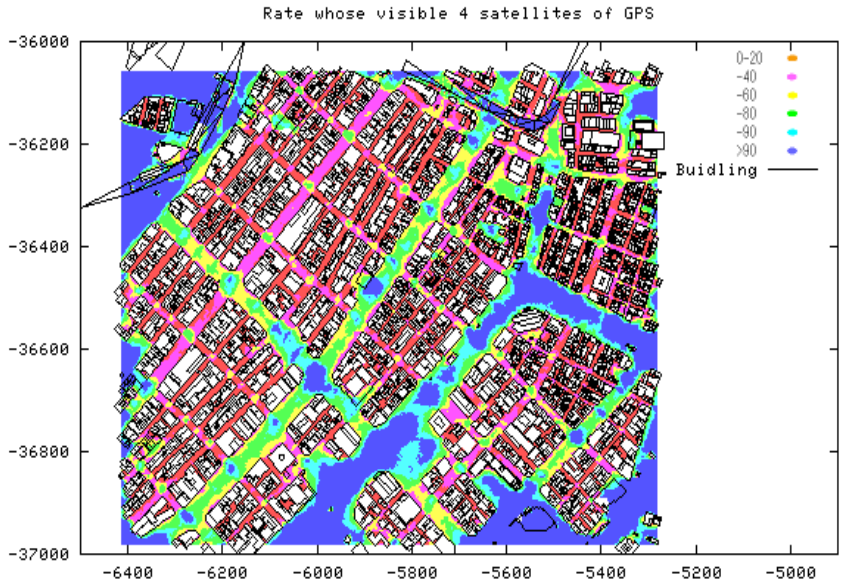




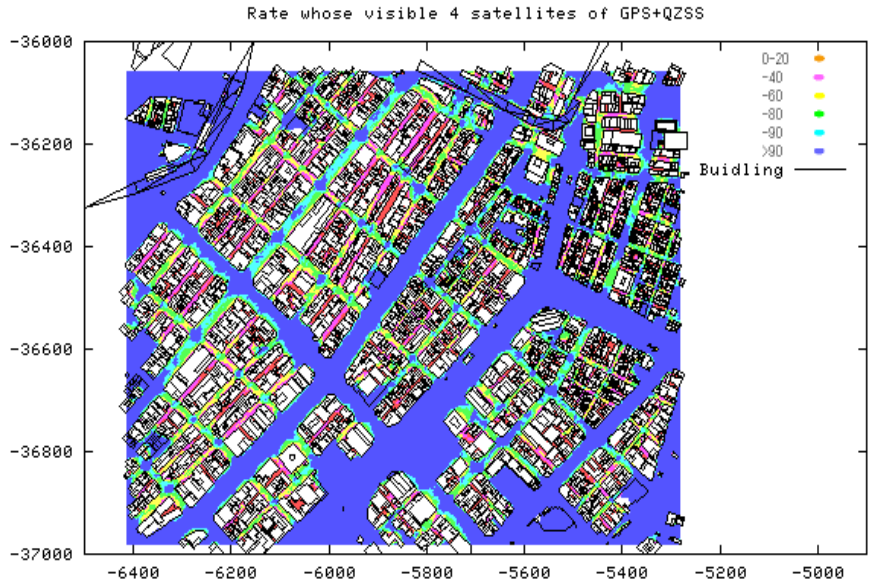
Introduction

User Benefits of QZSS (2/2)

Availability Analysis in Urban Areas using 3D Simulation



GPS only



GPS + QZSS (3 sat)

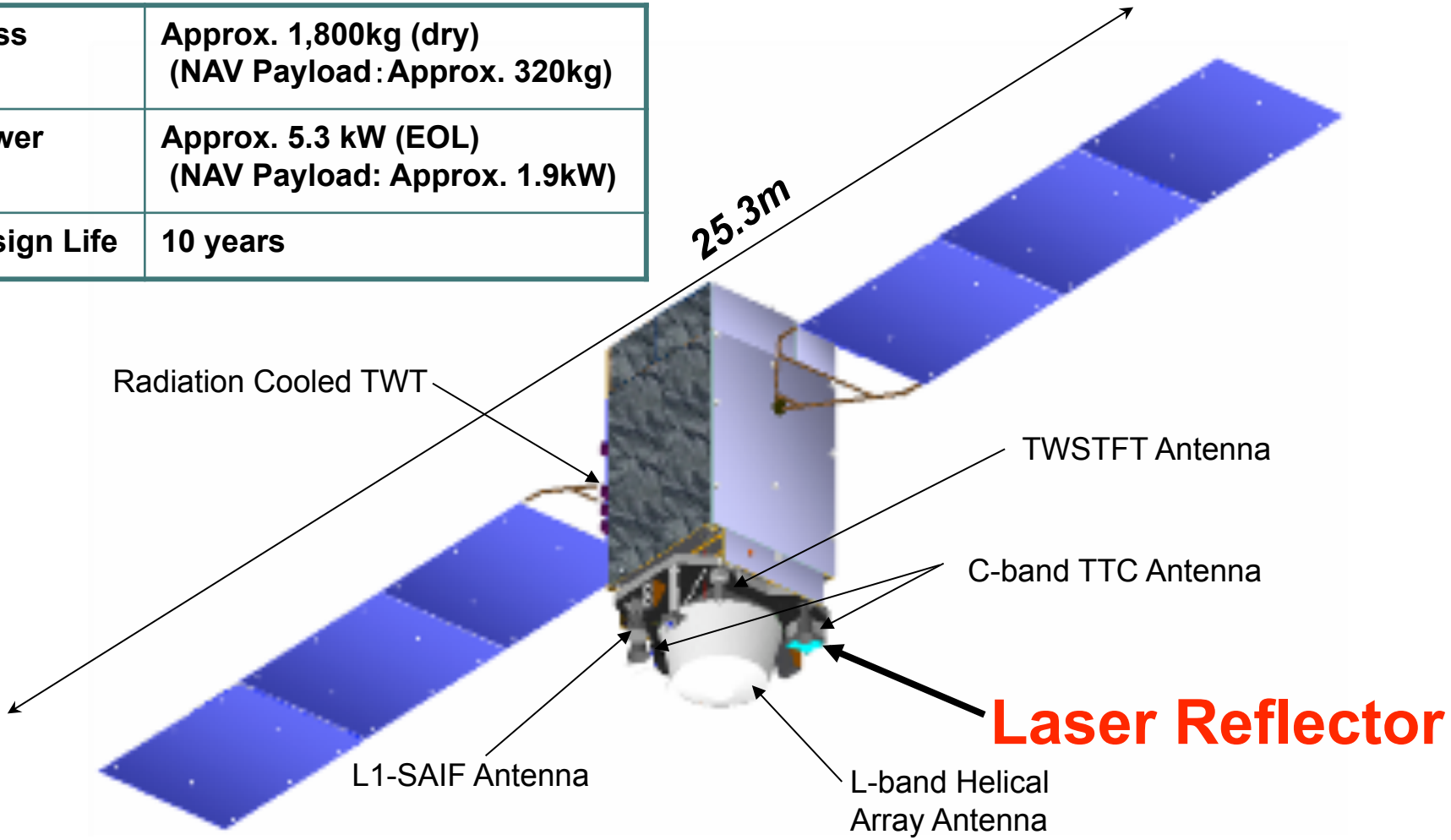
Legend. ■ 0-20, ■ 20-40, ■ :40-60, ■60-80, ■80-90 ■90-100 %

The time percentage of positioning availability in Ginza

- **Positioning availability is greatly improved by adding QZSS.**

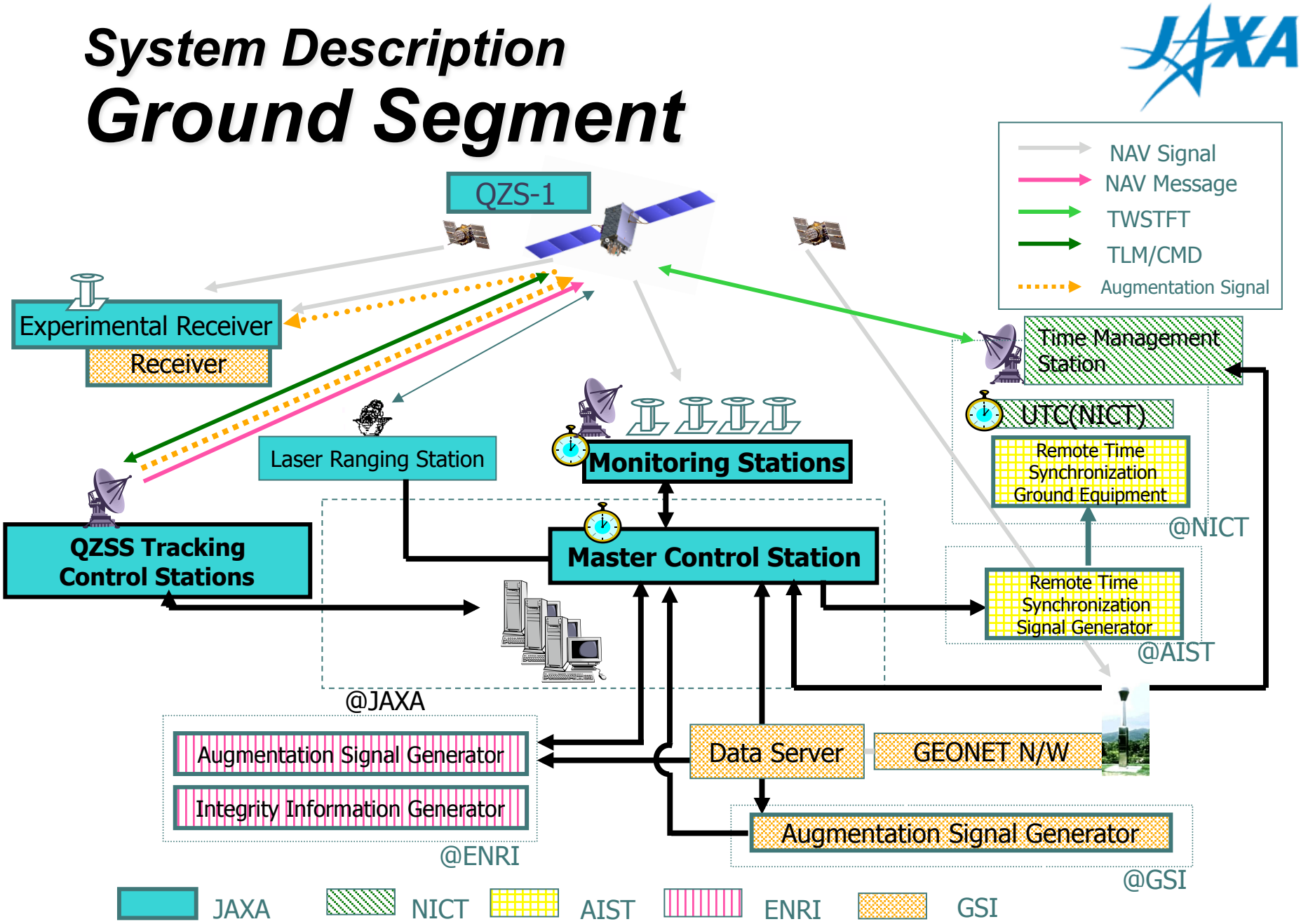
System Description
Space Segment - QZS-1 -

Mass	**Approx. 1,800kg (dry)** **(NAV Payload：Approx. 320kg)**
Power	**Approx. 5.3 kW (EOL)** **(NAV Payload: Approx. 1.9kW)**
Design Life	**10 years**

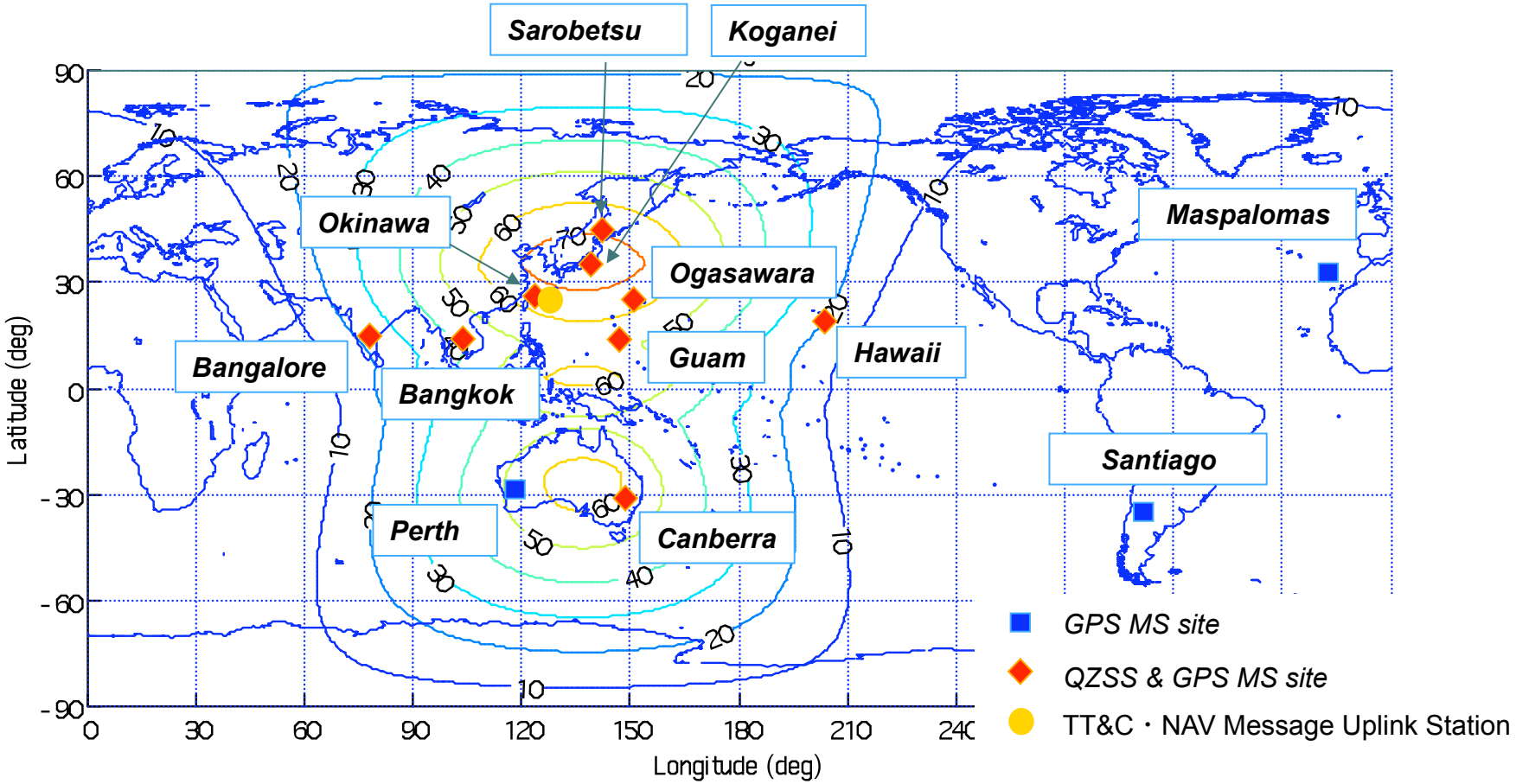


Satellite Configuration on Orbit

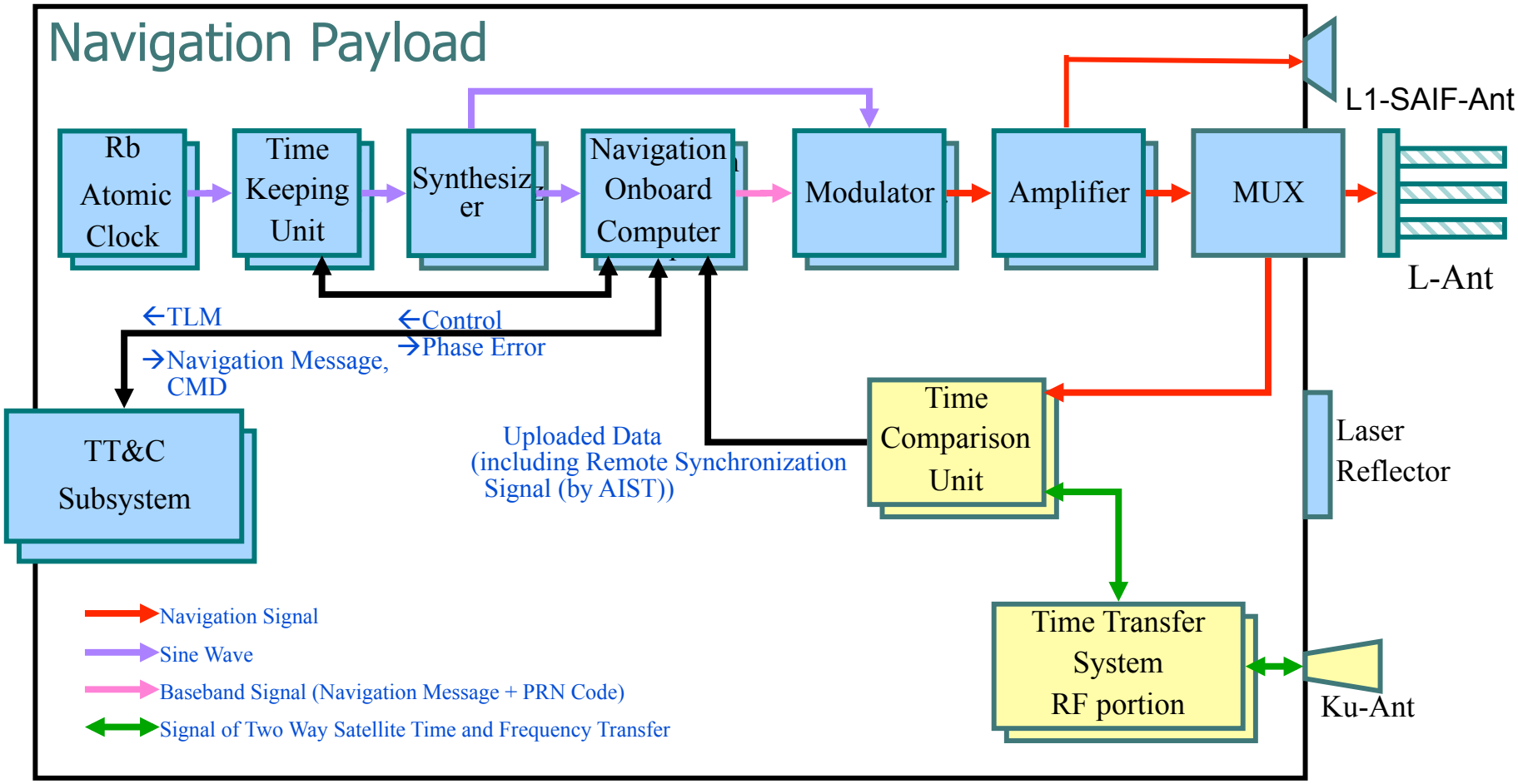
System Description
Ground Segment



System Description
Ground Segment



System Description
Navigation Payload on QZS-1



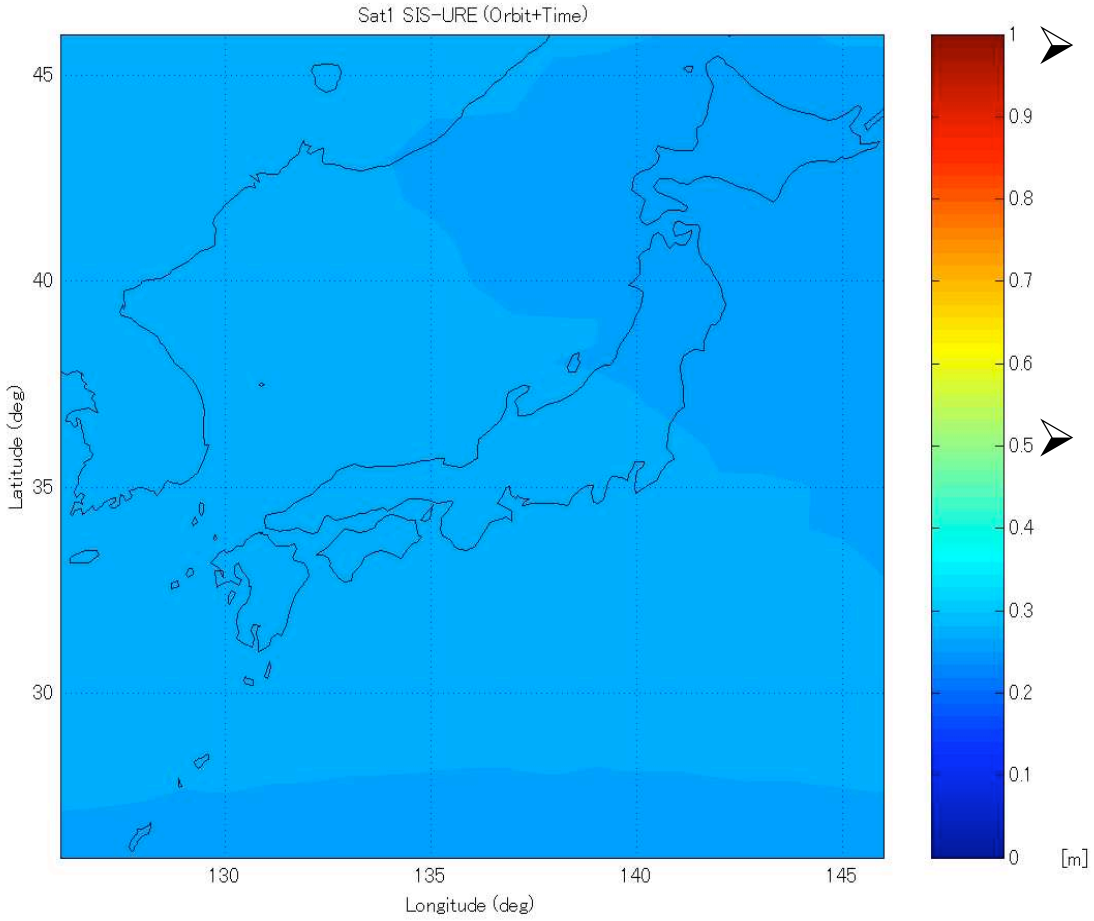
System Description
Planned Signals

- Planned Signal List for QZSS

Generic Signal Name	*Center Frequency*	*Notes*
L1-C/A	1575.42MHz	■ GPS interoperable signals ■ Compatibility and interoperability with existing and future modernized GPS signals
L1C		
L2C	1227.6MHz	
L5	1176.45MHz	
L1-SAIF*	1575.42MHz	■ Compatibility with GPS-SBAS ■ WDGPS
LEX	1278.75MHz	■ Experimental Signal with higher data rate message (2Kbps) ■ Compatibility with Galileo E6 signal

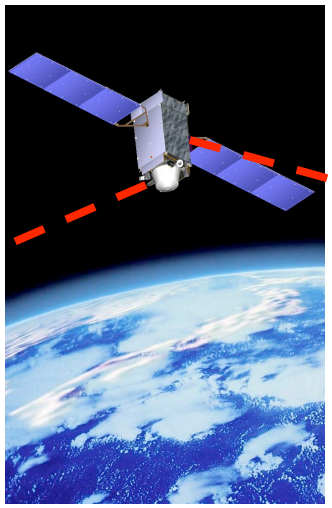
****L1-SAIF: L1-Submeter-class Augmentation with Integrity Function**

System Description
QZSS orbit and Clock estimation analyses

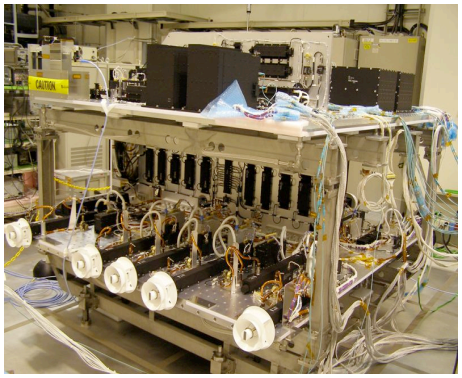


- Analyses were performed on the current conditions of QZSS dynamic models and monitor station locations and so on.
- Accuracy of SIS-URE (orbit + Clock) is expected 30cm (1-sigma) so that high positioning accuracy will be achieved using GPS + QZS.

Current Development status - Space segment -



L-band Antenna Pattern Test
Proto-Flight Model（July 2008）



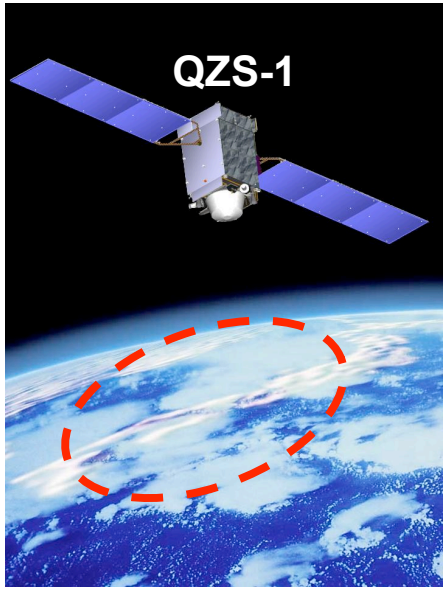
NAV Payload PFM TVT
（Jan 2009）

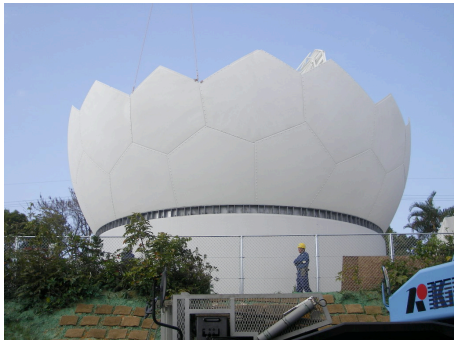
Satellite System（Aug 2009）

Current Development status - Ground segment -

@Sarobetsu (Sep 2009) @Guam (Aug 2009)

QZSS Monitoring Station





TT&C-NAV Message Uplink Station (July 2009)

@Okinawa, Japan

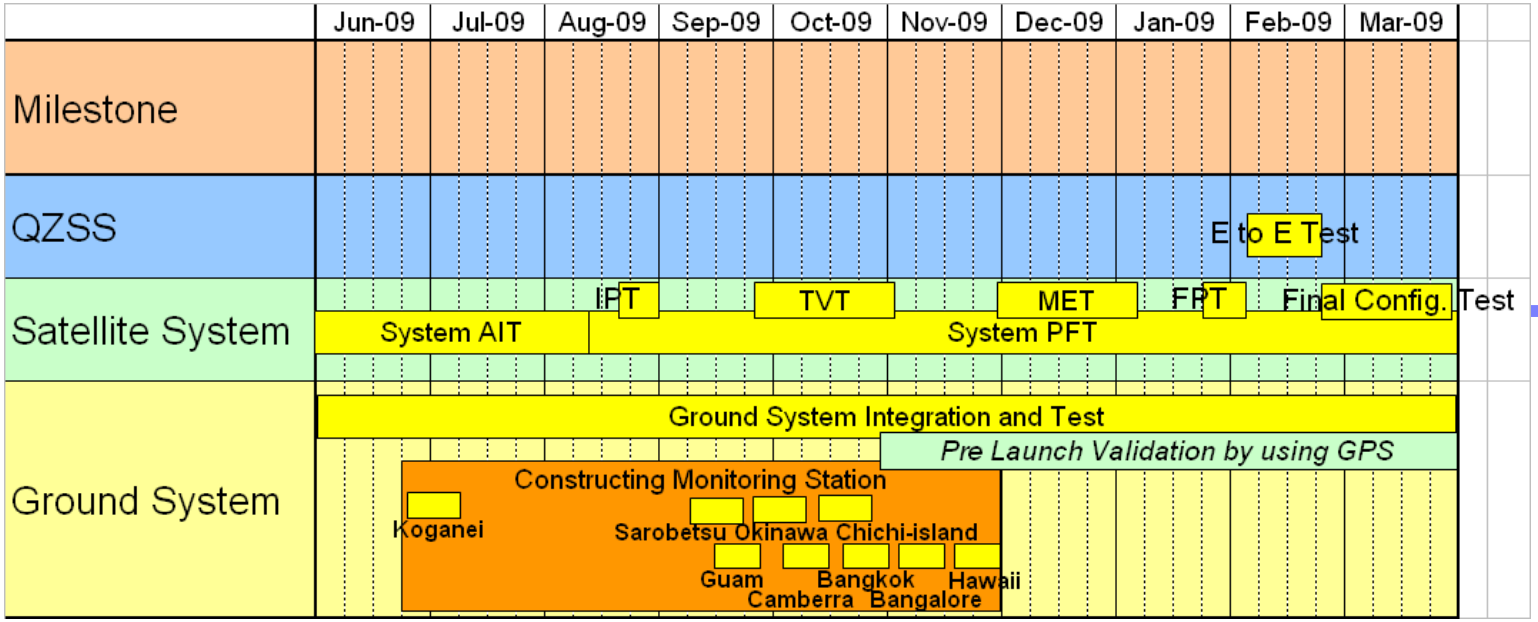
Current Development status - Site Survey for MS -

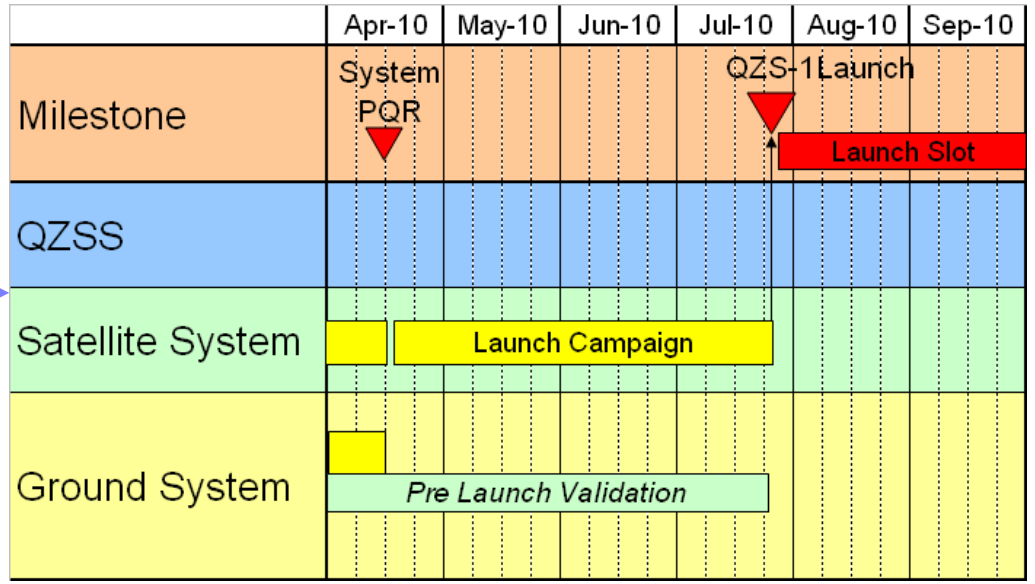
The site surveys for Monitoring Station completed, and Installation construction starts.

- **Canberra**
  Geoscience Australia (GA)
- **Hawaii**
  Kokee Park Geophysical Observatory (KPGO
- **Guam**
  National Weather Service Forecast Office (WFO)
- **Bangkok**
  Asian Institute of Technology (AIT)
- **Bangalore**
  ISRO Telemetry, Tracking and Command Network (ISTRAC)

@Mt.Stromlo August 28-30,2007

Development Schedule





3 months later from the launch :
In Orbit Validation

Summary

- ***QZSS Outline***
  - *QZSS is a Japanese regional space-based navigation system*
    - *Enhance GPS capability*
    - *High level interoperability with GPS*
  - *1st satellite will be launched in Summer of 2010*

- ***Development Status of the QZSS***
  - *Manufacturing the space system and the ground system is completed, and an integrated test is being executed now.*
  - *Site surveys for Monitoring stations have been completed, and an installation construction starts.*