



Current status of Quasi-Zenith Satellite System

***Japan Aerospace Exploration Agency
QZSS Project Team***

***#3 International Committee on GNSS,
@ Pasadena, USA
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Contents

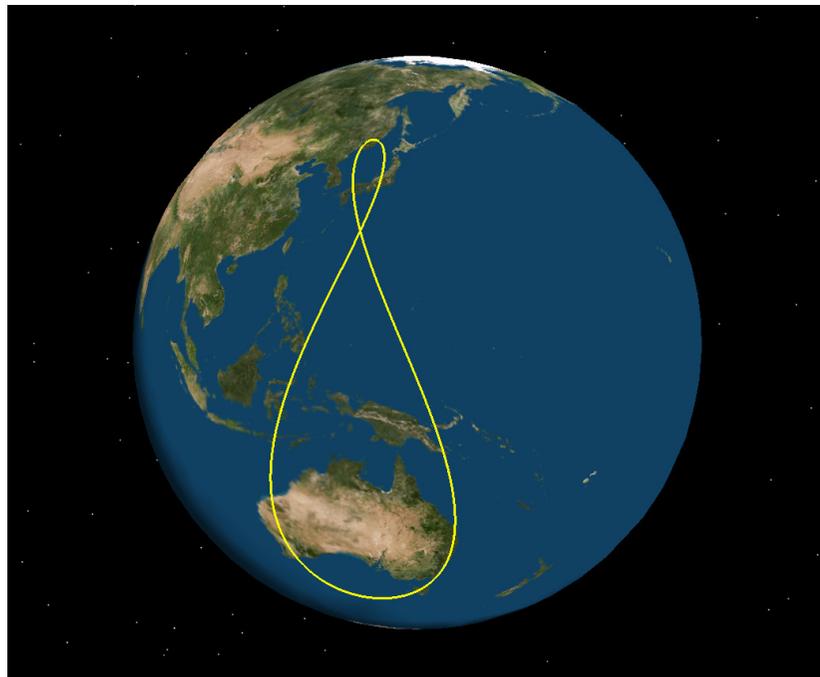
- ***I. System description***
 - ***Space Segment***
 - ***Ground Segment***
 - ***Signals***
 - ***System time and geodetic reference frame standards***
 - ***Performance***
 - ***Timetable for system deployment and operation***
- ***II. Service provided and provision policies***
- ***III. Perspective on Compatibility and Interoperability***
- ***IV. GNSS Spectrum Protection Activities***
- ***V. Other System Provider Issues***

I. System description

Concept of the QZSS (1/2)

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

($a=42,164\text{km}$, $e=0.06-0.09$, $i=39-47\text{deg}$, $\Omega = 120\text{deg}$ apart)



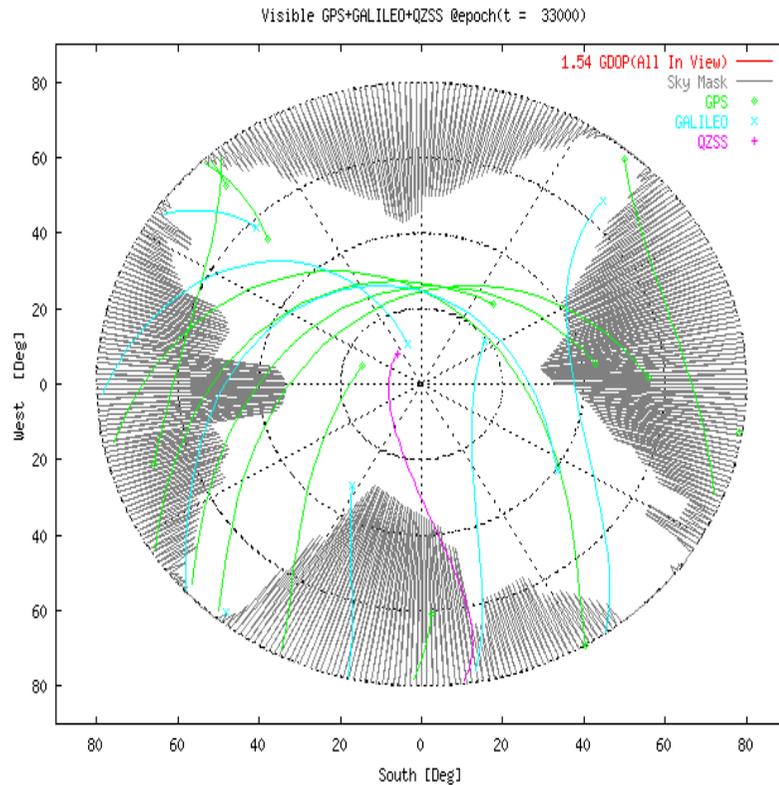
QZSS Ground Track



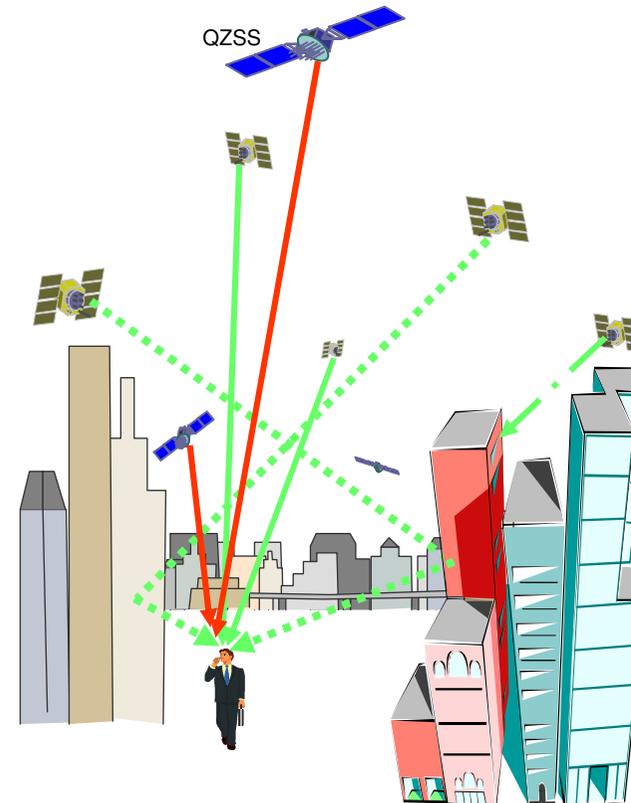
Constellation of 3 satellites

I. System description

Concept of the QZSS (2/2)

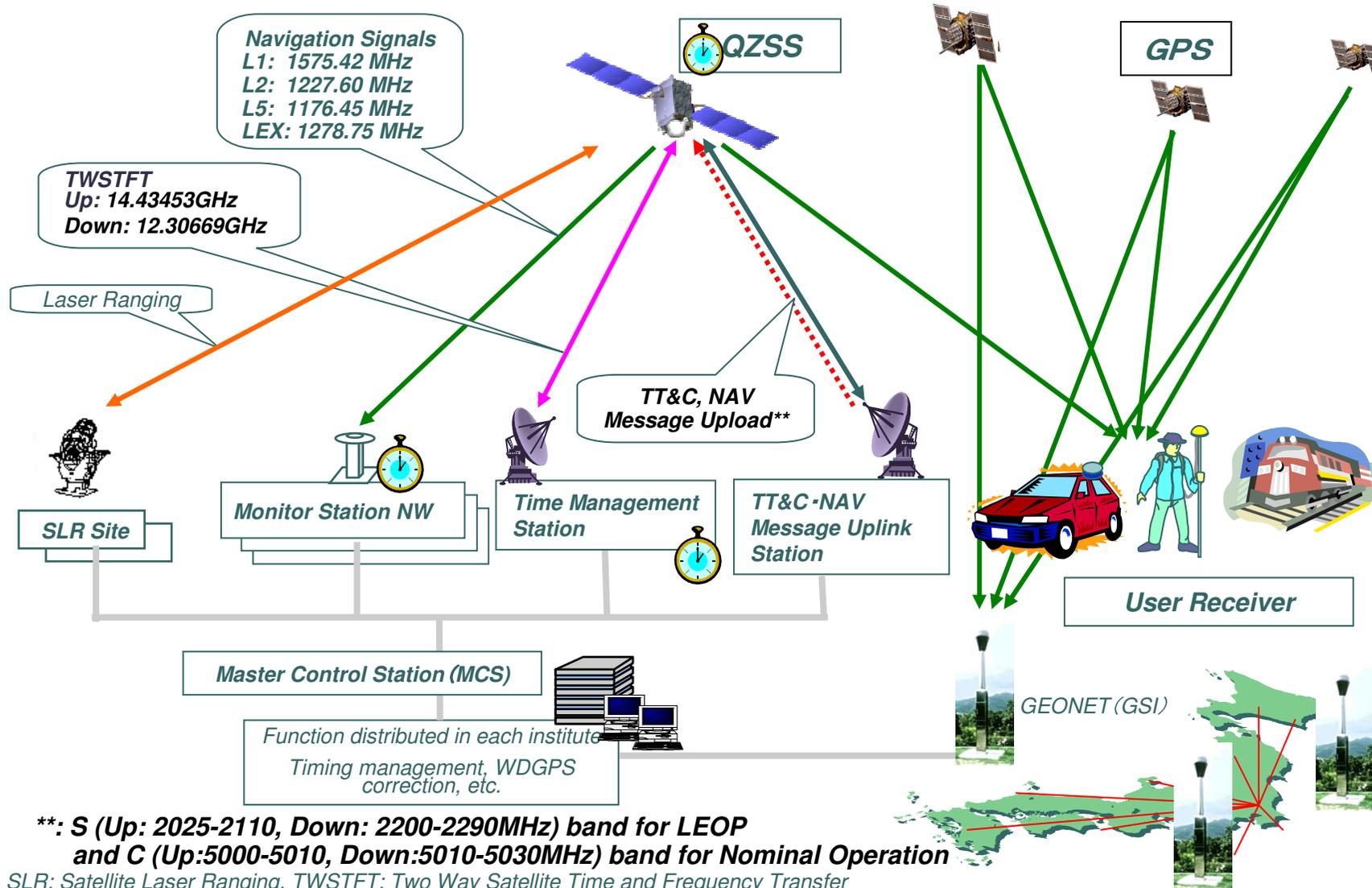


- **QZSS can provide a seamless service from high elevation angle.**
- **Increasing the availability of PNT services in downtown and mountainous areas.**



I. System description

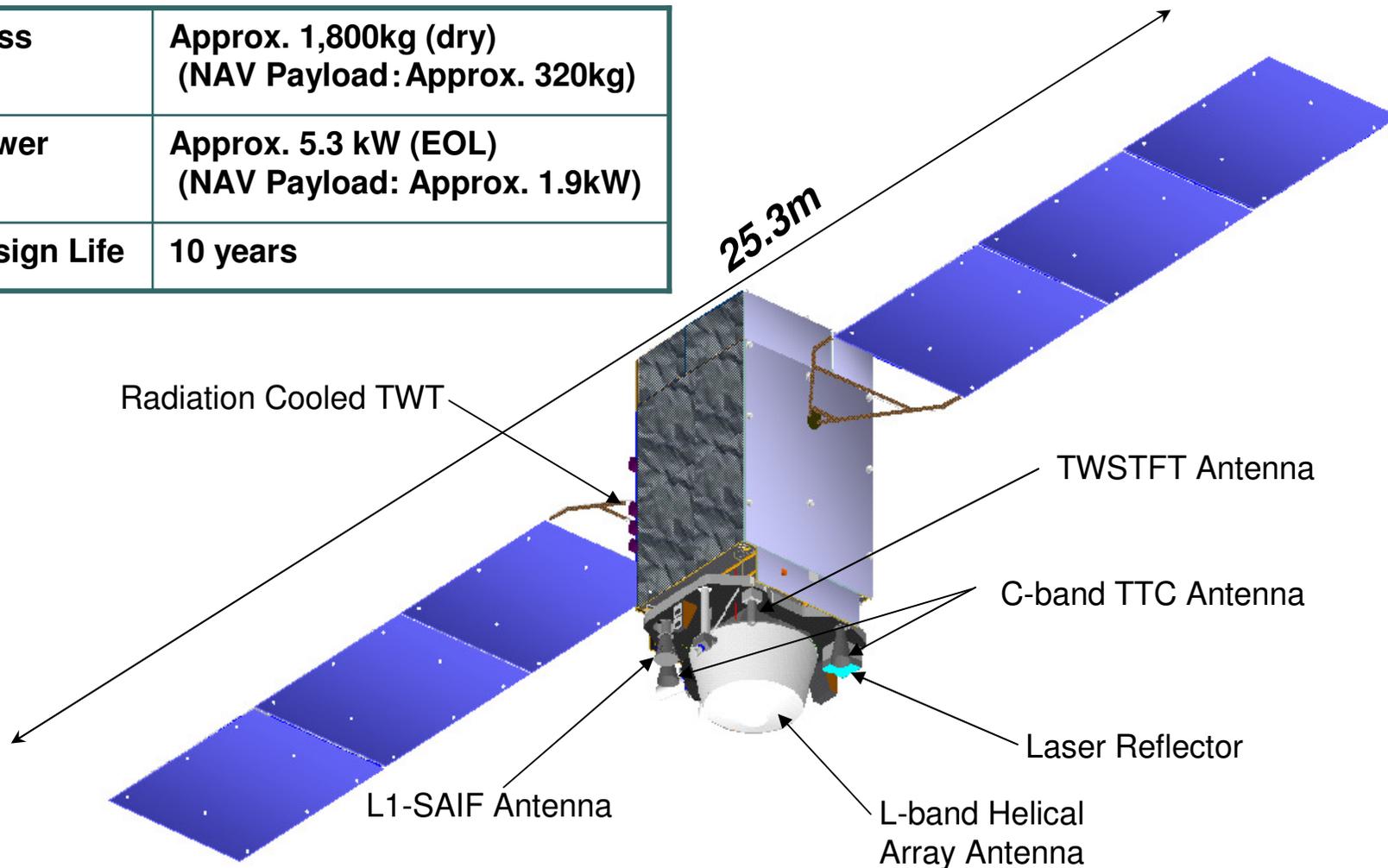
System architecture



I. System description

Space Segment - QZS-1 -

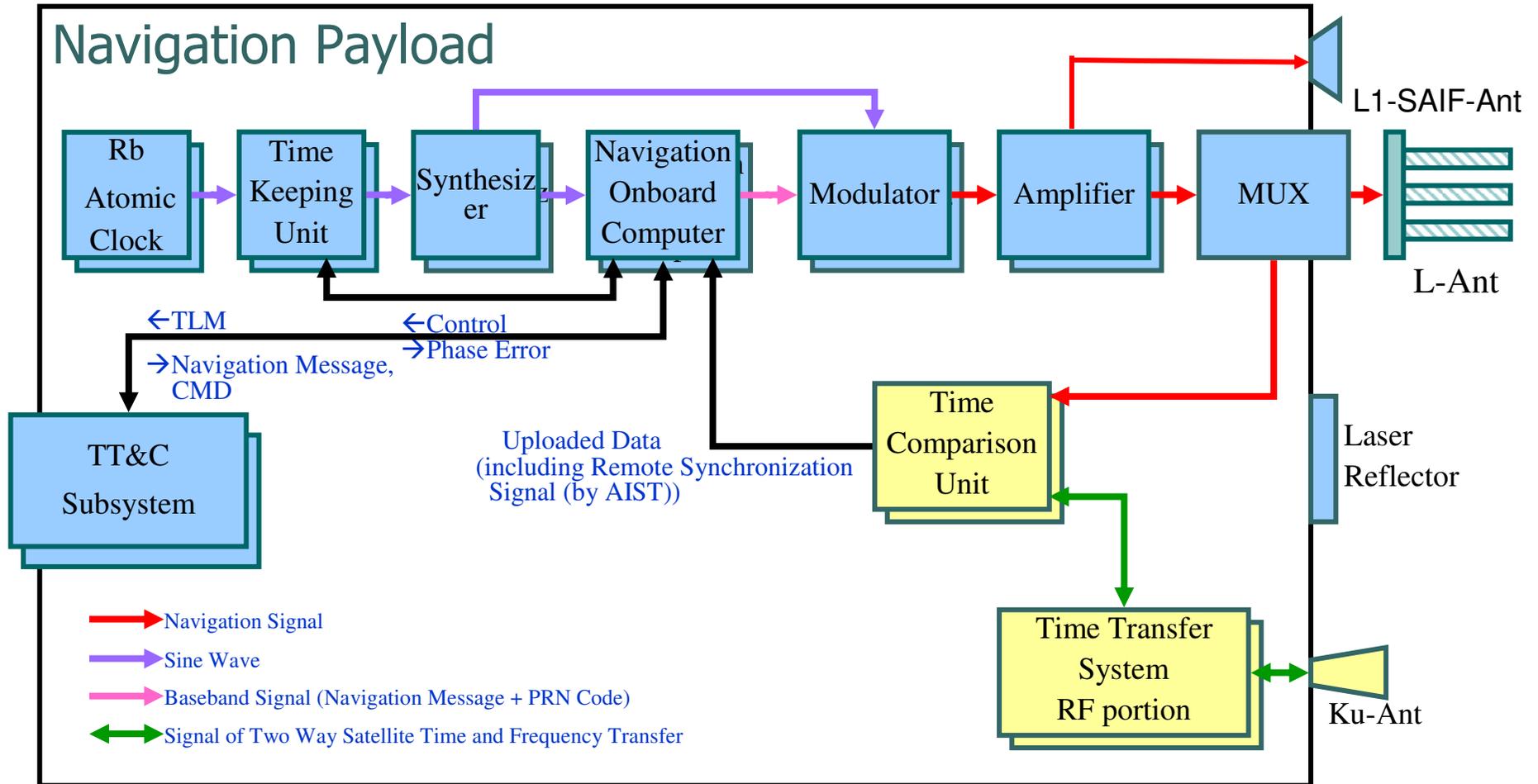
Mass	Approx. 1,800kg (dry) (NAV Payload: Approx. 320kg)
Power	Approx. 5.3 kW (EOL) (NAV Payload: Approx. 1.9kW)
Design Life	10 years



Satellite Configuration on Orbit

I. System description

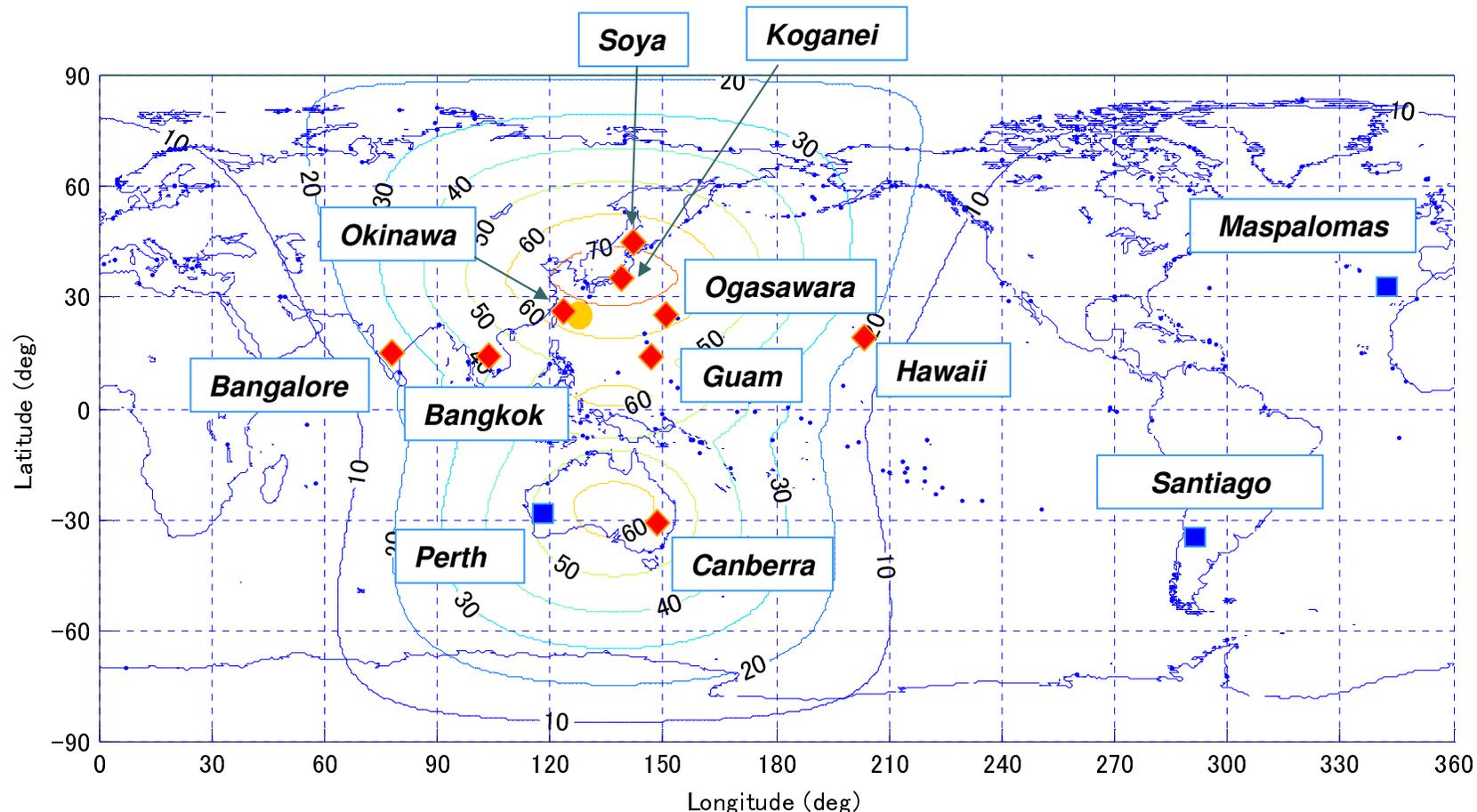
Navigation Payload on the QZS-1



JAXA NICT
(previously: CRL)

I. System description

Ground Segment (1/2)



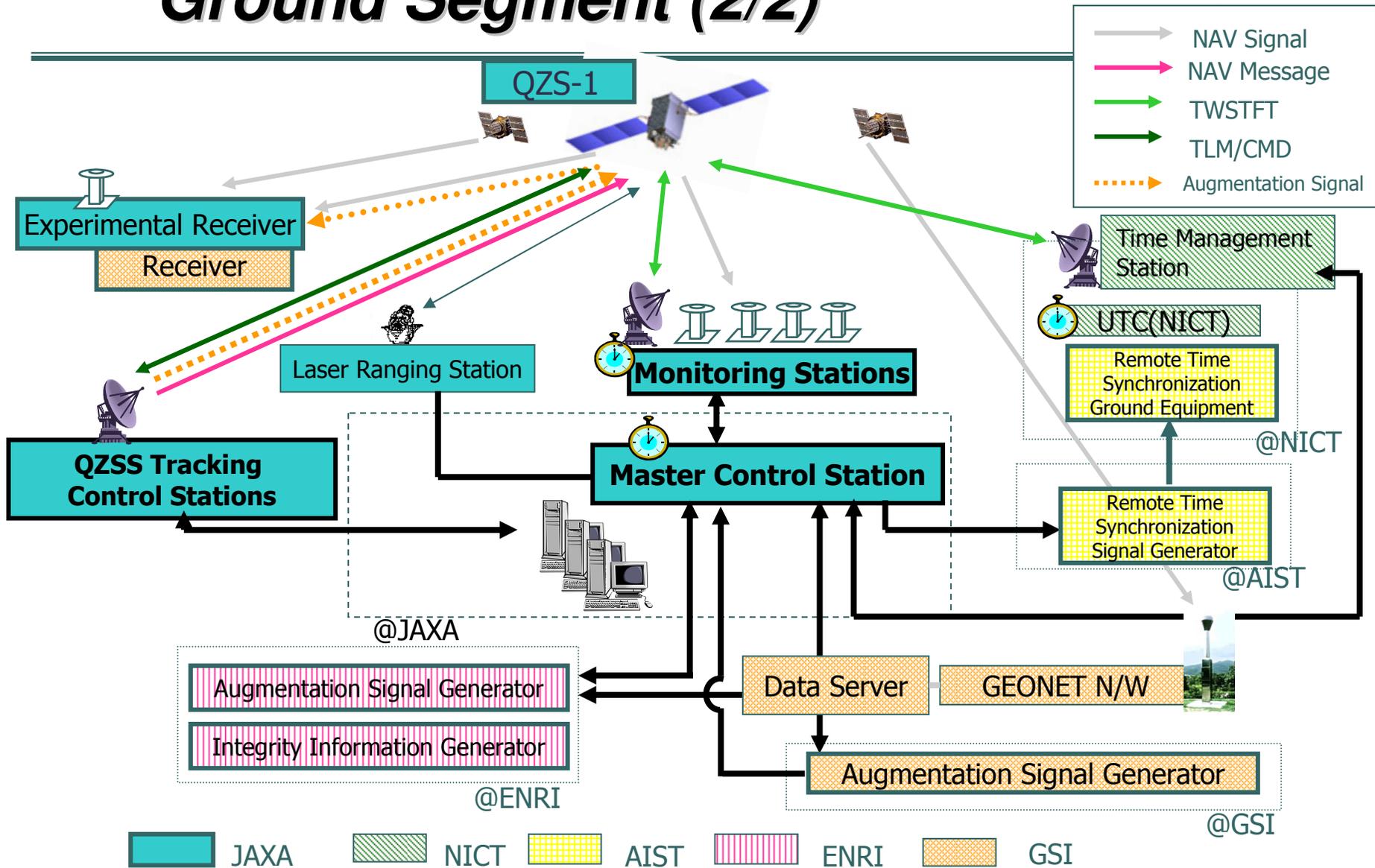
- GPS MS site
- ◆ QZSS & GPS MS site
- TT&C-NAV Message Uplink Station

Okinawa is primary TT&C station for nominal operation.

LEOP operation is to be conducted by using JAXA Ground TT&C Network

I. System description

Ground Segment (2/2)



I. System description

Planned signals

	<i>Frequency</i>	<i>Notes</i>
<i>L1-C/A</i>	<i>1575.42MHz</i>	<ul style="list-style-type: none"> ➤ <i>Complete compatibility and interoperability with existing and future modernized GPS signals</i>
<i>L1C</i>		
<i>L2C</i>	<i>1227.6MHz</i>	<ul style="list-style-type: none"> ➤ <i>Differential Correction data, Integrity flag, Ionospheric correction</i> ➤ <i>Almanac & Health for other GNSS SVs</i>
<i>L5</i>	<i>1176.45MHz</i>	
<i>L1-SAIF*</i>	<i>1575.42MHz</i>	<ul style="list-style-type: none"> ➤ <i>Compatibility with GPS-SBAS</i>
<i>LEX</i>	<i>1278.75MHz</i>	<ul style="list-style-type: none"> ➤ <i>Experimental Signal with higher data rate message (2Kbps)</i> ➤ <i>Compatibility & interoperability with Galileo E6 signal</i>

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

I. System description

System time and geodetic reference frame standards

■ Time scale: QZSST

- The length of one second is identical to **International Atomic Time (TAI)**.
- Integer second offset for TAI is the same as GPS, and TAI is **19 seconds** ahead of QZSST.
- Interface with GPS:
 - The SV clocks of QZS and GPS satellites are both controlled with respect to the offset with the GPS time scale (GPST).
 - GQTO: The time scale offset with the GPS is less than **2.0 [m] (95%)**.

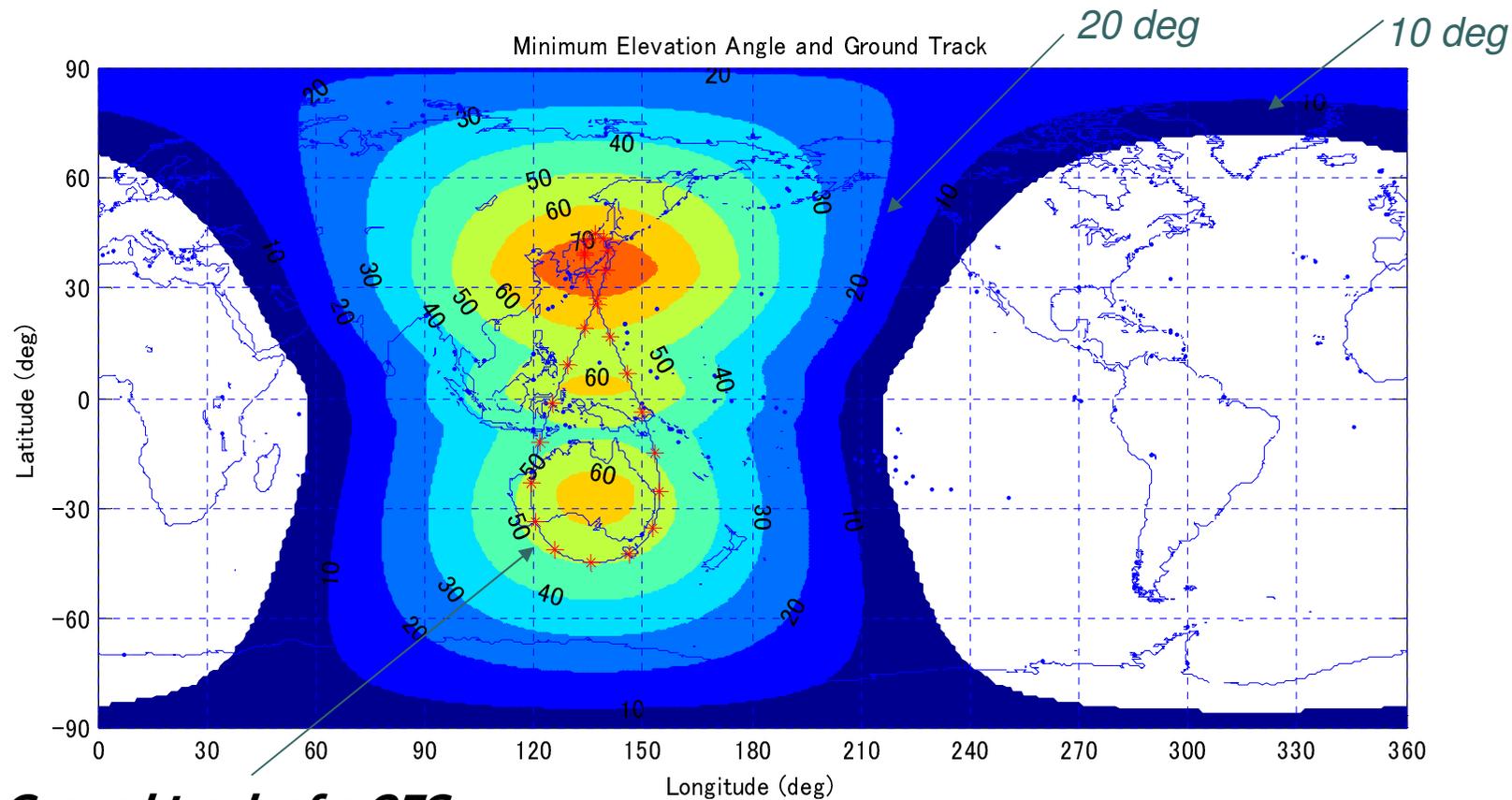
■ Coordinate System: JGS

- The QZSS coordinate system is known as the Japan satellite navigation Geodetic System (**JGS**). This coordinate System is operated so as to approach the **International Terrestrial Reference System (ITRS)**.
- The coordinate system offset with GPS is less than **0.02 [m]**.

I. System description



Expected Performance - Service Area -



Ground track of a QZS

Minimum Elevation Contour for 3 QZS over 24 hours

** for maximum elevation of visible satellites*

Expected Performance - Accuracy -

- The Signal-in-Space (SIS) User Range Error
 - is less than **1.6 m (95%)** Including time and coordination offset error.
- User positioning Accuracy
 - define as positioning accuracy combined GPS L1_C/A and QZSS L1_C/A for single frequency user, L1-L2 for dual frequency user.

	Specification	Simulation result
SIS-URE	1.6m (95%)	1.5m (95%)
Single frequency user	21.9m(95%)	7.02m(95%)
Dual frequency user	7.5m (95%)	6.11m(95%)

- L1-SAIF signal can provide WDGPS correction data, its positioning accuracy is 1m (1 sigma rms) except in cases of large multipath error and large ionospheric disturbance.

I. System description

Timetable for system deployment and operation

- 2005~6: Phase B (August 2007 PDR)
 - 2007~8: Phase C (August 2008 CDR)
 - 2008~10: manufacturing, assembly, integration and test
 - 2010 Summer : Launch of QZS-1
- 3 months later from the launch (for 1 year) : In Orbit Validation*



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