Introduction

The Japan Aerospace Exploration Agency (JAXA) has started a conceptual study of an altimetry mission for marine environment monitoring, fishery, etc. Conceptual team in JAXA is considering to name the mission COMPIRA (Coastal and Ocean measurement Mission with Precise and Innovative Radar Altimeter) and its main sensor SHIOSAI (SAR Height Imaging Oceanic Sensor with Advanced Interferometry). The sensor is a Cross-Track Interferometric Synthetic Aperture Rader (CT-InsAR) which enables much wider observable area than an existing nadir-looking radar altimeter.

This paper aims at reporting the present state of our conceptual study of the COMPIRA satellite system design, especially concerning (1) the way how candidates of orbit were selected, (2) results of electrical power analysis for some candidates of orbit, and (3) data transmission analysis.

Requirements Considered in Orbit Selection

[Requirement 1] Compensation of the influences of oceanic tidal constituents in terms of the aliasing period/frequency in altimetry.

a) Maximum aliasing period among tidal constituents(Tmax)≤0.5year
b) Minimum separation period between two arbitrary tidal constituents(Td)≥3years
c) Tidal constituents to be taken into consideration: the eight major tides and eight dominant tides near Japanese coast.

[Requirement 2] Temporal and spatial coverage of observation

a) More frequent observation of the sea around Japan:
   i) Once per 3-5 days as an period to suppress the errors in ocean 4D data assimilation
   ii) Orbital inclination to be as small as possible to cover the sea around Japan with more dense ground tracks, covering the region from Sakhalin to the North Pacific
b) Spatial coverage ratio per observation repetition cycle to be about 90% in the sea around Japan.

Current Nominal Orbit

<table>
<thead>
<tr>
<th>Observation Repetition Cycle (days)</th>
<th>Cycle of Orbital Plane relative to the Earth (T0)</th>
<th>Cycle of Orbital Plane relative to the Sun (T1)</th>
<th>Sub-Recurrent Parameters (day) N+L/M</th>
<th>Orbital Altitude (km)</th>
<th>Orbital Inclination (deg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.9</td>
<td>9.9</td>
<td>74.2</td>
<td>14.7</td>
<td>937.5</td>
<td>51.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Observation Repetition Cycle (days)</th>
<th>Maximum Separation Period (days)</th>
<th>Thin/Thick Tidal Constituent (Tc)</th>
<th>Observations (min)</th>
<th>Maximum Alasing Period (Tmax)</th>
<th>Tidal Constituents (Tc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4</td>
<td>10.1</td>
<td>T1</td>
<td>100/60</td>
<td>0.5</td>
<td>Tc1, Tc3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T2</td>
<td>100/60</td>
<td>0.5</td>
<td>Tc2, Tc4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T3</td>
<td>100/60</td>
<td>0.5</td>
<td>Tc5, Tc6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T4</td>
<td>100/60</td>
<td>0.5</td>
<td>Tc7, Tc8</td>
</tr>
</tbody>
</table>

[For Requirement 1]

1) Dominant tidal constituents in the sea around Japan were selected based on tidal stations data;
   Q1, O1, P1, K1, N2, M2, S2, K2, Mm, MS, MF, Mu2, Nu2, L2, M4, MS4.
2) Necessary period for the compensation tidal influences are shown in Table 1, (A) Tidal constituents with shorter cycle period than the observation time (Tmax).
   (B) Tidal constituents with shorter cycle period than the observation time with aliasing cycle.

Electrical Power Analysis

Assumptions
- Orbit: Current Nominal Orbit (see Table 1)
- Power Consumption of spacecraft including the payload: 2.5 kW
- Necessary Power Source and Energy Storage
  - With solar array paddles on ± Y planes
  - Battery: about 200 Ah
- Data Transmission
  - Data rate / Bandwidth: 643 Mbps / 80 MHz
  - Data transmission rate: 800 Mbps (to EOC and next-DRTS*)

Data Transmission Analysis

Assumptions
- Data rate / Bandwidth: 643 Mbps / 80 MHz
- Data transmission rate: 800 Mbps (to EOC* and next-DRTS*)
- * DRTS: Data Relay Test Satellite
- EOC: Earth Observation Center (Ground Station)
- *DRTS: Data Relay Test Satellite
- EOC: Earth Observation Center (Ground Station)

Mission Data Transmitting Analysis

Figure 2. Observed Ocean Area.

Data from global sea area will be transmittable.