

QZS-7 SATELLITE INFORMATION

Cabinet Office, Government of Japan

National Space Policy Secretariat

Oct 19,2026

1. Introduction

This documentation describes the information about QZS-7 satellite properties which need to be known in order to properly implement advanced processing algorithms for precise orbit determination (POD) and precise point positioning (PPP) etc.

2. Reference Frame

The QZS-7 satellite coordinate system is aligned with the main body axes and originates at the center of the launch adapter plane. The individual axes of QZS-7 satellite coordinate system are aligned in the following way: (see Figure 1)

- origin : Center of the launch adapter plane
- The +Z-axis is oriented to the bore sight direction of the L-ANT antenna.
- The +Y-axis is parallel to the rotation axis of the solar panels.
- The +X-axis is constituted by a right-handed system with +Y/+Z axis.
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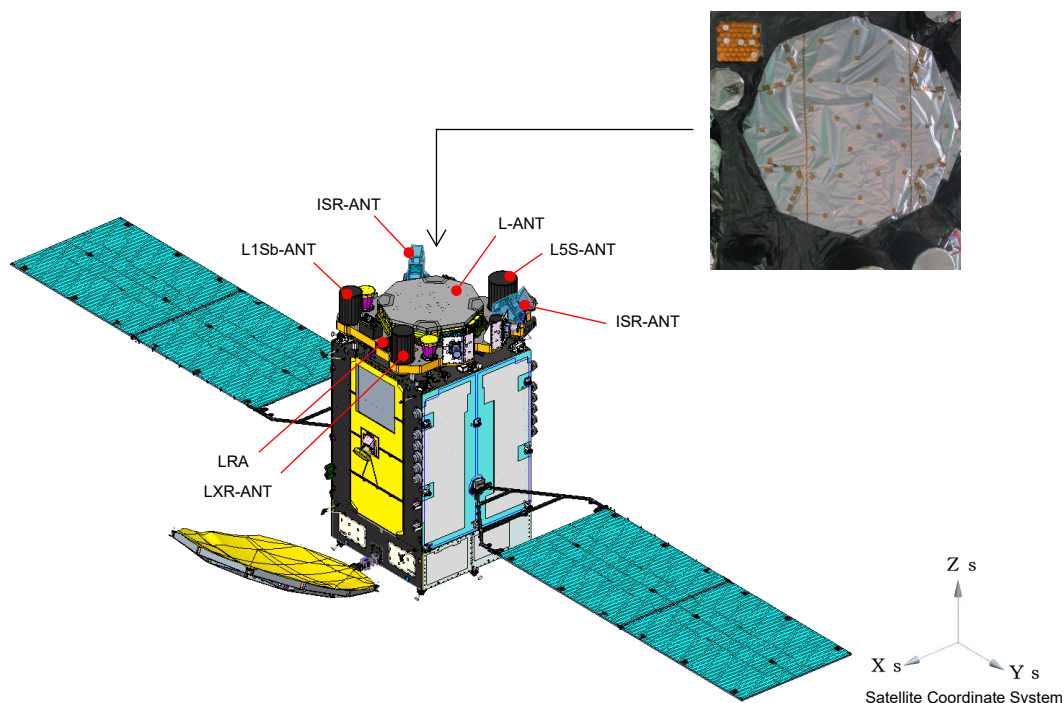


Figure 1 Reference Frame

3. Attitude Law

QZS-7 is continuously controlled in the normal mode as follows: (see Figure 3)

The +z-axis is pointing to the Earth.

The -y-axis is perpendicular to the orbital plane in the direction of the orbital angular momentum vector.

The +x-axis that is along the flight direction completes the right-handed system with +Y/+Z axis.

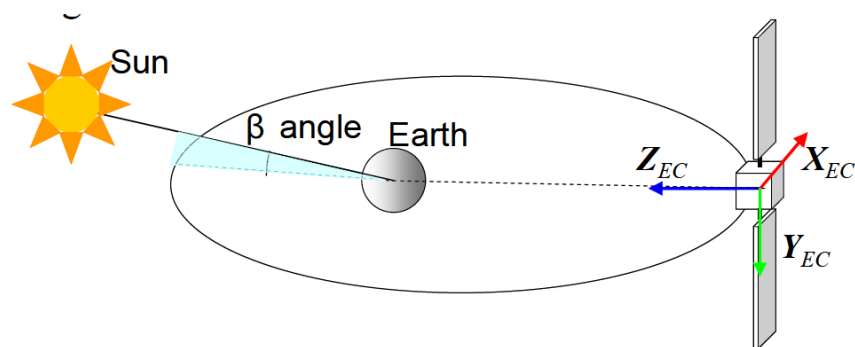


Figure 3 Normal mode

4. Mass and Center Of Mass

The spacecraft mass and the center of mass with respect to the satellite reference frame are provided in Table 1.

Table 1 Mass and center of mass

	Mass [kg]	CoM (w.r.t. origin) [mm]		
		Xs	Ys	Zs
BOL	2736.2	-2.2	3.7	1838.3
MOL	2703.6	-2.2	3.7	1841.5
EOL	2671.1	-2.3	3.8	1844.9

BOL : Completion of IOT (Estimation)

MOL : 7.5 years after launch (Prediction)

EOL : 15 years after launch (Prediction)

5. Navigation Antenna Phase Center Corrections †

The phase center offsets of the navigation antenna are provided in Table 2. The offsets from the center of mass are obtained by subtracting the X/Y/Z coordinates in Table 1 from those in Table 2.

Table 2 Phase center location

Signal	Coordinates (w.r.t. origin) [mm]		
	X	Y	Z
L1	0.00	0.00	+4743.89
L5	0.00	0.00	+4423.89
L6	0.00	0.00	+4823.89

The phase center variations of the navigation antenna are provided in Table 3, imitating the ANTEX format. The first column shows azimuth angles followed by PCVs at nadir angles from 0deg to 10deg at 0.5deg intervals. The azimuth angles count in the GNSS standard coordinate system, of which x and y axes are opposite to those of the QZS-7 satellite coordinate system respectively.

† PCO/PCV data are contained in the IGS ANTEX file:
<ftp://ftp.igs.org/pub/station/general/igs14.atx>

Table 3 Phase center variations

(a) L1																					
NOAZI	0.00	-0.01	-0.04	-0.08	-0.14	-0.20	-0.25	-0.30	-0.34	-0.36	-0.37	-0.36	-0.34	-0.30	-0.23	-0.16	-0.06	0.05	0.18	0.32	0.48
0.0	0.00	-0.01	-0.04	-0.08	-0.14	-0.19	-0.24	-0.29	-0.32	-0.34	-0.35	-0.34	-0.32	-0.28	-0.23	-0.17	-0.10	-0.03	0.06	0.16	0.26
10.0	0.00	-0.01	-0.04	-0.08	-0.15	-0.21	-0.28	-0.35	-0.40	-0.44	-0.46	-0.46	-0.45	-0.41	-0.37	-0.31	-0.24	-0.14	-0.04	0.07	0.19
20.0	0.00	0.00	-0.03	-0.07	-0.14	-0.22	-0.30	-0.37	-0.43	-0.47	-0.50	-0.50	-0.49	-0.46	-0.41	-0.35	-0.27	-0.18	-0.07	0.04	0.17
30.0	0.00	0.00	-0.02	-0.06	-0.12	-0.20	-0.28	-0.35	-0.41	-0.46	-0.47	-0.47	-0.45	-0.40	-0.34	-0.26	-0.17	-0.07	0.05	0.17	0.30
40.0	0.00	0.01	-0.01	-0.06	-0.13	-0.20	-0.28	-0.36	-0.41	-0.44	-0.45	-0.43	-0.39	-0.31	-0.21	-0.10	0.03	0.17	0.31	0.47	0.63
50.0	0.00	0.00	-0.03	-0.08	-0.16	-0.25	-0.34	-0.43	-0.49	-0.53	-0.54	-0.52	-0.47	-0.38	-0.27	-0.13	0.02	0.18	0.36	0.54	0.73
60.0	0.00	0.00	-0.03	-0.09	-0.17	-0.26	-0.35	-0.44	-0.49	-0.53	-0.55	-0.54	-0.50	-0.43	-0.34	-0.23	-0.10	0.05	0.21	0.39	0.58
70.0	0.00	-0.01	-0.05	-0.11	-0.19	-0.27	-0.35	-0.41	-0.46	-0.49	-0.51	-0.50	-0.48	-0.43	-0.37	-0.28	-0.17	-0.03	0.12	0.29	0.48
80.0	0.00	-0.01	-0.04	-0.09	-0.15	-0.20	-0.26	-0.30	-0.33	-0.35	-0.35	-0.35	-0.33	-0.29	-0.22	-0.15	-0.04	0.07	0.20	0.34	0.49
90.0	0.00	-0.01	-0.04	-0.08	-0.12	-0.17	-0.20	-0.23	-0.25	-0.26	-0.25	-0.24	-0.20	-0.15	-0.08	0.02	0.13	0.25	0.39	0.54	0.69
100.0	0.00	-0.02	-0.05	-0.08	-0.11	-0.14	-0.16	-0.17	-0.18	-0.19	-0.19	-0.19	-0.16	-0.13	-0.06	0.02	0.14	0.27	0.41	0.56	0.72
110.0	0.00	-0.02	-0.05	-0.07	-0.09	-0.10	-0.12	-0.12	-0.12	-0.13	-0.14	-0.13	-0.12	-0.09	-0.04	0.05	0.17	0.30	0.46	0.63	0.80
120.0	0.00	-0.02	-0.04	-0.05	-0.07	-0.07	-0.07	-0.07	-0.07	-0.06	-0.06	-0.05	-0.03	0.01	0.08	0.18	0.31	0.46	0.63	0.81	0.99
130.0	0.00	0.00	-0.01	-0.02	-0.03	-0.05	-0.06	-0.07	-0.06	-0.06	-0.04	-0.01	0.04	0.12	0.22	0.35	0.50	0.67	0.85	1.05	1.24
140.0	0.00	0.01	0.01	-0.01	-0.04	-0.08	-0.11	-0.14	-0.16	-0.16	-0.15	-0.11	-0.05	0.04	0.17	0.31	0.48	0.67	0.87	1.08	1.30
150.0	0.00	0.02	0.02	0.00	-0.04	-0.09	-0.14	-0.18	-0.22	-0.24	-0.24	-0.22	-0.18	-0.11	-0.01	0.12	0.26	0.43	0.61	0.81	1.02
160.0	0.00	0.01	0.00	-0.03	-0.07	-0.13	-0.19	-0.24	-0.28	-0.31	-0.31	-0.30	-0.27	-0.22	-0.14	-0.05	0.07	0.21	0.37	0.56	0.76
170.0	0.00	0.00	-0.01	-0.05	-0.09	-0.14	-0.19	-0.23	-0.26	-0.28	-0.28	-0.27	-0.25	-0.21	-0.16	-0.09	0.00	0.11	0.23	0.38	0.55
180.0	0.00	-0.01	-0.03	-0.08	-0.12	-0.18	-0.23	-0.27	-0.31	-0.32	-0.33	-0.32	-0.31	-0.27	-0.22	-0.15	-0.07	0.03	0.15	0.28	0.43
190.0	0.00	-0.01	-0.04	-0.09	-0.15	-0.21	-0.27	-0.33	-0.38	-0.41	-0.43	-0.44	-0.43	-0.40	-0.36	-0.29	-0.21	-0.10	0.02	0.15	0.29
200.0	0.00	-0.02	-0.06	-0.12	-0.20	-0.26	-0.33	-0.39	-0.44	-0.47	-0.48	-0.49	-0.48	-0.45	-0.40	-0.33	-0.25	-0.14	-0.01	0.13	0.30
210.0	0.00	-0.03	-0.08	-0.14	-0.22	-0.29	-0.36	-0.41	-0.45	-0.47	-0.48	-0.47	-0.44	-0.40	-0.34	-0.26	-0.16	-0.04	0.10	0.26	0.44
220.0	0.00	-0.02	-0.07	-0.13	-0.20	-0.28	-0.34	-0.39	-0.42	-0.43	-0.42	-0.39	-0.34	-0.28	-0.18	-0.08	0.05	0.20	0.37	0.56	0.76
230.0	0.00	-0.02	-0.08	-0.14	-0.23	-0.30	-0.38	-0.44	-0.48	-0.50	-0.50	-0.47	-0.42	-0.35	-0.25	-0.13	0.02	0.17	0.36	0.56	0.78
240.0	0.00	-0.03	-0.09	-0.16	-0.26	-0.34	-0.43	-0.48	-0.52	-0.54	-0.54	-0.53	-0.49	-0.44	-0.36	-0.26	-0.14	0.00	0.16	0.33	0.53
250.0	0.00	-0.03	-0.09	-0.17	-0.26	-0.36	-0.44	-0.51	-0.55	-0.57	-0.56	-0.55	-0.52	-0.48	-0.42	-0.35	-0.26	-0.16	-0.04	0.11	0.27
260.0	0.00	-0.02	-0.06	-0.13	-0.21	-0.30	-0.37	-0.44	-0.47	-0.49	-0.49	-0.47	-0.44	-0.41	-0.37	-0.32	-0.27	-0.21	-0.13	-0.03	0.08
270.0	0.00	0.00	-0.03	-0.08	-0.15	-0.22	-0.29	-0.35	-0.40	-0.43	-0.43	-0.43	-0.41	-0.37	-0.33	-0.28	-0.21	-0.15	-0.06	0.03	0.14
280.0	0.00	0.01	-0.01	-0.04	-0.09	-0.16	-0.23	-0.30	-0.36	-0.41	-0.44	-0.46	-0.46	-0.44	-0.42	-0.38	-0.32	-0.26	-0.19	-0.11	-0.02
290.0	0.00	0.02	0.01	-0.02	-0.06	-0.12	-0.20	-0.27	-0.33	-0.39	-0.43	-0.46	-0.46	-0.46	-0.43	-0.40	-0.35	-0.29	-0.23	-0.15	-0.07
300.0	0.00	0.01	0.01	-0.01	-0.05	-0.10	-0.16	-0.22	-0.27	-0.32	-0.35	-0.36	-0.36	-0.35	-0.32	-0.28	-0.24	-0.18	-0.11	-0.04	0.04
310.0	0.00	0.00	-0.02	-0.04	-0.08	-0.12	-0.17	-0.21	-0.25	-0.26	-0.27	-0.27	-0.25	-0.21	-0.17	-0.10	-0.03	0.05	0.14	0.24	0.34
320.0	0.00	-0.02	-0.05	-0.09	-0.14	-0.18	-0.23	-0.27	-0.29	-0.31	-0.32	-0.31	-0.29	-0.26	-0.20	-0.14	-0.05	0.05	0.17	0.29	0.42
330.0	0.00	-0.03	-0.08	-0.13	-0.18	-0.24	-0.28	-0.31	-0.34	-0.36	-0.37	-0.37	-0.37	-0.35	-0.32	-0.26	-0.19	-0.10	-0.01	0.11	0.22
340.0	0.00	-0.03	-0.07	-0.11	-0.17	-0.22	-0.26	-0.30	-0.32	-0.34	-0.35	-0.36	-0.36	-0.34	-0.32	-0.28	-0.23	-0.17	-0.09	0.00	0.11
350.0	0.00	-0.01	-0.05	-0.09	-0.14	-0.19	-0.24	-0.27	-0.30	-0.31	-0.32	-0.32	-0.31	-0.29	-0.26	-0.22	-0.17	-0.11	-0.04	0.03	0.12
360.0	0.00	-0.01	-0.04	-0.08	-0.14	-0.19	-0.24	-0.29	-0.32	-0.34	-0.35	-0.34	-0.32	-0.28	-0.23	-0.17	-0.10	-0.03	0.06	0.16	0.26

(b) L5

NOAZI	0.00	0.01	0.02	0.04	0.08	0.14	0.21	0.30	0.40	0.52	0.66	0.82	0.97	1.14	1.30	1.45	1.59	1.71	1.80	1.87	1.91
0.0	0.00	0.01	0.02	0.04	0.07	0.12	0.18	0.26	0.35	0.46	0.58	0.70	0.84	0.97	1.10	1.23	1.35	1.45	1.53	1.59	1.62
10.0	0.00	0.01	0.03	0.05	0.09	0.14	0.19	0.27	0.36	0.47	0.58	0.70	0.83	0.94	1.07	1.19	1.30	1.39	1.46	1.49	1.51
20.0	0.00	0.01	0.03	0.06	0.10	0.16	0.23	0.32	0.42	0.54	0.66	0.79	0.93	1.06	1.21	1.33	1.45	1.55	1.62	1.66	1.67
30.0	0.00	0.02	0.05	0.08	0.13	0.19	0.27	0.36	0.46	0.59	0.71	0.86	1.01	1.16	1.33	1.47	1.60	1.70	1.78	1.83	1.85
40.0	0.00	0.02	0.06	0.09	0.15	0.22	0.30	0.40	0.51	0.64	0.78	0.93	1.09	1.25	1.40	1.54	1.66	1.77	1.85	1.90	1.92
50.0	0.00	0.03	0.06	0.11	0.18	0.26	0.35	0.46	0.58	0.72	0.87	1.04	1.20	1.36	1.51	1.65	1.78	1.89	1.97	2.02	2.05
60.0	0.00	0.02	0.04	0.08	0.14	0.22	0.32	0.45	0.59	0.75	0.92	1.10	1.29	1.47	1.65	1.82	1.97	2.09	2.19	2.25	2.28
70.0	0.00	0.02	0.05	0.09	0.16	0.24	0.34	0.46	0.60	0.76	0.93	1.11	1.30	1.49	1.67	1.84	1.99	2.11	2.20	2.26	2.28
80.0	0.00	0.01	0.04	0.08	0.13	0.21	0.30	0.40	0.53	0.68	0.83	1.00	1.17	1.34	1.50	1.65	1.78	1.89	1.96	1.99	2.02
90.0	0.00	0.01	0.03	0.06	0.11	0.18	0.27	0.37	0.49	0.62	0.76	0.91	1.06	1.22	1.36	1.49	1.60	1.69	1.75	1.78	1.77
100.0	0.00	0.01	0.03	0.07	0.12	0.19	0.28	0.39	0.51	0.64	0.78	0.93	1.09	1.24	1.37	1.50	1.62	1.70	1.76	1.79	1.79
110.0	0.00	0.01	0.04	0.07	0.12	0.19	0.28	0.38	0.50	0.64	0.78	0.94	1.10	1.26	1.40	1.54	1.65	1.75	1.82	1.85	1.84
120.0	0.00	0.01	0.02	0.05	0.09	0.15	0.22	0.30	0.40	0.51	0.65	0.79	0.94	1.09	1.23	1.37	1.48	1.58	1.65	1.69	1.69
130.0	0.00	-0.01	0.00	0.02	0.05	0.09	0.14	0.21	0.30	0.40	0.51	0.63	0.76	0.88	1.01	1.12	1.23	1.32	1.39	1.43	1.44
140.0	0.00	-0.01	-0.01	0.01	0.03	0.07	0.12	0.18	0.25	0.34	0.43	0.55	0.66	0.78	0.89	0.99	1.09	1.17	1.23	1.27	1.28
150.0	0.00	-0.02	0.00	0.01	0.03	0.06	0.11	0.16	0.24	0.33	0.43	0.55	0.66	0.79	0.91	1.03	1.14	1.23	1.30	1.36	1.39
160.0	0.00	-0.01	-0.01	-0.02	-0.01	0.01	0.04	0.10	0.16	0.24	0.34	0.46	0.58	0.70	0.83	0.95	1.07	1.17	1.24	1.30	1.34
170.0	0.00	-0.01	-0.01	-0.02	-0.01	-0.01	0.02	0.05	0.11	0.18	0.27	0.36	0.47	0.59	0.70	0.80	0.90	0.99	1.05	1.09	1.11
180.0	0.00	0.00	-0.01	0.00	0.02	0.03	0.06	0.10	0.16	0.23	0.31	0.39	0.48	0.58	0.67	0.76	0.83	0.87	0.91	0.92	0.90
190.0	0.00	0.00	0.00	0.01	0.03	0.06	0.09	0.14	0.21	0.29	0.38	0.47	0.56	0.66	0.75	0.83	0.89	0.93	0.96	0.95	0.91
200.0	0.00	-0.01	0.00	0.01	0.04	0.08	0.12	0.19	0.27	0.36	0.46	0.57	0.68	0.80	0.91	1.00	1.08	1.14	1.17	1.17	1.14
210.0	0.00	-0.01	-0.01	0.00	0.01	0.05	0.09	0.16	0.24	0.34	0.45	0.57	0.70	0.84	0.97	1.08	1.19	1.27	1.32	1.35	1.34
220.0	0.00	-0.01	-0.01	-0.01	0.01	0.05	0.11	0.18	0.27	0.38	0.50	0.64	0.79	0.93	1.08	1.21	1.34	1.44	1.52	1.57	1.58
230.0	0.00	-0.01	-0.01	0.01	0.04	0.09	0.16	0.25	0.35	0.47	0.61	0.77	0.94	1.11	1.27	1.43	1.57	1.69	1.79	1.87	1.91
240.0	0.00	0.00	0.01	0.03	0.07	0.12	0.20	0.31	0.43	0.58	0.75	0.93	1.12	1.32	1.52	1.71	1.89	2.05	2.18	2.28	2.35
250.0	0.00	0.00	0.02	0.04	0.07	0.13	0.22	0.32	0.45	0.61	0.79	0.98	1.20	1.42	1.64	1.85	2.04	2.23	2.37	2.49	2.57
260.0	0.00	0.01	0.02	0.05	0.10	0.17	0.25	0.36	0.48	0.64	0.81	1.01	1.22	1.43	1.64	1.85	2.05	2.22	2.37	2.48	2.56
270.0	0.00	0.01	0.05	0.08	0.14	0.21	0.30	0.41	0.54	0.70	0.87	1.06	1.26	1.47	1.67	1.87	2.05	2.22	2.35	2.45	2.51
280.0	0.00	0.02	0.04	0.09	0.14	0.22	0.32	0.45	0.59	0.76	0.94	1.14	1.35	1.56	1.78	1.99	2.18	2.35	2.50	2.61	2.68
290.0	0.00	0.00	0.02	0.05	0.11	0.18	0.28	0.40	0.54	0.71	0.90	1.11	1.33	1.56	1.79	2.01	2.22	2.41	2.58	2.72	2.82
300.0	0.00	0.01	0.03	0.06	0.10	0.16	0.25	0.36	0.49	0.65	0.83	1.04	1.26	1.49	1.72	1.95	2.17	2.38	2.57	2.73	2.86
310.0	0.00	0.02	0.03	0.06	0.10	0.16	0.24	0.34	0.46	0.61	0.78	0.96	1.16	1.38	1.59	1.80	2.02	2.21	2.39	2.55	2.69
320.0	0.00	0.01	0.02	0.05	0.08	0.14	0.21	0.31	0.42	0.56	0.71	0.89	1.07	1.26	1.45	1.65	1.84	2.02	2.20	2.35	2.49
330.0	0.00	0.01	0.03	0.06	0.09	0.14	0.21	0.31	0.42	0.55	0.72	0.89	1.07	1.26	1.45	1.65	1.83	2.00	2.17	2.31	2.43
340.0	0.00	0.01	0.01	0.03	0.07	0.11	0.18	0.27	0.37	0.51	0.66	0.83	1.01	1.20	1.39	1.59	1.77	1.93	2.07	2.20	2.29
350.0	0.00	0.01	0.02	0.04	0.07	0.11	0.17	0.25	0.35	0.47	0.60	0.74	0.90	1.06	1.23	1.39	1.55	1.68	1.80	1.89	1.96
360.0	0.00	0.01	0.02	0.04	0.07	0.12	0.18	0.26	0.35	0.46	0.58	0.70	0.84	0.97	1.10	1.23	1.35	1.45	1.53	1.59	1.62

(c) L6

NOAZI	0.00	-0.01	-0.06	-0.12	-0.21	-0.30	-0.39	-0.46	-0.52	-0.56	-0.57	-0.55	-0.51	-0.44	-0.34	-0.22	-0.08	0.07	0.24	0.42	0.62
0.0	0.00	0.01	0.00	-0.02	-0.06	-0.10	-0.15	-0.18	-0.21	-0.20	-0.19	-0.15	-0.09	0.00	0.10	0.22	0.35	0.49	0.64	0.81	0.99
10.0	0.00	0.03	0.03	0.01	-0.03	-0.08	-0.13	-0.18	-0.21	-0.23	-0.23	-0.21	-0.18	-0.11	-0.02	0.08	0.21	0.34	0.48	0.64	0.80
20.0	0.00	0.03	0.04	0.01	-0.03	-0.08	-0.13	-0.18	-0.22	-0.24	-0.25	-0.21	-0.17	-0.08	0.01	0.13	0.27	0.42	0.59	0.76	0.94
30.0	0.00	0.04	0.05	0.04	0.00	-0.04	-0.09	-0.13	-0.17	-0.18	-0.17	-0.13	-0.07	0.02	0.13	0.27	0.43	0.60	0.79	1.00	1.21
40.0	0.00	0.04	0.04	0.02	-0.03	-0.08	-0.14	-0.19	-0.22	-0.25	-0.25	-0.23	-0.19	-0.11	-0.01	0.12	0.28	0.46	0.66	0.87	1.10
50.0	0.00	0.03	0.02	-0.01	-0.08	-0.15	-0.22	-0.30	-0.36	-0.41	-0.43	-0.43	-0.41	-0.35	-0.26	-0.16	-0.01	0.14	0.31	0.50	0.70
60.0	0.00	0.03	0.02	-0.02	-0.08	-0.16	-0.25	-0.34	-0.42	-0.49	-0.53	-0.55	-0.55	-0.52	-0.47	-0.39	-0.30	-0.19	-0.06	0.08	0.24
70.0	0.00	0.02	0.00	-0.05	-0.13	-0.22	-0.31	-0.40	-0.48	-0.53	-0.58	-0.60	-0.62	-0.60	-0.57	-0.52	-0.45	-0.38	-0.28	-0.17	-0.04
80.0	0.00	0.02	0.00	-0.06	-0.14	-0.23	-0.33	-0.42	-0.50	-0.57	-0.61	-0.65	-0.67	-0.67	-0.65	-0.61	-0.57	-0.51	-0.44	-0.35	-0.25
90.0	0.00	0.02	0.00	-0.06	-0.13	-0.22	-0.31	-0.40	-0.47	-0.53	-0.57	-0.60	-0.60	-0.59	-0.56	-0.52	-0.47	-0.40	-0.32	-0.22	-0.11
100.0	0.00	0.01	-0.01	-0.07	-0.15	-0.25	-0.36	-0.45	-0.54	-0.61	-0.66	-0.68	-0.70	-0.68	-0.65	-0.60	-0.54	-0.46	-0.37	-0.27	-0.14
110.0	0.00	0.00	-0.04	-0.11	-0.19	-0.29	-0.39	-0.48	-0.55	-0.61	-0.64	-0.65	-0.64	-0.59	-0.54	-0.45	-0.36	-0.24	-0.12	0.03	0.20
120.0	0.00	0.00	0.00	-0.03	-0.09	-0.16	-0.25	-0.33	-0.40	-0.46	-0.49	-0.50	-0.48	-0.45	-0.38	-0.28	-0.16	-0.03	0.13	0.30	0.49
130.0	0.00	0.00	-0.03	-0.08	-0.16	-0.24	-0.32	-0.39	-0.44	-0.47	-0.47	-0.45	-0.40	-0.33	-0.23	-0.10	0.04	0.20	0.38	0.58	0.80
140.0	0.00	-0.01	-0.05	-0.11	-0.20	-0.28	-0.37	-0.43	-0.49	-0.51	-0.51	-0.49	-0.43	-0.35	-0.24	-0.12	0.03	0.19	0.37	0.57	0.78
150.0	0.00	-0.01	-0.05	-0.11	-0.19	-0.27	-0.35	-0.43	-0.47	-0.51	-0.51	-0.49	-0.44	-0.35	-0.25	-0.12	0.02	0.18	0.35	0.54	0.73
160.0	0.00	-0.01	-0.04	-0.09	-0.16	-0.23	-0.31	-0.37	-0.42	-0.45	-0.45	-0.43	-0.38	-0.31	-0.21	-0.08	0.06	0.22	0.38	0.56	0.75
170.0	0.00	-0.02	-0.07	-0.13	-0.21	-0.29	-0.37	-0.43	-0.48	-0.51	-0.51	-0.49	-0.44	-0.37	-0.27	-0.15	-0.01	0.14	0.31	0.50	0.69
180.0	0.00	-0.03	-0.08	-0.15	-0.23	-0.31	-0.39	-0.45	-0.50	-0.52	-0.52	-0.49	-0.44	-0.36	-0.25	-0.12	0.03	0.20	0.38	0.58	0.79
190.0	0.00	-0.05	-0.13	-0.22	-0.32	-0.43	-0.53	-0.61	-0.68	-0.72	-0.74	-0.73	-0.69	-0.61	-0.52	-0.39	-0.25	-0.09	0.09	0.30	0.52
200.0	0.00	-0.06	-0.14	-0.25	-0.36	-0.48	-0.59	-0.67	-0.75	-0.79	-0.80	-0.78	-0.74	-0.66	-0.56	-0.42	-0.28	-0.10	0.10	0.31	0.55
210.0	0.00	-0.06	-0.15	-0.26	-0.38	-0.50	-0.61	-0.70	-0.76	-0.80	-0.81	-0.78	-0.73	-0.65	-0.53	-0.40	-0.24	-0.05	0.15	0.37	0.61
220.0	0.00	-0.07	-0.16	-0.26	-0.37	-0.49	-0.60	-0.69	-0.77	-0.82	-0.85	-0.84	-0.81	-0.75	-0.66	-0.54	-0.40	-0.23	-0.05	0.15	0.37
230.0	0.00	-0.05	-0.14	-0.25	-0.38	-0.51	-0.63	-0.75	-0.85	-0.92	-0.97	-0.99	-0.99	-0.95	-0.88	-0.78	-0.67	-0.53	-0.37	-0.19	0.00
240.0	0.00	-0.06	-0.16	-0.28	-0.42	-0.56	-0.70	-0.83	-0.93	-1.01	-1.06	-1.08	-1.06	-1.02	-0.94	-0.84	-0.72	-0.57	-0.42	-0.25	-0.07
250.0	0.00	-0.05	-0.14	-0.26	-0.39	-0.54	-0.68	-0.81	-0.91	-0.98	-1.02	-1.04	-1.01	-0.95	-0.86	-0.74	-0.60	-0.44	-0.27	-0.07	0.12
260.0	0.00	-0.05	-0.14	-0.25	-0.39	-0.53	-0.66	-0.77	-0.86	-0.91	-0.93	-0.91	-0.86	-0.77	-0.66	-0.52	-0.36	-0.19	0.00	0.20	0.41
270.0	0.00	-0.05	-0.13	-0.24	-0.35	-0.48	-0.59	-0.69	-0.76	-0.80	-0.80	-0.77	-0.69	-0.59	-0.46	-0.31	-0.14	0.05	0.26	0.47	0.69
280.0	0.00	-0.04	-0.12	-0.22	-0.34	-0.47	-0.59	-0.69	-0.76	-0.81	-0.82	-0.79	-0.73	-0.63	-0.51	-0.37	-0.20	-0.01	0.19	0.40	0.62
290.0	0.00	-0.03	-0.10	-0.19	-0.29	-0.39	-0.50	-0.58	-0.64	-0.66	-0.66	-0.61	-0.53	-0.42	-0.28	-0.11	0.08	0.28	0.50	0.73	0.97
300.0	0.00	-0.03	-0.09	-0.17	-0.26	-0.35	-0.44	-0.51	-0.55	-0.56	-0.54	-0.49	-0.40	-0.26	-0.10	0.09	0.30	0.53	0.77	1.03	1.31
310.0	0.00	-0.02	-0.07	-0.14	-0.23	-0.31	-0.38	-0.44	-0.47	-0.47	-0.44	-0.38	-0.28	-0.16	0.00	0.17	0.37	0.59	0.82	1.08	1.34
320.0	0.00	0.00	-0.05	-0.10	-0.17	-0.24	-0.31	-0.36	-0.39	-0.40	-0.37	-0.32	-0.24	-0.13	0.01	0.17	0.34	0.53	0.74	0.96	1.19
330.0	0.00	-0.01	-0.04	-0.10	-0.17	-0.25	-0.31	-0.36	-0.40	-0.40	-0.38	-0.33	-0.26	-0.15	-0.03	0.12	0.28	0.45	0.64	0.83	1.04
340.0	0.00	-0.01	-0.05	-0.10	-0.16	-0.23	-0.29	-0.34	-0.36	-0.37	-0.35	-0.31	-0.24	-0.14	-0.03	0.11	0.25	0.41	0.58	0.76	0.94
350.0	0.00	0.00	-0.02	-0.07	-0.12	-0.19	-0.24	-0.29	-0.32	-0.34	-0.32	-0.29	-0.23	-0.15	-0.05	0.07	0.21	0.35	0.50	0.67	0.85
360.0	0.00	0.01	0.00	-0.02	-0.06	-0.10	-0.15	-0.18	-0.21	-0.20	-0.19	-0.15	-0.09	0.00	0.10	0.22	0.35	0.49	0.64	0.81	0.99

6. Geometry

The spacecraft dimensions are described in Figure 4.

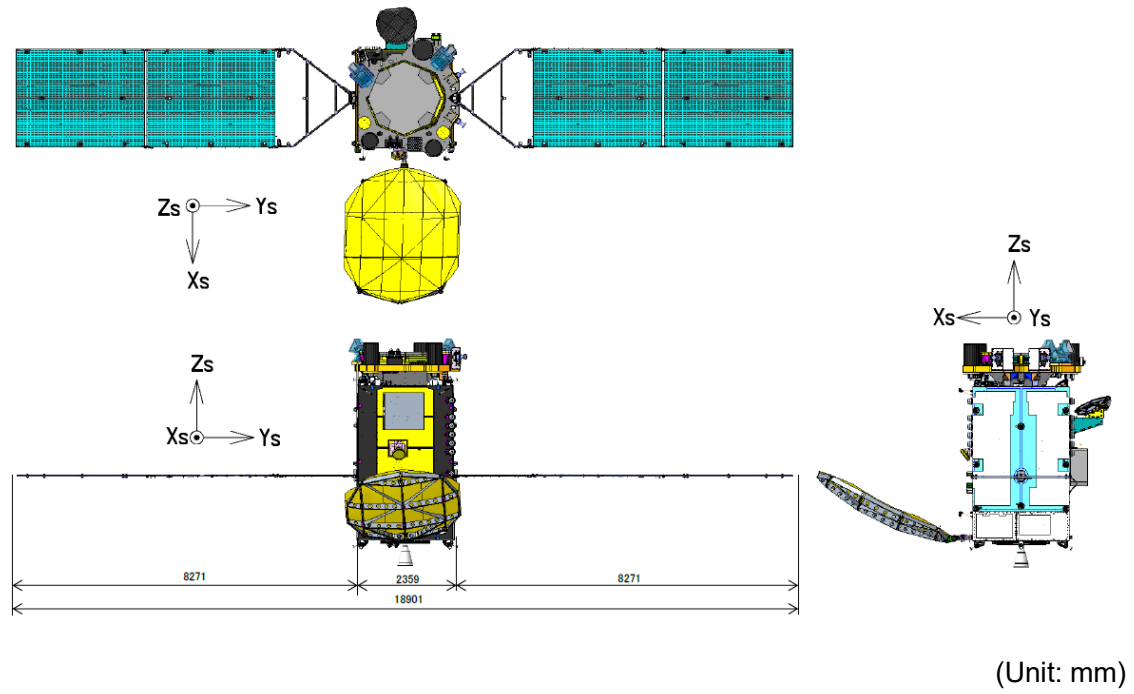


Figure 4 Satellite dimensions

The optical properties of surfaces at BOL are provided in Table 4.

Table 4 Optical properties^(*)

Location ^(*)2)	Material	Area [m ²]	Absorption	Specular	Diffuse
+X	MLI	10.0	0.926	0.035	0.039
	Radiator	0.8	0.026	0.954	0.020
	Reflector-1 (Front) ^(*)3)	8.6	0.930	0.000	0.020
	Reflector-1 (Back) ^(*)3)	8.6	0.930	0.000	0.020
-X	MLI	3.9	0.926	0.035	0.039
	MLI (Silver)	6.7	0.553	0.100	0.347
	Radiator	0.2	0.026	0.954	0.020
	Reflector-2 (Front) ^(*)4)	0.8	0.930	0.000	0.020
	Reflector-2 (Back) ^(*)4)	0.8	0.930	0.000	0.020
+Y	MLI	5.2	0.926	0.035	0.039
	Radiator	6.6	0.026	0.954	0.020
	SAP	14.9	0.923	0.068	0.009
-Y	MLI	5.6	0.926	0.035	0.039
	Radiator	5.7	0.026	0.954	0.020
	SAP	14.9	0.923	0.068	0.009
+Z	MLI	3.2	0.926	0.035	0.039
	L-ANT Cover	2.3	0.485	0.459	0.056
	LXR/ ISR-ANT Covers	0.5	0.553	0.100	0.347
-Z	MLI	5.6	0.926	0.035	0.039

*1 : Regarding the acquisition of these data, we received significant support from the associate professor “ Satoshi Ikari ” of Tokyo University.

*2 : “Location” indicates the face of the satellite body where the components and materials are attached. Note that it doesn’t necessarily indicate the direction normal to them.

*3 : Reflector-1 orients so that the normal vector of the front surface is (-0.443, -0.062, 0.895).

*4 : Reflector-2 orients so that the normal vector of the front surface is (0.294, -0.254, 0.922).

7. Laser Retro Reflector Location

The location of the optical center of the laser retro-reflector array (LRA) with respect to the satellite reference frame is provided in Table 5.

Table 5 Location of LRA optical center

	Coordinates (w.r.t. origin) [mm]		
	X	Y	Z
Optical Center	+1110.9	+258.1	+4373.3

8. Satellite Group Delay

8.1 Satellite Group Delay

Deleted

8.2 Differential Code Bias

The differential code bias (DCB) between L1 and L5 signals are provided in Table 7.

Table 7 Differential code bias

Signal	DCB [ns]
L1-L5	1.7

9. Antenna Transmit Power

Total transmit power is approximately 280W.

10. GNSS Bibliography

- [1] Quasi-Zenith Satellite System Interface Specification Satellite Positioning, Navigation and Timing Service, the Cabinet Office, Government of Japan, 2025
- [2] ILRS SLR Mission Support Request Form

Revision History

Rev.No	Date	Page	Revisions
Org	October 19, 2026		Original