

Quasi-Zenith Satellite System (QZSS)



Becoming a seven-satellite constellation
Transforming the future with centimeter-level precision

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What is the Quasi-Zenith Satellite System (QZSS)?

QZSS is the Japanese satellite positioning system

The Quasi-Zenith Satellite System (QZSS) is the satellite positioning system built and operated by the Japanese government. QZSS, nicknamed “Michibiki,” is also referred to as the Japanese GPS. As its name suggests, QZSS satellites remain near the zenith over Japan. This means signals are not easily obstructed by mountains or buildings, resulting in more stable positioning. The Centimeter Level Augmentation Service (CLAS) and other services are used in a wide range of fields like autonomous driving, smart agriculture, logistics, sports, and disaster prevention. QZSS has been maintained and operated as important social

infrastructure since services were started as a four-satellite constellation in November 2018. Development efforts are now underway to build a seven-satellite constellation and provide even better services.

QZSS features



Figure eight-shaped orbit



Quasi-zenith (high elevation angle)



Message functions

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Satellite Positioning, Navigation and Timing Service (PNT)

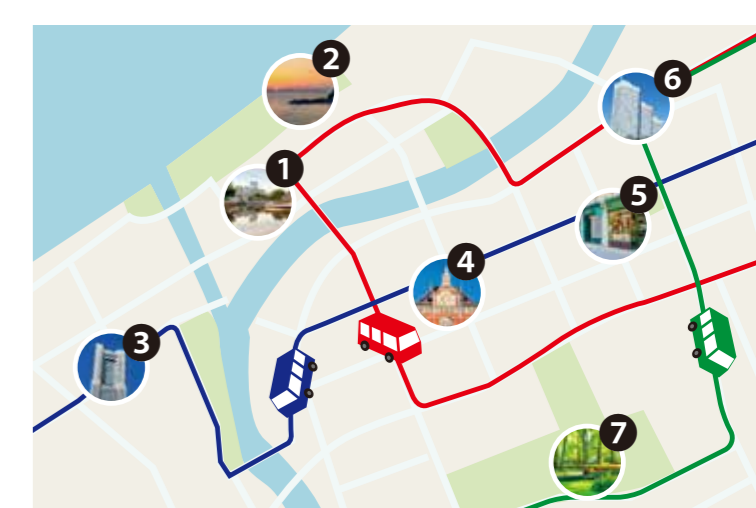
This service transmits positioning signals that are interoperable with GPS. It can be difficult to receive sufficient positioning signals in places like Japan with many urban and mountainous areas. QZSS enables stable positioning with satellites that remain above Japan for long periods of time and transmit the same type of signals as GPS, which helps compensate for insufficient positioning signals.



Smartphones



Car navigation systems



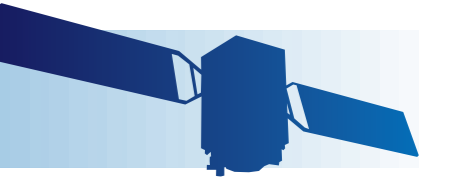
Positioning information services

Quasi-Zenith Satellite System (QZSS)



Augmentation Services Sending augmentation information to further improve positioning accuracy

CLAS Centimeter Level Augmentation Service



Centimeter-level precision helps upgrade many industries

CLAS enables highly precise positioning of the centimeter level. It is used in autonomous driving—including cars, agricultural equipment, construction machinery, and drones—and other fields that require more accurate positioning information.



Automated driving



Drones



Agriculture



Plowing ©Hokuriku Regional Development Bureau, MLIT

Main specifications	
Horizontal accuracy	Static: $\leq 6\text{cm}$ (95%)
Vertical accuracy	Static: $\leq 12\text{cm}$ (95%)
Service area	Japan and its coastal areas



Construction machinery

SLAS Sub-meter Level Augmentation Service



Enhancing lifestyles with accurate positioning of the meter level, even on small, low-cost receivers

SLAS can be used for accurate positioning of the meter level, even on the small, low-cost receivers that have come into more widespread use. It is frequently utilized on portable devices like dash cams, golf watches, and tracking devices.



Smart watches



Dash cams

Main specifications	
Horizontal accuracy	Static: $\leq 1\text{m}$ (95%)
Vertical accuracy	Static: $\leq 2\text{m}$ (95%)
Service area	Japan and its coastal areas



Logistics

MADDOCA-PPP Multi-GNSS ADvanced Orbit and Clock Augmentation - Precise Point Positioning

Scheduled to start in FY2024



Highly accurate positioning in the Asia-Oceania region



The MADDOCA-PPP highly precise positioning augmentation service will be available everywhere that QZSS signals can be received, both land and ocean areas. It is ideal in applications for which accurate positioning has been difficult to achieve, such as the marine transportation and fishing industries. This service will be launched in FY2024 (a trial service is currently available).



On the ocean



Outside Japan

Main specifications	
Horizontal accuracy	$\leq 30\text{cm}^*$
Vertical accuracy	$\leq 50\text{cm}^*$
Service area	Asia (including Japan) and the Oceania region

* At 1,800 seconds after signal is received

Quasi-Zenith Satellite System (QZSS)



Message Services Services for sending and collecting information during disasters and emergencies

Services for Southeast Asia and the Oceania region are scheduled to start in FY2025

DC Report Satellite Report for Disaster and Crisis Management

Sending important emergency and disaster messages via QZSS

DC Report transmits disaster and crisis management information from government agencies and other organizations. It currently sends disaster information and hazardous weather information from the Japan Meteorological Agency (tsunami warnings, earthquake warnings, flood warnings, volcanic eruption information, etc.). In the future it will also transmit J-Alert (missile launch information) and L-Alert (evacuation instructions and other information) messages, as well as disaster information for Southeast Asia and the Oceania region.



Q-ANPI QZSS Safety Confirmation Service

Helps provide prompt aid and relief to evacuation shelters and confirm individual safety

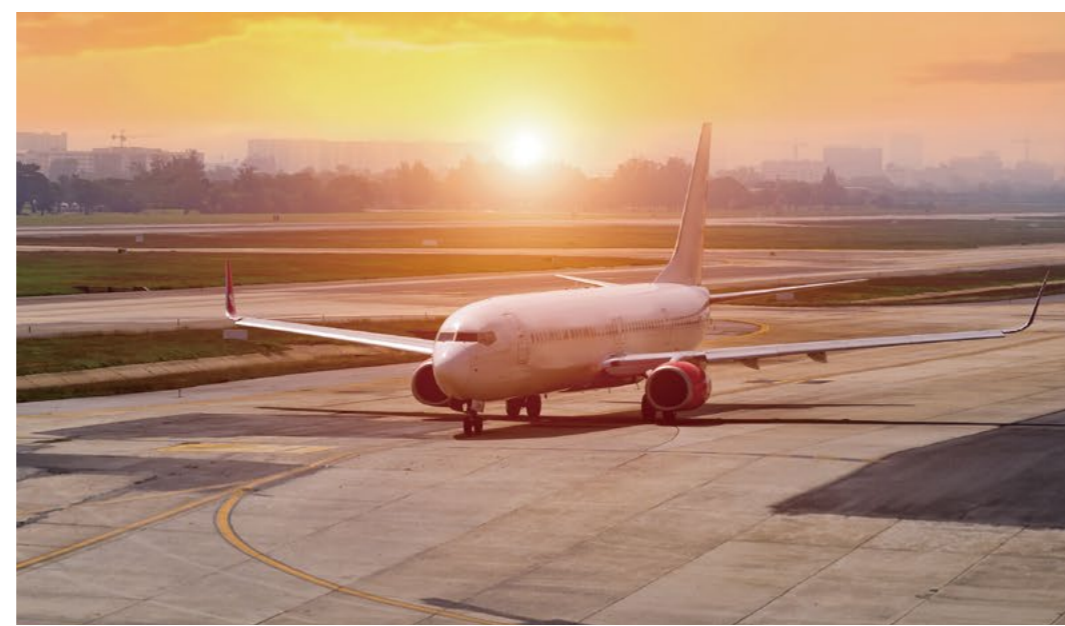
QZSS can be used to send messages when ground communications networks are cut off during a disaster, including evacuation shelter information and requests for supplies. This makes it possible to provide prompt aid and relief to isolated evacuation shelters. Close relatives and other people can also search for information regarding the safety of individuals on the official QZSS website, which contributes to safety and peace of mind.



Other Services

SBAS SBAS Transmission Service

Countries around the world operate the Satellite-based Augmentation System (SBAS) to provide aircraft with information about positioning error and satellite information reliability. Japan's Michibiki Satellite-based Augmentation Service (MSAS) transmits information via QZSS as the Japanese SBAS, and is operated by the Civil Aviation Bureau, Ministry of Land, Infrastructure, Transport and Tourism.



QZNMA QZSS Navigation Message Authentication service

Scheduled to start in FY2024

Improves signal security for safer positioning

QZNMA helps protect against GNSS spoofing, a method of interfering with satellite positioning. This service enables secure positioning using only authentic positioning satellite signals.



Services

Service	Overview	Signals	Area
Satellite Positioning, Navigation and Timing Service (PNT)	Transmits positioning signals that are interoperable with GPS, so it can be used in an integrated way with GPS.	L1C/A, L1C/B, L1C, L2C, L5	Asia (including Japan) and the Oceania region
Centimeter Level Augmentation Service (CLAS)	Sends highly precise augmentation information to achieve positioning accuracy with an error range of several centimeters.	L6D	Japan and its coastal areas
Sub-meter Level Augmentation Service (SLAS)	Sends sub-meter level augmentation information to achieve positioning accuracy with an error range of around one meter.	L1S	Japan and its coastal areas
Multi-GNSS Advanced Orbit and Clock Augmentation - Precise Point Positioning (MADCOA-PPP)	Enables highly accurate positioning in the Asia-Oceania region. Planned for FY2024 (trial service started September 2022)	L6E	Asia (including Japan) and the Oceania region
SBAS Transmission Service	Provides positioning satellite error correction and malfunction information to aircraft, etc.	L1Sb	—
Satellite Report for Disaster and Crisis Management (DC Report)	Sends disaster information and weather information from the Japan Meteorological Agency, including tsunami warnings, earthquake warnings, flood warnings, and volcanic eruption information.	L1S	Japan and its coastal areas
	Augments DC Report functions to transmit J-Alert (missile launch information) and L-Alert (evacuation instructions and other information) messages. Planned for FY2024	L1S	Japan and its coastal areas
	Augments DC Report functions to transmit disaster information for Southeast Asia and the Oceania region. Planned for FY2025	L1S	Southeast Asia and the Oceania region
QZSS Safety Confirmation Service (Q-ANPI)	Can be used by evacuation shelters and disaster prevention organizations in Japan to send and receive information during disasters, etc. Can also be used to confirm the safety of individuals.	S Band	Japan
Signal authentication service (QZNMA)	Authenticates information included in positioning signals to help protect against signal spoofing. Planned for FY2024	L1C/A, L1C/B, L1C, L5, L6E	Asia (including Japan) and the Oceania region
Positioning Technology Verification Service	Verifies new, high-precision positioning technologies. Currently used to verify practical, next-generation SBAS services.	L5S	—