GNSS utilization in Japan

Quasi-Zenith Satellite System

November 25, 2021

QZSS Strategy Office,
National Space Policy Secretariat,
Cabinet Office, Government of Japan

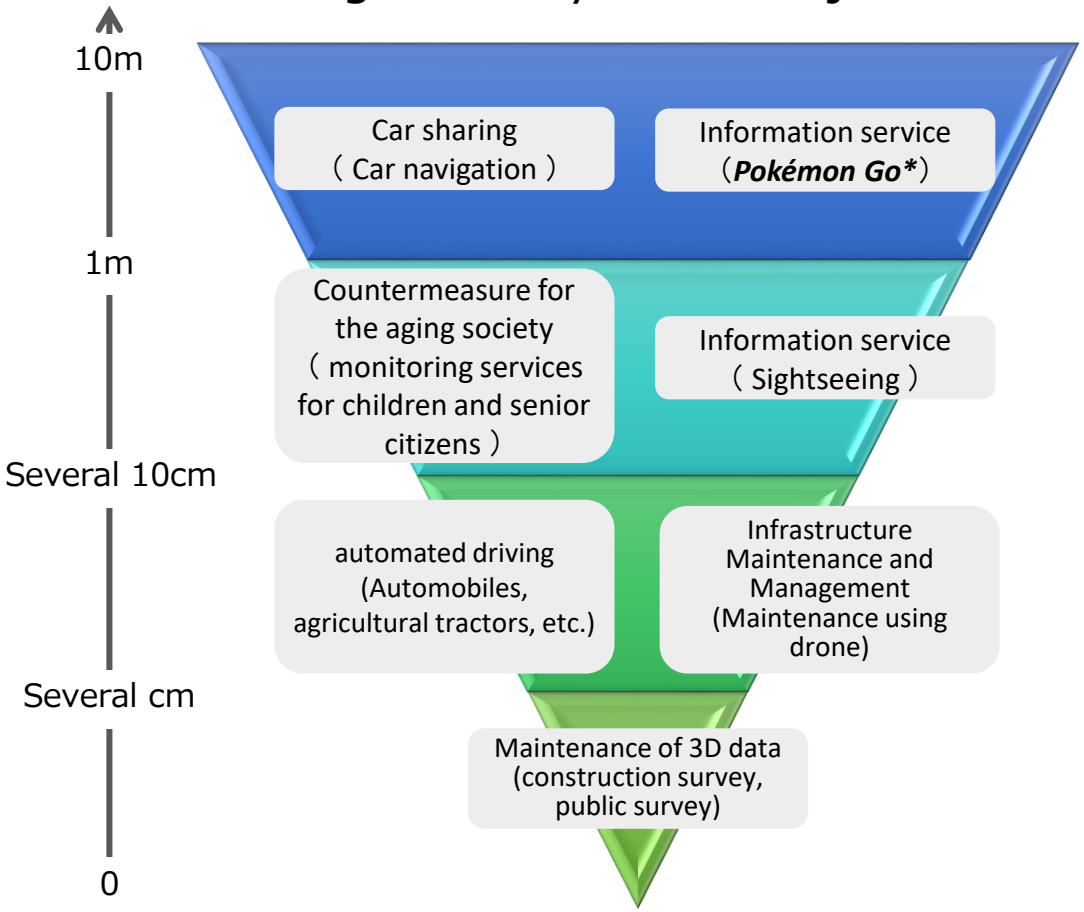
Chie Deguchi

Table of Contents

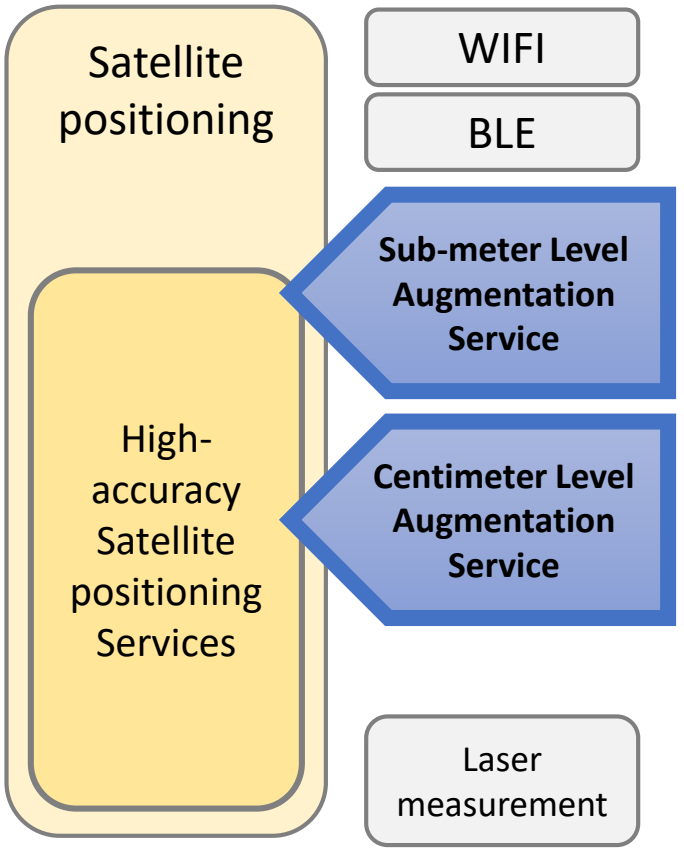
Relationship between positioning accuracy and services

○ ″Location and time″ plays important role in the big data solution so that it is requested that ″location information″ becomes more accurate.

【 Positioning accuracy 】× 【 Major Services 】



【 Positioning technology 】



* https://pokemongolive.com/en/

Trends in GNSS related fields in Japan

AUTOMOTIVE AND ROAD TRANSPORTATION

【Background】

- Level 3 automated driving system was launched in 2021. (Honda Legend)
- Commercial delivery of the high-precision 3D map of highways and motorways started in 2018.
- Demonstration experiments of automated driving and MaaS are in progress.

【ROAD MAP】

＜Automated Driving＞

- Marketization of the Level 4 in FY2025.

＜Mobility Services＞

- Commercialization of the unmanned following-vehicle convoy driving system on highways by FY2022 to FY2025.
- The unmanned autonomous driving mobility service (Level 4) in and after FY2025.
- The driver assistance and automated driving (more than Level 2) for buses on highways in and after FY2022.

＜ Promotion of MaaS ＞

- Promotion of the development of business models, scheme for the distribution, and data collaboration among related parties.

source：Cabinet Secretariat“Public-Private ITS Concept / Roadmap ”

Trends in GNSS related fields in Japan

Drone

【Background】

- Achieved unaided, BVLOS※ flight in uninhabited areas (Level 3) in FY2018.
- The Civil Aeronautics Act was amended to realize unaided and overflight BVLOS in inhabited areas (Level 4) in 2021.
- Promote the resolution of issues through technology development and demonstration experiments in sensing technology, operation management, etc.

※Beyond Visual Line-of-Sight

【ROAD MAP】

- For the time being, should achieve Level 4 in remote islands and mountainous areas first, and then expand to densely populated areas and simultaneous operation with a number of drones.
- The near-term goal is to achieve a Level 4 flight in inhabited areas by FY2022.
- In the future, develop and strengthen integrated “SKY" mobility measures, including aircrafts and flying cars.

source：Prime Minister‘s Office of JAPAN “Roadmap for the Industrial Revolution in the Sky 2021 ”

Trends in GNSS related fields in Japan

Agriculture

【Background】

- The labor shortages are becoming more serious.
- Advanced technologies such as robotics and ICT contribute to automation.
- There is an urgent need to develop technologies that contribute to the reduction of greenhouse gas emissions.

【ROAD MAP】

- Promote a variety of initiatives, including on-site implementation of Smart Agriculture using advanced technologies such as robotics, AI, and IoT.
- Achievement of practical application and widespread use of safer and more advanced automatic driving systems in and after FY2024.
- Realization of data-driven cultivation management technology, such as high-performance drones and its data utilization technologies in and after FY2024.

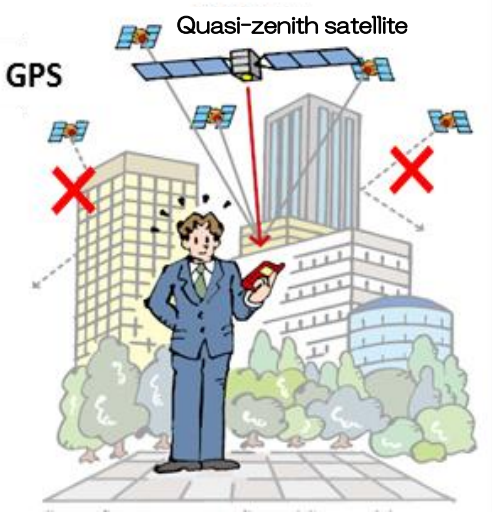
source：Ministry of Agriculture, Forestry and Fisheries “Agriculture, Forestry and Fisheries Research and Innovation Strategy”

Table of Contents

Functions of the Quasi-Zenith Satellite System (QZSS)

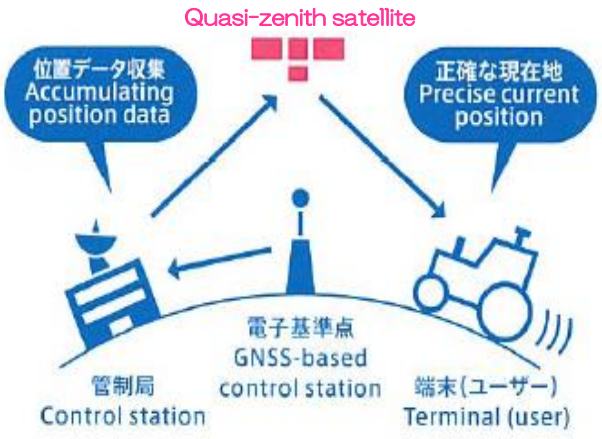
① Satellite Positioning Service (GPS completion)

- QZSS transmits identical signal with GPS
- Improving mainly in limited sky visibility area thanks to QZSS.



② Positioning Augmentation Services (GPS reinforcement)

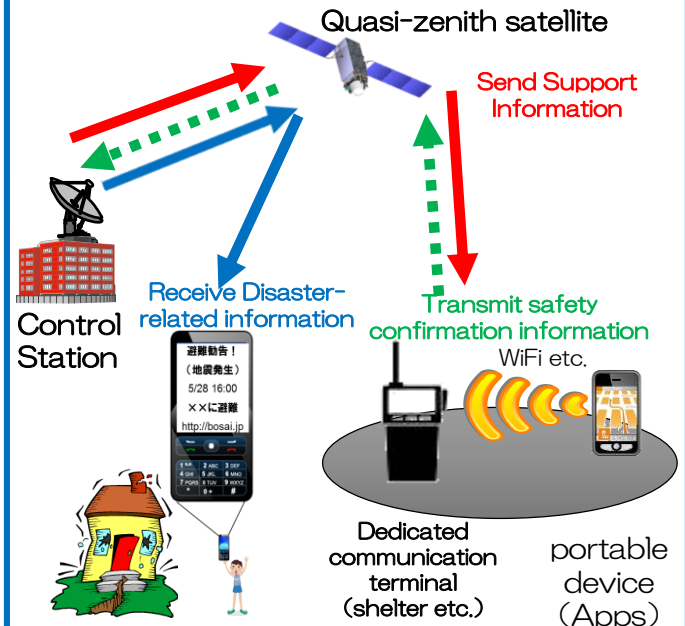
- Improving positioning accuracy with augmentation information
- CLAS / SLAS / MADOCA



(CLAS)

③ Message Service

- Satellite Report for Disaster and Crisis Management (DC Report)
- QZSS Safety Confirmation Service (Q-ANPI)



Expanding the use of QZSS

- QZSS has been operational since November 2018.
- Various government agencies have been conducting demonstrations, experiments and projects using QZSS services in major industrial fields.
- As of October 2021, about 370 products for QZSS from almost 50 product categories has been released.
- The advantages of using QZSS are that QZSS is free, services such as augmentation services, Satellite Report for Disaster and Crisis Management, and QZSS Safety Confirmation Service are attractive.

QZSS Business Innovation Council（QBIC）'s Surveys for members（2019,2020）

■ Main Business Fields of QZSS Applications

ROAD TRANSPORTATION AND AUTOMOTIVE

LOGISTICS

AGRICULTURE

MARITIME

CONSTRUCTION MACHINERY

DISASTER PREVENTION

CLAS

Fertilizer spreading by drone

Toko Tekko Co.,LTD.

Cabinet Office
National Space Policy Secretariat

- When using drones to spray chemicals as Smart Agriculture, it is necessary to fly with a high accuracy to avoid spraying chemicals on other fields.
- Toko Tekko Co.,LTD. has been developing an agricultural drone equipped with a CLAS receiver.
- In the demonstration experiment, they confirmed that the flight performance with CLAS was equivalent to that of RTK drones.
- By using CLAS, the work time can be shortened by eliminating the need for base station installation and prior field survey for an RTK drone.

Agricultural Drones

Verification of straightness

CLAS

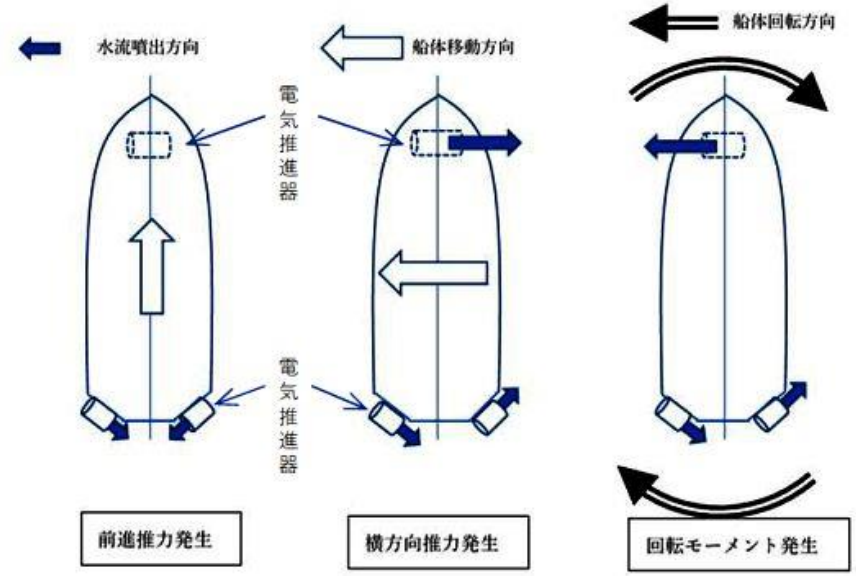
Automatic berthing of small boats

NEW JAPAN MARINE KYUSHU CO.,LTD.

Cabinet Office
National Space Policy Secretariat

- New Japan Marine Kyushu Co., Ltd. uses CLAS to develop a control device for automatic approaching of pleasure boats and obtains a domestic patent.
- By mounting 3 antennas on the boat, the position, orientation, and attitude of the boat are detected, and the boat can approach a port automatically.

3 GNSS antennas mounted on the boat



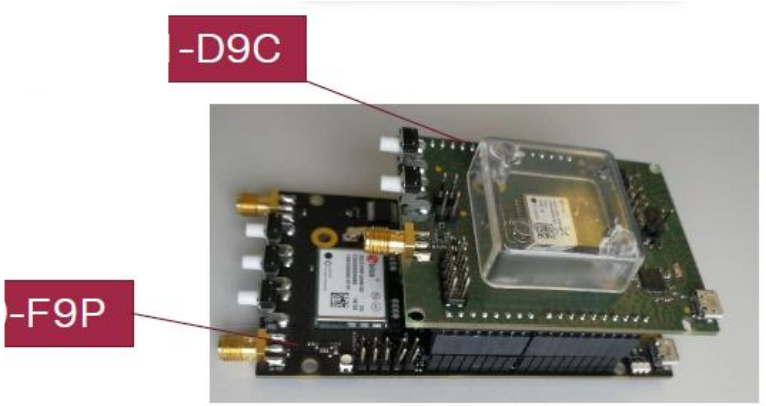
Automatic ship leveling and movement control

CLAS NEO-D9C receiver u-blox

内閣府
宇宙開発戦略推進事務局

- u-blox, headquartered in Switzerland, announced the u-blox NEO-D9C receiver for high precision GNSS correction services on November 24, 2021.
- Specifically targeting the Japanese market, the module integrates seamlessly with the u-blox ZED-F9P high precision GNSS receiver to deliver centimeter-level location accuracy.
- To maximize the availability of the position output, the receiver simultaneously decodes CLAS data from two QZSS satellites.

NEO-D9C receiver
（12.2 x 16 x 2.4mm）



SLAS

Drive recorder to support safe driving

Sompo Japan Insurance Inc.

Cabinet Office
National Space Policy Secretariat

- Sompo Japan Insurance Inc. lends driving recorders to the car insurance customers .
- In September 2021, in cooperation with Panasonic Corporation, the new model driving recorder equipped with SLAS was released.
- In the event of an accident, the system can more accurately determine the user's location for dispatching a tow truck, contacting the fire department and police, and requesting the dispatch of emergency vehicles.
- In addition, it is expected that the movement of the car can be checked more accurately when calculating the percentage of responsibility to resolve the accident.

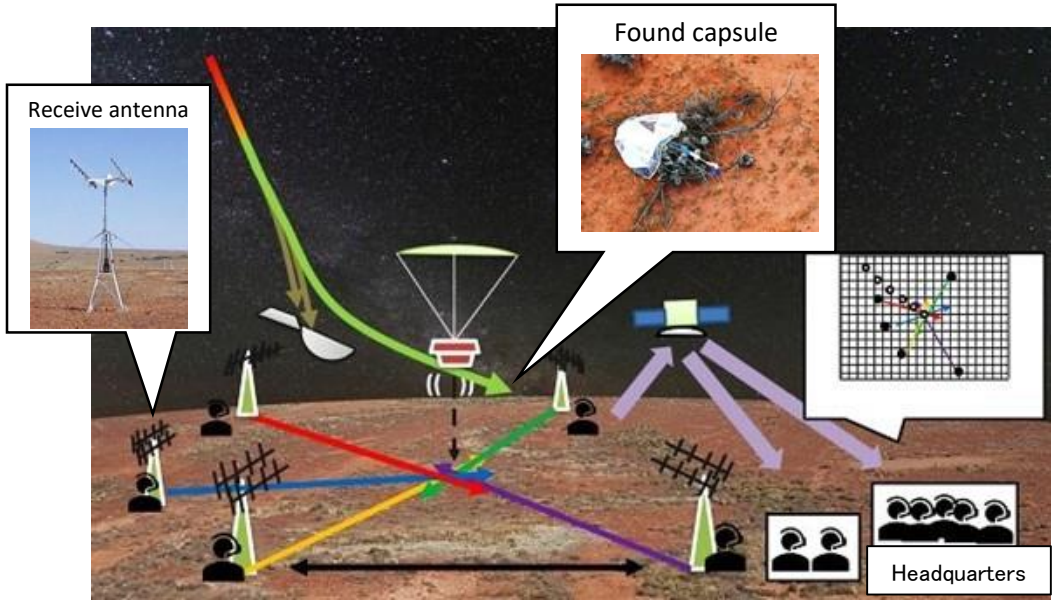
SLAS-compatible driving recorder（ left ）
Rear camera to shoot behind（right）

You can check
the recorded video
with a dedicated smartphone app

Hayabusa2 capsule recovery JAXA

- When JAXA recovered Hayabusa2 (※) capsule in Australia in 2020, MADOCA was utilized to survey the positions of the antennas in the desert where there is no means of communication and contributed to the early recovery.
- Five antennas received beacon signals from the capsule, and estimated the capsule's landing site with an error of about 200m in the vast landing prediction area of 100 km x 230 km.

(※) The spacecraft that collected samples from the surface of the asteroid Ryugu twice.



Direction search system

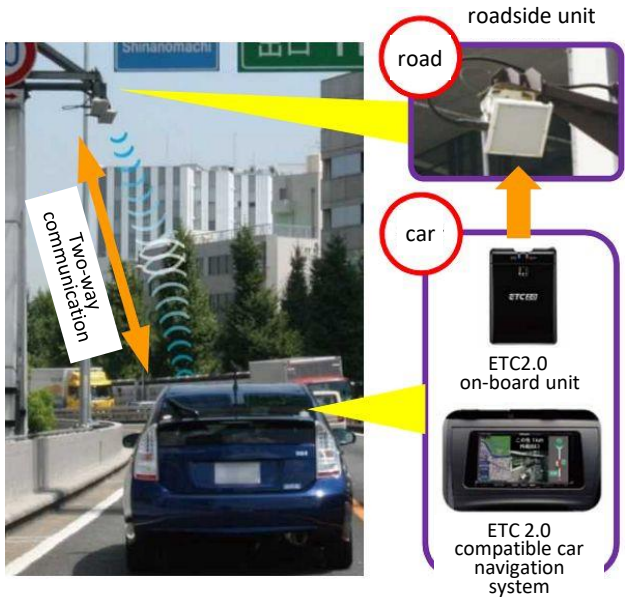
Five antennas received beacon signals, and the beacon arrival azimuth was measured. Data was collected at the headquarters, and the position of the capsule was estimated using the principle of triangulation.

ETC2.0 on-board unit

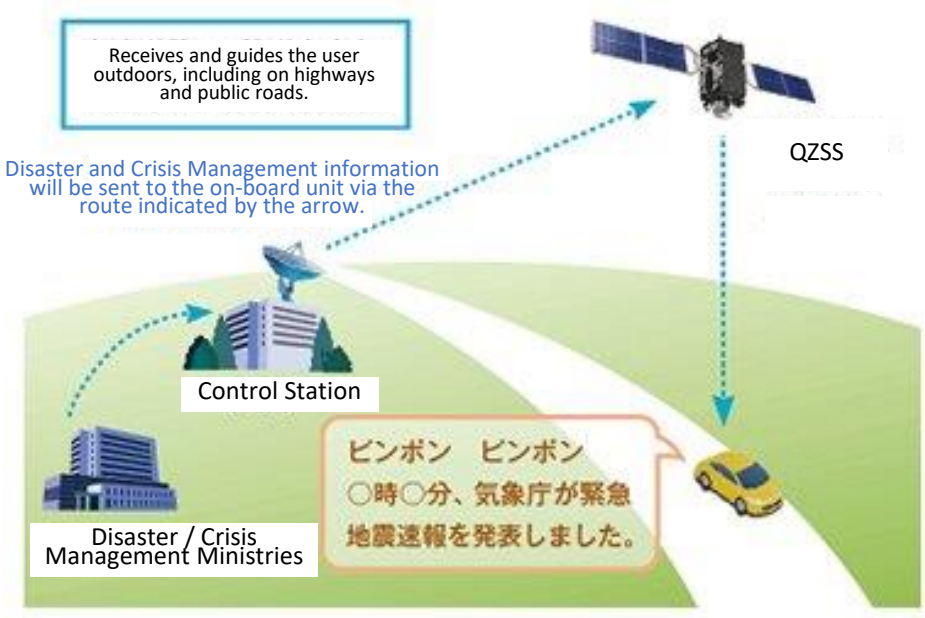
Panasonic Corporation

Cabinet Office
National Space Policy Secretariat

- Panasonic Corporation announced the launch of ETC2.0 on-board units that support Satellite Report for Disaster and Crisis Management in 2021.
- Even in areas where there is no cell phone signal, or when cell phone networks are unavailable due to earthquakes or other reasons, the system can receive disaster alerts and provide voice guidance, contributing to quick evacuation actions.



ETC2.0 system
（source：MLIT Website ）



Receiving Satellite Report for Disaster and Crisis Management
（ source ： Panasonic Corporation Press Release）

Recognition at IMO

- The International Maritime Organization (IMO) 104th Maritime Safety Committee (MSC 104) was held online from October 4 to 8, 2021.
- QZSS was recognized and approved as one of the WWRNS at IMO 104 in Oct. 2021. It means the performance of QZSS meets international standards for satellite navigation systems. ※
- This approval conforms to the operational standard for navigation support not only in the open ocean but also in coastal navigation where ships are congested, and is the world's first for a satellite navigation system.
- It enables ships to officially use QZSS as a receiving signal for their navigation aids.
- We expect to be widely used not only by Japanese ships but also by ships from other countries, thereby improving the safety of marine transportation in the future.

※: Positioning systems used in receivers and other equipment for satellite positioning systems installed on ships under the SOLAS Convention must meet the standards set by IMO and be WWRNS (World-Wide Radio Navigation System) certified.

Table of Contents

Summary

- Since the launch of the service in November 2018, the use of QZSS has been expanding in various fields.
- We plan to start 7 satellite constellation service for stable and sustainable positioning around FY2023.
- High-accuracy positioning augmentation services for Asia-Oceania markets and signal authentication services are scheduled to start in 2024.
- We will continue to expand the use of QZSS as well as enhance the services we provide.

Thank you for your attention.

For more information, please visit our web site
https://qzss.go.jp/en/