

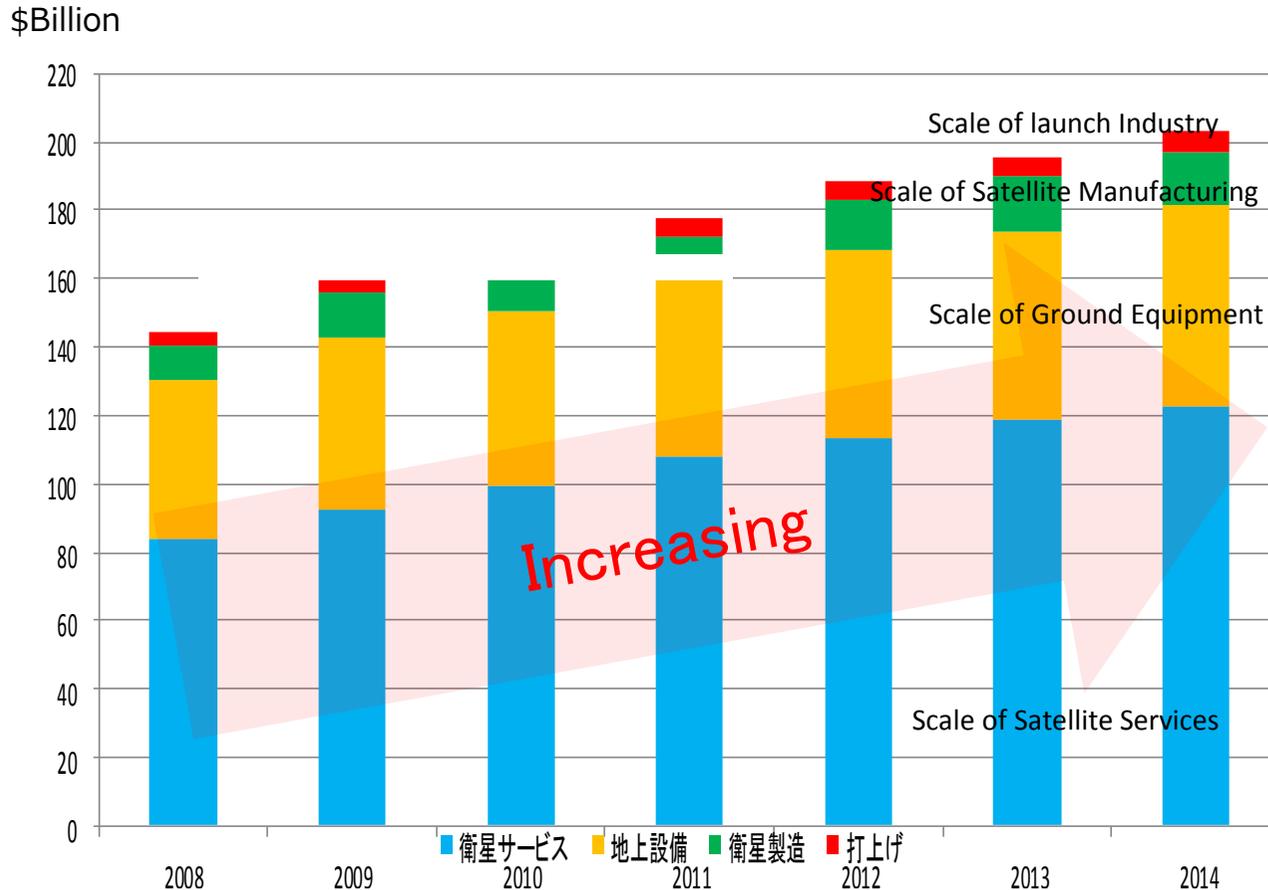
# The role of Japanese Government for the innovation of Space Industry

Feb. 2017

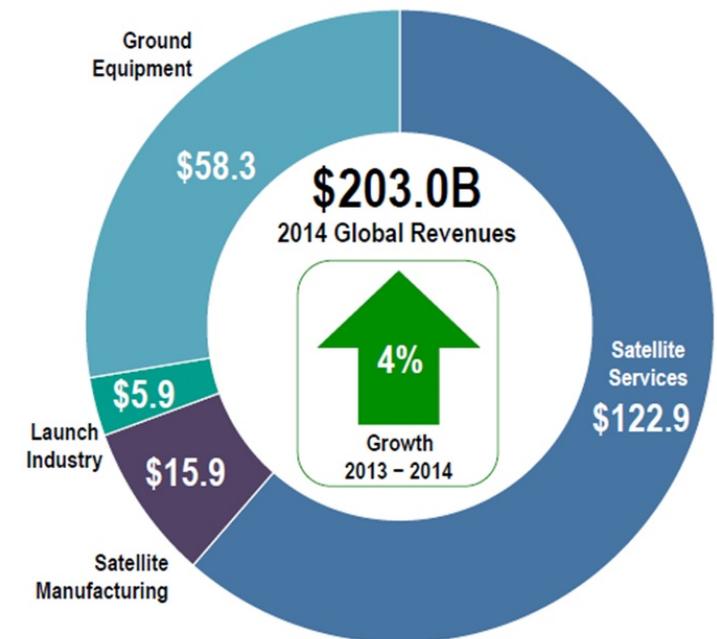
National Space Policy Secretariat  
Cabinet Office of Japan

# 1 Current status and trends of Space industry

## Increasing Space Industry Market



Sales Revenue per section of space industry (Breakdown in 2014)

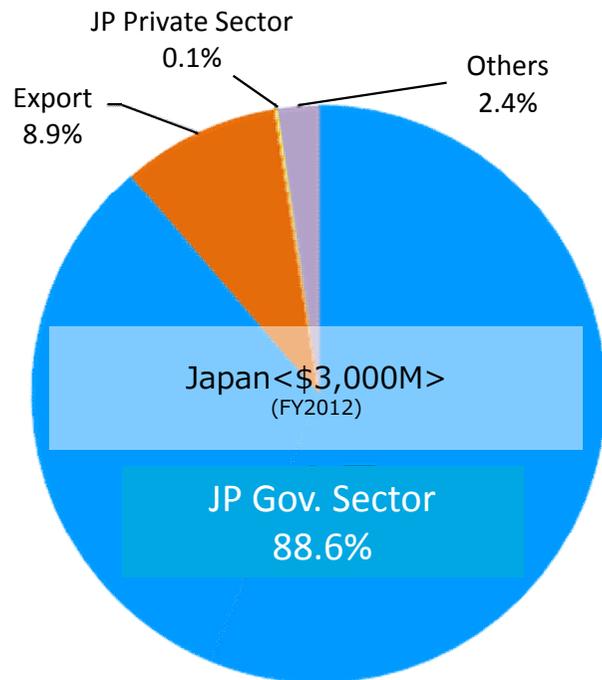


(State of the Satellite Industry Report 2015 by Satellite Industry Association)

## 2 Current status and challenges of Japanese space industry

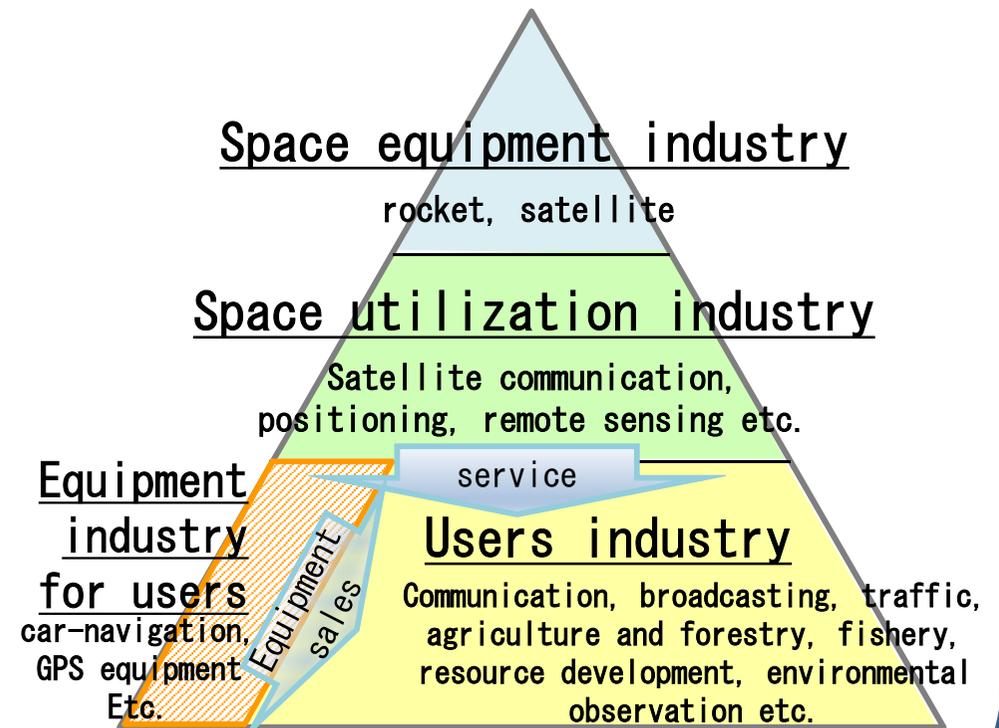
Japanese Market is mostly based on Government Sector's demands

→ Need to explore space utilization demands



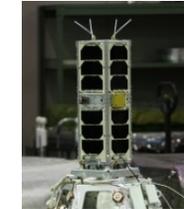
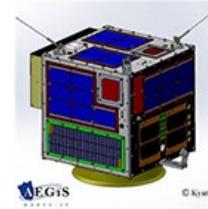
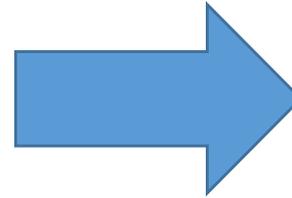
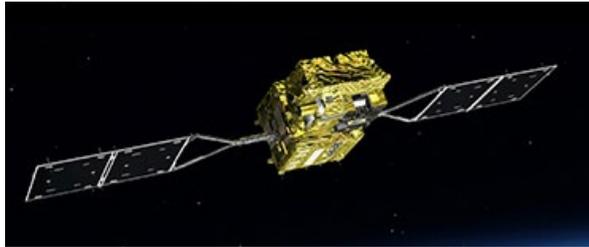
Japan Space Hardware Industry Sales

### Space Industry Structure



# 3 New space-related business ①

Paradigm change; Big satellite to Small satellite



(Ref JAXA)

## Global Communication Network



- OneWeb is aiming to deploy 648 satellites in orbit.

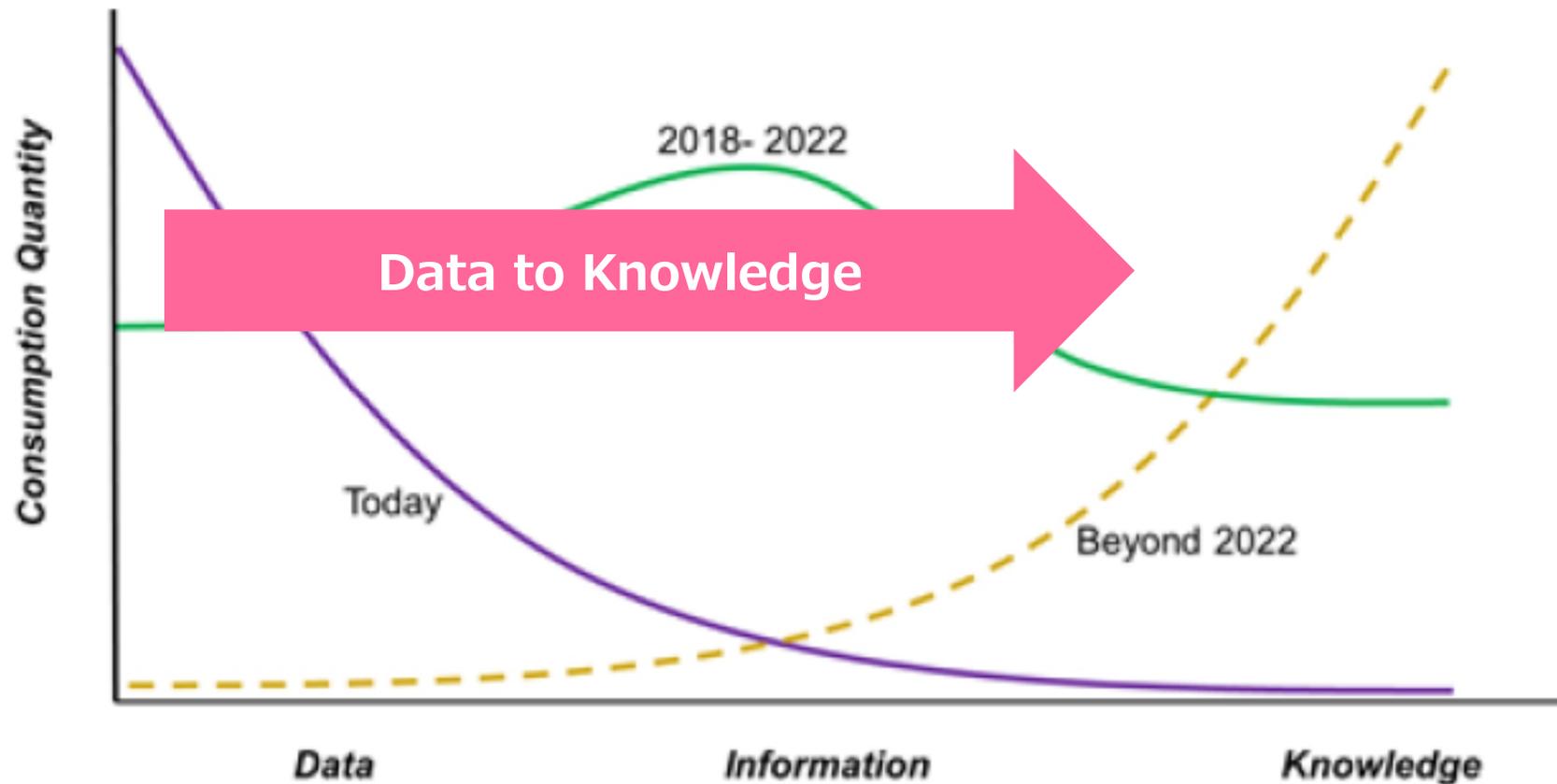
## Real-time Earth observation



- With high-frequency earth observation from low orbit, it enables to grasp changes in every hour.

## 4 New space-related business ②

- ◇ The remote sensing satellite business in Japan has been mostly limited to data (images).
- ◇ Increases in image resolution and bandwidth are creating "Big Data" and a need for AI-based analysis - and these in turn are creating new businesses and services.



(Ref : COMMERCIAL GEOINT\* STRATEGY, NGA) \* GEOINT : GEOspatial INTelligence

# 5 New space-related business ③

Create new business with added value, adding other information to satellite origin data

Analyzing satellite imagery to grasp global oil stockpile. Notify oil stock trend to energy related companies and futures market investors, etc.

Visualize protein content distribution by reflection intensity of near infrared ray.  
(To distinguish delicious rice from others with the information that protein rich rice is hard and not tasty.)



Satellite imagery

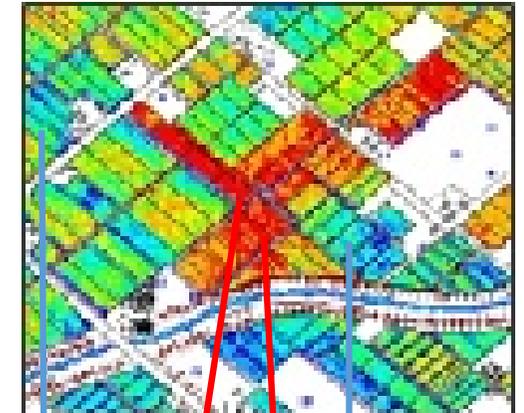
Analysis and processing

Shot after ears emergence © DigitalGlobe



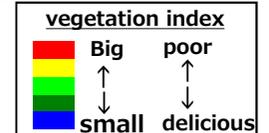
(Ref: J S I)

colored by vegetation index, and selected by application



<edible>  
·good rice  
·others  
(processed rice, crackers etc., or processed goods)

<for SAKE>  
·fine SAKE  
·others  
(ordinary SAKE etc.)



(Ref : FUJITSU LIMITED, ASAHI-SHUZO SAKE BREWING CO.,LTD.)

# 6 QZSS: as one of the most important activity in space policy

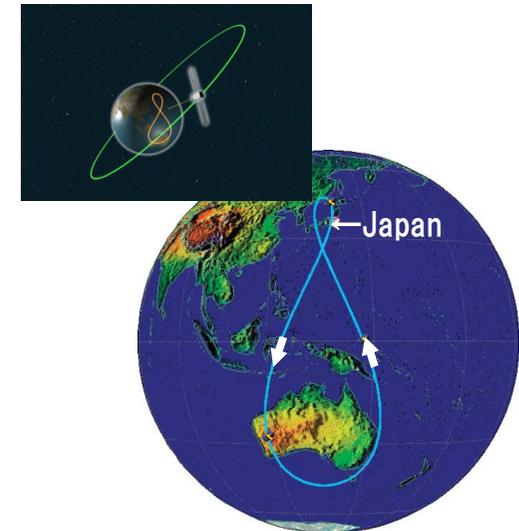
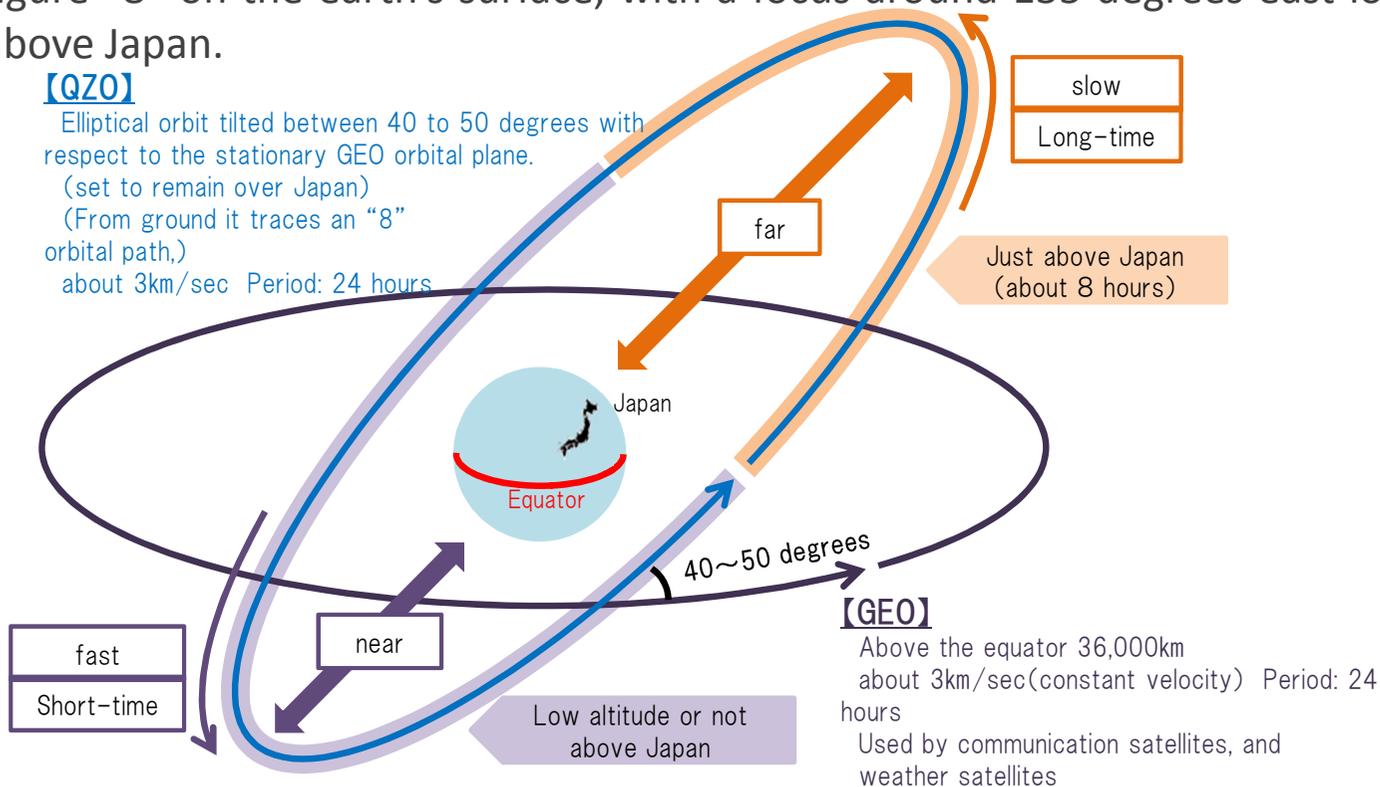
Japan Government is promoting 4 satellite constellation of QZSS realized in 2018.

## 【QZSS Orbit】

- QZSS is made up of 「3 QZO Satellites」 and 「1 GEO Satellite」 (to be deployed in 2018)
- 「GEO」 will have a circular orbit of an altitude of about 36,000km above the equator. The orbital period is about 24 hours and in-sync with the rotation of the earth. Therefore, the satellite appears to be stationary from the ground.
- 「QZO」 satellites move in elliptical orbits tilted between 40 to 50 degrees with respect to the 「GEO」 orbit. The orbital period is about 24 hours and in-sync with the earth's rotation, like GEO. As a result, they trace a figure "8" on the earth's surface, with a focus around 135 degrees east longitude, and stay long-term just above Japan.

### 【QZO】

Elliptical orbit tilted between 40 to 50 degrees with respect to the stationary GEO orbital plane.  
 (set to remain over Japan)  
 (From ground it traces an "8" orbital path.)  
 about 3km/sec Period: 24 hours



QZSS Satellite Ground Track

# 7 QZSS : Initial operations with 4 satellite constellation

## Three roles and functions of QZSS

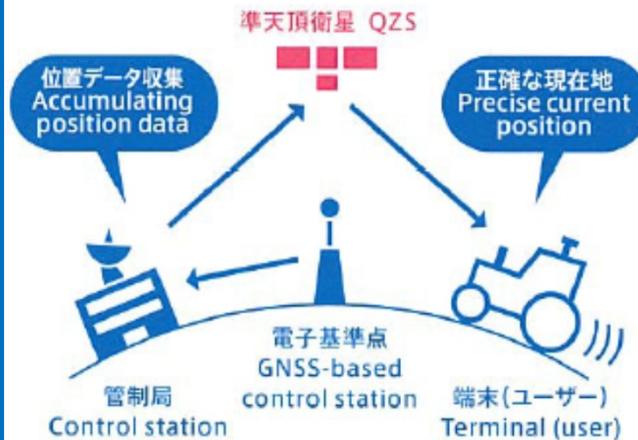
### ① GPS complementary

Improved accuracy by using more satellites (improved in urban areas)



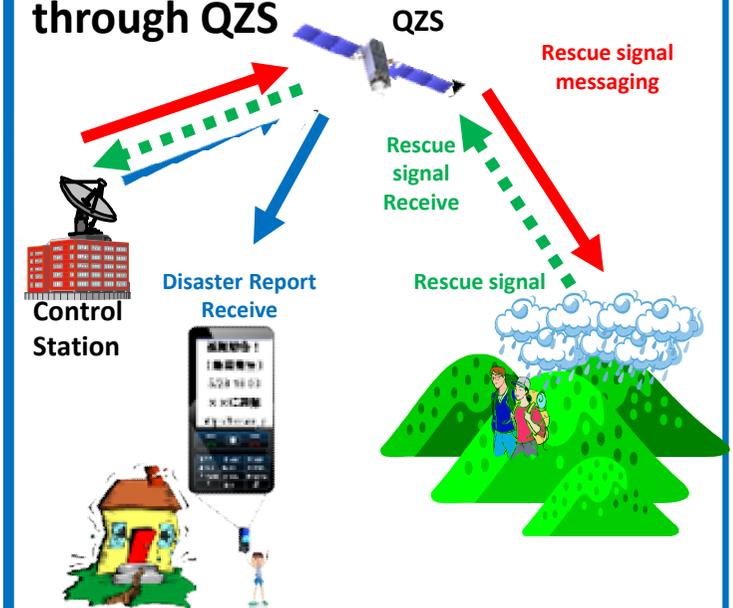
### ② GNSS augmentation

Improved precision positioning (enables cm-class positioning utilizing GPS-based Control Station)



### ③ Messaging service

- Disaster/crisis report
- Safety confirmation service through QZS

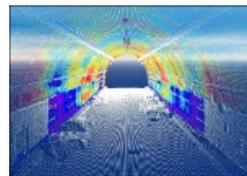


JFY	2012	2013	2014	2015	2016	2017	2018	2019	2020~2032
QZSS (No. 2~4)		Development / Design		Adjustments		3 Sats Launch ★ ★ ★	In operation		
1st (Michibiki) Successor				Preliminary design	Development Design		Adjustments		★ ★ ★ ★ ★ Around 2023; 7 satellites constellation

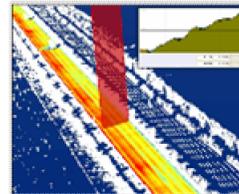
# 8 QZSS: Creating new business with QZSS

## 【Infrastructure maintenance / 3D mapping】

- maintain 3D map for autonomous cruising
- acquire the shape of the road / surrounding three-dimensional position information efficiently



Tunnel wall survey



Road surface survey

## 【Unmanned】

- Automatic running of tractors
- Cooperative work system with unmanned and manned



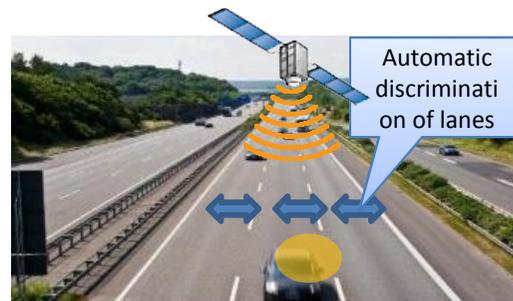
## 【Construction】

- Information construction with a satellite positioning antenna installed at the backhoe tip



## 【Autonomous cruising】

- Continuous running is possible even in tunnels, bridges, etc. by the combined method of cm class positioning service and inertial navigation system device "MEMS"



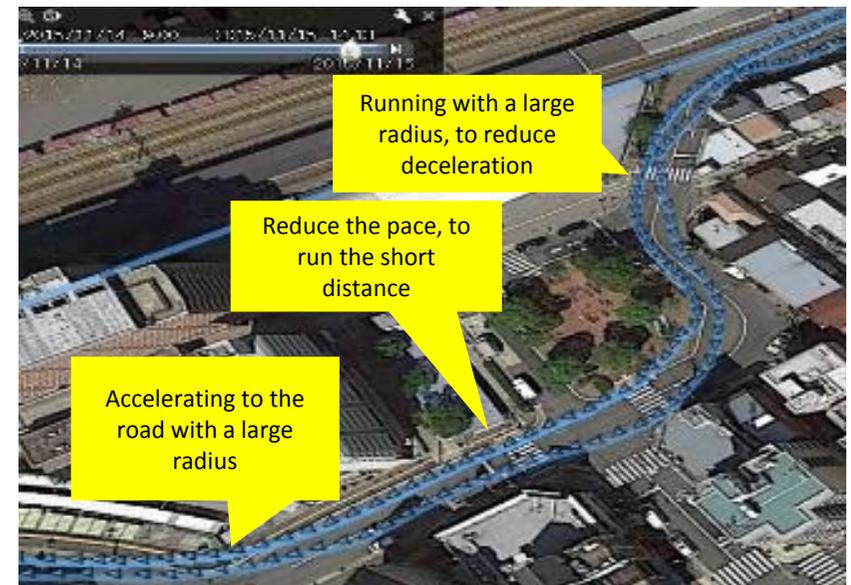
## 【Forestry】

- Automated forest situation awareness and precision forestry by remote sensing production control technology



## 【Sport】

- Positioning the running track of the marathon runner and providing pace allocation and course strategy to subsequent runners.



## 9 S-NET (SPACE - NEW ECONOMY CREATION NETWORK): Venture Business Support

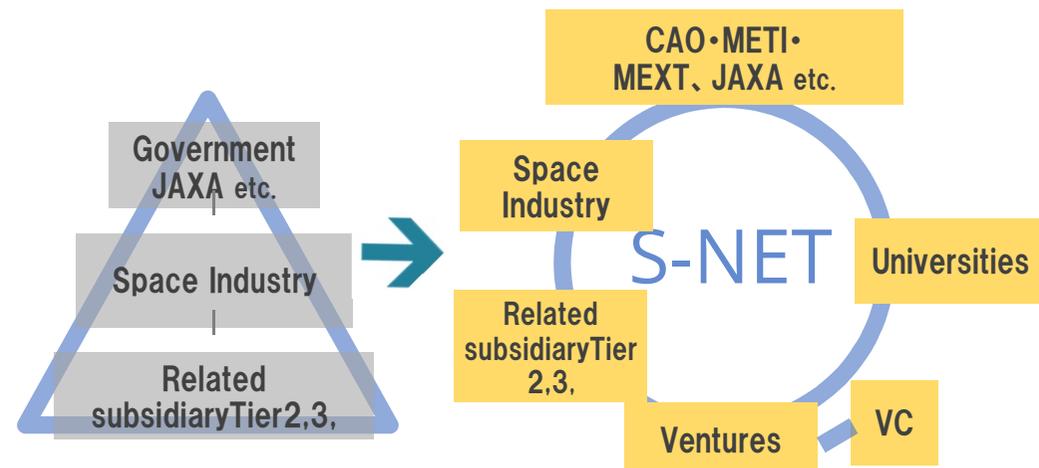
- S-NET aims to diversify the space industry by providing a “Platform” of companies and organizations from various fields – not limited to space
- Such as promoting venture companies to utilize space for business

### S-NET (National Space Policy Secretariat)

<b>Platform</b>	<ul style="list-style-type: none"><li>□ Companies, Universities, Individuals</li></ul>
<b>Support</b>	<ul style="list-style-type: none"><li>□ Promoting new business</li><li>□ Human resource training, Educating entrepreneurs</li><li>□ Government support</li><li>□ Global support (International network, personnel exchanges, overseas development)</li></ul>

Project and business creation

### Offering “Support and Coordination”



# 10 New Players in Space business in Japan

University oriented ventures and startups are entering the space industry also in Japan

Small satellite development,  
Imagery sales



○Deploying earth observation  
by micro satellites



Canon Electronics Inc.

○Applying precision machine  
manufactory technology such  
as cameras to small satellites

Launch service for small satellites



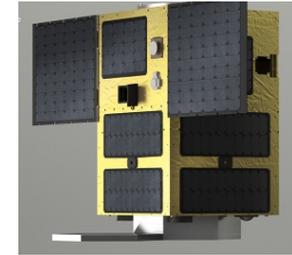
○small liquid fuel rocket development

Space resource development



○Moon resource exploration  
and development

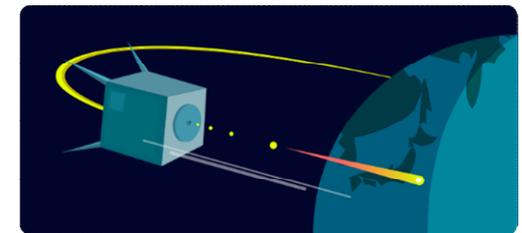
Sweeping space debris



Astroscale

○Sweeping space debris

Space entertainment



ALE

○On demand shooting star