

## Space-based business idea contest “S-Booster 2019”

### Japanese space assets

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## 1. QZSS (Quasi-Zenith Satellite System)



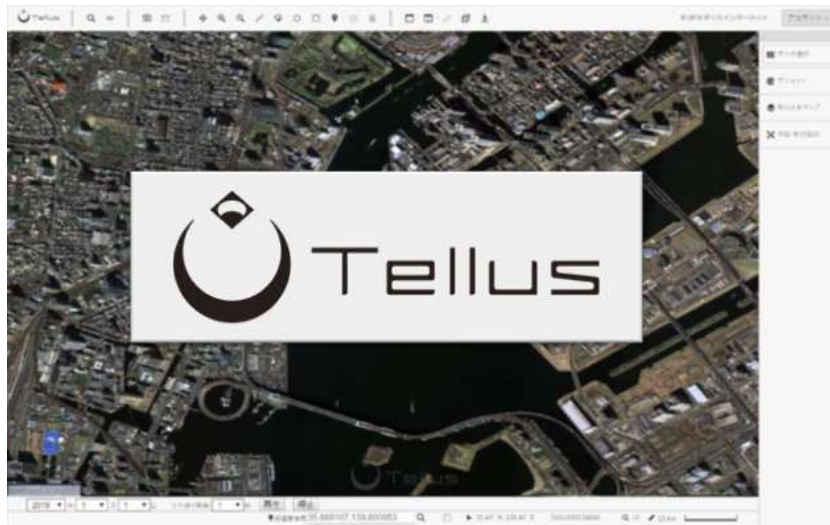
QZSS is a Japanese satellite positioning system composed mainly of satellites in quasi-zenith orbits (QZO) and can provide High-Precision Positional information services since November 2018.

Satellite positioning systems use satellite signals to calculate position information. One famous example is the American Global Positioning System (GPS); the QZSS is sometimes called the "Japanese GPS."

QZSS can provide the the Centimeter Level Augmentation Service for Experiment (called "MADOCA") via L6E signal. It means that we can easily get the centimeter level positional information by using QZSS Receiver n the Asia-Oceania region.

QZSS is expected to be utilized across a wide range of fields from autonomous vehicles and agricultural equipment to disaster prevention.

## 2. Satellite data platform "Tellus"



"Tellus" is the Japan's first satellite data platform designed for commercial use. Private enterprises, research institutes, universities to individuals can easily use satellite data and cloud computing resources free of charge.

"Tellus", having various satellite data including JAXA satellites and commercial satellites and ground datasets such as human logistics and meteorological information, provides data analysis environment with several functions to browse and combining datas. It is expected to generate new data utilization businesses in various industries.

### Data available in Tellus

- Satellite data: ALOS-2, ASHRO-1, ASTER-GDEM etc.
- Ground data: human logistics information, meteorological information etc.

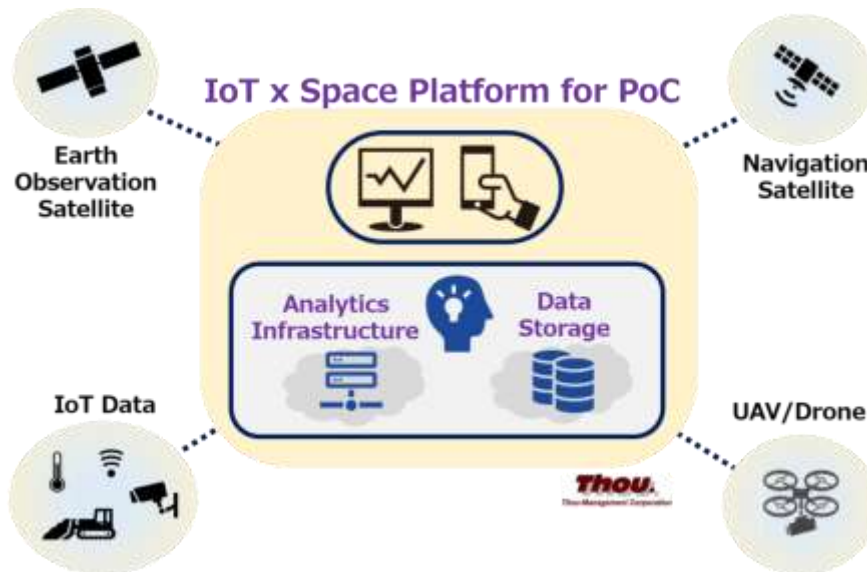
### Function

- Data operation system to search, brows and combining data
- Integrated development environment to analyse combined data and develop Apps

"Only Japanese satellite data in "Tellus" is available for S-Booster.

"Tellus" is to be updated accordingly as new data and functions are available.

### 3. IoT x Space Platform for PoC (Thou-Management Corporation)



Our asset is IoT Platform aligned with both EO (Earth Observation) Satellite Data Platform (e.g. Tellus) and GNSS (Global Navigation Satellite System e.g. Michibiki) service providers for enabling various PoC of new LBS-based businesses

Our Platform provides;

- Secure connectivity to THOU Cloud via the Internet for various sensing/monitoring devices (fixed and/or mobile including UAV) as IoT Gateway
- Data storage/management services, API/Application Template for acquisition of adequate EO satellite data and positioning data from GNSS to conduct IoT/EO data fusion
- Data processing/analytics infrastructure for creating new values of LBS (Location Based Service)-based businesses

Emerging IoT businesses at this moment seem mainly focusing on sensing/monitoring devices on the ground (aerial in some cases, utilizing UAVs) and leave much room for utilizing EO satellite and GNSS services.

Aligning with EO data platform edging closer to practical use such as Tellus, and GNSS services, our IoT Platform is readily available tool in order to enables for Asian partners to conduct PoC (Proof of Concept) for developing new LBS-based businesses.

#### 4. Communication Satellite Services and Typical Applications (SKY Perfect JSAT Corporation)



SKY Perfect JSAT operates Geo-Stational Communications Satellites at 36,000km above the equator and provides Satellite Communication services which cover a vast geographical area including Asia, Russia, Oceania, Middle East and North America. Within this wide coverage area, satellite communications allow wide range communications, simultaneous transmissions to multiple destinations and flexibility for link establishment.

We offer high quality and reliable satellite communications with back up ground facilities and in-orbit satellites support customer applications, such as Direct-to-Home (DTH), Satellite News Gathering (SNG), video distribution, Content Distribution Networks (CDN), corporate networks, mobile backhubs, internet backbones, networks for oil, gas and mining sites, maritime and aeronautical networks. Also communication satellites can be easily establish secure critical communications links for disaster recovery and restoration at where terrestrial networks are damaged from disasters such as earthquakes.

These days the communications are required over the ocean where only satellite can reach to. SKY Perfect JSAT Corporation launched "OceanBB plus" in April 2018 as the next-generation maritime broadband service, with faster and wider connectivity performance which has been upgraded from previous "Ocean BB" service.

## 5. Anesthesia in SPACE (STONY)



There is no anesthetic equipment in space yet. In future long termed manned space missions, medical treatment must be performed under the condition of non-supplementing, limited resources, narrow space and communication delay.

It is essential task to develop easy to handle and compact anesthesia system.

To solve this problem, "VapoJET" was invented, which is an ultra compact inhalation anesthesia aid system that can be mounted on a space ship. It does not require electricity for power, 3D printing is also possible, so you can instantly deliver and save lives no matter how far away from the earth.

"VapoJET" received the ANAHD Award at S-Booster 2017 and the R&D Innovation Award at the Aerospace Medical Association in 2018. Currently we are developing an anesthetic gas recycling system with Gumma Prefecture. When it is completed, we will not have to worry about pain in surgery, but also artificial hibernation will become a reality. Why don't you join our team?

## 6. Space-graded COTS computer with auto recovery function (Space Cubics, LLC.)



### (Summary)

Space Cubics is a JAXA Startup company to produce a high-reliability computer for satellites or other space products, incorporating techniques accumulated through operations at International Space Station (ISS) by Japanese Aerospace Exploration Agency (JAXA). Our products are easy to use, ready to use for start-ups and serious space industries.

### (Cost-saving vs Reliability)

Our products reduce your total budget for developing a space product. It is often the case that a project uses cheap single board computers because of the limited budget. But the decision may affect whether your mission succeed or not. Or even using radiation hardened parts doesn't solve all of your mission problems nor prevents any crashes of your space product, either. Don't you want to increase reliability with low cost?

### (Failure Tolerant)

In general, almost all of high-reliability products do not have failure tolerant function. Even if a space-graded high-reliability product is used, it's often the case that the computer is failed by single events in space. If the system will be frozen, you can not fix it from the Earth. On the other hand, our product is built on the idea of recovery from failures and has many failure tolerant functions. For instance, it will handle TMR (Triple modular redundancy) and hot/cold standby replication. The failure tolerant functions detect malfunction caused by radiation effects or software bugs in real-time, then it is recovered to normal state.

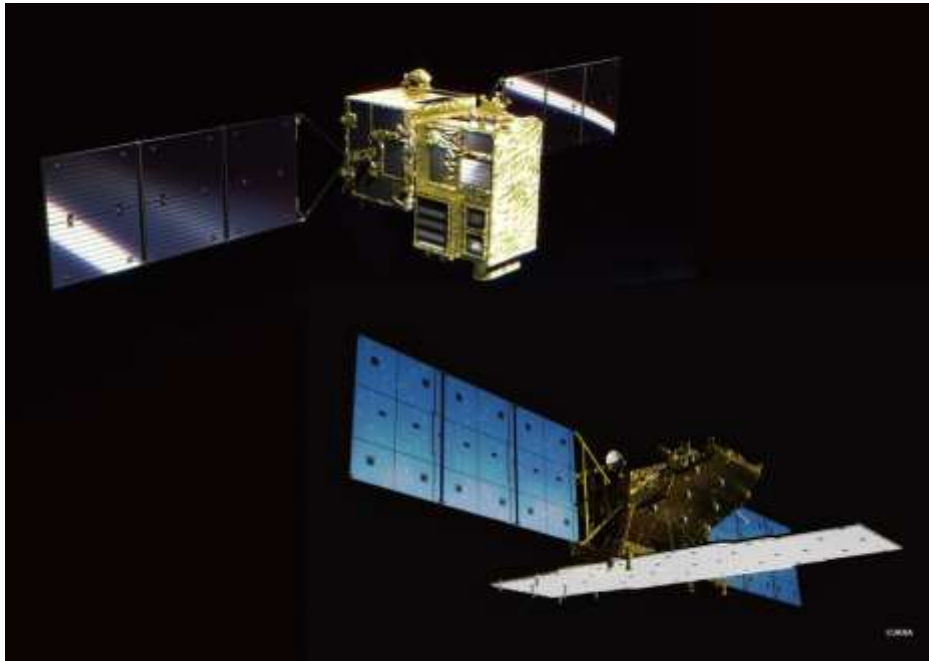
(Easy of use)

Best thing about our product is that all you have to do is to write your mission software and decide your command set, then just forget about everything else. In addition to the failure tolerant function, our products have other useful functions, such as ISS compatible network protocol, TTEthernet and popular middle-ware ROS or cFS. Furthermore, we can custom-design software/CPU board/FPGA as you would like to change.

Space Cubics supports the success of your mission.



## 7. Space Assets of PASC Corporation (PASC Corporation)



We are pleased to introduce you to our various space assets. Why don't you create your new business among our 11 space assets?

### **Population and Numbers of Household Estimation Data in ASEAN Region**

We established the methodology to estimate population and numbers of household data from satellite imagery and AI technology. It estimates the population and numbers of household data from building density to define the residential or non-residential areas by interpreting the satellite imagery. The data output is produced by 100m mesh unit, and the data is good to select the sales items, sales promotion and store roll-out planning.

### **ASNARO Series Satellites**

ASNARO 1 satellite is an optical satellite and provides 50 cm resolution. It has 8 bands, coastal, blue, red, red edge, near infrared. The satellite offers night observation mode in addition to day time image capturing.

ASNARO 2 satellite is an X Band SAR satellite and was launched in 2018. It has 1 m resolution and all-weather observing capability. ASNARO 2 can capture the surface of volcanic crater even if it is covered with smokes.

### **Monitoring crustal movements in mountainous regions by SAR Satellite Imagery**

SAR satellite imagery enables to monitor wide area crustal movements surface-wide, sustainable and

cost efficiently. It can also monitor the sign of crustal movements before a huge disaster occurs. Disaster monitoring agencies and local government's officials can expect more accurate and cost efficient observation by combining SAR and conventional way of monitoring. This method is effective to monitor subsidence of reclaimed land, fill districts and underground installations other than mountainous regions.

### **Monitoring subsidence by SAR satellite at underground construction period**

SAR satellite imagery enables to monitor the various amount of subsidence after the construction. It is able to monitor the area continuously even in residential or commercial areas where field survey is difficult to be conducted. It can grasp the subsidence situation by surface-wise. The survey result has been proven observation accuracy at millimeter level accuracy.

### **Interpretation of urbanization stages by SAR Satellite Imagery**

We create this service to classify land cover as water area, glass land, forest, artifacts and bare land by SAR satellite imagery and AI technology. It can calculate the increase ratio of urbanized area, by extracting differentials of artifacts. This method is effective to grasp the urbanization stages and its speed of each area.

### **Remote sensing data analysis and consulting service**

PASCO has a wide variety of project experience in remote sensing services all over the world. We offer various consulting services such as "Market and technical research", "Feasibility study", "Project development" and so on. We also offer data analysis services, such as "Data collection", "Data processing", "Data interpretation", "Value added data creation", "Data provision" etc., etc.

With our experiences, we propose best solutions for our clients' needs.

### **Image set for Machine Learning**

It takes a lot of time and cost to prepare the learning data for AI. By providing the sets of SAR and Optical satellite image chips as data sets, customers are able to order-made the learning data in accordance with the purpose of utilization of AI.

We use various types of AI tools, for instance one is unique to each corporation, one is off the shelf tool and one is open source AI tool, to create sustainable learning data.

### **Interpretation of change of buildings**

We develop the algorithm to detect buildings from satellite imagery and AI technology and interpret the changes by comparing with dual temporal data. With this method, customers can drastically save the labor cost comparing to the "traditional interpretation method", by human eyes. In order to introduce this technology, we submitted our paper to CVPR completion in 2018 and won the first prize.

### **Interpretation of Forest Areas and Tree Types**

We offer automatic interpretation of forest areas and tree types by using satellite imagery and AI technology. With this method, customers can make huge cost savings comparing to conventional interpretation method by human eyes. This is an effective tool for adequate forestry, afforestation and also disaster prevention.

### **Research of the situation of Farmland Utilization**

We offer to interpret the situation of farmland utilization by analysis of optical satellite imagery. In order to effectively grasp the urbanization stages and speeds of each area, we pick the images for the plowing seasons of farmland products.

### **ALOS series satellites**

We are selected as a prime distributor of ALOS 2, L-Band SAR satellite launched by JAXA in 2014. ALOS 2 is able to capture the images on earth in all-weather condition and also observe the ground surface covered by vegetation.

In 2020, JAXA plans to launch an optical satellite ALOS 2, which has 80cm resolution, 8 bands and 70km wide swath.

## **8. Fujitsu technology for safe satellite operation and satellite's data utilization (FUJITSU LIMITED)**



### **1. High accuracy orbit determination technology for satellites**

In order to control satellites, it is needed to know satellite's position and velocity.

FUJITSU has technology of satellite orbit determination using ground observation data or GPS data and has technology of satellite orbit prediction.

### **2. Tracking and control technology for satellites**

This technology is able to check the equipment's condition of satellite and command satellite in order to fly planned orbit. Furthermore this technology is able to know relative location of satellites and space debris to avoid collision.

### **3. Communication technology between space and earth**

DTN (Delay/Disruption Tolerant Networking) is able to connect data between space and the Earth with no delay/disruption. By bucket brigade communication, this technology has a feature that data can be sent even if the sender and destination are not connected at the same time.

### **4. Mission operation technology**

This technology is able to make observation plan (e.g. when, where, and what kind of observations are needed) and send command for satellites from the Earth. This technology is able to archive the observation data at the data center and distribute it for users.

### **5. High performance computing technology**

By using HPC (high performance computer), this technology is able to handle massive data acquired from satellites with high-speed processing.