

# AN INTRODUCTION OF COMMERCIAL EARTH OBSERVATION BY TERRASAR-X IN JAPAN

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## ABSTRACT:

TerraSAR-X, German Earth Observation SAR Satellite, was launched on June 15, 2007 and successfully providing commercial and scientific services to the entire global community. PASCO Corporation is the first exclusive distributor for the Japanese market and non-exclusive distributor for the overseas market, by entering into the partnership with Infoterra GmbH as the Direct Access Partner (DAP). PASCO has already constructed ground station to directly receive TerraSAR-X data and we are fully capable to carry out the operational management of the entire satellite data receiving installations. After reception we process the satellite data and check quality and deliver to our customers very efficiently in a shortest possible time. In this article we are introducing the outline of the mission and current scenario of our activities including the newly constructed ground receiving station, operation center systems for the commercial distributions of TerraSAR-X data in Japan.

## 1. INTRODUCTION OF TERRASAR-X IN JAPAN

TerraSAR-X was launched on 15 June 2007 and currently successfully providing commercial and scientific services for the entire global communities. This satellite is an active phased array X-band antenna system providing high-resolution and single-, dual polarization SAR imagery (H and V), which permits SpotLight, StripMap and ScanSAR operational modes. This is first commercially available high resolution X-band SAR satellite built under the PPP (Private Public Partnership) program between DLR (German Aerospace Center) and EADS Astrium which is leading satellite system specialist in Europe. Infoterra GmbH is heading the program for the commercial use. PASCO Corporation became the first exclusive distributor for the Japanese market and non-exclusive distributor for the overseas market, by entering into the partnership with Infoterra GmbH as the Direct Access Partner (DAP). The complete ground receiving system has recently been established in Japan under the contract with Infoterra GmbH.

In this paper we are not covering the technical specifications of the TerraSAR-X system and also not explaining the product specifications since all details are already been published for the past few years and after the satellite launch. We will mention about PASCO's ongoing operations for the utilization of the TSX commercially in Japan.

Figure 1 is showing the TerraSAR-X image acquired in high resolution SpotLight mode on 12 Feb 2008, geometric projection is Enhanced Ellipsoid Corrected (EEC), resolution mode is Spatially Enhanced (SE), SCIE orbit information, approximately 1 m geometric resolution and 10x5 km swath. This image is of Mt. Sakurajima which is an active volcano located in the southern most part of Kyushu island in Kagoshima. EEC product uses DEM which is SRTM 90 m mesh data.

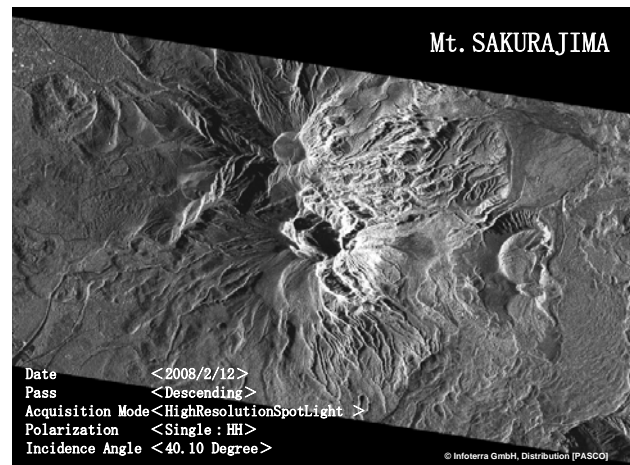


Figure 1. TerraSAR-X image of Mt. Sakurajima

## 2. TERRASAR-X OPERATION

### 2.1 Mission Management

Regarding the mission management, the TerraSAR-X Ground Segment and service infrastructure are the central element for control and operation of the satellite, for calibration of its SAR instrument, and for archiving the SAR-data as well as generating and distributing the basic data products. Ground Segment and service infrastructure consists of two major parts: (i) ground segment provided by DLR, (ii) commercial exploitation and service infrastructure coordinated by Infoterra GmbH.

The DLR Ground Segment is based on existing national infrastructure and is optimized for flexible response to (scientific and commercial) user requests and delivering the fast image products. The DLR Ground Segment provides the main functions, Space and Ground Segment planning, orbit control

and analyses, spacecraft telemetry reception and command, data reception and archiving, calibration and performance analyses, product generation, delivery and provision of user services (Werninghaus, 2004; Roth, 2005).

The commercial aspect of the mission is based on a sound market analysis performed by the Infoterra GmbH, responsible for the commercial exploitation rights of the TerraSAR-X data.

For the past few years PASCO has been preparing the TerraSAR-X commercial distribution system under the contract with Infoterra GmbH as the Direct Access Partner (DAP). In order to provide the TerraSAR-X data as rapidly as possible to the Japanese customers, PASCO constructed the ground receiving station for data downlink in Japan. Data processing system can process the raw data to images, and processed image data are delivered to the domestic customers, and also transferred into the archive server. We are fully capable to order the TerraSAR-X image acquisition for everywhere around the world from our mission operation center. We downlink the data just after the acquisition using our own ground receiving station and deliver the data rapidly to the customers in a shortest possible time after placing their orders.

## 2.2 Operation System in JAPAN

Below mentions PASCO's existing system:

### (a) Ground station monitoring system

This system monitors ground station. We can check the antenna system and track the TerraSAR-X and conduct remote operation. We can also check schedule about each orbit and monitor receiving TerraSAR-X data.

### (b) Order system

With this ordering system we place the orders, prepare plan of acquisition, search for acquisition and archive data, define acquisition parameter and processing parameter, send acquisition request to DLR, and monitoring of placed orders.

### (c) SAR image processing system

We can create the product according to the specified details in section 3 Basic products of DLR (Werninghaus, 2008). We can also export data to media or archive system and import DEM and other data.

### (d) Data archive system

All data received ground station is archived in this system and can be processed at any time.

### (e) Quality check system

We inspect radar shadow, foreshortening, layover, noise etc. of SAR images and also examine metadata.

## 3. CURRENT OPERATIONAL AND DATA DISTRIBUTION SCENARIO IN JAPAN

Below is the current scenario of our operation and data distribution services:

- (1) Receive the order from customer
- (2) Search and planning the acquisition considering with other acquisitions at order system
- (3) Information registration of the placed orders
- (4) Monitor order until successfully send commands to TerraSAR-X satellite (uplink at German Aerospace Center)

- (5) Data acquisition
- (6) Data reception
- (7) Process the SAR data using SAR Image processing system to produce the products according to customer's orders
- (8) Quality check of SAR image in accordance with internal quality check system
- (9) Data delivery to customer

The Figure 2 depicts the current operational scenario of the TerraSAR-X services in Japan.

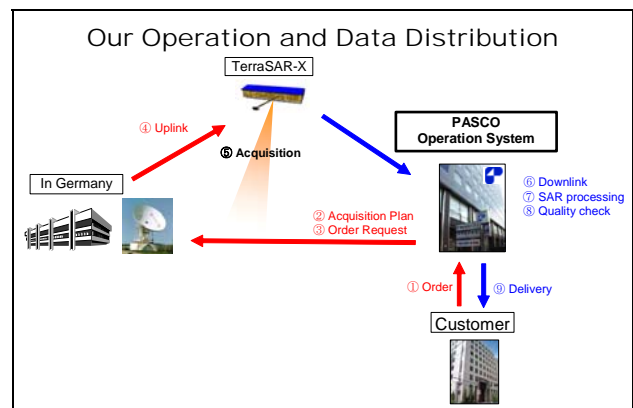


Figure 2. PASCO's existing operational scenario

## 4. FUTURE DIRECTION OF OUR SYSTEM

PASCO has started operational phase of TerraSAR-X services since January, 2008. We provide products efficiently enough for our customers for their needs to utilize the data products for various applications relating to GEOINFORMATION. We do acquisition planning, send information to DLR, process and inspect SAR data quality. Infoterra GmbH is providing full supports for our ongoing technical activities. Products are delivered to the customers using our highly integrated ordering system. We are able to order request and deliver the products more quickly to our customers with the established ground receiving station and sophisticated processing system.

In the future, the system will be implemented for better acquisition planning to best fit our customer's requirements and establish sales flows of archived products. We will also create new service menus (e.g., radar radargrammetry, interferometry etc.).

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