2.1.8 Summary

After the Great East Japan Earthquake, JAXA conducted disaster monitoring using the Advanced Land Observing Satellite "Daichi" and enlisted the help of international organizations involved in disaster monitoring (such as the Disaster Charter and Sentinel Asia), thereby contributing to efforts made by national/local government bodies to collect information and support relief operations.

- Top priority was given to emergency observation of affected areas using Daichi, and 643 satellite images were obtained.
- In reciprocation for Daichi's active international contribution to relief efforts in previous major disasters elsewhere, intensive observation was conducted in response to the Great East Japan Earthquake by 14 countries and regions using 27 satellites through the framework of international cooperation, which includes organizations such as the Disaster Charter and Sentinel Asia. As a result, approximately 5,700 satellite images were provided.
- These images were processed and analyzed by JAXA to facilitate usage by disaster management organizations, and were provided to ten ministries, agencies, organizations and municipalities, including the Cabinet Secretariat and the Cabinet Office for disaster management.
- The images were analyzed in various ways by institutions and researchers around the world, and the information obtained was shared extensively through the framework of the Disaster Charter, Sentinel Asia, Geo-Supersite and other organizations.
- The images were utilized to determine the extent of damage over wide areas that could not be viewed from the ground or from aircraft, and to plan disaster countermeasures.
- Approximately 80 analyzed images were provided to various organizations after the Great East Japan Earthquake. The Daichi Bosai WEB site received as many as 1,500 hits from central government ministries/agencies and local governments.
- The Cabinet Office sent letters of thanks to the Disaster Charter and Sentinel Asia.

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To: The Board and Executive Secretariat, International Charter, Space and Major Disasters	(to: The Secretariat of Sentinel Asia 5 July 2011
5 July 2011	Dear SinMadam
Deer Sic/Madam 1 woold like to express my gratitude for your support to Japan for providing satelline images to Japan with relate to the Creat East Japan Earthquake. I also would like you to extend our sincere supprecisative to suit the related organizations under the Charter that originally provided those mages. Soon after the Great East Japan Earthquake necessred on 11 March 2011, the operation of the International Charter, Space and Major Disastern took more than 5,000 satilline images on affected areas and provided financies, subject to prograte the simulators in the affected areas. In addition, the Charter's web site displayed the disaster situation and attracted transmer. Charter, thick the is is guide International community including International Born and your the world. For reciprocating the kind support provided by the international community including International Disaster Charter, thick the is is guide International Disaster chaid strategister that cooperation for disaster management via International Disaster Charter, which would led the promotion of countermeasures against disaster in whole commers on the sath.	I would like to express my gratitude for your support to Japan for providing antellike images to Japan with relate to the Creat Tase Japan Earthquike. I also would like you to useless do our shorest appreciation to all the member organizations of Santina JAAs that originally provided flose images. Shore after the Great Tase Japan Earthquike secured on 11 March 2011, Sentinel Asia, that originally provided flose transges. These images on affected ones and provided them and related information have a starting the sentences of the start of them and related information have a start of the sentences and the sentences and the start of the sentences and the sentences and the sentences at the start of the sentences at the sentences at the sentences at the start of the sentences at the sentences of contemposition of the sentences of the sentences at the sentences at the sentences at the sentences of contemposities at the sentences of Sentence Asia, which would lead the promotion of Contemposities and provides the sentences of Sentence Asia, which would lead the promotion of Contemposities and provides and the Sentence Asia and the Sentence Asia and the Sentence Asia and the Sentence Asia and the sentences. I strongly lope further progress of Sentence Asia and furner disaster risk reduccion.
the related organizations. I strengly hope further progress of the International Charter, Space and Major Disasters and future disaster risk reduction. Yours sincerely, Kiyotal Natori	Yours incorresy, Eigrachi: Watere Ksyoshi Natori Director for Disaster Provension and Proparedness Cabine Office, Government of Japan

Figure 2.1-73 Letters of thanks from the Cabinet Office to the Disaster Charter and Sentinel Asia

Based on the provision of disaster images, the following observations were made:

- When large-scale disasters like the Great East Japan Earthquake strike, satellite image products comparing pre- and post-disaster conditions are very useful primary information sources in the initial stages of response to determine the extent of the damage. Superimposing geospatial information (e.g., place and street names) onto satellite images and recent images taken in the months before the disaster in particular enhances the usefulness of such data.
- Daichi images provided useful extensive aerial views to support information collection immediately after the disaster.
- In terms of the division of roles, airplanes and helicopters were intensively used to observe tsunami-damaged coastal areas, while nadir observations by Daichi over extensive inland areas significantly contributed to the surveying of landslide-related damage.
- In response to the nuclear power plant accident triggered by the tsunami, satellite observation was useful in enabling ongoing unmanned monitoring of areas affected by high radiation levels.
- Planar crustal movement and inland areas at high risk of landslides could be determined using only data from Daichi, which is equipped with L-band SAR and optical sensors and is capable of observing extensive areas.
- Interferometric SAR images enabled identification of changes over the entire Tohoku region and helped to clarify that the cause of subsidence along the Pacific coast was not local surface ground contraction but extensive settlement resulting from the sliding of the earthquake source fault along the plate boundary.
- In addition to the monitoring of crustal movement triggered by inland active faults and volcanic activity resulting from earthquake-related changes in stress, local crustal movement stemming from inland aftershocks was also identified. In this way, observation data helped to clarify the fault mechanisms of several aftershocks.
- A combination of SAR and optical images was needed to improve data interpretation accuracy. As stereoscopic observation is also effective, stereovision was used to investigate damage from landslides.
- Repeated satellite observation over a long period of time was important in identifying changes in the affected areas. Japan's satellites play an important role in this regard.
- International organizations such as the Disaster Charter and Sentinel Asia serve to increase observation frequency. In particular, the European Space Agency (ESA) highlighted the activities of the Disaster Charter and GEO in response to the Great East Japan Earthquake.
- Through the Disaster Charter, commercial high-resolution satellites were used to assess the conditions of collapsed buildings, determine the extent of damage to roads and railways and carefully monitor the situation at the nuclear power plant.
- As it was impossible to determine conditions after the nuclear power plant accident using visible light and SAR images alone, infrared radiation sensor and other temperature detection data were needed.