

A Network of Trio Stations to Receive Land Observing Satellite Data

By the end of 2011, researchers from the Center for Earth Observation and Digital Earth (CEODE), Chinese Academy of Sciences had mainly completed the construction of a National Data Receiving Network for Land Observing Satellites, starting to use three stations in Miyun in suburban Beijing, Kashgar in west China's Xinjiang Uygur Autonomous Region and Sanya in south China's Hainan Province to receive land observing satellite data that cover the whole territory of China for civilian uses. As a key infrastructure for China's space endeavor in the next couple of decades, the Network is going to obtain operating data from the Small Satellite Constellation for Environment and Disaster Monitoring and Forecasting, the new China-Brazil Earth Resources Satellites and major foreign land observing satellites to meet the ever growing demand for satellite data reception, processing and

distribution and use these data to boost China's economic and social development and national security.

The Network has been established on the basis of Miyun Satellite Data Receiving Station, which was put into operation in suburban Beijing in 1986 with a data receiving coverage of about 80% of the Chinese territory. From the 1990s, CAS scientists proposed to the central government establishment of a ground system with 100% data coverage of China. They also selected sites for new stations to locate them in Huangdi Township in far west China's Xinjiang Uygur Autonomous Region and Zhuzhu Village in the southernmost island province of Hainan.

The construction of the Network was officially kicked off in May 2008. The project involved the development of a data receiving system, a data transmission system and an operation management system, the upgrade of Miyun



Foundation-laying ceremony of Sanya Station in April, 2009.

Station and the construction of Kashgar and Sanya stations.

The data receiving system has been established as planned. From 2004 when construction began in Kashgar Station to 2011 when Sanya Station's second antenna system passed site acceptance test, five new receiving antennae have been erected and put into operation. By far, the system has successfully received data from the Small Satellite Constellation for Environment and Disaster Monitoring and Forecasting, the China-Brazil Earth Resources Satellites and other land observing satellites.

Scientists have also set up the general-/special-purpose logging subsystem and the fiber-optic data transmission subsystem. In 2010 and 2011, the general-/special-purpose logging subsystem was successfully developed and put under trial operation in Miyun, Sanya and Kashgar, respectively, enabling the trio stations to achieve real time data logging as well as fast and simultaneous data transmission for satellites such as HJ-1A and HJ-1B. It has achieved not only the accurate and efficient logging and playback of data acquired from 14 satellites including HJ-1A/1B/1C, CBERS-03/04/02B, LANDSAT-5, SPOT-2/4/5, RADARSAT-1/2, ENVISAT and IRS-P6, but the local and long-distance real time quick-look of HJ-1A/1B/1C,



Installation of the second antenna set at Sanya Station.

CBERS-03/04/02B, LANDSAT-5 and SPOT-2/4.

Optical fiber transmission lines have been set up or upgraded between CEODE and the three stations to facilitate data transmission, and a 10 Gbps line linked CEODE to the China Center for Resources Satellite Data and Application. In May 2010, the success of the initial site test of data transmission from Sanya Station to CEODE marked the establishment of a high-speed and long-distance network for transferring remote sensing satellite data from

	Before the Network's establishment	After the Network's establishment
Data coverage	80% of the Chinese territory	100% of the Chinese territory
Number of receiving stations	1	3 (in Miyun, Kashgar and Sanya)
Number of antennae	3	8 (4 at Miyun Station, 2 at Kashgar Station and 2 at Sanya Station)
Data transmission	Largely by magnetic tapes	All by high-speed optical fibers
	Only 1 optical fiber link from Miyun Station to the Network's headquarters at CEODE	4 optical fiber links (from the Miyun, Kashgar and Sanya stations to CEODE, and from CEODE to China Center for Resources Satellite Data and Application)
Data logging and transmission	Via separate systems	Via an integrated platform capable of recording and transmitting data simultaneously
Operation management	Featuring manual intervention and separate management without a technical platform	Featuring an integrated operation platform capable of automatic management, work assignment and process monitoring



the three stations to the Network's headquarters in Beijing. So far, the transmission devices are working in sound condition. The 155 Mbps-capacity lines from Sanya and Kashgar to CEODE have reached an average transmission speed of 145 Mbps, while the 1 Gbps-capacity lines from Miyun to CEODE have arrived at an average speed of 880 Mbps. According to statistics, the data transmitted from the stations to the headquarters stood at some 110 GB every day between September 2008 and September 2011, totaling up to 120 TB over the three years. The system has been operating in a reliable and steady state for 36 months.

The operation management system, which plays a core role in controlling and monitoring the Network, was installed in 2010 and has passed the factory acceptance test, and scientists have carried out comprehensive field tests over its three subsystems (the planning and scheduling subsystem, the operation management information subsystem and the operation monitoring subsystem).

The construction of Kashgar, Sanya stations and the Network headquarters has been completed. The construction of Kashgar Station started in September 2004 and officially finished in November 2007. The campus of Sanya Station had been generally put up by August 2011 as scheduled. The Network's headquarters, located on the 8th floor of the Scientific Research Building of CEODE, was put in use in November 2010 with an area of 1,000 m².

The extension of Miyun Station is under way. Due to prolonged land requisition, the construction did not

officially kick off until September 2011 in Miyun. By the end of 2011, the main structure of the computer center, the research department and the antenna base had been completed. To guarantee data reception of the new system from HJ-1A and HJ-1B, an emergent task was carried out to relocate and upgrade the Station's 6m-aperture system. A new 12m-aperture receiving system was built on the existing 6m-aperture antenna, and a new 6m antenna base was erected. With the completion of the new system and the emergent renovation, the Miyun Station will go on to play a leading role in China's civilian satellite data receiving network.

At present, the Network is able to receive data from a number of land observing satellites, including HJ-1A/1B, satellites developed by China for environment and disaster forecasting; CBERS-02B, which was co-developed by China and Brazil; and the LANDSAT, SPOT, Envisat, Resourcesat and Radarsat satellites, which were developed by US, France, ESA, India and Canada, respectively. The data come from visible light, hyperspectral, infrared and synthetic aperture radar imaging with spatial resolution ranging from 2.5 to 100 meters. The various satellite data received by the Network have been widely applied to national land resources surveys, forest resources surveys, eco-environment investigation, urban expansion monitoring, desertification monitoring, crop yield estimation, disaster monitoring and assessment, geological and resources exploration as well as large construction projects.