The China-Brazil Earth Resources Satellite (CBERS)

By Tania Maria Sausen

In July of 1988, when the President José Sarney visited China, the Brazilian and the Chinese governments signed an agreement to initiate a programme to develop two advanced remote sensing satellites. This joint China-Brazil Earth Resources Satellite (CBERS) pooled the technical skills and financial resources of the two countries to establish a complete remote sensing system that is both competitive and compatible with present international needs.

The Brazilian space programme entered a new era after the engagement of Brazil in the CBERS programme, making possible the diversification of partnership in the science and technology area. The Chinese Academy of Space Technology (CAST) is in charge of implementing the CBERS programme in China as well as the Institute for Space Research (INPE) is in charge in Brazil.

Brazil and China have conceived a satellite with sensors specially designed to the management of the Earth resources, forests, geology and hydrology, besides a modern system to monitor the environment.

The co-operation between the two countries has showed an authentic effort, from both sides, to break down the developed countries' prejudice against advanced technology transfer. Both developing countries have experienced a new model of co-operation in which the main objective is the joint construction of two large operational satellites, opposed to the standard model of co-operation where the nations only exchange technical assistance along with researchers.

The programme was originally estimated in 150 million dollars from which Brazil must pay 30%, equivalent to 45 million dollars. The programme expected to build two identical satellites - 100 million dollars - and to launch them aboard the Long March 4 series vehicles from the Chinese base in Taiyuan.

Aiming to optimise the money exchange between the two countries as well as making the national industry stronger, one

It is a mosaic CBERS-CCD, path 162 , rows 128 and 129, date: 28/October/2000; path 161, row 129, date 31/October/2000. It is a colour composition:
Band 2 -0.45 to 0.52 mm (filter blue)
Band 3 - 0.52 to 0.59mm (filter green)
Band 4 – 0.63 to 0.69 mm (filter red)
It is Iguaçu Falls area (the falls are in the bottom, centre, in the Iguaçu river meander), the big area in red is the Iguaçu National Park. The river in the west side is the Paraná river. In the southwest area between the Iguaçu falls and the Parana River you can see Argentina, and in the West Bank of Parana River you can see the Paraguay. The area between the Iguaçu river and Parana river, with agriculture is Brazil. The huge dam in the northeast area is the Itaipu Dam, the biggest in the world. The city in Argentina is Puerto Iguazu, the city in Paraguay is Ciudade Deleste and the cities in Brasil are, just in the Parana river is Foz do Iguaçu city and the city in the middle of agricultural area is Santa Terezinha de Itaipu.

clause was included in the contract which obligated the Chinese to reinvest all the amount received from Brazil on importation of Brazilian products.

The first CBERS satellite was launched on 14 October 1999, aboard the Chinese rocket Long March 4B, from the Launch Center in Taiyuan, province of Shanxi, approximately 750 kilometres southwest of Beijing.

The successful launch happened accurately at 11:26:14 p.m., during the first 20 minutes of the scheduled time, so that the satellite would cross the Equator at 10:30 a.m. The CBERS-2 launch must happen by October 2001. The technicians from both countries have finished studies of feasibility for the construction of two more satellites, from the CBERS series, CBERS 3 and CBERS 4, substituting the present CCD camera with another of 5 metres resolution.
A unique characteristic of CBERS is its multi-sensor payload with different spatial resolutions and data collecting frequencies.

The Wide Field Imager (WFI) has a ground swath of 890 km wich provides a synoptic view with spatial resolution of 260m. The Earth surface is completely covered in about 5 days in two spectral bands: 0.66 mm (green) and 0.83 mm (near infra-red).

The High Resolution CCD Camera provides images of a 113km wide strip with 20m spatial resolution. Since this camera has sideways pointing capability of + 32 degrees it is capable of taking stereoscopic images of a certain region. In addition, any phenomenon detected by the WFI may be "zoomed" by the oblique view of the CCD camera with a maximum time lag of 33 days. The CCD camera operates in 5 spectral bands that include a panchromatic band from 0.51mm to 0.73mm. The two spectral bands of the WFI are also present in the CCD camera to allow complementing the data of the two types of remote sensing images. A complete coverage cycle of the CCD camera takes 26 days.

The Infrared Multispectral Scanner (IR-MSS) operates in 4 spectral bands such as to extend the CBERS spectral coverage up to the thermal infrared range. It images a 120 km swath with a resolution of 80m (160m in the thermal channel). In 26 days one obtains a complete Earth coverage that can be correlated with the images of the CCD camera.

The CBERS has a sun-synchronous orbit at an altitude of 778 km, completing about 14 revolutions per day. The local solar time at the crossing of the equator is always at 10:30 AM, the inclination is 98.504º, the period is 100.29 min and the lifetime is 2 years

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Based on extended abstracts and presentations at the workshop, full manuscripts of selected best papers will be solicited for peer review and possible publication in a theme issue of the *ISPRS Journal of Photogrammetry and Remote Sensing*