

VII Simposio Latinoamericano de Percepción Remota

Sexta Reunion Nacional
SELPER-Mexico

Latinoamérica Evaluada desde el Espacio
Puerto Vallarta, México

Memorias

Noviembre, 1995

Earth Observation on the Brazilian Space Program

Luiz Alberto Vieira Dias
OBT-Earth Observation Coordination
INPE-National Institute for Space Research
Avenida Dos Astronautas, 1758
12227-010 São José dos Campos, SP BRAZIL
E-mail: vdias@ltid.inpe.br

ABSTRACT

A major part of the Brazilian Space Program is its Earth Observation segment. Planned since 1968, when the first LANDSAT was launched, this segment has been actively acquiring satellite images since 1973. Today the Earth Observation in Brazil is capable of designing sensors (WFI), Earth observation satellites (SSR and CBERS), and Earth ground stations, as far as hardware engineering; to develop image processing, and geoprocessing software; and to perform studies on, Agriculture, Environment, Forestry, Geology, Urban Planning, and Economic-Ecological Zoning, as far as Applications. The satellites been presently acquired are: LANDSAT, SPOT and ERS. In the near future there will be acquired images from the RADARSAT (Canadian), CBERS (China-Brazil), and SSR (Brazil). Besides the activities being developed by INPE and a dozen of Brazilian Universities, there are more than twenty Remote Sensing Laboratories in the country (most of them supported in the beginning stages by INPE, but now entirely independent), and at least ten private companies involved in Earth Observation services.

I. INTRODUCTION - - HISTORY OF THE BRAZILIAN SPACE PROGRAM

The Brazilian Space Program started on August 3rd, 1961, when the Organizing Group of the National Commission for Space Activities, Go-CNAE, was formed, directly under the Presidency of the Republic. On 1971 the Commission was transformed into INPE, the Institute for Space Research, under the Ministry of Planning (INPE, 1991). Now INPE is the **National Institute for Space Research**, under the Ministry of Science and Technology. The Space Policy is determined by the Brazilian Space Agency, under the Presidency of the Republic.

Despite several changes in the organization, the backbone of the Brazilian Space Program remained relatively stable, especially the Remote Sensing Segment (now Earth Observation), being developed mostly by INPE.

This Program was initiated in 1968 when a group of INPE engineers was sent to the NASA facilities at Houston, Texas, USA, to accompany the birth of LANDSAT (then ERTS-1). At the same time a group of young scientists was assembled at São José dos Campos, SP, Brazil, to start the Remote Sensing Coordination of INPE (now Earth Observation Coordination, OBT)(INPE, 1991).

Since 1973, after the US and Canada, Brazil became the third country to receive and utilize LANDSAT imagery, with a ground station at Cuiabá, MT, Brazil (geographic center of South America), image pre-processing

and distribution facilities at Cachoeira Paulista, SP, Brazil (190 kilometers East of São Paulo), and an Applications Coordination at São José dos Campos, SP, Brazil (90 kilometers East of São Paulo), INPE's headquarters.

In the first years the main objectives were to train the staff and to provide government and private institutions with informations on Agriculture, Geology, Geography, Forestry, Environment, Economic-Ecological Zoning, and Urban Planning, using Remote Sensing imagery (INPE, 1993, 1994).

Now this service to the final users is provided by private companies, the role of INPE being the development of new techniques and methodologies for studies and evaluation of natural renewable and non-renewable resources, and to develop new software for geoprocessing and image processing.

The Brazilian Complete Space Mission (MECB) was established in 1979. Its main objective was to design and launch four satellites from a Brazilian launching base. Two of these satellites would be for data collection relay (SCD), and two for remote sensing. The first satellite, SCD-1, designed and built at INPE, was launched, by an American rocket Pegasus, on February 1993 and is performing above the specs since then. The launching base is near completion, and the launcher (VLS) is supposed to make its maiden flight in 1996 (INPE, 1993, 1994).

In 1989, Brazil signed with the Peoples Republic of China an agreement to jointly design and built an Earth Observation satellite, the CBERS (China Brazil Earth Resources Satellite). This program is under way, the CBERS being planned to be launched by a Chinese Long March rocket, in March 1997.

2. EDUCATION IN EARTH OBSERVATION

In 1972 a Master of Science Course on Remote Sensing was created at INPE (about 200 graduates until 1994), and more recently an International Course (seven month duration), co-sponsored by the United Nations University is now on its ninth year. This International course is aimed at Latinamerican students. There are other universities in Brazil with Remote Sensing graduate courses, like the Federal University of Rio Grande do Sul, University of São Paulo, University of Campinas and University of Brasilia. In Geoprocessing and Image processing, INPE grants degrees of Master of Science, since 1969, and Doctor of Philosophy (Ph.D.), since 1974, from its Applied Computer Science Course (INPE, 1991, 1993, 1994).

3. PRESENT ACTIVITIES

The scope of Earth Observation at INPE has widened a lot these days. The satellites directly received are: SPOT (France), ERS (ESA), and the LANDSAT series. Work is also being done with data from JERS-1 (NASDA), SIR-C (NASA), among other satellites. There are plans to receive soon RADARSAT (Canada) in 1995, and specially, CBERS, that will have a capability similar to the French SPOT, with the addition of a MSS, Multispectral Scanner and a WFI, Wide Field Imager (revisit time 4 days, spacial resolution 200 meters), from 1997. The Brazilian SSR is supposed to start sending data from 1998 (INPE, 1993, 1994).

A Brazilian designed and built camera (WFI-Wide Field Imager) is being tested, and scheduled to fly on the Space Shuttle (NASA) on 1997, and on the CBERS (China Brazil Earth Resources Satellite).

The mission of the SSR satellite will be to image, in the visible and near infrared, from 1000 km altitude, the equatorial belt (+5 to -15 degrees), with a WFI camera. A new image of the same location will be acquired every two hours, thus increasing the probability of obtaining cloud free images from the equatorial rain forests. The

space resolution is planned to be about 200 meters. The data could be transmitted directly to the users. They will use a especially developed low priced ground station. It will be also possible to obtain the images from a central ground station, with superior image processing, as far as geometric and radiometric corrections.

For the SPOT, LANDSAT and ERS, the processing facilities at Cachoeira Paulista, SP, now are producing images on CCT tapes, streamers, and CD-ROM's, in addition to photographic products. The receiving facilities at Cuiabá have been updated.

As far as software research, image research, and applications, the Earth Observation Coordination, OBT, located at São José dos Campos, SP, Brazil, about 90 scientists, of which 45 with Ph.D.'s, in two main Divisions: Image Processing, and Remote Sensing. Most of the projects are jointly conducted, under five Area Programs: Oceanography, Thematic Applications, Amazon Region Remote Sensing, Geoprocessing, and Microwaves and New Technologies.

There is an airplane (twin engine turbo-prop Bandeirante EMB-110) instrumented for Aerial Photogrammetry (NAE), a Group working on data handling on networks (ATSME), and a United Nations environmental data distribution node (GRID). OBT's objectives are restricted to software development and research and development on Geoprocessing, and Digital Image Processing; research and development on New Methods and Technologies for Remote Sensing Applications, like the use of radar imagery.

Recently, the Brazilian private service sector has taken charge of Earth Observation services with proven methodologies. The creation of this sector is an offspring of INPE's activities. There are six of these companies just at the São José dos Campos, SP area.

It should be emphasized that most of these tasks were possible only because of the large interaction with international groups around the world, like, NASA, ESA, NASDA, CNES, SELPER, ISPRS, CCRS, CONAE, Russian Space Agency, among others. After more than 20 years of Earth Observation, INPE's scientists and engineers have obtained the knowledge to design and built sensors and satellites for Earth Observation, to develop the software needed for its image processing and associated applications, and to develop methods for the utilization of space imagery for the advancement of the society.

4. FUTURE

For the future, besides keeping the presently acquired proficiency, it is planned to be created a modern Environmental Data Center at INPE, primarily for data acquired from Earth Observation satellites and ancillary instruments. This proposed center will use a distributed philosophy, the data will be physically in different places. The users will have access to the data mainly through computer networks.

5. BIBLIOGRAPHY

INPE (1991)- Instituto Nacional de Pesquisas Espaciais "Caminhos para o Espaço"- 30 anos do INPE". Editora Contexto, São Paulo, SP, Brasil, 1991.

INPE - (1993) Instituto Nacional de Pesquisas Espaciais "Relatório Anual, 1992-93 (Annual report)". INPE, São José dos Campos, SP, Brasil, Dezembro, 1993.

INPE - (1994) Instituto Nacional de Pesquisas Espaciais "Relatório Anual, 1994 (Annual Report)". INPE, São José dos Campos, SP, Brasil, Dezembro, 1994.