



# INPE Space News

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SÃO JOSÉ DOS CAMPOS - SP - BRAZIL

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## EDITORIAL

By the time you receive this issue of ISN, INPE in particular, and the Brazilian space program in general, will be at a long anticipated moment in their history - the launch of the first nationally developed satellite, an event experienced so far by only 16

countries in the world. After more than 10 years of difficulties, but also dedication, perseverance, and political determination, Brazil will certainly be proud to be "one of those who made it to space".

For a developing country like ours, scientific and technological achievements like this are only possible through the strong deter-

mination and effort of a small number of people who struggle against all kinds of adversities, to see their dreams and beliefs turn into reality. A reality that carries with it the resurgence of self-determination, of sovereignty, and that strengthens the belief that cooperation is the only way towards a better world.

## COUNTDOWN FOR THE LAUNCH OF THE FIRST BRAZILIAN MADE SATELLITE

Throughout the month of October and the first half of November, a group of INPE's technicians and engineers worked hard on the final tests for the launch of the flight model of the "Satélite de Coleta de Dados 1" (SCD1), the first Brazilian made satellite. At the end of October, INPE's satellite specialists celebrated the success of the vibration tests undertaken at the institute's Test and Integration Laboratory (LIT) to simulate the satellite's dynamic launch environment. The SCD1, a data relay

satellite, will be launched by a Pegasus air-launched rocket in January 1993, from Kennedy Space Center, Florida, USA.

The final contract for the launch of the SCD1 by a Pegasus vehicle was signed on August 20 last, in Brasília, by the Brazilian Government and Orbital Sciences Corporation.

The SCD1 is the first satellite of a series of four included in the Missão Espacial Completa Brasileira - MECB (standing for the Brazilian Complete Space Mission), a program established by the Brazilian government at the end of 1979. INPE's global budget

for MECB is in the order of US\$ 280 million. By December 1991, when the SCD1 was completed, INPE had invested US\$ 150 million in the program, including the installation of laboratories, personnel training and industrial contracts. The cost of the SCD1 alone was of the order of US\$ 20 million.

MECB also includes the development of a space launch vehicle and a launch base in Alcântara, in the state of Maranhão, northern Brazil. The Ministry of Aeronautics is in charge of these two parts of the program.

## THE SCD1 MISSION

The Satélite de Coleta de Dados 1 will operate as a real time relay for environmental data collected by ground-based Data Collecting Platforms (DCPs). By December there should be 20 DCPs installed in different parts of Brazil. Half of these platforms will be used to measure changes in the concentrations of gases such as carbon dioxide and ozone, mainly

produced by burning of vegetation that take place during the dry season. Oceanographical studies will also make use of data collected by the SCD1 via five DCPs installed along the Brazilian coast.

Meteorological information such as pressure, temperature and humidity will be transmitted to the SCD1 by five DCPs installed in the northeast of Brazil. These data will be used for meteorological and climatological studies,

especially relevant for this semi-arid region of the country, frequently affected by severe droughts. The SCD1 payload telemetry station is located in Cuiabá, in the state of Mato Grosso, located near South America's geographic center. From there the data will be sent to the Mission Center at INPE's facility in Cachoeira Paulista, in the state of São Paulo, for processing and dissemination to the final users.

## REMOTE SENSING SATELLITES UNDER CONSTRUCTION

The second series of MECB satellites, the Satélites de Sensoriamento Remoto 1 and 2 (SSR1 and SSR2), scheduled for launch in 1995 and 1996 respectively, are already at an advance stage of development. By the end of October, INPE's specialists were working on the documentation generated by the Conception Review (CR) of the SSR1 attitude

## IMAGING INSTRUMENT SYSTEM FOR THE REMOTE SENSING SATELLITES

The Brazilian company - ESCA (Engenharia de Sistemas de Controle e Automação) - is the main contractor for the conception and development of the imaging payload for the MECB remote sensing satellites. This same camera will be used in the China-Brazil Earth Resources Satellites payload as a Wide-Field Imager (WFI). The contract signed between INPE and ESCA in July 1991, envisages the complete payload consisting of the optical head block, the signal processing

## INPE TO HAVE EARTH SITUATION ROOM

During a ceremony at the Sheraton Hotel, Rio de Janeiro, on June 7, 1992, in appreciation for hosting the United Nations Conference on Environment and Development, UNCED'92, Brazil

and orbit control subsystem (AOCS), undertaken during the last month of August. The AOCS Preliminary Design Review (PDR) will take place by February 1993.

INPE is developing the on-board computer and the two axis digital solar sensor for the SSR1. The reaction wheel and the earth sensor, which are part of the AOCS, will come from abroad. The SSR2 earth sensor will be Brazilian made. INPE's engineers are also working on an experimen-

electronics, and an R.F. module consisting of an S-band transmitter and antenna. The contract also includes the Ground Support Equipment (GSE) for integration and tests.

The project went through it's PDR during the first semester of this year and it is now in the qualification phase (Phase C). The purpose of the MECB remote sensing satellite payloads is to provide earth surface images of the earth's surface with 200 meters resolution in an 800 kilometer swath width. The overall payload has a mass of less than 10 kilos, power consumption up to 15 watts, and operates in 2

tal reaction wheel for future satellites. The SSR1 also went through the CR and PDR of its thermal control subsystem and the structure of the satellite is being developed by the Brazilian company Composite.

Meanwhile the mission of the SSR satellites is also being studied by INPE's image processing specialists. They are using the Landsat Thematic Mapper to simulate SSR real target scenes.

spectral bands. It will be mainly used for vegetation surveying and it will be particularly important for the observation of dynamical phenomena, since its repeat-cycle is as short as 3 days at the Equator.

The engineering and qualification model of this push-broom type of orbital sensor will be completed by the end of 1993 and the flight model by the end of 1994. This contract, worth US\$ 9 million, is one of the best examples of the participation of Brazilian private industries in the country's efforts to build up a competent space industry.

received the first Earth Situation Room. INPE will be the custodian and operator of this facility, which includes a 2 meter diameter fiber glass geosphere and a computerized visualization unit. This is all part of the GeoSphere Project, idealized by the American artist Tom Van Sant, as the first

visually accurate model of the Earth. The surface was made from thousands of separate cloud-free NOAA satellite photographs. The system, which is being installed in INPE's Visitors Center, allows the visualization of global physical data and earth resources management.



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## **INPE AT THE WORLD SPACE CONGRESS**

Brazil was one of the few developing countries with a booth at the International Space Exhibition, held during the World Space Congress (WSC) in Washington, DC, from August 28 to September 5. INPE displayed photographic panels showing its activities in the areas of space sciences, applications and technology. Visitors at INPE's exhibit had the chance to get information on the country's main space programs such as the Brazilian Complete Space Mission (MECB), the China-Brazil Earth Resources Satellite (CBERS), and the Amazon Program.

Besides the exhibition, 17 technical papers authored by INPE's specialists were presented

at the World Space Congress. The papers were related to subjects such as Temporal Satellite Image Prediction by Neural Networks; Upper Atmosphere; Ionosphere; Astrophysics; Space and Remote Sensing in Developing Countries; Multiple Satellite and Deforestation Estimates; and Public Awareness about the Importance of Space Activities in Developing Countries.

Brazil was also represented by INPE at the United Nations Technology in Developing Countries symposium, held at the WSC from August 28 to 30. During the symposium there was a presentation on satellite forest monitoring, based on the experience acquired by INPE's remote sensing specialists, during the last 20 years, on the monitoring of

deforestation rates in the Amazon tropical rain forest.

INPE also participated in the meeting held on August 29 by the Space Agencies Forum for the International Space Year (SAFISY), in Washington. At this meeting Brazil was one of the countries appointed to participate in a special panel that will work on a proposal for the continuation of SAFISY activities started five years ago. In February 1993, at the final ISY meeting in Genoa, Italy, the panel - including representatives from NASA, the European Space Agency, Japan's National Space Development Agency, Canada, China and Italy - will present a plan for expanding cooperation in Earth observation to other fields, and to promote the involvement of developing nations in space related activities.

## **BRAZILIAN PARTICIPATION ON THE ISPRS CONGRESS**

Twenty three Brazilian remote sensing specialists from INPE and other organizations presented technical papers at the International Society for Photogrammetry and Remote Sensing (ISPRS) Congress, held in Washington, August 2-14, on behalf of the International Space Year. The papers were concentrated on subjects such as tropical forest satellite monitoring; analysis of urban areas; deforestation

rates; Geographical Information Systems (GIS) for soil erosion studies; regional planning of land use; environmental diagnosis for indigenous areas; the role of tropical forests and oceans in global change; and the Amazon Information System developed by INPE.

Brazilian remote sensing specialists have been active participants of the ISPRS activities for many years now. From July 1988 until this last Congress in Washington, INPE's director, Mar-

cio Nogueira Barbosa was the president of ISPRS Commission I. At the ISPRS elections that took place in Washington, INPE's coordinator for Institutional Relations, Roberto Pereira da Cunha, was elected president of ISPRS Commission 7, Resources and Environmental Monitoring.

INPE also had a booth at the ISPRS Congress international exhibition, showing its latest projects on satellite Earth observation in Brazil.

## **NEW SYSTEM TO ALLOW BETTER USE OF NOAA IMAGERY**

By the end of this year, INPE's specialists will be receiving new real time images from the NOAA (US National Oceanic and Atmospheric Administration) environmental satellites, allowing the improved studies of vegetation rates, sea surface temperatures, rain and wind estimates. These images are already being produced

by the Image Processing and Acquisition System, consisting of a Micro-Vax computer connected to a Silicon Graphics model Iris-4D workstation, installed at INPE's Cachoeira Paulista facility. The system was acquired from the American company General Science Corporation, GSC.

INPE has been receiving and processing NOAA satellite data since 1966, when the USA launched the first satellite of the

series. Nevertheless, before the installation of this new system, INPE's specialists were using NOAA imagery mostly for the monitoring of burning spots. Besides the applications mentioned above, the new system will allow the installation of a NOAA imagery historical archive for Brazil, and the generation of international standard images, accessible to any user from other countries who work with this type of environmental satellite data.

## **MONITORING OF AMAZON ECOSYSTEMS IN THE EOS PROGRAM**

In October, Dr. Jeffrey E. Richey, a scientist from the University of Washington, visited INPE to discuss the final terms of a Memorandum of Understanding to be signed by the two organizations. The agreement concerns the EOSRAM Project (Earth Observing System Regional Amazon Model), the main goal of which is to determine "how extensive land use change in the Amazon would

modify the route of water and its chemical load from precipitation, through the drainage system, and back to the atmosphere and to the ocean", as stressed in the Memorandum draft.

The origin of this project goes back to February 1989, when NASA accepted a proposal made by Getúlio Teixeira Batista, from INPE, and J.E. Richey, from the University of Washington, to develop a project called "Long Term Monitoring of Amazon Ecosystems: from Patterns to Processes". The proposal was a

response to the Announcement of Opportunities made by NASA to include scientific projects in the agency's Earth Observing System, EOS.

Remote sensing specialists from INPE and the University of Washington already have selected test areas in the Brazilian Amazon region to start field work. Next year, scientists from both organizations will be flying over many test areas as part of the Air-Sar Campaign '93, to start collecting data for the project.

## **MEETINGS TO DISCUSS THE IMPACT OF "EL NIÑO" EVENTS**

Last September, Brazilian and American scientists organized two international meetings in Brazil, to present the most recent scientific achievements on the prediction of the ENSO phenomenon (El Niño/South Oscillation). The main goal was to present proposals of effective mechanisms to promote the application of this knowledge to social and economic benefits. The meetings - named "Workshop on the ENSO Phenomenon and the Climate Variability in Seasonal and Inter-Annual Scales: Social-Economical Impacts, Prediction and Application to the Decision

Making Process" - were held in Fortaleza, state of Ceará (northeast of Brazil), September 9-11, and in Florianópolis, state of Santa Catarina (southeast), September 14-16.

In Fortaleza scientists discussed the association of the ENSO phenomenon with the frequent droughts in Brazil's northeast region. At the second meeting, in Florianópolis, the discussions were about the ENSO extra-tropical impact on South America's southeast, including Brazil's southern region, that suffers both flood and drought periods.

Major specialists on the ENSO phenomenon from Latin American and European countries, USA, Australia, and Japan, working in the areas of physical, natural and social sciences, participated in the workshop. The ENSO workshop was jointly organized by INPE and the US National Oceanic and Atmospheric Administration (NOAA), with the support of the State of Ceará Meteorology and Water Resources Foundation (FUNCEME), and the State of Santa Catarina Technology Diffusion, Agriculture and Cattle Research Company (EPAGRI), besides other organizations from both countries.

## **COMMITTEE ON EARTH OBSERVATIONS MEET AT INPE**

The Working Group on Calibration and Validation (WGCV) of the Committee on Earth Observations Satellite (CEOS) held its 6th meeting at INPE's facilities, in São José dos Campos, last November 23-25. The meeting was attended by representatives from INPE, the Canadian Centre for Remote Sensing (CCRS), the International Geosphere-Biosphere Program (IGBP), the European Space Agency (ESA), the National Oceanic and Atmospheric Administration (NOAA/USA), and other space organizations from Sweden (DARA), United Kingdom (RAL and DRA), and Australia (CSIRO). Other CEOS member countries are France, India, Italy and Japan.

The CEOS/WGCV-6 was chaired by Susan Till, head of the CCRS Sensor Section, and organized at INPE by Décio Castilho Ceballos, head of the Institute's New Satellites Project. Each delegate made a presentation on the status of remote sensing space systems Calibration and Validation (CAL/VAL) activities. The presentations concentrated on subjects such as radar calibration, infrared and visible optical sensors, terrain mapping activity, passive microwave imaging, etc. Following a suggestion made by INPE, the WGCV started work on the content, format, and production procedures for a handbook of sensor technical information, plans and calibration procedures.

The Committee was created in 1984 in response to a recommen-

dation from the Economic Summit of the Industrialized Nations Working Group on Growth, Technology and Employment. This group recognized the multidisciplinary nature of satellite Earth observations, and the value of coordinating across all proposed missions.

The objective of the WGCV is to coordinate sensor calibration and geophysical validation activities related to CEOS member missions. This includes identifying and exchanging information on requirements, plans, and techniques, as well as undertaking coordinated or joint activities to meet mission requirements. Besides the WGCV, CEOS also has a Working Group on Data. The 4th CEOS Plenary Meeting, in 1990, was also held at INPE.