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Editorial

A short history of the academic activities at the Brazilian National Institute for Space Research

The Brazilian National Institute for Space Research (INPE, acronym in Portuguese) is an institute in charge of activities related to space, which include not only Science, but also Aerospace Engineering, covering the development of the Brazilian satellites. The majority of the facilities are located in São José dos Campos (SP), but it also has activities in Santa Maria (RS), Natal (RN), Belém (PA), São Luís (MA), Cachoeira Paulista (SP), Eusébio (CE), Atibaia (SP), São Paulo (SP), Cuiabá (MT), Brasília (DF), and San Martino da Serra (RS). The Institute will complete 50 years in August 2011, and many important achievements in the space field were made in these five decades. Although the INPE is not a dedicated academic institution, it has a strong and large graduate school, which offers courses at the master and doctoral levels. This academic structure is very important for the Institute, and graduate students are involved in several important research projects organized by the institution. The main goal of the present text is to show some details about this activity.

But, first of all, it is important to take a look at the Institute itself. As can be seen in its official website (www.inpe.br), its mission is to foster science and technology in Earth and space context and be able to offer products and regular services in benefit of the country. The strategic goals to achieve this mission are to:

- extend and consolidate competences in technical-scientific excellence and innovation in the space and tropical environment in order to respond to national challenges;
- develop, in the worldwide sphere, scientific and technological leadership in space and tropical environment scope emphasizing Brazilian specificities;
- extend and consolidate competences in weather forecasting and global climate change;
- consolidate the INPE's performance as a unique institution in the segment of satellites and space technologies development;
- promote industrial policy for the space sector oriented towards the growth and sustainability of its space activities, and, additionally, oriented towards the technological-basis industrial development;
- strengthen positive actions along the national and international institutions;
- provide a sufficient infrastructure;
- establish a new human resource policy to the INPE, based on strategic management of competences;
- identify and implement a management and institutional pattern, in conformity with the specificities and challenges that have been presented to the INPE.

The Graduate school located in INPE contributes towards all of these strategic goals, but before going in more details about it, let us first recall some of the important milestones of the Institute in those 50 years of existence. To do this, some of the main facts related to INPE's history are shown in the following paragraphs.

THE FIRST DECADE (1961 TO 1970)

In 1961, a presidential decree created the Organization Group of the National Space Activities Commission (GOCNAE, acronym in Portuguese). This organization is considered as the creation of INPE, and it is the reason why we consider

2011 as the year that INPE makes its 50 years of existence. Then, in 1963, GOCNAE became the National Commission of Space Activities (CNAE, acronym in Portuguese). In the following year, 1964, the Aeronautics Ministry established the Workgroup of Space Studies and Projects (GTEPE, acronym in Portuguese). Some real activities started in the space field in 1965, when the first campaigns for launching INPE work-loaded probing rockets, from "Barreira do Inferno" Launching Center (Natal, in Rio Grande do Norte), took place.

In 1966, the Meteorology by Satellite (MESA) program began, which consisted on the reception of meteorological images. After that, in 1967, the first library started working at INPE and, in 1968, the graduate school was created, as a major step in the development of space related activities in the country. In 1969, the activities started in remote sensing. The project SACI started in 1970, with the purpose of studying the use of satellites in education.

THE SECOND DECADE (1971 TO 1980)

In 1971, the CNAE no longer existed and the INPE was created, associated with the National Council for Scientific and Technological Development (CNPq, acronym in Portuguese). In this same year, the Brazilian Commission of Space Activities (COBAE) was originated. In 1972 and 1973, we had the implementation of the remote sensing satellite data reception station in Cuiabá (MT). Also, in 1973, INPE received the first images of the American satellite LANSAT-1.

The first important mark of the second part of this decade was in 1978, when the first edition of the Brazilian Remote Sensing Symposium was organized. Later on, in 1979, a major step in the Brazilian aerospace engineering was made, with the creation of the Complete Brazilian Space Mission (MECB). It was established that INPE would develop data collecting and remote sensing satellites, and CTA would develop the satellite launching vehicle and the implementation of a Brazilian launching center. In 1980, the Mackenzie Radioastronomy and Astrophysics Center (CRAAM) transfer to INPE occurred, which is a fact that impacted in the graduate school activities in INPE, as will be further detailed.

THE THIRD DECADE (1981 TO 1990)

Starting this decade, in 1982, we had the first scientific expedition to Antarctica. There was also a large investment in infrastructure for the MECB: the Integration and Tests Laboratory (1983 to 1987) and the Satellite Tracking and Control Center (1987 to 1989). Another mark of 1982 was the realization of the first Brazilian Colloquium of Orbital Dynamics (CBDO). In 1985, the Science and Technology Ministry was created and INPE passed over to the MCT, as an autonomous organ.

For the second half of this decade, there was the creation of the Associated Laboratories – Plasma, Sensors and Materials, Computing and Applied Mathematics and Combustion and Propulsion, all of them in 1986. In this same year, we had the beginning of the burned land monitoring program. In 1987, there was the inauguration of the Integration and Tests Laboratory. Then, in 1988, the cooperation agreement was executed between Brazil and China, aiming at the development of satellites (CBERS-1 and CBERS-2). In 1989, the Brazilian Special Science and Technology Bureau (SCT) was created as an organ integrating the Republic's Presidency. In the same year, there was the start-up of the PRODES – Project Brazilian Amazonian Forest Monitoring by Satellites, with annual data survey about data on the deforestation of Legal Amazonia. In 1990, the INPE was denominated National Institute for Space Research and integrated to the SCT/PR Republic's Presidency Science and Technology Bureau's basic structure.

THE FOURTH DECADE (1991 TO 2000)

In 1992, SCT became the Science and Technology Ministry (MCT), and INPE was integrated to it in the condition of a specific organ. Then, in 1993, there was a very important milestone in the history of INPE, since it was the year that SCD-1, the first data collecting Brazilian satellite, wholly developed by INPE, was launched from Cape Canaveral, in Florida, USA. In the folowing year, 1994, INPE created the Weather Forecast and Climatic Studies Center (CPTEC). In this same year, the Brazilian Space Agency was created to replace COBAE. In 1995, MCT's Regulatory Structure was created and INPE came to integrate it, in the quality of a Singular Specific Organ.

For the second part of this decade, we also had very important events. Starting in 1998, when there was the launching of the satellite SCD-2, also from the American base in Cape Canaveral, Florida. The CBERS-1 – Earth Resources Chinese-Brazilian Satellite was launched from a base in China, in 1999.

THE FIFTH DECADE (2001 TO 2010)

For the fifth decade of the the INPE history, we can start in 2002, when there was the execution of a new cooperation agreement between Brazil and China for the development of Satellites CBERS-3 and CBERS-4. 2003 was also a year full of activities, with the launching of the Satellite CBERS-2, from the Chinese base. Also, the SCD-1 completed ten years in orbit and SCD-2 completed five years. The Amazonian monitoring system gained a digital image classification, which was made available on the Internet. In 2004, there was the introduction of the images divulgation from CBERS, with a catalog made available on the internet. Also, nation-wide Thunderbolt Monitoring Network was available on the Internet. In this same year, INPE Supercomputer placed Brazil among the eight countries with high processing capacity in weather and climate numerical forecast. In 2005, the Amazonian Deforestation Real Time Detection Program Data (DETER) was available on the Internet. In this period, INPE also reached the number of 100.000 CBERS images distributed; thus, becoming the largest world CBERS image distributor. Another mark of this year is the fact that the Integration and Tests Laboratory totalized 1,000 clients served.

In the second half of this decade, starting in 2006, free CBERS image catalog is extended to whole South America. In addition to that, the United States also received images from CBERS. In 2007, the satellite CBERS2-B was launched again from China. In the following year, we had the creation of the Center of Science of the Earth's System. In 2009, INPE reached the number of one million satellite images distributed, 70% from CBERS and 30% from LANDSAT. Finally, in 2010, we had the beginning of services of the most powerful supercomputer in South Hemisphere to perform climate and meteorological research.

MAJOR ASPECTS OF THE ACADEMIC ACTIVITIES HISTORY AT INPE

The Graduate Courses at INPE were gradually introduced, starting from 1968, with the purpose of training highly qualified human resources in the Institute areas of activities, because of the lack or inadequacy of institutions that generate knowledge in these areas in Brazil.

The Institute offers, nowadays, the following graduate courses: Astrophysics, Space Engineering and Technology (divided in four subdivisions: Space Mechanics and Control, Combustion and Propulsion, Sciences and Technology of Materials and Sensors and Engineering, and Management of Space Systems), Space Geophysics, Applied Computing, Meteorology, Remote Sensing, and Earth System Science.

Graduate courses are regulated by the Council of Graduate Studies, which is composed by representatives of all courses. In addition, each course has its own rules, which is made by a local Council elected by the professors that belong to that course. Now, we can address the history and goals of every individual course.

Astrophysics

The Astrophysics graduate courses at INPE were conceived to generate M.Sc. and Doctoral staff prepared to face the challenges of astrophysical research at INPE and, more generally, all over Brazil. The research activities carried at this course and by the Astrophysics Division of INPE (DAS) are:

- theoretical studies and observations in stellar astrophysics, extragalactic astrophysics, cosmology, and extrasolar planets;

- observations and phenomenological analysis of the cosmic microwave background radiation, as well as cosmic X- and gamma-ray sources;

- solar studies, including solar flares, their propagation effects in the interplanetary environment, solar-terrestrial phenomena, and their relation to space weather;

- studies in gravitational waves astrophysics, to support these researches, INPE is leading the efforts to build and operate the first gravitational waves observatory in Brazil;

- various studies in radioastronomy: quasars, radio galaxies, stars and star-forming regions, both in continuum and spectral lines.

Following the INPE's tradition, DAS and the Astrophysics Course strongly support the development of astronomical instrumentation in all areas. Their scientists are deeply involved in the design, production and operation of radio interferometers, gravitational wave detectors, satellites, microwave receivers, infrared detectors, besides other components and parts of the instrumentation.

Space Engineering and Technology

The Space Engineering and Technology Graduate Course came from a concentration area of the Space Science Course. With the name of Space Science, the course started in 1968, with a concentration in "Combustion" at the master's level and a concentration in "Astrogeophysics" at the master and doctoral levels.

In 1972, the Engineering field was established to concentrate the area of "Orbital Mechanics" at the Master level. In 1974, the area started offering also a doctoral degree. In 1980, the Graduate Course in Space Science added the areas of concentration in Astronomy and Solar Physics at the Masters and doctoral levels, as a result of the mentioned transfer before the Center for Radio Astronomy and Astrophysics Mackenzie (CRAAM) from the National Observatory (ON) to INPE, as a result of a determination of the Board of CNPq. Thus, the name of the Graduate Course in Space Science existed from 1968 until 1993.

At its meeting on April 18, 1996, the Technical Advisory Group (JWG) of CAPES authorized the split of the Graduate Course in Space Science, transforming their areas of concentration in independent courses, with retroactive effect from January 1, 1994. Thus, the designation "Graduate Course in Space Technology and Engineering", with concentration areas in Combustion and Propulsion and Space Mechanics and Control formally came into existence in January, 1994, although it was in effect since 1987. In December, 2001, a new concentration area in Science and Technology of Materials and Sensors was created, starting its activities in 2002.

The objective of the course is to improve staff-level Master and Doctoral in the areas of Orbital Dynamics, Guidance and Control, Structure and Thermal Control, Combustion and Propulsion of Space Vehicles, Engineering and Management Systems and Space Science, and Technology of Materials and Sensors for space applications, as a source of human resources to be used at the INPE, in other research institutions or in the industry and education.

General Characteristics of the areas of concentration in the Space Engineering and Technology course

The graduate course in Space Mechanics and Control works mainly in the Division of Space Mechanics and Control (DMC) at INPE, located in São José dos Campos, Brazil. It accounts with a specialized library with more than 30,000 books and 1,500 subscriptions to scientific journals, laboratories, and other facilities. It concentrates studies in the field of orbital dynamics, control of spacecrafts and structures and thermal control of satellites. Among its research topics, activities like the orbit determination and maneuvers of satellites, design of space vehicles, studies regarding thermal control and structures are developed.

The area of concentration in Combustion and Propulsion works at the Laboratory of Combustion and Propulsion (LCP) at INPE, located in Cachoeira Paulista, São Paulo. INPE Cachoeira Paulista occupies an area of 480 acres, containing an extensive green area with eucalyptus plantations, orchards and lakes. It has excellent sports and leisure, as well as catering to students. It is located halfway between Rio and São Paulo, equivalent to less than three hours of each city and is situated near the spa towns of Southern Minas Gerais, near the Northern coast of São Paulo and the Southern one of Rio de Janeiro. The infrastructure available to the students includes six buildings with total area of

approximately 1,500 square meters, including specialized library, office and research building, chemical laboratory, mechanical workshop, bank for altitude simulation tests – BTSA (Latin America only), and bank of tests in atmospheric conditions (BTCA). The experimental and computational capabilities are perfectly suited to the development of both the Master and Doctoral research, and technical work of all kinds in their projects. The library of the LCP/INPE has direct contact with other libraries and provides the most comprehensive collections in the specialized area of combustion and propulsion.

The area of concentration in Science and Technology of Materials and Sensors works in the Associated Laboratory of Sensors and Materials (LAS), Special Technologies Center (CTE), INPE, located in São José dos Campos, São Paulo. The LAS has several laboratories and the following research lines:

- Environmental Technologies: Research and development of sensors of environmental parameters; special ceramics – zircon, alumina e alumina-zircon; nanoparticle systems (nanopowders) and nanostructures ceramics; research and development on modification of surfaces and interfaces;

- Condensed Matter Physics: Strongly correlated electronic systems; superconductivity; critical phenomena and phase transition; disordered systems; crystal growth modeling; optical and transport properties in semiconductors; electronic structure of semiconductor nanostructures and spintronics;

- Solar Cells: Study and characterization of solar cells for space applications; monitoring of the solar cell experiment flying on INPE's Data Collecting Satellite (SCD-2) and study of albedo radiation through the data collected from this experiment; research and development of radiometer sensors for meteorological data platforms; development of techniques to obtain porous silicon;

- Material Technologies: Molecular beam epitaxy of IV-VI semiconductor compounds and alloys with europium; structural, electrical, optical, and magnetic properties of nanostructures of IV-VI compounds and respective alloys with europium; growth of bulk crystals of Groups IV-VI (PbSnTe) and II-VI (HgCdTe) semiconductor alloys; solidification of alloys in microgravity environment;

- Diamond and Related Materials: Growth of thin and self-sustained diamond films by chemical vapor deposition (CVD) on different substrates and surfaces; *in situ* characterization during diamond growth; optical characterization of synthetic diamond film; development and industrialization of devices based on synthetic diamond; modeling of diamond growth and graphic visualization; growth of boron doped diamond films for electrochemical applications; deposition of molybdenum disulfide thin films for tribological applications; deposition and characterization of diamond like carbon (DLC) for space applications; research and development on modification of surfaces and interfaces;

- Plasma immersion ion implantation (PIII): Surface treatment of materials by ion implantation using PIII technique.

Besides specific growth and sample preparation systems of each research group, several equipments for materials characterization and some facilities are installed in LAS/INPE: scanning electron microscope JEOL with the capability of energy dispersive X-ray analysis; high resolution X-ray diffractometer Philips X'Pert MRD; powder X-ray diffractometer Philips PW1840; Micro-Raman spectrometer Renishaw 2000; profilemeter Tencor Alpha Step 500; temperature dependent Hall effect and resistivity measurement system (10-450K); automated system to measure current and capacitance versus voltage curves; infrared Fourier transform spectrometer Perkin Elmer FTIR 1600 (2000 a 22000 nm); spectrophotometer Hitachi U3501 (185 a 3200 nm); equipment for mechanical tests; solar cells characterization bench; bench for photoacoustic and photothermic techniques; electron beam evaporator system Edwards Auto 306; clean room for photolithography and micromachining in silicon; and equipment for plasma etching.

The area of concentration in Management and Engineering of Space Systems is taught at the master and doctoral levels in different divisions of INPE, São José dos Campos, Brazil. This area is responsible for the design, development, assembly and integration of the satellites made by INPE. The lines of scientific and technological research and development are: design, specification, architecture and management of space systems, on-board systems for space missions, ground system for space missions, quality control of space missions, and modeling and simulation of space systems.

Space Geophysics

The Masters and Ph.D. in Space Geophysics from INPE aims at training graduate personnel, preferably in the areas of physics and engineering sciences, enabling them to act in areas of education, research and applications at universities, research institutes, companies, and government teams in subjects involving the direct knowledge of science or technology associated with or resulting from the development of space research. Subjects covered are magnetospheric and heliospheric physics, ionospheric physics, geomagnetism, atmospheric chemistry, airglow, atmospheric electricity and atmospheric electrodynamics, and atmospheric physics. Most of these areas are strongly connected to the science of space weather.

As a consequence of the Institute's purpose, the graduate course in Space Geophysics (GES) at INPE started in 1968 under the name of "Space Sciences - Astrogeophysics". The designation "Graduate Course in Space Geophysics" formally came into existence in January, 1994.

Since 2004, the Graduation Course in Space Geophysics has two new concentration areas: Solar-Terrestrial Environment Sciences (AST) and Atmospheric Sciences (ATM).

The GES course is a member of the "Excelence Program" of the Brazilian Ministry of Education, ranking in the top 20% of all graduate programs in Brazil.

Applied Computing

The graduate program in Applied Computing in the strict sense of the INPE aims at contributing to technological development and scientific level, generating knowledge, and training researchers with multidisciplinary knowledge and skills needed in information technology, extraction information, and computational modeling, which meet the current needs of the research and development in Science and Space Technologies, in line with the institutional mission of INPE.

Meteorology

Meteorology is the science that studies the weather and climate. Its goal is the understanding of physical and chemical processes that determine the atmosphere state in various spatial and temporal scales, ranging from local turbulence to the global atmospheric and oceanic circulation. The progress in knowledge of this science is of vital importance for the development of the country, especially in the agricultural, energy, and environment conservation.

The graduate course in Meteorology from INPE, Brazil's oldest in the field, is part of the activities of the Center for Weather Forecasting and Climate Studies (CPTEC). Its goal is to train staff at master and doctoral levels. It is within the mission of the CPTEC: "To provide the country with state of the art in weather forecasting and climate and have the scientific and technological capacity to continuously improve these forecasts, for the benefit of society."

CPTEC center is the most advanced numerical weather prediction and climate in Latin America, providing weather forecasts for short and medium term with high precision, since early 1995. CPTEC places Brazil in the first world of weather forecasts and the excellence of its work is recognized in countries with advanced technology. CPTEC mastered the techniques of numerical modeling of the atmosphere and oceans, with highly complex models used to predict future conditions in the atmosphere and oceans. It operates in a global atmospheric model with a resolution of 63 km, and a regional model with a resolution of 20 km.

Featuring highly skilled professionals, CPTEC uses supercomputers capable of processing billions of arithmetic operations per second. The combination of knowledge and technology makes the reliability achieved in numerical weather prediction and climate to have the same level of forecast centers in more developed countries. Its team is highly trained in the finest institutions in the country and abroad, and CPTEC is constantly investing in training and upgrading its employees to generate new scientific knowledge and develop technology for applications in various areas of meteorology.

CPTEC has offered scientific, technical and logistics capabilities for its students that is unparalleled in Latin America. It has a unique computational park, which features the supercomputer NEC-SX6-32 with a processing capacity of approximately 0.8 TFLOPS, considered one of the most advanced supercomputing systems in the world, and global and regional atmospheric models for weather and climate. Leads field experiments in the Amazon (Large-Scale Biosphere-Atmosphere Experiment in Amazonia - LBA), in Pantanal (IPE), experiment low level jet (LLJ), predictability of extreme weather events on the coastal range (Serra do Mar) and in environmental projects, among others. The Faculty is composed mostly by PhD researchers from CPTEC with high scientific productivity.

The students have the best libraries in Latin America and updated knowledge in these areas, containing a collection of more than 31,000 books and 1,500 periodicals, online access to the contents of many libraries worldwide and access to electronic versions of major publications in atmospheric sciences.

CPTEC combines research and development activities with advanced technological operational weather forecasting and climate to provide students, with an unparalleled work environment of advanced academic and professional training. The teaching activities and student research can be developed equally in São José dos Campos and Cachoeira Paulista. It also has modern appeal of telecommunications (video conference), allowing students to attend classes in São José dos Campos and Cachoeira Paulista, simultaneously. The Course accepts students with undergraduate or graduate degrees in meteorology, physics, engineering, mathematics, oceanography, and related fields.

Remote Sensing

Brazil, due to its continental dimensions, is one of the countries that can benefit from the use of remote sensing research and monitoring of natural resources renewable and nonrenewable. Since 1969, INPE collects and analyzes remote sensing data obtained by aircrafts (cameras, imagers, radars, and so on) and/or orbital platforms (LANDSAT, SPOT, SPACE SHUTTLE, NOAA, ERS, JERS, RADARSAT, etc.), researching, developing and applying methodologies to the study of the natural resources of the country. Foreseeing the great need to prepare researchers specialized in the analysis and interpretation of remote sensing data, INPE created in 1972 the Graduate Course in Remote Sensing at Master level. In 1998, the Doctoral program was created. The Course includes basic compulsory and optional subjects. The application and selection procedures are based on *curriculum vitae* analysis, examinations of proficiency in foreign language (English), basic mathematics, and physics. As soon as the required subjects are completed, a research proposal has to be presented by the Master student. The Doctoral student is submitted to a qualification examination and, if approved, a research proposal must also be presented. The final academic step is the Master Dissertation or the Doctoral Thesis presentations.

Earth System Science

Earth System Science seeks to understand the dynamics of natural and social systems complex interaction. It explores the interactions of natural components, such as oceans, soil and vegetation with the atmosphere, as well as their interactions at the levels of biodiversity, biogeophysics and chemistry with human systems and dynamics (institutions, policies, culture, economy, demographics, etc.).

The Center for Earth System Science (CCST) of the INPE aims to create interdisciplinary knowledge for national development, which integrates concern about equity and the preservation of planetary life-sustaining systems. It conducts studies to evaluate impacts of global and regional environmental changes on social, economic, and environmental systems, especially those bearing on national development and quality of life. By means of modeling tools and analysis of environmental data, it develops technologies for monitoring, mitigating and adapting environmental changes.

The Doctoral program in Earth System Science (PG-CST) provides high-level training in the above areas of research, enhancing human capacity to find practical solutions to global, regional and local environmental problems of importance to Brazil and South America. It offers to the students broad access to INPE's facilities in support of advanced research and teaching. The program seeks to facilitate the process of finding financial assistance for doctoral students through national education-oriented agencies, such as CAPES, CNPq and FAPESP, among others.

THE GRADUATE SCHOOL TODAY

Some details of the Graduate School at INPE can be seen from the statistics obtained from its history, in particular from the recent year of 2010. To have an idea of the size of the graduate school, we can mention that, by the end of 2010, the number of permanent professors was 201, and the number of participant professors was 58, making a total of 259. Regarding students, at the same time, we had 189 students enrolled in a master program, 293 enrolled in a doctoral program and 108 students registered in singles classes, making a total of 590 students.

As far as quality is concerned, we can say that the courses had a good result in the latest evaluation performed by CAPES. Table 1 shows the result of the last two evaluations. Those grades are good enough to place INPE as one of the best graduate schools in the country.

The number of graduates from INPE is also an important factor, and it is shown in Table 2. Table 2 shows the number of graduations made by INPE by every Course in the period from 2006 to 2010. From there, we can see that 53 master and 21 doctoral degrees were given by INPE in 2010. Since we had a total of 1,624 master and 435 doctoral degrees given by INPE until 2009, the new historic totals are 1,677 master and 456 doctoral degrees awarded.

Table 1: Results from CAPES evaluation in the last two periods

Program	Previous (2007)		Now (2010)	
	Master	Doctor	Master	Doctor
Astrophysics	4	4	3	3
Applied Computing	4	4	5	5
Engineering and Space Technology	5	5	5	5
Space Geophysics	6	6	6	6
Meteorology	6	6	6	6
Remote Sensing	6	6	7	7
Earth System Science	-	-	5	5

Table 2: Graduations by INPE in the last five years

Program	2006		2007		2008		2009		2010	
	M	D	M	D	M	D	M	D	M	D
Astrophysics	5	1	1	2	6	1	4	3	2	3
Applied Computation	9	11	20	10	16	10	15	13	8	2
Earth's Science	--	--	--	--	--	--	--	--	--	--
Science and Tec. of Materials and Sensors	4	6	9	1	3	4	5	6	6	4
Combustion and Propulsion	5	--	3	--	--	1	7	1	1	--
Space Mechanics and Control	3	4	3	--	6	3	13	9	3	--
Eng. and Management in Space System	--	--	--	--	--	--	--	--	--	--
Space Geophysics	4	2	1	4	5	6	7	7	7	3
Meteorology	8	1	10	3	12	8	15	10	11	5
Remote Sensing	19	4	20	7	18	8	22	4	15	4
Total	57	29	67	27	66	41	88	53	53	21
Total M and D	86		94		107		141		74	

M: Master; D: Doctor.

To conclude this text, we can say that the INPE reaches its 50 anniversary having a long list of important achievements in space related fields. In particular, the Graduate school that exists inside INPE has made large steps in the progress of space engineering and sciences in Brazil.

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