



INPE-297-PR/02

ERTS-B PROPOSAL

APPLICATION OF SATELLITE FOR NATURAL
RESOURCES SURVEY OF BRAZILIAN TERRITORY

31 January 1973

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APPLICATION OF SATELLITE FOR NATURAL
RESOURCES SURVEY OF BRAZILIAN TERRITORY

Submitted by:

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CURRICULUM VITAE

PART I
TECHNICAL PROPOSAL

PART II

MANAGEMENT PROPOSAL

APPENDIX B

INPE REMOTE SENSING PROJECT DISCIPLINARY ACTIVITIES PLANNED FOR THE NEXT YEARS

(NON-U.S.)

Investigation Synopsis

Part I - Investigation Description

Primary Discipline/Sub-Discipline Code 10. a. b. c. d. (15)

Secondary Discipline/Sub-Discipline Codes 1. 1. a. b. c. d. e. f. h. i. (15) 2. 3. a. d. i. j. k. m. n. (15)

Proposal Title:

Application of Satellite Imagery for Natural Resources Survey of (110)
Brazilian Territory.

Abstract:

Remote Sensing techniques are powerfull tools for natural resources (800)
survey of countries like Brazil since 75% of its territory is almost unknown. Orbital
data, due to its high synthesis power make these techniques unvaluable for surveying
continental size countries. This proposal refers to 11 test sites that covers the
whole Brazilian Territory and since this country is so large it would not make sense
making deep studies on limited areas. The approach to be adopted is the multilevel
one, starting with orbital data and going through aircraft data till limited field
work. The expected general results of this investigation is the establishment of
methodologies for surveying from a multidisciplinary point of view large areas.

Proposed Duration of Investigation (months) 18 Proposed Start Date Jan 1st, 1974

Investigation Synopsis

Part II - Personnel Information

Principal Investigator

Name: Dr. Fernando de Mendonça (30)
(title) (first name) (middle initial) (last name)

Affiliation: INPE (Brazilian Space Agency) (30)
(organization)

Mailing Address: C.P. 515
(branch, bldg., or street)

São José dos Campos SP 12.200 (155)
(city) (state) (zip)

Phone No.: 4866 (12) Extension: 120 (4) Telex/TWX no. 021-499 (10)

Other Proposals Submitted? (yes/no) No

List other proposal titles and associated numbers:

(110)

Co-Investigators

1. Name: Emmanuel Gama de Almeida (30)
(title) (first name) (middle initial) (last name)

Affiliation: * (30)
(organization)

Mailing Address: *
(branch, bldg., or street)

* * * (155)
(city) (state) (zip)

Phone No.: * (12) Extension: 171 (4)

Investigation Synopsis

Part II - Personnel Information (cont'd.)

2. Name: Gilberto Amaral (30)
(title) (first name) (middle initial) (last name)

Affiliation: * _____ (30)
(organization)

Mailing Address: * _____
(branch, bldg., or street)

* * * (155)
(city) (state) (zip)

Phone No.: * _____ (12) Extension: 171 (4)

Project Coordinator (if any)

Name: Edson Baptista Teracine (30)
(title) (first name) (middle initial) (last name)

Affiliation: * _____ (30)

Mailing Address: * _____
(branch, bldg., or street)

* * * (155)
(city) (state) (zip)

Phone No.: * _____ (12) Extension: 150 (4)

Government Agency Coordinator (if any)

Name: N/A (30)

Agency: N/A (30)

Mailing Address: N/A
(branch, bldg., or street)

N/A (155)
(city) (state) (zip)

Phone No.: N/A (12) Extension: _____ (4)

Investigation Synopsis

Part II - Personnel Information (cont'd.)

Test Site Coordinator (if any)

Name: N/A (30)
(title) (first name) (middle initial) (last name)

Affiliation: N/A (30)
(organization)

Mailing Address: N/A
(branch, bldg., or street)
N/A (155)
(city) (state) (zip)

Phone No.: N/A (12) Extension: (4)

Check this space if there are continuation sheets:

Part III - Proposal Information

Management/Organizational Structure

Is Research Staff Organizational Structure a Consortium? (yes/no) No

Number of institutions in consortium N/A (2)

List the names of each institution, country it represents, and staff size.

1. Institution N/A (30) Country N/A (30) Staff Size N/A (2)
2. Institution N/A (30) Country N/A (30) Staff Size N/A (2)
3. Institution N/A (30) Country N/A (30) Staff Size N/A (2)

If not a Consortium, indicate whether PI/Tech Staff is U.S., non-U.S., or
combination of U.S. and non-U.S. Personnel 2

(1=U.S., 2=non-U.S., 3=U.S. and non-U.S.)

Investigation Synopsis

Part III - Proposal Information (cont'd.)

Equipment

Data Collection Platforms:

Are Data Collection Platforms needed? (yes/no) No

If so, how many? N/A (3)

Are DCP's being used in ERTS-1? (yes/no) No Number N/A (3)

List platform sensors and/or interface equipment (e.g., barometers, thermometers, etc.) in the space provided:

N/A

N/A

N/A

N/A

(250)

Are you (the proposer) a selected ERTS-1 investigator (yes/no) Yes

Is this investigation a continuation of an ERTS-1 investigation? (yes/no) Yes

GSFC I.D. Number

Will you be using equipment from a previous ERTS-1 investigation in this ERTS-B investigation? (yes/no) Yes

Relationship to Other Investigations

Are you aware of other ERTS-B investigations in the same discipline/sub-discipline(s) and/or with the same or nearly the same geographical location of test sites as your investigation? No

(1=same discipline/sub-discipline, 2=same geographical area for test sites, 3=both).

Are you aware of other ERTS-B investigations with the same or similar objectives as your investigation? (yes/no) No

List the name(s) of the principal investigator(s) and/or the organization(s)

N/A

N/A

N/A

N/A

(150)

Investigation Synopsis

Part IV - Product Requirements

Product Requirements Information

Is imagery required? (yes/no) Yes

U.S. and/or non-U.S.: 2 (1=U.S., 2=non-U.S., 3=both U.S. and non-U.S.)

Is repetitive coverage required? (yes/no) Yes

Are there any seasonal constraints? (yes/no) Yes

Are there any cloud cover constraints? (yes/no) Yes

Remarks (indicate seasonal, cloud cover or other coverage constraints)

All the Test Site have cloud cover and seasonal constraints. Please see
Product Request Forms. (150)

Number of test sites: _____

Location of test sites (state(s) or country): 1. Brazil

2. Brazil 3. Brazil

4. Brazil 5. Brazil (30
each)

Check this space if there are continuation sheets: _____

Aircraft Support

Are aircraft data flights needed? (yes/no) Yes

Provided by whom? INPE (Brazilian Space Agency) (30)

Number of flights required: Not decided yet.

Purpose of flights (e.g., underflight, G.T.) _____

G.T. (150)

Ground Truth Data

Is ground truth data required? (yes/no) Yes

Type of ground truth support: 1

(1 = Field Team

2 = Data Collection Platform

3 = Existing System)

Investigation Synopsis

Part IV - Product Requirements (Cont'd.)

Other ground truth equipment needed? (yes/no) No

Type of equipment: N/A

(150)

If test site is non-U.S., has approval been obtained from host country for acquiring ground truth?

(yes/no) N/A Copy Attached (yes/no) N/A

Are there EREP* requirements relating to this investigation (yes/no) Yes

Supplemental Data Requirements

Are there any supplemental data requirements? (yes/no) Yes

Type:

1. Standard Catalog: 2 (1 = U.S., 2 = non-U.S., 3 = U.S. and non-U.S.)

2. Microfilm: 2 (1 = U.S., 2 = non-U.S., 3 = U.S. and non-U.S.)

3. DCS Catalog: 2 (1 = U.S., 2 = non-U.S., 3 = U.S. and non-U.S.)

*Earth Resources Experiment Package to be flown on Skylab missions

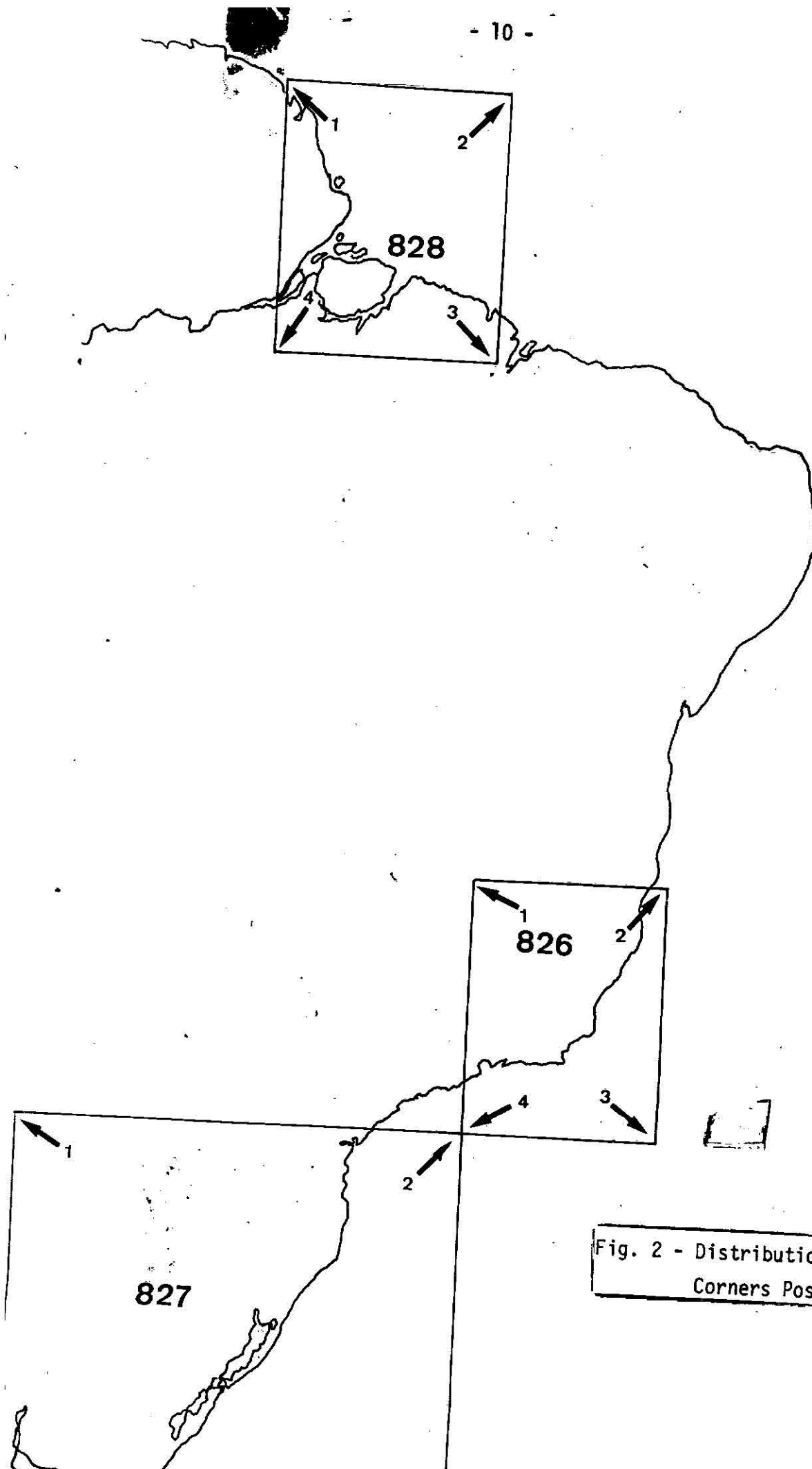


Fig. 2 - Distribution of Test Sites with
Corners Position

1.2 BACKGROUND

1.2.1 Remote Sensing and the Brazilian Environment

One means of extending progress to such an immense region as the interior of Brazil (an area of six million square kilometers with a population density of only 2 inhabitants per square kilometer) would be to develop activities compatible with such a vast region and low index of population. These activities could initially be restricted to points or limited areas where the emphasis should be on exploration of local natural resources. The capability of the satellite to survey with remote sensors extensive areas of the earth's surface within a short time and with relatively moderate costs, is suited perfectly to the necessity of an initial extensive reconnaissance of remote areas. This basic survey would permit the concentration of later surveys by aircraft or conventional surface methods in relatively small areas.

In relation to the regions situated between the central areas and the coast (also vast, with approximately 2.5 million square kilometers, contrasting for this reason with the above referred to region, with a population density of 35 inhabitants per square kilometer), the use of remote sensors in aircraft or orbital platforms would, besides permitting the discovery of new natural resource supplies, or exploration of existing productive supplies, most certainly be useful in the economical exploration and control on regional level. The necessity of information flow regarding these regions represents an almost unlimited demand for data collected by remote sensing. The collected data for specialists in agriculture, silviculture, geology, hydrology, etc would probably be of equal importance for geographers and planners interested in extensive regional development. On the other hand, there actually exist in Brazil organized forces for solving problems in economical development of immense regions with extremely different characteristics, such as the humid Amazon Basin and the dry Northeast.

Along the extensive Brazilian coast, (with more than 7 thousand kilometers) data collected at orbital altitudes, complemented by data collected by aircraft at lower altitudes, can delineate the temperature contrast which characterize the contour of the Brazilian current and the Falklands (Malvinas) current. Besides being important for navigation, this information presents correlation with the movement of communities of fish and wild life, and consequently with the commercial fishing.

Conscious of the importance of remote sensing activities for national development, the Federal Government has included it as a priority project in the document "Goals and Bases for Government Action" (Brazilian Space Program pgs. 132/133), published in September 1970 and in the I National Plan for Economical and Social Development of 1971 (pg. 43). The Institute of Space Research, ex-vi by Decree 68532 of April 22, 1971, is responsible, through its SERE Project, for the execution of the proclaimed goals of the above mentioned documents.

1.2.2 Previous Experience

Our experience in Remote Sensing started in July 1969, with the NASA/INPE mission, when several Brazilian Test Site areas were overflown, and multispectral and false colour photos were taken in conjunction with Radar and thermal imagery.

In 1971/1972 the RADAM project was implemented by the Ministry of Mines and Energy using a Caravelle Jet aircraft that has covered 4,500,000 square kilometers of the Amazonic Region and Northeast of Brazil, using SLAR imagery and multispectral and false colour photographs. INPE took charge of interpretation of part of the data have been collected.

During 1971 and 1972 INPE's aircraft has flown over several others Brazilian Test Sites, to get data to be correlated with ERTS-1,

Skylab and ERTS-B data.

INPE is also participating on ERTS-1 program, and its investigators are now interpreting the first sets of images they have received from NASA.

Finally, INPE is installing at Brazilian Territory, an ERTS Ground System. The Receiving and Recording Site will be ready by the first quarter of 1973; the Image Processing Site by the third quarter of 1973.

1.2.3 Future Plans

See Appendix B:

2.0 STATEMENT OF WORK

2.1 OBJECTIVES

The Scientific development of the investigation is substantially a multidisciplinary one, its main purpose are:

- the collection of earth resources data;
- the development of systems for the retrieval, reduction and use of data;
- training Brazilian personnel for execution and development of advanced technology.

Geology

For each of the areas specific objectives may be attributed such as mineral exploration, surface and ground water distribution, soil survey, support for engineering geology, fluvial dynamics and geomorphology, even thus lithologic and structural disclosure will be always of major interest. In this manner orbital survey will provide additional means for the geologic mapping of the

whole country at a scale of 1:1,000,000.

Agriculture and Forestry

Detailed interpretation of orbital data will be carried out wherever charting of cultural and natural resources is convenient. Survey in the Amazonic region, which is the site of a recent urban and rural development plan, will be emphasized in order to evaluate its yet unknown potential. In addition research will aim at the establishment of recognition techniques, having in view an extensive forestry, grassland and crop inventory and further production forecasting. These techniques would be applicable to the different regions of the country.

Oceanography

The objectives are specific for each of the areas:

- Area 826 - Rio de Janeiro and Espírito Santo States coast and offshore. Studies of coastal sedimentary environments including two major deltas (Rio Paraíba and Rio Doce). Reconnaissance of areas of upwelling discernable by color changes of offshore water.
 - Area 827 - Rio de La Plata Estuary and Southern Brazilian Coast. Studies of long term changes of sedimentation and erosion patterns in the Rio de La Plata estuary and coastal lagoons in Rio Grande do Sul State coast. Studies on the subtropical convergence of the Malvinas Current in connection with infrared imagery from the Nimbus Satellite.
 - Area 828 - Amazon River delta and offshore. Studies of long term sedimentation and erosion patterns in the Amazon estuary and discharge of turbid waters from the river mouth, supported by comparison with older photographic coverage and charts.
-

2.2 APPROACH

At the first stage of the implementation of the investigation the team will delimitate on ERTS-B index map (1:1,000,000) the exact extend of area which will be the subject of the investigation. Subsequent gathering of all maps, reports, aerial photographs and other remote sensing data pertinent to this area will follow. A data bank will allow quick access to this material. Planning and hardware assembling of the data bank is already in progress. Information which is considered significant for the investigation such as soil distribution, vegetation and geologic data will be classified and reformatted on separated maps at scales ranging from 1:200,000 up to 1:500,000 thus providing documents for easy handling and visual access. For selected orbital frames equivalent aerial photo mosaics may be assembled.

Original ERTS-B products will be reformatted, enlarged, reproduced and submitted to visual selection. Manual extraction of data will be accomplished by means of transparency overlaying making use of color, tonal and textural contrasts, and special attention will be paid to lineaments and other structural features. Subsequent control will select digital products or images which should be digitized for digital computer processing.

Statistics could be applied in conformity to different approaches: the image can be considered as a single product, the image can be considered as composed by multispectral components, and the image can be composed dynamically when repetitive data is available geometry and sun illumination angle permit superposition. Multivariate, discriminant and pattern recognition techniques may be applied, and carefully chosen frames of well known ground truth may serve as learning sets. In addition trend surface regression and directional data analysis techniques are supposed to be used. The adaptation and the development of these techniques is currently

underway, making use of our B3500 and B6700 computers. Line printers and plotters will yield color and symbol coded outputs.

Each frame of original and processed products will be compared with the maps containing the selected conventional information, and after assemblage of mosaics final maps can be drawn. Interpretation of these maps will determine if and which further remote sensing, geochemical, geophysical or standard field mapping would be indicated for the specific problems of each test site. Correlative remote sensing data can be collected by INPE's aircraft.

2.3 ANTECIPATED RESULTS

- a. The best orbital sensor, the most appropriate wave band of the spectrum, considering the spectral signature from the different elements in study.
- b. Pattern determination for the various types of crops, agricultural activities, forestry both artificial and natural, in view of future utilities, harvesting prediction, crops control, forestry, pastures and soil.
- c. Orbital data potential application for land use studies, management and agricultural inventory.
- d. New automatic interpretation methods and computer programs that offer the best results on orbital data treatment.
- e. Simulation studies of images based on analysis of obtained data from ERTS and Skylab.
- f. Define dangerous zones for navigation.
- g. Sea surface temperature charts in an attempt to locate propitious fishing zones.
- h. Further evaluation of the capability which orbital sensors offer for the solution of specific geologic problems.

- i. Disclosure of some large tectonic and structural features.
- j. Determination of the limitations which are derived from spectral and spatial resolution of each sensor.
- k. Determination of the most significant ground parameters for orbital geologic survey.

3.0 SUPPORTING BACK-UP DATA

3.1 DATA HANDLING PLAN

3.1.1 General

First of all each original ERTS-A product will be indexed and stored in the data bank. In the course of the investigation data may be submitted to every sort of processing, and the products which are obtained at the different stages will also be stored in the data bank. If a raw or processed product will be reproduced by means of xerox, repetitive execution of computer programs, drawing or photographic reproduction. All the facilities for the reproduction which were mentioned above are provided by INPE.

3.1.2 Processing

Processing will consist mainly of photographic enlargements and enhancements of images, of manual extraction techniques such as plotting contours and linear features over transparent overlays and drawing maps, and of digital computer processing.

For the accomplishment of manual work INPE has a complete set of light tables, magnifying glasses, stereo viewers, additive color viewers, pantographs and other drawing material, as well as specialized personnel for its execution.

Although digitizing for computer processing may be performed by manual or mechanic means making use of an ISCO spectrometer and of photocells, special emphasis will be placed on electronic digitizing. Images will therefore be read by a TV camera (120 000 elements per image) and the video signal will be recorded by an AMPEX FR 1900 system. The analog-digital conversion will be accomplished by HP digitizer. The flow of data which are submitted to digital computer processing is depicted in figure 3. At the time of the investigation INPE digital computer hardware will consist of a Burroughs 3500, Burroughs 6700 and Hewlett Packard 2116 computer system. In addition to line printers, two plotters will be available.

3.1.3 Photo Reproduction

Reduction and enlargement of some images will be made; conventional instrumentation and techniques from INPE photography laboratory will be used.

3.1.4 Data Products

Data products will consist mainly of images. Therefore enhanced photos, color, symbol and diget coded displays and maps will be produced.

3.2 DATA REQUIREMENTS

3.2.1 Product Requirement

Most of our work will be based on bulk products and we will request precision just for those areas were one can find ground control points (about 20% of Brazil territory). We antecipate a small amount of color composite products just for comparison with the compositions we can get with our additive viewer.

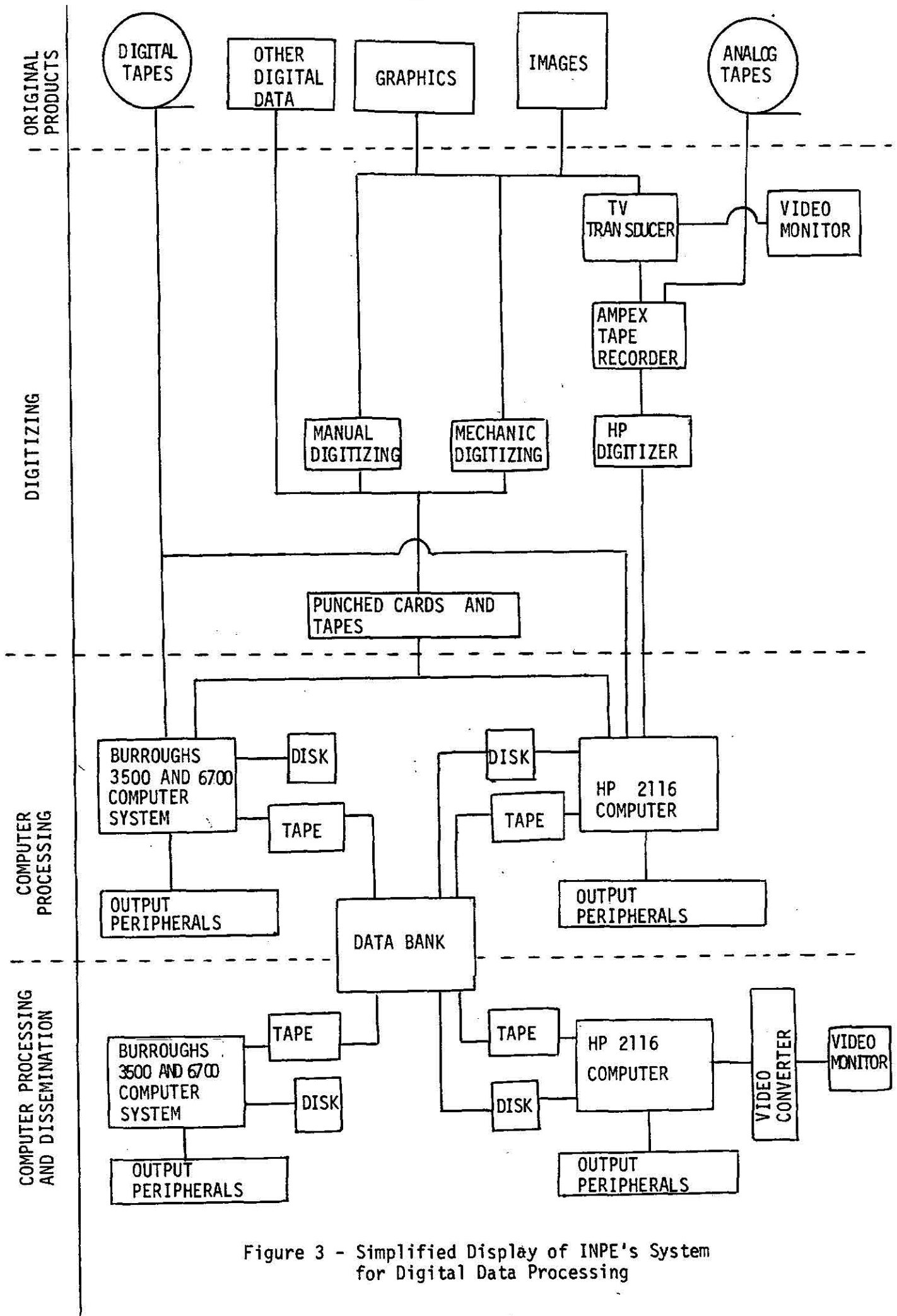


Figure 3 - Simplified Display of INPE's System for Digital Data Processing

3.2.2 DCS Requirements

The ERTS Data Collection System is not to be used in our experiments.

3.2.3 Ground Truth Requirements

For the Amazonic Basin and Northeast of Brazil we will use as "ground truth" the RADAM project SLAR imagery. For the rest, that corresponds to a better known area, we will deal with data we have been collecting since 1969 and whenever necessary we will get supporting data with field work and our aircraft.

1.0 MANAGEMENT ORGANIZATION AND PERSONNEL

The Instituto de Pesquisas Espaciais - INPE (Brazilian Space Agency), a branch of the National Research Council, is the principal Brazilian civilian agency for space research. From early days it has been carrying out research on several projects grouped in two sectors: Fundamental and Applied. At the present there are over 600 full time employees working at INPE. About half of them hold college degrees, with a growing percentage of MSc's and PhD's.

Within the Applied Research projects there is one related to Remote Sensing, the SERE project. Its disciplinary activities planned for the next years are shown in Appendix B. Project SERE's personnel resources are indicated below in this proposal (see item 3.0). In addition the INPE maintains agreement with the following Brazilian Government agencies which participate with investigators:

- . The Ministry of Mining and Energy through its National Department of Mineral Production and its Department of Water and Electrical Energy.
- . The Ministry of Agriculture through the Institute for Agricultural Research and Experiment.
- . The São Paulo State Secretary for Agriculture, through the Agronomical Research Institute of Campinas and the Institute of Agronomical Economy.
- . The University of São Paulo through its Oceanographic Institute.
- . The Brazilian Navy through its Hydrographic Office.
- . Brazilian Institute of Coffee.
- . The São Paulo State Secretary for Economics and Planning.
- . The Ministry of the Interior.

2.0 RESOURCE REQUIREMENTS

2.1 CAPITAL EQUIPMENT

INPE's Laboratory instrumentation is characterized by

the needs of the different functional groups. It includes:

- . Optics and electronics.
- . Data bank and ground truth for the various disciplines.
- . A photo lab with:
 - Automatic black and white processing of up to 9.5 inch wide films.
 - Semi-automatic color film processing up to 9.5 inch wide films.
 - LogElectronic Printing up to 9.5 inches wide.
 - Color and black and white enlargement.
- . Analog/digital data system with the following computers:
 - HP2116B with HP2311C, ADC subsystem with Waltham 56/DA.
 - HP2791A, Pacer for high speed action acquisition.
 - EAI680 Hybrid.
 - B-3500.
 - B-6700.
- . Our first aircraft (PP-ZCN) is a two-engine, low wing type, modified to carry passive sensor equipment, including the following:
 - Wild RC-10 Metric Camera.
 - Hasselblad 500 EL/70 Four Camera Cluster.
 - Bendix LN-3 Thermal Mapper (3 to 5 and 8 to 14 μ bands).
 - Barnes PRT-5 Precision Radiation Thermometer.
 - Ampex AR-1600 Tape Recorder.
 - Bendix AN/APN 184 Radar Altimeter.
 - I²S Four lenses Camera.
 - Bendix DRA-12 Doppler Radar.
 - Bendix M-4C Automatic Pilot.
 - Time Code Generator, Auxiliary data automation system.
 - RNA-26C VHF navigation receiver.

In addition INPE is installing at the Brazilian Territory in agreement with NASA, an ERTS Ground System. The Receiving and Recording Site will be operational by the first quarter

of 1973; the Image Processing Site by the third quarter of 1973.

2.2 DCS EQUIPMENT

It will not be used.

3.0 PERSONNEL

The Remote Sensing Project is divided into 6 groups: Soil Resources; Mineral Resources, Sea Resources, Geography, Automatic Data Interpretation and Technical and Logist Support.

At the moment we have the following groups of specialists at our Remote Sensing Project:

Agronomists	12
Geologists	07
Oceanographers	09
Geographers	04
Electronics Engineer/Physicists	08
Pilots	02
Electronic Technicians	03
Aerophotogrammetrist	01
System Analysts	03
Librarian	01
Secretaries	04

The SERE project receives also support of other branches of INPE, such as Electronics Laboratories, Computer Center, Photo Lab, etc.

The curriculum vitae of all the personnel involved in this proposal follows.

- c) From March 1959 to December 1961 studied at Stanford University with a Scholarship from the Brazilian Government with a leave of absence from the Air Force, obtaining a PhD in Radio Science.

3. Employment Record

Besides the above referred to experience in the Brazilian Air Force:

-During 1962 at Stanford as a Research Associate and then as a Visiting Scientist with a NASA Research Grant continued to do work on ionospheric physics and at same time planned the establishment of a Brazilian space research institution for the Space Activities Commission which was created with the National Research Council of Brazil.

-1963 - As former Scientific Director and present General Director of the National Commission for Space Activities (which as of April, 1971 has become the Institute of Space Research) and Director of the Space Center in São José dos Campos has managed to create a modern center with the organization based on systems approach techniques. This research center has over 620 people presently, including 209 with university degrees and all of them from the top third of their graduating classes. Excepting the ones holding PhD degrees (26 in October 1971) all the others are studying part time for higher degrees, including 40 in the best universities of the United States, France and England.

Dr. Mendonça is an active member in a number of international organizations, including Experimental Interamerican Meteorological Rocket Network (EXAMETNET), COSPAR, and International Radioscience Union (URSI). Has participated in many international meetings, and has published over 60 report and papers.

4. Proficiencies in Foreign Languages (Mother Tongue: Portuguese)

English: Write: Excelent

Speak: Excelent

Read: Excelent

French: Read: Good

Write: -

Speak: -

German: Read: Average

Write: -

Speak: -

Spanish: Read: Good

Write: -

Speak: Good

CURRICULUM VITAE
OF
EDSON BAPTISTA TERACINE

1. Personal Data

Nationality: Brazilian
Date of Birth: June 22, 1937
City: Pirassununga
State: São Paulo
Civil Status: Married

2. Schools Attended:

Senior High School (1953-1954)	Army Cadet Preparatory School - São Paulo
University: (1955-1957)	Military Academy of Agulhas Negras - Agulhas Negras, Rio de Janeiro. Degree obtained: lieutenant in December 1957. Classification: 1st place in class.
December 1960:	Entrance exam for engineering courses.
Feb. 1961 to Nov. 1961	Engineering Revision course. Due to qualifications, was permitted to enter the third year directly.
1962 to 1964:	Engineering Military Institute, Rio de Janeiro Degree obtained: Telecommunications engineer. Terminated course with mention of very Good.
Jan. 1967 to Sept. 1968:	National Space Activities Commission (CNAE) and the Air Force Technical Institute, São Jos dos Campos. Degree received: Master in Space Science (M.Sc.).
Sept. 1968 to Jan. 1969:	Pennsylvania State University, Pennsylvania, U.S.A. Doctoral program. Although term was completed with maximum grades for a full time course schedule, withdrawal was necessary due to personal reasons.

3. Employment Record:

Jan. 1958 to Oct. 1965	Brazilian Army official, specialized in Communications Engineering, leaving the Army as Captain (promoted in December 1964).
Jan. 1969 to Oct. 1965	Ceará State Telecommunications Co., Ceará. Worked in the projects and installation of the State Telecommunications System (VHF & UHF).
Oct. 1965 to Dec. 1966	Philips of Brazil (IMBELSA Division), São Paulo. Manager of the VHF and SSB lines, projects in telecommunications systems in VHF, SSB and Microwaves. I had the opportunity to participate in the projects and installation of telecommunications systems in various Brazilian states: São Paulo (COTESP, São Paulo Electric Co., Brinks, BRADESCO, Santos-Jundiaí, Railroad, etc.); Minas Gerais (USIMINAS, CEMIG, Transport Department, Public Security Department, Development Commission of Jequitinhonha, Valley, etc.); Bahia: (TEBASA, White Martins, etc.); Rio Grande do Sul; Paraná (TELEPAR); Pernambuco; Rio Grande do Norte (TELEFERN); Maranhão; Piauí; Amazonas; Paraíba; etc.. Participated in the initial study of telecommunications systems for the Southern Branch of the Brazilian Telecommunication Company (EMBRATEL) and the competition for installation of same, which was completed the end of 1966 (Thomson-Houston-Phillips). Left the company for continuation of academic studies.
Jan. 1967 to Dec. 1967	National Space Activities Commission (CNAE) São José dos Campos, São Paulo. Study, using Doppler and Farady effects, of electron content of the ionosphere of lower latitudes by means

reception of signals (40, 41 and 360 MHz) emitted by satellites BEB and BEC. Study of ionospheric irregularities by means of scintillation of signals (40 and 41 MHz), emitted by satellites BEB and BEC.

Project and coordination of construction of a VHF polarimeter (136 and 408 MHz) for measurement of electron content and scintillation by studying signals emitted by geostationary satellite ATS-3.

Study of determination of electron density profiles by means of Doppler effect in signal emitted by rockets passing through the ionosphere.

Study of distribution of space, temporal, and origin of interplanetary debris (meteorites, meteoroids, micrometeorites, micrometeoroids, etc.)

Jan. 1968 to
Sept. 1968

National Space Activities Commission (CNAE), São José dos Campos, Same as during the period of January 1967 to December 1967.

Coordination of post-graduate course in Physics of the Higher Atmosphere. Participation as professor, in the course.

Organization of post-graduate courses at the National Space Commission; elaboration of the first catalog of courses and rules that regulate post-graduate activities.

Sept. 1968 to
Jan. 1969

Pennsylvania State University, U.S.A. Study of the electron contents of the ionosphere by means of Faraday and Doppler effects. Study of planetary atmosphere.

Feb. 1969 to
June 1969

National Space Activities Commission (CNAE), São José dos Campos.

Assistant in the course of Higher Atmosphere Physics.

Study of polarization of electromagnetic waves in propagation in the ionosphere by utilization of the ionosphere model. Determination of propagation regions QL and QT.

Organization of the Scientific - Cultural Section of the National Space Activities Commission.

Collaboration in orientation of Master Thesis work in Ionosphere Propagation.

July 1969 to
Oct. 1969

National Space Activities Commission (CNAE).
Same as the period of February 1969 to June 1969.

Professor of post-graduate course in Ionosphere Propagation.

Oct. 1969 to J
June 1971

Institute for Space Research (INPE), Assistant to the Scientific Director.

Technical-administrative activities which made possible the acquisition of an ample scientific-technical background.

Since the beginning of 1971, coordination of the preliminary project study of a telecommunications system with satellite, with the main objective of mass media education via educational radio and TV. The group under supervision consists of nineteen elements including sociologists, pedagogues, engineers and economists.

Aug. 1971

Institute for Space Research (INPE), Remote Sensing Manager.

4. Publications:

- Introduction to the Study of the Nature of Interplanetary Debris
Scientific Report - National Space Activities Commission - 1967.
- Atmosphere of Mars - Scientific Report - National Space
Activities Commission - 1968.
- Observation of the Ionosphere of the Lower Latitudes by Means of
Satellites. Part I: Faraday Differential: Fundamentals. Part
III Study of Models of Electron Density Profiles.

5. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English:	Write:	Average
	Speak:	Good
	Read:	Very Good
French:	Write:	Average
	Speak:	Good
	Read:	Very Good
Spanish:	Write:	Good
	Speak:	Good
	Read:	Excellent
Italian:	Write:	Poor
	Speak:	Average
	Read:	Good

CURRICULUM VITAE
OF
JOÃO BOTELHO MACHADO

1. Personal Data:

Nationality: - Brazilian

Date of Birth: - April 21, 1917

City: - Rio de Janeiro

State: - Guanabara

Civil Status: - Married

Obs.: Vice-Admiral - Naval Engineer - from the Brazilian Reserve
since September 21, 1966.

2. Schools Attended

Brazilian Naval School - 4 years - finished in 1938

Degree: Navy Officer

U.S. Naval Post-Graduate School - 2 years - finished in June 1951

Degree: B.S.

Major Field: Electricity Engineering

Purdue University: - 1 year - finished in June 1952

Degree: M.S.

Major Field: Electricity Engineering

Naval War School - 1 year - finished in December 1958

Degree: -

Major Field: Logistics

3. Employment Record:

"Navios da Marinha Brasileira" (Ships from the Brazilian Navy)

Officer 7 years - from March 1939.

"Diretoria do Ensino da Marinha" (Marine Teaching Directorate)

Officer 3 years - from May 1946

"Universidades" (Universities) - Student - 3 years - from June 1949

"Fábrica de Torpedos da Marinha" (Brazilian Navy Torpedo Factory)

Head of the Technical Division and of the Industrial Department

7 years - from August 1952.

"Diretoria de Armamento da Marinha" (Brazilian Naval Army Division)
Head - 1 year and a half - from September 1959.
"Arsenal de Marinha do Rio de Janeiro" (Rio de Janeiro Marine Arsenal)
Head - 3 years - from March 1961.
"Fábrica de Torpedos da Marinha" (Brazilian Navy Torpedo Factory)
Director - 3 years - October 1964.
"Instituto de Pesquisas Espaciais" (Institute for Space Research)
INPE - Member of the Executive Group - since March 1962 up to now.
"Instituto de Pesquisas Espaciais" (Institute for Space Research)
INPE - Remote Sensing Project - Manager - since January 1968 up to now.

4. Other Courses

"Training of Remote Sensing Project Management" - Manned Spacecraft Center - Houston, Texas - 1968.

5. Publications

- Projeto Sensores Remotos - 1º relatório - 1967 - CNAE - J.B.Machado
- "Plano de Cooperação" - Projeto Sensores Remotos - CNAE - J.B. Machado.
- Projeto Sensores Remotos - 2º Relatório - 1968 - CNAE - J.B.Machado
- "Esboço de Programa de Pesquisa em Sensoriamento Remoto de Recursos Naturais" - Relatório Técnico LAFE-073, by J.B.Machado - June 1968
- "Elementos de Sensores Remotos e suas Aplicações" - Publicação LAFE -79, by Placidino M.Fagundes, João B.Machado e F.de Mendonça - September 1968
- "Programa de Sensores Remotos" - Face C - Plano da Missão da Aeronave - Publicação LAFE-87 and LAFE-87A - June 1969.
- "Description of the Brazilian Program for Remote Sensing of Earth Resources" - Technical Report LAFE-90 - by J.B.Machado - July 1969.

6. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: read: good
 write: average
 speak: average
French: read: good
 write: average
 speak: average

7. A Member of :

"Sociedade Honorária - TAU BETA PI" - since 1951
"Sociedade Brasileira de Engenharia Naval" - since 1963
"Clube de Engenharia" - since 1964.

CURRICULUM VITAE
OF
ABILIO CEZAR TARDIN

1. Personal Data:

Nationality: Brazilian
Date of Birth: December 4, 1943
City: Mimoso do Sul
State: Espírito Santo
Civil Status: Married

2. School Attended:

Name: Universidade Federal de Viçosa (UFV)
Location: Viçosa, Minas Gerais, Brazil
Date: Jan. 1963 to Dec. 1966 and
Jan. 1967 to Dec. 1968
Degrees: (Agronomy Course) B.S. (Awarded in Dec. 1966)
M.S. (Animal Science) (Awarded in Dec.
1968)
Major Field: Forages and pasture crops.

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and speak: average
Read: good
Spanish: Write and speak: average
Read: good

4. Travelling Experience

Uruguay and Argentina (28/06/68 to 10/03/69)
attending a Congress.

5. Employment Record

- Auxiliary Research Worker of the Department of Animal Science Escola Superior de Agricultura, U.F.V. - 1968.
- Instructor of Animal Nutrition - Department of Animal Science Escola Superior de Agricultura, U.F.V. - 1968.
- Assistant Professor of Forages and Pasture Crops at Faculdade de Medicina Veterinária e Agronomia de Jaboticabal, São Paulo 1969-1970.
- Research Assistant of the Institute for Space Research (INPE) which I joined in January 1971.

6. Publications

- Nutritive value of Guatemala-grass (Tripsacum sp) at different clipping ages - Viçosa, Revista Ceres 16(89): 141-147 - 1969.
- Effects of molasses level on the quality of elephant-grass silage (in press).
- Seasonal growth rate of Guatemala-grass (Tripsacum sp), Viçosa, Universidade Rural Minas Gerais, 1968, 37 p. (Ms.Thesis).

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CURRICULUM VITAE

OF

ANTÔNIO TEBALDI TARDIN

1. Personal Data:

Nationality: Brazilian
Date of Birth: May 15, 1945
City: Ponte de Itabapoana
State: Espírito Santo
Civil Status: Single

2. School Attended

Name: "Universidade Federal de Viçosa" - Viçosa - MG
Location: Viçosa - MG
Dates: (4 years)- 1968
Degree: Agronomist
Major Field: Agronomy

Name: "Universidade Federal de Viçosa" - Viçosa - MG
Location: Viçosa- MG
Dates: (2 years) - 1971
Degree: M.S.
Major Fields: Soils

3. Employment Record:

- Institute for Space Research - INPE (Ex-CNAE) - Since 1971

4. Publication:

- "Respostas da Soja Perene (Glycine Janamica) à Calagem. Inoculação e Adubação Fosfatada e Potássica" - Ms.Thesis) - Agronomy.

5. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: read: good
write: average
speak: average

6. Training Periods

"Universidade Federal de Viçosa" - Extension Course on Beef Cattle
8 days , 1968.

"Centro de Experimentação, Pesquisa e Extensão do Triângulo Mineiro"
Agronomical Researches - 20 days - 1970.

CURRICULUM VITAE
OF
ALMIR GOMES DE SOUZA

1. Personal Data

Nationality: Brazilian
Date of Birth: March 5, 1946
City: Jerônimo Monteiro
State: Espírito Santo
Civil Status: Single

2. School Attended:

Name: Universidade Federal Rural do Rio de Janeiro
Location: Antiga Rodovia Rio-São Paulo - km 47 - Brazil
Dates: Jan. 1966 to Dec. 1969
Degree: (Engineering Course) B.S. (Awarded in Dec. 1969)
Major Field: Agricultural Engineering

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Read: good
Write and Speak - average
Spanish: Read: good
Write and Speak - poor
French: Read: Average
Write and Speak - poor

4. Employment Record

Actually I am working as Research Assistant of the Institute
for Space Research (INPE) which I joined in January 1970.

CURRICULUM VITAE
OF
MARIO VALÉRIO FILHO

1. Personal Data

Nationality: Brazilian
Date of Birth: 07 May, 1946
City: Tremembé
State: São Paulo
Civil Status: Single

2. School Attended:

Name: "Universidade Federal Rural do Rio de Janeiro, Escola Nacional de Agronomia".
Location: km 47 da antiga Rodovia Rio-São Paulo, Rio de Janeiro - Brazil
Dates: January 1966 to December 1969
Degree: (Engineering Course) B.S. (Awarded in Dec. 1969)
Major Field: Agricultural Engineering

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Read - Average
Write and Speak: poor
Spanish: Read - Average
Write and Speak: Poor

4. Employment Record:

I am working as a Research Assistant of the Institute for Space Research (INPE) which I joined in January 1970.

CURRICULUM VITAE

OF

DYCKSON DIAS DE SOUZA

1. Personal Data:

Nationality: - Brazilian
Date of Birth: - January 6, 1946
City: - Araruama
State: - Rio de Janeiro
Civil Status: - Single

2. School Attended:

Name: "Universidade Federal Rural do Rio de Janeiro, Escola Nacional
de Agronomia"
Location: Km-47 da Antiga Rodovia Rio-São Paulo, Rio de Janeiro-Brasil
Dates: January 1966 to December 1969
Degree: (Engineering Course) B.S. (Awarded in Dec. 1969)
Major Field: Agricultural Engineering

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: read - average
 write and speak - average
Spanish: read - good
 write and speak - average

4. Employment Record:

I am working as a Research Assistant of the Brazilian Space Commission (CNAE) which I joined in January 1970.

CURRICULUM VITAE
OF
GETÚLIO TEIXEIRA BATISTA

1. Personal Data:

Nationality: Brazilian
Date of Birth: October 17, 1948
City: Apiaçã
State: Espírito Santo
Civil Status: Single

2. School Attended:

Name: "Universidade Federal Rural do Rio de Janeiro, Escola Nacional de Agronomia"
Location: km 47 da Antiga Rio São Paulo, Rio de Janeiro, Brazil
Dates: Jan. 1967 to Dec. 1970
Degree: (Engineering Course) B.S. (Awarded in December 1970)
Major Field: Agricultural Engineering

3. Proficiency in Foreign Language (Mother Tongue: Portuguese)

Spanish: Read: good
Write and Speak: average
English: Read: average
Write and Speak: poor

4. Employment Record:

I am working as a Research Assistant of the Institute for Space Research (INPE) which I joined in January 1971.

CURRICULUM VITAE

OF

CARLOS VICENTE BARBIERI PALESTINO

1. Personal Data:

Nationality: Brazilian

Date of Birth: March 31, 1949

City: Cruzeiro

State: São Paulo

Civil Status: Single

2. School Attended:

Name "Universidade Federal Rural do Rio de Janeiro - Escola Nacional de Agronomia".

Location: km 47 da Antiga Rodovia Rio-São Paulo, Rio de Janeiro, Brazil

Dates: January 1967 to December 1970

Degree: (Engineering Course) B.S. (Awarded in Dec. 1970)

Major Field: Agricultural Engineering

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Read: Average

Write and Speak: Poor

Spanish: Read: Average

Write and Speak: Poor

4. Employment Record

I am working as Research Assistant of the Institute for Space Research (INPE) which I joined in January 1971.

CURRICULUM VITAE
OF
MOSTAFA KANEL NOSSEIR

1. Personal Data:

Nationality: Egyptian
Date of Birth: February 10, 1943
City: Cairo - Egypt
Civil Status: Single

2. School Attended:

University of Alexandria - 4 years - finished in 1964
Degree: Agronomy Course - B.S.
Major Field: Agronomical Engineer

3. Employment Record:

Regwa Company - Egypt - Soil Research - one year - 1965
General Desert Development Organization (GDDO) - Egypt - Specialist
in Soils 2 years - 1966
F.A.O. and G.D.D.O. - Egypt - Vegetal Ecology and Soil Conservation
3 years - 1968.
G.D.D.O. (Egypt) - Manager of this sector - M.Matruth - one year - 1970
Institute for Space Research - INPE - Research - since May 1971.

4. Publications

- "Establishment of Shelter Belts and Windbreaks under Watering by Flooding"- November 1968
- "Establishment of Windbreaks under Terracing Watering System in Bed of Valley" - November 1968.
- "Establishment of Windbreaks under Spreading Systems" - Dec.1968.
- "Establishment of Windbreaks under Terracing System" - Jan.1969.
- "Fixation and Afforestation of Maritime Sand Dunes" - Jan. 1969.

5. Proficiency in Foreign Languages (Mother Tongue: Arabe)

English: Read: good

Write: good

Speak: good

German: Read: good

Write: good

Speak: good

CURRICULUM VITAE
OF
NILTON TOCICAZU HIGA

1. Personal Data :

Nationality - Brazilian
Date of Birth - December 31, 1948
City - Campo Grande
State - Mato Grosso
Civil Status: Single

2. School Attended

Name: "Universidade Federal Rural do Rio de Janeiro"
Location: Itaguai, Rio de Janeiro - Brazil
Dates: Jan. 1969 to December 1972
Degrees: B.S. in Agronomy Engineering (Awarded in Dec. 1972)
Major Field: Agronomy

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and Speak: Poor
 Read: Average
Spanish: Write and Speak: Average
 Read: Good

4. Employment Record

I have been working at INPE (Brazilian Space Agency) since Jan./1973.

CURRICULUM VITAE

OF

YOSIO EDEMIR SHIMABUKURO

1. Personal Data

Nationality: Brazilian

Date of Birth: April 1, 1950

City: Santos

State: São Paulo

Civil Status: Single

2. School Attended:

Name: "Universidade Federal Rural do Rio de Janeiro"

Location: Itaguaí, Rio de Janeiro, Brazil

Date: Jan. 1969 to Dec. 1972

Degree: B.S. in Forestry Engineering

(Awarded in Dec. 1972)

Major Field: Forestry

3. Proficiency in Foreign Languages: (Mother Tongue: Portuguese)

English: Write and Speak: Poor

Read: average

Spanish: Write and Speak: average

Read: Good

4. Employment Record

I have been working at INPE (Brazilian Space Agency) since Jan./1973

CURRICULUM VITAE

OF

ARMANDO PACHECO DOS SANTOS

1. Personal Data:

Nationality: Brazilian

Date of Birth: September 10, 1949

City: Santos

State: São Paulo

Civil Status: Single

2. School Attended:

Name: "Universidade Federal Rural do Rio de Janeiro"

Location: Itaguai, Rio de Janeiro, Brazil

Date: Jan. 1969 to Dec. 1972

Degrees: B.S. in Forestry Engineering (Awarded in Dec. 1972)

Major Field: Forestry

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and Speak: poor

Read: average

Spanish: Write and Speak: average

Read: Good

4. Employment Record:

I have been working at INPE (Brazilian Space Agency) since January, 1973.

CURRICULUM VITAE OF
OF
VITOR CELSO DE CARVALHO

1. Personal Data:

Nationality: Brazilian
Date of Birth: December 21, 1949
City: Rio de Janeiro
State: Guanabara
Civil Status: Single

2. School Attended:

Name: "Universidade Federal Rural do Rio de Janeiro"
Location: Itaguai, Rio de Janeiro, Brazil
Date: Jan. 1969 to Dec. 1972
Degrees: B.S. in Agronomy Engineering
(Awarded in Dec. 1972)
Major Field: Agronomy

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and Speak: poor
Read: average
Spanish: Write and Speak: average
Read: good

4. Employment Record

I have been working at INPE (Brazilian Space Agency) since January 1973.

CURRICULUM VITAE
OF
GILBERTO AMARAL

1. Personal Data:

Nationality: Brazilian

Date of Birth: February 20, 1939

City: São Paulo

State: São Paulo

Name of Wife: Ligia Assumpção Amaral

2. School Attended:

Name: University of São Paulo (USP)

Location: São Paulo - SP - Brazil

Duration: February 1959 to December 1962

Degree: B.S. in Geology

3. Military Situation:

São Paulo, Army R.O.T.C. - Infantry - 1958-1960

4. Proficiency in Foreign Languages: (Mother Tongue: Portuguese)

English: Write and Speak: Good

Read: Good

Spanish: Write, Speak and Read: Good

French: Read: Good

Write and Speak: Poor

Italian: Read: Good

Write and Speak: Poor

Russian: Basic Knowledge

5. Professional Training before Degree

- Applied Geophysics (Gravimetry and Electro-resistivity) - 1962 (3 months) with Dr. Rudolf Kollert of Aktiebolag Elektrisk Malmletning (Stookholm - Sweden) - São Paulo.

- Petroleum Geology - 1962 (four months) - Petrobrás, Amazon Region.

6. Extension and Specialization Courses before Degree

- Introduction to General Pre-History - 1960
- Astrobiology - 1960
- Micropalaentology - 1961

7. Post-Graduation, Specialization and Extension Courses after Degree

- Electrical Log Interpretation - 1963
- Geochronology - 1964
- Geotecnics - 1965
- Post-Graduation in Geology and Palaentology - 1966
- " " in Petrology - 1967
- Computer Scientific Programming - 1967
- Scientific Methodology - 1968
- Geology of Brazil - 1969
- Advanced Course in Scientific Computer Programming - 1969.

8. Professional Experience

- Petroleum Geologist - 1963 - At Petrobrás (Brazilian State Oil Company)
- Assistant Professor - 1964 - 1967 - Department of Geology and Palaentology - University of São Paulo.
- Assistant Professor - 1967 - 1968 - Politechnical School - University of São Paulo.
- Doctor Assistant Professor - 1968 - 1970 - Politechnical School - University of São Paulo.
- Doctor Assistant Professor - 1970 up to now - Institute of Geosciences and Astronomy - University of São Paulo.
- Consultant - 1971 up to now - Institute for Space Research (INPE)
- Chief-Researcher - 1970 up to now - Geochronology Research Center - University of São Paulo.

9. Teaching Experience

Graduation Courses

- Economic Geology - 1964-1967
- Historical Geology - 1965 and 1971
- Engineering Geology - 1968-1970
- Stratigraphy - 1968-1970
- Mineralogy - 1970
- Geology of Brazil - 1971

Post-Graduation Courses

- Highway Engineering Geology - 1968
- Mineralogy - 1968
- Geology - 1968
- Geochronology - 1968
- Computer Applications to Geology - 1970-1971
- Stratigraphy and Tectonic of South-America Precambrian - 1971
- Amazon Geology - 1971
- Geological Data Processing - 1971.

10. Completed Researcher (still unpublished)

- Detailed Geochronological Study of the Jacupiranga Alkaline Complex.
- Geobotanical Studies at Vazante, State of Minas Gerais
- Occurrence of Authigenic Albite in Limestones at Uruaçu, State of Goiás
- Study on the Extension of the Pre-Devonian Acidic Volcanism at the Borders of the Paraná Sedimentary Basin (colaborator).
- Geochronological Study on the Tectonic Development of Peru (main researcher)
- Application of Trend Surface Analysis to Geological Problems (main researcher).
- Study of the Sedimentary Complex at the Rio Doce Mouth (colaborator).

11. Published Papers

- Amaral, G., Cordani, U.G., Kawashita, K. and Reynolds, J.H. - 1966
Potassium-Argon Dates of Basaltic Rocks from Southern Brazil,
Geoch. Cosmoch. Acta 30:159-189.
- Amaral, G., 1966 - Isótopos de Chumbo e Gênese das Jazidas de Vazan-
te e Itacarambi (Res.) Publ. 1 do Núcleo do Rio de Janeiro da So-
ciedade Bras. Geol., p. 45.
- Amaral, G., 1966 - Idade de Rochas Sedimentares pelo Método Potás-
sio-Argônio (Res.). Publ. nº 1 do Núcleo do Rio de Janeiro, Soc.
Bras. Geol., p. 80.
- Amaral, G., 1966 - Idade do Distrito Alcalino de Jacupiranga (Res.).
Publ. nº 1 do Núcleo do Rio de Janeiro da Soc. Bras. Geol., p.81.
- Amaral, G., Bushee, J., Cordani, U.G., Kawashita, K. and Reynolds,
J.R. - 1967. Potassium-Argon Ages of the Alkaline Rocks from
Southern Brazil. Geoch. Cosmoch. Acta 31:117-142.
- Amaral, G., 1967 - Potassium-Argon Age Measurements on Some Brazilian
Glaucónites. Earth and Planetary Science Letters 3:190-192.
- Amaral, G., - 1967 - Programação FORTRAN para Cálculo Normativo em
Computador. Bol. Parana de Geociências nº 26, pp 46-47.
- Amaral, G., 1967 - Programa para Cálculos Petroquímicos em Computa-
dor (norma e valores de Niggli). Anais do XXI Congr. Bras. de
Geol., pp. 113-118.
- Amaral, G., Kawashita, K. - 1967 - Idade do Grupo Bambuí- Bol. Parana.
de Geociências nº 26, pp. 39-40.
- Amaral, G., Kawashita, K., 1967 - Determinação da Idade do Grupo
Bambuí pelo Método Rb-Sr. Anais do XXI Congr. Geol., pp. 214-217.
- Amaral, G., Damasceno, E.C., 1967 - Nota Sobre a Ocorrência de Mine-
rais de Prata da Serra do Cantinho, Município de Januária, MG -
Gemologia 11 (36):13-18.
- Amaral, G., 1968 - Contribuição ao Conhecimento dos Depósitos de Zn-
Pb-Cu-Ag de Vazante, Estado de Minas Gerais. Anais do XXII
Congre Bras. de Geol. (em impressão).
- Amaral, G., 1968 - Aplicação do Estudo sobre a Composição Isotrópi-
ca do Chumbo a Problemas Metalogenéticos: Estudo de Depósitos En-
caixados do Grupo Bambuí. Anais do XXII Congr. Bras. Geol. (em
impressão).

Amaral, G., Rocha-Campos, A.C. - 1970 - Edades K-Ar de la "Serie Porfirítica" en la Precordillera y Cordillera Frontal de Mendoza. Rev. Ass. Geol. Argentina (no prelo).

Amaral, G., Rocha-Campos, A.C. - 1970 - K-Ar Ages of Igneous Rocks of the Mitu Group, Huancayo Region, Central Peru. Bol. del Serv. Geol. Min. (no prelo).

12. Participation in Congress

1964 - XVIIth annual Meeting of the Brazilian Society of Geology - Poços de Caldas, State of Minas Gerais.

Presented paper - "Age of the Alkaline Rocks of Southern Brazil".

1966 - XXth Annual Meeting of the Brazilian Society of Geology - Vitória, State of Espírito Santo.

Presented papers - "Lead Isotopes and Ore Genesis of the Vazante and Itacarambi Deposits" - "Potassium-Argon Age Determination of Sedimentary Rocks" - "Age of the Jacupiranga Alkaline Complex".

1967 - XXIth Annual Meeting of the Brazilian Society of Geology - Curitiba, State of Paraná.

Presented papers - "Age of the Bambuí Group"
"FORTRAN Program for Petrochemical Calculations"

1968 - XXIIth Annual Meeting of the Brazilian Society of Geology - Belo Horizonte - State of Minas Gerais.

Presented papers - "Preliminary Results for Lead Isotopic Determinations on Galenas from Deposits of the Bambuí Group"
- "Ore Genesis of the Vazante Zinc-Lead Deposit".

1968 - IInd Week for Geological Studies of the State of São Paulo.

1969 - XXIIIrd Annual Meeting of the Brazilian Society of Geology - Salvador - State of Bahia.

Presented Papers - "Permo-Triassic Boundary in South-America"
"Preliminary Note on the Geochronological Reconnaissance of the Amazon Region Precambrian".

- 1969 - XXIVth Annual Meeting of the Brazilian Society of Geology-
Brasilia - Federal District
Presented Papers - "Potassium-Argon Ages for the Huancayo
Region Peru"
"Trend Surface Analysis Applied to the Study of the Basaltic
Differentiation of the Paraná Basin".
"Trend Surface Analysis Applied to Geological Problems".
- 1970 - Conference on Solid Earth Problems - Buenos Aires, Argentina
Presented Papers - "Precambrian Evolution of South America"
"Regional Differentiation of the Basaltic Rocks of Paraná
Basin"
"Potassium-Argon Age Determinations on the Jacupiranga
Alkaline Complex"
- 1970 - First Latin-American Geological Congress - Lima, Peru
Presented Papers - "Potassium-Argon Ages of the Andean Region
of Peru and Argentina".
"Precambrian Evolution of the Amazon Region"

13. Travelling Experience

- Geological trips in the States of São Paulo and Minas Gerais -
Several times from 1961 up to now.
- Field trip to the Amazon Region - 4 months - 1962.
- Field trips on the Alagoas - Sergipe Sedimentary Basin - 1963
- Field trip across the Brazilian Northeastern - 1964
- Field trip to the Rio Grande do Sul State - 1964.
- Field trip to central Goiás State - 1965
- Field trip to the Espírito Santo State - 1966
- Field trip to the Paraná State - 1967
- Field trip to the Bahia State - 1969
- Field trip to Goiás State and Brasília Federal District - 1970
- Field trip to the Sierras Australes Region, Argentina - 1970
- Field trip to the Huancayo Region, Peru - 1970

14. Award

In 1966 received the "Silver Hammer" award from the Brazilian
Geological Society.

CURRICULUM VITAE
OF
SERGIO KUNIO YAMAGATA

1. Personal Data:

Nationality: Brazilian
Date of Birth: March 13, 1949
City: Campos
State: Rio de Janeiro
Civil Status: Single

2. School Attended:

Name: "Instituto de Geociências e Astronomia" - São Paulo University
Location: São Paulo - Brazil
Dates: January/67 - December/70
Degree: Geologist
Major Field: Geology

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Read, Write and Speak: average
Spanish: Read: Good
Write and Speak: Average

4. Travelling Experience

All over Brazil
Field works as degree-credits mostly in Southern Brazil.

5. Experience acquired before graduation

Cooperative non-credit work at the Mineralogy and Petrology Department of the "Instituto de Geociências e Astronomia da USP" during one year and a half.

6. Employment Record

Institute for Space Research (INPE) - January 1971.

CURRICULUM VITAE
OF
JOSE BONIFÁCIO DE ALMEIDA E SOUZA

1. Personal Data:

Nationality: Brazilian

Date of Birth: June 5, 1940

City: Itabuna

State: Bahia

Civil Status: Single

2. School Attended:

Name: Escola de Geologia - Universidade Federal da Bahia

Location: Salvador, Bahia, Brazil

Date: April 1961 to Dec. 1965

Degrees: (Geology) BSc. (Awarded in Dec. 1965)

University of Warsaw

September 1968 to Dec. 1970

(Geophysics) M.S. (Awarded in Dec. 1970)

Major Field: Geophysics.

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and speak: average

Read: good

Spanish: Write and speak: average

Read: good

French: Speak and Read: average

Polish: Speak and Read: average

4. Travelling Experience

Uruguay, Argentine, Paraguay, (1965) and Venezuela (1970) Tourism
Polland, France, German, Sovietic Union, Portugal (1969);
Scientific Visit.

5. Employement Record:

- Teacher of Physics and Mathematics in several high school in
Salvador - Bahia - until 1965.
- Economic Geological Researcher of the refractory minerals - Indústrias
Brasileiras de Artigos Refratários - IBAR - São Paulo - 1966.
- Economic Geological Research of the industrial minerals. Minérios
do Brasil S.A. - MINEBRA - 1967.
- Geotecmician - Sondotécnica Engenharia de Solos S.A. - Rio de Janeiro
1967.
- Photointerpreter - Texas Instruments Inc. Rio de Janeiro - 1968.
- Assistant of Geophysics - Warsaw University - Polland - 1969/70.
- Seismologist - Observatório Nacional - Rio de Janeiro - 1971
- Assistant Researcher in remote sensing - Instituto de Pesquisas
Espaciais - INPE - São Paulo - 1972 - at present .

6. Publications

- Métodos Elétricos para Pesquisa de Estruturas Petrolíferas, Bahia
- Escola de Geologia da Univ. Federal da Bahia - PETROBRÁS. 1964.
- Curso de Mecânica Geral (apostilas),
- Instituto de Física da Univ. Federal da Bahia - 1964.
- Curso de Eletricidade (apostilas)
- Instituto de Física da Univ. Federal da Bahia - 1965.
- Relatório de Geologia de Superfície da Parte Central da Serra de
Jacobina - Bahia.
- Petróleo Brasileiro - S.A. PETROBRÁS - 1965.

- Relatório de Diagnóstico Geoeconômico de 16 jazidas de Minerais -
- Refratários - São Paulo,
 - Industrias Brasileiras de Artigos Refratários - 1966.
 - Relatórios Geoeconômicos de 12 jazidas de Minerais Industriais, - SP.
 - Minérios do Brasil S.A. -MINEBRA - 1966/67.
 - Levantamento de Recursos Naturais da Bacia do Rio Coreau - Ceará.
 - Departamento Nacional de Obras Contra Secas - DNOCS - 1967.
 - Levantamento de Recursos Naturais da Bacia do Rio Paraíba, Paraíba,
 - Departamento Nacional de Obras Contra Secas - DNOCS - 1967.
 - Pequenos Relatórios Geotécnicos Destinados a Obras de Encostas, Rodovias, Fundações etc. Rio de Janeiro.
 - Sondotécnica Engenharia de Solos S.A. 1967.
 - Estudo de Viabilidade de 42 Km do Oleoduto São Sebastião - Cubatão, PETROBRÁS - São Paulo - 1968.
 - Relatório de Aproveitamento Quantitativo e Qualitativo das plantações de Cacao do Brasil - Bahia, CEPLAC - 1969.
 - Magnetude, Énergie et Fréquence de Tremblements de Terre, Polónia.
 - Structure et Composition de la Terre, Polónia, (TESE).
 - Constantes des Sismographes Eletrodynamiques, Polónia,
 - Institut Geophysik Universitet Warszawski - 1970.
 - Fases de les Ondes Sismiques, Rio de Janeiro,
 - Observatório Nacional, 1970.
 - Curso de Fotointerpretação - Universidade da Bahia - 1964.
 - Elementos Computáveis no Custo de Levantamentos Aerofotogramétricos. INPE- 1972.

CURRICULUM VITAE

OF

CLOVIS CARLOS CARRARO

1. Personal Data:

Nationality: Brazilian

Date of Birth: February 18, 1934

City: Erechim

State: Rio Grande do Sul

Civil Status: Married

2. School Attended:

Name: "Universidade Federal do Rio Grande do Sul"

Location: Porto Alegre, RS, Brazil

Date: March 1952 to December 1956

Degree: Mining Engineering (B.S.)

Major Field: Geologic Photointerpretation

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and Speak: Good

Read: Good

4. Travelling Experience

Specialization Course of Geodesy, Topography, Photogrammetry and Cartography at the United States Geological Survey in Washington, D. C. and Rolla, MO. in the period between August 1965 and April 1966, sponsored by the Agency for International Development (AID).

5. Employment Record

Assistant Professor at Instituto de Geociências - Universidade Federal do Rio Grande do Sul, in the field of: Topography, Geodesy, Cartography, Geomorphology and Geologic Photointerpretation since 1959 to 1972.

Attending Post-Graduation Course in the Field of Remote Sensing at Instituto de Pesquisas Espaciais during 1972 and 1973

Assistant Geologist at the United States Geological Survey - Departamento Nacional da Produção Mineral non - ferrous program research during 1957 and 1958.

6. Publications

-Carraro, Clovis C. e Robertson, Jacques F - Geologic Map of Mina Janelão, near Itacarambi, Minas Gerais; Geologic map of the area west of Itacarambi, MG; Geologic map and section of Mina Grande, near Itacarambi, MG. In: Geology of the lead and zinc deposits in the Município de Januária, State of Minas Gerais, Brazil. Geological Survey Bulletin. Washington D.C., 1110-B, 1963.

- FORMOSO, Milton e CARRARO, Clóvis C. - Anortosito de Capivarita, Rio Pardo, RGS - Anais da Academia Brasileira de Ciências - Rio de Janeiro, 40(3), 1968.

-PINTO, Trajã D. et alii - Geology of the State of Rio Grande do Sul, Brazil,; Synopsis Publicação Especial. Escola de Geologia . Porto Alegre, 11, 1966.

-CARRARO, Clóvis C. et alii - Mapeamento do Distrito Alcalino de Altos do Rio Pinheiros, Município de Anitápolis, SC - Publicação Especial - Escola de Geologia - Porto Alegre, 16, 1967.

- RIBEIRO, M e CARRARO, Clóvis C. - Geotectonic map of the Caçapava do Sul region-RS-Brazil- Instituto de Geociências, mapa 1 - Porto Alegre, 1971.
- CARRARO, Clóvis C. - Reconhecimento de rocha mineralizada de Vazante nas transparências falsa cor - São José dos Campos, INPE - TI/SR/06/72, 1972.

Research Report (To be Published) by the Instituto de Geociências - UFRGS
Porto Alegre;

- EICK, Nilo C. - A discordância pré Formação Serra Geral
- CARRARO, Clóvis C. et alii - Geologia da Região do Rio Itú, RS
- ISSLER, Roberto S. et alii - Geologia do Grau de São Gabriel, RS.

CURRICULUM VITAE
OF
JOÃO AUGUSTO DANTAS DE OLIVEIRA

1. Personal Data:

Nationality: Brazilian
Date of Birth: June 26, 1948
City: Natal
State: Rio Grande do Norte
Civil Status: Single

2. School Attended:

Name: Universidade Federal do Rio de Janeiro (UFRJ) - Instituto
de Geociências
Location: Rio de Janeiro - GB
Date: March 1969 to July 1972
Degree: BS awarded in August, 1972
Major Field: Geology

3. Employment Record:

September 1972 - Investigator in the Remote Sensing Project - Ins-
tituto de Pesquisas Espaciais.

4. Proficiency in Foreign Languages: (Mother Tongue: Portuguese)

English: Read, Write and Speak: very good.

5. Travelling Experience:

- December, 1970 - Diamantina, Minas Gerais - Instituto
Eschwege, Geological Mapping.
- January/February, 1971 - Currais Novos, RN - Mineração Tomás
Salustino - Mining and detailed mapping of scheelite deposits.

- July, 1971 - Uberlândia, Minas Gerais - National Commission of Nuclear Energy (CNEN), Uranium Prospecting and Geological Mapping.
- September, 1971 - Brazilian Navy R/V "Almirante Saldanha" - Participation in LEST IV Oceanographic expedition.
- December, 1971 - Carrancas, Minas Gerais - Geological and Structural Mapping (UFRJ).
- February, 1971 - Nova Trento, Santa Catarina;- Geological Mapping and Mining in Wolframite Deposit.
- July, 1972 - Conselheiro Lafaiette - Minas Gerais - Geological Mapping with Ektachrome and False Color aerial photographs (INPE).

Foreign Countries:

- United States - lived and studied (High School) in Leavenworth, Kansas, from May, 1963 to August, 1964. Trip extended to Canada.

CURRICULUM VITAE
OF
JOÃO BATISTA CORREA DA SILVA

1. Personal Data:

Nationality: Brazilian
Date of Birth: February 5, 1949
City: Novo Horizonte
State: São Paulo
Civil Status: Single.

2. School Attended:

Name: Universidade Federal do Rio de Janeiro
Location: Rio de Janeiro - GB
Date: March 1969 to July 1972.
Major Field: Geology.

3. Employment Record:

September 1972 - Investigator in the Remote Sensing Project -
Instituto de Pesquisas Espaciais.

4. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Read: Good
German: Write, Speak and Read: Good
French: Read: Good.

5. Travelling Experience:

Field Experience:
- Diamantina - Minas Gerais - Nov. 1970
- Catalão - Goiás - January/February, 1971
- Diamantina - Minas Gerais - July, 1971
- Carrancas - Minas Gerais - December, 1971

- Conselheiro Lafaiette - Minas Gerais - July, 1972.
- Belém - PA - September, 1970 - Operation GEOMAR III
- Vitória - ES - September, 1970 - Operation LESTE IV.

CURRICULUM VITAE
OF
LIU CHAN CHIANG

1. Personal Data:

Nationality: Chinese
Date of Birth: February 15, 1931
City: Kaiguan
State: Liaope
Civil Status: Married

2. School Attended:

Name: National Taiwan University
Location: Taipei, Taiwan (Formosa), Republic of China
Date: September 1956 to June 1960.
Degrees: (Geology Course) B.S. (Awarded in June 1960)
Major Field: Geology

3. Proficiency in Foreign Languages (Mother Tongue: Chinese)

English: Read and Write: good
Speak: average
Portuguese: poor

4. Travelling Experience:

Korea (1962-1963)

5. Employment Record

- Teacher, in the Overseas Chinese High School, Seoul, Korea.
(1962-1963) Teaching mathematics and physics.
- Instructor, teaching physical geology in the Department of Water and Soil Conservation, National Chunghsing University, Taiching.
Taiwan, China. (1964-1965).

- Geologist of Taiwan Petroleum Exploration Division (TPED), Chinese Petroleum Corporation (CPC). (1965-1966);
- Senior Geologist of TPED-CPC. (1967-1970)
- Acting chief and chief of the Section Geology of Southern Part of Taiwan, TPED-CPC (1971-January 30, 1972).
- Research Assistant of the Institute for Space Research (INPE) Since October 16, 1972.

The following teaching and research part-time jobs were under the appointment of TPED-CPC.

- Instructor, teaching Petroleum Geology in Taiwan Provincial Hsinchu Technical Institute, Taiwan, China. (1968-1972)
- Assistant professor, teaching Field Geology and Structure Geology in the Petroleum Training Institute of CPC, (1970-1972).
- Receiving "B Grade" fund from the National Council of Science for Scientific research work.

6. Publications:

- Geology of Chunglun Structure, Chiagi, Taiwan 1966
- Geology of the Region between Chiahsien and Chishan, Kaobsing, Taiwan, 1967.
- Some Geologic Problems in the Mudstone Area of Taiwan, 1968.
- Stratigraphic Correlation in the Southern Part of Western Taiwan Based on Photogeologic Study, 1969.
- Subsurface Geology of the Chunglun - Niushan Structure Regions, Taiwan, 1970.
- Geology of the Mutan and Ssuchungchi Anticlines, Pingtung, Taiwan, 1971.
- Geology of the Hoshe Anticline, Norton, Taiwan, 1971.

5. Employment Record

- Technical book translator in Spain from 1970 to 1972.
- Research Assistant of the Institute for Space Research (INPE) which I joined in 1972.

CURRICULUM VITAE
OF
EMMANUEL GAMA DE ALMEIDA

1. Personal Data

Nationality: Brazilian
Date of Birth: April 19, 1935
City: Rio de Janeiro
State: Guanabara
Civil Status: Married

2. Schools Attended

Brazilian Naval College - 2 years
Brazilian Naval Academy - 3 years
Hydrography and Navigation - Post Graduation Course for Officers -
1 year
Basic and Applied Oceanography Course (U.S.Oceanographic Office) -
6 months
Remote Sensing Technology Applications (NASA - University of Michigan)
6 months.

3. Employment Record

Hydrographic Service

a) Sea Service (4 years)

- Oceanographic surveys on Brazilian Coast during the International Geophysical Year.
- Amazon River measurements commission with the team of U.S. Coast and Geodetic Survey.
- Remote Sensing Oceanographic Survey in Gulf of Mexico on board RV Alaminos from Texas A & M University - (August 1968)
- Remote Sensing Oceanographic Survey in Cabo Frio Test Site (July 1969).

b) Shore Service (10 Years)

- Hydrographic Surveys:
- Chart 515 - Pôrto de Luiz Correia; Chart 1602 - Baía de Jacuacanga e Proximidades; Chart 1602 - Baía da Ilha Grande (Parte Central)
- Officer in Charge of Tidal Branch of Brazilian Hydrographic Office.
- Officer in Charge of Oceanographic Division of Brazilian Hydrographic Office.
- Instructor, Tides and Oceanography in the Hydrography and Navigation Post Graduate Course for Officers.

Non-Hydrographic Service

- Teacher of Oceanography and Tides in Engineering Military Institute
- Brazilian representative in the Group of Experts on Long-Term Scientific Policy and Planning (GELTSPAR) from the Intergovernmental Oceanographic Commission.
- Naval representative in the Plan for Cooperation between Brazilian and U.S. Agencies on research of Remote Sensing for Earth Survey of the Institute for Space Research (INPE)
- Principal Investigator in INPE on research of Remote Sensing for Oceanography.

4. Publications

- Comparison of Remote Sensing Data with a Mathematical Model of Upwelling at Cabo Frio (Technical Report LAFE-135 - Sept. 1970).
- Remote Sensing as Applied to Locate Shoals Dangerous to Navigation and Bottom Topography in Shallow Water Zones. (Technical Report LAFE-135 Sept. 1970).

5. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Read: Average
Write: Average
Speak: Average

6. A member of Brazilian Cartographical Society.

CURRICULUM VITAE

OF

AFFONSO DA SILVEIRA MASCARENHAS JUNIOR

1. Personal Data:

Nationality: Brazilian

Date of Birth: May 12, 1938

City: Rio de Janeiro

State: Guanabara

Civil Status: Married

2. Schools Attended:

Name: Faculdade de Filosofia, Ciências e Letras - Universidade de São Paulo

Location: São Paulo - Brazil

Degree: Bs in Physics

Name: Instituto Oceanográfico - Universidade de São Paulo

Location: São Paulo - Brazil

Field: Physical Oceanography

Name: Escola Politécnica - Universidade de São Paulo

Location: São Paulo - Brazil

Course: Statistics Description of Sea Waves

Name: Manned Spacecraft Center - National Aeronautics and Space Administration

Location: Houston - Texas - U.S.A.

Course: Remote Sensing of the Environmental

3. Employment Record

- Instituto Oceanográfico da Universidade de São Paulo, Assistant Oceanographer

- Instituto Oceanográfico da Universidade de São Paulo, Physical Oceanographer

- Instituto Oceanográfico da Universidade de São Paulo - Assistant
- Professor of Physical Oceanography
- Instituto de Pesquisas Espaciais
Investigator

4. Travelling Experience

- Oceanographic Survey on the South Brazil Coast aboard the Brazilian Navy R/V "Almirante Saldanha" (February 1966)
- Oceanographic Survey in the North Sea and African Coast aboard the University of São Paulo R/V "Prof. W.Besnard" (May, June, July 1967)
- Remote Sensing Oceanography Survey in Gulf of Mexico aboard the Texas A & M University R/V "Aluminios" (August 1968).
- Oceanographic Surveys in Cabo Frio aboard the University of São Paulo R/V "Prof. W.Besnard" (December 1968) (January 1969) (May 1969) (October 1969) (February 1970) (Abril 1970) (January 1971).
- Oceanography Remote Sensing survey in Cabo Frio aboard the University of São Paulo R/V "Prof. W.Besnard" (July 1969)
- Manned Spacecraft Center (NASA) for preliminary analysis of the data of the 96 Mission - Houston - Texas.

5. Publications

- Johannessen, O.M., Ikeda, Y. and Mascarenhas, A.S. - "Sea Level Variation along the Brazilian Coast" - 1966.
- Almeida, E.G., Mascarenhas Jr., A.S. - "Resultados Preliminares do Sensoriamento Remoto em Cabo Frio" - 1969.
- Mascarenhas Jr., A.S., Rock N.J., Miranda, L.B. - "A Study of Oceanographic Condition in the Region of Cabo Frio" - 1969.
- Miranda, L.B., Ikeda, Y., Mascarenhas Jr, A.S. - "Flutuações de Corrente do Brasil e Variações da Distribuição Horizontal de Temperatura entre Cabo São Tomé e São Sebastião - 1970.
- Mascarenhas Jr., A.S., Ikeda, Y., Miranda, L.B. - "Distribuição das Temperaturas de Superfície do Mar com Dados Colhidos pelos Sensores Remotos em Cabo Frio" - 1970.

CURRICULUM VITAE
OF
SYDNEA MALUF

1. Personal Data:

Nationality: brazilian
Date of Birth: October 7, 1949
City: Piracicaba
State: São Paulo
Civil Status: single

2. School Attended:

Name: Faculdade de Filosofia Ciências e Letras de Rio Claro (FFCLRC)
Location: Rio Claro, São Paulo, Brazil
Date: Jan. 1968 to Dec. 1971
Degrees: (Natural History Course)
 B.S. (Awarded in Dec. 1971)
Major Field: Marine Biology

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and speak: average
 Read: good
Spanish: Write and speak: average
 Read: good

4. Employment Record

FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo) _____
scholarship of the Genetic Department of the "Escola Superior de Agri-
cultura Luiz de Queiróz (ESALG) , from september 1970 to December
1971.

Research Assistant of the Institute for Space Research (INPE) which I joined in January 1972.

6. Publications

- J.T.A. Gurgel, G. Bandel, S. Maluf - Introdução de manutenção em Eucalyptus pela radiação gama, Relatório Científico de 1970 da ESALQ, 23-31. 1970.
- S.Maluf,G.Bandel,J.T.A.Gurgel - Efeitos da Radiação Gama sobre a sobre viência de plantas de Eucaliptus, Resumos da XXIII Reunião Anual da SBPC, Curitiba - Paraná, Seção F-34,junho de 1971.
- S.Maluf,G.Bandel,J.T.A.Gurgel - Introdução de Manutenção em Eucalyptus Relatório I da 1ª semana Brasileira de História Natural e Ciências Biológicas da Faculdade de Filosofia Ciências e Letras de Rio Claro, 1 a 6 de nov. 1971.
- S.Maluf,G.Bandel,J.T.A.Gurgel - Dose letal em Eucalyptus staigeriana F.Mucell pela radiação gama, Resumos da XXIV Reunião Anual da SBPC, São Paulo, Secção G-23, julho de 1972.
- S. Maluf - Dados Preliminares do Estudo da Coloração da Água, Clorofi la e sua influência na produção primária.Dec. 1972.

CURRICULUM VITAE
OF
TSENG YUN-CHI

1. Personal Data:

Nationality: Chinese
Date of Birth: October 15, 1935
City: Amoy
State: Fukien
Civil Status: Married

2. School Attended:

Name: Tunchai University
Location: Taiwan, China
Date: December 1958 to July 1962
Degrees: (Physics) B.S. (Awarded in July 1962)
Major Field: Physics

3. Proficiency in Foreign Languages (Mother Tongue: Chinese)

English: Write and Speak: Average
Read : good

4. Travelling Experience:

The United States of America (August 1968 to May 1969): Researching advanced petroleum Engineering in the University of Kansas and practising in the Bureau of Mines of America and in many leading petroleum corporations under to a research program sponsored by the United Nations.

5. Employment Record

- Junior and Senior petroleum Reservoir Engineer of the Taiwan petroleum Exploration Division, the Chinese petroleum Corporation 1963-1968.

- Acting chief and chief engineer of the petroleum Reservoir Engineering section of the Taiwan Petroleum Exploration Division, the Chinese Petroleum Corporation. 1969-1972.
- Part-time assistant professor of the petroleum Corporation - 1963-1968.
- Acting chief and chief engineer of the petroleum Reservoir Engineering section of the Taiwan Petroleum Exploration Division, the Chinese Petroleum Corporation . 1969-1972.
- Part-time assistant professor of the petroleum Training Institute of the Chinese Petroleum Corporation, the Taiwan Provincial Hinchu Technical Institute (1969-1972), and the National Chen Kun University (1970-1972).
- Assistant researcher of the Institute for Space Research (INPE) joined in August 1972.

6. Publications

- The Importance of production Rate in an Oil Well, Chinese, petroleum Engineering, n^o7, December 1966, p.222.
- A Study of Well Spacing and Reservoir Development, Chinese Petroleum Engineering, n^o 8, December 1967, p.115.
- Estimation of Gas Reserve, Petroleum, vol. 4, n^o 3, September 1968. p.11.
- Prediction of the performance of a Solution Gas Drive Reservoir with a Computer, the Bulletin of the Chinese Institute of Mining & Metallurgical Engineers, vol. XIII n^o 2, June 1969, p. 73, and Chinese Petroleum Engineering, n^o 10, December 1969, P.135.
- A Study of Two-Rate Flow Test and Its Applications, Chinese Petroleum Engineering, n^o 10. December 1969, p.159.
- Theory of Natural Gas Flowing through Pipeline and Its Applications, Chinese Petroleum Engineering, n^o 11, December 1971.

CURRICULUM VITAE
OF
JOSE LUIZ RODRIGUES

1. Personal Data:

Nationality: Brazilian
Date of Birth: August 24, 1946
City: São Paulo
State: São Paulo
Civil Status: Single

2. School Attended:

Name: "Universidade de São Paulo" (Physics Institute)
Location: São Paulo - Brazil
Date: Jan. 67 to Dec. 71
Degree: Physics Course - B.S. (Awarded in Dec. 1971)
Major Field: Physical Oceanography

3. Proficiency in Foreign Language: (Mother Tongue: Portuguese)

English: Speak, Write, Read: Good

4. Publications

- Study about the seasonal oscillation of the Brazilian Current Utilizing Orbital Images and Ground Truth Data - RODRIGUES, J. Luiz and LUIZ TOSHIO TAKAKI: (INPE 1972)
- Spectrophotometric and Colorimetric Studies of some natural targets INPE (1972) - RODRIGUES; J. Luiz; CLÓVIS CARLOS CARRARO and S. A. FERREIRA, PINTO.

5. Employment Record

- Researcher of the Institute of Space Research (INPE)
since Feb. 1972 - S.J.Campos - SP-Brazil

CURRICULUM VITAE
OF
LUIZ TOSHIO TAKAKI

1. Personal Data:

Nationality: Brazilian
Date of Birth: March 14, 1941 -
City: São Paulo
State: São Paulo
Civil Status: Single

2. School Attended:

Name: "Universidade de São Paulo" (Physics' Institute)
Location: São Paulo - Brazil
Date: Jan. 67 to Dec. 71
Degree: Physic B.Sc. (Awarded in Dec. 1971)
Major Field: Physical Oceanography

3. Proficiency in Foreign Languages: (Mother Tongue: Portuguese)

English: Write and speak: average
Read: good
Spanish: Write and speak: average
Read: good

4. Publications:

- Study about the seasonal oscillation of the Brazilian Current Utilizing Orbital Images and Ground Truth Data - RODRIGUES, J. Luiz and LUIZ TOSHIO TAKAKI (INPE 1972).

5. Employment Record

Researcher of the Institute for Space Research (INPE) Since March 1972.

CURRICULUM VITAE

OF

RUTE MARIA BEVILAQUA RODRIGUES

1. Personal Data:

Nationality: Brazilian

Date of Birth: February 3, 1947

City: São Paulo

State: São Paulo

Civil status: married

2. School Attended:

Name: "Instituto de Física da Universidade de São Paulo"

Location: Cidade Universitária-São Paulo-SP-Brazil

Dates: 1967-1971

Degrees: Physics B.Sc.

Major Field: Physics

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English : Write and Speak: average

Read: good

French: Write and Speak: average

Read: good

Spanish : Write and speak: average

Read: good

4. Employment Record:

Joined INPE (Institute for Space Research) Jan./1973.

CURRICULUM VITAE

OF

KEIKO TANAKA

1. Personal Data:

Nationality: Brazilian

Date of Birth: January 8, 1947

City: Penāpolis

State: São Paulo

Civil Status: Married

2. School Attended:

Name: "Universidade Mackenzie"

Location: São Paulo, SP, Brazil

Date: Jan. 1969 to Dec. 1972

Degrees: Physics B.S.

Major Field: Physic

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and Speak: Average

Spanish: Write and Speak: Average

Japanese: Write: average

Speak: Good

French: Write, Speak and Read: Average

CURRICULUM VITAE

OF

RENATO HERZ

1. Personal Data:

Nationality: Brazilian

Date of Birth: July 24, 1936

City: São Paulo

State: São Paulo

Civil Status: Married.

2. School Attended:

Name: University of São Paulo (USP)

Location: Cidade Universitária - São Paulo - SP

Date: 1971

Degree: Geographer

Major Field: Physical Geography and Cartography.

3. Proficiency in Foreign Languages: (Mother Tongue: Portuguese)

English: write and speak: average

Read: Good

Spanish: Write and speak: average

Read: Good.

4. Travelling Experience:

Oceanographic missions in South Atlantic.

5. Employment Record:

! Auxiliary Research Worker at Instituto Oceanográfico da USP

. Auxiliary Teacher at Departamento de Geografia da USP in
Cartography and Oceanography.

. Research Assistant of the Institute for Space Research (INPE).

6. Publications:

- . "Atlas de São Paulo" - Geography Department of USP - et ali.
- . "Retrato de uma cidade" - Geography Department of USP - coauthorship" (in press) - et ali.
- . "Measuring Method for Fishery Ships" - Instituto Oceanográfico da USP (in press) - coauthorship V. M. A. Verrone.
- . "Photomechanical Methods in Thematic Cartography" - Geography Department of USP, coauthorship V. R. Bochicchio.

CURRICULUM VITAE
OF
VICENZO RAFFAELE BOCHICCHIO

1. Personal Data:

Nationality: Brazilian
Date of Birth: May 24, 1936
City: Montemurro (Italy)
Civil Status: Married

2. School Attended:

Name: Universidade de São Paulo (USP)
Location: São Paulo, São Paulo, Brazil
Date: Jan. 1959 to Dec. 1962 and
Jan. 1965 to Dec. 1966
Degrees: (Geography Course) B.S. (Awarded in Dec. 1962)
M.S. (Geography) (Awarded in Dec. 1966)
D.Sc. (Geography) (To award in March 1973)
Major Field: Thematic Cartography

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

French: Write, Speak and Read: good
Italian: Write, Speak and Read: good
English: Write, Speak and Read: average
Spanish: Write and Speak: average
Read: good

5. Travelling Experience

- France (Sept. 1963 to June 1964) attending a Course of Geographic Cartography at École Supérieure de Cartographie Géographique de l'Université de Paris.
- France (May 1966) attending the Meeting from the Commission of the National and Regional Atlases of the I.G.U. (International Geographical Union).

- France (May to July 1968) attending a Training Course of Photo Interpretation at École Nationale de Sciences Géographiques de l'Institut Géographique National.

5. Employment Record

- Assistant Professor of Cartography and Elements of Photogrammetry at Department of Geography, University of São Paulo, SP- 1964 to yesterday.
- Director of the Laboratory of Cartography and Aerophotogrammetry at Institute of Geography, University of São Paulo - 1965 to 1967.
- Research Assistant of the Institute for Space Research (INPE) which I joined in September 1971.

6. Publications

- Atlas of the State of São Paulo - basic scale 1:20.000.000, printing in off-set colours, representing the principal facts physics and socio-economics of the State-Partial press-work of 20 sheets - Published by the Institute of Geography, University of São Paulo, 1971-
- São Paulo Desenvolvimento - Atlas - Basic scale 1:2.000.000, printing in off-set colours. Press-work of 6 sheets maps: Administrative Division, Demographic Distribution, Educational Situation, Agriculture Production, Industrial Categories and Energetic Transportation - Published by the Secretaria de Economia e Planejamento do Estado de São Paulo, 1970.
- Map of the Great São Paulo - scale 1:200.000, printing in off-set colours. Press-work of one sheet (96cm x 75cm). Present the administrative division, urban extent, transportation system, etc. Published by Editora Duas Cidades Ltda. São Paulo.

CURRICULUM VITAE
OF
JOSE CARLOS GODOY CAMARGO

1. Personal data:

Nationality: Brazilian

Date of Birth: October 15, 1945

City: Rio Claro

State: São Paulo

Civil Status: Single

2. School Attended:

Name: Faculdade de Filosofia, Ciências e Letras de Rio Claro

Location: Rio Claro, São Paulo, Brazil

Date: March 1966 to Dec. 1969

Degrees: Geography Course - B.S. - (Awarded in Dec. 1969).

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and speak: average

Read; good

French: Read; good

4. Employment Record

FAPESP (Fundação de Amparo à pesquisa do Estado de São Paulo)

Scholarship during the period from January to December 1970,
developping a research: Phyto-geographic study of the Hydrographic
Basin of the Ribeira River.

Research Assistant of the Institute for Space Research (INPE) which
I joined in January 1972.

5. Publications

- Camargo, J.C.G. e Sérgio dos Anjos Ferreira Pinto - "Estudo Fito geográfico da Vegetação Ciliar do Rio Corumbataí-SP", em Biogeografia Nº 3, Universidade de São Paulo, Instituto de Geografia, São Paulo, 1971.
- Camargo, J.C.G. e Sérgio dos Anjos Ferreira Pinto - "A teoria das Ondas Cinemáticas e o seu Emprego na Geografia" em Boletim de Geografia Teorética nº 2, 1971, Rio Claro-SP.
- Camargo, J.C.G. e Sérgio dos Anjos Ferreira Pinto - "Estudo Fito geográfico da Bacia Hidrográfica Paulista do Rio da Ribeira" em Biogeografia Nº 5, Universidade de São Paulo, Instituto de Geografia, São Paulo, 1972.

CURRICULUM VITAE
OF
SERGIO DOS ANJOS FERREIRA PINTO

1. Personal Data:

Nationality: Brazilian
Date of Birth: August 1, 1946
City: Julio Mesquita
State: São Paulo
Civil Status: Single

2. School Attended:

Name: "Faculdade de Filosofia, Ciências e Letras de Rio Claro"
Location: Rio Claro, State of São Paulo
Date: March 1966 to December 1969
Degrees: (Geography Course) - B.S. (Awarded in December 1969)

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and Speak: average
 Read: good
French: Read: average

4. Employment Record:

- FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo)
Scholarship during the period from January to December 1970,

developing a research: Phytogeographic Study of the Hydrographic Basin of the Ribeira River (State of São Paulo)

- Biogeography Instructor, Geography Department - "Faculdade de Filosofia Ciências e Letras de Catanduva, São Paulo" - March 1970 to December 1972.
- Research Assistant of the Institute for Space Research (INPE) which I joined in January 1972.

5. Publications:

-
- Camargo, J.C.G. e Sergio dos Anjos Ferreira Pinto - "Estudo Fitogeográfico da Vegetação Ciliar do Rio Corumbataí-SP", em Biogeografia Nº 3, Universidade de São Paulo, Instituto de Geografia, São Paulo, 1971.
 - Camargo, J.C.G. e Sérgio dos Anjos Ferreira Pinto - "A Teoria das Ondas Cinemáticas e o seu Emprego na Geografia" - em Boletim de Geografia Teórica nº 2, 1971, Rio Claro-SP.
 - Camargo, J.C.G. e Sergio dos Anjos Ferreira Pinto - "Estudo Fito-geográfico da Bacia Hidrográfica Paulista do Rio da Ribeira" - em Biogeografia Nº 5, Universidade de São Paulo, Instituto de Geografia, São Paulo, 1972.

CURRICULUM VITAE

OF

CELINA FORESTI

1. Personal Data:

Nationality: Brazilian

Date of Birth: March 22, 1939

City: Rio Claro

State: São Paulo

Civil Status: Single

2. School Attended:

Name: "Faculdade de Filosofia, Ciências e Letras de Rio Claro"

Location: Rio Claro, São Paulo, Brazil

Date: Jan. 1969 to Dec. 1972

Degree: (Geography Course) B.S. (Awarded in Dec. 1972).

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: write and speak: average

read: good

Spanish: write and speak: average

read: good

French: write and speak: average

read: good

4. Employment Record

- First Grade Teacher from January 1962 through 1972-State of S.Paulo

- Assistant Researcher at INPE (Institute for Space Research) since Jan/73.

CURRICULUM VITAE
OF
ERNESTO DE VITA JR

1. Personal Data:

Nationality: Brazilian
Date of Birth: 3/19/33
City: Bragança Paulista
State: São Paulo - Brazil
Civil Status: Single

2. School Attended:

Name: Escola Politécnica da Universidade de São Paulo
Location: São Paulo
Dates: 1961
Degree: Nava Architect & Electronic Engineer
Major Field: Computer Science

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Read, Write and Speak: Good
French: Read: Good
 Speak: Poor
Spanish: Read and Speak: Good
 Write: Fair
German: Read: Fair

4. Travelling Experience

Have travelled through all North, Central & South America, as student, trainee & visiting researcher.
Stanford University (9 months); Donald Powell Lab., Cal; Fairchild, Cal, Control Data Corp Miun/Cal; Bank of America, Cal, etc.

6. Other Courses:

Several graduate courses, seminars, symposiums on Computer Science in the area of: Software Design & Implementation, Hardware Design & Implementation. Artificial Intelligence, etc..

7. Publications:

- "Random Methods for Solution of Parametric Nonlinear Systems".
- "Introduction to Logical Design of Switching Circuits".
- "Topics on the Design of an Arithmetic Unit Based on Threshold Logic".
- "Statistics on the Portuguese Synthetic Structure".

8. Employment Record

- Leader of the Project of Installation (now director) of the Computer Center of the University of São Paulo.
- Assistant Professor of the Applied Mathematic Department of the University of São Paulo.
- Leader of the project of Installation of the Computer Center of the University of Brasília.

CURRICULUM VITAE
OF
PAULO AUGUSTO MARQUES LENTINO

1. Personal Data:

Nationality: Brazilian
Date of Birth: August 11, 1947
City: São Paulo
State: São Paulo
Civil Status: Married

2. School Attended

Name: Escola Politécnica University of São Paulo (USP)
Location: São Paulo - SP - Brazil
Date: Jan. 1967 to Dec. 1971
Degrees: B.Sc. (Electronic Engineering)
Major Field: Computer Software and hardware

3. Proficiency in Foreign Languages (Mother Language: Portuguese)

English: Write: average
Speak : average
Understand: good
Read : good

French: Write: regular
Speak: regular
Understand: good
Read : good

Spanish: Writ: good
Speak: good
Understand: good
Read: good

4. Employment Record

- Trainee at the Institute for Technological Researches (IPT, USP)
Jan. 70 to July 1971
- Trainee at the Institute for Space Research (INPE) September 1971
to December of 1971.
- Engineer at the Institute for Space Research (INPE) since Jan. 1972.

5. Publication

Topics on Image Data Acquisition - Institute for Space Research,
1971 (with Russo, A.G).

CURRICULUM VITAE
OF
ARYLDO GENTIL RUSSO

1. Personal Data:

Nationality: Brazilian
Date of Birth: October 2, 1948
City: São Paulo
State: São Paulo
Civil Status: Married

2. School Attended

Name: University of São Paulo (USP)
Location: São Paulo, SP, Brazil
Date: Jan. 1968 to Dec. 1971
Degrees: B.S. (Physicist) (Awarded in Dec. 1971)
Major field: Computer hardware and Software

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and speak: average
Read: good
Spanish: Write, speak, read: average.

4. Employment Record

Won Scholarship from the Institute for Technological Research (IPT-USP)
Jan. 1970 to Dec. 1971.
Won a scholarship from the Institute for Space Research (INPE)
Sept 1971 to Nov. 1971.
Associate Research at the Institute for Space Research (INPE) since
Dec. 1971

5. Publications

- Topics on Image Data Acquisition - Institute for Space Research -
1971 (With Lentino P.A.M.).

CURRICULUM VITAE
OF
JOSE LUIZ DE BARROS AGUIRRE

1. Personal Data:

Nationality: Brazilian
Date of Birth: September 12, 1949
City: São Paulo
State: São Paulo
Civil Status: Single

2. School Attended

Name: Escola Politécnica-University of São Paulo (USP)
Location: São Paulo, SP, Brazil
Date: Jan. 1968 to Dec. 1972
Degrees: B.Sc. (Electronic Engineering) awarded in Jan. 1973
Major Field: Computer Software and Hardware

3. Proficiency in Foreign Languages (Mother language: Portuguese)

English: Write and speak: average
 understand and read: good
French: Write and speak: regular
 understand and read: good
Spanish: Write and speak: good
 understand and read: good

4. Employment Record:

- Trainee at the Institute for Technological Researches (IPT-USP)
Jan. 1970 to Jul. 1971
- Trainee at the Institute for Space Research (INPE) Jan. 1972 to
Dec. 1972
- Junior engineer at the Institute for Space Research (INPE)
since Jan. 1973

CURRICULUM VITAE
OF
LISIONG SHU LEE

1. Personal Data:

Nationality: Brazilian

Date of Birth: January 21, 1949

State: Canton

Country: China

Civil Status: Single

2. School Attended:

Name: Instituto Tecnológico de Aeronáutica (ITA)

Location: São José dos Campos, São Paulo, Brazil

Date: March 1968 to December 1972

Degree: B.Sc. in Electronic Engineering (Awarded in Dec. 1972)

Major Field: Computer Software and Hardware

3. Proficiency in Foreign Languages (Mother Language: Portuguese)

English: Read and Write: good

understand and speak: average

4. Employment Record

Trainee at Computer Department of Instituto Tecnológico de Aeronáutica (ITA) from March 1971 to March 1972.

Trainee at Space Research Institute (INPE) From March 1972 to December 1972

Junior Engineer at Space Research Institute since January 1973.

CURRICULUM VITAE
OF
SERGIO DE PAULA PEREIRA

1. Personal Data

Nationality: Brazilian
Date of Birth: January 3rd, 1948
City: Formiga
State: Minas Gerais
Civil Status: Single

2. School Attended:

Name: Engineering School of the University of Minas Gerais
Location: Belo Horizonte - Minas Gerais
Dates: March-1966 to December-1970
Degree: (Engineering Course) B.S. (Awarded in December 1970)
Major Field: Electrical Engineering

3. Proficiency in Foreign Language (Mother Tongue: Portuguese)

English: Speak: Average
Write: Good
Read: Excellent
Spanish: Read: Good
Write and Speak: Poor

4. Travelling Experience

None.

5. Employment Record

- Probationer at Brown Boveri Electrical Industry
- Probationer at Paraná Electrical Company

CURRICULUM VITAE
OF
ALDERICO RODRIGUES DE PAULA JUNIOR

1. Personal Data:

Nationality: Brazilian
Date of Birth: December 14, 1947
City: Belo Horizonte
State: Minas Gerais
Civil Status: Single

2. School Attended:

Name: Engineering School of the University of Minas Gerais
Location: Belo Horizonte - Minas Gerais
Dates: March 1966 to December 1970
Degree: (Engineering Course) V.S. (Awarded in December 1970)
Major Field: Electrical Engineering

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Good
German: Average
Spanish: Poor

4. Travelling Experience

Argentina and Uruguay

5. Employment Record

- Probationer in Minas Gerais Electricity Company (CEMIG) - 1969
- Assistant Teacher in the Engineering School of Minas Gerais University - 1970.
- Research Assistant of the Brazilian Space (Institute for Space Research - INPE) (as full time engineer) since January 1971.

CURRICULUM VITAE
OF
RONALDO VILELA GUIMARÃES

1. Personal Data:

Nationality: Brazilian
Date of Birth: 30 January, 1948
City: Prata
State: Minas Gerais
Civil States: Single

2. School Attended

Name: Technology Faculty - University of Brasília
Location: Brasília - DF - Brazil
Dates: March 1966 to December 1970
Degree: Engineering Course - B.S.
Major Field: Electronic Engineering

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and Speak: Average
 Read: Good
Spanish: Write and Speak: Average
 Read: Good
French: Write and Speak: Poor
 Read: Average

4. Employment Record

At present I am working as a Research Assistant of the Institute for Space Research (INPE) which I joined in January 1971.

- Probationer at CEMIG (Minas Gerais Electrical Company)
- Assistant-teacher in Engineering School of the University of Minas Gerais.

6. Publications (Report)

None.

CURRICULUM VITAE
OF
FERNANDO MARTIN

1. Personal Data:

Nationality: Belgian
Date of Birth: August 1, 1948
City: Zaragoza - Spain
Civil Status: Single

2. School Attended:

Name: Katholieke Universiteit Leuven
Location: Louvain - Belgien
Date: Jan. 1966 to Dec. 1970
Degrees: Electronic Engineer
Major Field: Low Noise Amplifiers

3. Proficiency in Foreign Languages

(Mother Tongue: French and Spanish)
French - Write, speak and read: good
Spanish- Write, speak and read: good
Dutch - Write, speak and read: good
English- Write, speak and read: good
Portuguese-Write, speak and read: good
German - Write, and speak: average
Italian- Write and speak: average.
read: good

4. Traveling Experience.

Italy, Argentina, Spain, England, Belgium, French, Germany, Brazil.

CURRICULUM VITAE
OF
ANTONIO EDUARDO COSTA PEREIRA

1. Personal Data:

Nationality: Brazilian

Date of Birth: July 29, 1948

City: Uberaba

State: Minas Gerais

Civil Status: Single

2. School Attended:

Name: Universidade de São Paulo . (USP)

Location. São Paulo, SP, Brazil

Date: Jan.1967 to Dec. 1971 and

Jan.1968 to Dec. 1971

Degrees: Electronic Engineer (Awarded in Dec. 1971)

Major Field: Radiative Transfer

3. Proeficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and speak: average

Read: good

Esperanto: Write, speak and read: good

5. Employment Record.

- Research Assistant of the INPE which I joined in January 1971.

CURRICULUM VITAE
OF
DAVID THOMAS ANDERSON

1. Personal Data:

Nationality: British
Date of Birth: 12th December 1943
City: Ulverston, Lancashire
Country: England
Civil Status: Single

2. University Attended:

Rugby College Engineering Technology - Rugby, Warwickshire, England
Date: Sept 1963 to June 1967
Degree: B.Sc. General Honours (London)
in Mathematics & Physics

3. Employment Record:

- Junior Geophysical Engineer with Geophysical Service International in Croydon, London. Period in London - processing of seismic data. Period in Vitoria, Spain - Assistant seismologist with seismic survey crew. 1967 - 1968.
- Assistant quality control engineer with G.S.I. shallow water marine seismic crew at Warri, Nigeria and at Majunga, Madagascar-1969.
- Assistant quality control engineer with G.S.I. deep water seismic crew based in the North Sea. After 3/4 months promoted to Senior quality control engineer/Geophysical engineer - 1970.

- Geophysicist with Terratec (Pty.) Ltd. in Randfontein, Transvaal, South Africa - 1971.
- Geophysicist with Map Studio Productions (Pty.) Ltd. in Johannesburg South Africa - 1971
- Joined Institute for Space Research (INPE) in January 1972.

4. Proficiency in Foreign Languages (Mother Tongue: English)

Portuguese: good

Spanish: fair

5. Travelling Experience

With work - Norway, Holland, Ireland, most of Britain, Spain, Nigeria, Madagascar, South Africa & Brazil.

Other travelling experiences - France, Portugal, Germany, Italy & United States.

**CURRICULUM VITAE
OF
DIETRICH ERDMANN GELLERS**

1. Personal Data:

**Nationality: Brazilian
Date of Birth: July 21, 1938
City: Rio de Janeiro
State: Guanabara
Civil Status: Married**

2. Schools Attended:

- Brazilian Air Force Academy
Date: 1957 to 1959
Degree: Pilot**
- Instituto Tecnológico de Aeronáutica - ITA -
City: São José dos Campos
Date: 1966 to 1970
Degree: Aeronautics Engineering**
- Brazilian Air Force Advanced Training
1971**

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

**German: Read, Speak and Write: Good
English: Read, Speak and Write: Average
Spanish: Read, Speak and Write: Average
French: Read, Speak and Write: Poor**

CURRICULUM VITAE

OF

LUIZ CARLOS DE ARRUDA PRADO

1. Personal Data:

Nationality: Brazilian

Date of Birth: December, 7, 1930

City: Campinas

State: São Paulo

Civil Status: Married

2. School Attended:

Name: Escola de Oficiais Especialistas

Location: Curitiba, Paraná

Date: Jan. 1961 to Dec. 1963

Degree: Air Force Officer

Major Field: Communications and Electronics

3. Proficiency in Foreign Languages: (Mother Tongue: Portuguese)

English: Write and speak: Average

Read: Good

4. Travelling Experience

USA - (15/08/57 to 20/09/58)

AC & W Radar Course

USA - (2/3/68 to 3/4/68)

(Instructor training Course)

5. Employment Record

- Instructor of Electronics in the Aeronautical Speciality School at Guaratinguetã - SP-Brasil (1964 to 1969).

CURRICULUM VITAE
OF
CELSO DE ALBUQUERQUE MONTEIRO

1. Personal Data:

Nationality: Brazilian
Date of Birth: September 30, 1927
City: Campo Grande
State: Mato Grosso
Civil Status: Married.

2. School Attended:

Name: Escola de Oficiais Especialistas
Location: Curitiba - Paraná - Brazil
Date: Jan. 1957 to Dec. 1958
Degrees: Air Force Officer
Major Field: Photography and Aerophotogrametry.

3. Proficiency in Foreign Languages: (Mother Tongue: Portuguese)

English: Read: average
Spanish: Write and Speak: average
Read: Good.

4. Travelling Experience:

Panamá (Canal Zone), Feb. 70 to May 70.
Advanced Cartography Course.

5. Employment Record:

Instructor of Photography and Aerophotogrametry in Air Force Academy at Rio de Janeiro and Aeronautical Speciality School at Guaratinguetá (1964 to 1971).

CURRICULUM VITAE
OF
GERALDO GUILHON LOURES

1. Personal Data:

Nationality: Brazilian
Date of Birth: 4 October, 1932
City: Piau
State: Minas Gerais
Civil Status: Married

2. Schools Attended:

Name: Federal University of Juiz de Fora
City: Juiz de Fora - MG
Date: 1956 to 1963

Name: Federal University of Viçosa
City: Viçosa - MG
Date: 1967 to 1968
Degree: Economy, Law (BS) and Rural Economy (MS)
Major Field: PPC - Planning Program Control.

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

English: Write and Speak: None
Read and Understand: Average

French: Write and Speak: None
Read and Understand: Average

Spanish: Write and Speak: Average
Read and Understand: Average.

4. Travelling Experience and Employment Record

- Office of Law of the Dr. José Rodrigues Valle Junior - law
- Ministério da Agricultura (Ministry of Agriculture) - Research
- Secretaria da Agricultura do Estado de Minas Gerais (State Secretary of Agriculture of Minas Gerais) - Research
- Universidade Federal de Viçosa/Conselho Nacional de Pesquisas UFV/CNPq (Federal University of Viçosa/National Research Council) - Research
- Instituto de Pesquisas Espaciais - INPE (Institute for Space Research) - Research
- Instituto de Pesquisas Espaciais - INPE (Institute for Space Research) - PCP - Planning Program Control.

5. Publications (Reports)

- Estudos dos Aspectos Sociológicos de Três Sistemas Sociais - Luziânia, Planaltina, Silvânia, Goiás, 1967 (co-authority with C.N. Gama)
- Projeto para Diagnóstico Sócio-Econômico da Região de Ponte Nova Subsídios aos Planejamento do Desenvolvimento Regional (co-author) with C.N. Gama, A. Fagundes and L. Fagundes);
- Relatório LAFE 147 - E - Banco de Dados (co-author)
- Relatório LAFE 147 - F - Processamento de Dados (co-author)
- Esforços do Governo para o Desenvolvimento da Agricultura 1950 - 1970.

CURRICULUM VITAE
OF
EUZÉBIO MATTOSO BERLINCK

1. Personal Data

Nationality: Brazilian
Date of Birth: 26 December 1933
City: Rio de Janeiro
State: Guanabara
Civil Status: Married

2. School Attended:

Name: University Gama Filho
Location: Rio de Janeiro
Dates: 1966 to 1969
Degree: Economy (B.S.)
Major Field: Planning Program Control (PPC)

3. Proficiency in Foreign Languages (Mother Tongue: Portuguese)

None.

4. Travelling Experience

Ministry of Treasury - Planning Program Control
INPE (ex-CNAE) - Planning Program Control

5. Employment Record

At present I am working as a researcher at the Institute for Space Research (INPE) which I joined in January 1970.

APPENDIX A

PRODUCTS REQUEST FORM

[illegible]

Section 3.0 CLOUD COVER AND TIME PERIOD REQUIREMENTS

3.1 CLOUD COVER

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	X								

3.2 PERIOD REQUIREMENTS

1973		1974												
MONTH	NOV.	DEC.	JAN.	FEV.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
							X	X	X	X	X			

Section 4.0 REQUESTS FOR BULK BLACK AND WHITE FILM PRODUCTS

M	Bulk Black & White 70 mm Negative Transparency	1	1	2	3	RBV	4	5	6	7	MSS
S	Bulk Black & White 70 mm Positive Transparency	1	1	2	3		4	5	6	7	
T	Bulk Black & White 9 1/2 inch Positive Transparency	1	1	2	3		4	5	6	7	
P	Bulk Black & White 9 1/2 inch Positive Paper Print	1	1	2	3		4	5	6	7	

Section 5.0 ANTECIPATED REQUIREMENTS FOR PRECISION, COLOR AND DIGITAL PRODUCTS

5.1 PRECISION BLACK AND WHITE PRODUCTS

AN	Precision Black & White 9 1/2 inch Negative Transparency	1	1	2	3	RBV	4	5	6	7	MSS
AT	Precision Black & White 9 1/2 inch Positive Transparency	1	1	2	3		4	5	6	7	
AP	Precision Black & White 9 1/2 inch Positive Paper Print	0	1	2	3		4	5	6	7	

5.2 COLOR COMPOSITE BULK PROCESSED PRODUCTS

BT	Bulk Color 9.5 inch Positive Transparency	1	A	B	C
BP	Bulk Color 9.5 inch Positive Paper Print	0	A	B	C

5.3 COLOR COMPOSITE PRECISION PROCESSED PRODUCTS

CT	Precision Color 9.5 inch Positive Transparency	1	A	B	C
CP	Precision Color 9.5 inch Positive Paper Print		A	B	C

5.4 DIGITAL PRODUCTS

D9	Bulk Digital 9-track CCT, 800 bpi	1	RBV	MSS
				X
E9	Precision Digital 9-track CCT, 800 bpi	0		

ERTS-B

PRODUCT REQUEST FORM

DATE _____

Principal Investigator Dr. Fernando de Mendonça

Identification Number: GSFC F0-398

Section 1.0 GENERAL INFORMATION

1.1 TEST SITE NUMBER

a. Total number of test sites requested 11

b. This request is for test site number 820

1.2 SHIP TO ADDRESS

São Paulo - Congonhas Airport
Varig Cargo Directorate
Attn.: Mr. Carlos Ivan Puersch - Director

Final Destination:

Fernando de Mendonça
Instituto de Pesquisas Espaciais - INPE
CP. 515
12.200 - São José dos Campos - SP - Brazil.

Section 2.0 TEST SITE (GEOGRAPHICAL AREA) REQUIREMENTS

2.1 GENERAL TEST SITE LOCATION: Brazil

2.2 TEST SITE COORDINATES

[illegible]

Section 3.0 CLOUD COVER AND TIME PERIOD REQUIREMENTS

3.1 CLOUD COVER

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	X								

3.2 PERIOD REQUIREMENTS

	1973		1974											
MONTH	NOV.	DEC.	JAN.	FEV.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
									X	X	X			

Section 4.0 REQUESTS FOR BULK BLACK AND WHITE FILM PRODUCTS

M	Bulk Black & White 70 mm Negative Transparency	1	1	2	3	4	5	6	7
					RBV			MSS	
S	Bulk Black & White 70 mm Positive Transparency	1	1	2	3	4	5	6	7
T	Bulk Black & White 9 ¹ / ₂ inch Positive Transparency	1	1	2	3	4	5	6	7
P	Bulk Black & White 9 ¹ / ₂ inch Positive Paper Print	1	1	2	3	4	5	6	7

Section 5.0 ANTECIPATED REQUIREMENTS FOR PRECISION, COLOR AND DIGITAL PRODUCTS

5.1 PRECISION BLACK AND WHITE PRODUCTS

AN	Precision Black & White 9 ¹ / ₂ inch Negative Transparency	0	1	2	3	4	5	6	7
					RBV			MSS	
AT	Precision Black & White 9 ¹ / ₂ inch Positive Transparency	0	1	2	3	4	5	6	7
AP	Precision Black & White 9 ¹ / ₂ inch Positive Paper Print	0	1	2	3	4	5	6	7

5.2 COLOR COMPOSITE BULK PROCESSED PRODUCTS

BT	Bulk Color 9.5 inch Positive Transparency	1	A	B	C
BP	Bulk Color 9.5 inch Positive Paper Print	0	A	B	C

5.3 COLOR COMPOSITE PRECISION PROCESSED PRODUCTS

CT	Precision Color 9.5 inch Positive Transparency	0	A	B	C
CP	Precision Color 9.5 inch Positive Paper Print	0	A	B	C

5.4 DIGITAL PRODUCTS

D9	Bulk Digital 9-track CCT, 800 bpi	1	RBV	MSS
				X
E9	Precision Digital 9-track CCT, 800 bpi	0		

ERTS-B
PRODUCT REQUEST FORM

DATE

Principal Investigator: Dr. Fernando de Mendonça

Identification Number: GSFC F0-398

Section 1.0 GENERAL INFORMATION

1.1 TEST SITE NUMBER

a. Total number of test sites requested 11

b. This request is for test site number 821

1.2 SHIP TO ADDRESS

São Paulo - Congonhas Airport

Varig Cargo Directorate

Attn.: Mr. Carlos Ivan Puersch - Director

Final Destination:

Fernando de Mendonça

Instituto de Pesquisas Espaciais - INPE

C.P. 515

12.200 - São José dos Campos - SP - Brazil.

Section 2.0 TEST SITE (GEOGRAPHICAL AREA) REQUIREMENTS

2.1 GENERAL TEST SITE LOCATION: Brazil

2.2 TEST SITE COORDINATES

POINT NO	LATITUDE					LONGITUDE					
	DEG		MIN		DIR	DEG			MIN		DIR
1	0	0	0	0	S	0	7	2	0	0	W
2	0	4	0	0	N	0	6	6	0	0	W
3	0	5	3	9	N	0	5	8	0	0	W
4	0	4	0	0	N	0	5	0	0	0	W
5	0	0	4	5	S	0	4	7	0	0	W
6	0	2	3	0	S	0	4	7	1	5	W
7	0	3	0	0	S	0	6	3	1	5	W
8	0	1	4	5	S	0	6	9	3	0	W

Section 3.0 CLOUD COVER AND TIME PERIOD REQUIREMENTS

3.1 CLOUD COVER

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	X								

3.2 PERIOD REQUIREMENTS

	1973		1974											
MONTH	NOV.	DEC.	JAN.	FEV.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
			X	X	X									

Section 4.0 REQUESTS FOR BULK BLACK AND WHITE FILM PRODUCTS

M	Bulk Black & White 70 mm Negative Transparency	1	1	2	3	RBV	4	5	6	7	MSS
S	Bulk Black & White 70 mm Positive Transparency	1	1	2	3		4	5	6	7	
T	Bulk Black & White 9 ¹ / ₂ inch Positive Transparency	1	1	2	3		4	5	6	7	
P	Bulk Black & White 9 ¹ / ₂ inch Positive Paper Print	1	1	2	3		4	5	6	7	

Section 5.0 ANTECIPATED REQUIREMENTS FOR PRECISION, COLOR AND DIGITAL PRODUCTS

5.1 PRECISION BLACK AND WHITE PRODUCTS

AN	Precision Black & White 9 ¹ / ₂ inch Negative Transparency	0	1	2	3	RBV	4	5	6	7	MSS
AT	Precision Black & White 9 ¹ / ₂ inch Positive Transparency	0	1	2	3		4	5	6	7	
AP	Precision Black & White 9 ¹ / ₂ inch Positive Paper Print	0	1	2	3		4	5	6	7	

5.2 COLOR COMPOSITE BULK PROCESSED PRODUCTS

BT Bulk Color 9.5 inch Positive Transparency **1** A B **C**

BP Bulk Color 9.5 inch Positive Paper Print **0** A B C

5.3 COLOR COMPOSITE PRECISION PROCESSED PRODUCTS

CT Precision Color 9.5 inch Positive Transparency **0** A B C

CP Precision Color 9.5 inch Positive Paper Print **0** A B C

5.4 DIGITAL PRODUCTS

D9 Bulk Digital 9-track CCT, 800 bpi **0** RBV MSS

E9 Precision Digital 9-track CCT, 800 bpi **0**

POINT	THICK	THIN	THICK	THIN	THICK	THIN	THICK	THIN	THICK	THIN	THICK	THIN
1	1	2	3	4	5	6	7	8	9	10	11	12
2	1	2	3	4	5	6	7	8	9	10	11	12
3	1	2	3	4	5	6	7	8	9	10	11	12
4	1	2	3	4	5	6	7	8	9	10	11	12
5	1	2	3	4	5	6	7	8	9	10	11	12
6	1	2	3	4	5	6	7	8	9	10	11	12
7	1	2	3	4	5	6	7	8	9	10	11	12
8	1	2	3	4	5	6	7	8	9	10	11	12
9	1	2	3	4	5	6	7	8	9	10	11	12
10	1	2	3	4	5	6	7	8	9	10	11	12
11	1	2	3	4	5	6	7	8	9	10	11	12
12	1	2	3	4	5	6	7	8	9	10	11	12

[illegible]

Section 3.0 CLOUD COVER AND TIME PERIOD REQUIREMENTS

3.1 CLOUD COVER

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	X								

3.2 PERIOD' REQUIREMENTS

[illegible]

Section 4.0 REQUESTS FOR BULK BLACK AND WHITE FILM PRODUCTS

M	Bulk Black & White 70 mm Negative Transparency		
S	Bulk Black & White 70 mm Positive Transparency		
T	Bulk Black & White 9 1/2 inch Positive Transparency		
P	Bulk Black & White 9 1/2 inch Positive Paper Print		

Section 5.0 ANTICIPATED REQUIREMENTS FOR PRECISION, COLOR AND DIGITAL PRODUCTS

5.1 PRECISION BLACK AND WHITE PRODUCTS

AN	Precision Black & White 9 ¹ / ₂ inch Negative Transparency	1	1	2	3	4	5	6	7
			RBV			MSS			
AT	Precision Black & White 9 ¹ / ₂ inch Positive Transparency	1	1	2	3	4	5	6	7
AP	Precision Black & White 9 ¹ / ₂ inch Positive Paper Print	0	1	2	3	4	5	6	7

5.2 COLOR COMPOSITE BULK PROCESSED PRODUCTS

BT	Bulk Color 9.5 inch Positive Transparency	1	A	B	C
BP	Bulk Color 9.5 inch Positive Paper Print	0	A	B	C

5.3 COLOR COMPOSITE PRECISION PROCESSED PRODUCTS

CT	Precision Color 9.5 inch Positive Transparency	1	A	B	C
CP	Precision Color 9.5 inch Positive Paper Print	0	A	B	C

5.4 DIGITAL PRODUCTS

D9	Bulk Digital 9-track CCT, 800 bpi	1	RBV	MSS
				X
E9	Precision Digital 9-track CCT, 800 bpi	0		

Principal Investigator: Dr. Fernando de Mendonça

Identification Number: GSFC ID-F0398

1.1 TEST SITE NUMBER

a. Total number of test sites requested 11

b. This request is for test site number 823

São Paulo-Congonhas Airport
Varig Cargo Directorate
Attn.: Mr. Carlos Ivan Puersch - Director

Final Destination:

Fernando de Mendonça
Instituto de Pesquisas Espaciais - INPE
CP. 515 -
12.200 - São José dos Campos - SP - Brazil.

Section 2.0 TEST SITE (GEOGRAPHICAL AREA) REQUIREMENTS

2.1 GENERAL TEST SITE LOCATION: Brazil

2.2 TEST SITE COORDINATES

[illegible]

5.2 COLOR COMPOSITE BULK PROCESSED PRODUCTS

BT	Bulk Color 9.5 inch Positive Transparency	1	A	B	C
BP	Bulk Color 9.5 inch Positive Paper Print	0	A	B	C

5.3 COLOR COMPOSITE PRECISION PROCESSED PRODUCTS

CT	Precision Color 9.5 inch Positive Transparency	0	A	B	C
CP	Precision Color 9.5 inch Positive Paper Print	0	A	B	C

5.4 DIGITAL PRODUCTS

D9	Bulk Digital 9-track CCT, 800 bpi	1	RBV	MSS
				X
E9	Precision Digital 9-track CCT, 800 bpi	0		

Principal Investigator: Dr. Fernando de Mendonça
Identification Number: GSFC ID-F0398 -

a. Total number of test sites requested 11

b. This request is for test site number 824

Fernando de Mendonça
Instituto de Pesquisas Espaciais - INPE
C.P. 515 -
12.200 - São José dos Campos - SP - Brazil.

2.2 TEST SITE COORDINATES

[illegible]

Section 3.0 CLOUD COVER AND TIME PERIOD REQUIREMENTS

3.1 CLOUD COVER

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	X								

3.2 PERIOD REQUIREMENTS

	1973		1974											
MONTH	NOV.	DEC.	JAN.	FEV.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
	X	X	X	X	X								X	X

Section 4.0 REQUESTS FOR BULK BLACK AND WHITE FILM PRODUCTS

M	Bulk Black & White 70 mm Negative Transparency	1	1	2	3	RBV	4	5	6	7	MSS
S	Bulk Black & White 70 mm Positive Transparency	1	1	2	3		4	5	6	7	
T	Bulk Black & White 9 1/2 inch Positive Transparency	1	1	2	3		4	5	6	7	
P	Bulk Black & White 9 1/2 inch Positive Paper Print	1	1	2	3		4	5	6	7	

Section 5.0 ANTECIPATED REQUIREMENTS FOR PRECISION, COLOR AND DIGITAL PRODUCTS

5.1 PRECISION BLACK AND WHITE PRODUCTS

AN	Precision Black & White 9 1/2 inch Negative Transparency	1	1	2	3	RBV	4	5	6	7	MSS
AT	Precision Black & White 9 1/2 inch Positive Transparency	1	1	2	3		4	5	6	7	
AP	Precision Black & White 9 1/2 inch Positive Paper Print	0	1	2	3		4	5	6	7	

5.2 COLOR COMPOSITE BULK PROCESSED PRODUCTS

BT	Bulk Color 9.5 inch Positive Transparency	1	A B C
BP	Bulk Color 9.5 inch Positive Paper Print	0	A B C

5.3 COLOR COMPOSITE PRECISION PROCESSED PRODUCTS

CT	Precision Color 9.5 inch Positive Transparency	1	A B C
CP	Precision Color 9.5 inch Positive Paper Print	0	A B C

5.4 DIGITAL PRODUCTS

D9	Bulk Digital 9-track CCT, 800 bpi	1	RBV	MSS
				X
E9	Precision Digital 9-track CCT, 800 bpi	0		

ERTS-B

PRODUCT REQUEST FORM

DATE _____

Principal Investigator: Dr. Fernando de Mendonça

Identification Number: GSFC ID-F0398

Section 1.0 GENERAL INFORMATION

1.1 TEST SITE NUMBER

a. Total number of test sites requested 11

b. This request is for test site number 825

1.2 SHIP TO ADDRESS

São Paulo - Congonhas Airport

Varig Cargo Directorate

Attn.: Mr. Carlos Puersch - Director

Final Destination:

Fernando de Mendonça

Instituto de Pesquisas Espaciais - INPE

CP. 515

12.200 - São José dos Campos - SP - Brazil.

Section 2.0 TEST SITE (GEOGRAPHICAL AREA) REQUIREMENTS

2.1 GENERAL TEST SITE LOCATION: Brazil

2.2 TEST SITE COORDINATES

[illegible]

Section 3.0 CLOUD COVER AND TIME PERIOD REQUIREMENTS

3.1 CLOUD COVER

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	X								

3.2 PERIOD REQUIREMENTS

	1973		1974											
MONTH	NOV.	DEC.	JAN.	FEV.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
									X	X				

Section 4.0 REQUESTS FOR BULK BLACK AND WHITE FILM PRODUCTS

M	Bulk Black & White 70 mm Negative Transparency	1	1	2	3	4	5	6	7
					RBV		MSS		
S	Bulk Black & White 70 mm Positive Transparency	1	1	2	3	4	5	6	7
T	Bulk Black & White 9 ¹ / ₂ inch Positive Transparency	1	1	2	3	4	5	6	7
P	Bulk Black & White 9 ¹ / ₂ inch Positive Paper Print	1	1	2	3	4	5	6	7

Section 5.0 ANTECIPATED REQUIREMENTS FOR PRECISION, COLOR AND DIGITAL PRODUCTS

5.1 PRECISION BLACK AND WHITE PRODUCTS

AN	Precision Black & White 9 ¹ / ₂ inch Negative Transparency	0	1	2	3	4	5	6	7
					RBV		MSS		
AT	Precision Black & White 9 ¹ / ₂ inch Positive Transparency	0	1	2	3	4	5	6	7
AP	Precision Black & White 9 ¹ / ₂ inch Positive Paper Print	0	1	2	3	4	5	6	7

ERTS-B

PRODUCT REQUEST FORM

DATE _____

Principal Investigator: Dr. Fernando de Mendonça

Identification Number: GSFC F0-398

Section 1.0 GENERAL INFORMATION

1.1 TEST SITE NUMBER

a. Total number of test sites requested 11

b. This request is for test site number 826

1.2 SHIP TO ADDRESS

São Paulo - Congonhas Airport

Varig Cargo Directorate

Attn.: Mr. Carlos Ivan Puersch - Director

Final Destination:

Fernando de Mendonça

Instituto de Pesquisas Espaciais - INPE

CP. 515 -

12.200 - São José dos Campos - SP - Brazil.

Section 2.0 TEST SITE (GEOGRAPHICAL AREA) REQUIREMENTS

2.1 GENERAL TEST SITE LOCATION: Brazil

2.2 TEST SITE COORDINATES

[illegible]

Section 3.0 CLOUD COVER AND TIME PERIOD REQUIREMENTS

3.1 CLOUD COVER

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		x							

3.2 PERIOD REQUIREMENTS

[illegible]

Section 4.0 REQUESTS FOR BULK BLACK AND WHITE FILM PRODUCTS

M	Bulk Black & White 70 mm Negative Transparency	1 RBV 1 2 3	4 MSS 5 6 7
S	Bulk Black & White 70 mm Positive Transparency	1 1 2 3	4 5 6 7
T	Bulk Black & White 9 1/2 inch Positive Transparency	1 1 2 3	4 5 6 7
P	Bulk Black & White 9 1/2 inch Positive Paper Print	1 1 2 3	4 5 6 7

Section 5.0 ANTECIPATED REQUIREMENTS FOR PRECISION, COLOR AND DIGITAL PRODUCTS

5.1 PRECISION BLACK AND WHITE PRODUCTS

AN	Precision Black & White 9 1/2 inch Negative Transparency	0	1	2	3	4	5	6	7
AT	Precision Black & White 9 1/2 inch Positive Transparency	0	1	2	3	4	5	6	7
AP	Precision Black & White 9 1/2 inch Positive Paper Print	0	1	2	3	4	5	6	7

5.2 COLOR COMPOSITE BULK PROCESSED PRODUCTS

BT	Bulk Color 9.5 inch Positive Transparency	1	A	B	C
BP	Bulk Color 9.5 inch Positive Paper Print	0	A	B	C

5.3 COLOR COMPOSITE PRECISION PROCESSED PRODUCTS

CT	Precision Color 9.5 inch Positive Transparency	0	A	B	C
CP	Precision Color 9.5 inch Positive Paper Print	0	A	B	C

5.4 DIGITAL PRODUCTS

D9	Bulk Digital 9-track CCT, 800 bpi	1	RBV	MSS
				X
E9	Precision Digital 9-track CCT, 800 bpi	0		

ERTS-B

PRODUCT REQUEST FORM

DATE

Principal Investigator: Dr. Fernando de Mendonça

Identification Number: GSFC FO-398

Section 1.0 GENERAL INFORMATION

1.1 TEST SITE NUMBER

a. Total number of test sites requested 11

b. This request is for test site number 827

1.2 SHIP TO ADDRESS

São Paulo - Congonhas Airport

Varig Cargo Directorate

Attn.: Mr. Carlos Ivan Puersch - Director

Final Destination:

Fernando de Mendonca

Instituto de Pesquisas Espaciais - INPE

CP. 515

12.200 - São José dos Campos - SP - Brazil.

Section 2.0 TEST SITE (GEOGRAPHICAL AREA) REQUIREMENTS

2.1 GENERAL TEST SITE LOCATION: Brazil

2.2 TEST SITE COORDINATES

[illegible]

Section 3.0 CLOUD COVER AND TIME PERIOD REQUIREMENTS

3.1 CLOUD COVER

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		X							

3.2 PERIOD REQUIREMENTS

	1973		1974											
MONTH	NOV.	DEC.	JAN.	FEV.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Section 4.0 REQUESTS FOR BULK BLACK AND WHITE FILM PRODUCTS

II	Bulk Black & White 70 mm Negative Transparency	1	1	2	3	RBV	4	5	6	7	MSS
S	Bulk Black & White 70 mm Positive Transparency	1	1	2	3		4	5	6	7	
T	Bulk Black & White 9 ¹ / ₂ inch Positive Transparency	1	1	2	3		4	5	6	7	
P	Bulk Black & White 9 ¹ / ₂ inch Positive Paper Print	1	1	2	3		4	5	6	7	

Section 5.0 ANTECIPATED REQUIREMENTS FOR PRECISION, COLOR AND DIGITAL PRODUCTS

5.1 PRECISION BLACK AND WHITE PRODUCTS

AN	Precision Black & White 9 ¹ / ₂ inch Negative Transparency	1	1	2	3	RBV	4	5	6	7	MSS
AT	Precision Black & White 9 ¹ / ₂ inch Positive Transparency	1	1	2	3		4	5	6	7	
AP	Precision Black & White 9 ¹ / ₂ inch Positive Paper Print	0	1	2	3		4	5	6	7	

[illegible]

5.2 COLOR COMPOSITE BULK PROCESSED PRODUCTS

BT	Bulk Color 9.5 inch Positive Transparency	1	A	B	C
BP	Bulk Color 9.5 inch Positive Paper Print	0	A	B	C

5.3 COLOR COMPOSITE PRECISION PROCESSED PRODUCTS

CT	Precision Color 9.5 inch Positive Transparency	0	A	B	C
CP	Precision Color 9.5 inch Positive Paper Print	0	A	B	C

5.4 DIGITAL PRODUCTS

D9	Bulk Digital 9-track CCT, 800 bpi	1	RBV	MSS
				X
E9	Precision Digital 9-track CCT, 800 bpi	0		

[illegible]

Section 3.0 CLOUD COVER AND TIME PERIOD REQUIREMENTS

3.1 CLOUD COVER

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	X								

3.2 PERIOD REQUIREMENTS

	1973		1974											
MONTH	NOV.	DEC.	JAN.	FEV.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
			X	X	X									

Section 4.0 REQUESTS FOR BULK BLACK AND WHITE FILM PRODUCTS

M	Bulk Black & White 70 mm Negative Transparency	1	1	2	3	RBV	4	5	6	7	MSS
S	Bulk Black & White 70 mm Positive Transparency	1	1	2	3		4	5	6	7	
T	Bulk Black & White 9 1/2 inch Positive Transparency	1	1	2	3		4	5	6	7	
P	Bulk Black & White 9 1/2 inch Positive Paper Print	1	1	2	3		4	5	6	7	

Section 5.0 ANTICIPATED REQUIREMENTS FOR PRECISION, COLOR AND DIGITAL PRODUCTS

5.1 PRECISION BLACK AND WHITE PRODUCTS

AN	Precision Black & White 9 1/2 inch Negative Transparency	0	1	2	3	RBV	4	5	6	7	MSS
AT	Precision Black & White 9 1/2 inch Positive Transparency	0	1	2	3		4	5	6	7	
AP	Precision Black & White 9 1/2 inch Positive Paper Print	0	1	2	3		4	5	6	7	

5.2 COLOR COMPOSITE BULK PROCESSED PRODUCTS

BT	Bulk Color 9.5 inch Positive Transparency	1	A	B	C
BP	Bulk Color 9.5 inch Positive Paper Print	0	A	B	C

5.3 COLOR COMPOSITE PRECISION PROCESSED PRODUCTS

CT	Precision Color 9.5 inch Positive Transparency	0	A	B	C
CP	Precision Color 9.5 inch Positive Paper Print	0	A	B	C

5.4 DIGITAL PRODUCTS

D9	Bulk Digital 9-track CCT, 800 bpi	1	RBV	MSS
				X
E9	Precision Digital 9-track CCT, 800 bpi	0		

APPENDIX B

**INPE REMOTE SENSING PROJECT DISCIPLINARY ACTIVITIES PLANNED
FOR THE NEXT YEARS**

1. INTRODUCTION

The purpose of this study is to investigate the effects of various factors on the performance of the system.

The results of the study are as follows:

CHAPTER III

SOIL RESOURCES GROUP

3.1 - General Considerations

Agriculture is involved in approximately 30% of the Brazilian Gross National Product. In spite of its large importance to the National Economy, it is characterized by low productivity and production indexes in relation to quantity and conditions of agricultural areas available and to be colonized.

Any strategical plan for developing agriculture in regard to increase of production and productivity would necessarily involve Government action:

- In transformation of traditional agriculture by changing production methods and intensifying utilization of modern inputs.
- In increasing cultivated areas, which would involve determining areas in the Brazilian territory which are most adequate for colonization projects or large plantation or cattle raising projects.
- In breaking supply barriers by solving principal problems

regarding structure and function of food commercialization.

It is obvious that the problem assumes different aspects according to the region of the country and its respective social - economical conditions. As an example, the agriculture in the Central - South has presented within the last few years a certain equilibrium between the growth of productivity and the growth of cultivated areas; in the Northeast, the growth was basically due to the incorporation of new cultivated areas.

It is essential to explain here that lack of good statistics is a serious hindrance in many development projects, both in planning and actual implementation phases. In considering agriculture, the problem becomes more complicated because changes occur very rapidly and significantly affect the final results. The necessity of constantly acquiring updated information is fundamental for technicians, economists and planners.

The annual variations in agriculture products show that agriculture is a complex biological system subject to devastations by climatic extremes (heat, cold, dry, flood) biological pests (insects, fungus, virus, bacterias, nematodes) and all this affects the production in varying degrees.

Considering the size, the location sometimes being remote,

diversity of conditions and variability in exploitation, we conclude that obtaining precise information repeatedly and within a reasonable time, on the diverse factors that affect production is very difficult by traditional methods, which in many situations is slow, onerous and inaccurate.

A probable means to satisfy the present and future information necessities within this sector, would be by an operational system of remote sensing with a multi-level elaboration ranging from the orbital level to the collection of information at ground level. Satellites equipped with high resolution sensors operating in various bands of the spectrum make possible macroscopic surveys on a synoptic and routine basis. More detailed surveys could be made by aircraft at varying scales depending on objectives and degree of detail necessary in each case.

3.1.1 - Methodologies for the Brazilian Situation

A - Unexplored Areas

In the Amazon region and a large part of Central Brazil, there is a low population density. The pressure increase for natural resources has forced the way to orderly conquest of land in Central Brazil and the Amazon, and consequently the colonization of extensive areas of savannas and forests. The oriental migration to the interior in large groups of plantation and cattle raising colonization projects, within a modern doctrine of national security, deserves an ample study of real

potentialities of these areas with the final objective of integrating them with the rest of the country.

A program which would permit a rapid and economical survey of the immense unexplored Brazilian regions, should make the maximum use of orbital and aerial means for data collection. Then, for these regions, the first level for data collection would be orbital which would provide a global and repeated coverage of the area.

An analysis of these data, assisted by multi-disciplinary regional specialists, would lead to a general recognition of the principal features of the area and the establishment of priority areas for more detailed surveys in scales appropriate with the size of the selected area and with the level of detail required for the implementation of a given project.

B - More Developed Areas

We refer to areas which have a reasonable population density and which present large variations in the indexes of exploration technology. Organs responsible for research, advancing and assisting agriculture techniques in the country, concentrate their forces in these areas. They have found, however, one big problem: the collection and processing of data necessary to calculate and control agricultural production, which could be done by means of good estimates

of planted areas and losses during the vegetation cycle (sicknesses, noxious weeds, floods, dry spells etc.). The conventional methods actually in use for plantation and cattle raising survey are prolonged, expensive and inaccurate. The remote sensing techniques could be extremely beneficial in these areas.

In the case of more developed areas, two problems appear to require specific elaboration: general reconnaissance, and survey of particular areas with well defined objectives. The analysis of orbital data would provide important information on forests, vegetation coverage in general, extensive agriculture, hydric resources, natural fields, differentiation between cultivated areas and uncultivated areas, general information on soil, etc. With this information, using the levels of data collection by aircraft, patterns and interpretation keys could be established. Data collected by aircraft would also serve to clear doubts arising in the interpretation of orbital data and for obtaining resolution, when necessary, not contained in this data.

For study of particular areas with well defined objectives, it is necessary to begin directly at the level compatible with the degree of detail desired, be it orbital or one of the aircraft levels, keeping in mind the establishment of the most economical level for data collection.

3.2 - General Objectives of the Soil Resources Group

3.2.1 - General Objectives up to December 1974

Using data collected by aircraft, ERTS, and SKYLAB, establish methodologies and variations for:

- A) Making maps of soil use
- B) Estimating areas occupied with different agriculture exploitations
- C) Crop forecasts
- D) Survey and classification of soil
- E) Forest inventory
- F) Updating of the vegetation map
- G) Study of hydrographic basins
- H) Coffee plantation inventory
- I) Savanna studies
- J) Special problems (soil salinity, water deficiency, plant sicknesses etc.)
- K) Study of thermic and spectral properties of the soil and plants under different conditions.

3.2.2 - General Objectives for 1973

With a view to reaching the general objectives forecasted for the next two years:

- A) Continue with the work in missions underway or planned,

correlating data already obtained with orbital images as mentioned in items 3.1.1 A and 3.1.1 B.

B) Study the ERTS images, and in relation to this, conduct missions as described in items 3.1.1 A and 3.1.1 B.

C) Conduct studies and missions generated by collaboration plans to be established by the technological impact and the degree of dependence on INPE, which will certainly be created by the ERTS-A products.

3.2.3 - General Objectives as of January 1975

See General Objectives of Phase E.

3.3.- General Chronogram

See Figure 3.1.

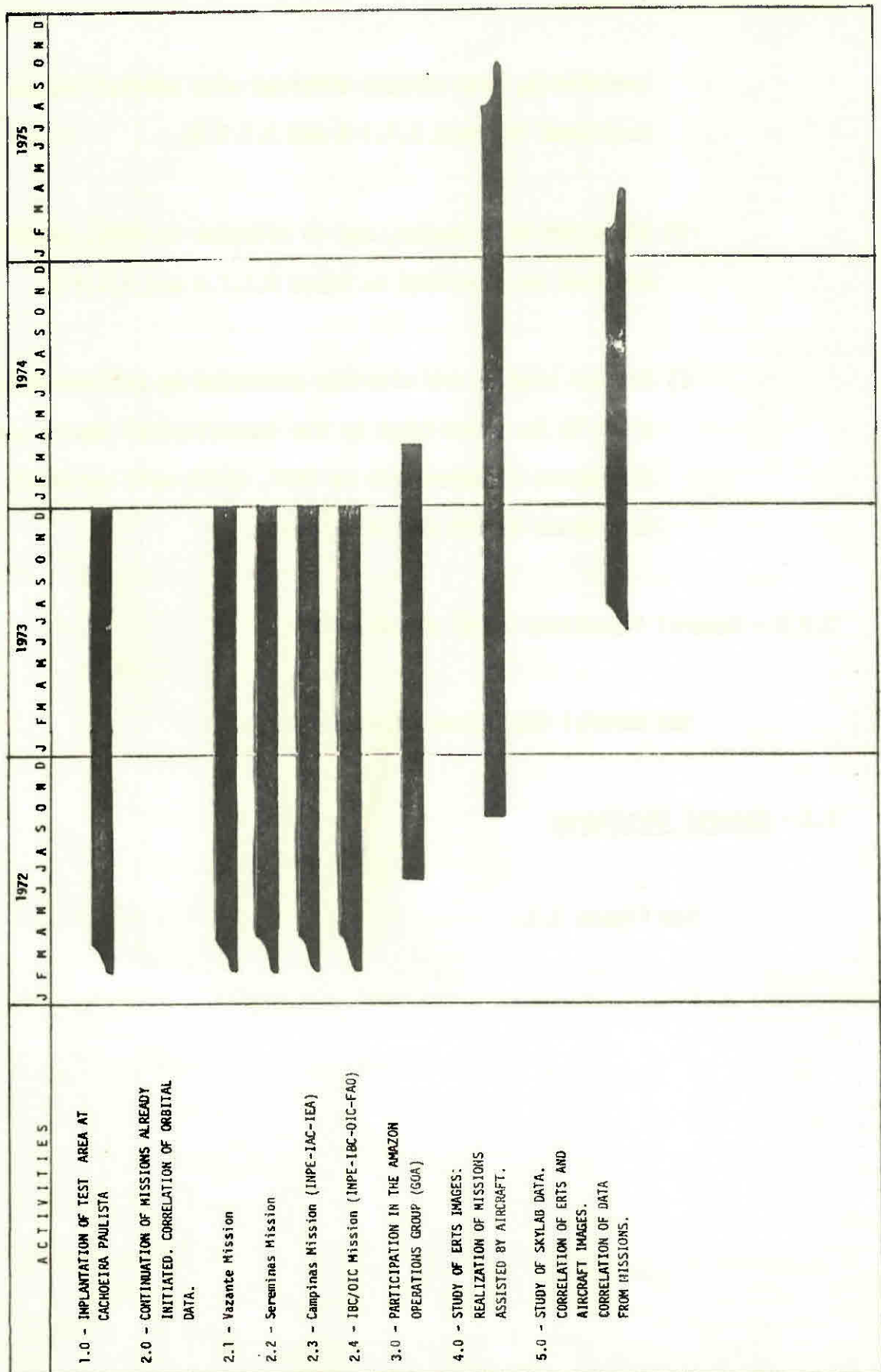


FIG. 3.1 - GENERAL CHRONOGRAM OF SOIL RESOURCES GROUP ACTIVITIES

CHAPTER IV

MINERAL RESOURCES GROUP

4.1 - General Considerations

4.1.1 - The Brazilian Reality Regarding Mineral Resources

Mineral exploration contributes only 1% of the Gross National Product, while agriculture constitutes 30%, industry 26%, and sector of services 43%. In more developed countries the participation of the mineral industry reaches levels higher than 5%. Our country represents one of the biggest international examples of dependence on external minerals (65% of consumption), importing petroleum, coal, copper, aluminum, zinc, lead, sulphur, salts of potassium and sodium, etc.

On the other hand, the Brazilian geological situation, with such an enormous extension of territory, highly indicates a large potenciality of mineral resources. Here we might mention that the three largest discoveries of mineral deposits (tin, iron, and aluminum) within the last few years were made in the Amazon, when exploration work was initiated in that region.

Our deficiency in mineral resources is almost totally a result of lack of geological knowledge. The most recent geological

map of Brazil, scale 1:5,000,000, presents many imperfections, derived from extrapolation, and inferences made from regions geologically little known to unknown regions. In 1958, DNPM indicated a program for geological mapping of the country on a 1:1,000,000 scale. The fact that up to the present no charts from this project have been presented, shows the impossibility of completing such a task under actual prevailing conditions. A minimum percentage of the area of the country is mapped in larger scales (1:100.000; 1:250.000; etc.).

As mineral resources are controlled by geological features, any prospection program for mineral deposits should be preceded by geological mapping.

The ore deposits represent concentrations of elements or minerals many times larger than normal. These concentrations are the result of a convergence of favorable geological factors which took place during various phases of the evolution of the earth's crust. The development of geological sciences has reached a point where various rules for formation of mineral deposits are already established. It is known, for example, that nickel deposits are associated with ultrabasic rocks formed in determined phases of deformation and movement events of the earth's crust. These events are the object of tectonic studies and are developed on a continental scale. The study of the conditions of formation of mineral deposits during tectonic events is the principal objective of metalogenesis. The tectonic as well as the metalogenesis depend on geological mapping on a continental level, in scales between

1:5,000,000 and 1:1,000,000 (exploration level).

With these maps and the complementary studies (geochronology, regional stratigraphy analysis etc.) it is possible to study the tectonic evolution of the region and select the areas most favorable to the existence of mineral deposits. These areas can, then, be the object of basic projects for the evaluation of potentialities in mineral resources and geological mapping on a compensating level (scales between 1:100,000 and 1:250,000). These projects can be accompanied by geophysics and geochemical surveys. When locals presenting a convergence of favorable factors or geochemical and geophysical anomalies are identified, it is possible to then proceed with geological mapping with definition in scales between 1:50,000 and 1:25,000. This work can be also accompanied by geophysical and geochemical detail.

After the mineral deposits are located, it is possible to proceed with quality and quantity evaluation, with detailed geological mapping in scales between 1:10,000 and 1:2,000, subterranean work, laboratory analysis, etc. The results of this, together with studies of the market, etc. permit a definition of economical usability of the deposits.

In each one of the geological research levels above described, a large quantity of data is collected. As the research passes from a continental level to a local level, the quantity of data per unit of

area increases, increasing consequently the cost of collection. These costs can be minimized by development of a strategy for localization of mineral deposits, with the execution of surveys integrated in those which utilize a combination of techniques, each providing specific information on some geological aspect of the region. An efficient strategy (methodology) can lead to the discovery of deposits on more general levels, and consequently at a much lower cost.

Geological studies are not restricted only to the discovery of mineral deposits (including petroleum), but also to the investigation of ground water, support for engineering projects, projection and operation of mines, forecast and control of geological accidents etc. The petroleum fields and ground water tables are generally associated with large geological structures, with dimensions on the order of a few kilometers; on the other hand, the geological studies applied to civil engineering and to mining planning and control, are restricted to small areas. The mineral concentrations occupy the intermediate position between these two extremes, but with a tendency to the second case.

Remote sensing can be considered as an activity for generating data. The analysis of data coming from application of one or more sensors to a determined problem can lead to the establishment of "recipes" (methodologies) applicable to similar problems in other locations.

The application of remote sensing to geological problems is fundamentally for obtaining information on three principal aspects:

lithology, structures and soils.

Various species of rocks are in themselves mineral resources, such as limestone, gypsum, etc. Many geological structures such as fractures, faults and folds are hosts for mineral deposits. Some soils, such as bauxite, nickeliferous laterites, and manganimiferous laterites, are mineral deposits. These facts indicate that, with favorable conditions, some mineral deposits can be easily located by application of a small number of techniques. This is not always the case, as ore deposits are frequently covered by vegetation or soil, or are too small to be located directly.

4.1.2 - Possible Applicable Methodologies for Geological Problems

A) Regional Geological Mapping

The images obtained by the RADAM project and those obtained by the ERTS project permit without a doubt, the establishment of a basic geological map on the scale 1:1,000,000. The experience obtained during the last year with the interpretation of radar images of the Amazon, indicate that it would be difficult to construct maps on the scale 1:250,000 from those images, unless there would be an intense field control. The radar images are excellent for the definition of large structures but are comparable with the normal aerial photographs for lithology identification. In this aspect, and in view of the multi-spectral character, we expect better results with the ERTS images.

B) Prospection of Mineral Resources

The choice of research objects in this area should adhere, principally, to the criteria of priorities dictated by the national necessities such as social, as in the case of underground water, and economical, as in the case of petroleum, copper, etc.

The localization of ground water sources is a problem of very great importance for the region of approximately 2 million square kilometers and intensely populated, which extends from the northeast of Brazil to the interior of the State of São Paulo. An applicable methodology to this problem should be initiated by a geological regional mapping, which will be the starting point for the selection of more favorable areas. These could be investigated with infrared black and white photographs, so as to localize more humid zones. From a combined analysis of topography and geology, and localization of humid zones, conditions of ground flow can be defined and ideal points for the execution of underground work selected. It is possible that thermal sensors can provide data on the circulation of underground water, since this phenomenon is an important factor in the superficial thermic balance. Other types of images could provide information on lithology and local geological structure.

The localization of petroleum deposits is one of the most intense geological prospection activities in Brazil. Currently, this

work is concentrated on the continental platform, where the geological situation appears more favorable. It is difficult to imagine the applicability of conventional sensors for petroleum research in these conditions, where the water sheet reaches 200 m in thickness. However, the use of multi-spectral photographs for the mapping of the ocean bottom in zones of least depth could be experimented. In this case, the object would be to localize superficial manifestation (at the ocean bottom) of favorable geological structures. Another possibility is the utilization of aeromagnetometry for the localization of large structures; this has already been tried by Petrobrás. An attractive possibility would be utilization of sensors activated by laser, working in the ultra-violet region, for localizing oil spots on the surface of the ocean. In some locations, it has been verified that this oil escapes from underground reservoirs through fractures and spreads on the ocean surface. The problem is to locate the escape zone, which could be done by successive surveys, identifying the smallest area possible so that other methods could be applied. Within the continent, especially in the Amazon region, Petrobrás is studying the applicability of radar images for the localization of structures favorable to the accumulation of petroleum.

INPE has underway three missions for the study of metallic mineral deposits, each one with specific objectives. The Vazante mission aims to test the applicability of infrared photographs for the identification of zinc deposits in the savanna zone, using as a basis the notable association between minerals and determined species of

vegetation. The preliminary results are very encouraging; it is possible to delimit perfectly the zinc deposits in the infrared colored photographs. One of the objectives of the Itabira mission is to test the applicability of colored photographs for the identification of ultrabasic rock groups (favorable to the existence of Cr, Ni, Co, Pt, etc. deposits) intrusive in quartzites of the Espinhaço Group. The preliminary results here were also encouraging; the Ektachrome photos sharply show the basic rock zones by soil coloration. On the Senhor do Bonfim mission, the principal objective was the characterization of a group of ultrabasic quartzites using thermal sensors. Ground truth indicates that at determined hours of the day these rocks present great differences in temperature, which could be investigated in thermal images.

We are considering the possibility of developing two research projects: one with a view to establishing methodology for prospecting concentrated radioactive elements and another with a view to testing the applicability of infrared photographs for detecting vegetation behavior anomalies associated with copper deposits. In the first case, a behavior model was established by which a concentration of radioactive elements (U, Th or I) could produce measurable differences in temperature if thermal imagers are used. An approximate calculation, made for the only known deposit of uranium in the country, in Poços de Caldas, indicates that temperature differences are possible between the deposit and the host rock, to the order of two degrees centigrade, which is within the

sensibility of the thermal imager. It is necessary to establish which part of the year and at what hour of the day is best for this type of survey. The application of thermal sensors would be one of the steps in the method which involves spectral-scintilometry, geochemics and field work.

In the case of research for copper deposits, it is known that anomaly concentrations of this metal in the soil produces metabolic alterations in the vegetation which develops there, which can cause anomalies in the characteristics of their spectral reflection. These anomalies can be investigated by means of infrared and multi-spectral photographs. It is intended to test this methodology in known areas and then apply it to regions in the Amazon which are potentially favorable.

Figure 4.1 presents various classes of problems of mineral resources, the scales in which they are better observed, and considerations on current and potential techniques.

4.2 - General Objectives of the Mineral Resources Group

4.2.1 - General Objectives up to December 1974

A) Elaboration of the basic geological map, on the scale 1:1,000,000, of the geological test region in the ERTS-1 project.

B) Research on the applicability of ERTS-1 images for the identification

and localization of mineral deposits, based on available data or data to be collected by the missions underway.

- C) Development of methodologies for the interpretation of images by the combined use of visual and automatic analysis, as well as multi-disciplinary elaboration (vegetation - soil - rock).
- D) The establishment of methodologies applicable to various geological problems, especially: localization of underground water sources; definition of potential areas for concentrations of radioactive minerals; localization of concentrations of utile metals (particularly copper, lead and zinc).
- E) Comparative study of the images from RADAM, ERTS-1 and SKYLAB projects, with a view to definition of applicability to geological problems.
- F) Participation in a multi-disciplinary mission to be executed on the Rio Grande do Sul coastland.

4.2.2 - General Objectives for 1973

- A) Conclusion of ongoing missions: Sereminas, Senhor do Bonfim; Vazante and Terezina.
- B) Development of the principal phase of interpretation of the ERTS

images, with definition of the methodology to be followed in the future, involving visual analysis, automatic analysis and compilation of existing data.

- C) Planning and initiation of research development on the applicability of remote sensing to localize deposits of underground water. As an initial test area, the interior of the State of São Paulo is suggested due to the abundance of data. Contact with the Geographical and Geological Institute, with the possibility of eventual cooperation.
- D) Planning and initiation of research project with a view to testing the applicability of thermal sensors for the localization of concentrations of radioactive elements, or optimization of prospecting methods actually in use. Contacts are being made with the National Commission of Nuclear Energy with a view to eventual collaboration.
- E) Planning and initiation of research project with the objective of testing the applicability of sensors in the infrared band for the localization of geochemical anomalies in soil, based on characteristic spectral anomalies of vegetation. This research would be a continuation of what was initiated in the Vazante Mission.
- F) Analysis and interpretation of images to be taken in Caraguatatuba for the Institute of Technological Research of the University of São Paulo, with the objective of testing image applicability to the

planning of roads and delimitation of landslide areas.

B) Planning and initiation of the geological part of the Rio Grande do Sul mission.

4.2.3 - General Objectives as of 1975

See General Objectives of Phase E.

4.3 - General Chronogram

See Figures 4.2 and 4.3.

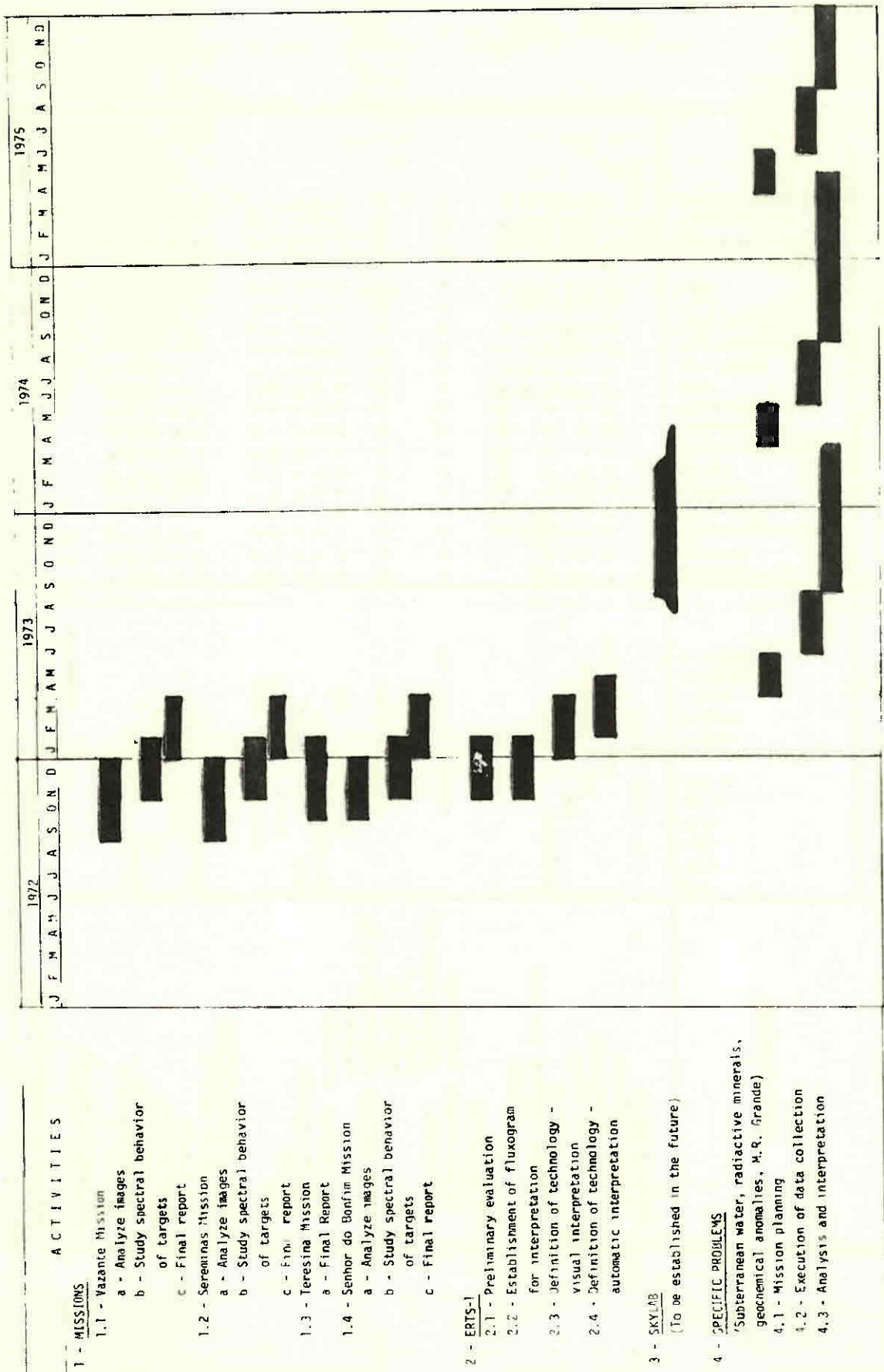


FIG. 4.2 - GENERAL CHRONOGRAM OF MINERAL RESOURCES GROUP ACTIVITIES

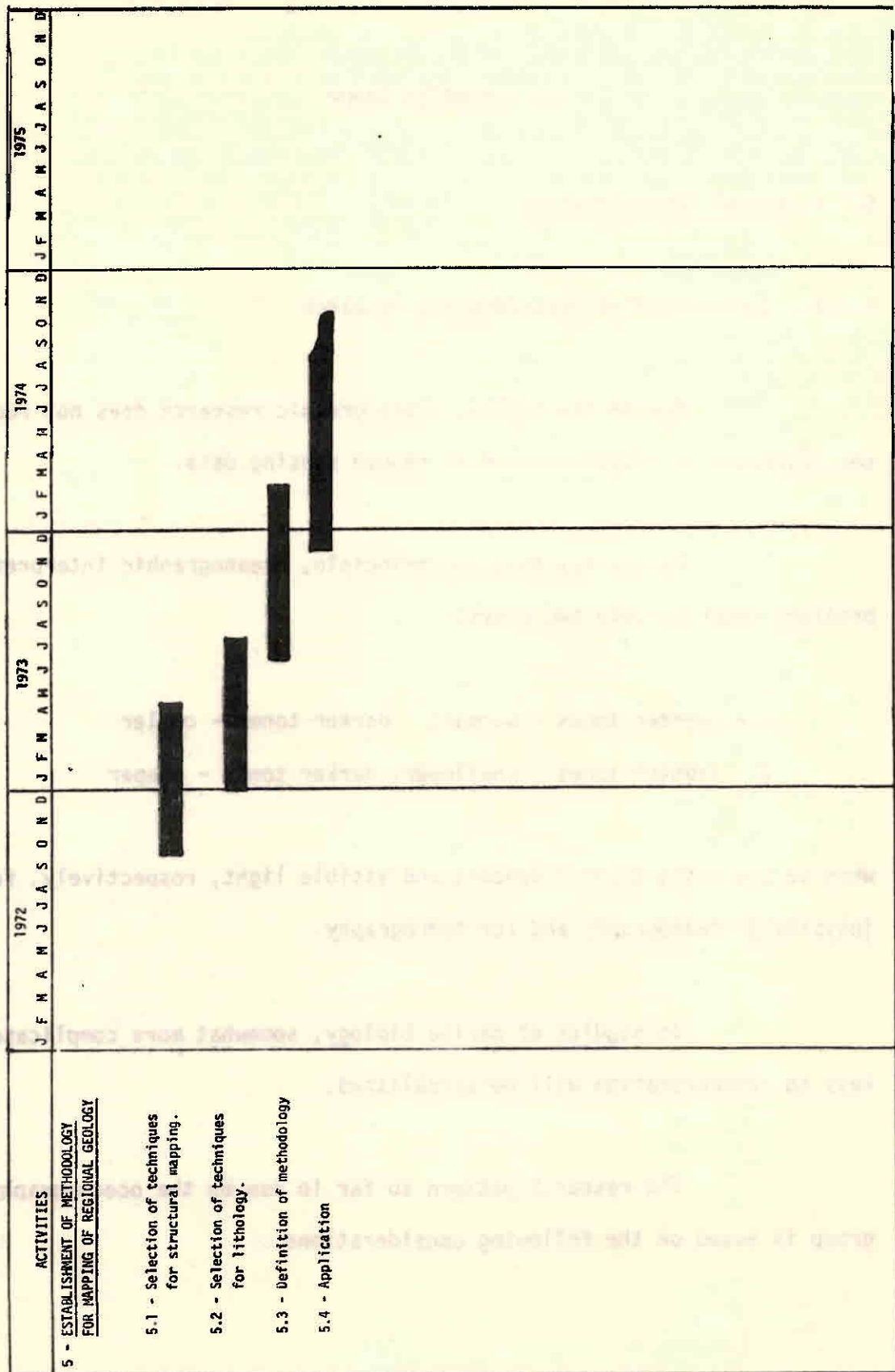


FIG. 4.3 - GENERAL CHRONOGRAM OF MINERAL RESOURCES GROUP ACTIVITIES

CHAPTER V

SEA RESOURCES GROUP

5.1 - General Considerations

5.1.1 - Systematics of Oceanographic Research

Due to its nature, oceanographic research does not require too elaborate an interpretation of remote sensing data.

We may say that, in principle, oceanographic interpretation problems comprise only two cases:

- 1 - lighter tones - warmer; darker tones - cooler
- 2 - lighter tones - shallower; darker tones - deeper

when we are using thermal sensors and visible light, respectively, for (physical) oceanography and for hydrography.

In studies of marine biology, somewhat more complicated keys to interpretation will be established.

The research pattern so far in use by the oceanography group is based on the following considerations:

- A) The research design should be formulated only after a prior investigation of the phenomenon to be studied by remote sensing.
- B) The area selected for the experiment should have small dimensions, that is, the test site where the main effort will be brought to bear should be limited and should present, preferentially, the phenomena that occur in the larger circumscribing area.

The choice of the Cabo Frio area aimed at the fulfillment of considerations previously made and for the following main reasons:

- It is the spot on the Brazilian coast where the phenomenon of upwelling is most marked.
- The boundaries of the Brazilian current are found relatively near the coast.
- Sea water around Cabo Frio is very clear allowing light to penetrate to the bottom in shallow zones.
- Permanent local support is available from a government owned chemical plant and from the Navy Research Institute.
- Oceanographically it is one of the most investigated Brazilian coastal sites.

The initially selected test site was the 60 X 30 nautical mile rectangle shown in Figure 5.1.

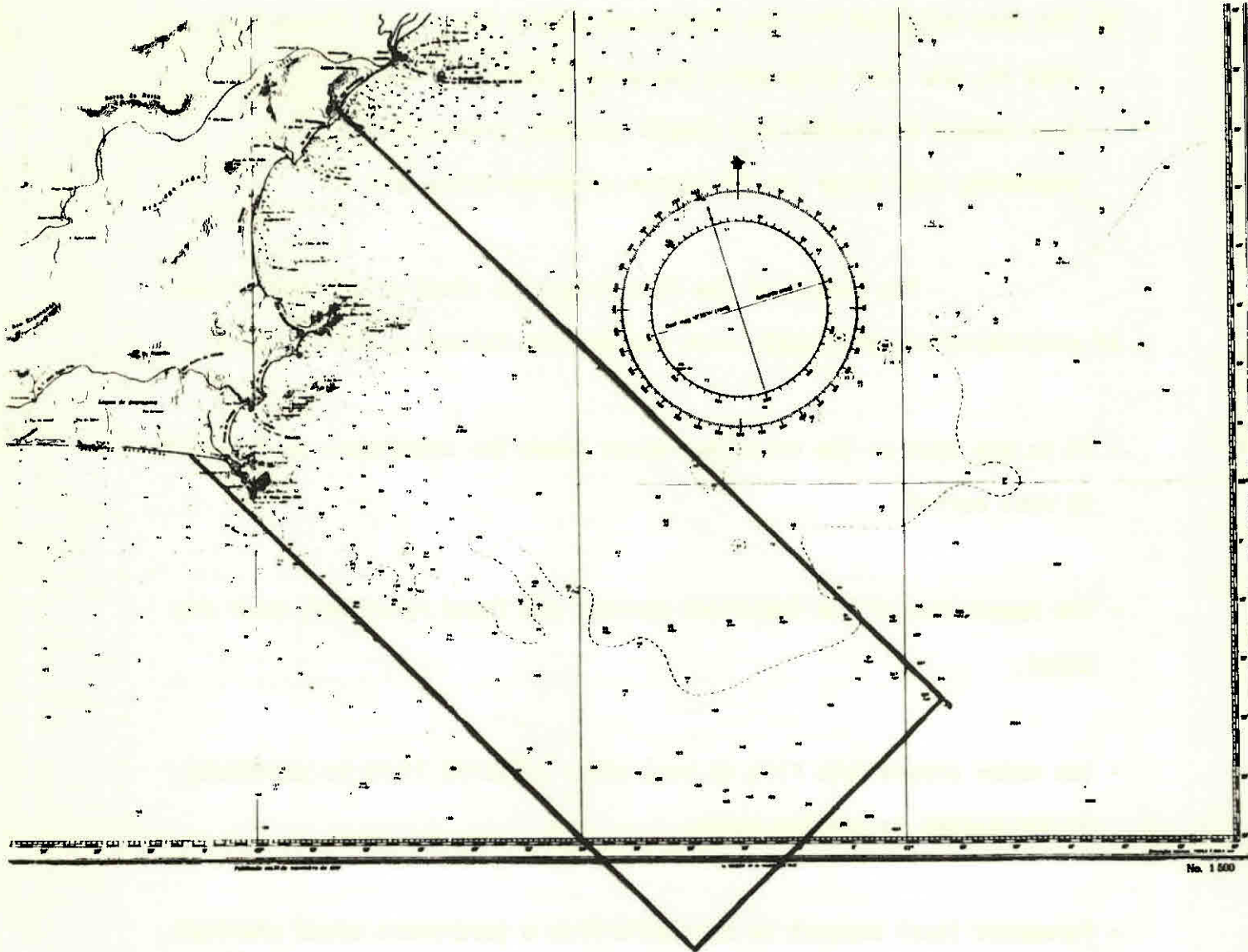


Fig. 5.1 - Cabo Frio Test Site (SEREMAR I)

- And, still more important, studies of Cabo Frio phenomena could possibly be extrapolated for the whole Southern coast of Brazil.

In 1969 and in 1971, two missions in the SEREMAR research series were accomplished in this area with the support of a NASA aircraft, Brazilian Navy helicopters from the Aero-Naval Base of São Pedro da Aldeia and oceanographic vessels belonging to the Brazilian Navy and to the University of São Paulo. In 1973 Mission SEREMAR III will be carried out, with the support of INPE's aircraft, on the area shown in Fig. 5.2.

From the previous missions it was realized that remote sensors can detect not only thermal contrasts on the surface of the sea, due to the Brazilian current and to upwelling, but can also take photographs of shallow bottoms. One other interesting phenomenon was brought out by these missions - the Brazilian current oscillates perpendicularly to the coast with an average speed of 1.8 nautical miles per day, reaching a maximum swing of 20 miles in 11 days.

Such results prompted us to undertake further upwelling and sea bottom topography studies using data collected from medium and orbital levels.

As for medium levels, correlation studies were made between data collected by infrared sensors onboard aircraft and a mathematical model of upwelling. Such studies gave rather encouraging

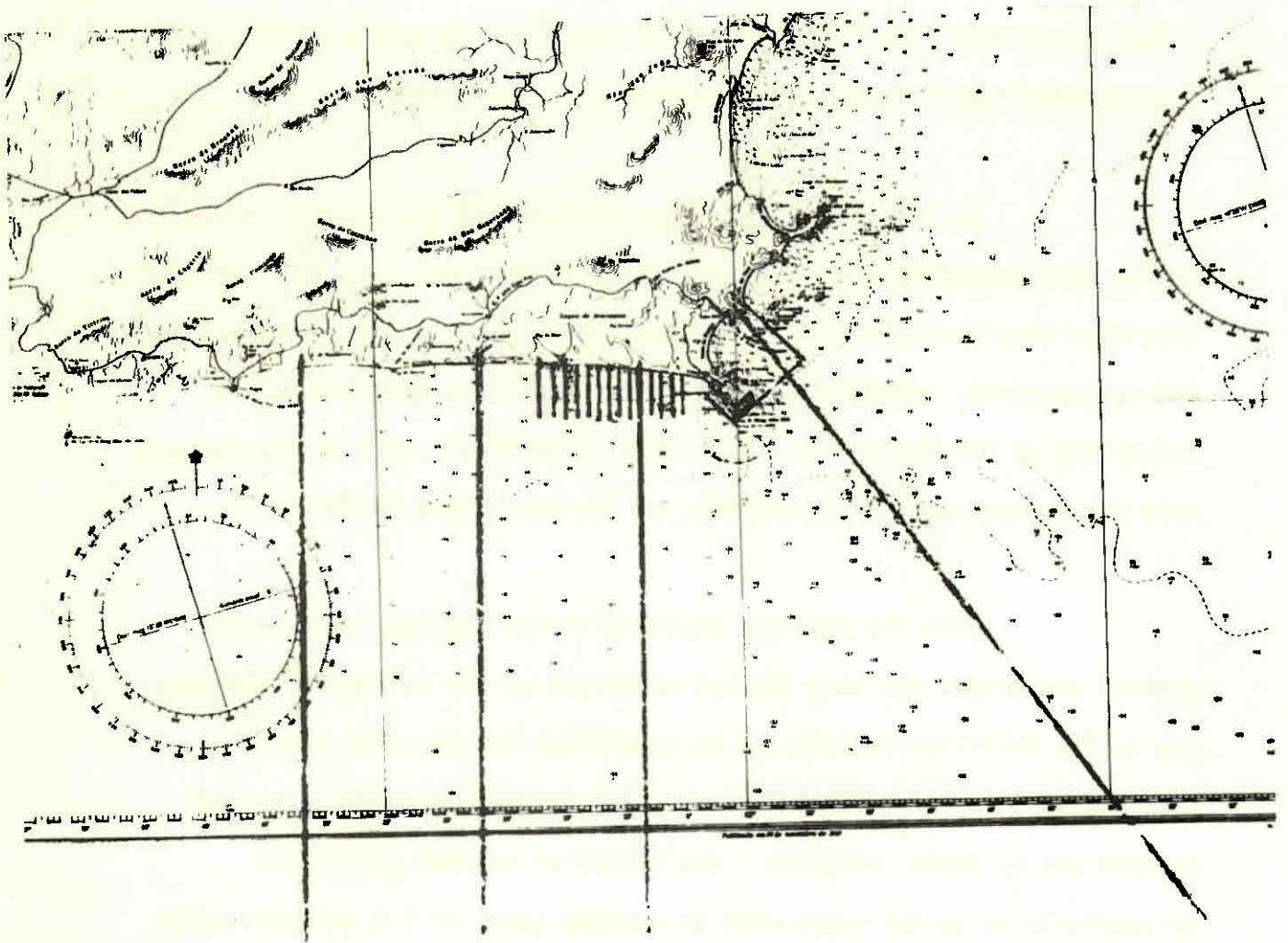


Fig. 5.2 - Cabo Frio Test Site showing flight lines established for both missions SEREMAR II and III.

results. With data collected in the visible band preliminary studies of sea bottom bathymetry were made using photogrammetric and mathematical techniques.

Research results led to three new avenues:

- Theoretical studies of upwelling over a larger area between Cabo Frio and Guanabara Bay, using aircraft, i.e., medium level data collection.
- Sea bottom bathymetry studies of the Abrolhos region using mathematical techniques and ERTS satellite, i.e., orbital level data collection.
- Studies of the oscillations of the Brazilian current on the area between Cape São Tomé and Itajai or Santos with data collected by NIMBUS IV and SKYLAB satellites, i.e., data from orbital levels.

Notice, therefore, that studies of the Cabo Frio area were instrumental to the formulation of studies of the above mentioned new areas which are shown in Figure 5.3.

Although not connected with the Cabo Frio activities, but based on classical oceanography and on studies made by NASA using the NIMBUS satellite, the area between Imbituba and Mar del Plata will also be covered from an orbital level, as per Figure 5.3.

The object of such studies is to follow the seasonal evolution of the sub-tropical zone of convergency, the movements of which are directly related to fishing in the region.

The pattern of the research so far accomplished can be summarized as follows:

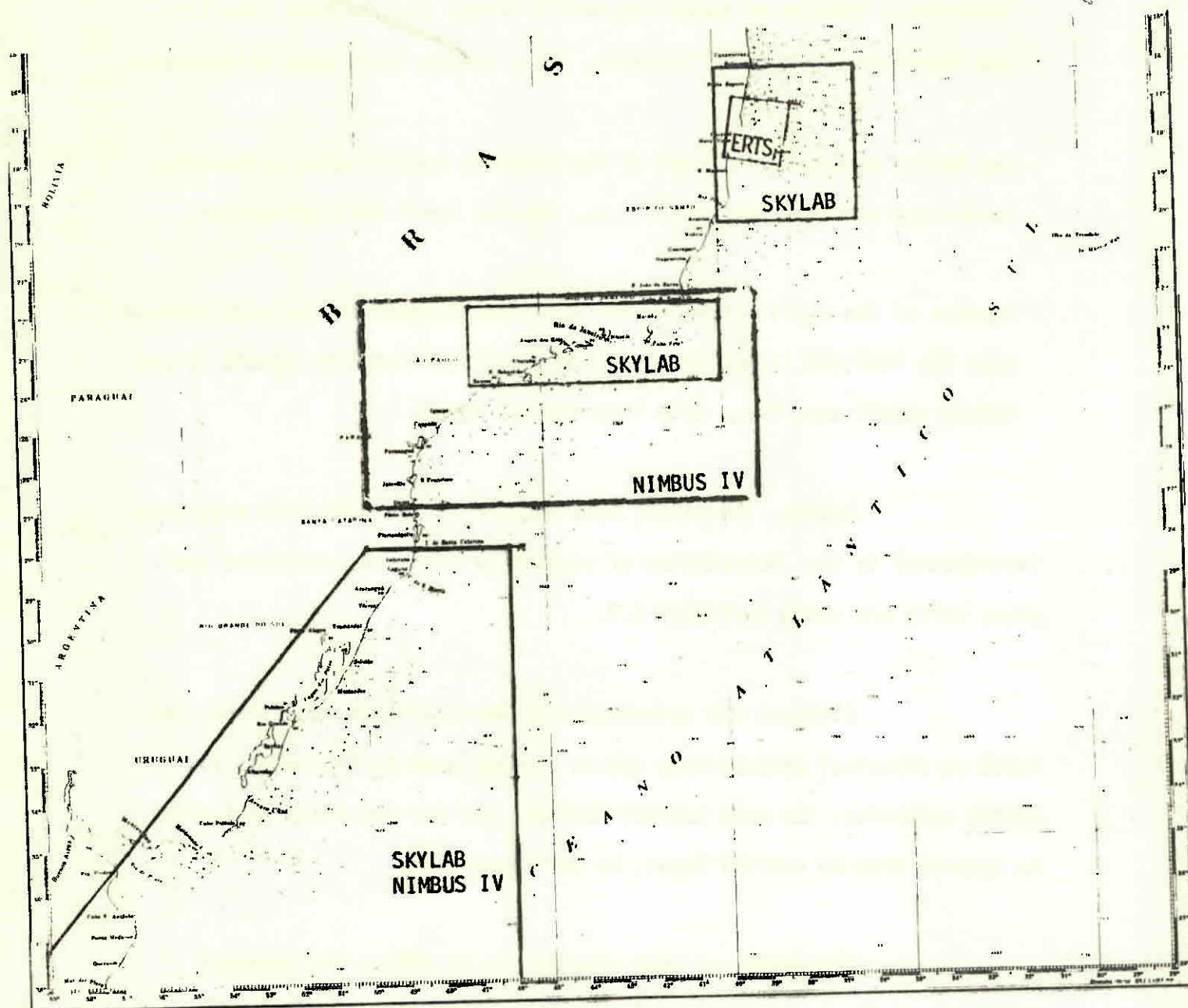


Fig. 5.3 - Areas of the Brazilian coast where experiments are being made from orbital distances, with indication of corresponding satellites.

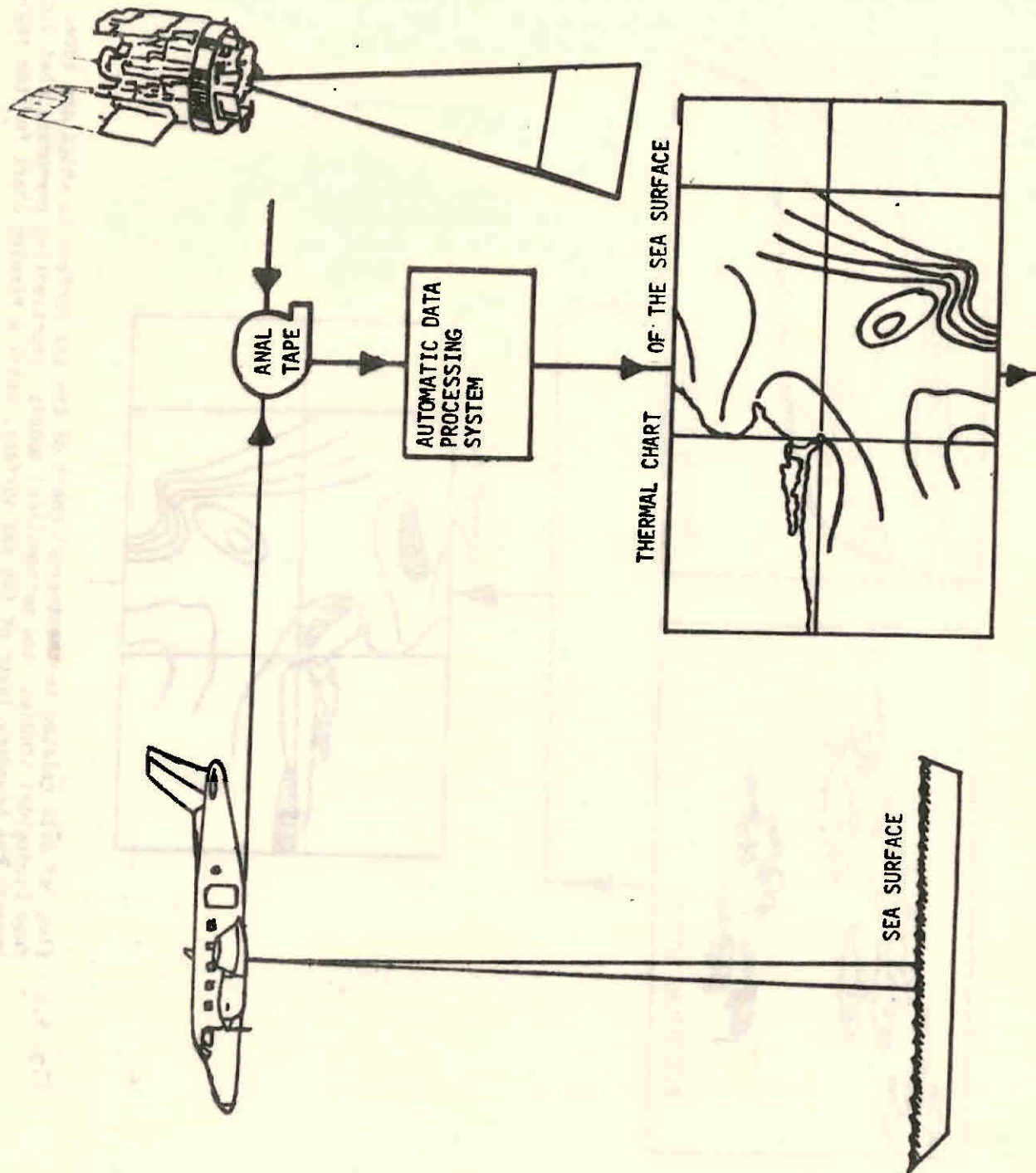


Fig. 5.4 - Flow diagram for data collected by Remote Sensors on board aircraft (or satellite) up to the finished thermal chart of the sea surface.

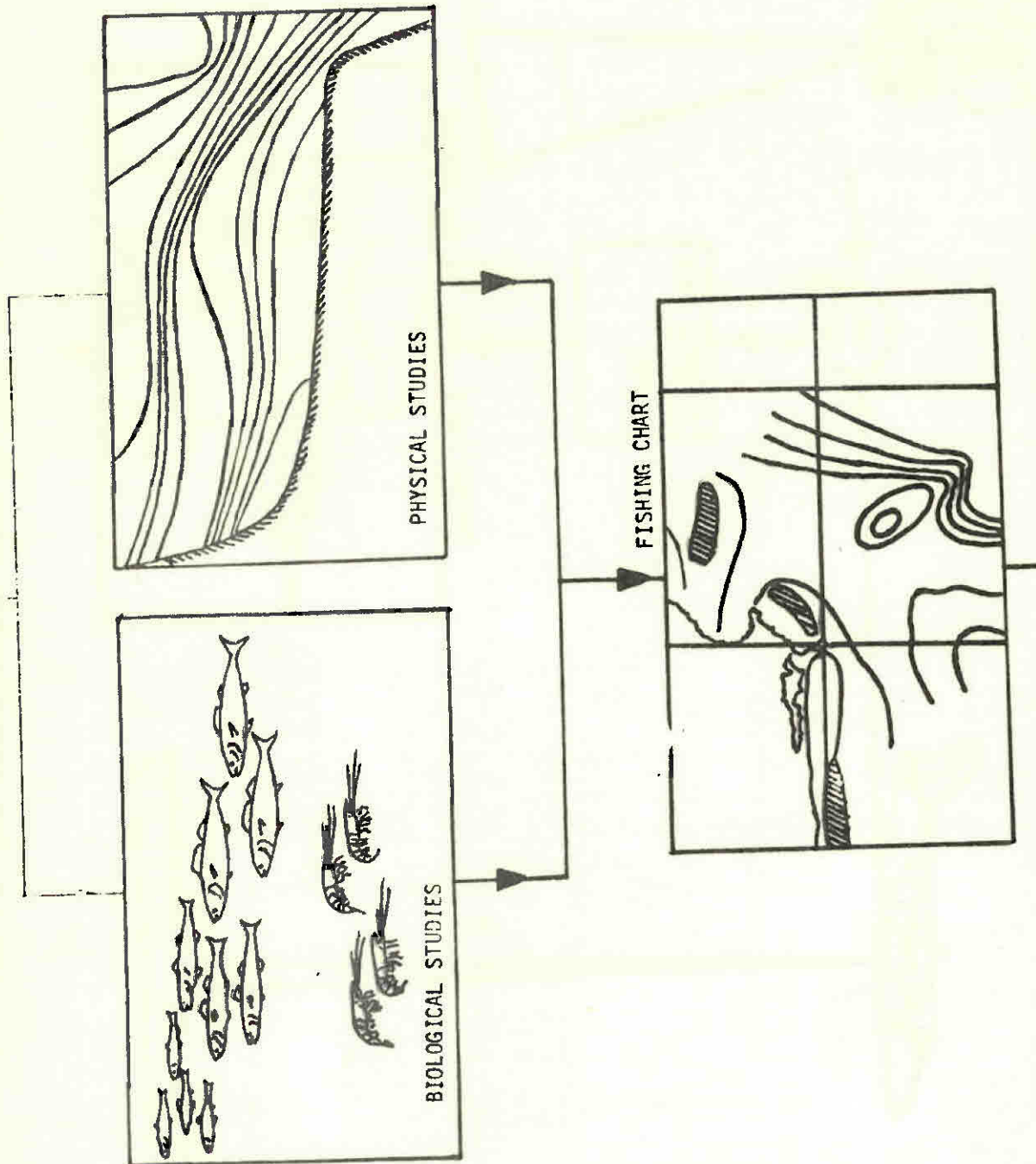


Fig. 5.5 - Flow of data related to the thermal chart of the sea surface to which are added data from biological studies and mathematical models representing phenomena that occur beneath the boundary layer of the sea surface, until a fishing chart for the region is produced.

From a test site of small dimensions where important oceanographic phenomena occur in a very marked way, periodical collections of data are made which may allow the development of studies aiming at the interpretation of the mechanisms that generate those phenomena. Such mechanisms, also present in the larger area circumscribing the test site, are then studied in a more global way, in smaller scale representation, with the help of existing oceanographic data and remote sensing data from orbital distances. The new understanding brought about by these latter studies is used to orient further research in the test site, and an iterative process is started.

This iterative process represents the research pattern for the interpretation of oceanographic phenomena under study by the group on Sea Resources.

However, the pattern of the research to be carried out over the southern coast will start from the smaller scale representations and existing oceanographic data; only after this will the "ideal" test site be selected.

On the other hand, studies on sea bottom bathymetry using ERTS data obey the pattern described in the first place.

It should be noted that as the interpretation of remote sensing data per se is, in principle, rather simple, the big concern in our research is the interpretation of the oceanographic phenomena.

5.1.2 - Final Research Product

As already stated, the end-product of the on-going research should reach the largest possible number of users and should be of a practical nature.

It is, therefore, imperative to use a system as shown in Figs. 5.4 and 5.5, that is, it is necessary to have a pattern of work consisting of the following:

Data, as collected (by aircraft or satellite borne sensors) are recorded on magnetic tape. At INPE laboratories these data are converted from analogue to digital and further processed to be transformed in a thermal chart of the sea surface.

This thermal chart will then be made available, in real time, through the laboratories of the Department of Hydrography and Navigation (DHN, Brazilian Navy) to marine biologists and physical oceanographers.

The data on the chart will be the basic elements for the study of biological and physical phenomena which occur beneath the sea surface. It should be noted that such studies will be carried out at INPE, DHN, the Navy Research Institute and the Oceanographic Institute of the University of São Paulo.

The desired end-products are fishing charts indicating the

areas most promising for fishing in the region under study.

Such charts, due to the variability of oceanographic conditions, should be placed in the hands of fishing personnel as quickly as possible.

Thence the need for real time processing of data, in the INPE computers, and its transmission to remote terminals at DHN.

A similar work pattern could be applied to the images obtained in the visible band for studies of hydrography. In this case the end product will be bathymetric charts of regions dangerous to navigation.

5.2 - General Objectives of the Sea Resources Group

The general and long range objectives of oceanographic studies with remote sensors aim at establishing methodologies intended to:

- Localize zones favorable to fishing
- Localize zones hazardous to navigation
- Create a working structure capable of making available to users the end product of the researches.

5.2.1 - General Objectives of the Sea Resources Group up to December 1972

Considering the existing possibilities of data acquisition and the experience of the group, the following objectives can be set for the next few years:

- A) To create a system capable of showing, in cartographic form, oceanographic information regarding the oscillations of the Brazilian current in the Eastern coast and the variation of the sub-tropical convergence in the Southern coast.
- B) To establish a theoretical model of the wind effect on the sea in the area between Cabo Frio, Guanabara Bay and the $23^{\circ}30'S$ parallel.
- C) To establish a system of processing periodic functions and corresponding spectral distribution for the analysis of both oceanographic and meteorological data.
- D) To develop methods for the application of Trend Surface Analysis techniques for studies of sea bottom bathymetry from orbital images.
- E) To develop studies intended to better know the effects of atmospheric absorption on the thermal radiation emitted by the sea.
- F) To develop studies of marine biology using remote sensors.
- G) To establish plans of collaboration with Brazilian agencies having

to do with problems of fishing.

5.2.2 - General Objectives for 1973.

The following objectives should be accomplished in 1973 so that the objectives for 1974 can be reached:

- A) Construction of monthly charts of the dynamic sea relief and of surface temperature charts for areas covered by SKYLAB and NIMBUS IV satellites. Use will be made of information from the recently created National Oceanographic Data Bank.
- B) Analysis of missions SEREMAR II and III in the light of the first phase of the theoretical model on the effect currents produced by the wind blowing on the sea in the area covered by those missions.
- C) Correlation of charts mentioned in objective (A) with NIMBUS IV and SKYLAB data.
- D) Continuation, using SEREMAR III mission data, of studies on effects of atmospheric absorption using the remote sensing data obtained in the infrared.
- E) Continuation of biology studies on primary productivity, in cooperation with the Navy Oceanographic Institute and the Oceanographic Institute

of São Paulo.

F) Beginning of meteorological studies to support the theoretical model studies on the effect of wind produced sea currents.

5.2.3 - General Objectives as of January 1975.

See General Objectives for Phase E.

5.3 - General Chronogram

See Figs. 5.6 and 5.7

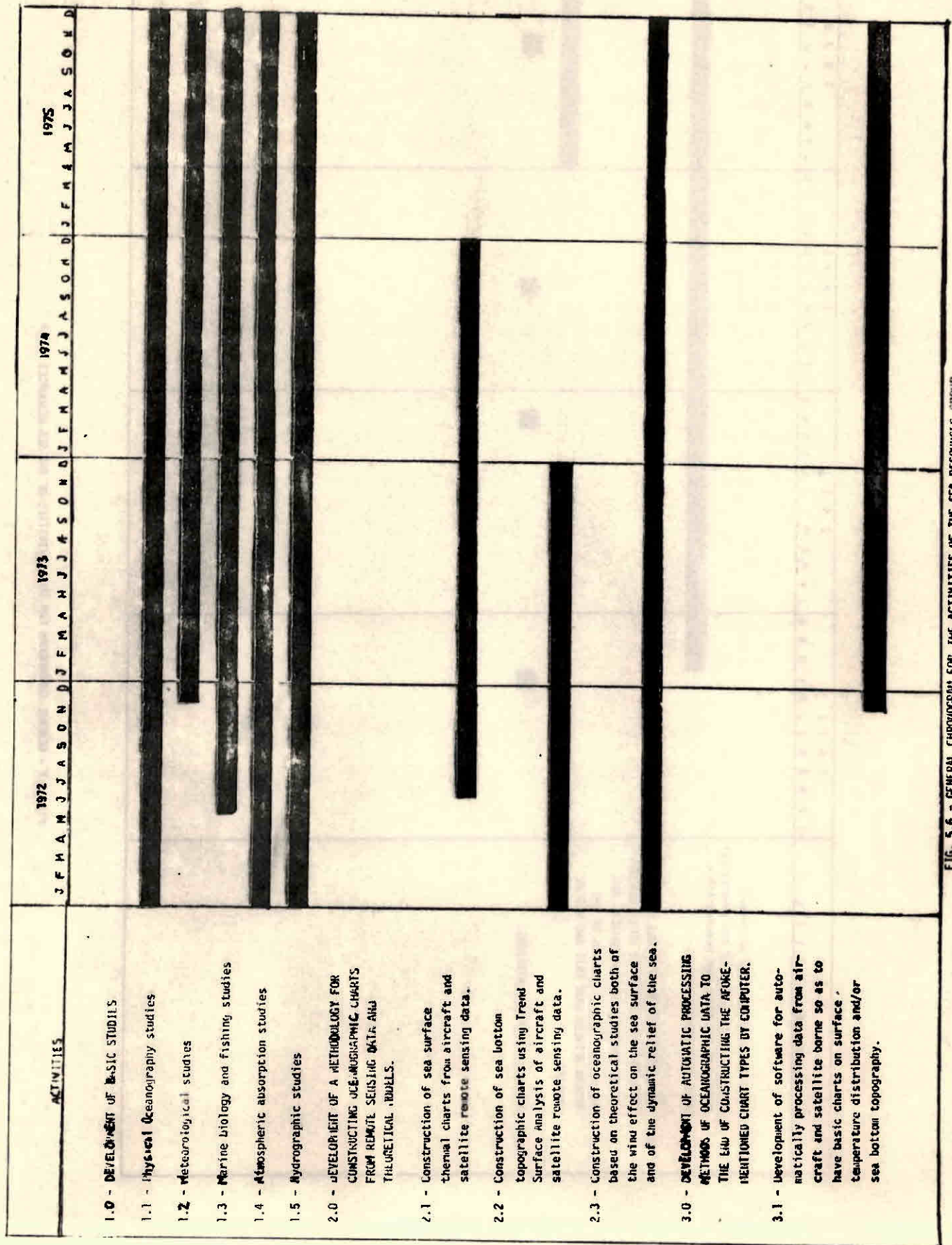


FIG. 5.6 - GENERAL CHRONOGRAM FOR THE ACTIVITIES OF THE SEA RESOURCES GROUP

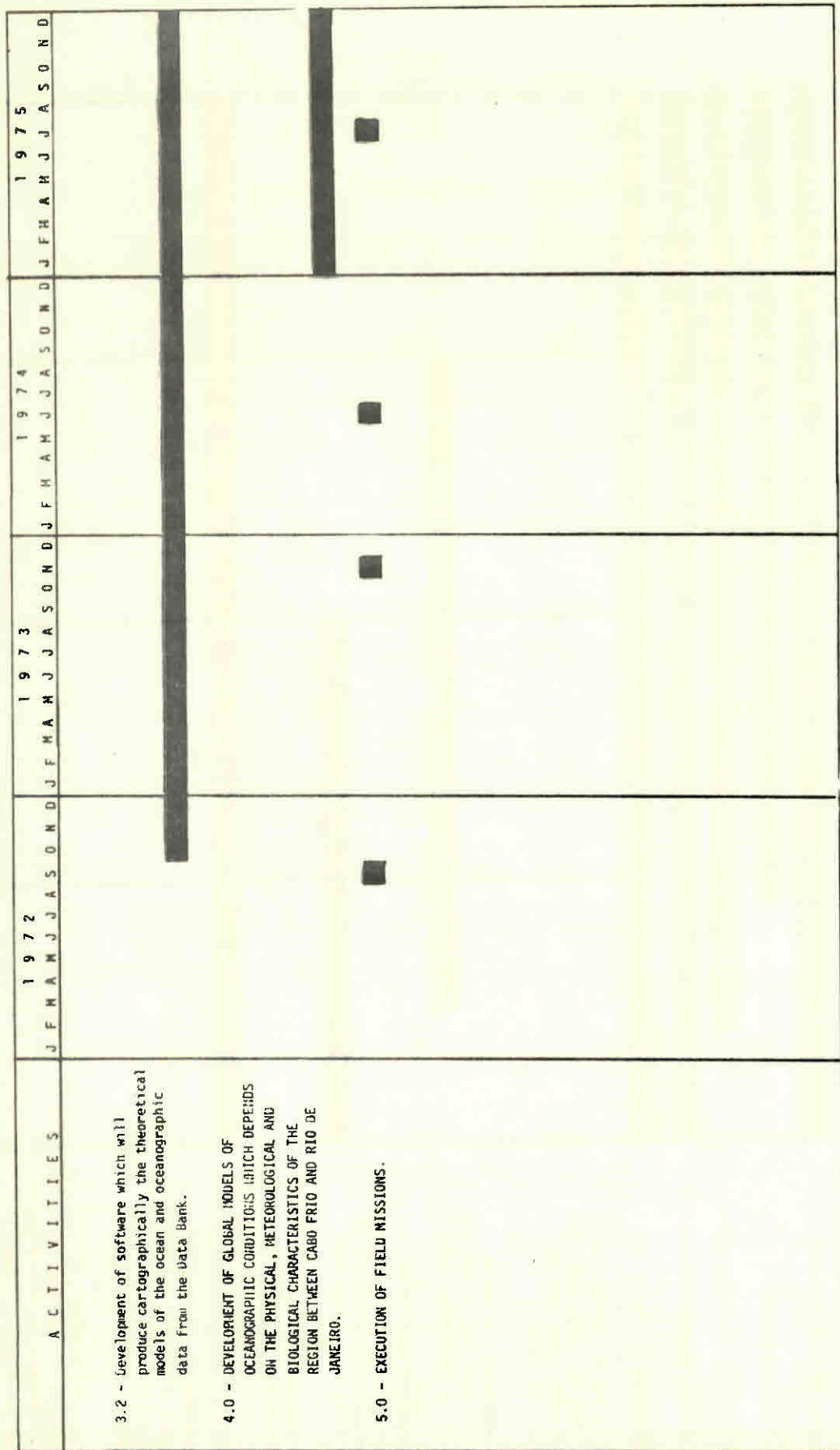


FIG. 5.7 - GENERAL CHRONOGRAM FOR THE ACTIVITIES OF THE SEA RESOURCES GROUP

CHAPTER VI

GEOGRAPHY GROUP

6.1 - General Considerations

6.1.1 - Modern Concept of Geographical Science

By definition, geography is a science dedicated to the study and understanding of the relationship between man and environment, analyzing its spatial occurrence in different scales and levels, circumscribed to the ecological system where man is the chief and central part (see Berry, Brian in "Approaches to Regional Analysis: A Synthesis" - Annals of the American Geographers, 1964). This concept establishes a basic difference between geography and the other social sciences, because none of them concerns itself with spatial distribution or correlation within the ecological system; besides geography also differs from geology, meteorology and other spatial sciences because it studies spatial problems with attention turned to human activity (see Hagget, Peter in "Location Analysis in Human Geography").

The new tendencies of modern geography, above all the adoption of quantitative methods, have profoundly altered the panorama of geographic research where concern for the definition of theoretical concepts becomes more and more closely related to the mathematization,

from the simplest forms for quantifying phenomena to the most involved reasonings on the logic of regional systems and/or urban networks; on the construction of models for spatial organization, and finally on the very concept of geographical space (see Galvão, Marília Velloso (and) Faissol, Speridião in "A Revolução Quantitativa no Geografia e seus Reflexos no Brasil" - Revista Brasileira de Geografia, Ano 32, nº 4, IBGE).

Completing the situation explained above we should mention an important geographical activity: thematic and/or geographic cartography. In it geography finds its most expressive language, the materialization and synthesis of concepts, theories and information into graphical forms, resting on specific methods of transforming qualitative and quantitative data, encompassing a whole spectrum of variables that have to do with the understanding of spatial phenomena (see George, Pierre, in "Methodes de la Geographie", Collection que sais-je?).

6.2 - General Objectives of the Geography Group

6.2.1 - General Objectives up to December 1974

Establishment of methodologies for:

- A) Obtaining planimetric and/or plani-altimetric cartographic bases for the execution of such thematic maps as:

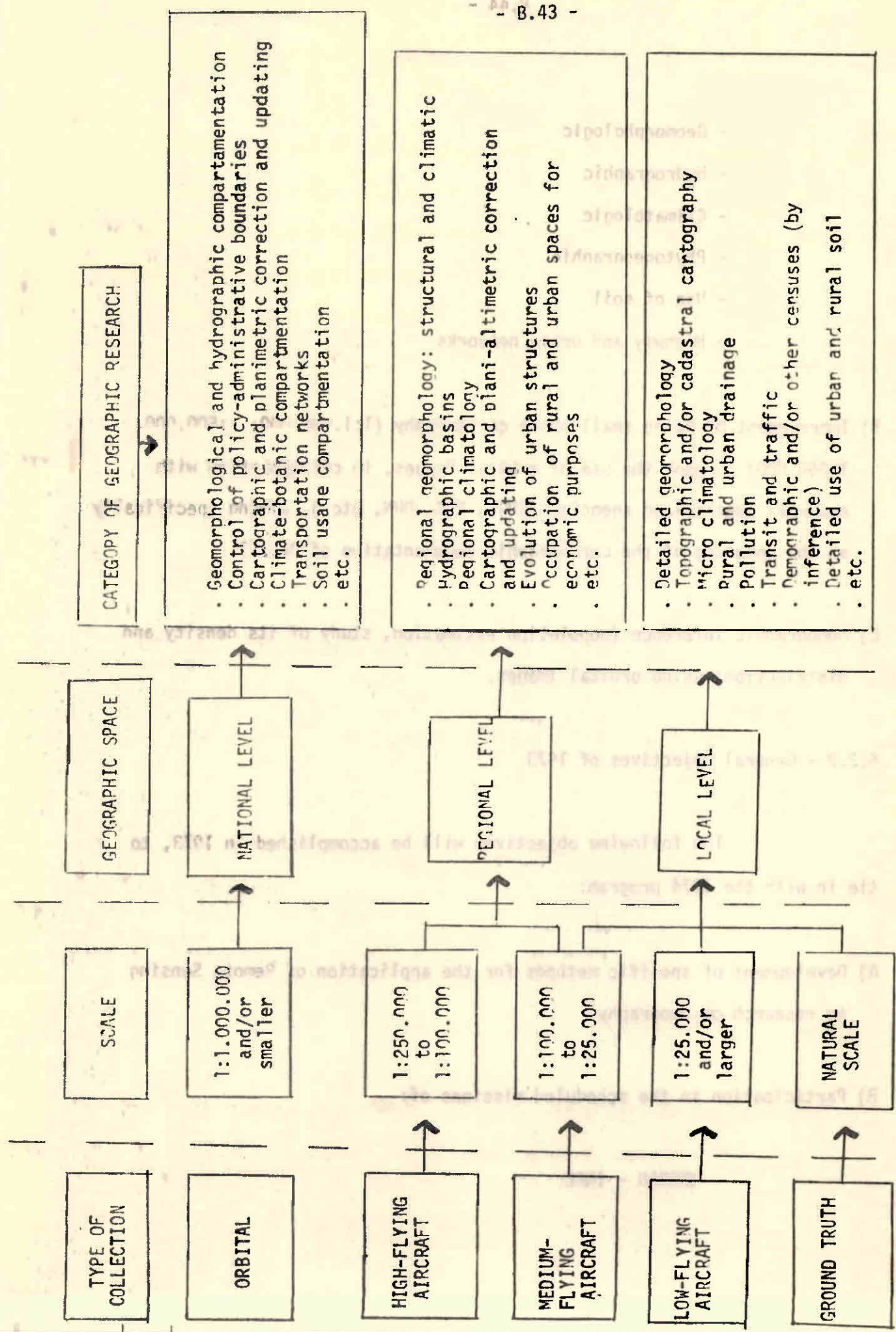


Fig. 6.1 - Classes of current problems in geography and levels of data collection.

- Geomorphologic
- Hydrographic
- Climatologic
- Phytogeographic
- Use of soil
- Highway and urban networks

R) Improvement of basic small scale cartography (1:1.000.000; 1:500.000; 1:250.000) through the use of orbital images, in collaboration with external specialized agencies (IPGE, DSG, DNM, etc.), aiming specifically at the updating of the cartographic documentation of Brazil.

C) Demographic inference (population estimation, study of its density and distribution) using orbital images.

6.2.2 - General Objectives of 1973

The following objectives will be accomplished in 1973, to tie in with the 1974 program:

A) Development of specific methods for the application of Remote Sensing to research on geography.

B) Participation in the scheduled missions of:

- GEGRA - INPE

- Rio Grande do Sul State

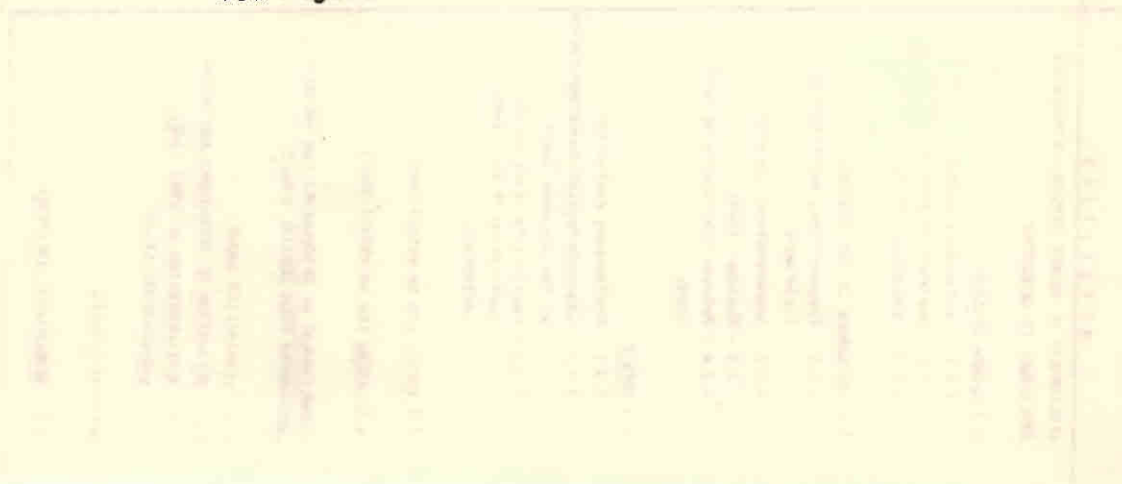
C) Collaboration in the activities of the other groups of the SERE Project in multi-disciplinary studies.

D) Exploitation, to the maximum, of the potentialities of aircraft and ERTS images by:

- Defining levels of data collection based on scale, image resolution and work objectives;
- Establishing planimetric and/or plani-altimetric cartographic bases for the execution of thematic maps such as geomorphologic, hydrographic, climatological, phytogeographic, soil use;
- Developing techniques and methods for updating thematic information from ERTS imagery.

6.3 - General Chronogram

See Figure 6.2



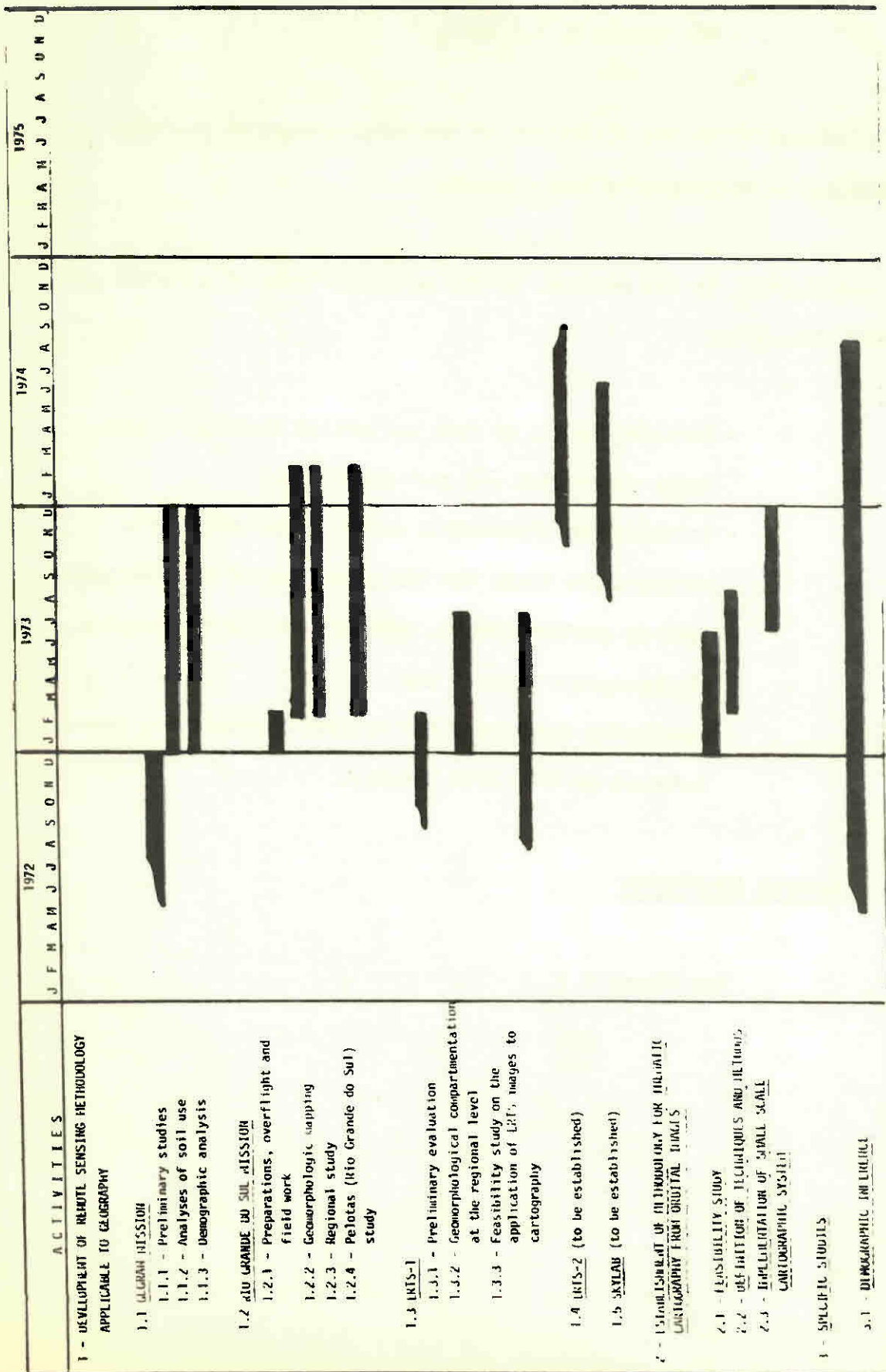


FIG. 6.2 - GENERAL CHRONOGRAM FOR THE ACTIVITIES OF THE GEOGRAPHY GROUP