

# Natal City Multi-Mission Station

## 1 The Old SACI Station

SACI Project Control Station, located in Natal City, Brazil, had been inactive since the 90's.



Figure 1. Physical aspects of SACI Station

Basically the Station operated receiving telemetry and transmitting remote controls using frequencies between 2.0 and 2.1 GHz (S-Band).

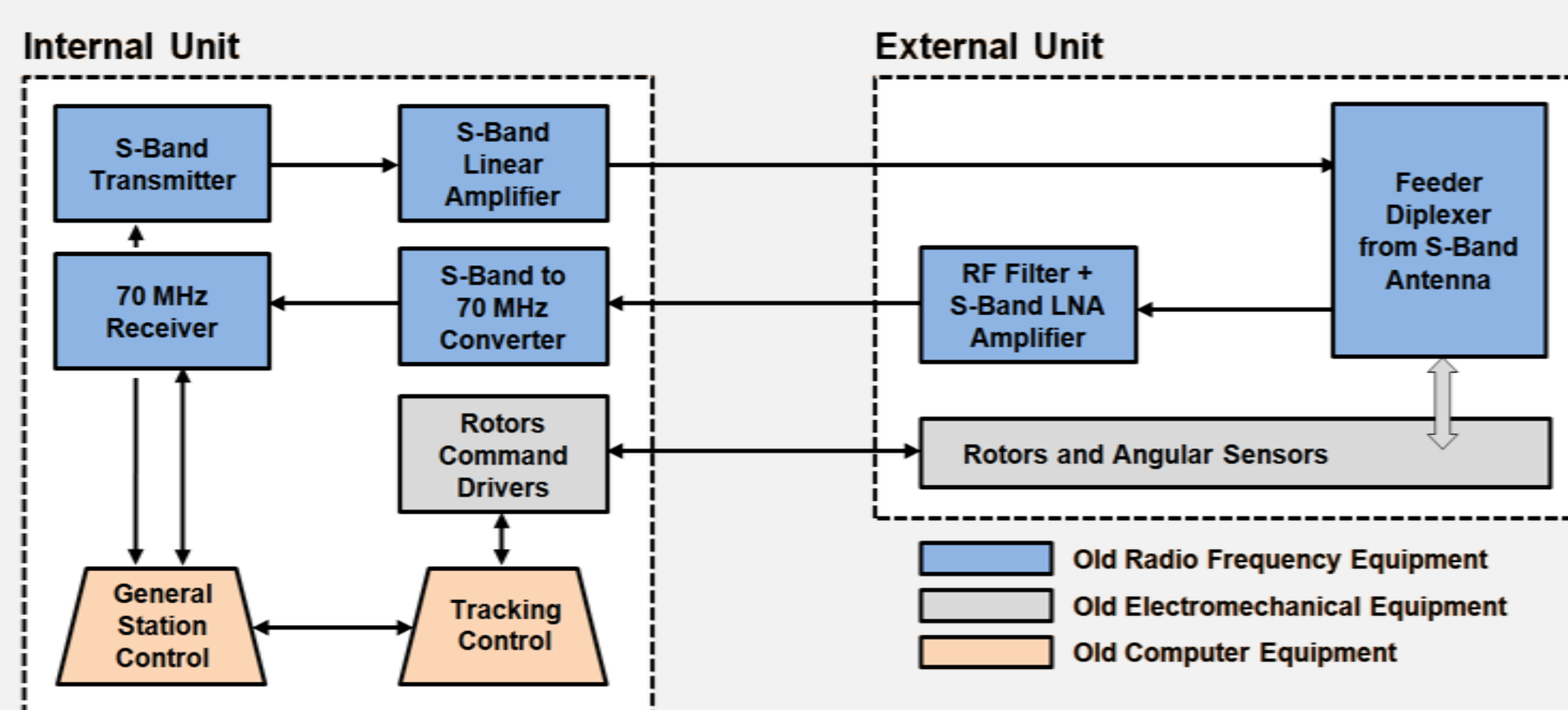


Figure 2. Simplified diagram of SACI Station

## 2 The Recovery

The physical structure was with a high degree of corrosion and was submitted to a process of recovery and exchange of components.



Figure 3. Some aspects of station recovery

## 3 The New EMMN Facilities

The station, originally planned to operate only in the S-band range, was upgraded with equipment to include the VHF and UHF bands, widely used by the vast majority of nanosatellites, such as the CubeSats.

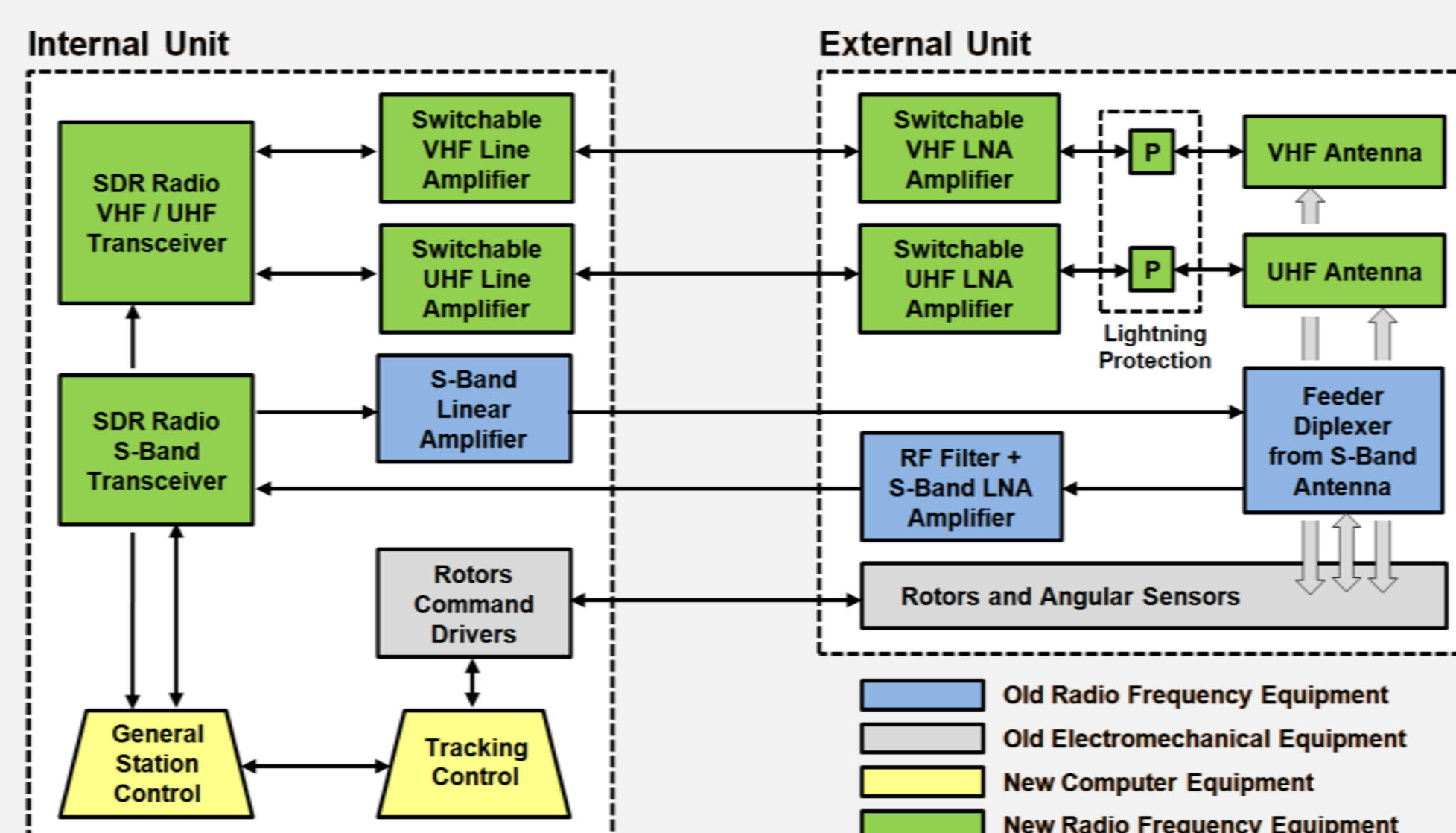


Figure 4. Simplified diagram of EMMN Station



Figure 5. Antennas with circular polarization for VHF and UHF



Figure 6. Low Noise LNA Amplifiers for S-Band, VHF and UHF



Figure 6. Software Defined Radio (SDR) and Linear Amplifiers

## 4 The New Technologies

- Compact Computing Platforms
  - Interface between the electromechanical system and the station's software.
  - Antenna motor drive control.
  - Antenna physical security system.
- Software Defined Radio (SDR)
  - Treatment of Radio Frequency Signals.
  - Modulation, demodulation, encoding and decoding of signals.
  - Other functions performed by the internal FPGA.
- GNU Radio Software
  - Ease of configuration/optimization of parameters.
- Comprehensive Open-architecture Space Mission Operations System (COSMOS).
  - Offers numerous tools for planning, scheduling and operation of missions, control and operation of stations, data management, and various analyzes.

## 5 The Missions

- First Mission - CONASAT Project
  - Constellation of CubeSat for environmental data collection.
  - Project of the Northeast Regional Center of INPE, in Natal City.
  - The mission payload is the transponder, also project of the same Regional Center.
  - Mission Control for VHF and UHF links.
  - Additional point of reception of S-Band Mission data.
- Second Mission – SPORT Project (Scintillation Prediction Observation Research Task)
  - Cooperation between NASA, the INPE, the Aeronautical Technological Institute (ITA) and the American Universities of Utah, Alabama (in Huntsville) and Texas (in Dallas).
  - Launch forecast for November 2019.
- Other Missions – (in progress)

## 6 The Future

The EMMN is fully embedded in the new concept for space applications in environmental data collection, consisting of a collaborative constellation based on Cubesat for environmental monitoring.

The GOLDS (Open Global Data Coverage System) network opens INPE's environmental data collection system to all institutions in the world interested in populating the constellation, whether by adding new nano-satellites, terrestrial facilities or sensors to the monitored environment.

This opens new perspectives of participation of the academic and scientific environment in this area of knowledge, counting on the collaboration of entities that already hold this knowledge for a long time.

We put our Multi-Mission Christmas Station at the disposal of all, hoping to contribute to the common progress.

## 7 Contacts

INPE – Instituto Nacional de Pesquisas Espaciais  
(National Institute of Space Research)  
Centro Regional Nordeste  
(Northeast Regional Center)  
Address: Rua Carlos Serrano, n° 2073  
Lagoa Nova - CEP: 59076-740  
Natal - RN - Brasil  
Phone: +55 84 3204-9100  
Site: INPE General [www.inpe.br](http://www.inpe.br)  
INPE/CRN – Natal [www.crn.inpe.br](http://www.crn.inpe.br)  
E-mail: [manoel.carvalho@inpe.br](mailto:manoel.carvalho@inpe.br)  
[lucio.iotha@inpe.br](mailto:lucio.iotha@inpe.br)