

# Fortaleza Station: 2010 Status and Antenna Repair

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## Abstract

This is a brief report about the activities carried out at the Fortaleza geodetic VLBI station (ROEN: Rádio Observatório Espacial do Nordeste), located in Eusébio, CE, Brazil, during the period from January 2010 until January 2011. The main activities concentrated on the repair of the antenna azimuth bearing and are described in detail in this report. They were successfully finalized on January 29, 2011. Regular GPS observations and new tests of the high speed network for e-transfers for e-VLBI were also performed in the period.

## 1. General Information

The Rádio Observatório Espacial do Nordeste, ROEN, located at INPE facilities in Eusébio, nearly 30 km east of Fortaleza, Ceará State, Brazil, began operations in 1993. Geodetic VLBI and GPS observations are carried out regularly, as contributions to international programs and networks. ROEN is part of the Brazilian space geodesy program, which was initially conducted by CRAAE (a consortium of the Brazilian institutions Mackenzie, INPE, USP, and UNICAMP) in the early 1990s. The program began with erecting antenna and instrumental facilities, with activities sponsored by the U.S. agency NOAA and the Brazilian Ministry of Science and Technology's FINEP agency. ROEN is currently coordinated by CRAAM, Center of Radio Astronomy and Astrophysics, Engineering School, Mackenzie Presbyterian University, São Paulo, in agreement with the Brazilian National Space Research Institute, INPE. The activities are currently carried out under an Agreement of Cooperation signed between NASA—representing research interests of NOAA and USNO—and the Brazilian Space Agency, AEB. Under the auspices of the NASA-AEB Agreement, a contract was signed between NASA and CRAAM, Mackenzie Presbyterian Institute and University to partially support the activities at ROEN. The contract was extended until 2014. The counterpart of the operational costs, staff, and support of infrastructure are provided by INPE and by Mackenzie.

## 2. Main Instruments

The largest instrument at ROEN is the 14.2-m radio telescope, on an alt-azimuth positioner. It is operated at S- and X-bands, using cryogenic radiometers. The system is controlled by the Field System, Version 9.9.2. Observations are recorded with a Mark 5 system. One Sigma-Tau hydrogen maser clock standard is operated at ROEN. GPS monitoring is performed within a cooperative program with NOAA (USA). There is a Leica System 1200 installed at the station that operates continuously. The collected data are provided to the NOAA/IGS center and to the Brazilian IBGE center. ROEN has all basic infrastructures for mechanical, electrical, and electronic maintenance of the facilities.

## 3. Staff

The Brazilian space geodesy program is coordinated by one of the authors (PK), who is Brazil's AEB representative in the NASA-AEB Agreement. The coordination receives support from the

São Paulo office at CRAAM/Instituto and Universidade Presbiteriana Mackenzie, with administrative support from Valdomiro S. Pereira and Lucíola Russo. e-VLBI connectivity tests have been conducted with the assistance of Dr. C. Guillermo Gimenez de Castro, of Mackenzie. The Fortaleza Station facilities and geodetic VLBI and GPS operations are managed on site by Dr. A. M. P. de Lucena (CRAAE/INPE), assisted by Eng. Adeildo Sombra da Silva (CRAAE/Mackenzie), and the technicians Avicena Filho (CRAAE/INPE) and Carlos Fabiano B. Moreira (CRAAE/Mackenzie).

## 4. Current Status and Activities

### 4.1. Operational and Maintenance Activities

The summary of activities performed in the period is listed below:

- 1) Contracting and supervising services for the update of the cryogenic system;
- 2) Operation and maintenance of geodetic GPS (NOAA within the scope of NASA contract);
- 3) Review and update of all technical documentation of the observatory (electrical designs, tables, lists of components, etc.);
- 4) Realization of high speed connectivity performance tests, connection improvements, national and international, to allow e-VLBI experiments;
- 5) Operation and maintenance of power supply equipment at the observatory (main and diesel driven standby);
- 6) Procurement and technical discussion with companies and consultants to evaluate and repair the antenna azimuth bearings;
- 7) Contracting and supervising services for the antenna azimuth bearing repair (See Figures 1-6);
- 8) Planning and preparation of documentation needed for electrical cabling disassembly required for the azimuth drives removal;
- 9) Repair and maintenance of antenna brakes and antenna motor fans;
- 10) Hiring and supervision of the antenna painting service;
- 11) Refurbishment of receiver box;
- 12) Maintenance of the Web site (<http://www.roen.inpe.br>) and the local server computer.



Figure 1. Antenna ready to be lifted up from the azimuth base for bearing replacement.



Figure 2. Antenna after being moved to the side of the pedestal.

## 4.2. Repair of the Antenna Azimuth Bearing

When searching for companies to provide the repair services, we received proposals from four companies, each offering a different solution. The repair job was awarded to the Brazilian company Robrasa and their installation company partner Peyrani, who had presented the best and most technically consistent bid for the job. Their offer exhibited the best solution in terms of risk, cost, and benefit. The repair consisted of the fabrication of a new bearing, which was performed at the Robrasa factory in Diadema, near São Paulo, and accomplished in six months, and of the new bearing shipment to Eusébio site (the Fortaleza VLBI facility), followed by the replacement. For this, the antenna was lifted up and displaced, the old bearing was removed, the new bearing was put into place, the antenna was relocated, and checks, tests, and azimuth movements were done for final acceptance. The installation was performed over a period of twelve days. All phases were performed successfully and on schedule. A pictorial of the work steps can be found at <http://200.129.55.1>. A rather unique methodology was used by Robrasa. The entire antenna structure, without removal of any pieces, was separated from the tower using hydraulic jacks running on rails, leaving the azimuth area free for the work. Figures 1–6 illustrate the procedure.



Figure 3. Old bearing being removed.



Figure 4. Detail of the new bearing installed.



Figure 5. Antenna being moved back.

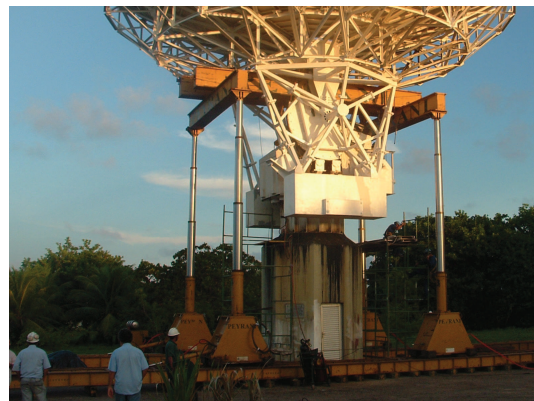


Figure 6. Antenna resting on its base again.

## 5. Future Plans

For the immediate future, plans are to reassemble the receiver antenna at the focus, redo the electrical connections, and complete the testing and necessary adjustments in order to resume geodetic VLBI observations in a time scale of 4–6 weeks.

## Acknowledgements

We acknowledge the advice on the azimuth repair job received from Prof. Antonio G. de Mello, head of the Mechanics Dep. of Mackenzie's Engineering School. These activities have received partial support from NASA, within an agreement with the Brazilian Space Agency (AEB) and a contract with Mackenzie, as part of an agreement between Mackenzie and INPE.