

Fortaleza Station Report for 2004

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Abstract

This is a brief report on the activities carried on at Fortaleza geodetic-VLBI Station (ROEN: Rádio Observatório Espacial do Nordeste), located in Eusébio, CE, Brazil, in 2004. Observing activities consisted of 73 VLBI sessions and continuous GPS monitoring recordings. Further results were obtained on the dynamics of quasar spatial structures. A new contract was signed between NASA and CRAAM, Mackenzie Presbyterian Institute and University to partially support the activities at ROEN until 2009. The contract was made under the auspices of an Agreement of Cooperation between NASA—representing research interests of NOAA and USNO—and the Brazilian space agency AEB.

1. Introduction

The Rádio Observatório Espacial do Nordeste, ROEN, located at INPE facilities in Eusébio, nearly 30 km east from 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. During that time the antenna and instrumental facilities were erected, and it was the beginning of the activities sponsored by U.S. agency NOAA, Brazilian Ministry of Science, and Technology's FINEP agency. ROEN is currently coordinated by CRAAM, Center of Radio Astronomy and Astrophysics, Mackenzie Presbyterian University, São Paulo, in agreement with the Brazilian National Space Research Institute, INPE. A new contract was signed in May 2004 between NASA and CRAAM, Mackenzie Presbyterian Institute and University to partially support the activities at ROEN until 2009. The contract came into being under the auspices of an Agreement of Cooperation that was recently signed between NASA—representing research interests of NOAA and USNO—and the Brazilian Space Agency AEB. Part of the operational cost, staff, and support of infrastructure are provided by INPE and by Mackenzie.

2. Brief Description of ROEN Facilities

The largest instrument of ROEN is the 14.2 m radio telescope, on one alt-azimuth positioner. It is operated at S- and X-bands, using cryogenic radiometers. The system is controlled by Field System, Version 9.6.2 program. Observations are recorded with a Mark III data acquisition system. One Sigma-Tau hydrogen maser clock standard is operated at ROEN.

GPS monitoring is performed by one dual frequency GPS Rogue receiver operated continuously. The collected data are provided to the IGS center, as well to Brazilian IBGE center. ROEN has all basic infrastructure for mechanical, electrical and electronic maintenance of the facilities.

3. Space Geodesy Team

The Brazilian space geodesy program is coordinated by Prof. Pierre Kaufmann, from São Paulo main office at CRAAM(CRAAE)/Instituto and Universidade Presbiteriana Mackenzie, re-



Figure 1. The 14.2-m antenna of Fortaleza (Eusébio) station

ceiving scientific assistance from Dr. Claudio E. Tateyama, and partial administrative support from Valdomiro S. Pereira and Neide Gea. Partial technical assistance is given by Itapetinga Radio Observatory staff, near São Paulo, also operated by INPE/Mackenzie.

The Fortaleza Station facilities and geodetic VLBI and GPS operations are managed on site by Eng. A. M. P. de Lucena (CRAAE/INPE), assisted by Eng. Adeildo Sombra da Silva (CRAAE/Mackenzie), and technician Avicena Filho (CRAAE/INPE). A position of an electronic technician was in the process of being filled.

4. Geodetic VLBI Observation

Fortaleza participated in the following geodetic VLBI experiments, as detailed in the table below for the year 2004.

Experiment	Number of Sessions
IVS-R4	50
IVS-T2	11
IVS-CRF	03
IVS-OHIG	07
IVS-R&D	02

5. Development and Maintenance Activities in 2004

Considerable attention was given to technical maintenance problems, specially to the following ones:

1. Tests and electrical alignment of the DC motors in both axes.
2. Installation of Mark IV formatter.
3. Repair on cryogenic system with replacement of cold head and helium lines.
4. Repairs on the following circuits, modules, or systems: Mark III video converters, Mark III

power supplies, Mark III IF3 module and Mark IV formatter.

5. Maintenance of web site (<http://www.roen.inpe.br>).

6. GPS Operation

The IGS network GPS receiver operated regularly at all times during 2004. Data were collected and uploaded to IGS/NOAA computer.

7. Visitors

In 2004 Mr. William T. Wildes, VLBI Network Manager at GSFC/NASA, visited ROEN for final discussions on the application plan of the new contract between NASA and Mackenzie. The contract was signed in May. The Rector of Mackenzie Presbyterian University, Professor Manasses C. Fonteles, visited ROEN in order to discuss the establishment of a cooperative agreement with Ceará State University, from Fortaleza, that is aimed at providing further support to ROEN and to the development of joint research on space geodesy-related fields, with emphasis on the exploration of GPS- and VLBI-derived meteorology parameters.

8. VLBI-related Research on Astrophysics

The astrophysics research work was continued with the participation of the student Danilo M. Teixeira. Using geodetic VLBA data it was shown for the first time a direct evidence of precession of the jet of OJ287 which before was only deduced from models of observations of a light curve. A study was started on the structure of compact sources; the quasar 0552+398 in particular shows a very complex structure which appears to be a combination of an extended component (1 mas in diameter) and a core-jet structure (1 mas in size). Plans have been established to use more extensively the geodetic VLBI data available at USNO, in cooperation with Kerry Kingham, not only to extend the present research but also to explore properties of other interesting sources.

9. Future Plans

It is planned to complete the Mark IV updating during 2005. The Mark IV formatter module was installed at the beginning of 2004. It is necessary to install new filter boards and upgrade the mixer board in the video converters to accomplish the Mark IV upgrading. The installation of a Mark 5 recorder unit is planned for 2005.

10. Publications

Tateyama, C.E. and Kingham, K.A.: "Structure of OJ287 from geodetic VLBA data", *ApJ*, 608, 149, 2004.

Teixeira, D.M., Tateyama, C.E., Kaufmann, P., de Lucena, A.M.P., Lister, M., Kingham, K.: "Observations of VLBI and VLBA of quasar 0552+398". *Boletim da SAB*, Vol. 24, No. 1, p. 156, 2004.