Badary Radio Astronomical Observatory

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Abstract

This report provides information about the Badary network station: general information, facilities, staff, present status, and outlook.

1. General Information

The Badary Radio Astronomical Observatory (Figure 1) was created by the Institute of Applied Astronomy (IAA) as one of three stations of the Russian VLBI network QUASAR [1].

The sponsoring organization of the project is the Russian Academy of Sciences (RAS). The Badary Radio Astronomical Observatory is situated in the Republic Buryatia (East Siberia) about 130 km east of Baikal Lake (see Table 1). The geographic location of the observatory is shown on the IAA RAS Web site (http://www.ipa.nw.ru/PAGE/rusipa.htm). The main instruments of the observatory are the 32-m radio telescope equipped with special technical systems for VLBI observations, GPS/GLONASS/Galileo receivers, a DORIS antenna, and the SLR system.

Figure 1. Badary observatory.

Table 1. The Badary observatory location and address.

Longitude	102°14′
Latitude	51°46′
Republic Buryatia	
671021, Russia	
oper@badary.ipa.stbur.ru	

2. Technical Staff

Vladimir Shpilevsky — the head of the observatory,
Roman Sergeev — the chief engineer, FS, pointing system control specialist, and
Roman Kuptsov — the engineer.

3. Technical and Scientific Information

Characteristics of the radio telescope are presented in Table 2.

Table 2. Technical parameters of the radio telescope.

Year of construction	2005
Mount	AZEL
Azimuth range	±270° (from south)
Elevation range	from $-5°$ to 95°
Maximum azimuth *	
- velocity	0.83 °/s
- tracking velocity	2.5 ′/s
- acceleration	12.0 $'/s^2$
Maximum elevation *	
- velocity	0.5 °/s
- tracking velocity	0.8 ′/s
- acceleration	12.0 $'/s^2$
Pointing accuracy	better than 10″
Configuration	Cassegrain (with asymmetrical subreflector)
Main reflector diameter	32 m
Subreflector diameter	4 m
Focal length	11.4 m
Main reflector shape	quasi-paraboloid
Subreflector shape	quasi-hyperboloid
Main reflector surface accuracy	± 0.5 mm
Frequency range	1.4–22 GHz
Axis offset *	3.7 ± 2.0 mm

* These values were changed to optimize the performance of the antenna system. The axis offset was measured in summer 2012 by geodesist Andrey Shamov.

4. Co-location of VLBI, GPS/GLONASS, DORIS, and SLR System

The Javad GPS/GLONASS/Galileo receiver with automatic meteorological station WXT-510 is in operation (Figure 2).

The SLR system “Sazhen-TM” (Figure 3) was mounted in July 2011. The “Sazhen-TM” SLR system was manufactured by Open Joint-stock Research-and-Production Corporation “Precision Systems and Instruments”. Technical characteristics of the system are presented in Table 3. The SLR system at Badary joined ILRS in March 2012.

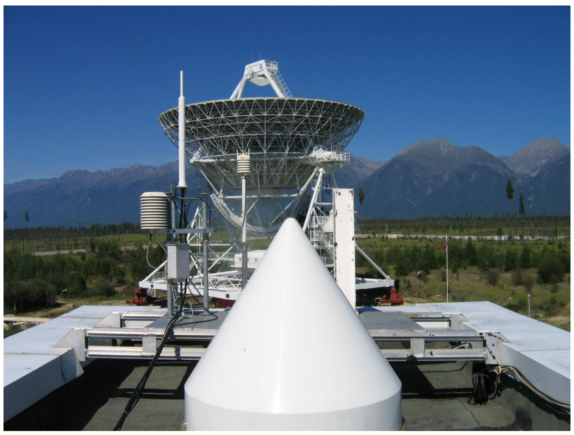

Figure 2. Javad GPS/GLONASS/Galileo receiver and DORIS beacon at the Badary observatory.

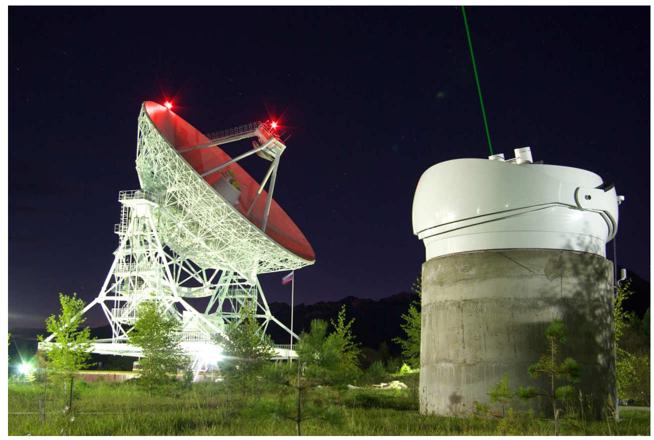

Figure 3. “Sazhen-TM” SLR system at Badary observatory.

Table 3. Technical parameters of the SLR system “Sazhen-TM”.

Ranging distance, day	400-6000 km
Ranging distance, night	400-23000 km
Aperture	25 cm
Wavelength	532 nm
Beam divergence	$12''$
Laser pulse frequency	300 Hz
Pulse energy	2.5 mJ
Mass	170 kg
Normal points precision	1 cm
Angular precision	1-$2''$

5. Current Status and Activities

The Badary observatory participates in IVS and domestic VLBI observational programs. In 2012 Badary station participated in 27 diurnal IVS sessions — IVS-R4, IVS-T2, and EURO.

Badary participated in 47 diurnal sessions of the domestic Ru-E program to determine all Earth orientation parameters and in 191 one-hour Ru-U sessions for obtaining Universal Time using e-VLBI data transfer. Since July 2012, observations for the Ru-U program have been performed daily.

6. Outlook

We have the following plans for the coming year:

- To participate in IVS observations
- To carry out domestic observational programs with e-VLBI data transfer to daily obtain Universal Time and to weekly obtain Earth orientation parameters
- To carry out SLR observations of geodetic and navigation satellites
- To participate in EVN and RADIOASTRON observational sessions
- To continue geodetic monitoring of the antenna parameters
- To build foundation and to conduct survey operations for VLBI2010 antenna installation in 2014 (Figures 4 and 5).

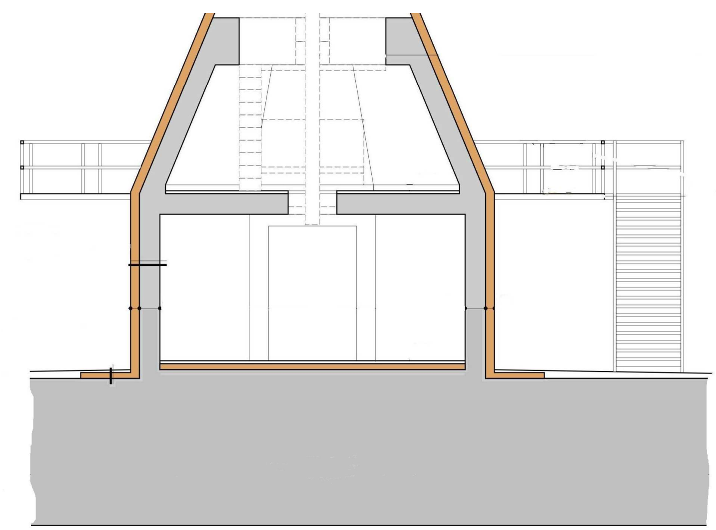

Figure 4. The foundation for RT-13 is planned to be built in 2013.

Figure 5. RT-13 is planned to be installed in 2014.

References

[1] Finkelstein A., Ipatov A., Smolentsev S. The Network “Quasar”: 2008 — 2011 // “Measuring the future”, Proceedings of the Fifth IVS General Meeting, A. Finkelstein, D. Behrend (eds.), St. Petersburg, “Nauka”, 2008. pp. 39–46.