

The current status of the Russian SLR network and future plans

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The Russian subnetwork of the active laser stations participating in ILRS Network consists of 10 stations, 8 of which are located in the territory of Russia, one in Kazakhstan and one in Brazil.

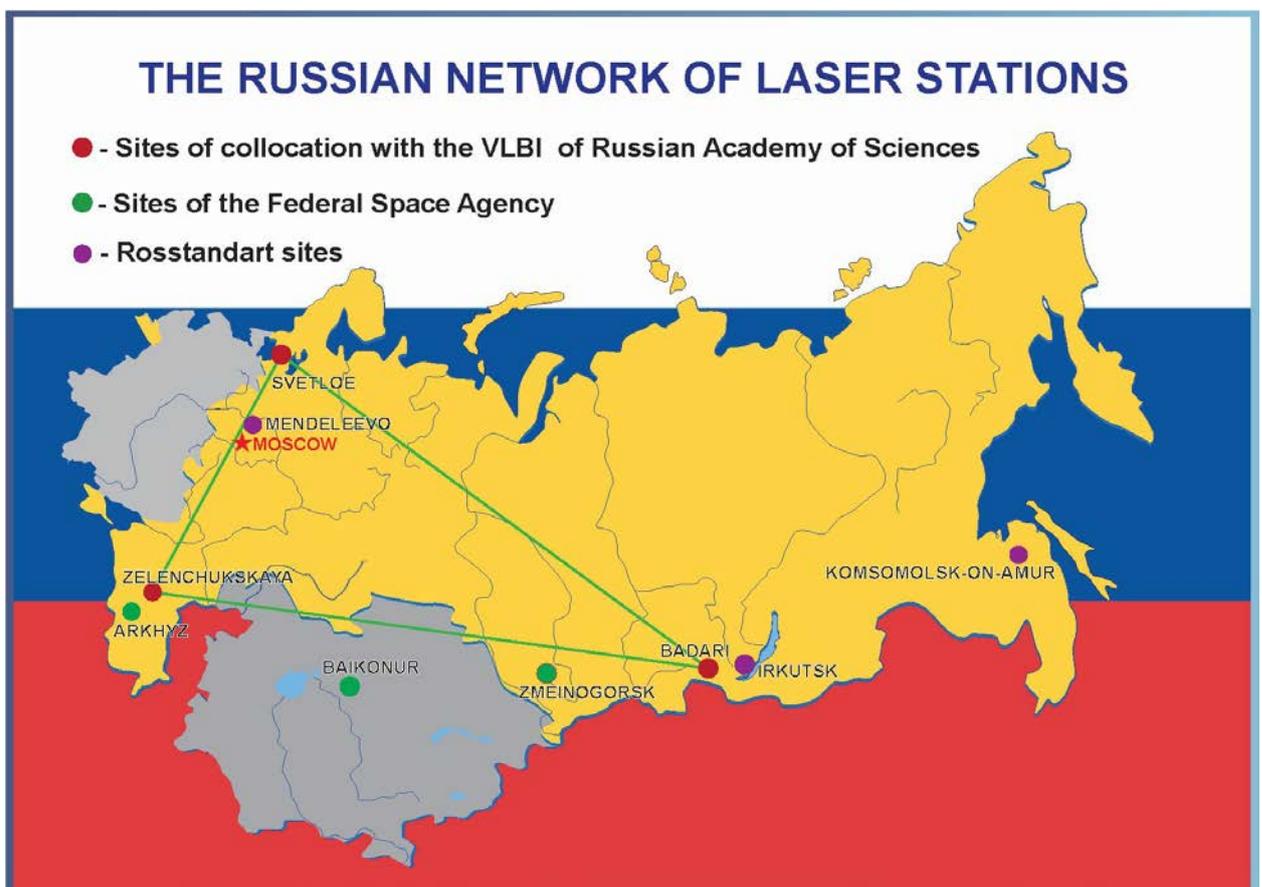


Figure 1 The Russian active SLR stations (on Russian territory), participating in ILRS Network

Until the end of 2016 it is planned to be operational SLR station in the Republic of South Africa at site HartRAO near 7501 SLR station and VLBI.



August 2016



December 2016

Figure 2. HartRAO, the installation of the Russian SLR station

SLR stations of the Russian network are divided into three groups depending on strategy and priorities at planning objects for tracking. The priority direction of

SLR stations Komsomolsk, Altay, Arhyz, Baikonur and Brazil is ranging of the navigation satellites (GLONASS).

The priority direction of SLR stations Svetloe, Zelenchukskaya and Badary located on sites of a collocation (SLR, VLBI, GNSS, DORIS (Badary)) - observation of geodetic satellites.



Figure 3. Badary SLR station

The priority direction of SLR stations Mendeleevo 2 and Irkutsk – time transfer.

As all SLR systems of all ten stations (plus the SLR station in the Republic of South Africa) are developed and manufactured by PSI corporation, PSI provides supervision of the equipment and introduces all improvements intended for increase of accuracy, reliability and expansion of functional properties of SLR systems and also helps to increase skill level of station operators during trips of developers of the equipment for carrying out repair work or an upgrade of SLR systems on sites.

In 2018 the station of a Lunar Laser Ranging will begin to work on the Altai Optic-Laser Center (AOLC) where the Altai SLR station is located.



Figure 4. Altai Optic Laser Center

The LRR array which is planned to be installed on the Moon in 2019 (a mission Luna-25) near the South Pole of the Moon (in Boguslavsky's crater, 75° of southern latitude, 48,5° east longitude) will be one of the purposes of observation of this station.

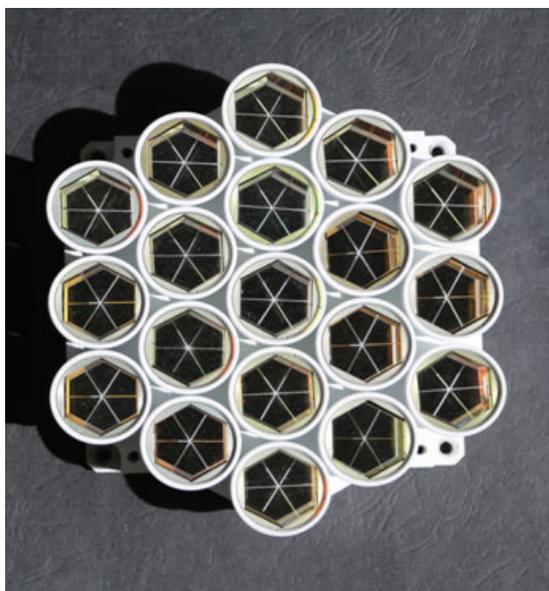


Figure 5.

LLR array «Luna-25»:

19 CCR's (Ø28 mm);

Габариты: 190 x 170 mm;

Масса: 950 g;

Cross section: $2,3 \cdot 10^8 \text{ m}^2$.

According to an established order all SLR stations of the Russian network participating in the observation programs of ILRS are sending raw measurements in data-processing center of IAC PNT FSUE TSNIMASH where processing of measurements, calculation of normal points, formation of data the CRD format and mailing at station the Consolidated Prediction Format (CPF) is carried out, and also carries out delivery of these measurements of the Russian SLR stations in the European data-processing center of EDC.

Improvement of the existing laser stations is supposed to be carried out in the following directions:

- to increase the accuracy of measurements by replacement of lasers with pulse duration 300 - 400 ps on lasers with pulse duration about 50 ps;
- to implement on stations the software, designed for daytime laser ranging.

At three Russian SLR stations (Brazil, Svetloe and Mendeleevo 2) such software is already set.



Figure 6. Brazil SLR station

Future plans

It has been developed and is in the process of manufacturing a prototype of new generation SLR station millimeter accuracy «Tochka», which will be installed at the site Mendeleevo of State Service of Time and Frequency (SSTF), and at another two sites of its branches, as well as at four foreign GNSS sites from six sites currently under consideration: Mexico (California), Argentina (Falda del Carmen), French Polynesia (Tahiti.), Indonesia (Java.), Israel, Peru.



Figure 7. Existing (yellow) and possible (green) placement of Russian laser stations on foreign territories.

When selecting the locations of the laser stations on foreign territories, we are guided by the following criteria:

- it is desirable that stations have been located in those places of the globe where are possible measurements of those parts of satellite orbits which are inaccessible from the territory of the Russian Federation (the western and southern hemisphere of Earth);
- it is desirable that the station has been located in the site where many days suitable for optical observations;
- welcome sites, where possible colocation with other geodetic techniques;
- we need to be able to involve local specialists for the operation of the station on a contract basis;

- and, most importantly, on the governmental level should be the basis for a possibility of an arrangement of the station in this country.

Therefore the list of possible places for placement of stations constantly changes depending on the current geopolitical situation.