

Commissioning of the New Laser Station in Irkutsk

V.A. Emelyanov [1], G.I. Modestova [1], V.V. Kaplenko [1], S.I. Raschetin [1], E.P. Gladkevich [1],
E.N. Myasnikova[1], I.N. Bobrik [1], I.Yu. Ignatenko [2]

[1] East-Siberian Branch of National Research Institute for Physical-Technical and Radio Engineering Measurements (VNIIFTRI), Irkutsk

[2] National Research Institute for Physical-Technical and Radio Engineering Measurements (VNIIFTRI), Mendeleevo

IgIg@vniiftri.ru

Abstract

It describes the history of the development of laser observations in Irkutsk. There are the main characteristics of the station and the first results of observations presenting

In July 2013 on the territory of astrogeodynamic polygon East-Siberian branch of VNIIFTRI (Irkutsk) small-sized modular quantum-optical system "Sazhen-TM" (figure 1) was introduced into the work.



Figure 1 - "Sazhen-TM" in Irkutsk

The East-Siberian branch of FSUE «VNIIFTRI» is an autonomous structural subdivision of FSUE «VNIIFTRI». The major aim of foundation of the East-Siberian branch is carrying out of technical-scientific activity of measurement assurance either in the territory of Eastern Siberia or the whole country.

At present, the East-Siberian branch carries out basic and applied researches of measurement assurance. The branch fulfills works on industrial and residential supply of metrological productions and services, carries out a complex of researches and developments on high-precision equipment for time-and-frequency, radiotechnical and gas humidity measurements, takes part in the Federal Target Program on maintenance and development of Research-and-Technology Base of Standards.

The branch participates in international cooperation, key and supplementary comparisons of national standards between Russia, Finland, USA, Japan, Great Britain, China and other countries.

The East-Siberian branch of FSUE «VNIIFTRI» as a part of FSUE «VNIIFTRI» has the status of the State scientific metrological centre and the State Centre for Testing Measuring Instruments. The branch also performs functions of the Siberian metrological centre of the State service of time, frequency and the Earth rotation parameters determination.

The field of application of the results of laser location by "Sazhen-TM" is coordinate and time support of GNSS GLONASS; space geodesy and navigation; Earth rotation parameters determination and other.

"Sazhen - TM" is the third modification of the devices performing laser location in Irkutsk astro- geodynamic polygon. The first observation of two satellite - GEOS-A and GEOS-C were held in 1978 on the first generation of laser rangefinder LD-2. (figure 2).



Figure 2 - Installation of LD-2 in Irkutsk (1978)

During the operation of a laser rangefinder great volume of works on its improvement was executed. Special program of the refraction accounting and of processing of results of laser location satellites were developed, an equipment for registration of laser location data has been created, a connection with the standard of a copy of the time and frequency of the FSTF USSR was established. Observations were conducted before 1980, when it was decided to start the development and manufacture of second generation of laser rangefinder LD-3 (figure 3). In 1984 development of LD-3 was completed and experimental location of low-orbit geodetic satellites AJISAI, GEOIK-I and GEOIK-II started.

In early 1985, the next, more difficult task became more remote location of "Lageos" satellites (up to 6000 km) and "Ethalon" (up to 20 000 km), which caused the necessity of serious modernization of transmitting-receiving devices, laser emitter and tracking system. In 1987-1988 the rangefinder LD-3 videos playthroughs satellites with subsequent precise definitions of the angular coordinates of the satellite were successfully conducted.



Figure 3 – Installation of LD-3 in Irkutsk (1985)

In 1993, work on the LD-3 was discontinued, due to commissioning in the service of a laser rangefinder "Gran", but delivery "Gran" to Irkutsk was abolished, and in 1994 the topic of laser location was closed – for ten years.

At the polygon observations on astro-optical instruments, initiated in 1975, continued, (on Danjon prismatic astrolabe and transit instruments), and since 1995, in parallel optical observations, work to identify Earth rotation parameters determination by electronic methods started (for this case stationary receivers GNSS were installed). Rotation device of "Sazhen - TM" is mounted on a special pylon, and it is under shelter (figure 4); remote control (figure 5) is in the special control room in 25 meters away from the pylon. Concrete pylon for the placement of the antenna GNSS of 216-channel receiver "Sigma" (company "Javad GNSS"), operating in the continuous mode as without-application oriented query station and reflector, designed for external calibration range finder is mounted on a common footing with satellite laser rangefinder. The

foundation was founded in 1974 under the placing of the photoelectric tool FPI-1F and there were fulfilled astrometric observations for ERP Service on this foundation about forty years. The foundation was made at the depth below the soil freezing (3.5 meters) to the bedrock and is made according to the rules of laying foundations under the astronomical instruments with dirt interchange.

From August 2013 by the location of "Lageos" coordinates of the station were determined as follows:

$$X=-968\ 340,3245\ \text{m}, Y=3\ 794\ 415,0978\ \text{m}, Z=5\ 018\ 178,1013\ \text{m}.$$

Preliminary results of the measurements are presented in figure 6.



Figure 4 - shelter for "Sazhen - TM"

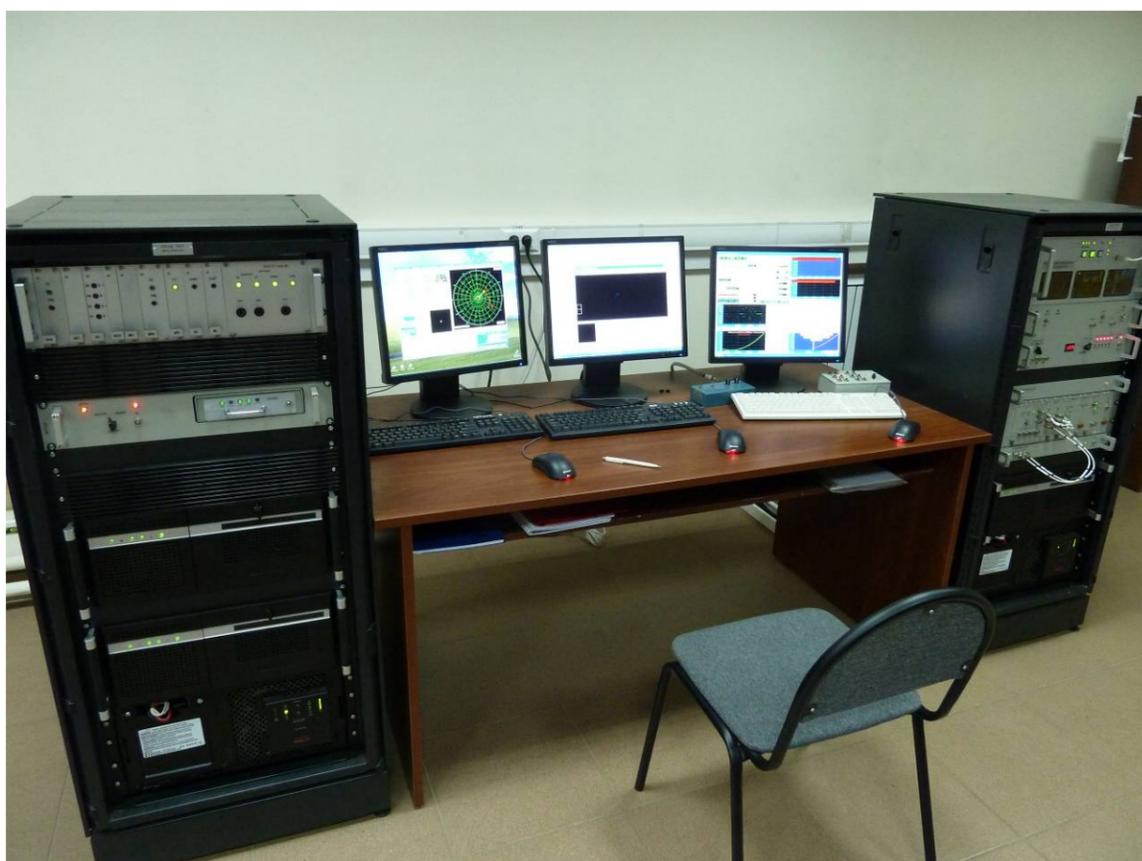


Figure 5 - control panel of "Sazhen - TM"

