

The Chinese National Space Geodetic Network

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Abstract. The status and projects of Chinese VLBI, SLR and GPS networks are described, the application of a mobile VLBI system are investigated in establishing a Chinese geodetic VLBI network. The establishment of the Chinese National Space Geodetic Network by the VLBI network together with the SLR stations and GPS densification network are studied.

1. The Status and Projects of Chinese VLBI, SLR and GPS Networks

In China, the Chinese Academy of Science, National Bureau of Surveying & Mapping and National Seismology Bureau began to undertake the Chinese VLBI, SLR and GPS networks projects in 1980s.

The VLBI network would consist of three fixed VLBI stations and a data analysis center. The Shanghai 25-m antenna VLBI station has been operated since 1987 which is equipped with Mark III(A) and VLBA data acquisition terminals. The Urumqi station with a 25-m antenna and a Mark III(A) terminal is due to available in 1993. The Kunming VLBI station will be constructed with the Russian QUASAR Network project. The data analysis center, operated by the Shanghai Observatory, is nearly completed. In addition, a mobile VLBI station will be constructed in the next few years. The main designed performance of it are a collapsible antenna of about 3.5 m diameter with the efficiency more than 0.55 at X band and 0.48 at S band, a dual frequency S/X band receiver with HEMT amplifier, a data acquisition system compatible with Mark III(A) using the S-2 VLBI recording terminal with the maximum data rate 128 Mb/s, and a hydrogen maser standard with frequency stability better than 2×10^{-14} . This system is transportable, the antenna and pedestal can be moved by a crane and mounted to a prepared permanent base.

The SLR network would consist of six third generation fixed stations. Shanghai, Wuhan, Beijing, and Changchun SLR stations now have been operated. Lasha and Kunming SLR stations are planned and will be available in the next few years. The location of VLBI and SLR stations are shown in Fig. 1.

The GPS densification network is divided into two orders. The first order GPS network of 40 to 50 points with accuracy of 0.1 ppm have been set up during 1991 to 1992. The second order GPS network of about 400 points with accuracy of 1 ppm will be set up in the near future. And there are also four GPS tracking stations located

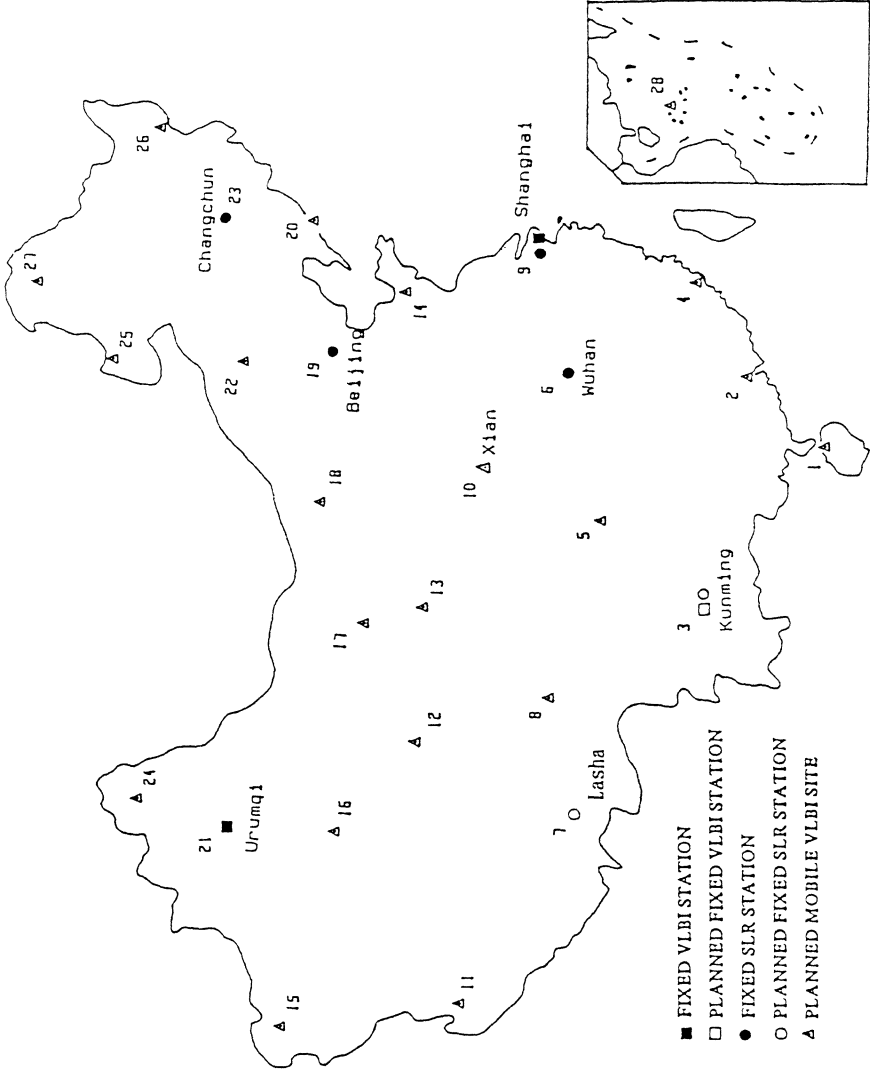


Fig. 1. Chinese Geodetic VLBI Network Site Locations.

in Shanghai, Urumqi, Kunming and Changchun. Two tracking stations will be constructed in Wuhan and Lasha. Being collocated with VLBI or SLR stations, these tracking stations could provide the tracking data with high accuracy that can be used to determine precise GPS satellite orbits.

2. The Establishment of a High Accuracy Geodetic VLBI Network

As stated in Section 1, the number of fixed VLBI stations in China is too small to meet the requirements for establishing the Chinese National Space Geodetic Network. It is necessary to use the mobile VLBI system together with three fixed VLBI stations to lay out a fiducial network—geodetic VLBI network, which will provide the primary framework for the national network.

The geodetic VLBI network will consist of 20 to 30 stations, which are distributed throughout China. The locations of network sites are also shown in Fig. 1, selected according to the following criteria:

- *Include all fixed VLBI and SLR stations.
- *Include six GPS satellite tracking stations.
- *A number of sites will be located in the border regions of China, so as to strengthen geodetic control of the national network in these areas.
- *Considering the uniformity of site distribution and traffic conditions to these sites.

In the observation program of this network, all three fixed VLBI stations would participate in observations with each mobile VLBI site. Observing sessions of 48 hours would be used and 10 to 15 sources with adequate strength would be observed. A variance-covariance analysis program was used to optimize an observation schedule which is applicable to this network and to estimate the accuracies of relevant parameters. The results show that baseline accuracies would range from 1×10^{-8} to 1×10^{-9} and site position accuracies would be better than 3 cm.

3. The Chinese National Space Geodetic Network (CNSGN)

According to the status and projects of Chinese VLBI, SLR and GPS networks described above. Now we study the establishment of the Chinese National Space Geodetic Network (CNSGN).

The CNSGN will be constructed by four parts:

*The first part is the geodetic VLBI network, which is as the primary framework.

*The second part consists of six SLR fixed stations and six GPS tracking stations which are also as the primary framework.

*The third part is the GPS densification network, which have the first and second order with several hundred points.

The CNSGN will have the sites/points distributed throughout China with the relative accuracy of 1×10^{-6} to 1×10^{-9} .

4. The Applications of the CNSGN

The Chinese National Space Geodetic Network has many applications. Considering the particular conditions of China, the CNSGN is deemed appropriate for four major applications:

- *To strengthen the Chinese Astrogeodetic Network which was set up from 1950s to 1960s.

- *To refine the geoid in this region, integrating with levelling.

- *To determinate the tectonic plate motion and monitor the crustal deformation in China.

- *To realize a regional terrestrial reference frame.

We planned to use the selected 10 to 15 sites of the geodetic VLBI network to establish the regional frame. The maintenance of this frame would be performed by repeated occupation of these mobile sites using the mobile VLBI system. The three fixed VLBI stations are always participating this activity.

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