

THE VLBI COMPLEX "QUASAR": CURRENT STATE AND PERSPECTIVE

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ABSTRACT. The Institute of Applied Astronomy of the Russian Academy of Sciences (IAA RAS) is constructing the VLBI complex "QUASAR" consisting of six antennas across the former USSR. The complex will be a dedicated instrument for space geodesy and radioastronomy. Three aspects of the "QUASAR" project will be discussed. First, the description of the project and its concept will be presented. Secondly, the current state and problems of constructing the network will be outlined. Finally, some information on the international cooperation will be given.

1. THE "QUASAR" PROJECT: A SHORT DESCRIPTION

In 1988 the USSR Academy of Sciences made a decision to construct the dedicated VLBI complex "QUASAR". A description of the "QUASAR" project can be found in Finkelstein et al., 1990, and Yatskiv and Finkelstein, 1990. More technical details on the design and construction can be obtained from IAA RAS.

The "QUASAR" complex consist of six (prospectively, ten) 32-m diameter antennas for centimeter wavelength, linked by communication lines to a center for operation, control and data acquisition and processing. The configuration and size of the antennas have been optimized for best mapping of radiosources and for precise determination of the Earth orientation parameters (EOP) from within the former USSR.

The baselines range in separation from about 1000 to 6000 km (max. separations along longitude is about 120 degree and along latitude is about 25 degree).

Each antenna will be equipped with radio receiving systems between 1.5 to 22.2 GHz in 5 frequency bands including the S/X bands.

The antennas will run entirely under control from the operation

center in St.-Petersbourg in a mode of synchronized reception of radio emissions from natural and artificial radiosources.

For reason of compatibility with the international VLBI systems the recording system of the "QUASAR" complex will be similar to the MK-III system. Besides the recording of the signals on magnetic tape over a wide band the signal will be transmitted in a narrow band (up to 2.5 MHz) via a geostationary satellite. The tapes brought together to the operation centre in St.-Petersbourg will be cross-correlated using the "QUASAR" correlator of special design. This correlator performs a massive data compression and determination of time delay and delay-rate normal points, which are subsequently fit to produce a few baseline parameters.

It is also envisioned that the "QUASAR" stations will be equipped with the radiointerferometric system "SYRIUS" for observation of navigation satellites (diameter of antenna is 1.3m) (Umarbaeva et al.,1991).

According to initial plan the "QUASAR" network as regional net of geodynamical stations was intended for a coordinate-and-time support of a wide range of fundamental researches and applications, in particular for realization of terrestrial reference frame in Eastern Europe and Asia. The geodetic concept of this network consists of a few "core" sites on Eurasian plate where VLBI systems are collocated with permanent SLR and/or GPS systems. The network would then be densified with additional mobile stations "MOST". The latter's will be equipped by two systems: SYRIUS and/or GPS receivers for observation of navigation satellites and DUPLEX (Gubanov,Kajdanovskij and Umarbaeva,1989) for time comparison between the "QUASAR" and "MOST" stations. When the number of the "QUASAR" core stations is not less then 4 and they are observing the NAVSTAR/GLONASS satellites simultaneously with the observation of the "MOST" stations it is possible to determine the coordinates of the latter's by geometrical solution (independent on satellite positions)(Gubanov in this issue).

So, the "QUASAR" network will serve as the reference standard for other space geodetic techniques to be operated in the Eurasian continent for geodynamical studies. It is also envisioned that the "QUASAR" stations will be major contributors to the IERS results from the East European and Asian region, which is not well represented in this service.

2. CURRENT STATE OF THE "QUASAR" PROJECT

The modular structure of the "QUASAR" complex permits to construct the stations in several stages. It was proposed in the plan:

(1) Three stations (Svetloye near St.-Petersbourg, Zelenchukskaya at North Caucasus and Bodary near Lake Baikal) and Operation Center should be ready for observations at the end of 1992.

(2) Three additional stations (in Ukraine,Turkmeniya and Kamchatka) will be in operation by the end of 1995.

(3) The possibility of location a few "QUASAR" stations abroad (in China, Bulgaria and other countries) has to be considered after finishing the first stage.

The construction of the "QUASAR" complex and pre-completion opera-

tions depend on the year-to-year funding and stability of political situation in the former USSR. Nevertheless the three antennas are under construction and should be ready for observations at the end of 1993 (one year delay as compared with plan). These three stations have nearly a full complement of time service and electronics, communication lines, SYRIUS and DUPLEX systems etc. The construction of operation center in St.-Petersbourg is practically completed.

There is some technical problems with construction of the antennas and recording system. We hope they will be solved in near future.

As to stage 2 due to disintegration of the USSR it is necessary to find new solution of the problem, for example to sign agreement between independent states involved in the "QUASAR" project on the cooperation in the field of coordinate-and-time support of researches and applications. Special committee of the representatives of astronomical institutes of former soviet republics has recommended the "QUASAR" project to be approved as interstate project.

As to stage 3 there is no final decision concerning the participation of foreign countries in this project.

3. INTERACTION OF THE "QUASAR" TEAM AND INTERNATIONAL VLBI COMMUNITY

From the very beginning of its activity the "QUASAR" team wanted to have a "open status" and a wide international cooperation. A few protocols of intention in this field were signed by the IAA and other institute representatives. NASA has been negotiating with the USSR Academy of Sciences for the inclusion of its "QUASAR" network stations into the global network as they come on-line. In 1991 the "QUASAR" international Directing Board was formed.

We hope that all this actions will lead the "QUASAR" project to success.

REFERENCES:

- Finkelstein, Andrei M. et al. (1989) 'Dedicated Soviet VLBI - Network QUASAR', in J. H. Lieske and V. K. Abalakin (eds.), *Inertial Coordinate System on the Sky*, Kluwer Academic Publishers, Dordrecht, pp. 293-294.
- Gubanov, Vadim S. (1992) 'A New Method of Relative Coordinate-and-Time Determinations (in this issue).
- Gubanov, V., Kajdanovskij, M. and Umarbaeva, N. (1989) 'Applications of interferometric technique in clock comparison via geostationary retranslator', *Kinematics and Physics of Celestial Bodies*, Allerton Press, New York (English translation) 5, No.6, 84-88.
- Umarbaeva, N. et al. (1991) 'SYRIUS-A Observes NAVSTAR in the Campaign GIG-91. Chapman Conference "Geodetic VLBI: Monitoring Global Change", Washington, D.C. (in press).
- Yatskiv, Ya. and Finkelstein, A. (1990) 'The Kvazar Radiointerferometric Complex: Concept, Tasks, Basic Characteristics' *Kinematics and Physics of Celestial Bodies*, Allerton Press, New York (English translation) 6, No.3, 61-67.