

# Data Center at NICT

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## Abstract

The Data Center at National Institute of Information and Communications Technology (NICT) archives and releases the databases and analysis results processed at the Correlation Center and the Analysis Center at NICT. Regular VLBI sessions with the Key Stone Project VLBI Network were the primary objects of the Data Center. These regular sessions continued until the end of November 2001. In addition to the Key Stone Project VLBI sessions, NICT has been conducting geodetic VLBI sessions for various purposes, and these data are also archived and released by the Data Center.

## 1. Introduction

In April 2004, the Communications Research Laboratory was integrated with the Telecommunications Advanced Organization of Japan (TAO) to establish the National Institute of Information and Communications Technology (NICT) as a new institute. The IVS Data Center at NICT archives and releases the databases and analysis results processed by the Correlation Center and Analysis Center at NICT. Major parts of the data are from the Key Stone Project (KSP) VLBI sessions [1], but other regional and international VLBI sessions conducted by NICT are also archived and released. Since routine observations of the KSP network terminated at the end of November 2001, there were no additional data for the KSP regular sessions since 2002. In 2006, for example, five geodetic VLBI sessions were added. The analysis results in SINEX (Solution INdependent EXchange) file format as well as other formats are available on the WWW server. Database files generated with the Mark III database file format are available upon request and will be sent to the users on DDS tape cartridges. Database files of non-KSP sessions, i.e. other domestic and international geodetic VLBI sessions, are also available on the WWW server. Table 1 lists the WWW server locations maintained by the Data Center at NICT. In the past, an FTP server was used to provide data files, but it was decided to terminate the FTP service because of security risks of maintaining an anonymous FTP server. Instead, the WWW server [www3.nict.go.jp](http://www3.nict.go.jp) was prepared to place large size data files.

Table 1. URL of the WWW server systems.

Service	URL
KSP WWW pages	<a href="http://ksp.nict.go.jp/">http://ksp.nict.go.jp/</a>
IVS WWW mirror pages	<a href="http://ivs.nict.go.jp/mirror/">http://ivs.nict.go.jp/mirror/</a>
Database files	<a href="http://www3.nict.go.jp/w/w114/stsi/database/">http://www3.nict.go.jp/w/w114/stsi/database/</a>
e-VLBI Sessions	<a href="http://www.nict.go.jp/w/w114/stsi/research/e-VLBI/UT1/">http://www.nict.go.jp/w/w114/stsi/research/e-VLBI/UT1/</a>
Hayabusa Sessions	<a href="http://www.nict.go.jp/w/w114/stsi/research/Navi/HAYABUSA/">http://www.nict.go.jp/w/w114/stsi/research/Navi/HAYABUSA/</a>

The responsibilities for maintenance of these server machines were moved from the VLBI research group of NICT to the common division for the institutional network service of the laboratory in 2001 to improve the network security of these systems.

## 2. Data Products

### 2.1. KSP VLBI Sessions

The KSP VLBI sessions were performed with four KSP IVS Network Stations at Kashima, Koganei, Miura, and Tateyama on a daily or bi-daily (once every two days) basis until May 1999. The duration of each session was about 23.5 hours. Within that period, daily observations were performed from March 1 to April 1, 1999 to obtain continuous VLBI data series for various investigations such as studies about the atmospheric delay models and for the improvements of the data analysis technique. The high-speed ATM (Asynchronous Transfer Mode) network line to the Miura station became unavailable in May 1999, and the real-time VLBI observations with the Miura station became impossible. Thereafter, the real-time VLBI sessions were performed with three stations only—Kashima, Koganei, and Tateyama. Once every six days (every third session), the observed data were recorded to the K4 data recorders at three stations, and the Miura station participated in the sessions with the tape-based VLBI technique. In this case, the observed data at three stations except for the Miura station were processed in real-time, and the analysis results were released promptly after the observations completed. A day later, the observed tapes were transported from Kashima, Miura, and Tateyama stations to Koganei station for tape-based correlation processing of the full six baselines. After the tape-based correlation processing was completed, the data set produced with the real-time VLBI data processing was replaced by the new data set.

In July 2000, unusual site motion of the Tateyama station was detected from the KSP VLBI data series, and the frequency of the sessions was increased from bi-daily to daily since July 22, 2000. The daily sessions were continued until November 11, 2000, and the site motion of the Tateyama and Miura stations were monitored in detail. During the period, it was found that Tateyama station moved about 5 cm to the northeast direction. Miura station also moved about 3 cm to the north. The unusual site motions of these two stations gradually settled, and the current site velocities seem to be almost the same as the site velocities before June 2000. By investigating the time series of the site positions, the unusual site motion started sometime between the end of June 2000 and the beginning of July 2000. At the same time, volcanic and seismic activities near the Miyakejima and Kozushima Islands began. These activities are believed to have caused the regional crustal deformation in the area, explaining the unusual site motions at Tateyama and Miura.

### 2.2. Other VLBI Sessions

In addition to the KSP regular VLBI sessions, domestic and international geodetic VLBI sessions were conducted by NICT in cooperation with Geographical Survey Institute (GSI) and other organizations. These sessions are listed in Table 2. The observed data of these sessions were correlated by using the K4 correlator and the K5 software correlator at NICT either at Koganei or at Kashima.

In 2007, 35 geodetic VLBI sessions were performed in total. Ultra-rapid e-VLBI sessions were performed based on the proposal submitted to and approved by the IVS Observing Program Committee in May 2007. The purpose of these sessions is to demonstrate e-VLBI capabilities for ultra-rapid data processing after intensive type short period (typically 1 hour) observing schedules. Observed data at one site are transferred to the other site in real-time by using high speed research

Table 2. Geodetic VLBI sessions conducted by NICT (since 2005)

Year	exp. names	sessions
2005	Geodetic	c0505 (CONT05, partial participation), GEX13
	Hayabusa	14 sessions
2006	Geodetic	GEX14, viepr2, CARAVAN (3 sessions)
	Spacecraft	Geotail: 1 session
	Pulsar	1 session
2007	Ultra Rapid e-VLBI	15 times, 29 sessions
	Time Comparison	4 sessions, 12 days in total
	Cs-Gas-Cell	1 session
	Spacecraft	Hayabusa: 1 session

networks, and the format conversion and data correlation processing are done immediately after the real-time file transfer. Thus, it is expected to provide the database with a minimum time of latency after each session. Two stations in Japan, Tsukuba and Kashima, and two stations in Europe, Onsala and Metsähovi, are the regularly participating stations, and Wettzell station will participate when regular IVS intensive observation session (INT2) is used for the project. Under the project, we are developing necessary software programs to realize real-time and near real-time data processing and automated data analysis. Our goal is to release the database file on the data center WWW server as soon as possible, as well as to release the analyzed results to the wide community by using e-mail. For this purpose, 29 sessions were scheduled over 15 days. The number of sessions performed on each day varies for different reasons. Sometimes, only one session was scheduled and performed on one day, whereas 6 sessions were scheduled and performed on November 26, 2007.

A series of time transfer sessions were also performed in 2007. The purpose of the sessions is to evaluate the capability of geodetic VLBI experiments for precise and accurate time transfer between Time and Frequency Laboratories located worldwide. At first, two one-day sessions were performed on January 11th and 22nd, 2007. Then a 3-day session was performed from February 28th, and a one-week continuous session was performed from June 15th.

One geodetic VLBI session was performed on the baseline between Kashima 34-m station and Koganei 11-m station to evaluate the performance of the Laser Diode pumped Cesium gas cell type frequency standard system. This frequency standard has been developed by Anritsu Corporation to provide better frequency stability at the short time scale less than one day compared with the normal Cesium beam type frequency standard system. The system has a frequency stability reaching  $2 \times 10^{-14}$  for a time interval of about 1000 seconds. Although the performance of the frequency stability is not as good as hydrogen maser frequency standard systems, it was demonstrated that the system can be used for geodetic VLBI observations.

In addition, one VLBI session was performed on March 7, 2007 to determine the precise orbit of the Hayabusa spacecraft. It was planned to perform maneuver operation of the spacecraft to return to the Earth, and the precise orbit information was necessary.

Figure 1 shows the number of geodetic VLBI sessions and number of valid observed delays used in the data analysis for each year up to the year 2007.

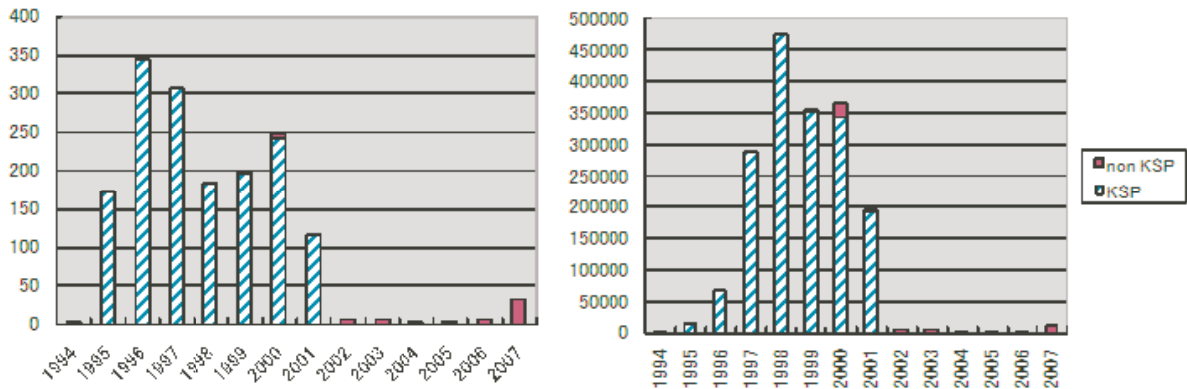


Figure 1. Number of sessions (left) and observed delays (right) used in the data analysis.

### 3. Staff Members

The data center at NICT is operated and maintained by the Space-Time Standards Group at Kashima Space Research Center, NICT. The staff members are listed in Table 3.

Table 3. Staff members of Space-Time Standards Group, KSRC, NICT

Name	Main Responsibilities
KOYAMA Yasuhiro	Administration of Servers, Generation and Archival of Databases
SEKIDO Mamoru	Responsible for e-VLBI sessions
TSUTSUMI Masanori	System Engineer

### 4. Future Plans

Although the regular VLBI sessions with the KSP VLBI network finished in 2001, the IVS Data Center at NICT will continue its service and will archive and release the analysis results accumulated by the Correlation Center and Analysis Center at NICT. In addition, a number of VLBI sessions will be conducted for the purposes of various technology developments.

### References

- [1] Special issue for the Key Stone Project, J. Commun. Res. Lab., Vol. 46, No. 1, March 1999
- [2] Koyama, Y., T. Kondo, M. Kimura, and H. Takeuchi, IVS NICT TDC News, No. 26, Sep. 2005, pp. 9-12