

# Data Center at NICT

*Yasuhiro Koyama*

## Abstract

The Data Center at National Institute of Information and Communications Technology archives and releases the databases and analysis results processed at the Correlation Center and the Analysis Center at National Institute of Information and Communications Technology. 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, National Institute of Information and Communications Technology 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, Communications Research Laboratory was integrated with the Telecommunications Advanced Organization of Japan (TAO) and the National Institute of Information and Communications Technology (NICT) was established 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 in the end of November 2001, there were no additional data for the KSP regular sessions since 2002. In 2005, two geodetic VLBI session was carried out and processed. The analysis results in the SINEX (Solution Independent Exchange) file format and other form of data formats are available from the WWW server. Database files generated with the Mark-III database file format are available upon request and will be sent to the users in DDS tape cartridges. Database files of non-KSP sessions, i.e. other domestic and international geodetic VLBI sessions, are also available from the WWW server. Table 1 shows the list of 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 determined to terminate the FTP service by considering security risk of maintaining anonymous FTP server. Instead, [www3.nict.go.jp](http://www3.nict.go.jp) WWW server 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>
Data server	<a href="http://www3.nict.go.jp/dk/c256/ivs/">http://www3.nict.go.jp/dk/c256/ivs/</a>

The maintenance of these server machines has been moved from the VLBI research group of the 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 the period, daily observations were performed from March 1 until 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. After this time, the real-time VLBI sessions were performed with three stations at 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-base correlation processing of the full six baselines. After the tape-base correlation processing 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 seems to be almost same as the site velocities before June 2000. By investigating the time series of the site positions, the unusual site motion started from 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 near the area, and the unusual site motions at Tateyama and Miura are explained by the event.

### 2.2. Other VLBI sessions

In addition to the KSP regular VLBI sessions, domestic and international geodetic VLBI sessions have been 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 K-4 correlator and the K5 software correlator at NICT either at Koganei or at Kashima.

In 2005, two geodetic VLBI sessions were performed. The GEX13 session was carried out with the baseline between 11m VLBI stations at Kashima and at Koganei. The purpose of this session was to demonstrate the capability of the newly developed multi-channel Giga-bit A/D sampler unit ADS2000 [2]. At both stations, the ADS2000 sampler unit was used to sample 10 X-band channels and 6 S-band channels at the sampling data rate of 32MSPS for each channel and the

Table 2. Geodetic VLBI sessions conducted by NICT (since 2003)

Year	exp. names	sessions
2003	CUTE	CUTE04
	K5 Test	U03031, JD0306
	e-VLBI	evlbi4, tsev6
	Nozomi	34 sessions
	Hayabusa	10 sessions
2004	e-VLBI	tsev7, tsev8
	Geodetic	U04306
	Hayabusa	5 sessions
	Huygens	2 sessions
2005	Geodetic	c0505 (CONT05, partial participation) ,GEX13
	Hayabusa	14 sessions

digitizing level of 2 bits/sample. The data observed at Koganei site were transferred to Kashima over the high speed network, and processed with the K5 software correlator. As the results from the session, the baseline length between two sites was estimated with the RMS uncertainty of 1.3 mm, and the performance of the ADS2000 sampler unit was demonstrated. Another geodetic VLBI session c0505 was performed for 24 hours from 17:30 UT on September 16. The session was one of the 15 continuous global sessions of cont05, and 34m VLBI station at Kashima was used to record data according to the c0505 observation schedule. Only the KASHIM34-TSUKUB32 baseline was processed for correlation processing by using the K5 software correlator. The main purpose of this partial participation of the 34m VLBI station at Kashima was to evaluate the performance of the extended X-band receiver. After the session, fringes were detected from all channels observed during the c0505 session and the performance of the extended X-band receiver was evaluated. Currently, the receiver noise temperature is worse in the upper edge of the extended X-band receiver, and we are planning to improve the receiver noise characteristics in the upper edge of the extended X-band receiver.

Hayabusa spacecraft was launched on May 9, 2003 by JAXA to investigate the asteroid Itokawa. The X-band telemetry signal from the spacecraft was used to demonstrate precise orbit determination by means of VLBI observations. Since precise orbit determination of the spacecraft Hayabusa was required to efficiently navigate the spacecraft to approach the asteroid Itokawa. Many VLBI stations in Japan including the 34-m and 11-m VLBI stations at Kashima and 11-m VLBI station at Koganei participated in the observations. The spacecraft Hayabusa finally approached the asteroid Itokawa in September 2005 and test VLBI experiments of the spacecraft were performed before and after the arrival of the spacecraft at the asteroid.

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 2005.

### 3. Staff Members

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

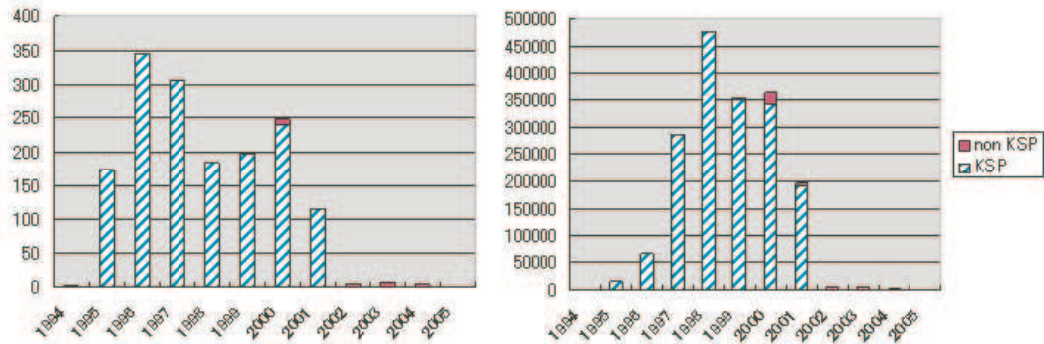


Figure 1. Number of sessions (left) and observed delays (right) used in the data analysis.

Table 3. Staff members of Radio Astronomy Applications Group, KSRC, NICT

Name	Main Responsibilities
Tetsuro KONDO	Research Center Supervisor / Software Correlator
Yasuhiro KOYAMA	Group Leader / International e-VLBI
Eiji KAWAI	Antenna system
Ryuichi ICHIKAWA	Spacecraft VLBI
Junichi NAKAJIMA	VLBI System Developments
Mamoru SEKIDO	Spacecraft VLBI
Hiroshi TAKEUCHI	VLBI System Developments
Moritaka KIMURA	VLBI System Developments
Hirimitsu KUBOKI	Antenna System
Masanori TSUTSUMI	System Engineer
Atsutoshi ISHII	Developments for Small Antenna System

#### 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