

# Kashima and Koganei 11-m VLBI Stations: Report for 2019-2020

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**Abstract** The Kashima 11-m and Koganei 11-m stations have participated in R1, T2, CRF, APSG, and AOV sessions conducted by the IVS and Asia-Oceania VLBI Group for Geodesy and Astrometry (AOV)<sup>1</sup>. Unfortunately, serious degradation of performance was found for Kashima 11-m antenna in July 2019. After this accident, Kashima 11-m station could not return back to normal operation. Following to the decision to close the Kashima VLBI site, Kashima 11-m antenna was dismantled in 2020. Collocation local surveys were performed for four sites of KSP (Kashima, Koganei, Miura, Tateyama) in 1996-1999 and only for Koganei site in 2013. These local tie information were submitted to ITRF2020 combination center.

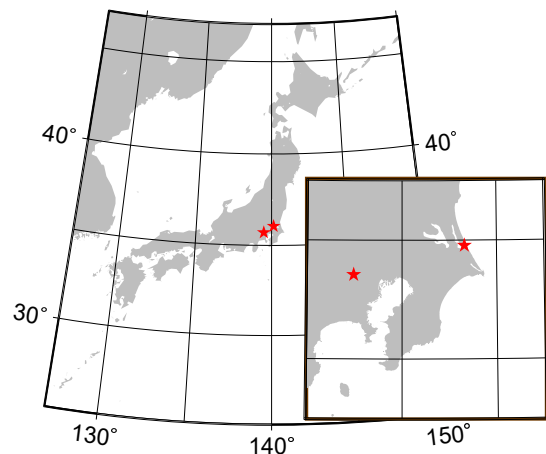


Fig. 1 Location of NICT-Koganei Headquarters and Kashima.

## 1 General Information

A pair of 11-m diameter antennas have been operated by VLBI group of the Space-Time Standards Laboratory (STSL) of the National Institute of Information and Communications Technology (NICT). The Kashima 11-m antenna is located at Kashima Space Technology Center (KSTC), on the east coast of the Japanese main island. The Koganei 11-m antenna is located at the headquarters of the NICT in Koganei Tokyo (Figure 1). These two 11-m VLBI antennas (Figure 2) were built together with two other VLBI stations for Key Stone Project (hereafter referred as KSP).

NICT/ Kashima Space Technology Center

NICT KSP Network Station

IVS 2019+2020 Biennial Report

<sup>1</sup> <http://auscope.phys.utas.edu.au/aov/index.html>

The aim of the KSP [1] was monitoring of crustal deformation around the Tokyo metropolitan area by using multiple space geodetic techniques: VLBI, GPS, and SLR. That project was operated in the period between 1995 and 2001. After the KSP project has terminated in 2001, two 11-m antenna at Miura and Tateyama were transferred to Gifu University and Hokkaido University and used for radioastronomy. Two antennas at Kashima and Koganei have been used for geodetic observations and technology developments. Regular participations to the IVS sessions started after the “Great East Japan Earthquake” in March 2011.

### 1.1 Data Acquisition Systems

The K5/VSSP32 [2] system, which has four channels of video band signal input per unit, is deployed at



**Fig. 2** 11-m VLBI antennas at Kashima (left panel) and Koganei (right panel).

both stations. The data stream is recorded on a standard Linux file system in K5/VSSP32 format<sup>2</sup>. Software tool<sup>3</sup> has been used for data format conversion from K5/VSSP32 to Mark IV, VLBA, and Mark-5B.

All the VLBI data acquired by NICT were exported to correlation centers over the network from data server at Kashima. Network connection at 10 Gbps were provided by the High Speed R&D Network Testbed JGN. All the VLBI station of NICT (Kashima 11-m, Koganei 11-m, and The Kashima 34-m) shares the same 10 Gbps network.

## 2 Events and activities during the Past Year

Two 11-m antennas participated in the IVS and AOV sessions as listed in Table 1.

### 2.1 Kashima 11-m antenna

In preparation of T2133 session of 23 July 2019, serious degradation of sensitivity was found for the Kashima 11-m station. It was due to rainwater filled in the waveguide feed of its S/X-band receiver system, and that was caused by breakage of feedome sheet

<sup>2</sup> [https://www2.nict.go.jp/sts/stmg/K5/VSSP/vssp32\\_format.pdf](https://www2.nict.go.jp/sts/stmg/K5/VSSP/vssp32_format.pdf)

<sup>3</sup> <https://www2.nict.go.jp/sts/stmg/K5/VSSP/index-e.html>

**Table 1** VLBI Sessions of Kashima and Koganei stations in 2019-2020.

<b>Kashima 11-m</b>	<b>2019</b>	<b>2020</b>
IVS & AOV	aov032 aov035 apsg44 apsg45 t2130 t2131 t2132	—
<b>Koganei 11-m</b>	<b>2019</b>	<b>2020</b>
IVS & AOV	apsg44 apsg45 crf112 crf113 crf115 t2130 t2131 t2133 t2135 t2136 aov032 aov035 aov038 aov039 aov041 aov042	apsg46 apsg47 t2137 t2138 t2139 t2140 t2141 t2142 t2143 aov044 aov047 aov048 aov049 aov050 aov051 aov053 aov054
Freq. transfer	in001 in002	

of the antenna (Fig. 3). Although we made tentative repair by closing the hole, additional holes were found after a few weeks later. Since feedome top is made of strong and durable sheet, it was unlikely to be caused by accidental hit by some falling object. Bird-repelling needles were equipped at the top of feed cone; thus, we never had such trouble before. Though it was suspected to be caused by sharp bill such as woodpecker, we could not identify the reason. Finally, the dismantlement of 11-m antenna together with Kashima 34-m antenna was decided. T2132 session on 21 May became consequently the last VLBI observation for the Kashima 11-m antenna.



**Fig. 3** A hole was found on the feedome sheet of Kashima 11-m antenna in July (left). The hole was closed by tentative repair. However, additional holes were found in August (right).

## 2.2 Koganei 11-m antenna

Koganei 11-m antenna has participated in geodetic VLBI sessions conducted by IVS and AOV. It has been pointed out by correlator report that correlation amplitude of Koganei 11-m antenna related baselines was smaller than expected from SEFD. Regarding on this issue for S-band receiver, it is already known that strong RFI coming from cell phone base stations has been sometimes saturating the first low noise amplifier (LNA) for this antenna. However, reason of smaller correlation amplitude in X-band is not clear yet. Detailed local investigation is required though, visiting to Koganei from Kashima is restricted due to COVID-19 in 2020, thus study on this issue remains as future task.

Antenna time is shared with the Space Environment Laboratory (SPEL), when the antenna is free from VLBI observation. Receiving down-link signal of the STEREO satellite<sup>4</sup> has been performed for monitoring of solar activity.

## 2.3 Local tie information

KSP was a project to monitor crustal deformation around Tokyo metropolitan area with multiple space geodetic techniques of VLBI, SLR, and GPS. With the aim of comparison and confirming the consistency of

<sup>4</sup> [http://www.nasa.gov/mission\\_pages/stereo/main/index.html](http://www.nasa.gov/mission_pages/stereo/main/index.html)

the different space geodetic techniques, local surveys have been conducted in the KSP project in the period 1996-2000. In addition, another survey was conducted lately only at Koganei site in 2013. It was triggered by construction of 1.5m diameter new optical telescope at Koganei for the purpose of optical communication with satellite.

Responding to the call for participation to ITRF2020, these survey data were summarized and submitted to ITRF Combination center. The same data is available on the web page<sup>5</sup>. Table 2 shows the domes number participated to the local tie measurement at each site.

## 3 Future plan

Koganei 11-m antenna will keep operation for participation to VLBI sessions of IVS and AOV after 2021. The cause of discrepancy between correlation amplitude of VLBI observation and single dish antenna sensitivity need to be investigated.

## Acknowledgements

We thank the High-Speed R&D Network Testbed JGN and the Information System Section of NICT for supporting the high-speed network environment.

<sup>5</sup> <https://ksp.nict.go.jp/survey/Supplement/KSP-colloc.html>

**Table 2** Domes Numbers, which participated in the local tie surveys, are listed. Note that SLR geodetic ground marker (Site reference point: SRP) is located separately from the cross point of azimuth/elevation axes of the SLR telescope.

Domes Number/SLR Code	Site Name	CDP	GNSS	Description	
21701S001	KASHIMA	1856		26m VLBI antenna	
21701M002	KASHIMA	7335		SLR geodetic ground marker (Site Reference Point:SRP)	
21701S004	KASHIMA	1857		34m VLBI antenna	
21701S006	KASHIMA	7334	KSMV	Steerable 11m Cassegrain VLBI antenna/intersection of axes	
21701S007	KASHIMA			Ashtech Z-XII with GEODETIC L1/L2 antenna/ARP	
KASL(SLR)	KASHIMA			SLR telescope Az/El axis cross point at Kashima KSP	
21704M001	KOGANEI	7328		KGNI	SLR geodetic ground marker (Site Reference Point:SRP)
21704S002	KOGANEI	7308			SLR CRLAS IAR
21704S004	KOGANEI	7327	Steerable 11m Cassegrain VLBI antenna/intersection of axes		
21704S005	KOGANEI		Ashtech Z-XII with GEODETIC L1/L2 antenna/ARP		
KOGL(SLR)	KOGANEI		SLR telescope Az/El axis cross point at Koganei KSP		
21739M001	MIURA	7337		SLR geodetic ground marker (Site Reference Point:SRP)	
21739S001	MIURA	7336		Steerable 11m Cassegrain VLBI antenna/intersection of axes	
MIUL(SLR)	MIURA	7337		SLR telescope Az/El axis cross point at Miura KSP	
21740M001	TATEYAMA	7339		SLR geodetic ground marker (Site Reference Point:SRP)	
21740S001	TATEYAMA	7338		Steerable 11m Cassegrain VLBI antenna/intersection of axes	
TATL(SLR)	TATEYAMA			SLR telescope Az/El axis cross point at Tateyama KSP	

## References

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