Kokee Park Geophysical Observatory

Ron Curtis

Abstract

This report summarizes the technical parameters and the staff of the VLBI system at Kokee Park on the island of Kauai.

1. KPGO

The Kokee Park Geophysical Observatory (KPGO) is located in the Kokee State Park on the island of Kauai in Hawaii at an elevation of 1,100 meters near the Waimea Canyon, often referred to as the Grand Canyon of the Pacific.

Table 1. Location and address of Kokee Park Geophysical Observatory.

Longitude	159.665° W
Latitude	22.126° N
Kokee Park Geophysical Observatory P.O. Box 538 Waimea, Hawaii 96796 USA	

2. Technical Parameters of the VLBI System at KPGO

The receiver is of NRAO (Green Bank) design (dual polarization feed using cooled 15 K HEMT amplifiers). The DAR rack and tape drive were supplied through Green Bank. The antenna is of the same design and manufacture as those used at Green Bank and Ny-Ålesund. We presently employ a Mark 5B+ recorder for all of our data recording.

The technical parameters of the radio telescope are summarized in Table 2.

Timing and frequency is provided by a Sigma Tau Maser with a NASA NR Maser providing backup. Monitoring of the station frequency standard performance is provided by a CNS (GPS) Receiver/Computer system. The Sigma Tau performance is also monitored via the IGS Network.

3. Staff of the VLBI System at KPGO

The staff at Kokee Park from January 1 through April 8, 2011 consisted of five people employed by Honeywell Technology Solutions, Inc. under the NENS contract to NASA for the operation and maintenance of the observatory. Matt Harms, Chris Coughlin, and Ron Curtis conducted VLBI operations and maintenance. Ben Domingo was responsible for antenna maintenance, with Amorita Apilado providing administrative, logistical, and numerous other support functions. Kelly Kim of Caelum Research Corporation also supported VLBI operations and maintenance during 24-hour experiments and as backup support.

On April 9, 2011 the NENS contract transitioned to the SCNS contract operated by ITT

Table 2. Technical parameters of the radio telescope at KPGO.

Parameter	Kokee Park
owner and operating agency	USNO-NASA
year of construction	1993
radio telescope system	Az-El
receiving feed	primary focus
diameter of main reflector d	$20m$
focal length f	$8.58m$
f/d	0.43
surface contour of reflector	$0.020 inches rms$
azimuth range	$0 \ldots 540^\circ$
azimuth velocity	$2^\circ/s$
azimuth acceleration	$1^\circ/s^2$
elevation range	$0 \ldots 90^\circ$
elevation velocity	$2^\circ/s$
elevation acceleration	$1^\circ/s^2$
X-band	$8.1 - 8.9\,GHz$
(reference $\nu = 8.4GHz, \lambda = 0.0357m$)	
T_{sys}	$40\,K$
$S_{SEFD}(CASA)$	$900\,Jy$
G/T	$45.05\,dB/K$
η	0.406
S-band	$2.2 - 2.4GHz$
(reference $\nu = 2.3GHz, \lambda = 0.1304m$)	
T_{sys}	$40\,K$
$S_{SEFD}(CASA)$	$665\,Jy$
G/T	$35.15\,dB/K$
η	0.539
VLBI terminal type	VLBA/VLBA4-Mark 5
Field System version	9.7.6

Information Systems. The staff at Kokee Park consisted of six people under the new contract to NASA. Matt Harms retired, and Kiah Imai and Lawrence Chang were added to the Kokee Park staff to conduct VLBI operations and maintenance.

4. Status of KPGO

Kokee Park has participated in many VLBI experiments since 1984. We started observing with GAPE, continued with NEOS and CORE, and are now in IVS R4 and R1. We also participate in the RDV experiments. We averaged 1.5 experiments per week during calendar year 2000 and increased to an average of two experiments of 24 hours each week, with daily Intensive experiments starting in year 2002 and continuing into 2011. After the earthquake in Japan in March 2011,

KPGO supported weekend Intensive experiments for the rest of the year while data from the Tsukuba VLBI station was being analyzed for supporting weekend Intensive experiments.

Kokee Park also hosts other systems, including a 7-m PEACESAT command and receive antenna, a DORIS beacon, a QZSS monitoring station, a TWSTFT relay station, and a Turbo-Rogue GPS receiver. Kokee Park is an IGS station.

In October 2007, Japanese interests, along with representatives from NASA, USNO, and the State Department, held a meeting at KPGO to explore the possible installation of a project called Quasi-Zenith Satellite System (QZSS). In 2008, further investigation continued towards making the QZSS project a part of KPGO. NASA sent an engineering team to investigate the support requirements that would be needed to implement the QZSS project here, and an engineering team from Japan surveyed the site for the hardware that would be installed. The aging KPGO infrastructure was upgraded in stages as the project progressed. In October 2009, the power at KPGO was upgraded to support the QZSS and Two-Way Satellite Time and Frequency Transfer (TWSTFT) requirements. In March 2010 the construction of the antenna base for the project was completed, and all components were installed and tested. In July 2010 the TWSTFT for the project was operationally configured by USNO and NICT.

In June 2010, the remote control capability for the DORIS beacon was installed at KPGO.

In October 2010, two members of the Ny-Ålesund VLBI team visited KPGO for the sharing of processes and procedures on operations and maintenance.

Also, in 2008, advances were made for making real-time VLBI data from KPGO a reality. The agencies that will be responsible for the wideband pipes leading from the site entered into a service agreement late in 2008. The coordination with the parties involved in the communication infrastructure upgrades continued through 2010. While work continues towards implementing the final architecture, an interim configuration has permitted some successful testing. Initially, the daily Intensive experiments are being targeted so that correlation back at the Washington Correlator can happen days earlier than it previously did. 24-hour experiment data flow will hopefully follow when the final architecture is implemented. The testing of the new communication infrastructure progressed slowly in 2011 but looks more promising in 2012.

5. Outlook

KPGO will be undergoing incremental changes and upgrades in the coming year to replace aging components as well as preparing to support VLBI2010 technical specifications. Plans are in progress to upgrade the KPGO backend to use the RDBE architecture in 2012. The Mark 5B+ data recorders will be upgraded to a Mark 5C. There are plans to migrate the e-transfer data connection to dedicated fiber supporting 1 Gbit/s or higher data rates. Plans are in progress for developing a new receiver box and feed for the 20-m antenna to support VLBI2010 specifications. Discussions are also in progress that may bring to KPGO a new 12-m antenna capable of supporting VLBI2010 specifications, including the faster slew rates.

KPGO's support of the PEACESAT mission will end in 2012 as the project comes to an end.

CNES has reached out to NASA on the possibility of upgrading KPGO to be part of their REGINA Network.

Figure 1. KPGO VLBI 20-m antenna (right) with the old NASA USB 9-m antenna in the background.

Figure 2. TWSTFT antennas.

Figure 3. DORIS remote control (left foreground) and beacon (right foreground).

Figure 4. QZSS/TWSTFT equipment racks.