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 addresses 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 5A 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 during calendar year 2010 consisted of five people employed by Honeywell Technology Solutions, Inc. under 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.

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	$0 \dots 540°$
azimuth velocity	$2°/s$
azimuth acceleration	$1°/s^2$
elevation range	$0 \dots 90°$
elevation velocity	$2°/s$
elevation acceleration	$1°/s^2$
X-band (reference $\nu = 8.4GHz, \lambda = 0.0357m$)	$8.1 - 8.9\,GHz$
T_{sys}	$40\,K$
$S_{SEFD}(CASA)$	$900\,Jy$
G/T	$45.05\,dB/K$
η	0.406
S-band (reference $\nu = 2.3GHz, \lambda = 0.1304m$)	$2.2 - 2.4GHz$
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

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 2 experiments of 24 hours each week, with daily Intensive experiments, starting in year 2002 and continuing into 2010.

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 of 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 of 2009, the power at KPGO was upgraded to support the QZSS and Two-Way Satellite Time and Frequency Transfer (TWSTFT) requirements. In March of 2010 the construction of the antenna base for the project was completed, and all components were installed and tested. In July of 2010 the TWSTFT for the project was operationally configured by USNO and NICT.

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

In October of 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 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 is expected to continue in 2011.

5. Outlook

Now that we have started flowing real-time data for the daily USNO Intensive experiments in 2010, we hope to build on that start and support 24-hour experiments in (almost) real time as well in 2011. If the sustained data rate requirements cannot be met, we will need to set up a buffering system of some sort with the Mark 5 recorder.

In late 2010 work began on running fiber cable up the mountainside so the data rate needs can be fully met. The local Navy plans to provide the fiber cable when the run is completed and tested in 2011.

Plans are in progress to upgrade KPGO to Mark 5B mode in 2011.

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

Figure 2. QZSS antenna.

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

Figure 4. QZSS/TWSTFT equipment racks.