Kokee Park Geophysical Observatory

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Abstract This report summarizes the technical parameters of the VLBI systems at the Kokee Park Geophysical Observatory and provides an overview of the activities that occurred in 2021–2022.

1 Location

The Kokee Park Geophysical Observatory (KPGO) is located in 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. KPGO is located on the map at longitude 159.665° W and latitude 22.126° N.

2 Technical Parameters

The 20-m receiver is of NRAO (Green Bank) design (a dual polarization feed using cooled 15 K HEMT amplifiers). The antenna is of the same design and manufacture as those used at Green Bank and Ny-Ålesund. A Mark 5B+ recorder is currently used for all data recording.

The 12-m receiver is of MIT design. The ultra wideband receiver uses a Quadruple-Ridged Flared Horn (QRFH) and LNAs, developed at the California Institute of Technology, cooled to ∼15 K and is dual polarization. The antenna was developed by InterTronic Solutions Inc. A Mark 6 recorder is currently used for all data recording.

Fig. 1 12-m and 20-m telescopes.

Table 1 Technical parameters of the radio telescopes at KPGO.

Parameter	**20-m**	**12-m**
Owner and operating agency	USNO-NASA	USNO-NASA
Year of construction	1993	2015
Diameter of main reflector d	20 m	12 m
Azimuth range	±270°	±270°
Azimuth velocity	2°/s	12°/s
Azimuth acceleration	1°/s^2	1°/s^2
Elevation range	±90°	±90°
Elevation velocity	2°/s	6°/s
Elevation acceleration	1°/s^2	1°/s^2
Receiver System		
Focus	Primary Focus	Cassegrain
Receive Frequency	2.2–8.9 GHz	2–14 GHz
T_{sys}	40 K	40 K
$S_{SEFDRange}$	500–2000 Jy	1500–3000 Jy
G/T	40 dB/K	43 dB/K
VLBI terminal type	VLBA4	RDBE
Recording media	Mark 5B+	Mark 6
Field System version	10.0.0	10.0.0

Timing and frequency is provided by a Sigma Tau Maser with a second Sigma Tau Maser backup. Monitoring of the station frequency standard performance is

1. USNO
2. NASA GSFC

provided by a CNS (GPS) Receiver/Computer system. The Sigma Tau performance is also monitored via the IGS Network.

Fig. 2 KPGO site overview.

3 Staff

The staff at Kokee Park consists of seven full time employees employed by Peraton Corporation under the SENSE contract to NASA for the operation and maintenance of the observatory. Chris Coughlin (KPGO Station Manager), Kiah Imai (KPGO Lead Engineer), Lawrence Chang, Durwin Akita, Jacob Decker, and Jeffrey Batangan conduct all site VLBI operations and maintenance. Amorita Yaris provides administrative and logistical support.

4 Mission Support

Kokee Park participates in many VLBI experiments for both Legacy and VGOS Networks. KPGO (Kk) participates in the R4, R1, RDV, CRF, APSG, RD, and OHIG 24-hour sessions along with the INT1 one-hour sessions and the new midnight one-hour Intensive experiments centered on 00:00 UTC. KPGO (Kk) averaged two sessions of 24-hour duration each week, two midnight Intensive experiments of one-hour duration each week, and weekday INT1 sessions in 2021 and 2022. KPGO (K2) participates in the VO 24-hour sessions along with the V2 one-hour sessions. KPGO (K2) averaged one experiment of 24-hour duration each week, with weekday Intensive experiments in 2021 and 2022.

Kokee Park hosts other systems, including the following: a Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS) beacon and remote control, a Quasi-Zenith Satellite System (QZSS) monitoring station, a Two-Way Satellite Time and Frequency Transfer (TWSTFT) relay station, and a Turbo-Rogue GPS receiver. Kokee Park is an IGS station.

5 Recent Activities

Much of 2021 and 2022 was limited as far as major site activities and/or upgrades due to the COVID-19 Pandemic. KPGO staff was able to report to the site and continue our mission as normal during the pandemic, achieving excellent data acquisition metrics with both the 20-m and 12-m systems. While no major activities were carried out in 2021 or 2022, there were planning efforts for upcoming improvements to the 20-m telescope, the 12-m telescope, the DORIS System, and the QZSS System. The 20-m system also started supporting a new Intensive experiment referred to as the “midnight” Intensives with one-hour sessions centered on the change of UTC day, 00:00 UTC.

Fig. 3 20-m telescope VGOS Broadband Receiver.

6 Outlook

KPGO is still planning numerous site improvements in the future. When funding is acquired, we are still planning to perform several upgrades to our 20-m system, including VGOS Broadband Signal Chain Install, New Servo System and Cabling, Reflector Backup Structure Refurbishment, Elevation Gearboxes and Gear Replacement, and Reflector RF Alignment. For the 12-m VGOS system we are planning to retrofit the system with some improved design components with recently built systems. KPGO staff will be working on this with ISI and MIT in 2023–2024. The current, aged Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS) beacon and remote control system has a much needed upgrade scheduled for January 2023. There are also plans to upgrade the Quasi-Zenith Satellite System (QZSS) monitoring station in 2023. Peraton is working with a NASA Network Engineer and Correlator Sites to further optimize the speeds for our e-transfer circuit currently topping out around $\sim$1 G.