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 2023 – 2024.

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.

Fig. 1 KPGO site overview.

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 ∼15K and is dual polarization. The antenna was developed by InterTronic Solutions Inc. A Mark 6 recorder is currently used for all data recording.

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

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, maintenance, and sustainment of the observatory. Chris Coughlin (KPGO Station Manager), Kiah Imai (KPGO Lead Engineer), Lawrence Chang, Durwin Akita, Glenn Victa, and Jeffrey Batangan conduct all

1. USNO
2. NASA GSFC

Fig. 2 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	$\pm 270^\circ$	$\pm 270^\circ$
Azimuth velocity	$2^\circ/\mathrm{s}$	$12^\circ/\mathrm{s}$
Azimuth acceleration	$1^\circ/\mathrm{s}^2$	$1^\circ/\mathrm{s}^2$
Elevation range	$\pm 90^\circ$	$\pm 90^\circ$
Elevation velocity	$2^\circ/\mathrm{s}$	$6^\circ/\mathrm{s}$
Elevation acceleration	$1^\circ/\mathrm{s}^2$	$1^\circ/\mathrm{s}^2$
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

site VLBI operations, maintenance, and sustainment. 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, T2P, and OHIG 24-hour sessions, along with the INT1 one hour sessions and the 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 2023 and 2024. KPGO (K2) participates in the VO and VR 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 2023 and 2024.

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

The 2023–2024 period involved some new activities at KPGO as well as a few hurdles. One common trend from previous years was excellent data acquisition metrics for both the 20-m and the 12-m systems for 2023–2024, thanks to the dedication of the KPGO staff members. A new QZSS system installation was completed in March of 2023 successfully. DORIS system upgrades were completed successfully in April of 2023, including the installation of a new 4G beacon. The National Geodetic Survey (NGS) was completed in May of 2023. The NGS report can be found at https://www.ngs.noaa.gov/corbin/iss/index.shtml.

Fig. 3 Wild fires in the KPGO area.

The KPGO area experienced some natural wild fires in July of 2024. Site and staff all remained safe, but roughly one mile of our Etransfer Network Fiber was destroyed in the fires. KPGO has been without an Etransfer connection from July 2024 to the time this report was written. All VLBI data is currently being sent out via FedEx until fiber repairs can be completed or an alternate location can be set up with an Etransfer system and connection. Despite the current Etransfer infrastructure issue, we were able to work with NASA network engineers and correlator sites in March of 2024 to improve our Etransfer speeds from ∼2G to ∼10G successfully. We are looking forward to restoring the connection and utilizing our 10G bandwidth!

6 Outlook

KPGO is still planning numerous site improvements in the future. Funding was acquired and work awarded to the MIT Haystack Team for the 20-m VGOS Broadband Signal Chain Upgrade. Planning is still in progress, but the installation target is late 2025. Planning for other 20-m system upgrades are still being worked on as well, including the installation of a new servo system and cabling, Reflector Backup Structure Refurbishment, Elevation Gearbox 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 as well as improved control and tracking performance. KPGO staff will be working on this with ISI and MIT in 2025–2026.