SUPPLEMENTARY MATERIALS FOR

Island Wakes Observed from High-Frequency Current Mapping Radar

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HF RADAR TECHNICAL DESCRIPTION AND VALIDATION

In order to mitigate effects of local electromagnetic field distortions on the high-frequency (HF) radar receive antenna, an antenna pattern measurement (APM) is periodically collected as a component of HF radar site maintenance. The APM utilized by the MUltiple SIgnal Classification (MUSIC) direction-finding technique has been shown to be essential for HF radar data quality control (Barrick and Lipa, 1999; de Paolo and Terrill, 2007). APMs are typically conducted using a signal source or transponder deployed on a boat that navigates an arc around the receiving antenna. With the advent of low-cost quadcopter drones, the current best practice is to attach the signal source to a drone that is programmed to fly an arc or circle around the receiving antenna. The APM measures the relative amplitude and phase of the directive loop-antenna elements to the omnidirectional monopole at 1° to 5° intervals around the receive antenna.

The Kayangel and Angaur radar sites located on remote islands with minimal infrastructure require off-grid solar power, while Melekeok is powered off the local grid. A 3.6 KW system was installed at Kayangel, and Angaur was expanded to 5 KW due to relatively lower insolation and shading from nearby tall trees. A 1,200 ampere-hour bank of AGM (absorbent glass mat) batteries provides nearly two days of backup power at these remote installations. Telemetry to these sites was initially established using Inmarsat's BGAN satellite communication service, but recent developments in Palau's telecommunications infrastructure allowed the sites to be transitioned to the Palau National Communications Corporation (PNCC) 4G cellular network, with the BGAN serving as an automatic telemetry backup using a switching router. The transition to cellular service has facilitated improvements in our remote management capabilities, including smart infrastructure for targeted power load balancing and cycling, better computer management, and real time monitoring and management of the solar system.

REFERENCES

Barrick, D.E., and B.J. Lipa. 1999. Using antenna patterns to improve the quality of SeaSonde HF radar surface current maps. Pp. 5–8 in *Proceedings of the IEEE Sixth Working Conference on Current Measurement*. https://doi.org/10.1109/CCM.1999.755204.

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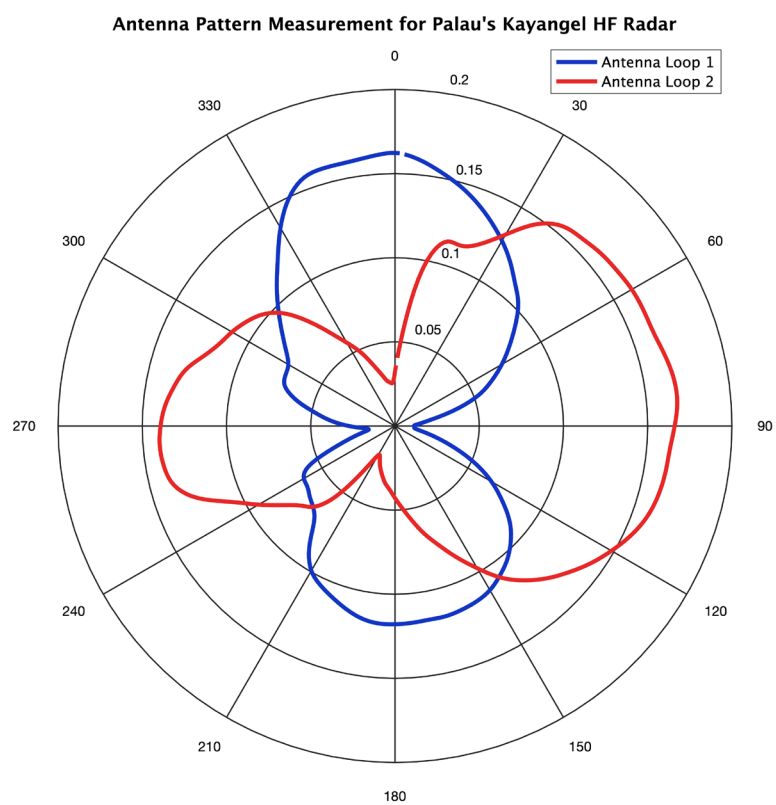

FIGURE S1. Polar plots of the receive sensitivity of the two loop/dipole receive antennas that provide diversity to the receiver and allow for direction finding of the backscattered HF signal.