

## **Moorea WET Net: A wireless sensor network for use in a coral reef ecosystem.**

The Moorea Coral Reef Long Term Ecological Research (MCR LTER) site was established in 2004 as an interdisciplinary, decadal- and landscape-scale program to provide a greater understanding of the processes that modulate coral reef ecosystem function, shape community structure and diversity, and determine abundance and dynamics of constituent populations. The overarching goal of the site is to provide increased insight into the responses of coral reef ecosystems to a variety of perturbations that operate across a range of spatial and temporal scales in order to increase our capacity to forecast the responses of coral reefs to changing environmental conditions.

All field activities on Moorea are based at University of California Berkeley's Richard B. Gump Biological Research Station. Broadband internet connectivity is achieved via a 512 Kbps ADSL connection to the island's ISP. We are collaborating with telecommunication engineers at CalIT2 (UC San Diego) to develop strategies to improve our network backhaul, currently estimated at 100 Kbps, and to develop new cyberinfrastructure in the areas of remote data acquisition and visualization. Wireless connectivity at the Gump Station is enabled using standard 2.4 GHz 902.11b/g access points. The MCR LTER site itself consists of the complex of coral reefs and lagoons that surround the island of Moorea in French Polynesia. Currently, several instruments containing a variety of environmental sensors and onboard data loggers are deployed within the major reef habitats at sites around the island. Instruments are retrieved from the field by divers and returned to the Gump Station where data are transferred from onboard loggers to PCs, archived onto optical media and then transmitted via internet to a data storage array maintained at University of California Santa Barbara. As a node in the emerging Coral Reef Environmental Observatory Network (CREON), the MCR LTER provides the public with access via our website (<http://mcr.lternet.edu/data/realtime>) to near real-time data streams obtained from a met station at the Gump Station and a Conductivity, Temperature and Depth (CTD) recorder on the fringing reef immediately adjacent to the Gump Station in Cooks Bay.

We are requesting funds to extend our existing wireless network to the reef by erecting a small wireless relay station on the barrier reef along Moorea's north shore. The relay station would consist of a pole extending approximately 4-5m in height above the sea surface and anchored onto the back reef near our field site LTER1, which is ~2 km Line-of-Sight from the Gump Station. Instrumentation would include a met station, a controllable web cam and a wireless communication package incorporating redundant 2.4 GHz 902.11g routers to provide a 54 Mbps data link. Commercially available solar panels and 12v deep cycle marine batteries would provide 500 W peak and up to 100 W of continuous power. We also are requesting funds for 5 inductively coupled oceanographic devices for deployment on our physical oceanographic mooring at LTER1 and an inductively coupled modem for the instrument mooring. Such a system would allow full two-way communication between the various instruments deployed on the mooring and the Gump Station (and hence the web) via a small surface buoy and the newly installed wireless relay station (see [www.seabird.com/technical\\_references/IMtutorialR2.htm](http://www.seabird.com/technical_references/IMtutorialR2.htm)).

Extending our existing wireless network to the reef itself would dramatically increase the research and educational scope of the MCR LTER site. The presence of a reef deployed met station and upgraded physical oceanographic mooring providing near real-time streaming data on parameters such as photosynthetically active radiation (PAR), wave height and current speed and directionality would improve our estimates of reef and water column based primary productivity, enable near real time circulation modeling and allow for the development of more "event based" sampling protocols. The web cam provides increased public outreach opportunities. The cost estimate for the relay station and mooring fabrications includes \$55,000 for hardware and \$20,000 for hardware installation, communication equipment set-up and tuning, and software modification for web access to the streaming data. Total estimated cost: \$75,000.