

## Implementation of Wireless Communications for the McMurdo Dry Valleys LTER

The opportunity of working with ADEC to implement a wireless communications capability holds great promise for the scientists and educators of the McMurdo Dry Valleys LTER. One of the main themes of our research has been the regulation of ecosystem structure and function by the harsh environment. Therefore, we invest significant effort in maintaining climate and hydrologic monitoring stations under the challenging conditions of extreme cold and complete darkness in winter and highly variable climatic conditions in summer. The McMurdo LTER Automatic Weather Network (LAWN) currently consists of seventeen stations and the McMurdo Dry Valleys hydrologic network consists of 17 stream gauging stations. The stream gauges are operated during the austral summer when meltwater is generated on the glaciers depending on the intensity of the continuous sunlight and air temperatures. The reliability of our stations is critical because these two networks are the only networks operating in the McMurdo Dry Valleys region. For example, we maintain the stream flow record for the longest river in Antarctica, the Onyx River. These stream flow measurements were begun by the New Zealand Antarctic research program in 1968, representing the longest environmental record for South Victoria Land overall.

Our current capabilities and limitations. Voice communications across the site are limited to handheld radios, VHS radios and cellular transmissions from the three field camps which depends upon a repeater located on a nearby mountain peak in the Asgaard Range between Taylor and Wright Valleys. Meteorological Stations are operational in Beacon Valley, Explorer's Cove, on the shores of Lakes Fryxell, Hoare, Bonney, Brownsworth, Vida and Vanda, and on the Commonwealth, Howard, Canada and Taylor glaciers. Stations sample sensors every 30 seconds and send summary statistics (averages, maximums, minimums etc.) to solid-state storage modules every 15 minutes. These storage modules are downloaded during the austral summer season and the data are added to the database once a year. The stream gauges are located on the 15 major streams that flow into the three large lakes in Taylor Valley and on two sites on the Onyx River which flows into Lake Vanda in Wright Valley. Stream flow in the Dry Valleys is highly variable, responding rapidly to changing climatic conditions, and a series of warm days can cause flood events that can alter conditions at the stations. Similar to the LAWN, the stage, temperature and conductivity sensors of the stream gauge stations transmit data to solid state storage modules, which are downloaded during regular site visits during the summer. The stream gauge network is operated by the investigators and students on the MCMLTER project in collaboration with the U.S. Geological Survey, Wyoming District office.

Transportation in the McMurdo Dry Valleys to the meteorological and hydrologic stations is by helicopter or on foot. Thus, each station visit represents an investment of our most limited field resources- person hours in the field and helicopter hours. In the 2005/2006 season, data from one of the Onyx River gauges was successfully telemetered on a daily basis via satellite by the USGS and the data were available not only to the field team, but also to the public via the USGS web site through linkages such as Google Earth. The operation of the stream gauge network was greatly enhanced by the telemetry of data because the field team was able to schedule station visits to optimize the range of conditions for determining the relationship between stream stage and stream flow.

We have an active outreach program that targeting elementary through high school students. In the higher grades we have a prepared curriculum that is distributed on a DVD and utilizes our web database. At the elementary level we have published a children's book, *The Lost Seal*, which has been purchased by libraries and schools internationally, as well as the general public through bookstores and online vendors. Making data available real time would greatly enhance the educational experience for students.

Our vision. We envision blanketing Taylor Valley, where our primary field sites are located, with a wireless communications network, prioritizing valley bottoms with stream gauging stations and the glacier sites with meteorological stations. In Wright Valley, we envision telemetering both stream flow and meteorological data on a daily basis throughout the austral summer, and meteorological data during the entire year. To avoid bottlenecks, we envision having capability to transmit and telemeter data from several key stream gauge stations and meteorological stations directly via satellite without going through the communications system at McMurdo Station.

What this would mean for research and education. The wireless LAN and telemetry system would provide an invaluable step forward in capability for research and educational outreach. We will prioritize telemetry for both improving field operations and data quality and enhancing public and educational outreach. The operation and maintenance of the key datasets upon which we rely will be improved because we will be able to respond to any system failures or impairments in a timely manner, rather than discovering these failures on arrival at the station for a visit. This will minimize data loss and allow us to diagnose system failures and bring replacement equipment along to the site visit, potentially reducing 2-fold the number of visits required.

The opportunities for enhancing our educational outreach are great because we are in the field in the winter when school is in session in the Northern Hemisphere. For example, we will telemeter daily stream flow data for Lost Seal Stream, which is named to commemorate the event of the first recorded encounter with a living seal in the McMurdo Dry Valleys, which is also the event recounted in the children's book. This will provide a stronger educational link for the Lost Seal section of our website, which now receives about half of the total hits for the MCMLTER website.

Details. We look forward to working with the experts from ADEC to help us design and optimize a system that would be appropriate for our site. We would like to consult with ADEC to evaluate the costs and benefits of solar vs. line power at key locations. Note: There is a link on the McMurdo web page that can be used to create a map that includes the various layers and, by expanding on LTER layers, the met and stream gauge stations can be included, as well as the camp locations. The site is <http://www.mcmlter.org/mapping.html>. This can also be used to change the scale and calculate distances.

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