California Mediterranean Research Learning Center

National Park Service
U.S. Department of the Interior

Excited Students Explore a Mix of Technology and Science At the 2007 High Tech Fair in San Diego

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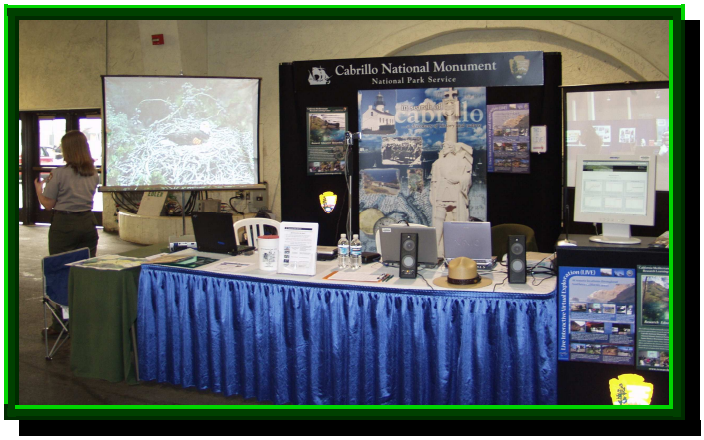
Cabrillo National Monument Ranger, Patricia Heusner, facilitates student questions for SDSU's Pablo Bryant, who was broadcasting live from the Santa Margarita River

The California Mediterranean Research Learning Center and Cabrillo National Monument in partnership with University of California San Diego (UCSD) High Performance Wireless Research and Education Network (HPWREN) and San Diego State University (SDSU) Field Stations Program hosted a booth at the 2007 San Diego Science Alliance High Technology Fair. The partners collaborated to demonstrate how the HPWREN wireless network enables the communication of real time data and video from remote locations directly to students, educators, and scientists through the Internet. The Live Interactive Virtual Exploration (LIVE) system, developed by HPWREN, was used to establish real-time video and audio communication between students at the High Tech Fair and scientists stationed at banks of the Santa Margarita River running through the Santa Margarita Ecological Reserve (SMER) in Temecula. The LIVE programs connected technology and science by demonstrating the application of wireless systems to the management and preservation of natural systems.



The National Park Service booth at the San Diego Science Alliance 2007 High Tech Fair displayed two large screens depicting live video and images from remote locations

Ranger Patricia Heusner at Cabrillo National Monument developed a storyline and program format for the HPWREN LIVE back-pack system and coordinated demonstrations at the event. Interpretation Division Chief, Karl Pierce, provided pre-event planning, staff support, and the Cabrillo National Monument skyline display. Ranger Marcy Marquez organized and assembled the teacher packets for the event.

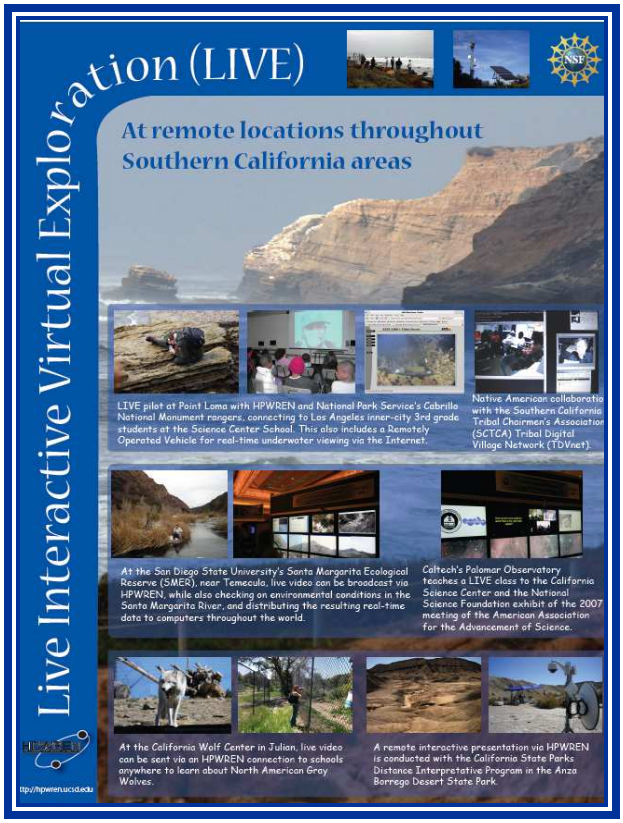
Kim Miller from the California Wolf Center generously provided informational brochures for inclusion in the teacher packets. San Diego Science Alliance 2007 High Tech Fair Co-Chairs Cathy Akin and Carin Holliday helped to iron out logistical details for the booth.

Mike Maki (right), Computer Specialist from Santa Monica Mountains National Recreation Area ensures laptops and cameras are linked to the HPWREN Network

Mike Maki, Computer Specialist from Santa Monica Mountains National Recreation Area worked at the booth to set-up, prepare, and test the cameras, laptops, and equipment to ensure all were hooked up to the HPWREN network and working properly. Chief of Administration at Santa Monica Mountains NRA, Marilyn Sutton, graciously provided behind the scenes support in the form of staff time, purchasing, and contracting assistance for this event. Interpretive

Rangers Judy Joy Lively and Ken Low of Santa Monica Mountains NRA generously lent their skills to printing and mounting posters for the event.

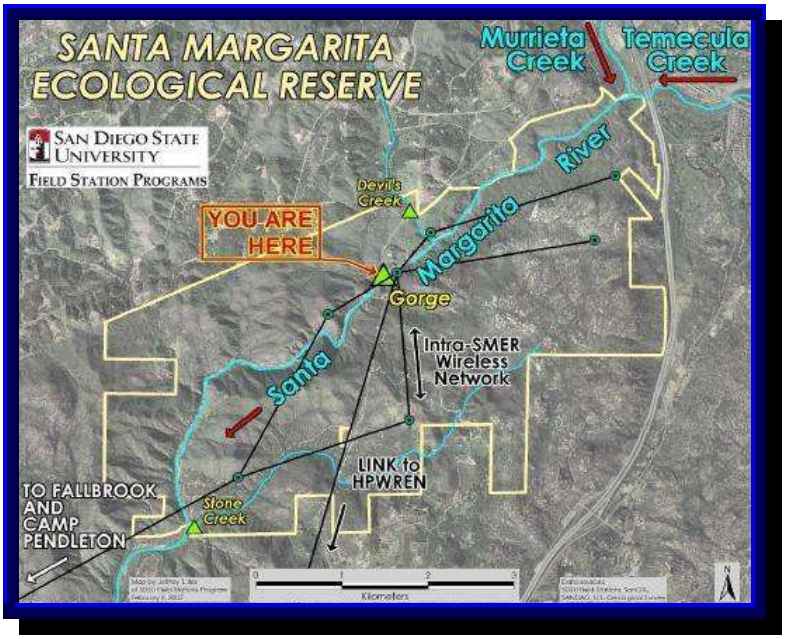
Graphic Design Artist Monika Braun of Akinom Design generously donated her time and artistic ability to produce two graphic designs for display at the NPS booth.



HPWREN Technician and Programmer Jim Hale coordinated with the Del Mar Fairgrounds managers to extend the HPWREN wireless network and install temporary wireless equipment to establish Internet connectivity at the NPS booth. The morning of the fair, Mr. Hale addressed several crucial technical glitches and got the system operating at maximal capacity within moments.

HPWREN Technician, Jim Hale, (left) maintains HPWREN connectivity and keeps all systems operating smoothly prior to and during the fair

Hans-Werner Braun, HPWREN Principal Investigator, configured wireless radios and made last minute modifications to the NPS Remotely Operated Vehicle (ROV) the day prior to the Fair. The ROV was deployed in the Santa Margarita River to add another real-time sensor in the form of live underwater video intended to increase the level of excitement and interest of the fair participants.



A map of the San Diego State University Field Station Programs' Santa Margarita Ecological Reserve which depicts the location of the LIVE broadcast and outlines the wireless network enabling remote research and education activities.

The NPS booth displayed three real-time video feeds, real-time hydrologic sensor data, and interactive communication with scientists at Santa Margarita Ecological Reserve. The primary video feed employed HPWREN LIVE back-pack system using video-capable Skype. This system allowed the audiences at the booth to see, hear, and interact with SDSU Field Stations Program, Pablo Bryant at the Santa Margarita River. A second video camera was aboard the NPS Remotely Operated Vehicle (ROV) maneuvering underwater in the Santa Margarita River. The third video camera was deployed on the bank of the river to provide a broader view of the river and to observe the movements of the ROV.

The LIVE program video feed was displayed on one large screen, while the video from the ROV and the river bank video where viewed on the second large screen.

An Axis Server allowed NPS staff to control live video from the ROV and river bank simultaneously or alternate between larger versions of the video feeds.

Real-time water quality sensors deployed in the Santa Margarita River and throughout SMER are monitored by SDSU Station Program's staff on-line. A flat screen computer monitor displayed real-time water quality readings in graphical format.

National Park Service Ranger Patricia Heusner and Research Learning Center Specialist Morgan Robertson took turns drawing students over to the booth and leading interactive discussions with Pablo Bryant. HPWREN's Jim Hale commented that, "Morgan and Patricia engaged the students and immediately involved them in discussions and the interactive presentations. They conveyed an excitement that was infectious, drawing the fair participants to the booth such that students were sometime crowed three to four people deep around the booth. The Rangers would trade off taking a group around the hall with the mobile wireless camera pack while another would stay back at the booth encouraging interaction with friends through the wireless connection on the big display."

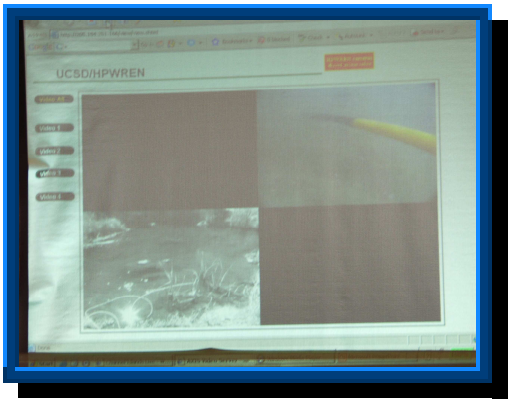
SDSU Field Stations Program's Pablo Bryant near the river at the Santa Margarita Ecological Reserve (left) talking with students live at the High Tech Fair

Students at the booth engaged Pablo Bryant, Research Technology Manager for SDSU Stations Programs in real time discussions regarding water quality sensors at the Santa Margarita Ecological Reserve. Pablo was stationed at the bank of the Santa Margarita River and manipulated hydrological parameters by inserting the hydro-sensor probe in several treatments such as; the river to establish ambient conditions, ice water to change water temperature, baking power to influence dissolved oxygen, and vinegar to drop pH. The students at the Fair were able to see, hear, and speak with Mr. Bryant via the LIVE system which employs video capable Skype. Fair participants observed real-time graphical depictions of the hydrological parameter changes as Mr. Bryant moved the sensor probe to various

treatments. The data changes, river camera, and interactions with Pablo kept the students asking questions.

At times, HPWREN Outreach Manager Kim Bruch stepped in and helped out with student requests to direct the video camera towards interesting action such as the ROV cruising around underwater or ducks floating along the far bank of the Santa Margarita River.

The ROV on the second large screen held the interest of participants while they waited to check out the water quality sensors with Pablo. Students at the booth were particularly interested when they were able to see Hans-Werner Braun controlling the ROV and working to unclog clumps of algae from the thrusters. Occasionally the river camera caught glimpses of Monika Braun helping to manage and tend the ROV. Most interesting for the students were times when the three video cameras, the video capable Skype camcorder, the river video, and the underwater ROV video camera all focused on the same area of action and the images overlapped.



Hans-Werner Braun, Principal Investigator of HPWREN, pilots the ROV (left), in the Santa Margarita River. Live underwater video from an on-board camera (right), along with images of the ROV from the river bank, were transmitted to the fair through the HPWREN Wireless Network.

As a special treat for fair participants, students donned a LIVE back-pack system and explored the exhibit hall. The students roving around the hall interacted with their friends at the NPS booth. This demonstration allowed the fair participants to gain first hand experience with the equipment demonstrated earlier by Pablo Bryant from SDSU Field Stations Program.

Students try out the LIVE wireless back-pack system, developed by HPWREN.

Students conducted virtual tours of the fair, and fielded questions from classmates watching them from the NPS booth.

Jim Hale at HPWREN noted that "the NPS booth hosted multiple live activities which easily gained the attention of students and teachers. The NPS staff presented programs along side disciplines such as robotics and rocketry, and thus was constantly competing for student attentions. Thanks to the efforts of HPWREN and SMER staff to maximize the number of "cool" equipment in the field, the NPS staff managed to keep a crowd of attentive students from moment the fair opened till the last bus had left."

A special thank you to Morgan Robertson for coordinating the event and volunteering to field the emails associated with student responses and inquiries regarding job opportunities with the National Park Service

Lessons Learned

The majority of students did not follow the event format which suggested student groups travel from booth to booth and spending 15 minutes to engage in a program with pre-established questions. In fact, the NPS booth fielded water quality questions intended for another exhibitor booth. The PowerPoint presentation developed to lead students through a story board format did not hold the interest of students and was shelved early in the morning. The presentation was designed to inform participants how HPWREN connected all of the partners and enabled real-time communication. This information was conveyed first hand by NPS staff as an introduction to the LIVE programs from SMER.

To orient people to a LIVE event already in progress, it would be helpful to have an on-screen label that identifies the place (ex. "Santa Margarita Ecological Reserve") and indicates that the demonstration is an "HPWREN LIVE event."

Perhaps this could be accomplished by adding an Internet window frame on a corner of the broadcast screen. Ideally, the window would clearly indicate that the presentation is a live, interactive, Internet broadcast through the HPWREN wireless network.

Pablo Bryant at SMER addressed the students by name and engaged them in a discussion regarding the changes they were observing in the graphs depicting real-time hydrological parameters. The dialogue with Pablo helped make the virtual event more like a field trip rather than a broadcast. As groups of students formed around the speakers and microphone to talk to Pablo, more students would crowd the table wanting to know what was going on. Jim Hale, HPWREN, commented that "Pablo did an excellent job as a presenter. Several groups of students returned to interact with Pablo a second time." The students had a great time with Pablo and by lunch some of them were telling us that they had talked to Pablo and wanted to try the system for themselves.

Jim Hale contributed the following suggestions:

> The video feed from the ROV was appealing, although it may have been under used at the event. When Pablo referenced the ROV as part of his presentation, it brought an extra dimension to the presentation, though an underwater camera would have been just as useful. At one point, Pablo was talking to a student during a presentation and reached his hand into the water in front of the ROV and waved.
>
> The two video feeds provided by the axis server captivated interest while students were waiting to interact with Pablo. Attendees were more interested in the ROV when Hans-Werner spent time cleaning gunk out of the thrusters or when they could see him controlling it via the river camera. An improvement for the next time would be to include the people at the controls performing various functions or scrambling to fix equipment. Commentary or the ability to listen in on the conversation would have added an extra dimension of interest.