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In keeping with NASA's emphasis on "inspiring the next generation of explorers", the Planetary Data System (PDS) has begun work on a new intuitive web interface that will provide easy access to data collected by planetary exploration spacecraft. The ultimate goal of this tool is to allow more citizens and students to become active participants in the exploration of space. The simple interface allows the user to define collections of data based on intuitive search criteria, such as geographic coordinates, feature names (Valles Marineris) and features types (craters). The interface allows the user to download files in numerous image file formats, including JPEG, TIFF, GIF, BMP, PNG and raw pixels. The user can access the collection for subsequent integration with their educational tool or curriculum. In this session we will describe and demonstrate the interface and its capabilities, walk through user scenarios, discuss the relationship of this interface to the PDS access tools and functions developed for the scientific community, and discuss the potential for its utilization in K-14 formal and informal (museums, amateur groups, etc.) settings. The tool discussed in the session is designed to provide a foundation for access to planetary data and test for the basic, broad scope needs of the formal and informal educational communities.

ED32D MCC: 3012 Wednesday 1340h

Education and Outreach Efforts of Major Research Facilities and Organizations I (*joint with OS, P, T, C*)

Presiding: P G Coble, College of Marine Science, University of South Florida; H Gröschel, Henrike Gröschel

ED32D-01 1340h

The National Center for Atmospheric Research Education and Outreach Program: Successes, Lessons Learned, and the Role of Research Institutions

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The growing consensus that improving science education and public science literacy requires the focused efforts of a wide spectrum of specialists, including scientists, provides the opportunity for national research centers to develop programs that seek to bring their unique science perspectives to educators and the public. At the National Center for Atmospheric Research (NCAR) in Boulder, Colorado, we have developed a multifaceted program for science education and outreach designed to bring our science to these audiences in ways that build on our specialized expertise. Collaboration with scientists internal to NCAR, as well as in the broader University Corporation for Atmospheric Research community, has lead to numerous education and outreach projects that bring the results of funded research projects to the public. Education and outreach activities at NCAR include opportunities to engage with the public in informal as well as more formal settings. Our exhibit and tour program offers topically focused exhibits, interactive activities, and opportunities to learn about the science underway at the laboratory. We hold annual events, providing high-energy science demonstrations and lectures for the public. Our web sites disseminate extensive resources enabling students (K-12 and undergraduate), educators, and the public to learn on their own about our science, supplemented by interactives and hands-on activities. Our professional development programs engage middle and high school educators in standards-based activities and cutting-edge science content that highlights global and climate change topics and modeling in the geosciences. Central to all of these activities is the active participation of lab scientists and staff, whose personal enthusiasm and science expertise enriches the program for our audiences.

URL: <http://www.ncar.ucar.edu/eo/>

ED32D-02 1355h

Implementing and Supporting Earth Science Curriculum Reform in Secondary Schools

Michael J Smith (302-731-7707; msmith@agiweb.org) The American Geological Institute has been actively involved in developing earth science curricula for more than 40 years through programs like Earth Science Sourcebook and the Earth Science Curriculum Project. Recently, the AGI was funded by the National Science Foundation to develop curriculum for secondary school (grades 6-12) that would address the Earth science and inquiry content standards of the National Science Education Standards. The EarthComm (high school) and Investigating Earth Systems (middle school) curriculum programs were developed through funding from the National Science Foundation and corporate sponsors of the AGI Foundation, and published for the 2002-2003 school year. The AGI is now actively involved in developing and refining systems for supporting the professional development of teachers who implement EarthComm and Investigating Earth Systems. The paper presentation will outline how AGI is supporting teachers through a combination of web-based programs, teacher workshops, and DVD and video materials.

URL: <http://www.agiweb.org/education/>

ED32D-03 1410h

K12 Education Program Lessons Learned at the Center for Earthquake Research and Information

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The Center for Earthquake Research and Information at the University of Memphis has been committed to increasing awareness for Seismic Hazard, Earthquake Engineering, and Earth Science among Mid-America's policy-makers, engineers, emergency managers, the general public, and K-12 teachers and students for nearly three decades. During that time we have learned many lessons related to providing effective education and outreach programs, especially for K-12 students. The lessons learned from these activities may be particularly appropriate for other regions where large earthquakes occur infrequently but have disproportionately high consequence areas due to low attenuation of seismic waves. Effective education programs in these settings must provide a consistent message across many states to a wide variety of socio-economic groups and professional communities through the leveraged resources of various groups and agencies. It is also beneficial to hire and train staff with K-12 teaching experience to work directly K-12 education organizations, and science curriculum coordinators.

URL: <http://www.ceri.memphis.edu>

ED32D-04 1425h

EARTH (Education and Research: Testing Hypotheses) -Educational Outreach Efforts by the Monterey Bay Aquarium Research Institute (MBARI) and the Monterey Bay Aquarium (MBA).

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Recognizing the need to educate the public about the value of research and help them understand scientific methodology, this collaboration allows us to test new ideas for public outreach and education. One of MBARI's joint projects with MBA, Education and Research: Testing Hypotheses (EARTH) lays new groundwork, providing teachers with means for integrating real-time data with existing educational standards and tested curriculum in an interactive and engaging way. EARTH will use real-time data from the ocean observatory to design and test outreach with the Internet as an interface to scientists, teachers, students, and the public. Several workshops will be held at MBARI in 2002-2004 bringing educators, scientists, and engineers together to develop effective educational practices for access and use of real-time data in preparation for the

deployment of benthic observatories. Participants include educators from other research institutions, universities, community colleges, and high schools as well as MBARI and MBA staff. Initial efforts of EARTH target high school and undergraduate students, with the ultimate goal of reaching kindergarten through college. This presentation will focus on the first two years of this project looking at lessons learned, current status, and plans for the future.

URL: <http://www.mbari.org/education/earthwkspt.htm>

ED32D-05 1440h

Southern California Earthquake Center (SCEC) Communication, Education and Outreach Program

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The SCEC Communication, Education, and Outreach Program (CEO) offers student research experiences, web-based education tools, classroom curricula, museum displays, public information brochures, online newsletters, and technical workshops and publications. This year, much progress has been made on the development of the Electronic Encyclopedia of Earthquakes (E3), a collaborative project with CUREE and IRIS. The E3 development system is now fully operational, and 165 entries are in the pipeline. When complete, information and resources for over 500 Earth science and engineering topics will be included, with connections to curricular materials useful for teaching Earth Science, engineering, physics and mathematics. To coordinate activities for the 10-year anniversary of the Northridge Earthquake in 2004 (and beyond), the "Earthquake Country Alliance" is being organized by SCEC CEO to present common messages, to share or promote existing resources, and to develop new activities and products jointly (such as a new version of *Putting Down Roots in Earthquake Country*). The group includes earthquake science and engineering researchers and practicing professionals, preparedness experts, response and recovery officials, news media representatives, and education specialists. A web portal, <http://www.earthquakecountry.info>, is being developed established with links to web pages and descriptions of other resources and services that the Alliance members provide. Another ongoing strength of SCEC is the Summer Intern program, which now has a year-round counterpart with students working on IT projects at USC. Since Fall 2002, over 32 students have participated in the program, including 7 students working with scientists throughout SCEC, 17 students involved in the USC "Earthquake Information Technology" intern program, and 7 students involved in CEO projects. These and other activities of the SCEC CEO program will be presented, along with lessons learned during program design and implementation.

URL: <http://www.scec.org>

ED32D-06 1455h

NASA's Learning Technology Project: Developing Educational Tools for the Next Generation of Explorers

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Since 1996, NASA's Learning Technology has pioneered the use of innovative technology to inspire students to pursue careers in STEM (Science, Technology, Engineering and Math.) In the past this has included Web sites like Quest and the Observatory, webcasts and distance learning courses, and even interactive television broadcasts. Our current focus is on development of several mission oriented software packages, targeted primarily at the middle-school population, but flexible enough to be used by elementary to graduate students. These products include contributions to an open source solar system simulator, a 3D planetary encyclopedia, development of a planetary surface viewer (atlas) and others. Whenever possible these software products are written to be 'open source' and multi-platform, for the widest use and easiest access for developers. Along with the software products, we are developing activities and lesson plans that are tested and used by educators in the classroom. The products are reviewed by professional educators. Together these products constitute the NASA Experiential Platform for learning, in which the tools used by the public are similar (and in some respects) the same as those used by professional investigators. Efforts are now underway to incorporate actual MODIS and other real time data uplink capabilities.

URL: <http://learn.arc.nasa.gov>

ED32D-07 1510h

Fine Tuning the IRIS Education and Outreach Program: Choosing an Optimal Balance of Activities

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The IRIS Education and Outreach (E&O) Program is committed to making significant and lasting contributions to science education, science literacy and the general public's understanding of the Earth, using seismology and the unique resources of the IRIS consortium. The E&O program has activities that span all educational levels from public outreach to K-12 and college education. The activities are designed for a wide range of individual interaction time, from minutes for a museum display to an entire summer for an undergraduate research internship. In general, the longer the interaction time, the smaller the audience. The educational goals for a particular audience, as stated in the E&O Program plan, define whether an activity is focused more on breadth of audience or depth of content. An activity's ability to meet the educational goals of the E&O program is the most important criteria in assessing its value. However, to help determine which activities are most worthy of continued support and to help select new activities to engage in, we have begun estimating the cost of providing each hour of interaction time for an activity. The lower the cost for each person-hour of interaction, the more efficient the activity, assuming maximum effectiveness of each activity. Thus the importance of assessment is magnified, as a more effective activity could cost more per person-hour and still be supported if no equally effective but more efficient activity is viable. As an example of how resources are divided between different activities, two activities that have similar budgets but very different goals, content depth and audience sizes are our museum program and our professional development workshops. The museum program, a partnership between IRIS, the US Geological Survey, and several major museums across the nation, reaches large audiences (up to 16 million people per year) via 1 traveling and 4 permanent exhibits. The exhibits include real-time earthquake location maps and continuous seismograms from multiple global seismograph stations, providing wide exposure to seismology, though for a very limited time per individual. One-day professional development workshops provide content knowledge and classroom activities modeled using inquiry-based instructional practices. Approximately 140 teachers and college faculty attended IRIS-led workshops in the past year. The time spent with a limited number of teachers is leveraged through each teacher's interactions with a much larger number of students. When teacher-student interactions for 1-2 years after attending a workshop are included in the estimation of person-hours of interaction time, the museum and workshop programs generate a similar total interaction with the target audiences. Thus by this simple measure, the two programs are roughly equally efficient uses of E&O program resources, even though the target audiences, level of content depth and number of people engaged are very different. Using this measure, it is possible to assess if the relative cost of different activities matches the relative importance of the goals they are addressing.

URL: <http://www.iris.edu/about/ENO/>

ED32D-08 1525h

An Overview of Education Outreach From the Graduate School of Oceanography at the University of Rhode Island

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The Office of Marine Programs (OMP) at the University of Rhode Island Graduate School of Oceanography (GSO) is a national leader in ocean science education and outreach. Current and planned efforts target grades K-16 and a variety of public audiences. Funding from a host of federal agencies, foundations, and industry has allowed OMP to serve as a bridge between its audiences and GSO scientists and graduate students for over 25 years. From museum exhibits to scientist/educator partnerships and interactive educational Internet sites, OMP projects cover a wide range of activities. Successes and lessons learned will be discussed, in particular with regard to engaging the scientific community in education and outreach. Implications for the impact on science education will be highlighted.

URL: <http://omp.gso.uri.edu>

ED32E MCC: 3012 Wednesday 1600h

Education and Outreach Efforts of Major Research Facilities and Organizations II (joint with OS, P, T, C)

Presiding: K Ellins, Institute for Geophysics, University of Texas; M K Hall-Wallace, University of Arizona

ED32E-01 1600h INVITED

Facilitating Participant Success: Teachers Experiencing Antarctica and the Arctic Program

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Through the NSF-funded Teachers Experiencing Antarctica and the Arctic (TEA) Program K-12 science teachers participate as members of polar field projects. Objectives of the program include: immersing the science teacher in the experience of research; 2) leveraging the research experience of the teacher to better inform teaching practices; and 3) sharing the experience with the broader educational and general community. The polar field experience is an exciting opportunity accompanied by a daunting number of responsibilities. In addition to preparing for field research, TEA teachers bring their experience to colleagues, classrooms, and communities. Before going into the field, they give presentations, help plan how students can connect to the polar regions, and share the expedition with the public. In the field, the TEA teacher is a team member and educational liaison, responding to questions by e-mail, and posting e-journals describing the research experience. Upon return, the TEA again shares the experience broadly with the community. In addition, they work closely with 3 colleagues for 140 hours to bring the experience of research into classrooms. Formative evaluation of the TEA Program underscores the need to support teachers in accomplishing their responsibilities; this support is necessary to achieve program objectives. TEA teachers are responsible for sharing the science content of their research. While many broadcast the excitement of the experience, they may not have the scientific background to convey the content. This is due, in part, to many teachers having to be generalists in their classrooms. Shifting into the role of specialist can be challenging. In the year of preparation before the field experience, TEA teachers attend orientation, meet with their research teams for several days, and are encouraged to learn more about their science topic. Understanding builds through the field experience. It may take two or more years after the field work for the science content to solidify. This is illustrated by the changing emphasis of presentations. Presentations after the field season progress from being "experience" based to being "content" based as the teacher continues to develop understanding through interactions with researchers and teaching colleagues. The participants bring a wide array of skills to the program; rarely is one individual accomplished at every responsibility. Some participants are gifted speakers, others are talented writers, and others are exemplary mentors. The TEA Program has attempted to put into place support mechanisms to help build skills, and to leverage the strengths of the participants by providing opportunities for them to collaborate. Presentations are practiced within the TEA community before being presented at conferences. Classroom resources are identified, analyzed, and/or developed by teams of teachers in collaboration with curriculum writers at workshops. The mentoring requirement, considered the most challenging responsibility, is supported by bi-monthly conference calls that include several TEA teachers. Through these mechanisms, TEAs share successes, brainstorm solutions, and help each other with challenges. Facilitating the interaction and support of TEAs by each other is, perhaps, one of the strongest mechanisms for achieving success.

URL: <http://tea.rice.edu>

ED32E-02 1615h

Paving the Road to Broader Impact: California Center for Ocean Sciences Education Excellence (CA COSEE)

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It's hardly surprising that new requirements to address how their research will have impact beyond academia send many ocean and earth scientists reaching for the aspirin. Sympathetic to the increasingly heavy demands on researchers' time, we at California COSEE work to make scientists' education and outreach efforts easier, more effective and more rewarding. Strategies we'll describe include: a) identifying and efficiently meeting the needs of the individual scientists and educators we serve; b) finding the right "tool" for the job, i.e. connecting scientists with the educators and organizations best positioned to incorporate elements of their research into widely-disseminated resources for teachers, students and the public; and c) building institutional and community-scale support for scientists' outreach contributions. We'll describe specific CA COSEE-facilitated collaborations between scientists and educators, as well as share lessons we're learning about the catalytic process we've undertaken. The value of the services we provide in terms of leveraging limited resources and forging partnerships that ultimately make ocean research relevant to non-scientists will be reflected in the quality of education resources generated as well as scientists' changing attitudes toward outreach. We invite all those interested, especially ocean scientists (including technical staff and graduate students) and informal science educators to visit www.cacosee.net, and click on **Engaging Scientists**.

URL: <http://www.cacosee.net>

ED32E-03 1630h

Ridge 2000 Education and Outreach: Past, Present and Future

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Ridge 2000 is a multidisciplinary NSF sponsored research initiative to explore Earth's spreading ridge system as an integrated whole. The program's science plan aims at a comprehensive understanding of the relationships among the biological, geological, and chemical processes associated with plate spreading at mid-ocean ridges. Ridge 2000 replaces its predecessor program RIDGE, started in 1989, and begins a new decade of mid-ocean ridge research. Two main research themes of the new program are Time Critical Studies and Integrated Studies. The Ridge 2000 community is comprised of scientists from universities and research institutions across the country, and administration of the program rotates among institutions every three to four years. Several exemplary education outreach efforts (e.g., REVEL, Dive and Discover, Extreme 2000, NeMO, Voyage of the Deep Sea IMAX film) have been developed by individual scientists to share various aspects of deep-sea ridge research with the public and K-12 audiences. However, no RIDGE program outreach effort has been developed. Since 2001, the new program has sought ways to develop a coordinated, community-wide education outreach plan to help promote Ridge2000 research to the public. Our goals include helping Ridge2000 researchers develop ideas for their own outreach efforts as well as orchestrating community-wide efforts entraining scientists from multiple institutions. Community-wide efforts offer the advantage of serving larger audiences and provide an avenue for those individuals interested in E&O but with less time or experience. These programs also offer a means of developing program recognition. To identify ways to use the uniqueness and excitement of deep-sea research to enhance science education throughout our nation, we conducted a 3-day teacher workshop with 26 invited participants. The workshop was designed to obtain expert opinion on how to help meet the needs of students in today's science classroom with the unique skills and resources of our research community. As a result of the workshop, we have identified a plan for outreach to the K-12 community that includes educational products, dissemination and teacher professional development to ensure the offerings reach the students in an effective manner. Four Ridge2000 community outreach efforts currently in development include (1) SEAS - Student Experiments At Sea, (2) a coordinated outreach effort for the Lau Integrated Study Site expeditions, (3) R2K-based Data Tips, and (4) a Ridge2000 Distinguished Lecturer Series. We are also developing plans to work with COSEEs to disseminate these and other Ridge2000 outreach products.