ED41A MCC: 3012 Thursday 0800h

The Benefits and Challenges of Education and Public Outreach Efforts Associated With Scientific Research Programs I *(joint with OS, P, SA, SH, SM)*

Presiding: **D Alexander,** Rice University**; F Ireton,** Science Systems and Applications, Inc.

ED41A-01 0800h

A Science Classroom for America: Hands-on Science Education on the International Space Station Using the Distributed Mentoring Network of the National Space Grant Program.

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Our purpose is: 1) to encourage young students to get involved in, or deepen their involvement with science by using the excitement of their actually participating in science on the ISS; and 2) to provide opportunities for the citizens of the US and of other participating countries to participate and feel ownership in their Space Station. Their involvement is at the local community level through their children's education and their children's school. We have established the following design guidelines: 1) Each education component will not only conform to the science standards established nationally and in the individual states, but also will be designed to dovetail into established curricula. To the extent possible, material inserted will replace an existing unit, rather than being an addition. 2) We will avoid proposing new flight hardware, rather we shall design the education modules around manifested hardware, supplied by the various offices of NASA for other purposes. This will require partnering with many NASA PI's and Project Offices. 3) There will be a ground classroom activity corresponding to each Space activity. Flight opportunity will not be automatic. Each student (or class of students) will be selected for flight based on a written submission and professional review. This protocol was developed for the student protein crystal growth program on the ISS. 4) The Science Classroom for America will be distributed nationally by the National Space Grant network.

ED41A-02 0815h

Introducing Space Weather to High School Students, Undergraduates and the General Public

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Space environment studies and space weather investigations have typically been conducted at the university and graduate level. The Air Force Academy is an undergraduate-only institution. Our research efforts, funded by the National Science Foundation and the Air Force Office of Scientific Research have spawned a significant educational and public outreach program directed at a very diverse audience. We interact with the public and with students in three significant ways: In public presentations, in undergraduate and professional development course work and in physics laboratories. The Open Houses at the US Air Force Academy's Planetarium and Observatory provide a natural avenue for informing the general public about space weather impacts and initiatives. We have developed a satellite drag laboratory for our introductory physics class which is taken by all Academy cadets. This lab is easily modified for advanced undergraduate use and high-school use. The drag lab, along with several applications from AF GEOSPACE, forms the basis of several exploratory activities in our undergraduate space weather course. In this presentation we will show how research activities are supporting the introduction of space weather and space environment concepts to a very broad audience.

ED41A-03 0830h INVITED

Sharing Planetary Exploration: The Education and Public Outreach Program for the NASA MESSENGER Mission to Orbit Mercury

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The Education and Public Outreach (EPO) Program of the MESSENGER mission to the planet Mercury, supported by the NASA Discovery Program, is a full partnership between the project's science and engineering teams and a team of professionals from the EPO community. The Challenger Center for Space Science Education (CCSSE) and the Carnegie Academy for Science Education (CASE) are developing sets of MESSENGER Education Modules targeting grade-specific education levels across K-12. These modules are being disseminated through a MESSENGER EPO Website developed at Montana State University, an Educator Fellowship Program managed by CCSSE to train Fellows to conduct educator workshops, additional workshops planned for NASA educators and members of the Minority University - SPace Interdisciplinary Network (MU-SPIN), and existing inner-city science education programs (e.g., the CASE Summer Science Institute in Washington, D.C.). All lessons are mapped to national standards and benchmarks by MESSENGER EPO team members trained by the American Association for the Advancement of Science (AAAS) Project 2061, all involve user input and feedback and quality control by the EPO team, and all are thoroughly screened by members of the project science and engineering teams. At the college level, internships in science and engineering are provided to students at minority institutions through a program managed by MU-SPIN, and additional opportunities for student participation across the country are planned as the mission proceeds. Outreach efforts include radio spots (AAAS), museum displays (National Air and Space Museum), posters and traveling exhibits (CASE), general language books (AAAS), programs targeting underserved communities (AAAS, CCSSE, and MU-SPIN), and a documentary highlighting the scientific and technical challenges involved in exploring Mercury and how the MESSENGER team has been meeting these challenges. As with the educational elements, science and engineering team members are active partners in each of the public outreach efforts. MESSENGER fully leverages other NASA EPO programs, including the Solar System Exploration EPO Forum and the Solar System Ambassadors. The overarching goal of the MESSENGER EPO program is to convey the excitement of planetary exploration to students and the lay public throughout the nation.

ED41A-04 0845h

ESIP Federation Education and Outreach

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The goal of the Federation of Earth Science Information Partners (ESIP Federation) is "to establish and continuously improve science-based end-to-end processes that increase the quality and value of Earth science products and services throughout their lifecycle for the benefit of the ESIP Federation's stakeholder communities." In order to attain that goal, members of the ESIP Federation work together to develop educational products that utilize Earth science data and information and to coordinate related outreach efforts to increase the use of Earth science information in formal and informal educational contexts. In this presentation we will describe some of our educational products, many of which can be viewed on the ESIP Federation Education Center Web site; and describe some of our outreach efforts, which range from attending teacher professional meetings, and running teacher workshops to make our products more visible and usable, to presenting our products at educational and science meetings to help develop our pool of collaborators.

URL: http://www.esipfed.org/education_center/index.jsp

ED41A-05 0900h

Integration of Research and Education at USGS

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Education and research are always in the public service and therefore are inextricably bound at all levels. When present, effective integration of research and education infuses the acquisition of knowledge with the spirit of inquiry and assures that the findings and methods of research are quickly and effectively communicated in a broader context and to a larger audience. It can be shown that the best supported and sustained research programs within government, academia or the corporate sector have developed a projectable identity that allows for ready identification. This identification is especially important in public settings as it works both within the organization and without clarifying what it is about, the importance of the group's activities, and what they are striving to accomplish. Working from the Survey's mandated role of providing long-term monitoring, research and assessments, the Survey's Strategic Plan reflects the high priority given to meeting partner and customer needs in disseminating reliable and impartial scientific information. The way in which USGS research translates knowledge and makes it available to scientific organizations and to the public is critical to the intrinsic societal value of USGS. Consequently, in a conformable way, both research and education have, as their ultimate goal, providing useful knowledge within a relevant context. USGS has a long history of integrating its education and research endeavors. Criteria and examples for assessing quality educational contributions, commensurate with bureau's unique role as the nation's principal natural sciences, and information agency will be presented.

ED41A-06 0915h INVITED

Astrobiologists Seed The Future: Education and Public Outreach in the NASA Astrobiology Institute

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Understanding the diversity of life in the universe, its relative abundance or rarity, and its origins is the work of astrobiology. The answers to astrobiological questions require the expertise of scientists from different fields as well as different generations to answer. It may take several lifetimes before we understand the potential for life beyond Earth. The multi-generational nature of the work drives the NASA Astrobiology Institute's interest in education and training. NASA has identified strategic goals in education which focus on inspiring and motivating "students to pursue careers in science, technology, engineering, and mathematics," (NASA 2003 Strategic Plan Goal 6) as a way of developing its future workforce; this is perhaps most pressing in a relatively new field of research which cannot be continued without future researchers to pursue and follow through on new discoveries. The NASA Astrobiology Institute (NAI) assures student involvement through both an education and public outreach program and direct training. NAI is a virtual institute of 16 Lead Teams around the country. Each team is an interdisciplinary collaboration in pursuit of one or more astrobiological goals complemented by efforts to strengthen the astrobiology community through training, education, and professional development. The specific education and public outreach (E/PO) and training efforts of each team are determined by the unique opportunities provided by the institution, specialty, and expertise of the team. Inherent in all NAI E/PO and training efforts is the inclusion of NAI researchers and their current work. The principle investigators of NAI Lead Teams have embraced the interdisciplinary

nature of astrobiology; by building and leading their team's work, they become ideal candidates for communicating the broad topics of astrobiology to students of all levels. Each NAI PI identifies unique E/PO and training opportunities and includes their team members in these efforts. The result is an amalgamated program reaching the full spectrum of K-Postdoctoral students receiving information and opportunities in astrobiology. Research is embedded throughout the NAI's E/PO program with the ultimate goal of seeding future researchers and their discoveries of life in the universe.

URL: http://nai.arc.nasa.gov

ED41A-07 0930h

Field/Lab Training Workshops in Planetary Geology and Astrobiology for Secondary School Teachers

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Thematic field-lab-classroom workshops can be successful in training secondary teachers in planetary geology and astrobiology, from the LPI's 4 years experience. A typical workshop includes ∼4 days of field study and ∼3 days of related classroom/lab lectures and exercises. Up to 30 teachers have participated at once, and the staff averages 5 researchers and educators. The 2003 workshop, The Great Desert, focused on geology and life in the Colorado Plateau as analogs for Mars. Specific emphases were on geologic processes exemplified in the Grand Canyon, Sunset Crater and Meteor Crater, and on biotic communities in desert soils and hot springs. The classroom portion, hosted by UNM, included lectures, lab work, and teaching exercises keyed to the field experience and its extensions to Mars. Formal followups: non-directive exit questionnaires; email list-serves for participants; websites with images, presentations, and exercises from the workshop, and links to related materials (e.g., http://www.lpi.usra.edu/education/EPO/yellowstone 2002/index.html); and interviews for six-month retrospective. Graduate and continuing education credit are available. Past workshops, all relevant to Mars, have targeted: geology and extremophiles of Yellowstone NP, geology of the Cascade volcanos; and giant floods and lava flows of central Washington. The greatest benefit of this workshop format is the teachers' intense, deep experience, emphasizing scientific content. They learn from field, classroom, and laboratory perspectives, and work with PhD level researchers who contribute their excitement, demonstrate and teach critical thought processes, and provide authoritative background and answers. The small group size permits personal interactions (among teachers and presenters) that complement each other's understanding and appreciation of the subject. They log ∼65 contact hours with the staff, in small groups or one-on-one. Teachers return to the classroom with personal experiences, with heightened appreciation, excited, and energetic. The teachers are asked to share their knowledge in their districts (in one case, saving the district thousands of dollars). For the presenters, the workshop format allows personal interactions with the teachers, leading to enhanced appreciation of their perspectives and needs. This year, teacher input assisted with an NSF-sponsored National Park education initiative. And in one case, a meaningful research collaboration has come from these workshops. Logistics is the greatest challenge of this workshop format. Hosts and teaching/lab venues need to be arranged early in sites dictated by science content, not convenience. Travel and lodging must be arranged for teachers and presenters at several sites, usually all distant from the organizing institution. Logistics also dictates that each workshop cannot serve more than about 30 teachers. The depth of knowledge imparted and its long-term effects on the teachers and their districts offsets the small number of teachers reached per year. Authors here are the 2003 organizers and presenters. Many others have organized and presented at past workshops - especially Dr. A.J. Irving of U. Wash. We are grateful for past support from NASA Broker/Facilitator, and now from Sandia National Laboratory and NASA OSS/EPO.

URL: http://www.lpi.usra.edu/education/EPO/yellowstone2002/index.html

ED41B MCC: Level 2 Thursday 0830h

Undergraduate Research in Geoscience Posters *(joint with OS, P, C, PA)*

Presiding: **I Doxas,** University of Colorado**; G White,** American Institute of Physics**; K McCall,** University of Nevada, Reno

ED41B-1159 0830h POSTER

A Preliminary Geophysical Study Involving Remote Sensing at the Archaeological Site Trinchera Cave, Colorado

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Resistivity, magnetic, seismic, and geodetic surveys were performed at Trinchera cave, an archaeological site ∼50 km east of Trinidad, Colorado, in order to locate the foundation walls of an ancient jacal structure. This structure, a shelter built during the Apishapa phase (earlier than 750 years before present), was reported - and backfilled - during a 1974 excavation; recent excavations have failed to again find it. The cave is a ∼8 m high overhang, the bottom of which marks the contact between the Dakota formation (yellowish-brown, fine-grained sandstone) and the underlying Purgatoire formation (bedded, organic-rich shale). The foundation was reported to be made of blocks of sandstone surrounded by cave fill/soil that is estimated to be 1.5 m thick in the cave. A total station survey mapped the topography beneath the overhang (the cave, ∼30 by 8 m) and within the adjacent creek. This part of the study should be useful to tie together future archaeological and geophysical work. Our magnetic map of the area is inconclusive due to the presence of metallic pipes left at the site by previous excavations and because of the overhang. Seismic refraction tests yielded varying thicknesses of the cave fill (0.7-2.3 m); however we experienced problems with the equipment in the field and realized that a 1-D model is insufficient to explain the data. A future reflection experiment might produce more useful seismic data. Our most reliable results were obtained by resistivity profiling. They show a more resistive structure in the SW part of the cave, about 1 m from the overhang and at a model depth of 2 m. We interpret this as the 'lost' foundation.

ED41B-1160 0830h POSTER

Preliminary Geophysical Investigations of the Ship Rock Diatreme, Navajo Nation, New Mexico

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Magnetic and gravity data were collected at the Ship Rock minette neck and dikes, part of the Navajo volcanic field in the central Colorado Plateau, to investigate their subsurface structure. The deep root system of Ship Rock, an exhumed Oligocene maar-diatreme complex, has not been resolved. The diatreme is largely composed of minette tuff-breccia with a large wallrock fraction, whereas the dikes are composed of hypabyssal minette. The country rock is the Upper Cretaceous Mancos Shale. Density and magnetic contrasts between the igneous rock and surrounding shale suggest that the buried structure of Ship Rock can be imaged. Preliminary geophysical investigations were carried out in order to test this hypothesis. We collected magnetic and gravitational data along four lines selected to transect the major south and northeast dikes and to partly encircle the diatreme. Modeling differently sized, oriented and shaped intrusions, we created theoretical Free Air anomaly curves to try to match the two clearest anomalies. Modeling necessitates (i) that the major north-south dike dips west and (ii) the presence of a high-density, deep body near the diatreme. The Free Air anomaly curves show that smaller dikes might not be detected from gravity data; however, they are necessary to determine the presence of large, dense bodies. Although not modeled, the magnetics curves show that smaller dikes can easily be detected. Our study results are promising, and we plan a more thorough investigation in the future which will produce a magnetic map to determine if further buried dikes exist in the vicinity, and measure gravity along additional profiles to better constrain the location of the dense body at depth.

ED41B-1161 0830h POSTER

A COARSE Receiver Function Survey of the Southern Arizona Lithosphere

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Project COARSE (COnsortium for Arizona Reconnaissance Seismic Experiment) operates a temporary network of broadband seismic stations in southern Arizona. The goal of the project is to investigate the crustal and deep structure across the transition from the Southern Basin and Range to the southern Colorado Plateau. Southern Arizona is a region of notable undersampling in tomographic and receiver function studies of the lithospheric-scale structure of the western United States. In addition, these data will provide unique first-order constraints on crust and upper mantle structure beneath the region in preparation for more focused efforts as EarthScope and USarray pass through the region. We are currently operating eight broadband seismographs recording continuously at 25 samples/sec in an approximate SW-NE swath across southeastern Arizona. When combined with the two permanent broadband stations in the state (TUC and WUAZ), the array will provide the requisite data to delineate the first-order structure of the lithosphere and sublithospheric mantle, as well as improve imaging capabilities for deep Earth structure in adjacent regions. One key question we are addressing is the nature of extension in the Southern Basin and Range, and how this extension is accommodated at greater depths. The current study therefore focuses on data collected at stations located at astronomical observatories on mountain summits associated with metamorphic core complexes. From SW to NE the seismic stations are located at 1) Kitt Peak (KITT), 2) Mt. Lemmon (LEMN) and the nearby GSN station TUC, and 3) Mt. Graham (SQRL). Analyses of receiver functions from teleseismic events at each station indicate a gradual SW to NE increase in crustal thickness from 29 km at KITT, to 30 km at LEMN, and 32 km at SQRL. This crustal thickness increase correlates with the increase in summit elevations from 2100m at KITT, to 2800m at LEMN, and 3050m at SQRL. Among these stations, only the TUC station has a clear Moho multiple from which we can estimate the bulk crustal Vp/Vs value of 1.74. The receiver functions from stations KITT and SQRL have prominent arrivals from the top of a crustal low-velocity zone at depths of 17 km and 14 km, respectively. Inter-crustal arrivals in this region possibly mark shallowly dipping shear zones that have played a role in accommodating extension during core complex formation. We hope to characterize how crustal thickness, anisotropy, extension, and shear within the crust are related in southern Arizona.

ED41B-1162 0830h POSTER

Modeling of Geodetic Crustal Motion Velocities in Southern California: Undergraduate Research

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