two-week summer professional development institutes that are part of AMSTI. A key component of AMSTI is a mentoring program conducted by math and science specialists - classroom educators loaned to the AMSTI hub sites by the school systems each hub site serves. The AMSTI mentoring program mirrors the GIA mentoring model begun in 1999 that originally funded regional GLOBE master teachers to provide technical assistance, feedback, and coaching for other GLOBE teachers. In schools where GIA mentor teachers were working, nearly a 100% increase in GLOBE student data reporting was noted. The GIA mentors now work within the hub site framework to ensure implementation of GLOBE as an integrated part of AMSTI. With the continued support of the State of Alabama, GIA will establish a network of mentors who work with the AMSTI hub site specialists in providing support for all AMSTI teachers. GIA is administered by the National Space Science and Technology Center, a partnership between NASA and the State of Alabama's seven research universities. Operational funding for GIA has been provided by the University of Alabama in Huntsville's Earth System Science Center, the NASA Marshall Space Flight Center, the Alabama Space Grant Consortium, The Alabama Department of Economic and Community Affairs, the Alabama State Department of Education, and Legacy. GIA has been able to build on these strong funding partnerships by leveraging the infrastructure provided by the NASA-led GLOBE Program (www.globe.gov).

ED22A MCC: Level 2 Tuesday 1330h

Earth and Space Science Materials for Students With Special Needs Posters

(joint with P, C)

Presiding: **C Runyon,** College of Charleston**; K Watt,** Arizona State University

ED22A-1225 1330h POSTER

AudioGuides at a National Research Laboratory Supporting Visitors With Special Needs: Initial Lessons Learned

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The National Center for Atmospheric Research (NCAR) Mesa Laboratory offers the public an opportunity to visit an internationally recognized research laboratory housed in an architectural landmark located in a dramatic geological setting. The Mesa Lab's exhibits are viewed by over 80,000 people each year. Exhibits provide information about NCAR's scientific mission, current research efforts, technology, and the societal benefits of weather and climate research. Nearly 13,000 of NCAR's visitors are served with staff-led guided tours, including 3,000 students in school groups. Frequently, these tours are tailored to address the interests, ages, nationality, and special needs of the visitors. In June 2003, an audioguide was unveiled in English and Spanish versions for both adults and children. Based on preliminary summer usage figures, the audioguides may reach an additional 7,000 visitors in the coming year, many of whom may have special needs. With this in mind, the University Corporation of Atmospheric Research (UCAR) Office of Education and Outreach (EO) contracted local experts as advisors on the needs of people with low-vision, hearing loss, and Spanish language accessibility as the audioguide was developed. The script was written with the help of scientists and an internationally recognized audioguide production firm. Since the installation of the audioguide in July, visitors of all ages appear to be enthusiastic about this service and better focused on their learning experiences while viewing the exhibits. Interviews are helping EO to learn more about how the audioguide is helpful or may be revised to more effectively serve visitors in general as well as visitors with special needs. The audioguide was made possible by grants from the National Science Foundation Geoscience Education Program and the Friends of UCAR Fund.

ED22A-1226 1330h POSTER

Space Science IS Accessible to Students with Exceptional Needs: Results from Exceptional Needs Workshops

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The majority of students with disabilities in the US are required to achieve the same academic levels as their non-impaired peers. Unfortunately, there are few specialized materials to help these exceptional students. To assist students in meeting their goals, SERCH, a NASA Office of Space Science Broker/Facilitator, has been working with NASA education product developers and educators from informal and formal settings to identify what kinds of materials they need and what mediums will work best. As a result of both direct classrooms observations and hands-on workshops we have begun generating adaptive lessons plans that meet the national standards for Science, Technology, Engineering and Mathematics. During the workshops, participants simulate various disabilities (e.g., hearing, vision, orthopedic impairments, learning difficulties) while working through Space Science activities and discuss necessary adaptations/modifications in real-time. For example, we modified the Solar System Distance activity first designed by ASU to include the use of larger beads or pom-poms instead of the suggested small plastic beads. This simple adaptation permits students with orthopedic impairments to more readily take part in the lesson and to actively "observe" the distance between the planets. Examples of this activity and more will be illustrated. In addition to making modifications and suggestions for adaptations, workshop participants shared many simple recommendations that can help ALL learners participate more readily in classroom activities and discussions. Among these are: (1) Use simple, sans-serif fonts and high contrast presentation media (e.g., white text on black is most effective); (2) Repetition and use of multiple presentation modes is very helpful. (3) Actively involve the learner, and (4) Keep things simple to begin with, then work toward the more complex - think of the audience, the ultimate user.

URL: http://serch.cofc.edu/serch/special/workshops.htm

ED22A-1227 1330h POSTER

Tactile Approaches for Teaching Blind and Visually-Impaired Students in the Geosciences

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Hearing and touch are perhaps the two most important senses for teaching visually-impaired students in any context. Classroom lectures obviously emphasize the auditory aspects of learning, while touch is often relegated to either Braille texts or raised–line drawings for illustrative figures. From the student's perspective, some lecture topics, especially in the sciences, can be a challenge to grasp without additional stimuli. Geosciences have a distinct visual component that can be lost when teaching blind or visually-impaired students, particularly in the study of geomorphology and landform change. As an example, the matters raised concerning volcanic hazards can be difficult to envision without due attention to the limitations of visually-impaired students. Here, we suggest an example of a tactile approach for introducing the study of volcanoes and the hazards associated with them. Large, visually-stimulating images of a volcanic, populated region in southern Peru are supplied for those students who have poor but extant visual acuity, while precise, clay-based models of the region complement the images for those students, as well as for students who have no visual ability whatsoever. We use a model of the terrestrial volcano El Misti and the nearby city of Arequipa, Peru, to directly reflect the volcanic morphology and hazardous aspects of the terrain. The use of computer-generated digital elevation models from remote sensing imaging systems allows accurate replication of the regional topography. Instructors are able to modify these clay models to illustrate spatial and temporal changes in the region, allowing students to better grasp potential geological and geographical transformations over time. The models spawn engaging class discussions and help with designing hazard mitigation protocols.

ED22A-1228 1330h POSTER

Making Astronomy and Space Science Accessible to the Blind and Visually Impaired

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One of the biggest obstacles blind and visually impaired people face in science is the ubiquity of important graphical information, which is generally not made available in alternate formats accessible to them. Funded by NASA's Initiative to Develop Education through Astronomy and Space Science (IDEAS), we have recently formed a team of scientists and educators from universities, the SOFIA NASA mission, a science museum, an observatory, and schools for the blind. Our goal is to develop and test Braille/tactile space science activities that actively engage students from elementary grades through introductory college-level in space science. We will discuss effective strategies and low-cost technologies that can be used to make graphical information accessible. We will also demonstrate examples, such a thermal expansion graphics created from telescope images of the Moon and other celestial objects, a tactile planisphere, three-dimensional models of near-Earth asteroids and tactile diagrams of their orbits, and an infrared detector activity.

ED22A-1229 1330h POSTER

Special Education Students Improve Academic Performance through Problem-Based Learning and Technology

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Boulder High School Special Education students work in teams on donated wireless computers to solve problems created by global climate change. Their text is Richard Somerville's The Forgiving Air. They utilize Wheeling Jesuit University's remote sensing web site and private computer bulletin board. Their central source for problem-based learning (PBL) is www.cotf.edu, NASA's Classroom of the Future Global Change web site. As a result, students not only improve their abilities to write, read, do math and research, speak, and work as team members, they also improve self-esteem, resilience, and willingness to take more challenging classes. Two special education students passed AP exams, Calculus and U.S. Government, last spring and Jay Matthews of Newsweek rates Boulder High as 201st of the nation's top 1000 high schools.

URL: http://www.bvsd.co.us/boulderhs

ED22A-1230 1330h POSTER

NASA's Astro-Venture Engages Exceptional Students in Earth System Science Using Inquiry

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Astro-Venture is an educational, interactive, multimedia Web environment highlighting NASA careers and astrobiology research in the areas of Astronomy, Geology, Biology and Atmospheric Sciences. Students in grades 5-8 role-play NASA careers, as they search for and design a planet with the necessary characteristics for human habitation. Astro-Venture uses online multimedia activities and off-line inquiry explorations to engage students in guided inquiry aligned with the 5 E inquiry model. This model has proven to be effective with exceptional students. Students are presented with the intellectual confrontation of how to design a planet and star system that would be able to meet their biological survival needs. This provides a purpose for the online and off-line explorations used throughout the site. Students first explore "what" conditions are necessary to support human habitability by engaging

in multimedia training modules, which allow them to change astronomical, atmospheric, geological and biological aspects of the Earth and our star system and to view the effects of these changes on Earth. By focusing on Earth, students draw on their prior knowledge, which helps them to connect their new knowledge to their existing schema. Cause and effect relationships of Earth provide a concrete model from which students can observe patterns and generalize abstract results to an imagined planet. From these observations, students draw conclusions about what aspects allowed Earth to remain habitable. Once students have generalized needed conditions of "what" we need for a habitable planet, they conduct further research in offline, standards-based classroom activities that also follow the inquiry model and help students to understand "why" we need these conditions. These lessons focus on standards-based concepts such as states of matter and the structure and movement of the Earth's interior. These lessons follow the inquiry structure commonly referred to as the five E's as follows: Engage: Draws on students' prior knowledge, builds on previous lesson concepts, introduces the purpose of the lesson and the scientific question which is the problem or intellectual confrontation they will explore. Explore: Students form hypotheses and conduct an exploration that will help them to collect data and evidence to answer the scientific question. Explain: Students reflect on the explore activity by recording their results and conclusions. They participate in guided discussions or activities that help to guide their understanding of the concepts. Extend/Apply: Students demonstrate their understanding of the concept and/or apply it to another situation. Evaluate: Students are evaluated on their understanding of the concept often using rubrics. After students have mastered the "whats" and "whys," they engage in multimedia mission modules that simulate "how" scientists might search for a planet and star system that meets these requirements using the inquiry process. Students are first asked to hypothesize the likelihood of finding a star system that meets these requirements. They then simulate the methods scientists might use to collect data on various stars and planets to deduce whether the star system meets the requirements for habitability or not. After collecting and analyzing this data, students are asked to draw conclusions in comparing their results to their initial hypothesis. Students apply all that they've learned to design a planet that meets the requirements for human habitability in all areas. Through this process, they learn that Earth works as a system in meeting our needs.

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

ED22B MCC: Level 2 Tuesday 1330h

Enhancing K-12 Earth Science Education Through Partnership II Posters *(joint with OS, PA)*

Presiding: **M J Smith,** American Geological Institute**; A E Benbow,** American Geological Institute**; R Brame,** Wright State University

ED22B-1231 1330h POSTER

Oceanographers in the Fifth Grade

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Graduate students and recent doctorates at the University of South Florida College of Marine Science and K-12 teachers in Pinellas County, Florida come together in a new GK-12 OCEANS initiative to bring science to life in the classroom. In our particular partnership, we are working with four fifth grade classes and a combined fourth and fifth grade class at Frontier Elementary School in Clearwater, Florida. Our students have made weekly weather measurements, making their own instrumentation, building a data set, evaluating time series, and coming to understand the changing nature of climate and weather over the course of the school year. Additionally, they have conducted a number of shorter-term projects, engaging in hands-on, minds-on scientific research into many different aspects of the ocean environment, individually and in groups.

ED22B-1232 1330h POSTER

Cataclysms and Catastrophes: A Case Study of Improving K-12 Science Education Through a University Partnership

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The K-12 science teacher is always seeking ways of improving and updating their curriculum by integrating the latest research into their most effective classroom activities. However, the daily demands of delivering instruction to large numbers of students coupled with the rapid advances in some fields of science can often overwhelm this effort. The NSF-sponsored Cataclysms and Catastrophes curriculum, developed by scientists from the The University of Texas at Austin Institute for Geophysics (UTIG) and Bureau of Economic Geology (BEG), middle and high school teachers, and UT graduate students (NSF GK-12 fellows) working together through the GK-12 program, is a textbook example of how universities can facilitate this quest, benefiting education at both K-12 and university levels. In 1992, "The Great K-T Extinction Debate" was developed as an activity in the Planet Earth class at the Liberal Arts and Science Academy of Austin as an interdisciplinary approach to science. Taking advantage of the media attention generated by the impact scenario for the K-T extinction, the activity consists of students participating in a simulated senate hearing on the potential causes of the K-T extinction and their implications for society today. This activity not only exposes students to the wide range of science involved in understanding mass extinctions, but also to the social, political and economic implications when this science is brought into the public arena and the corresponding use of data in decision making and disaster preparedness. While "The Great K-T Extinction Debate" was always a popular and effective activity with students, it was in desperate need of updating to keep pace with the evolving scientific debate over the cause of the K-T extinction and the growing body of impact evidence discovered over the past decade. By adding two inquiry-based learning activities that use real geophysical data collected by scientists studying the buried Chicxulub feature as a culmination to the classroom debate, we developed a curriculum module on Asteroids Impacts for the Cataclysms and Catastrophes project. This approach proved to be the ideal way to update the existing Planet Earth curriculum and to provide students with opportunities to use cutting-edge, hands-on geophysical and computer techniques to understand the most up-to-date science concerning the K-T extinction event.

URL: http://www.ig.utexas.edu/outreach/gk-12/cat-intro.htm

ED22B-1233 1330h POSTER

Devious Lies: Adventures in Freelance Science Outreach

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Observations are given from two freelance science outreach projects undertaken by the author: Tutoring at-risk secondary students and teaching astronomy to 5th-7th graders in a camp retreat environment. Two recurring thematic challenges in these experiences are considered: First the 'Misperception Problem', the institutionalized chasm between the process of doing science and K-12 science education (wherein science is often portrayed as something distant and inaccessible, while ironically children are necessarily excellent scientists). And second the 'Engagement Problem', engaging a student's attention and energy by matching teaching material and–more importantly–teaching techniques to the student's state of development. The objective of this work is twofold: To learn how to address these two challenges and to empower the students in a manner independent of the scientific content of any particular subject. An underlying hypothesis is that confidence to problem solve (a desirable life-skill) can be made more accessible through a combination of problem solving by the student and seeing how others have solved seemingly impossible problems. This hypothesis (or agenda) compels an emphasis on critical thinking and raises the dilemma of reconciling non-directed teaching with very pointed conclusions about the verity of pseudo-science and ideas prevalent about science in popular culture. An interesting pedagogical found-object in this regard is the useful 'devious lie' which can encourage a student to question the assumption that the teacher (and by extension any professed expert) has the right answers.

ED22B-1234 1330h POSTER

The Sombrero Marsh Education Program: Diverse partnerships building strong Earth System science programs

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Broad-based science education partnerships can create exemplary education programs because each partner brings their particular expertise to the table. The Sombrero Marsh Education Program provides an example of such a program where a school district, a local government agency, a non-profit organization, and an institute of higher learning developed a field-based watershed curriculum for upper elementary students at Sombrero Marsh, a recently restored rare saline marsh located in Boulder Valley. The partners' expertise, ranging from wetland ecology and restoration to pedagogy, yielded a curriculum that includes many of the characteristics that are highlighted within the National Science Education Standards, such as inquiry-based, hands-on activities where students serve as scientists and collect real data that will be used to monitor the progress of marsh restoration. Once established, these diverse partnerships can attract further funding and expand their programs from the local to the national level, thus providing a successful model with a widespread impact. The Sombrero Marsh Program will soon be making this transition because the Cooperative Institute for Research in Environmental Science (CIRES), along with 4 other departments of the University of Colorado, was awarded a NSF GK-12 Grant to expand the marsh program to the secondary science level. Using the initial Sombrero Marsh Program as a guide, eight GK-12 Fellows from the departments of Chemistry and Biochemistry, Geological Sciences, Environmental and Evolutionary Biology, and Astrophysical and Planetary Sciences will develop a secondary science level program at Sombrero Marsh, which initially will be delivered to schools with a significant population of students from under-represented groups. Several dimensions of the marsh program, such as community-based research and ecological sterwardship, can serve as a national model for similar science education programs that aim to promote Earth System science.

ED22B-1235 1330h POSTER

The PISCES Project: How Teacher-Scientist Partners can Enhance Elementary Science Instruction

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The PISCES Project (Partnerships Involving the Scientific Community in Elementary Schools www.sdsa.org/pisces) is an innovative program that brings high quality standards-based elementary science curriculum and hands-on laboratory materials into San Diego County's classrooms. The project is funded by the NSF Graduate Teaching Fellows in K-12 Education (GK-12) program. The project was designed and is administered through cooperation among faculty at San Diego State University and the Science Department of the San Diego County Office of Education. Undergraduate and graduate students enrolled in science programs in San Diego area universities including San Diego State University, California State University San Marcos, and University of California San Diego partner with elementary school teachers. Through this