11th GLOBE Annual Conference

San Antonio, Texas

Inspiring the Next Generation of Earth System Scientists

Program Addendum

29 July - 3 August 2007

GLOBE representatives came from across the world — 44 countries and 35 U.S. states and Washington D.C. — to participate in the 11th GLOBE Annual Conference in San Antonio, Texas.

Teachers, students, Country Coordinators, Partners and government representatives from 44 countries, along with staff members of the GLOBE Program Office in Boulder, Colorado, and Conference organizers from Texas, celebrated the opening of the 11th Annual GLOBE Conference with a reception and dinner in the Ballroom of the historic Menger Hotel. Members of the Latin American and Caribbean Consortium (CLAC) and the GLOBE International Advisory Committee (GIAC) had arrived days earlier to hold their meetings. GLOBE Director Dr. Ed Geary, together with the Conference Co-Chairs Dr. Teresa Kennedy, GLOBE Deputy Director, Dr. Michael Odell and Ms. Marsha Willis, sporting traditional Texan dress, welcomed the gathering and gave a short introduction to the nuances of English as spoken in Texas…Yee-Haw! The week-long event included Prestigeous Keynote Speakers, Presentations, Round Table Discussions, Field Day Activities and ESSP Workshops.

Attendees from the 11th Annual GLOBE Conference represented the following countries:

Africa (6 countries):
Cameroon
Ethiopia
Mali
Nigeria
Rwanda
South Africa

Asia-Pacific (4 countries):
India
Japan
New Zealand
Thailand

Europe-Eurasia (13 countries):
Croatia
Czech Republic
Estonia
France
Germany
Greenland
Iceland
Lithuania
Poland
Russia
Spain
Sweden
United Kingdom

Near East (2):
Bahrain
Lebanon

Latin America-Caribbean (17 countries):
Argentina
Bahamas
Chile
Colombia
Costa Rica
Dominican Republic
Ecuador
Guatemala
Honduras
Mexico
Panama
Paraguay
Peru
Suriname
Trinidad and Tobago
Uruguay
Puerto Rico (bridging this region with the North American Region)

North America (2):
Canada
United States:

Alaska	Indiana	New Jersey
Alabama	Kansas	New Mexico
Arkansas	Kentucky	New York
Arizona	Louisiana	Oregon
California	Massachusetts	Pennsylvania
Colorado	Maryland	Texas
Connecticut	Michigan	Utah
Florida	Missouri	Virginia
Georgia	Mississippi	Washington
Iowa	Montana	Wisconsin
Idaho	North Carolina	West Virginia
Illinois	New Hampshire	*Washington D.C. and Puerto Rico

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Additional Conference Strand Presentations

STRAND 1C:

Insolation as an Instructional Tool in Atmospheric Sciences
Mr. Allan Wade Geery (Arkansas) & Dr. David R. Brooks (Pennsylvania) (U.S.A.)

Insolation, or the measurement of solar energy at the earth's surface, is the engine that drives our environment. Any study of the Earth as a system eventually recognizes the concept of our energy balance as the controlling influence for all other atmospheric phenomenon. The science teacher at Norfork Elementary School has attempted to incorporate the measurement of insolation using a pyranometer in the school's science curriculum at a variety of levels from ordinary instruction to open ended inquiry. The results of this initiative are presented and the concept of examining other successful student-teacher-scientist collaborations are discussed. Finally, the benefits of GLOBE's adoption of an insolation protocol are presented.

How to Keep Schools in GLOBE
Mrs. Diana Garasic (Croatia)

There are 100 GLOBE schools in Croatia; about 70% of those are active and are currently reporting data. However, the number of active schools varies over one school year. This year marked the 10th Croatian Annual GLOBE Conference. The Annual GLOBE conference is part of the Program of National Students' Competitions, and therefore financed by the Ministry of Education. The number of participants is limited to 200 (150 students and 50 teachers from 50 schools). Based on 12 years of experience in GLOBE implementation, our intention is to achieve persistence of the schools and their GLOBE teachers by stronger teachers' support and stronger commitment of the entire school. Strategies include a required written school application to participate in GLOBE, signed by the principal after the teacher/school representative has finished initial training. We recommend schools to have more than one GLOBE teacher to share tasks and responsibilities and in order to strengthen support within the school, we organized four workshops for school principals. We also provide examples that identify how GLOBE content fits with certain parts of the national curriculum and have posted these resources on the Croatian GLOBE Web site, in a folder named "GLOBE within different subjects". In addition, the Five Regional GLOBE centers in Croatia are described.

STRAND 2C

GLOBE Freshwater Ice Phenology Protocols
Ms. Kim Morris, Dr. Martin Jeffries & Dr. Elena Sparrow (Alaska, U.S.A.)

The freeze-up and break-up dates of rivers and lakes have been documented throughout the world for centuries. The duration of the ice cover of a freshwater body integrates a number of environmental factors during the ice growth and decay season, particularly the air temperature and snowfall. The inter-annual variability of the freshwater ice cover duration (and ice thickness) is directly affected by these parameters. Furthermore, freshwater ice cover duration can be used as an indicator of climate change. Magnuson, J.J. et.al. (2000. Historical trends in lake and river ice cover in the northern hemisphere. Science, vol.289 (5485): 1743-1746) analyzed data from the Northern Hemisphere and found that freeze-up occurs 8.7 days later and break-up occurs 9.8 days earlier than in 1845. This represents a decrease of about 19 days in the ice cover duration which corresponds to a change in mean annual air temperature of about 1.2°C per 100 years.

Monitoring the freeze-up and break-up of local lakes and rivers is relatively straightforward and of significant scientific value in this time of changing environmental conditions. Through the GLOBE Seasons and Biomes Earth System Science Project (ESSP), we have developed a set of freshwater ice phenology protocols that can be performed by upper elementary to high school level students. Using a combination of prescribed digital photographs and a checklist of observations of ice and general environmental conditions, the freeze-up (initial ice formation to 100% ice cover) and break-up (100% bare ice cover to 0% ice cover) are characterized. These observations are made daily. Through these protocols, the students learn science process and inquiry skills by making observations, integrate complementary data sets, and analyze data with various scientific tools and procedures.

These protocols can be used in conjunction with other GLOBE protocols to build an educational program that provides a full appreciation of the relationships between the ice conditions and the forcing environmental conditions (weather based), and an integrated understanding of the fall-winter and winter-spring seasonal transitions (vegetation and fauna based). For example in Alaska, the data acquired using the GLOBE Freshwater Ice Phenology Protocol will complement the snow and ice thickness data acquired by 4-12 grade students and teachers participating in the Alaska Lake Ice and Snow Observatory Network (ALISON, http://www.gi.alaska.edu/alison/). Similarly, freshwater ice phenology data will complement vegetation phenology and weather data acquired by GLOBE students in climate change studies in Alaska as well as in other regions of the United States and the world.

STRAND 3C

Young Soil Doctor: Student-Teacher-Scientist-Community Collaboration Research Project on Sustainable Land Development Activities in Thailand
Ms. Samornsri Kanphai (Thailand)

The use of unsuitable land for agriculture has been problematic to land degradation in Thailand. Not only soil erosion and soil organic matter deficiency, but also saline soil, acid soil, and sandy soil cover as very large areas that impact the farmer's living; about 30 million people which represent most of the people in Thailand. Most of the forested watershed area of the Kingdom was destroyed through the notoriously shifting cultivation practices cutting down forest of the hill tribes. Such long deteriorating conditions immensely reduce the water retention capacity of the watershed. The loss of the forest-cover areas will increase the rate of soil erosion and further worsen the fertility status of the soils.

His Majesty the King of Thailand has long been exposed to those soil problems through constantly visiting every region of the country. His Majesty's concerned and initiative dedicated to solving the problems and sustaining of natural resources usage of the Kingdom lead to many "Royal Development Projects Regarding Environment." Being trained as effective "Young Environmental Scientists", GLOBE students can successfully work as "Young Soil Doctors" in collaboration with farmers, "Volunteer Soil Doctors", soil scientists from the universities, from Land Development Department, and from Royal Development Projects in their local communities. GLOBE students can share their GLOBE experiences in using rational inquiry and standardized measurements of different soil protocols with community expertise and local wisdom to identify soil problems, explain and predict soil phenomena, and search for the answers of those soil problems on agriculture, natural resources, and environment focuses for the benefit of their communities.

The Institute for the Promotion of Teaching Science and Technology (IPST) as the Thailand GLOBE Country Coordinating Agency, in cooperation with the Land Development Department, has created the "Young Soil Doctor Project" based on the "Student-Teacher-Scientist-Community Collaboration Research" approach since the year

2005 and scale up to be "The Special Project in the occasion of The Sixtieth Anniversary Celebrations of His Majesty's Accession to the Throne" in the year 2006. At present, 120 8th -12th grade students, 60 teachers from 60 GLOBE schools all over Thailand are involved in this project. The expertise and mentoring functions of concerned agencies of all parts of Thailand are pooled. The focus is on the major soil problems in each part of Thailand such as peat soil and acid soil in the southern part, saline soil in the northeastern and eastern part, soil erosion in the dry and sandy soil due to cultivation, compact clay, infertile soil and severe drought in the central part, the development and conservation of watershed areas for protection against flooding in the northern part, the cultivation of vetiver grass which aims to control soil erosion and maintenance of soil moisture in every part of Thailand.

STRAND 3D

Environmental Geocaching with GLOBE
Mr. Todd Ensign (West Virginia, U.S.A.)

Environmental Geocaching combines the sport of Geocaching with the protocol-based GLOBE Program to provide local scientists with research data for remote or hard to monitor sites. In West Virginia, an effort to obtain stream temperature data as an indicator of habitability for local fish populations used a series of environmental geocaches with the data published on the GLOBE Web site. Students, teachers and parents are involved in this high-tech scavenger hunt to better understand our environment. We will discuss other ideas for implementing this concept and you will receive an information packet covering how to replicate thisactivity with your GLOBE partnership.

POSTER SESSION

Regional Partnerships for GLOBE Activities in Japanese Schools
Dr. Tomoyasu Yoshitomi (Japan)

Many teachers are required to create their own GLOBE activities in their environments. In order to support the diversity of activities, the regional partnership for GLOBE activities is important. The investigation of the sixth period MEXT (Japanese Ministry of Education, Culture, Sport, Science and Technology) selected 20 schools and showed that 80% of schools received help from non-GLOBE teachers in their schools. This included data input and presentation assistance from English teachers, observation equipment maintenance and field observation support from science teachers, as well as other assistance. There was interaction between 75% of schools and outside researchers and specialists from various institutions such as national institutes, universities, and science museums. Their involvement included research planning, field investigation instruction, lectures at schools, and other related activities. Only 15% of schools had contact with foreign GLOBE-related institutions and individuals. This mainly took the form of participation in the GLOBE Annual Conference, discussion in the research congress in Japan, and communication by e-mail. GLOBE Japan partnerships are spreading outside of schools throughout the domestic regional network. However, chances for international interaction have been very few. GLOBE Japan needs to create more communication and presentation opportunities and increase regional and international collaboration and exchange.

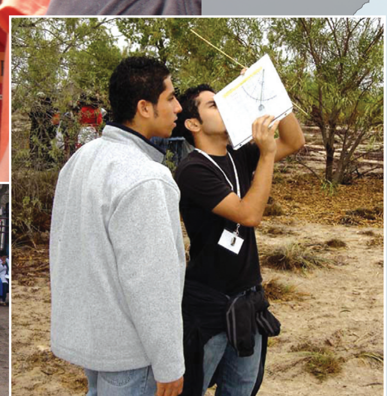
The GLOBE Program

Global Learning and Observations to Benefit the Environment

The GLOBE Program is a hands-on, school and community-based, science and education program that unites students, teachers, and scientists in the study and research about the dynamics of the Earth's environment. GLOBE is implemented through a worldwide network of more than 18,000 primary and secondary schools in over 100 countries involving more than a million students.

GLOBE students:

- Collect environmental data and report their observations to the GLOBE database;
- Use GLOBE Web-based tools to create maps and graphs of data;
- Analyze data and conduct research with scientists and other students;
- Publish their research on the GLOBE Web site; and
- Present their research at GLOBE Learning Expeditions, sharing their findings with their peers around the world.



The GLOBE Teacher's Guide contains more than 50 scientific protocols and more than 60 learning activities covering atmosphere, hydrology, soil, land cover and phenology.

GLOBE provides students and their teachers access to top scientists from around the world and exposes them to programs that are on the cutting edge of Earth systems science research.

Visit our Website:
www.globe.gov

The Goldman Sachs Foundation Prizes for Excellence in International Education
Asia Society

National Aeronautics & Space Administration

National Science Foundation

U.S. Department of State

Providing global connections for the next generation of scientists.

Keynote Speaker
Michael L. Coats
(Captain, USN, RET.)
Director, Johnson Space Center
Houston, Texas

"The Ultimate Fieldtrip: Exploring Earth, Moon and Mars."

It's a pleasure to speak to you today on behalf of NASA. NASA is proud to be a strong supporter and sponsor of your activities, especially GLOBE's new Earth System Science Projects which are the highlight of this conference.

Christa McAuliffe, our first teacher in space who was among those tragically lost aboard the space shuttle Challenger in 1986, looked forward to the mission and to taking a nation of students, as she said, on an "ultimate fieldtrip." One week from today, her backup, Barbara Morgan, will continue that educational mission when the space shuttle Endeavour launches. Today I would like to take you on a similar fieldtrip of sorts by discussing NASA's progress in returning human beings to the moon and the plans and missions that NASA has for the future exploration of Mars. And of principal importance to you, I'll discuss our Earth Science Program and its mission to planet Earth.

The 2005 NASA Authorization Act approved by Congress, committed our nation to a new journey of exploration of the solar system. The Act calls for NASA to develop a sustained human presence on the moon, including a robust precursor program to promote exploration, science, commerce and U.S. preeminence in space. Establishing a human outpost on the moon will also be a stepping-stone for future exploration of Mars and other destinations.

But to make these goals a reality will require a strong base of students educated in Science, Technology, Engineering and Math, or STEM, disciplines which enhance the workforce. Our universities are among the best in the world and offer the best graduate programs in the life and physical sciences. But there is a quiet crisis in U.S. science and technology that we must address. Fewer and fewer students are pursuing studies in STEM disciplines.

- U.S. enrollment in science and engineering has dropped by 12 percent in the last five years.
- In 1975, the United States ranked 3rd in the world in the percentage of its students who were receiving degrees in science and engineering. Today we are 17th in the world.

Students who choose to study only the minimum requirements for high school graduation in areas of STEM reduce their options for careers as much as 60 percent. STEM courses are the basis for a multitude of degrees and job opportunities. We need to continue encouraging our youth to take advantage of the free education system and imbue it with science, technology, engineering and math opportunities which will make them successful. I whole heartedly commend your work in stimulating student interest while also enhancing environmental awareness and achieving a more complete scientific understanding of the Earth system. The work you do in contributing to the advancement of science and technology is critical to sustaining our nation's economy, maintaining our national security and advancing our space program. Through your efforts, K-12 students around the world contribute research quality data to the study of the environment.

NASA shares your mission of promoting the teaching and learning of science, enhancing environmental literacy, promoting scientific discovery and contributing to scientific understanding of the Earth as a system. And we are pleased to play a role in helping accomplish your mission. GLOBE education activities include NASA-sponsored Earth System Science Projects which focus on the seasons and biomes, the carbon cycle, watershed dynamics and extreme environments. Students collect critically needed science measurements to validate NASA satellite data used in research on regional climate change, prevention and management of diseases, and understanding of the water and carbon cycles. Students learn how interactions within the Earth system affect the local environment and how it in turn affects regional and global environments.

These activities support the NASA Education mission by involving students in authentic science, improving student achievement in science and math, contributing to understanding the Earth as a system and preparing students for technical careers. GLOBE students use rigorous data collection protocols, coupled with NASA remote sensing data and upcoming innovative tools such as MathTrax, to research and analyze the elements of and interactions between Earth systems. The GLOBE program is one of NASA's strategic education partnerships to promote STEM literacy and awareness of NASA's mission.

The 2005 NASA Authorization Act calls for us to return humans to the moon and, eventually, to send explorers to Mars. NASA has been given very specific objectives to:

- Fly the space shuttle as safely as possible until its retirement . . . not later than 2010
- Complete the International Space Station in a manner consistent with our International Partner commitments and the needs of human exploration
- Bring a new Orion crew exploration vehicle into service as soon as possible after shuttle retirement
- Develop a balanced overall program of science, exploration and aeronautics at NASA . . . consistent with the redirection of the human spaceflight program to focus on exploration
- Encourage the pursuit of appropriate partnerships with the emerging commercial space sector
- And establish a lunar return program having the maximum possible utility for later missions to Mars and other destinations . . . we will extend human missions to the moon by 2020 to establish a lunar base

So how are we doing? We continue to fly the shuttle safely . . . we will fly another mission to the International Space Station next week. Endeavour will fly for the first time in almost 5 years. We have a solid plan for completing the International Space Station . . . we have completed a major milestone with the installation of new truss sections and solar arrays that will provide more power . . . specifically power for two laboratories from the Japan Aerospace Exploration Agency and the European Space Agency that will be delivered to the station in upcoming years . . . tripling the station's laboratories. And development of Orion is well under way with Lockheed Martin as the prime contractor. Orion is one of a new generation of spacecraft being designed and developed to enable us to fly crews to and from the International Space Station after the shuttle is retired and to eventually carry human beings on future journeys back to the moon and to Mars. Orion will be carried into space by the Ares I crew launch vehicle. The combination will be 10 times safer than the space shuttle, primarily due to its in-line design and abort system. Should a malfunction occur, the spacecraft and crew can separate from the upper stage of the launch vehicle and make a safe landing on land or water. NASA plans to fly Orion no later than 2015 but its current schedules support a first crewed flight in 2013 to the International Space Station.

We plan to return humans to the moon no later than 2020. Lunar exploration requires the development of a heavy lift vehicle. NASA's Ares V cargo launch vehicle will be used in this capacity. Right now I would like to show you a short video presentation of how our journey begins. NASA cannot possibly carry out these endeavors alone . . . we all have a role to play in this great enterprise. Other nations and other federal agencies have roles to play . . . and industry, academia and researchers play an obvious and significant role and are major partners for NASA.

NASA has challenged private industry to provide commercial crew and cargo delivery to and from the International Space Station. If private companies successfully demonstrate their ability to provide the capabilities and they are proven to be reliable and cost effective, we intend to buy those services. NASA has signed Space Act Agreements with two companies (SpaceX and Rocketplane Kistler) for Commercial Orbital Transportation

Services demonstrations. Five more private companies have signed agreements with NASA to pursue their own launch capabilities entirely with their own money. And we're already collaborating with other nations on a series of satellite missions to map the resources of the moon, which one day will be mined to help establish a permanent lunar outpost. Over half of NASA's armada of more than 50 robotic science missions involves some form of international participation and almost two-thirds of our science missions on the drawing board today have an international component.

Extending a human presence across the solar system and beyond will require a sustained and affordable human and robotic program using innovative technologies, knowledge and infrastructures. First, I'd like to talk about the moon. Returning to the moon provides opportunities to develop the technologies and operational capabilities needed for long-term survival on other worlds. It builds confidence so we can venture farther from Earth and stay for longer periods. Our plans include robotic exploration of planetary bodies in the solar system, advanced telescope searches for Earth-like planets around other stars, and studying the origin, structure, evolution and destiny of the universe in addition to extending human presence to the moon, Mars and beyond. Journeys to the moon and establishing an outpost there will be key first steps as we move beyond low Earth orbit in our exploration of the universe. Studying the moon and its history will provide critical data on the formation history of the Earth-moon system, as well as opening a window onto some of the earliest history of the inner solar system. A number of upcoming robotic missions will provide data on the moon.

The Lunar Precursor Robotic Program will explore the moon robotically to gather data to satisfy exploration program requirements. The first mission in this program, the Lunar Reconnaissance Orbiter, will provide high-resolution lunar topography as well as high-resolution stereo imaging of the moon, enabling better definition of geology and surface morphology. A smaller, secondary payload spacecraft will travel with the Lunar Reconnaissance Orbiter to the moon on the same rocket. The Lunar Crater Observation and Sensing Satellite will help determine if there is water hidden in the permanently dark craters of the moon's South Pole using an approach similar to the impactor-flyby spacecraft of the Deep Impact asteroid mission. An impactor will kick up a debris plume and the companion satellite will scan the plume for evidence of water. Data from these missions will be made available to all researchers. As new lunar data become available, NASA-sponsored research focused on lunar science will certainly grow.

Next, let's talk about Mars. Mars, another target for human missions, is a highly attractive object of study. Not only does it provide an excellent laboratory for studying planetary evolution in the context of the Earth and Venus, but it is also the most compelling destination in the solar system to search for life's existence beyond Earth. Results from the missions launched between 1996 and 2005 show that Mars was once wet and that large quantities of water ice remain on and near the surface. Recent data support the theory that surface environments were probably habitable billions of years ago and that the diversity of environments on Mars through time was far greater than had been appreciated previously. Together these findings suggest that the search for localized habitats, past or present, and evidence of life on Mars has scientific merit. Thus significant progress is being made in determining where and when habitats and, possibly, life may have evolved on the planet. Five spacecraft are currently exploring Mars: NASA's Mars Odyssey, Mars Reconnaissance Orbiter, the Mars Exploration Rovers Spirit and Opportunity, and the European orbiter Mars Express. These spacecraft have begun to reveal Mars as a dynamic planet, with remnants of a magnetic field, recently carved gullies, a history of volcanism, water ice on its poles and a history of major climate change.

Two NASA missions to Mars are currently in development: Phoenix and the Mars Science Laboratory. The Phoenix mission, scheduled for launch next month, is designed to measure chemical makeup of Mars, especially water, and complex chemistry in the northern polar plains of Mars, where the Mars Odyssey orbiter has discovered evidence of ice-rich soil near the surface.

The Mars Science Laboratory will explore the geochemical, mineralogical and geological diversity of Mars in search of potential habitable zones. The Mars Science Laboratory is scheduled to launch in 2009.

Other future missions include:

- The Mars Science Orbiter will be launched in 2013. It will address planetary evolution and potentially habitability.
- The Astrobiology Field Laboratory, a pair of mid-rovers or a set of three to four long-lived landers, is planned for launch in 2016. Results of upcoming investigations will determine which mission is developed. And a sample return mission is now being planned for the end of the next decade.

These and other missions will help researchers answer five fundamental questions in the planetary science community:

1. How did the sun's family of planets and minor bodies originate?
2. How did the solar system evolve to its current diverse state?
3. What are the characteristics of the solar system that led to the origin of life?
4. How did life begin and evolve on Earth and has it evolved elsewhere in the solar system?
5. What are the hazards and resources in the solar system environment that will affect the extension of human presence in space?

These questions form the basis for NASA's approach to the exploration of the solar system. The theme guiding these questions is habitability—the capacity of an environment to support life. To address these questions, NASA relies on a balanced program of technology development, data and sample research programs and missions of various sizes. Answering these planetary science questions requires comprehensive research programs to be conducted by NASA and our partners.

Now to my favorite heavenly body, Earth. There are also fundamental questions facing the Earth science community. NASA's Earth Science Program is dedicated to advancing Earth remote sensing and pioneering the scientific use of global satellite measurements to improve human understanding of our home planet.

Key Earth Science questions include:

- How is the global Earth system changing and what are the consequences for life on Earth?
- How does the Earth system respond to natural and human-induced changes?
- And how will the Earth system change in the future and how can we improve predictions through advances in remote sensing observations, data assimilation and modeling?

Perhaps more than any other human activity, 50 years of progress in Earth observation from space has steadily changed our perception of the Earth as our home planet. Satellite measurements of essential characteristics have enabled human understanding of the Earth as a system of interconnected parts. It is now clear, for example, that the characteristics of Earth's atmosphere so critical to human habitability are maintained by complex and tightly coupled circulation dynamics, chemistry, and interactions with the oceans, ice and land surface . . . all of which are driven by solar radiation and gravitational forces. From the vantage point of space we see at continental and planetary scales the vast extent and complexity of human activities. Over the past 50 years, world population doubled, world grain supplies tripled, and total economic output grew sevenfold. From space, we see that expanding human activities now affect virtually the entire land surface.

We live on a planet undergoing constant change due to natural phenomena and our own activities. To maintain and improve quality of life on Earth, we need global information about the state of the environment and its future evolution. Continuous global observations of variability and change are required to reveal natural variability and the forces involved, the nature of the underlying processes and how these are coupled within the Earth system. From the 1960s through the 1980s, space and airborne observations allowed the first global view of the Earth and led to important discoveries such as the processes behind Antarctic ozone depletion, the Earth's response to incoming solar radiation and the extent, causes, and impacts of land use and land cover change.

In the 1980s and 1990s, NASA's comprehensive suite of global measurements led to the development of the interdisciplinary field of Earth System Science. NASA deployed the first set of platforms in the Earth Observing System and promoted research focused on the Earth as a system. In this decade, NASA has begun to deploy new types of sensors to provide three-dimensional profiles of Earth's atmosphere and surface. From this year through 2016, NASA will develop and demonstrate new sensors and interacting constellations of satellites to address critical science questions and enable advances in the nation's operational, remote Earth-sensing capabilities.

Earth system science and space-based observations will continue to be essential tools in national and international efforts in avoidance, adaptation and mitigation of global change. Since 1961, astronauts have photographed the Earth from orbit, observing the world's geography and documenting events such as hurricanes and other natural phenomena. This database of astronaut-acquired Earth imagery is a national treasure for both the science community and general public. While researchers and students collect data on environmental changes here on Earth, our space program acquires imagery that can enhance those studies. Let's take a look at some recent Earth images taken from space.

Italy: Po River Valley

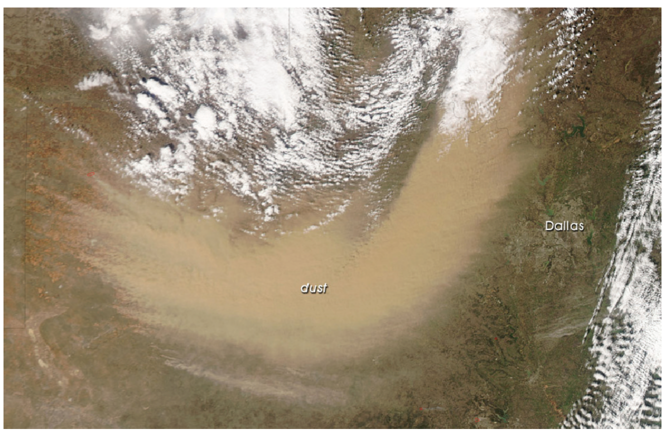
This image is an example of monitoring industrial and urban pollution from space. The floor of the Po River valley is obscured by haze caused by industrial smog. Industrial haze from the urban region of the central and upper Po valley accumulates to visible concentrations under conditions of high atmospheric pressure. The surrounding mountains prevent easy dispersal.

Tibetan Landscape from Space

This particular image from the International Space Station shows Lake Morari in the Tibetan Plateau. Alluvial fan and river pattern show complex geology of this region. Space images are used to study long-term geologic changes in remote regions like Tibet.

New Orleans, LA

New Orleans has been in the news lately. In this image of New Orleans from the International Space Station, you can see the wetland setting of the city as the sun reflects off of the water areas. The city has a complicated system of levees, pumps and upstream control structures on the Mississippi River which are necessary to maintain dry conditions in the city. It sits below sea level and is vulnerable to sinking and flooding. This type of image from space was used in emergency management events in New Orleans in 2005.



Texas Dust Storm

In February of this year, high winds wreaked havoc across Northern Texas. Gusts up to 60 miles per hour fueled grass fires and kicked up dust. This NASA satellite picture shows a boomerang-shaped plume of dust sweeping across the state. According to news reports, blowing dust reduced visibility to less than a mile in some Texas locations. It caused power outages to 37,000 homes and businesses and the cancellation of 300 flights at DFW airport that day.

Utah Fires

Space enables us to monitor natural processes and disasters. This satellite image was taken in July 2003 of two widely spaced fires burning in Utah. Fires across the entire United States in places like Nevada, California and New Mexico have been monitored using NASA satellites and other assets.

Those of us in today's workforce are paving the way toward meeting the challenge of returning humankind to the moon and journeying on to Mars and other destinations. We are expanding the search for answers to some of these fundamental questions in the planetary and Earth sciences that I have discussed. But enormous challenges lie ahead. Today's students will be the leaders, scientists, engineers, and explorers of tomorrow who will take humankind to Mars and resolve key issues facing the scientific community. That's why the goal of inspiring the next generation to pursue careers in science, technology, engineering and math and is so important. And that's why the work you do in encouraging students to pursue studies in science, technology, engineering and mathematics through studies of Earth science and environmental research is so critical.


The GLOBE
Welcomes you to the 11th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MK 5
Program
Annual Conference

Keynote Speaker
Ted McCain
Coordinator of Instructional Technology for
Maple Ridge Secondary
Vancouver, British Columbia, Canada

Mr. McCain is also the Associate Director
of The Thornburg Center for
Professional Development

“Making Schools Work in the 21st Century:
Why it can’t be business as usual in schools.”

Keynote Presentation sponsored by Forestry Suppliers, Inc.

What I mean when I say making schools work in the 21st century: I mean that we will organize our schools and adjust our instruction to prepare the next generation for success in the increasingly complex and interconnected modern world. I also mean that we will create in students a love for learning and inspire them to see this as a worthwhile life-long endeavor. But we face some significant challenges. Schools are not engaging students. I remember having a problem with the behavior of some students in my first year of teaching so I went to Mike Josiah, a Master Teacher in our school for advice. He said, “The key to classroom management is engaging methodology.” What Mike was saying is really quite simple - if your instruction is interesting, then you won’t have behavior problems. Interest is the key to effective instruction. I now believe that generating interest is the prime task of any teacher.

Richard Saul Wurman puts it this way…Learning can be seen as the acquisition of information, but before it can take place, there must be interest; interest precedes learning. Wurman has another way of underlining the importance of engaging students in learning. He says that instruction without interest is like having only one side of a piece of velcro - it just doesn’t stick. To have *velcro learning* we must have instruction and interest. But here is the problem: In the rush for accountability in schools, in the push for higher test scores, a major casualty has been interest and engagement. Neil Postman said students enter the school system as a question mark wanting to ask and learn and they leave as a period. It is a tragedy that school can rob kids of their desire to learn. Is that what we want? Of course not. We want engagement, we want interest, we want *velcro learning*. But the killing of a young person’s desire to learn is being repeated over and over again in schools all across North America. The lack of engagement in school is a major problem that we must address. And this problem goes hand in hand with the next issue we must deal with as we try to prepare students for success in the modern world.

Schools are not connecting with the world outside. What are our mandates in public education? We have two mandates. First - the acculturation of an individual. Passing on the accumulated wisdom of our society through literature, poetry, history, geography, science, mathematics. Also an appreciation of the aesthetic, philosophical, moral, ethical through art and music. But we have a 2nd mandate. Equally important to the first. That is to prepare students to be productive members of society. Learning to work, acquiring useful skills for the world of today and the future. To do this effectively school must connect with the world at large. But this is not one of our strong points and this is not a new problem.

Here’s my story of leaving the school system. I did a bachelor’s degree in computer cartography, then went into a Masters program. At 23 I took a break to earn money for school. My grad school advisor arranged a job with a cartographic company and I was hired as a programmer. I used the university computer to do the things I had done in school to make maps. And I convinced the company that they needed a computer. Then they did something that caught me completely off guard. I was called into the president's office and told they were impressed with what I had made the computer do. So they wanted me to recommend on the purchase of a Minicomputer, gave me a budget of $500,000 (this was 1978 – cheapest $200,000), told me to travel around the world to do the research, gave me 6 months - then left me on my own… So how did I do? Not well. This was my first real-world problem to solve. Not a theoretical exercise - a real problem with real money being spent by a real company. No one there to tell me what to do. Where do I start? Where do I get the info? More importantly, how do I assess the information I do get? I faked it. But the problem was I didn't have time to learn on the job. I was fired after 4 months. I was absolutely crushed.

Looking back now it's obvious what I should have done but at the time I was at a loss. Why did this happen? Not because I was uneducated. Not because I was stupid. Not because I was uninterested. Not because I chose a field of study that was impractical – I was in Computer Science. So why? Because all I had were school skills; the skills necessary for success inside the school system and those skills that are the ticket to higher levels of schooling. But I was unprepared for the world outside school. I could write an essay, do a lab report, write computer programs, but I was a highly educated useless person with no real world problem solving skills. Half of my education began at 23 - the real-world part. It was disillusioning for me and it's disillusioning for kids today. Kids are recognizing the increasing irrelevance of school and many are leaving the system altogether.

According to the 2005 report, "Getting Honest About Grad Rates" by Daria Hall and also in 2005 the report "1/3rd of a Nation" from Education Testing Service, more than 1/3rd of students and almost 1/2 of minorities drop out before finishing high school. Among the states, the lowest grad rate was in Arizona – only 55% of youth graduated in 2000. In Texas only 67.7% graduate - 1 in 3 drop out. Even if there is some debate about the exact graduation rate, these are not numbers to be proud of. Data from The Center for Education Statistics in the report "The Condition of Education 2002", shows the seriousness of the disconnect between the school world and the rest of life. Kid's view of the relevancy of their school experience to their future lives has declined steadily since the late 1980s. Today only 28% of 12th-grade high school students believe that school work is meaningful, only 21% believe that their courses are interesting, a mere 39% believe that school work will have any bearing on their success in later life.

These stats are more shocking when one realizes that these are the opinions of those students who have remained in high school. Students who find the high school experience the least relevant have already exited the system in huge numbers. If their voices were heard in the above poll, the profile of the relevancy of school would be far worse. For those who do remain in school, their blunt assessment of the interest level and relevancy of school is an indictment. Kids' disconnect with the usefulness of school should be a wake up call to all involved in education. We should have all the motivation to try new approaches to learning. And it's going to get worse because the world around us is changing. Bringing new opportunities for learning and new demands on education. So let's look at the third challenge we face as we try to make schools work in the 21st century.

Schools face a world on the move. The world of the near future (read 5 to 10 years) will be more different and more fantastic than we could have dreamed and have a more profound impact on education than anyone here has imagined - even me. How can I make such a statement? Because the world of the 21st century is based on a new kind of change. That no one in this room has fully experienced before. 21st century life will be marked with continual and ever increasing change based on exponential development. This is not change that happens incrementally, but change where the impact of development is sudden, massive and overwhelming due to doubling, tripling and even quadrupling of power each year. Let's look at 4 trends that are developing exponentially that will impact us greatly.

Trend 1: Awesome Tech Power
The astounding changes we have seen in the modern world have been fueled by increasing technological power. But there's much more coming than we have seen to date. To get a sense of where things are headed we must understand that tech development is following Moore's Law. In 1965, Gordon Moore, the co-founder of Intel, cited in a journal article that tech power doubles every 18 months while costing half as much over the same period of time. Is this true? And if so, what does it mean? I remember sitting with my friend Ian Jukes thinking about this a few years ago wrestling with the meaning of Moore's Law and I decided to create a spreadsheet that illustrated the math. To our surprise we discovered that the math of Moore's Law matched perfectly with the reality of the development of computer power. Moore was interviewed recently and said he sees no diminishing for at least 15 years. But, recent breakthroughs at IBM and HP in molecular electronics lead many to believe that Moore's Law will continue much longer. The extrapolation of this trend is unbelievable! I want to see where we'll be in 10 years, but before we look at that let's consider some new developments that are on the horizon…I want to talk about nanotechnology. This is the world of the incredibly small. Not making things smaller but building things up one atom at a time. First done by IBM several years ago when they used 35 precisely placed Xenon atoms to spell out IBM logo. Nanotechnology will be used to greatly boost tech power. In Ray Kurzweil's book The Age of Spiritual Machines, he talks about the Law of Accelerating Returns. He says that as Moore's Law starts to diminish it will be superceded by 3 dimensional nanotechnology chip designs, nanotubes, silicon photonics. This will increase technology speeds by a factor of many millions. Consequently we can see a continuum of astounding technological development that extends at least 50 years perhaps as much as 100 years into the future. In his new book, The Singularity is Near, Kurzweil tells us that due to nanotechnology Moore's Law will be adjusted again by the year 2010 to doubling in power every 6 months. What you must see is that raw technological power is the foundation of the astounding developments we will see in the future. This explosion in power will soon make possible many new features of technology that seem only in the realm of science fiction today.

Trend 2: Universal Connectivity
Real online speed is just coming into view - 2006 - Alcatel/NEC - crystal dark fiber - 10 trillion bps down single glass fiber. What about tomorrow? George Gilder, in his book Telecosm, talks about Law of the Photon. He says that since 1983, when the first fiber line was installed between New York and Washington, D.C., that bandwidth speed and capacity per dollar was tripling every 12 months. He projects this will continue for the next 20 years. But amazing as this is, it's only a part of the story. True universal connectivity can only come from cables and wireless access. Did you realize, as of today, already more wireless Internet access than from desktop? And think of the power of universal access to network resources - just beginning to see it. Here's an example - a vending machine in Tokyo - use a cell phone to buy your drinks. This is the power of networks - and remember this is being driven by exponential development - sooner than you think we will have universal access to the networked world. But when you combine awesome technological power and universal connectivity with this next trend you begin to see a much bigger picture.

Trend 3: The Online World
The online world is an amazing development providing access to information and communication literally around the globe. But the Internet is fast becoming much more than surfing Web sites, e-mail, and online chatting. It will soon become a means of natural transparent communication between people for a whole range of activities. Transparency has been a long-standing goal of computer use. It is completely natural interaction with machines. Just think of Captain Kirk or Captain Picard of Star Trek – how do they interact with computer technology? "Computer…" - access is transparent - they are completely focused on the task. A key area of focus for high tech companies is in new ways to interact with technology, especially online. We are already seeing the first steps away from traditional keyboard input. Natural hand-writing devices are starting to become really useful. Voice

input for computers and cell phones is just starting to come to the main stream market. And eye monitoring systems show promise for new forms of interaction. All these are functional today.

Here is a look at a medical tutoring system developed at the University of Florida that uses natural input. Students must examine Diana, a virtual patient and ask the right questions. The system responds to voice commands. Vic, a virtual tutor, provides medical students with feedback on the student's performance - remember this is Artificial Intelligence (AI). But natural input will go quite a bit further.

I want to show you two technologies that will soon combine to radically change the way we interact with the online world. The first is one that has flown below the radar of most educators. It is the development of customizable computer generated figures for use in games with 3 dimensional worlds. You choose a figure, and the computer let's you customize it. And then play a sports game as that figure in a simulated 3D world. How many of you play World of Warcraft or Grand Theft Auto? Amazingly complex 3D worlds with customizable figures. Here you see an adventure role play game. These are figures from EverQuest. Literally many thousands of users are playing this online game and others as we speak. Many adults including educators are not aware of the development in computer gaming, but astounding advances in computing power originate in this area of computer use. Now the second technology I want you to consider is Digital animation and human motion capture. This is how they create realistic motion for animated figures. This technology has come a long way with some fantastic results. The most famous is Gollum, an animated figure in Lord of The Rings. Gollum's motion was captured from the real person Andy Ferkus then transferred to a digital figure. The result was astounding realism in Gollum's motion. Today it takes time to transfer the motion data to the digital figure, but let's throw exponential growth of computational power and photonics into the mix and soon this transfer will happen instantly. You will put on one of these animation suits that mark key spots on your body with sensors and the computer will digitize your motion in real time and send it out on the Internet. This will create a digital online version of you called an Avatar that is completely customizable just like the figures we see in games today. These two technologies will combine to let you literally walk out onto the Internet. You put on a headset and a motion suit and you will see and interact with other avatars much like today's 3D games. Except you will control your digital figure by moving your body. What will you do walk out onto the Internet? Besides talking with other figures you will also manipulate virtual objects. Already impressive strides made in creating 3D worlds. This is a 3D image system created at Simon Fraser University that lets multiple users manipulate images online. All those watching around the world can see you make changes and then take turns making their own. It is operational today.

This is an article about a system from the Scripps Research Institute that allows people to hold virtual molecules in their hands and manipulate the objects in 3D space. It allows students and researchers to see and understand what is otherwise invisible. Soon you will see, touch and manipulate 3D objects in a virtual online world, all the while interacting with digital figures. These will be truly natural interactive experiences. That will let you speak and listen with people from around the globe in a virtual 3D world. This will have a profound impact on education. These digital online experiences will allow students to discover rather than be told. To wander the halls of the Louvre and interact with knowledgeable guides. To travel down to the microscopic and watch atoms join to form molecules. To break free of earth and explore the solar system and beyond. To manipulate 3D simulations of everything from math formulas to traffic control systems. To learn while interacting naturally with teachers and fellow students online. This is absolutely amazing, but there is more…There is one more exponential trend I want to highlight so you can see the educational potential of the online world. This is the exponential trend of Hyper Information.

Trend 4: Hyper Information

Exponential growth in tech power has had an incredible impact on the shear volume of information available in the modern world. How many of you have a "to be read" pile? How many of you are reading it? It's getting harder to keep up isn't it? You are experiencing the effects of a powerful 21st century trend. We're drowning in data. The amount of data in the world has gone crazy. According to research from University of California in Berkeley, the world produced 5 billion gigabytes of digital information in 2003. That's like a stack of books that reaches one third of the way from earth to the sun. But that's nothing - remember we said we are dealing with exponential trends? Here's what happened last year…According to the Expanding Digital Universe IDC White-paper, the world generated 161 billion gigabytes of digital information in 2006. That's 161 exabytes - that's like 12 stacks of books that reach from earth to the sun. Or think of it as 3 million times more info than in all the books ever written. And all that in just 1 year! And it doesn't stop - by 2010 estimates are that the world will generate 988 exabytes of digital information. And it just keeps growing exponentially into the future. Here's another way to see what is happening to information in the world. George Gilder estimates that the amount of unique new technical information is now doubling every year. But again it doesn't stop - Gilder has predicted that it will soon be doubling every 2 weeks. In the first quarter of the 21st century it will be doubling every 72 hours. We are in a world of disposable information, has shelf-life that is getting shorter each day.

But it's much more than just the amount of information - it's the kind of info and how it's interconnected. There is a profound shift in information taking place even as we speak. It involves the creation of a digital library of great literary works. Google started this shift when it announced in December 2004 it would digitize all of the books in 5 major research libraries (Stanford University, Harvard University, Oxford University, University of Michigan and New York Public Library). Google is now partnering with several major publishing companies to digitize vast numbers of out of print books and excerpts from books currently in print. Also in 2004, Raj Reddy, professor at Carnegie Mellon University began scanning books from his University's library - Called the Million Book Project - goal a million books by 2008. Superstar, a company based in Beijing, has scanned every book from 200 libraries in China - half of all the books published in the Chinese language since 1949. There is a rapidly growing digital library of digital books being created. Just think of what will be available when people do searches. But it is much more than just access…There is great power when books are seamlessly linked together. Just imagine being able to jump to each book in a bibliography to see the context of quotes. Or being able to assemble all of the passages from all digital books on a specific term or concept. Or accessing all of the works with an opinion on a particular issue. And we are only talking about print here - what happens when recordings and film are linked to the books in the same way?

Now a question - Hyper Information is a staggering trend for us personally but it also has profound implications for us professionally. Take a look at the vast majority of evaluation that takes place in school - tests and assignments. What is the primary skill that students develop? Memorization. Now the critical question: Is rote memory a useful skill in the age of instantaneous online access and Hyper Information? If not, it is critical we look at what skills do kids need for success in the 21st Century. And the 5th issue we must consider if we want schools to work is…that schools face a different kind of student.

Trend 5: Schools face a different kind of student

Digital technology affects those who use it - and I don't mean you - you dabble with technology - kids live with it. What you need to know is that digital technology and online experiences have already profoundly affected the minds of young people today. Research is now confirming that the interactive visual and auditory presentation of information kids experience in the digital world is actually rewiring their brains. In books like…How People Learn by John Bradsford, How the Brain Learns by David DeSousa and Teaching With The Brain in Mind by Eric Jensen. These publications indicate that kids are actually using different parts of their brains than we do. Most educators are oblivious to this change and continue to teach as if its 1975. But research is confirming that kids today are different than kids from previous generations. We know this from Neuroinformatics. This involves the analysis of brain processes by means of neural scanning and imaging. Using the incredible number-crunching power of computers and our growing understanding of the chemistry and biology of the brain. Combined with powerful scanners called FMRI's. That allow us to examine living brains non-invasively while they're in the process of thinking. Using this technology, researchers can pinpoint to within a few mm the parts of the brain that "light up" when people move a finger, feel sad, add 2 plus 2, or do specific tasks. Researchers like Johnson, Restak, Rushkoff, Jensen and others are telling us is that if you were to take an electronic scan of our parents' brains and compare it to a scan of our brains we would quickly discover that we use slightly different neural pathways to process the same information than our parents do.

But what is really remarkable is that if we were to take an electronic scan of our brains and compare them to scans of our children's brains we would find that they use fundamentally different neural pathways to take in, process and store the same information we do when doing the same tasks. We see this particularly in the area of the visual cortex. According to Eric Jensen at least 87% of students in any given classroom are NOT auditory or text-based learners. But they're either visual or visual kinesthetic learners. They're visual kinesthetic not to drive us crazy but because they've grown up that way - they're wired for multi-media. But most of the people in this room grew up in the 1960's through the 1980's. And just as kids today have been shaped by their digital world, we were shaped by our text-based, simpler, lower-tech world. As a result today we face a 2nd digital divide - not just one based on haves and have-nots, but a far more serious digital divide due to the fundamental difference in the way we grew up versus the way our students are growing up… we come from another land and time. As Marc Prensky says - in today's world kids are the digital natives who have grown up in this digital environment and adults are the foreigners who speak digital as a 2nd language.

Digital learners prefer:
- receiving information quickly from multiple multimedia sources
- parallel processing and multi-tasking
- to process pictures, sounds and video before text
- random access to hyperlinked multimedia information
- interact/network simultaneously with many others
- to learn "just-in-time"
- instant gratification and instant rewards
- online up-to-date visual and auditory information sources
- learning that is relevant, instantly useful and fun

Many teachers prefer:
- slow and controlled release of information from single or limited sources
- singular processing and single/limited-tasking
- to provide text before pictures, sounds and video
- to provide information linearly, logically and sequentially
- students to work independently rather than network and interact with others
- to teach "just-in-case"
- deferred gratification and deferred rewards
- text-based handouts and books
- to teach memorization of material in the curriculum guide in preparation for standardized tests

This is a recipe for disaster. And it has profound implications for anyone involved in education. It begins with the realization that there is empirical data that tells us that teachers, administrators, board members and you are not understanding the learning styles of your clientele of digital kids. This tells us that the instructional methods that used to work will not be successful with the students of today and tomorrow. And if schools are currently not engaging students. And a changing world and changing clientele are only going to make this worse…Can we continue to teach kids in the same way? Of course not - we must look for innovative new ways to reach the digital generation to make schools relevant for 21st century students. So how do we make schools work for the 21st century? I want to leave you with two important changes that I believe are critical if we hope to make schools work in the 21st century.

The first has to do with us…We must catch up. It is a whole new world out there! We must also acknowledge our ignorance of this new age. It's time for us to let go of our pride in being highly trained experts. Because that training was based on 20th century thinking. In the 21st century we are all facing a new world with new ways of doing things. It is critical that we all become learners in this new environment. I think this quote from Eric Hoffer captures this best… "In times of radical change the learners inherit the earth, while the learned find themselves perfectly equipped for a world that no longer exists." How could we do things differently as teachers to effectively reach the kids of today? I have written a book about 21st century teaching and learning in which I outline 6 major changes we must make to instruction to make it effective in the modern world (I actually have 8 changes now). But if I had to choose just one it would be that we must resist the temptation to tell.

My son's experience in Science—he went from his elementary school experience of a wonderful range of discovery learning experiences to junior high school where he had to sit still and listen as he was told what science had already discovered. Where does this desire come from? For most teachers it's all they have ever known. It is the most common instructional approach that is modeled throughout the entire school system. I believe telling is the native language of teachers. We persist in using it even though there are indications it is the least effective way for students to learn.

The most important reason for stopping teachers telling things to kids is that telling takes the life out of learning. Just think about watching a suspense movie. The experience of watching the actors narrowly escape certain death as the music creates a suspenseful atmosphere would keep you on the edge of your seat. The experience would be indelibly etched in your mind. But what would the experience be if just before the movie someone told you what was going to happen and they all made it through without a scratch? The problem is that telling takes the excitement of discovery out of learning.

Why is discovery so important? It generates the interest that was highlighted in the quote from Richard Saul Wurman that I shared with you earlier. Interest creates the other side of the velcro to make learning stick. Our job as teachers is to create the other side of the velcro - the interest that is so desperately needed to engage students. I believe the most important job we have as teachers is to create the interest that gets kids hooked on learning. For Science teachers we must remember that even if we know a science concept well and it's as old as the hills. If it is the first time a student has encountered it, the potential exists for a wonderful discovery experience. And isn't that what Science is supposed to be all about anyway?

So what is stopping us? In a word – change. And I know I am preaching to the choir when I speak to this group of people - if you are here the chances are you know that we have to change. But the vast majority of our colleagues their motto is Change is good - you go first. So let's do just that - let's change the way we teach and blaze a trail for other teachers to follow. Let's make learning engaging and relevant in our classrooms. Let's make sure our schools work effectively with teaching that addresses the important issues I have presented this morning. So that our students can be ready for their future in this wild new world of the 21st century.




















The GLOBE Program

The GLOBE Program Office is pleased to announce the new and improved GLOBE Web site! In response to extensive feedback from the GLOBE community, we are changing the site to be more user-friendly and offer more useful functionality. For the first stage of this development, we have revitalized our Web site with a fresh look, as well as simplified navigation and site structure. This stage features a new homepage, new "Student" section, reorganized Menu Bar, and improved search function using Google Search.

www.globe.gov

GLOBE Earth Systems Science Projects (ESSPs)

Carbon Cycle
Investigating the Carbon Cycle in Terrestrial Ecosystems

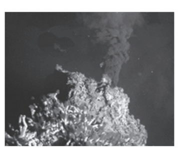
SEASONS&BIOMES

Carbon Cycle

"Carbon - the building block of life." You may have heard this phrase, but have you understood what it really means? Carbon is the most abundant element in living things and accounts for approximately 50% of the total mass of plants and animals. Carbon is also present in Earth's atmosphere, soils, oceans and crust, and cycles between these components on varying time and spatial scales. The GLOBE Carbon Cycle Project links an international team of scientists and educational outreach specialists with the GLOBE educational community. Through field exercises, computer modeling, and remote sensing, primary and secondary grade level teachers and students will gain knowledge about current carbon cycle research, develop strong analytical skills, and increase their overall environmental awareness.

Seasons and Biomes

What is a biome? A biome is a large geographic area of distinctive plant and animal groups that are adapted specifically for a particular environment. Biome type is determined by the climate and geography of a region. Through the GLOBE Seasons and Biomes project, students and teachers will contribute critically needed science measurements to validate satellite data used in research on regional climate change, prevention and management of diseases, and understanding of the water and carbon cycles. By monitoring the seasons in their own biome, students will learn how interactions within the Earth system affect their local environment and how it in turn affects regional and global environments.



FLEXE From Local to Extreme Environments

Watershed Dynamics

FLEXE (From Local to Extreme Environments)

How extreme is the deep sea? What does it take to flourish along a mid-ocean spreading center 2,500 meters below sea level? Characterized by crushing pressure, near freezing temperatures, and no light, the deep sea is the largest environment on Earth. Scientists are currently conducting investigations to learn more about features that make this ecosystem extreme and unique. The FLEXE project invites students to join the scientists of the NSF-sponsored Ridge 2000 program and associated research programs.

Watershed Dynamics

Where does your water come from? Do you always have enough or is the supply limited where you live? What factors affect the flow of water in the area where you live? The GLOBE Watershed Dynamics Project will enable students to investigate their own watershed in order to understand the flow of water through the watershed, how human activities within the watershed both depend on and impact its hydrology, and how land use changes can affect the plant and animal communities in the watershed.

Notes

The GLOBE Program Office and GLOBE South Africa
are pleased to announce the next major GLOBE event:

4th GLOBE Learning Expedition
and
12th Annual Conference

Cape Town, South Africa
22 - 28 June 2008

GLOBE LEARNING EXPEDITION (GLE)
22 - 27 June 2008

The GLE will provide an excellent venue for GLOBE students from around the world to interact with scientists and with each other. In addition to student presentations, there will be field activities, student art displays and cultural events. Student delegations and their supervisors may participate in optional tours beginning on 28 June 2008.

12th ANNUAL CONFERENCE
22 - 28 June 2008

We encourage all GLOBE Partners to attend the GLOBE Learning Expedition (22 - 27 June) and take part in the student/teacher activities associated with the GLE as well as attend the Regional Meetings for Country Coordinators and U.S. Partners that will occur during the week. Partner discussion will include strengthening and sustaining the GLOBE Program, with particular attention paid to building regional consortia that strengthen and empower GLOBE coordinators and learning communities with top scientists and educators from around the world. On Saturday, 28 June, Partners will have an opportunity to present their local activities through poster presentations and / or concurrent sessions. Presentation submissions must be received by Friday, 1 February 2008. This deadline will not be extended.

More information is available on the GLOBE Web site.

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