NOAA/NSTA Symposium: GPS and Geodesy for Dummies: Do You Know Where You Are?
Saturday, March 31, 2007

8:00 AM – 8:25 AM
Welcome, Introductions, Goals for the Symposium

Al Byers, Assistant Executive Director of Government Partnerships and e-Learning, NSTA
Peg Steffen, Education Coordinator, National Ocean Service, NOAA
Flavio Mendez, Symposia and Web Seminars Program Manager, NSTA

- About NSTA Symposia
- Agenda/Goals
- Forms/Logistics/Introductions

Dr. Dru Smith, Chief Geodesist, National Geodetic Survey, NOAA
Galen Scott, Coastal Team Lead, National Geodetic Survey, NOAA
Casey Brennan, Communications and Outreach Specialist, National Geodetic Survey, NOAA
Bruce Moravchik, Education Specialist, National Ocean Service, NOAA

8:25 AM – 9:00 AM
The Earth Is Not a Sphere! : The Horizontal Component of Geodesy

Dr. Dru Smith

Learning Outcomes:

After participating in the presentation,

- Participants will describe the general size and shape of the Earth, and explain how the concept has changed through time.
- Participants will explain why knowing the size and shape of the Earth is important, and how this knowledge has changed through time.
- Participants will define the terms geodesy, latitude, and longitude.
- Participants will explain the difference between magnetic north and “true” north.

9:00 AM – 10:05 AM
Activity 1: How Big is the Earth?

Dr. Dru Smith, Peg Steffen, and Bruce Moravchik

Learning Outcomes:

After participating in the activity,

- Participants will describe the Eratosthenes experiment, its historical importance, and how it served as the first true “geodetic” measurement of the size of the Earth.

10:05 AM – 10:25 AM
Sir Edmund Hillary Climbed the Wrong Mountain: The Vertical Component of Geodesy

Galen Scott

Learning Outcomes:

After participating in the presentation,

- Participants will explain that "height" is not absolute; there are different height systems for different applications.
- Participants will explain what is right and what is wrong with the term “height above sea level.”
- Participants will explain the importance of accurate “height" measurements for several applications.

10:25 AM – 10:40 AM
Break

10:40 AM – 11:15 AM
Introduction to the Global Positioning System

Casey Brennan

Learning Outcomes:

After participating in the presentation,

- Participants will describe the basics of GPS.
- Participants will describe the method GPS uses to calculate your position.
- Participants will list at least three ways that GPS is important to your daily life.

11:15 AM – 12:05 PM
Activity 2: Simulation of GPS Positioning

Casey Brennan, Peg Steffen, and Bruce Moravchik

Learning Outcomes:

After participating in the activity,

- Participants will present a classroom based activity that describes the basic operation of GPS.

12:05 PM – 12:30 PM
Final Words

- Post-assessment form
- Evaluation form/Survey
- NSTA Web Seminars
- Raffle of door prizes

National Science Education Standards Addressed:
Content Standards, Grades 5-8

Content Standard A:
Abilities Necessary to do Scientific Inquiry

- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Develop descriptions, explanations, predictions and models using evidence.
- Think critically and logically to make the relationships between evidence and explanations.

Understanding about Scientific Inquiry

- Scientific explanations emphasize evidence, have logically consistent arguments, and use scientific principles, models, and theories. The scientific community accepts and uses such explanations until displaced by better scientific ones. When such displacement occurs, science advances.

Content Standard E:
Science and Technology
As a result of activities in grades 5-8, all students should develop

- Understandings about science and technology
  - Science and technology are reciprocal. Science helps drive technology, as it addresses questions that demand more sophisticated instruments and provides principles for better instrumentation and technique. Technology is essential to science, because it provides instruments and techniques that enable observations of objects and phenomena that are otherwise unobservable due to factors such as quantity, distance, location, size, and speed. Technology also provides tools for investigations, inquiry, and analysis.
  - Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.

Content Standard F:
Science in Personal and Social Perspectives
As a result of their activities in grades 5-8, all students should develop understanding of

- Science and Technology in Society
  - Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technological changes are often accompanied by social, political, and economic changes that can be beneficial or detrimental to individuals and to society. Social needs, attitudes, and values influence the direction of technological development.
  - Science and technology have advanced through contributions of many different people, in different cultures, at different times in history. Science and technology have contributed enormously to economic growth and productivity among societies and groups within societies.

Content Standard G:
History and Nature of Science
As a result of their activities in grades 5-8, all students should develop understanding of

- Nature of science

  - Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical methods. Although all scientific ideas are tentative and subject to change and improvement in principle, for most major ideas in science, there is much experimental and observational confirmation. Those ideas are not likely to change greatly in the future. Scientists do and have changed their ideas about nature when they encounter new experimental evidence that does not match their existing explanations.
- History of Science
  - Many individuals have contributed to the traditions of science. Studying some of these individuals provides further understanding of scientific inquiry, science as a human endeavor, the nature of science, and the relationships between science and society.

Content Standards, Grades 9-12

Content Standard A:
Abilities Necessary to do Scientific Inquiry

- Formulate and revise scientific explanations and models using logic and evidence.

Understanding about Scientific Inquiry

- Scientists usually inquire about how physical, living, or designed systems function. Conceptual principles and knowledge guide scientific inquiries. Historical and current scientific knowledge influence the design and interpretation of investigations and the evaluation of proposed explanations made by other scientists.
- Mathematics is essential in scientific inquiry. Mathematical tools and models guide and improve the posing of questions, gathering data, constructing explanations and communicating results.

Content Standard E:
Science and Technology
As a result of activities in grades 9-12, all students should develop

- Understandings about science and technology
  - Science often advances with the introduction of new technologies. Solving technological problems often results in new scientific knowledge. New technologies often extend the current levels of scientific understanding and introduce new areas of research.
  - Science and technology are pursued for different purposes. Scientific inquiry is driven by the desire to understand the natural world, and technological design is driven by the need to meet human needs and solve human problems. Technology, by its nature, has a more direct effect on society than science because its purpose is to solve human problems, help humans adapt, and fulfill human aspirations. Technological solutions may create new problems. Science, by its nature, answers questions that may or may not directly influence humans. Sometimes scientific advances challenge people's beliefs and practical explanations concerning various aspects of the world.
  - Technological knowledge is often not made public because of patents and the financial potential of the idea or invention. Scientific knowledge is made public through presentations at professional meetings and publications in scientific journals.

Content Standard G:
History and Nature of Science
As a result of their activities in grades 9-12, all students should develop understanding of

- Nature of scientific knowledge
  - Scientific explanations must meet certain criteria. First and foremost, they must be consistent with experimental and observational evidence about nature, and must make accurate predictions, when appropriate, about systems being studied. They should also be logical, respect the rules of evidence, be open to criticism, report methods and procedures, and make knowledge public. Explanations on how the natural world changes based on myths, personal beliefs, religious values, mystical inspiration, superstition, or authority may be personally useful and socially relevant, but they are not scientific.
  - Because all scientific ideas depend on experimental and observational confirmation, all scientific knowledge is, in principle, subject to change as new evidence becomes available. The core ideas of science such as the conservation of energy or the laws of motion have been subjected to a wide variety of confirmations and are therefore unlikely to change in the areas in which they have been tested. In areas where data or understanding are incomplete, such as the details of human evolution or questions surrounding global warming, new data may well lead to changes in current ideas or resolve current conflicts. In situations where information is still fragmentary, it is normal for scientific ideas to be incomplete, but this is also where the opportunity for making advances may be the greatest.
- Historical perspectives
  - Occasionally, there are advances in science and technology that have important and long-lasting effects on science and society. Examples of such advances include the following: Copernican revolution, Newtonian mechanics, Relativity, Geologic time scale, Plate tectonics, Atomic theory, Nuclear physics, Biological evolution, Germ theory, Industrial revolution, Molecular biology, Information and communication, Quantum theory, Galactic universe, and Medical and health technology.

National Geography Standards Addressed: Grades 5-8

Standard 1: The World in Spatial Terms:

A. Describe the essential characteristics and functions of maps and geographic representations, tools and technologies by being able to:
- Explain map essentials (scale, directional indicators, symbols).

C. Use geographic tools and technologies to pose and answer questions about spatial distributions and patterns on Earth by being able to:
- Use maps to make and justify decisions about the best location for facilities.

Principles and Standards for School Mathematics: Geometry Standard for Grades 3-5

Specify locations and describe spatial relationships using coordinate geometry and other representational systems.
- Describe location and movement using common language and geometric vocabulary.
- Make and use coordinate systems to specify locations and to describe paths.