

**Education and Public Outreach
Workshop for RBSP Mission Scientists and
Engineers
*Getting Ready for Launch Activities***

May 16, 2012

Space Department Education and Public Outreach

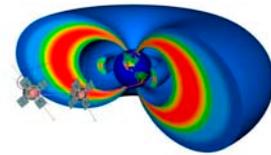
Alexandra Matiella Novak

RBSP

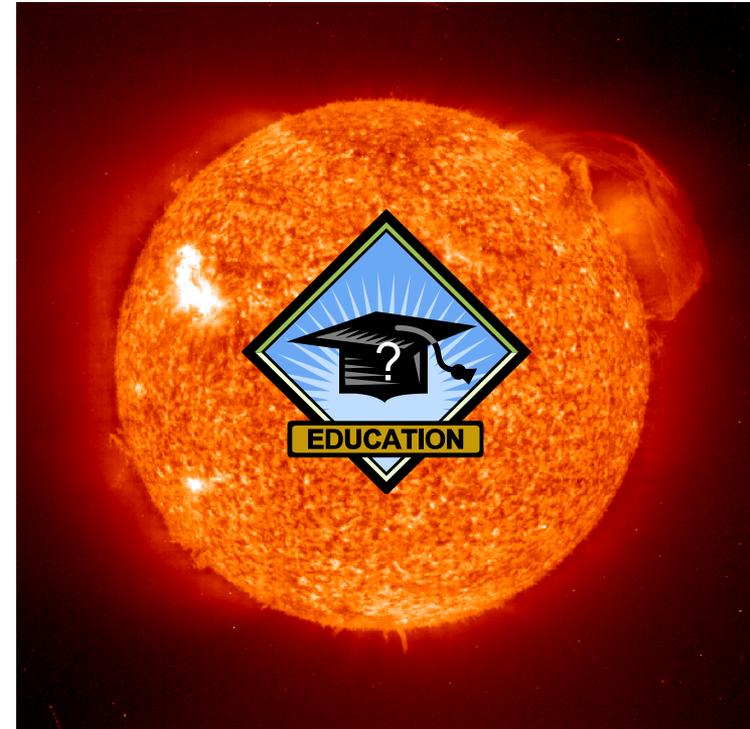
Radiation Belt Storm Probes

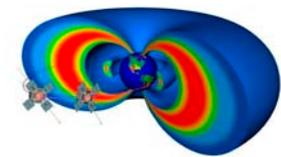


Overview



1. **Pre-assessment: What is your experience with EPO audiences?**
2. **Why an EPO workshop at SWG?**
 - Opportunities at Launch
3. **What are the Goals for NASA Education?**
4. **Exploring the National Science Education Standards (this applies to formal and informal education, you'll see why)**
 - How well are students learning these standards?
 - Exploring common misconceptions about the NSES
5. **The Next Generation Science Standards**
6. **Preparing for public talks and interaction at KSC**
 - Speaking to young audiences
 - Speak to the general public



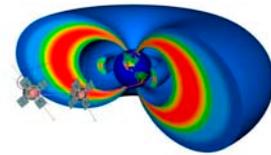


Upcoming E/PO Opportunities

- **Launch Site Public Talks**
 - 1 speaker needed per day L-5 through L-3; 2 speakers needed per day L-2 through L;
 - Will take place at KSC VC Astronaut Encounter Theatre;
 - Audience is at the 5th-7th grade level (this includes adults!).
- **Launch Site Exhibits**
 - We will need RBSP scientists and engineers to help us staff these booths starting L-5;
 - Opportunity for informal interaction with KSC VC guests
 - Right outside the IMAX theater, so potential for high traffic (again, 5th-7th grade level audience)
- **Teachers Workshop**
 - Currently planning agenda and activities with instrument teams;
 - Middle and high school teachers.
- **Curriculum development**
- **Museum Alliance teleconferences**
 - Next one will focus on mission and launch.



NASA E/PO Targets



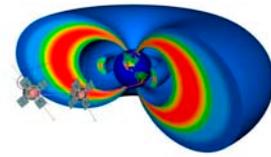
1) Higher Education – Employ and Educate: Contribute to the development of the STEM (Science, Technology, Engineering, Mathematics) workforce in disciplines needed to achieve NASA's strategic goals, through a portfolio of investments.

2) Elementary and Secondary Education – Educate and Engage: Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers and faculty.

3) Informal Education – Engage and Inspire: Build strategic linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission.



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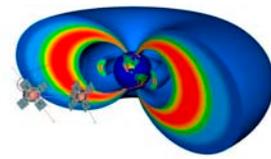
3) Informal Education – Engage and Inspire: Build strategic linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission.

This will be our audience for launch at the KSC Visitor's Center!!!!



NSES Standards 5th-8th Grade

(This will be the level of your KSC audience)



- **B: Physical Science (p.149-154):**

- Transfer of Energy

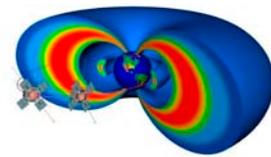
- Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.
- In most chemical and nuclear reactions, energy is transferred into or out of a system. Heat, light, mechanical motion, or electricity might all be involved in such transfers.
- The Sun is a major source of energy of changes on Earth's surface. The Sun loses energy by emitting light. A tiny fraction of that light reaches the Earth, transferring energy from the Sun to the Earth. The Sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.

RBSP Key Message #1) RBSP advances our understanding of dramatic and puzzling aspects of Earth's radiation belts. The "Van Allen Belts", named for their discoverer James Van Allen, are two donut-shaped regions encircling the Earth, where high energy particles from the Sun and space are trapped by our planet's magnetic field.



NSES Standards 5th-8th Grade

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- **D: Earth and Space Science (p.158-161):**
 - Structure of the Earth System
 - Earth's system includes the sub-lithosphere, lithosphere, hydrosphere, atmosphere and *magnetosphere* (*references to the magnetosphere are not in these standards!*).
 - Earth in the Solar System
 - The Sun is the major source of energy for phenomena on the Earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result from variations in the amount of the Sun's energy hitting the surface, due to the tilt of the Earth's rotation on its axis and the length of the day.

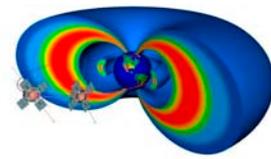
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RBSP Key Message #2) RBSP enables the prediction of extreme & dynamic space conditions. Changes in the Sun's energy flow cause changes in space. These changes are referred to as space weather and have broad impacts on Earth's systems and inhabitants.



NSES Standards 5th-8th Grade

(This will be the level of your KSC audience)



- **E: Science and Technology (p.161-166):**

- Abilities of Technological Design

- Identify appropriate problems for technological design.
- Design a solution or product.
- Implement a proposed design.
- Evaluate completed technological designs or products.
- Communicate the process of technological design.

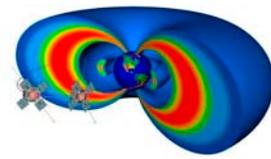
- Understandings about Science and Technology

RBSP Key Message #3) RBSP provides understanding needed to design satellites to survive in Space. RBSP will explore space weather, and especially its extreme conditions, all of which can disable satellites, cause power grid failures, and disrupt GPS services.



NSES Standards 5th-8th Grade

(This will be the level of your KSC audience)



- **F. Science in Personal and Social Perspectives (p. 166-170):**
 - Natural Hazards
 - Risk and Benefits
 - Science and Technology in Society
 - Societal challenges inspire questions for scientific research and social priorities often influence research priorities through availability of funding for research.
 - Science and technology have advanced through the contributions of many different people, cultures, and times in history.
 - Scientists and engineers work in many settings.

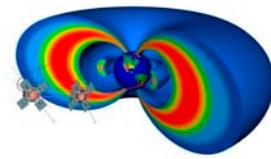
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NSES Standards 5th-8th Grade

(This will be the level of your KSC audience)



- **G. History and Nature of Science (p. 170-171):**

- Science as a Human Endeavor

- Women and men of various social and ethnic backgrounds – and with diverse interests, talents, qualities and motivations – engage in the activities of science, engineering, and related fields such as the health professions. Some scientists work in teams, and some work alone, but all communicate extensively with others.

YOU!!!

NSES Standards 9th-12th Grade

(Might be beyond the level of the KSC audience)

- B. Physical Science:

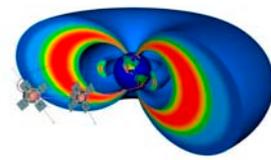
- Structure of Atoms
- Motions and Forces
- Conservation of Energy and Increase in Disorder
- Interactions of Energy and Matter

- D. Earth and Space Science:

- Energy in the Earth System (*although we might get some questions about how the Sun's energy influences climate change!*).
- The Origin and Evolution of the Earth System
- The Origin and Evolution of the Universe



How Well Are These Standards Teaching our Kids About Space Science?



A comprehensive testing of 7,599 students K-12 and their 88 teachers found that:

Grade Band	Standard	Student Scores %	Teacher Scores%
K-4	Objects in the Sky & Changes in the Earth and Sky		
	There are different objects in the sky	39	74
	The sun heats the Earth	49	92
	There are many stars in the sky	58	85
	Objects in the sky have patterns of motion	55	86
	Standard average	51	83
5-8	Earth in the Solar System		
	The solar system has a star, planets and other objects	51	84
	Solar system objects move predictably	41	84
	Gravity is the key force in the solar system	40	67
	The sun's energy underlies many terrestrial phenomena	33	70
	Stars are fixed relative to each other	33	68
	Planets move relative to stars	33	70
	Telescopes extend our vision	52	89
	Stars are clustered in galaxies	42	100
	Light takes time to travel	36	87
	Standard average	41	79



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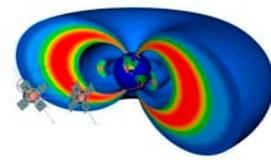


Table continued from previous slide...

Grade Band	Standard	Student Scores %	Teacher Scores%
9-12	The Origin and Evolution of our Universe		
	The big bang theory	39	87
	Early star galaxy formation	43	73
	Stellar fusion and its effects	29	88
	Stellar variation	54	94
	Light element formation	34	90
	Heavy element formation	48	84
	Obtaining and analyzing astrophysical data	44	91
Standard average	42	87	

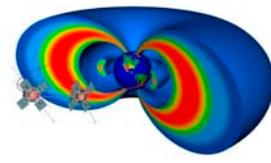
Take Away Message:

Our students are struggling to understand basic Earth and Space Science concepts!!!

This is not just an issue for science outreach, but also for the development of a future workforce.



Misconceptions You Need To Know About (at the grade 5-8 level)



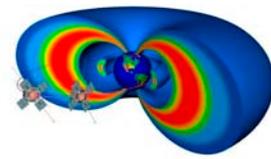
Misconceptions are a major barrier to learning!!!

1. **The Sun is not a star not a member of the solar system.**
2. **There are many stars within the solar system.**
3. **Stars other than the Sun are closer to us than Pluto.**
4. **The Earth's orbit is highly elliptical.***
5. **The Earth turns on its axis once a year.**
6. **The Earth orbits the Sun once a day, producing day and night.**
7. **The space shuttles traveled in the vicinity of other planets and/or stars.**
8. **There is no gravity in space.**

***Misconception also held by the teachers.**



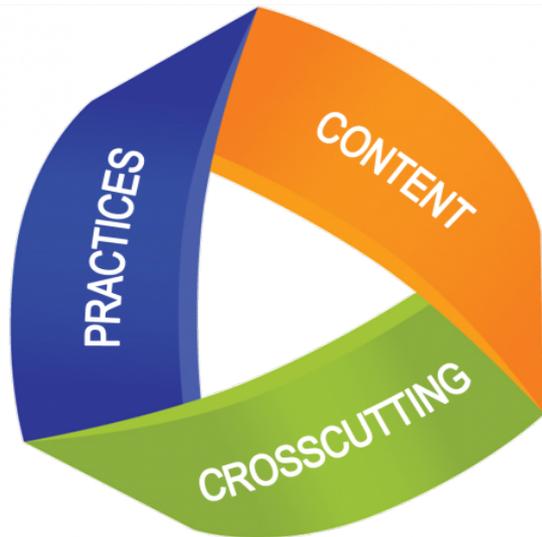
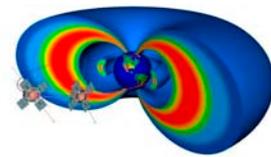
7 Common Misconceptions About the NSES



1. The NSES are required for all schools.
2. The NSES are a list of scientific facts students should know.
3. Standards-based methods of science teaching are consistent with the way most of today's scientists learned science in school (grades K-14).
4. "Standards-based activities" are equivalent to "hands-on activities."
5. The NSES applies only to curricular materials.
6. Scientific research topics are easily linked to standards, and thus a K-12 educational product or activity that is "standards-based" or "aligned with standards" is easy to create.
7. Practicing teachers generally know all about the standards and how to apply them.



PUBLIC DRAFT – Next Generation Science Standards



The Next Generation Science Standards (NGSS) are distinct from prior science standards in that they integrate three dimensions within each standard and have intentional connections across standards:

1. Science and Engineering Practices
2. Disciplinary Core Ideas (Content)
3. Crosscutting Concepts

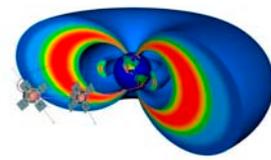
<http://www.nextgenscience.org/next-generation-science-standards>

Don't like the current state of science education?
This is your chance to help shape the science education of the next generation!

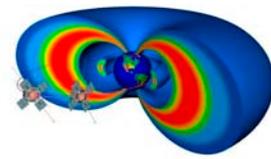
Survey closes June 1!!!



Techniques for Speaking with Young Audiences (K-12)



- 1. Communicate using unique style.**
- 2. Speak on familiar topics (NSES resources).**
- 3. Speak at a level appropriate for the audience (NSES resources).**
- 4. Show enthusiasm!**
- 5. Acknowledge and show respect for audience members.**
- 6. Start the presentation with a dynamic demonstration using volunteers on stage**
- 7. Design the presentation to be more like a “show”**
- 8. Use appropriate humor whenever possible**
- 9. Tie in real-world science and engineering examples**
- 10. Keep visual aids and props simple yet dynamic**



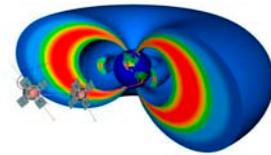
Guidelines for Public Speaking – ABC LIVE!!!

- **A = Audience (Know it, Care about it)**
- **B = Big Picture (Background, Basics, Begin at the Beginning, Relevance, Use Frameworks of Understanding)**
- **C = Communication Skills**
 - Language
 - Interactivity
 - Visuals
 - Excitement/Enthusiasm

Remember 5th-7th grade level!!!



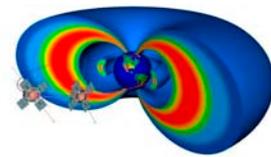
FAQs So Far



- What are the Van Allen Radiation Belts?
- Why is it important to study the radiation belts?
- What questions will be investigated during the mission?
- How will new discoveries about the radiation belts be applied?
- What is space weather?
- What is the difference between particle radiation and electromagnetic radiation, and how does each affect us?
- What is geospace?
- What are electrons, protons and neutrons?
- What is an ion?
- What is plasma?
- Why is plasma more commonly found in stars than on Earth?
- What is coronal mass ejection and why is it important to me?
- What is solar wind? How is it different from a coronal mass ejection?
- As the particles spiral around the magnetic field lines do the particles produce EM radiation (radio waves) and therefore lose energy and slow down?
- What is DST and what does it tell us?
- Since electrons and protons are in the same region in the outer belt, do they neutralize each other?
- What are the mechanisms for electrons to be lost?
- In simple terms, what do the instruments do?
- How big are the spacecraft?
- Why do the booms have to be so long?



THANK YOU



Questions???

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