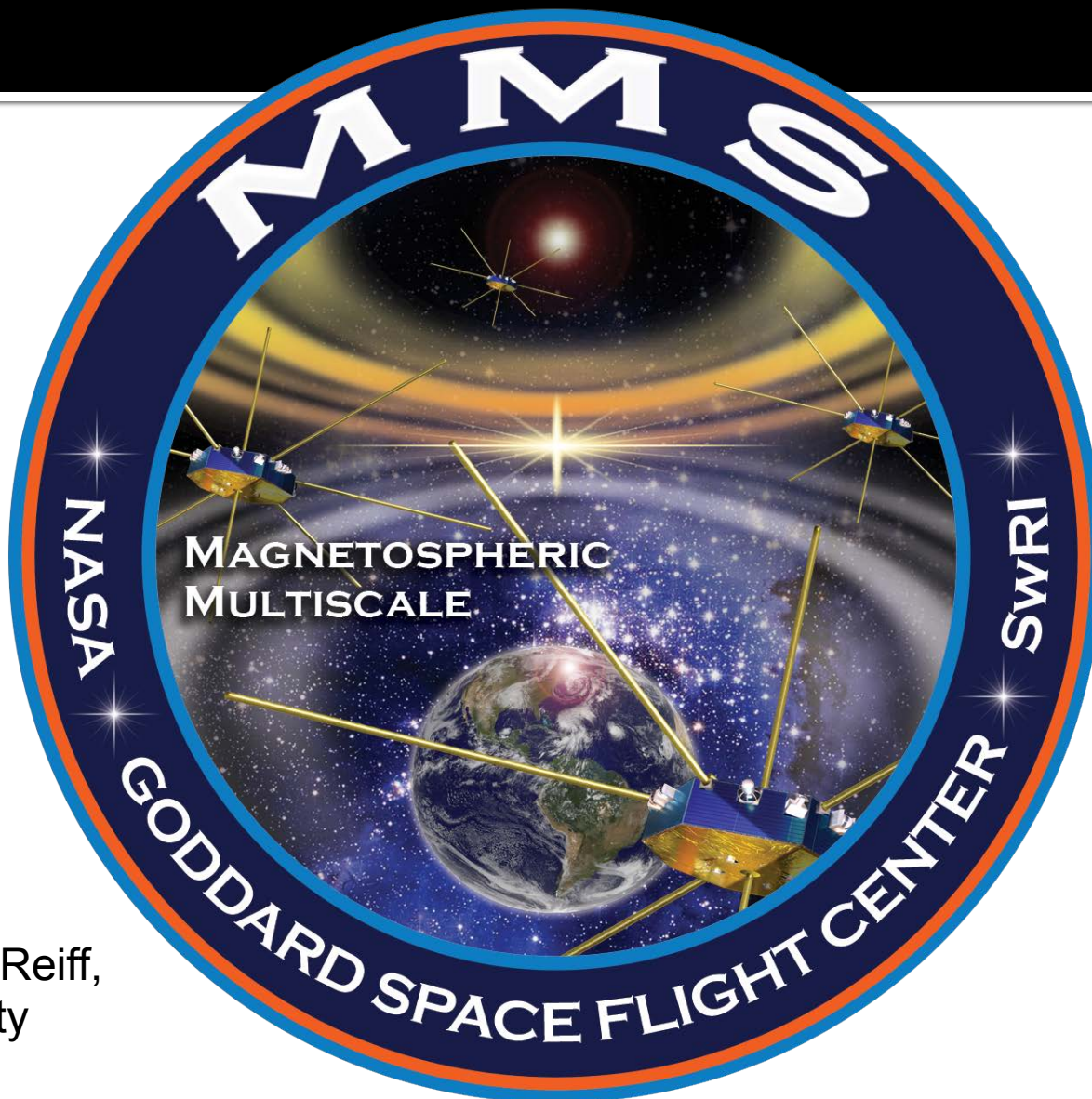




# Science E/PO Efforts



Prof. Patricia Reiff,  
Rice University  
E/PO Lead



# Science E/PO Efforts

## The E/PO Pyramid





# Science E/PO Efforts

## ➤ **Student Activities and Products**

Space Weather DVD

Sally Ride Festival, Rice

SMART, UNH

YES, SWRI

Brownsville Space Days; Mars Rovers; Solar Week

Space Camp for the Blind

SACNAS Awards (2 undergrad awards annually)

## ➤ **Teacher Activities and Products**

Heliophysics Ambassadors

Master of Science Teaching

NSTA, CAST



# Science E/PO Efforts

## ➤ Public Activities and Products

Space Weather DVD

Planetarium Show "Force 5"

Planetarium show "Magnetism"

Lectures and Events: Birkeland Lecture

USA Science and Engineering Festival

(2012, 2014)

Exploration Station

Sun-Earth Day, Eclipses

**TOTAL REACHED in person in 2012: 17,750**

**(in domes 13,866); total reached 75,000**





# E/PO Highlights Space Weather now V. 17 (240,000) installer can be downloaded freely

## INSTALLATION

Run the SETUP application located on the SPACE WEATHER® disc. You can run the Space Weather software directly from the disc and explore the many HTML resources included on the disc, or, if you choose to install the Space Weather software package, you have to select an install location and install options. The software must be installed on a hard drive for the updating features to work. After installation, use the UPDATE DATA button to bring down the latest data and images.

## UPDATING

Use the UPDATE DATA button to download the latest space weather topics and updates.



Use this update image button in SPACE WEATHER to download the latest versions of specific images (e.g. in "The Sun Today")



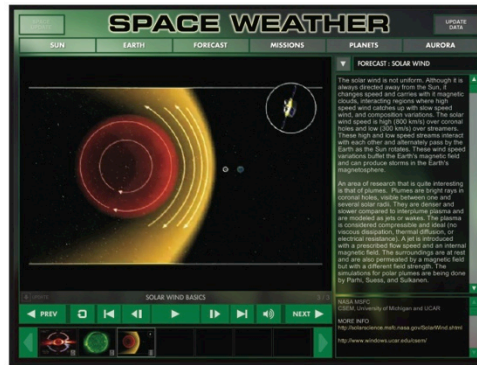
## SYSTEM REQUIREMENTS

- Mac OSX (10.1 - 10.8)
- Windows XP, Vista, 7
- 500 MHz, 512 MB RAM
- 1024x768, millions of colors
- QuickTime 7 (included)



**VISTA & 7 Users:** must be in administrator mode with UAC disabled to use updating features - see Help.html.

*QuickTime and the QuickTime logo are trademarks or registered trademarks of Apple Computer, Inc., used under license therefrom.*



SAMPLE SOFTWARE SCREEN

**VERSION 17  
MAC / WIN**

ISBN 978-1-931523-47-9



**CON VERSIÓN EN ESPAÑOL**

Produced by the NASA Magnetosphere Multiscale (MMS) mission <http://mms.rice.edu/>  
with prior support from IMAGE and ESA/Cluster missions



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**SPACE WEATHER®**

**EXPLORING SUN-EARTH CONNECTIONS**

Brought to you by the Magnetospheric Multiscale Mission

<http://mms.rice.edu/>



# UNH "SMART" program

## Description:

- The **SMART** (is a four-week summer program at UNH to introduce students to the science and technology of the MMS mission.

## MMS Connections:

- **Science** (instructing the students)
- **Technology** (introducing the experiments, testing the SDP motors)
- **Experiments** (students build hands-on experiments related to mission instrumentation – balloon flights in 2010 and 2011)

## Impact

- 3-20 students annually get extensive experience in space science
- Encourages careers



website: <http://www.smart.unh.edu/>





# SWRI "YES" program

## Description:

- The YES (Young Engineers and Scientists) is a four-week summer program at Southwest Research Institute to introduce students to the science and technology of the MMS mission.

## MMS Connections:

- **Science** (instructing the students)
- **Technology** (introducing the experiments, seeing them being built)
- **Experiments** (students build instrumentation)

## Impact

- 20 students annually have extensive experience in space science
- Encourages underserved students in science careers



Patricia Reiff gave a lecture on space weather and brought the dome to YES 2012.

website: <http://yesserver.space.swri.edu/>



# "SCIVIS" Space Camp

## Description:

- The SCIVIS (Space Camp for Interested Visually Impaired Students) is a one week residential program at Space Camp - Huntsville to introduce students to the science and technology of space travel, including STS and ISS.

Visually impaired student using Braille to control an ISS simulation



## MMS Connections:

- **Science** (instructing the students)
- **Technology** (using technology to run simulated missions)
- **Sounds of Space** (hearing the sounds of space data – eventually MMS data)

## Impact

- 150 students annually have extensive experience in space science
- Encourages underserved students in science careers
- MMS sponsors 4 students each year



website: <http://www.tsbvi.edu/space/>





# Sally Ride Festival (Rice)

## Description:

- **The Sally Ride Science and Engineering Festival** is a one day program to encourage middle school girls in science. Includes a street fair, a keynote by a woman astronaut, and two hands-on workshops – even an ozone-measuring balloon launch!

## MMS Connections:

- **Science** (instructing the students)
- **Technology** (exposing them to instrumentation)
- **Hands-on Activities** (getting girls excited about science)

## Impact

- 1100 middle school girls in 2012, plus teachers and parents
- Encourages girls in science careers

Peggy Whitson sent the girls a welcome from space in 2008, then in 2009 came in person!



website: <https://www.sallyridescience.com/festivals>



# NASA Space Day (Brownsville)

## Description:

- **NASA Space Day** is a one day program to encourage and educate Hispanic middle school students. Includes an evening family lecture, a keynote by a scientist, and six hands-on workshops or demonstrations. Leveraged with other NASA missions

## MMS Connections:

- **Science** (instructing the students about NASA science)
- **Technology** (exposing them to instrumentation)
- **Hands-on Activities** (getting underserved students excited about science)

## Impact

- 640 middle school students annually, plus teachers and parents
- Totalled nearly 1000 in 2012



website: <http://www.tsbvi.edu/space/>





# Master of Science Teaching (Rice)

## Description:

- **The Master of Science Teaching** is a non-thesis degree program to enhance teacher content knowledge and use of space in their classrooms

## MMS Connections:

- **Science** (instructing the teachers in the basics of space science)
- **Technology** (using technology to teach magnetism and other topics)
- **Mathematics** (teachers learn and practice math to use in science teaching)

## Impact

- 6-8 teachers take two 3-hour courses per year and do a project
- 25 alumni as of 2012
- Teachers do workshops at state and national meetings and help with public events



website: <http://space.rice.edu/MST>





# Heliospheric Ambassadors

## Description:

- **Heliospheric Ambassador Program** trains teachers in the science of the heliosphere and gives them tools to teach with. Leveraged – several missions share the training expense.

## MMS Connections:

- **Science** (instructing the teachers in the basics of heliospheric science)
- **Technology** (using technology to teach magnetism and other topics)

## Impact

- 30 teachers come for a one-week training by mission educators
- 90 alumni as of 2012
- Teachers do workshops at state and national meetings
- National information network
- 2013 – focus will be informal science educators



website: <http://cse.ssl.berkeley.edu/HEA/>



# “Discovery Dome” theater

## Description:

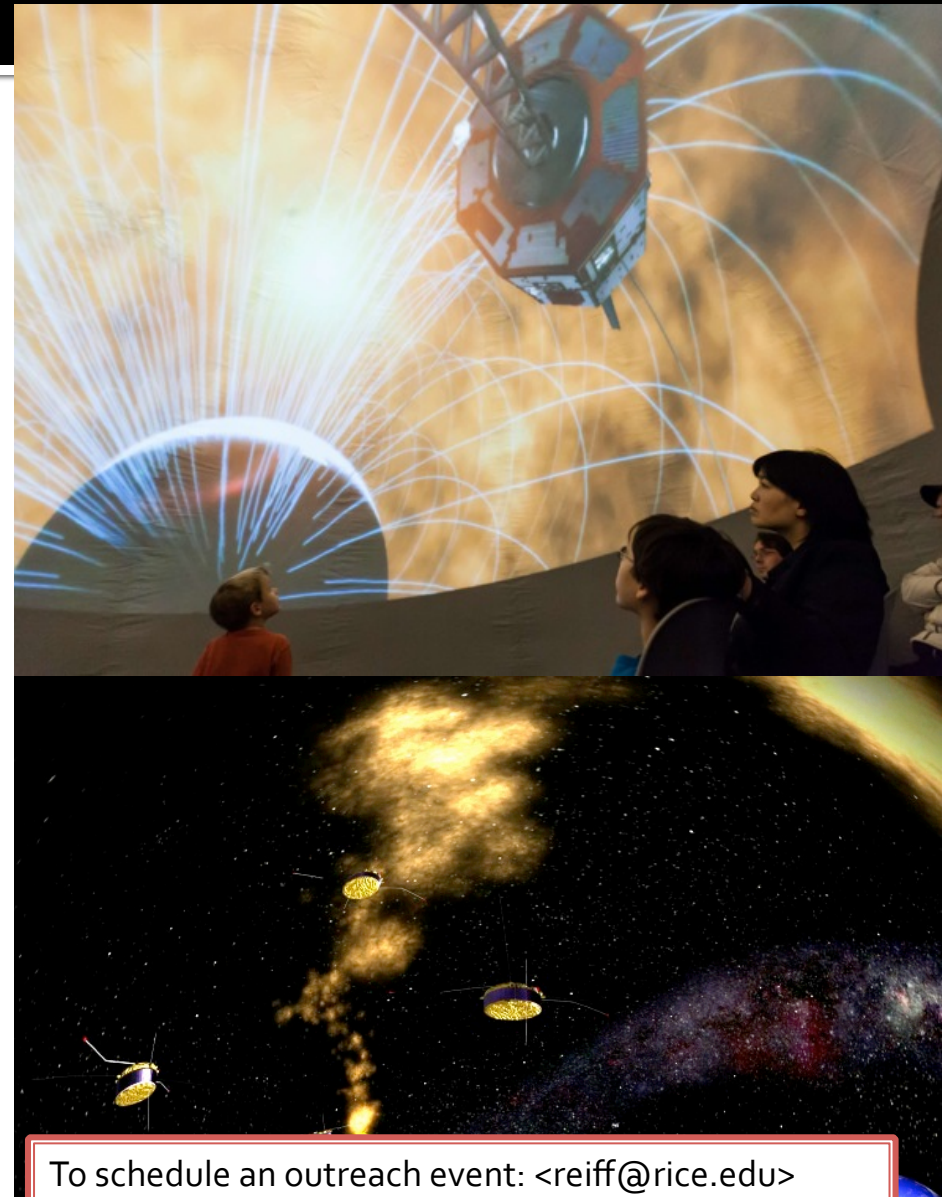
- **The Discovery Dome** is portable planetarium where students and the public can become engaged in earth and space science. It can show traditional star shows, but many shows feature heliospheric science.

## MMS Connections:

- **“Force 5” show** – (MMS is discussed in the space storms segment of the show)
- **“It’s About Time”** (space weather is a plot device in this space elevator show)
- **“Night of the Titanic”** (talks about solar influences on climate)
- **New magnetic field show** (in development now, with forum support)

## Impact

- Over 180 domes in the field
- Over 200,000 reached in 2012
- Shows are also shown on other planetariums







# Public Events

Events

## Description:

- MMS participates in many outreach events for the public.
- The Discovery Dome is an engaging way that the public learn about MMS Science

## MMS -co sponsored events:

- USA Science Festival – (featured the MMS banners and lego model )
- World Science Festival
- Texas Science and Engineering Festival
- Exploration Station
- SpaceUP Houston
- Sun-Earth Day

## Impact

- Over 180 domes in the field
- Over 200,000 reached in 2012
- Also shown on other planetariums

To schedule an outreach event: <reiff@rice.edu>







# Public Lectures

## Description:

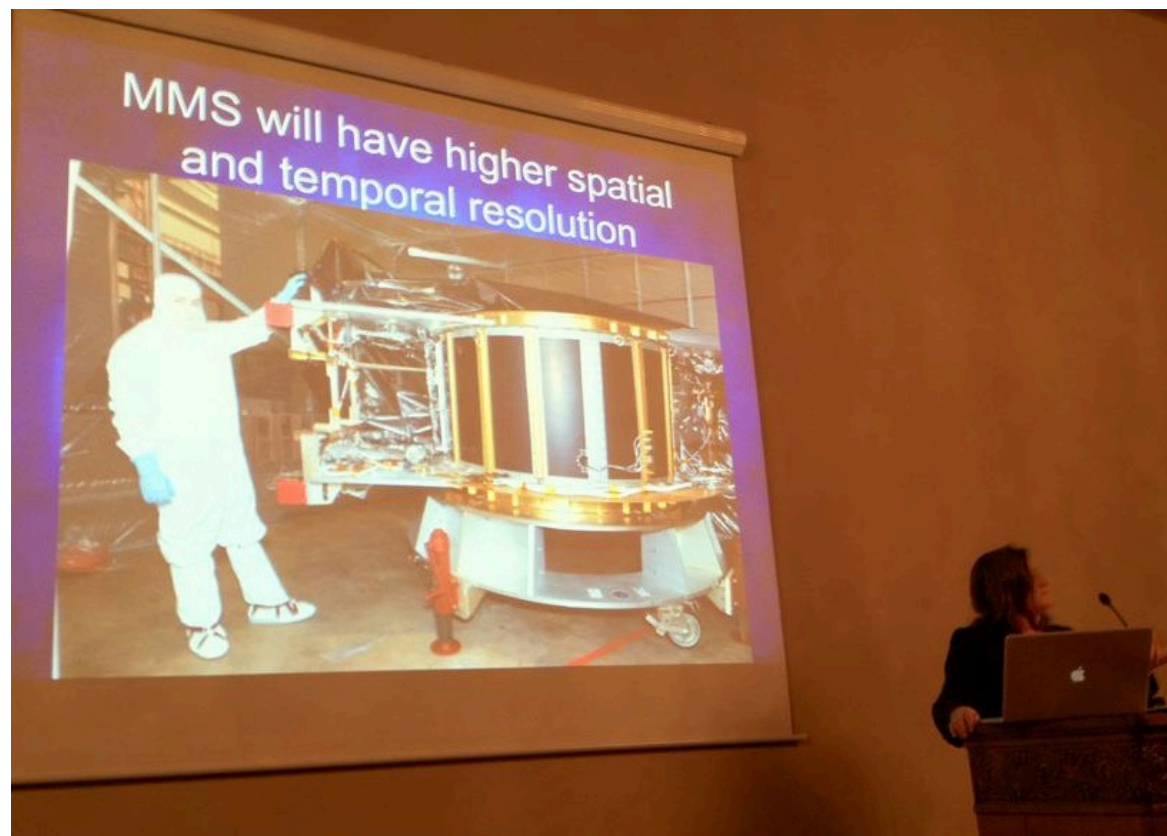
- MMS participates in many lectures open to the public.
- I know mine... please send me yours!

## MMS featured talks:

- **Birkeland Lecture** – (sponsored by the University of Oslo, Norwegian Academy of Science) (can be downloaded at [mms.rice.edu](http://mms.rice.edu))
- **Departmental Colloquia and Seminars**
- **Keynote Speeches** (ham clubs, etc.)
- **Eclipse interviews**
- **Sun-Earth Day activities, talks**

## Impact

- Many featured talks
- Over 4,000 reached in 2012



Let me know your activities: [<reiff@rice.edu>](mailto:<reiff@rice.edu>)



# "Space Weather" Software

## Description:

- The Space Weather DVD-Rom high-lights NASA heliospheric science. Designed to be museum kiosk soft-ware, it can also be used on personal computers. Many images that appear in the software are "near-real time".

## MMS Connections:

- Images (near-real time)
- Illustrations (science content)
- Visualizations (animations)
- Videos (interviews, mission clips)
- Activities (aligned with standards)

## Impact

- Discs: 30,000/ year: 240,000 total
- 'e-teacher' email user list – over 7500 active users
- 'spacemus' and 'spaceup' lists adds another 1800 active users

**SPACE WEATHER**

EXPLORING SUN-EARTH CONNECTIONS

VERSION 1.0

© 2008 Rice University • Distributed by Space Weather, Inc.

**SPACE WEATHER**

SPACE UPDATE UPDATE DATA

SUN EARTH FORECAST MISSIONS PLANETS AURORA

MISSIONS : MMS

1 - The Magnetospheric Multiscale Mission (MMS) will explore magnetic reconnection and its effects on the Earth's environment by means of four spacecraft flying in formation. The team includes both experimenters, theorists, modelers, and education experts. The mission is in development now with a launch scheduled for August, 2014. This shows the orbit of the spacecraft through the Earth's magnetosphere.

Educational materials are being developed to show why four spacecraft are needed to separate space and time. In addition, MMS will use sonification tools so that vision impaired learners can still 'see the invisible' - see the MMS link at Rice University for the most up to date educational materials.

MMS MISSION 1/2

MMS Team, led by J.L. Burch, SWRI  
EPO lead: P.H. Reiff, Rice University

Download from: <http://MMS.rice.edu>

<http://space.rice.edu/MMS/>





# EPO Website

## Description:

- **MMS outreach site** links to images, activities, videos blogs, etc.
- faster, more capable, more storage, videos

## MMS Connections:

- **Instruments** (described by the scientists)
- **Science**(science of MMS)
- **Careers** (why did you get into science?)
- **Videos** (interviews, mission clips)

## Impact

- Available to post material quickly

# MAGNETOSPHERIC MULTISCALE

A SOLAR-TERRESTRIAL PROBE

SOLVING MAGNETOSPHERIC ACCELERATION, RECONNECTION AND TURBULENCE

- Home
- Mission News
- Outreach News
- About the Mission
- About the Instruments
- What is Reconnection?
- Activities for Students ▶
- Materials for Teachers
- Fun and Games ▶
- Multimedia
- Online Resources
- Space Weather Resources

facebook

facebook

FOLLOW TRIGGER ON

Magnetospheric Multiscale Mission Science Working Team - March 2011

**MMS** will use a four-spacecraft suite to study reconnection, the most important process in the Earth's magnetosphere and in astrophysical objects such as solar flares. [Rice](#) will be leading the EPO for this mission.

**COMPONENTS OF THE MMS EPO PROGRAM INCLUDE**

- + **Micro to Macro** workshops, held every other summer (most recently 2006) at Rice University, teaching about Cluster, MMS and other ways we use measurements in spacecraft data analysis.
- + **YES** (Young Engineers and Scientists) workshop at SWRI in San Antonio
- + **SMART** workshops for students at the University of New Hampshire
- + **Space Camp for the Blind**, sponsored by the Texas School for the Blind and Visually Impaired. We will be creating data sonifications for the blind, with a sample kiosk this year
- + **Sally Ride Science Festivals**. MMS will be a major sponsor of the 2007 festival at Rice, and also was for the 2006 festival

**MMS LINKS OF INTEREST**

- + **MMS-SMART** website at SWRI (includes links to fact sheet, proposal, and other information)
- + **Movie** showing how four spacecraft can determine the orientation and motion of a boundary by using a weather

<http://mms.rice.edu>





# Space Weather Predictions

## Description:

- MMS space weather prediction uses ACE to predict Kp, AE, Dst
- One and three-hour ahead in real time

## MMS Connections:

- Triggers (can help identify upcoming events, SITLs)

## Impact

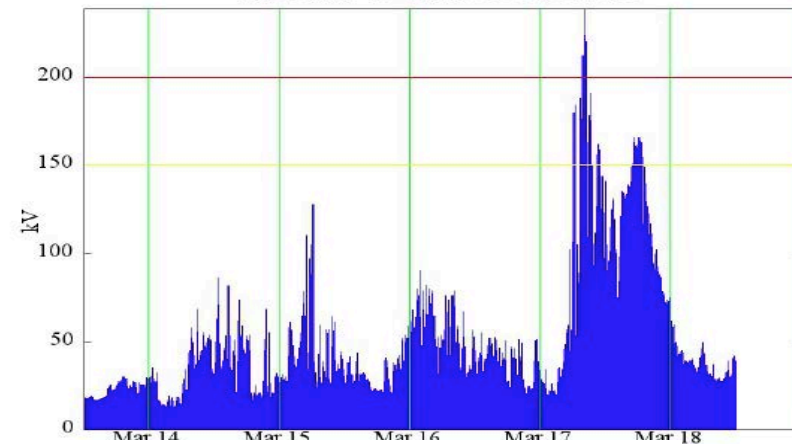
- Email notices to "spacalrt" subscribers
- 884 (free) subscribers

<http://mms.rice.edu/realtime/forecast.html>

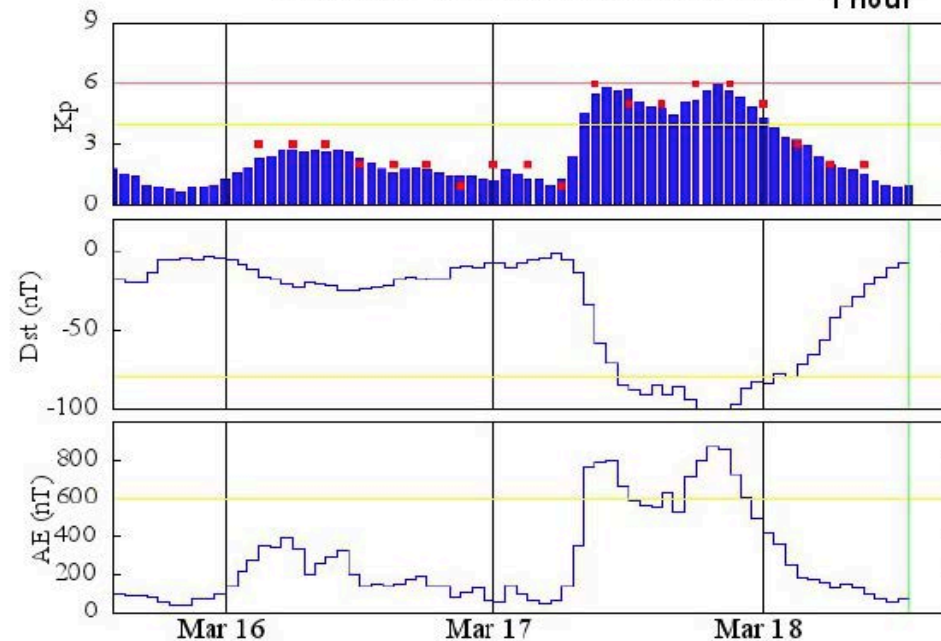
to subscribe: spacalrt-subscribe@mailman.rice.edu

## Boyle Index (Asymptotic Polar Cap Potential)

Mon Mar 18 12:14:00 UTC 2013



Mon Mar 18 12:13:00 UTC 2013 1 hour





# "NASAMMS" YouTube Channel

## Description:

- **MMS Multimedia** highlights the MMS mission and its instruments through interviews with MMS scientists. Each instrument team will describe their instrument, how it works, and how they got involved in science

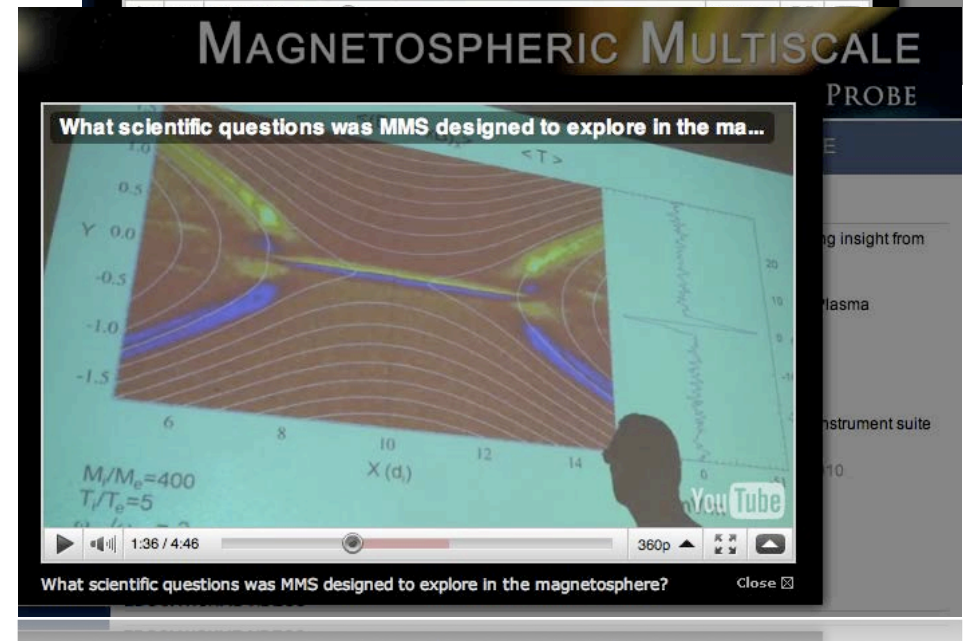
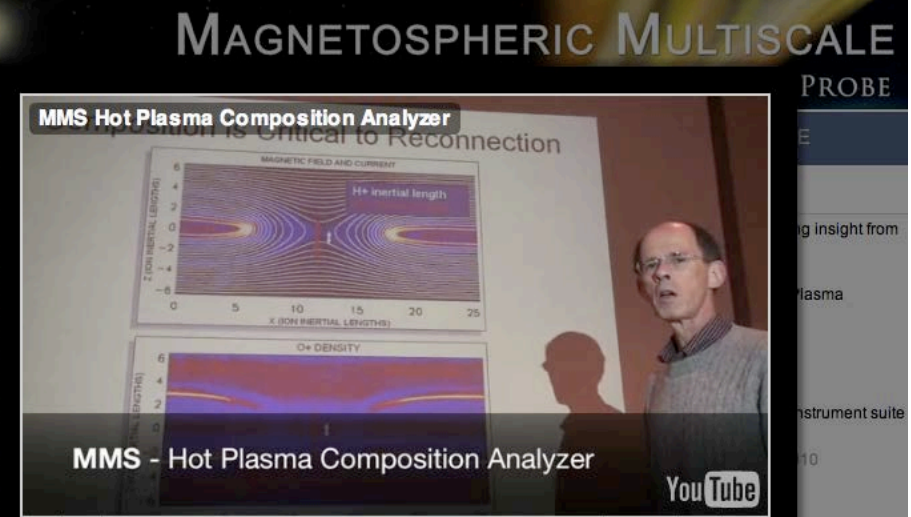
## MMS Connections:

- **Instruments** (described by the scientists)
- **Science** (science of MMS explained)
- **Careers** (why did you get into science?)
- **Videos** (interviews, mission clips)

## Impact

- Thousands of views already: 9134
- 39 videos so far, more wanted!
- 87 subscribers so far

Available from server: <http://MMS.rice.edu>  
Or <http://www.youtube.com/NasaMMS/>







# Social Media

## Description:

- MMS facebook page links to images, activities, blogs, etc
- @DiscoveryDome and @TriggerMMS twitter feeds

## MMS Connections:

- Instruments (described by the scientists)
- Science (science of MMS explained)
- Careers (why did you get into science?)
- Videos (interviews, mission clips)

## Impact

- Available to millions
- Many “likes” – more coming!

<http://www.facebook.com/MagMultiScale>

<http://www.twitter.com/#!/TriggerMMS>



**MMS (Magnetospheric Multiscale)**  
Community · Greenbelt, Maryland · Edit Info

Wall MMS (Magnetospheric Multi... · Everyone (Most Recent)

Share: Status Photo Link Video Question

Write something...

MMS (Magnetospheric Multiscale)  
Bob Ergun talking about the Trigger process. Data from the four spacecraft are combined so that the most exciting data are sent down...

---

**Trigger MMS**  
@TriggerMMS Houston  
Mascot for the NASA MMS Mission  
(<http://mms.rice.edu>).  
<http://mms.rice.edu/tetrahedron>

Edit your profile →

Tweets Favorites Following Followers Lists

**TriggerMMS** Trigger MMS  
At MMS team meeting. The team is discussing how to decide which data are downlinked to the ground -they use Triggers!  
[pic.twitter.com/YphEQ8Q](http://pic.twitter.com/YphEQ8Q)  
3 minutes ago

**TriggerMMS** Trigger MMS  
Big solar storm going on now! If you are in the dark and in northern latitudes, go out and look! #NASA Here's our site:  
[t.co/MJmL9YEK](http://t.co/MJmL9YEK)  
21 hours ago

**TriggerMMS** Trigger MMS  
At the #NASA MMS science team meeting in New Hampshire



# Mascot "Trigger"

## Description:

- MMS mascot: Trigger
- Directly related to the mission
- Gets the mission out into many social media opportunities
- Photographed in various sites (balloon flights, etc)

## Impact

- Captures attention
- Popular following
- Mascots help each other



Variance Burst Triggers  
as Short Scale Triggers

• Small L	Big L
• Small V	Perhaps No
• Big V	Probably Perhaps

SUCCESSFUL  
TRIGGER THRESHOLDS CANNOT  
BE INDEPENDENT OF  $\langle X \rangle$

Trigger Happy, or Gun Shy?







# Mission Handouts

## Description:

- Tetrahedron and other handouts
- Used in various teacher training events
- Also various magnetism activities

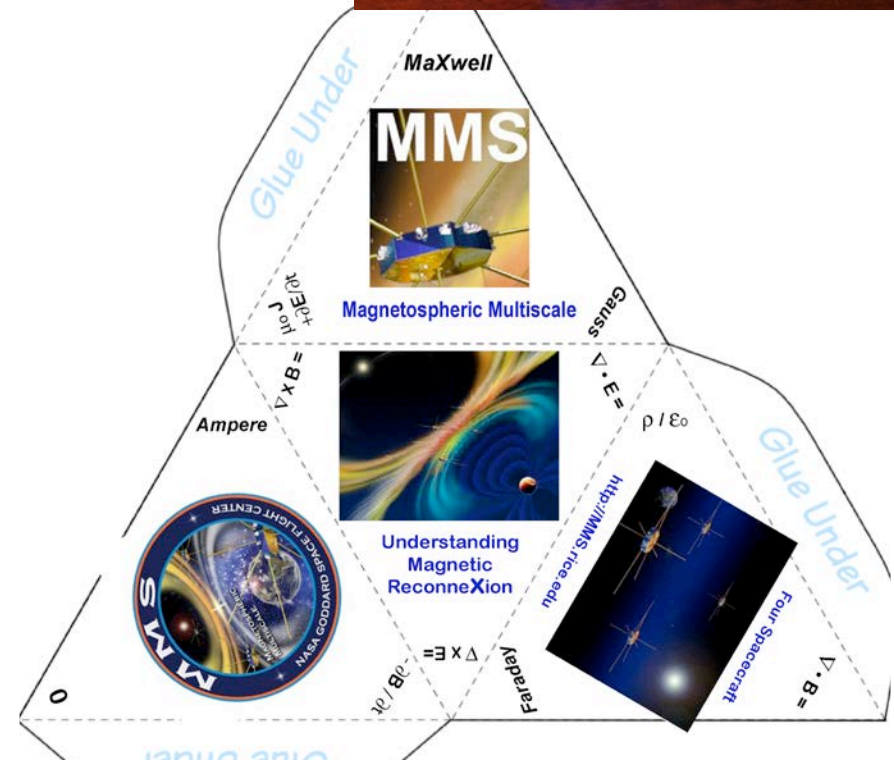
## MMS Connections:

- Tetrahedron (teaches the formation and the geometry)
- Maxwell's equations (on the corners of the tetrahedron)

## Impact

- Captures attention
- Paper tetrahedron model is inexpensive
- Free downloads

<http://MMS.rice.edu/tetrahedron/>





# Mission Metrics

## Description:

- MMS submits annual performance metrics
- “OEPM” System for metrics input (need graduate student info)

## MMS Activities:

- Student programs (short and long term programs)
- Teacher Programs (MST, HEA, workshops)
- Public and Social Media Programs

## Impact

- 55,000 direct and indirect users were submitted for 2012
- 2013 will be another banner year! (opens soon...)

The screenshot shows the NASA Office of Education website interface. At the top left is the NASA logo. To its right is the text "OFFICE OF EDUCATION". Below this are navigation tabs: "ABOUT US", "EDUCATION CALENDAR", "NASA EDUCATION", "FAQ", and "HELP". A "Perform" button is visible on the far right. Below the navigation is a "Welcome" section for "Patricia Reiff" with a "Switch Project" button and a year selector set to "2011". The main content area lists several menu items: "Administrative Tasks", "Dashboard", "Profiles / Awards" (with sub-items "Profile Search" and "Awards Pending Approval"), and "Scanned Survey Upload". Below these are two sections for "MMS: Master of Science Teaching Degree (FY2011)" and "MMS: Teacher Workshops and Presentations (FY2011)", each containing links for "Summary Data Collection Forms", "Surveys", and "Reports".

Projects linked from: <http://MMS.rice.edu/>