Geospace Sciences at NSF
Status and Opportunities

Vladimir Papitashvili
Acting Head, Geospace Section (also with Antarctic Astrophysics & Geospace Sciences Program)

Geospace Program Directors:
Kile Baker, Janet Kozyra, Therese Moretto Jørgensen, Ilia Roussev, and Anne-Marie Schmoltner

NSF Directorate for Geosciences

- Earth Sciences
- Ocean Sciences
- Polar Programs
  - Antarctic Geospace

Paul Shepson

Division of Atmospheric and Geospace Sciences

- Atmosphere Section
- NCAR and Facilities Section (High Altitute Observatory)
- Geospace Section

Programs:
- Aeronomy
- Geospace Facilities
- Magnetospheric Physics
- Solar–Terrestrial Research
- Space Weather Research

AGS Budget: about $250M

GS Budget: ~$43M in FY 2014

Staff Changes

Departures: Rich Behnke & Bob Robinson have recently retired

New arrivals:

Magnetospheric Physics

Janet Kozyra

Geospace Facilities

Kile Baker (helping temporarily)

Aeronomy

Anne-Marie Schmoltner

Solar-Terrestrial Research

Ilia Roussev

Space Weather Research

Therese Moretto Jørgensen

GS Research Programs

- **Aeronomy (AER)** Budget: $9.2M
  - Program Director – Anne-Marie Schmoltner
  - About 100 proposals per year, about 1/3 funded
  - Home for CEDAR
- **Magnetospheric Physics (MAG)** Budget: $6.8M
  - Program Director – Janet Kozyra
  - Around 70 proposals per year, 1/5 funded
  - Home for GEM
- **Solar Physics (STR)** Budget: $7.3M
  - Program Director – Ilia Roussev
  - Around 80 proposals per year, 1/5 funded.
  - Home for SHINE
- **Space Weather Research (SWR)** Budget: $5.7M
  - Program Director – Therese Moretto Jørgensen
  - Every other year: ~20 CubeSat proposals, 2-3 funded
  - Faculty Development in Space Science program
  - AMPERE-II, SuperMAG, SuperDARN, and CCMC
- **Geospace Facilities (GSF)** Budget: $14.0M
  - Program Director – Kile Baker
  - AMISR, Arecibo, Jicamarca, Millstone Hill, Sondrestrom, Lidars

CEDAR/GEM/SHINE Competitions

CEDAR FY 2015

- 55 proposals (44 independent projects) submitted
- 9-10 to be funded (annual cumulative funding ~$3.0M)
- Next competition deadline is July 2015

GEM FY 2015

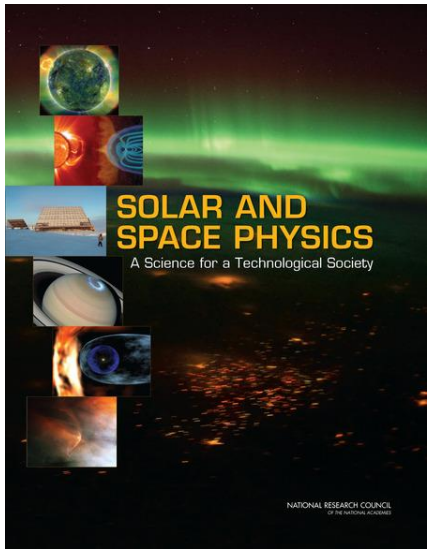
- 59 proposals (45 independent projects) submitted
- 6-7 to be funded (annual cumulative funding ~$2.5M)
- Next competition deadline is mid-October 2015

SHINE FY 2015

- 55 proposals (45 separate projects) submitted
- 8-9 to be funded (annual cumulative funding ~$3.0M)
- Next competition deadline is mid-August, 2015

2013 Decadal Strategy for Solar & Space Physics (Heliophysics)

- DRIVE would provide high leverage to current and future space science research investments.
- Five DRIVE components are "basic building blocks" in which NSF/Geospace Section already invests… and will continue to invest!



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- **D**iversify observing platforms with microsatellites and midscale ground-based assets.
- **R**ealize scientific potential by sufficiently funding operations and data analysis.
- **I**ntegrate observing platforms and strengthen ties between agency disciplines.
- **V**enture forward with science centers and instrument and technology development.
- **E**ducate, empower, and inspire the next generation of space researchers.

Diversify observing platforms with microsatellites and midscale ground-based assets

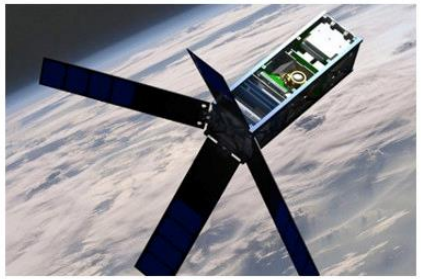
- **CubeSat Instrumentation Program**
  - Two new Cubesat projects are at work: QBUS and ELFIN (NASA with NSF's participation)
  - NSF's Cubesats: ExoCube and Firebird-II were launched January 31, 2015; CADRE is scheduled for launch in 2015

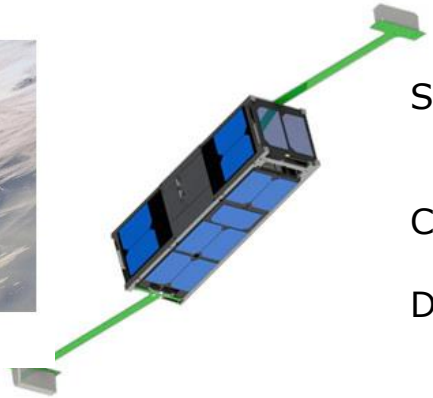
FIREBIRD

University of New Hampshire & Montana State University
Relativistic electron micro-bursts in the Van Allen belts
High time-resolution energetic electrons
Multi-spacecraft mission - two identical 1.5U CubeSats

CADRE

Univ. of Michigan – Ann Arbor
Thermospheric dynamics during ionospheric storms
Wind Ion Neutral Composition Suite by a 3U CubeSat





ExoCube (CP 10)

Scientific Solutions, Inc, U. Wisconsin & California Polytechnic State Univ.
Composition of the Upper Atmosphere
Densities of 4 ion and neutral species by a 3U CubeSat

- CubeSat proposals last deadline May 12, 2014; 21 projects; expecting 2 awards in FY15
- NRC Study – NSF jointly with NASA: "Achieving Science Goals with CubeSats"

Realize scientific potential by sufficiently funding operations and data analysis

Geospace Facilities Program

- **Program Director -- Kile Baker** (helping; replacement is underway)
- Six incoherent scatter radar sites (five awards:~$12M)
- LIDAR Consortium (six institutions: ~$2M)
- Miscellaneous facility-related awards

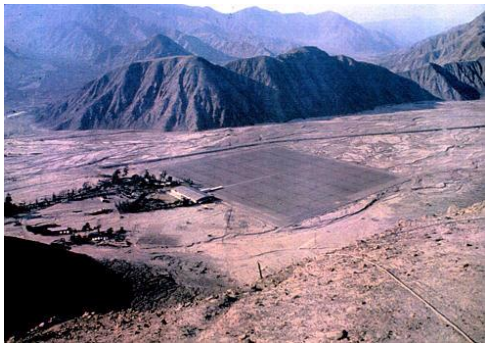
RISR-North

PFISR

Sondrestrom

Millstone Hill

Arecibo



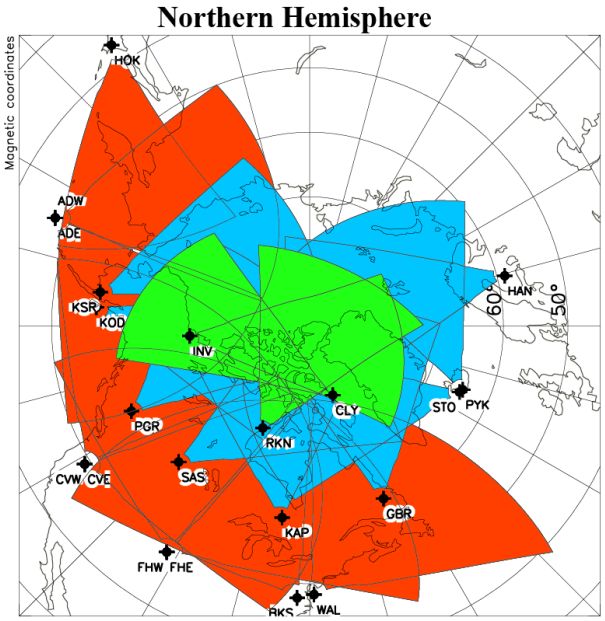
Jicamarca

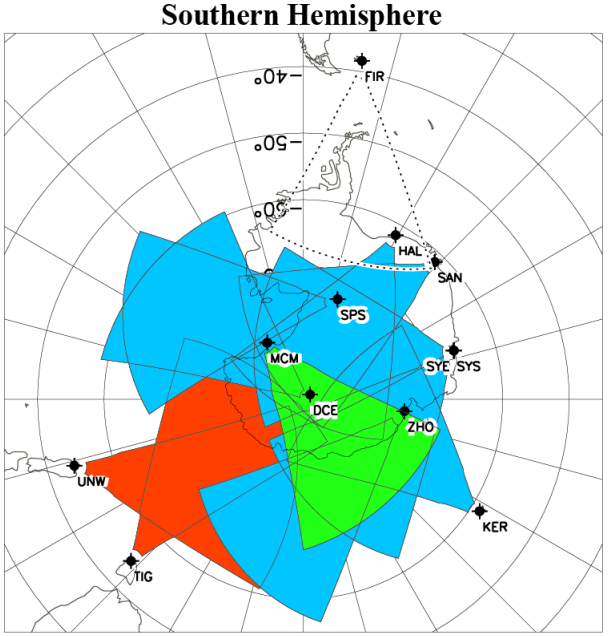
Integrate observing platforms and strengthen ties between agency disciplines

SuperDARN continuation:

- All 11 US Northern Hemisphere radars in one award:
  - Extended consortium: VT, JHU/APL, UAF, Dartmouth
  - Total award $4.7M
- Two NSF-funded radars are operational in the Antarctic:
  - South Pole and McMurdo
  - Total award $1.2M

SuperDARN is a worldwide collaboration of 34 radars funded by 11 different countries!





Polar Cap | High-Latitude | Mid-Latitude

SuperDARN
Super Dual Auroral Radar Network

Virginia Tech
Invent the Future

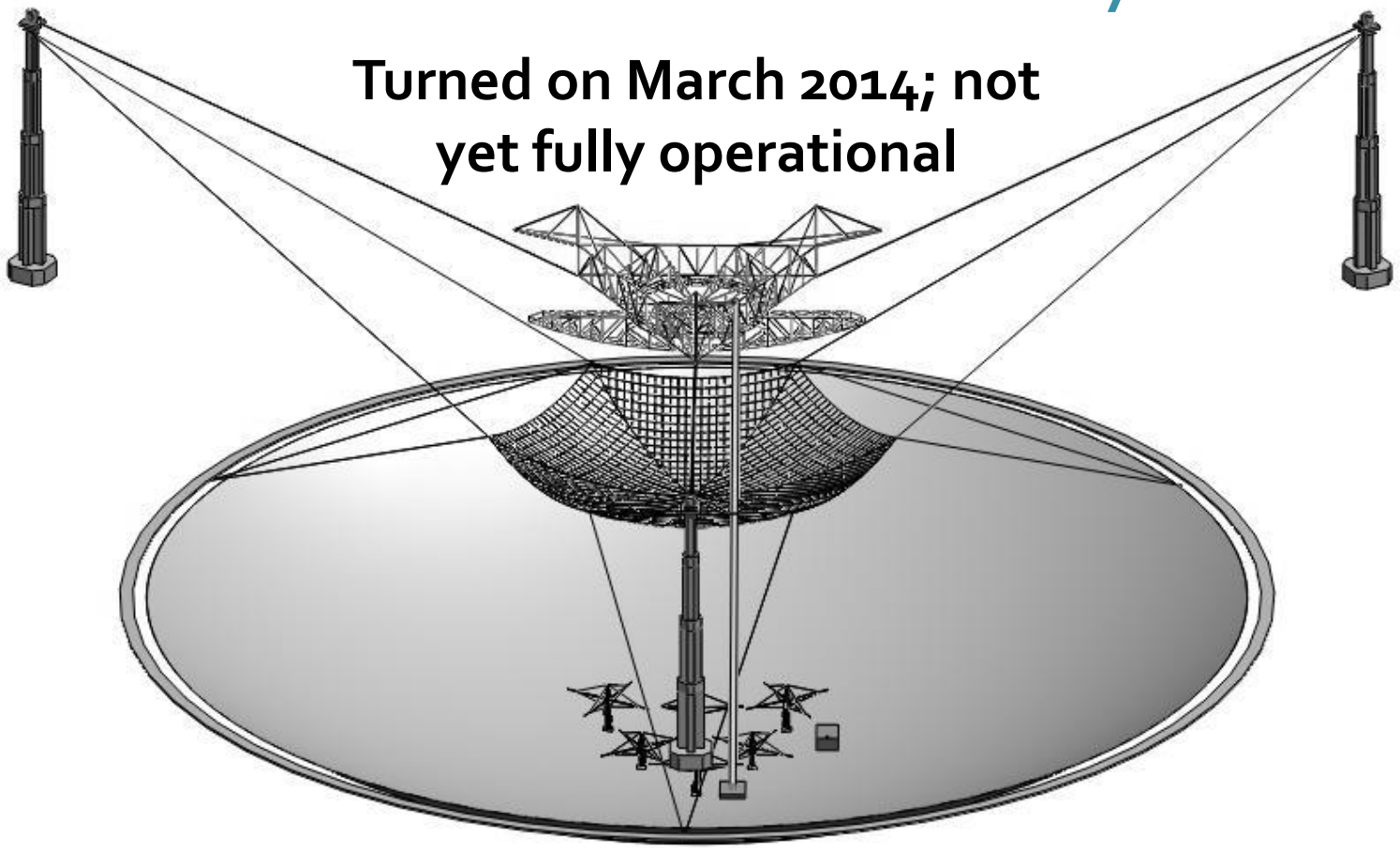
Thayer School of Engineering at Dartmouth

The Johns Hopkins University

UAF University of Alaska Fairbanks

New Ionospheric Heater is finished for the Arecibo Observatory

Turned on March 2014; not yet fully operational

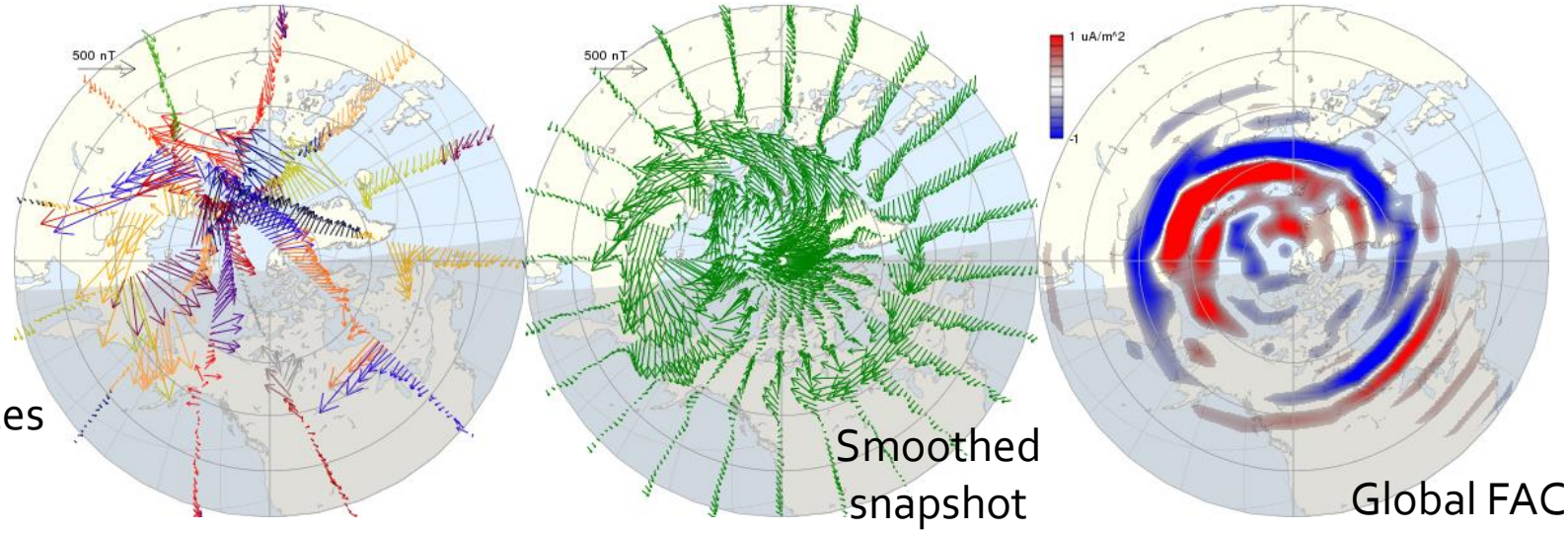


Broad interest at NSF with Science & Technology Centers ($4M/yr) and Mid-Scale Science Infrastructure ($10M-50M)

Venture forward with science centers and instrument and technology development

- **AMPERE- II**
  - $5.1M Award for continuation of AMPERE and installation on Iridium NEXT

Global Space Weather Research Facility
(every ~10-min snapshots of both Polar Regions)



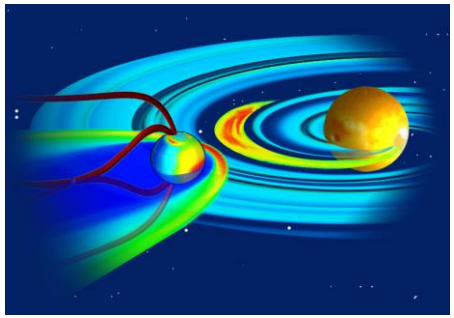
Measured magnetic disturbances

Smoothed snapshot

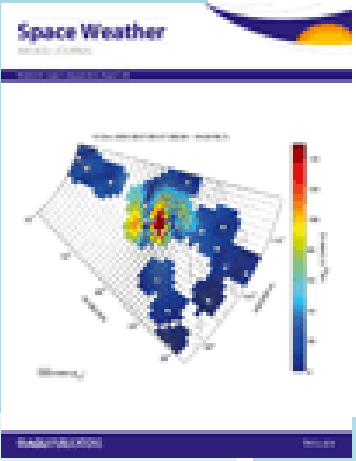
Global FAC snapshot

- **SuperMAG**
  - $450K Award for continuation of SuperMAG service to Geospace communities

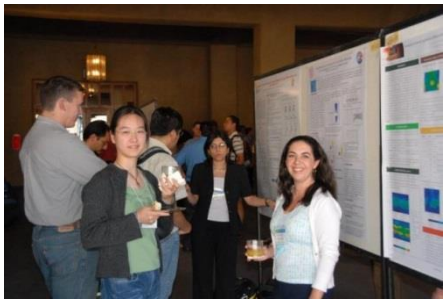
Educate, empower, and inspire the next generation of space researchers



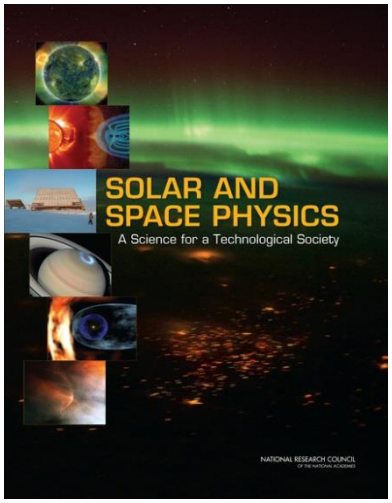
- **Faculty Development in Space Sciences: New Biennial Solicitation**
  - Proposal deadline was Jan 27, 2014
  - 22 proposals received
  - Two selected for implementation (Univ. of Minnesota and Univ. of Illinois at Urbana Champaign); searches completed and awards are out
- **Continue efforts to train the next generation of space scientists** through proactive efforts within the GEM, CEDAR, and SHINE Programs
- **Continue to support Research Experiences for Undergraduates programs and sites** through both the formal and informal programs at the universities, laboratories, centers, and facilities



- **Support early career scientists through the NSF CAREER Awards program**
- **Continued supporting the AGU/Space Weather Journal and sponsor Geospace workshops,** such as Space Weather Week and the Space Weather Enterprise Forum



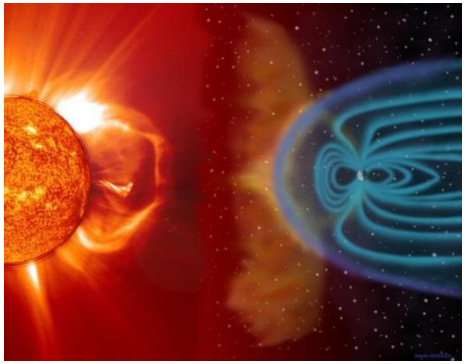
Key Science Goals of the Decadal Survey



1. Determine the origins of the Sun's activity and predict the variations in the space environment.
   NSF/Geospace Section: ~$7.5M (STR)
2. Determine the dynamics and coupling of Earth's magnetosphere, ionosphere, and atmosphere and their response to solar and terrestrial inputs.
   NSF/Geospace Section: ~$25M (all programs)
3. Determine the interaction of the Sun with the solar system and the interstellar medium. *NSF/Geospace funds:* **~$0.5M (STR & Antarctic Geospace)**
4. Discover and characterize fundamental processes that occur both within the heliosphere and throughout the Universe. ***NSF/Geospace Section: ~$10M***

NCAR/High Altitude Observatory:
Mauna Loa Solar Observatory
Community Spectropolarimetric Analysis Center
Thermosphere Ionosphere Global Circulation Models
~$5.5M in Geospace Research & Facilities

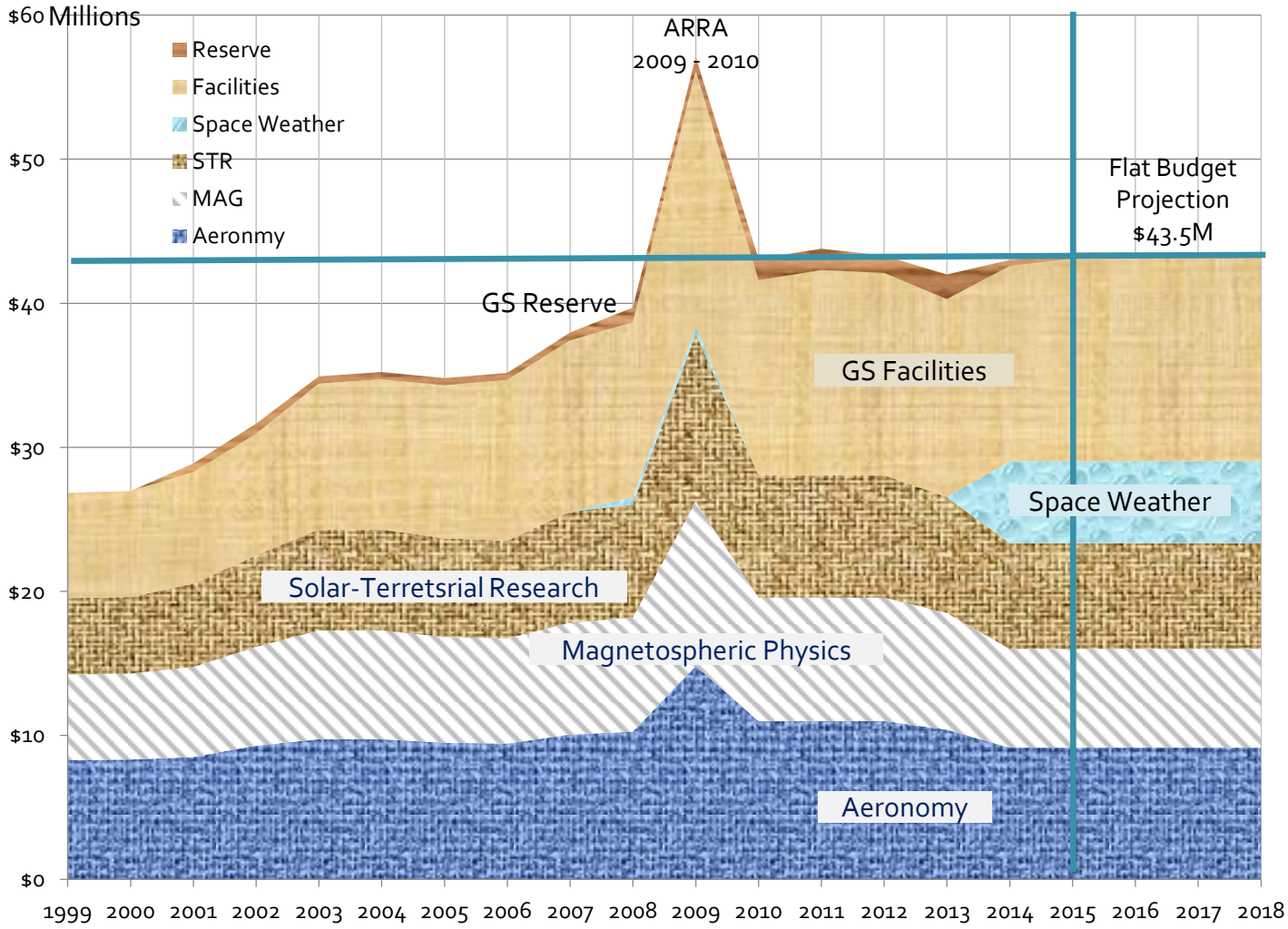
NSF Antarctic Geospace Research Program
~$3.5M in Geospace Research & Instrumentation



Geospace Section Budget Profile 1999-2015

U.S. Bureau of Labor Statistics' Inflation (http://data.bls.gov/cgi-bin/cpicalc.pl)

$1.00 in 1999 equals to $1.41 in 2015



Portfolio Review

- ***This review is motivated in part by priorities highlighted*** for the Geospace scientific community ***in*** the National Research Council's ***Decadal Survey: Solar and Space Physics*** – *A Science for a Technological Society* (2013) ***and by the current challenging outlook for the U.S. Federal budget***.
- ***Examine the balance across the entire portfolio of activities*** supported by NSF's Geospace Section (GS) within the Division of Atmospheric and Geospace Sciences (AGS).
- ***Ensure that GS investments are guided by and aligned with the above-cited Survey recommendations.*** These recommendations should encompass not only observational capabilities, but also theoretical, computational, and laboratory capabilities, as well as capabilities in research support, workforce, and education.
- ***The Portfolio Review will consider not only what new activities need to be introduced or accomplished, but also what activities and capabilities will be potentially lost in enabling these new activities and discontinuing current activities.***
- .

GS Portfolio Review Timeline

- ***PR Committee membership (13 members; January 2015)***
- ***Criteria and strategy (January-February 2015)***
- ***PR Committee Charge and Formation (February 2015)***
- ***PR Teleconferences (March 4, 16, and 31, 2015)***
- Collect data and begin assessment (February – March, 2015)
- First PR Committee in-person meeting at NSF (April 6-7, 2015)
- Seeking community input via emails and workshops (April – June 2015)
  see (**http://www.nsf.gov/geo/ags/geospace-portfolio-review-2015**)
- Visiting selected facility sites (tentative; April – June, 2015)
- PR Committee drafts their report (June - August 2015)
- Second PR Committee in-person meeting at NSF (August 2015)
- GS Portfolio Review Report to GEO/Advisory Committee (Sep 2015)
- GEO/Advisory Committee reviews the GS/PR Report (October 2015)
- GS programs response to the PR Committee Report (November 2015)
- Final (revised if necessary) GS/PR Report released (December 2015)

Questions?

Thank you!