Geospace Science Update

Ilia I. Roussev

Solar-Terrestrial Research

NSF/AGS/GS

Outline

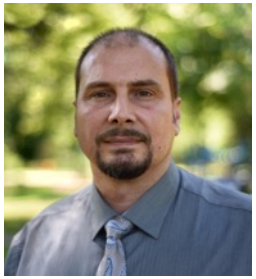
- Section Update
  - Staffing
- FY18 Quick Review
  - Program budgets
  - Science Highlights
- FY19 Activities
  - Budgets and the 10 Big Ideas
  - Facilities Update
  - Mid-scale and DASI
  - New CubeSats
  - HDR and GEO-CI
  - FDSS
  - SWORM and NSB

AGS and the Geospace Section

AGS Division Director
Anjuli Bamzai

Section Head
Michael Wiltberger

Space Weather Research
Irfan Azeem



Solar Terrestrial Research
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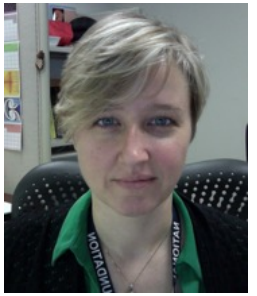


Geospace Facilities
Carrie Black

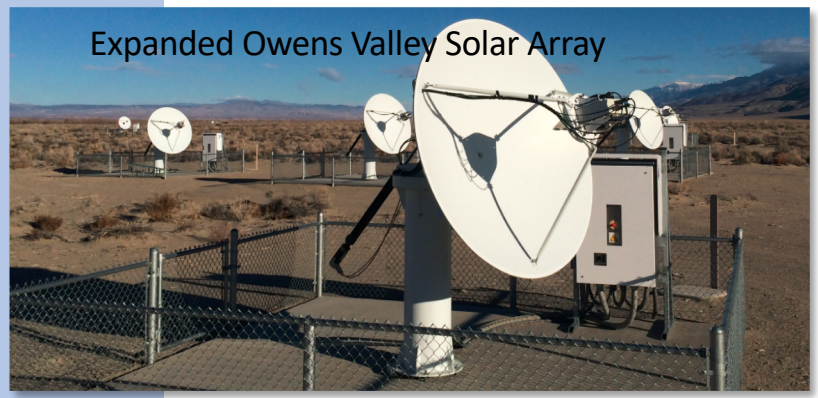
Magnetosphere
Lisa Winter

Aeronomy
Roman Makarevich

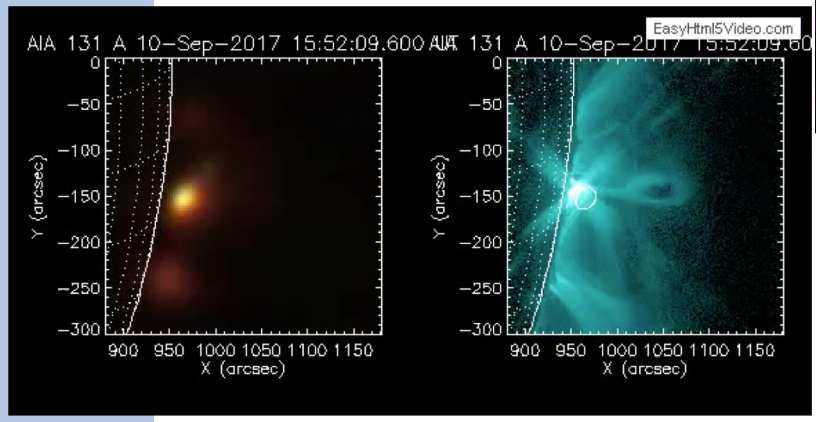
Expert
John Meriwether

Expert
Sunanda Basu

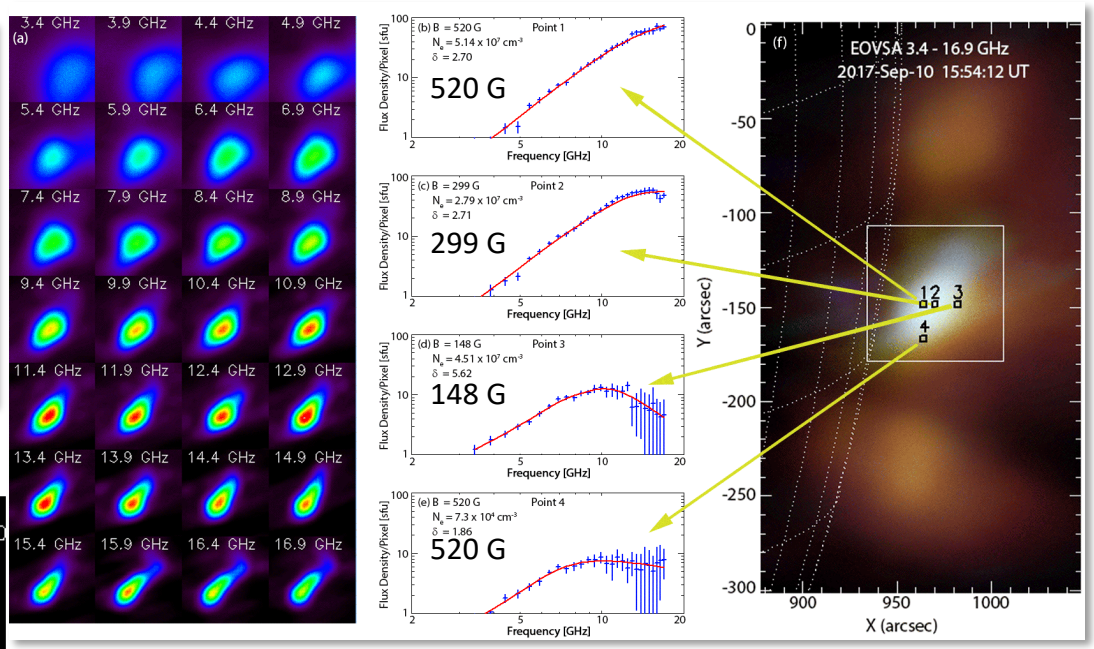
EOVSA X class flare obs



>100 frequencies, 2.5-18 GHz, 1-s cadence



Multi-Frequency Movie



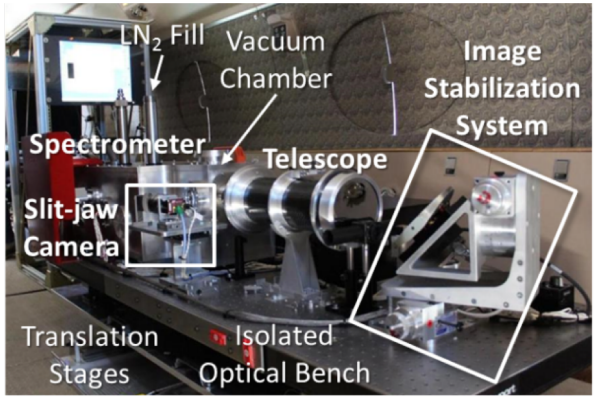
Imaging spectroscopy at a single time, 15:54 UT:
(a) Individual images at 28 frequencies
(b-e) Spectra from locations 1-4, showing position-dependence
Lines are multi-parameter fits from theory, including B field
(f) Frame from multi-frequency movie used to locate spectra

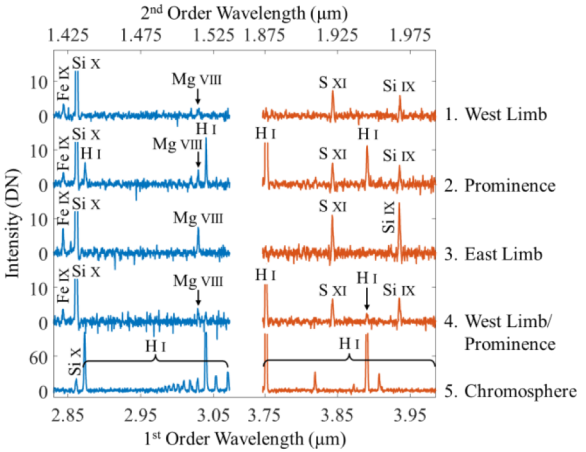
Gary et al. (2018), *ApJ*, ***863***, *83*

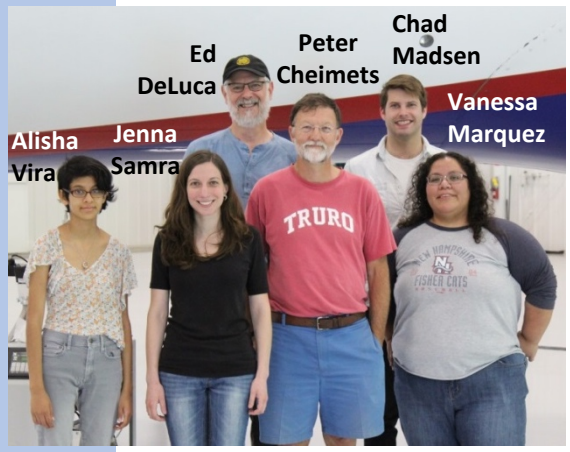
Air Spec 2017 & 2019

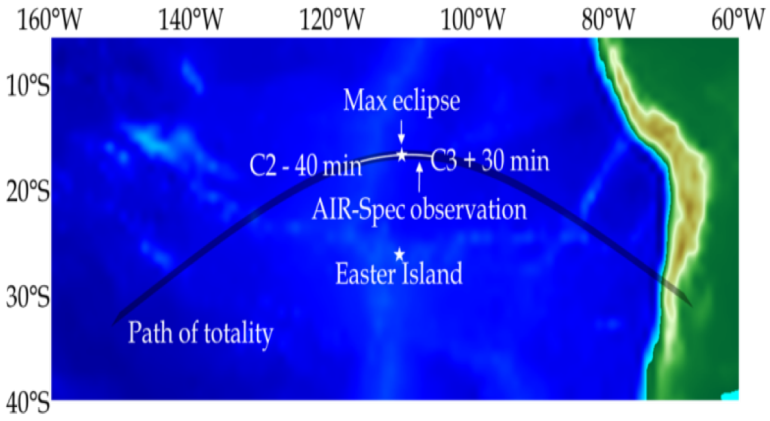
The 2017 eclipse flight was fully successful.

- AIR-Spec observed its **5 target lines** & more
  - **First detection of Fe IX**, 2.844/1.427 µm
- 1 chromospheric and **4 coronal positions**
- **Radial intensity gradient** measurements
  - Info on line excitation processes
- **Line-of-sight velocity** measurements









The 2019 eclipse observation will feature:

- *Improved SNR*
  - 15-20x reduction in dark background
- *Improved pointing stability*
  - 20x reduction in jitter
- *Improved operability*

SH11C-2889	Monday 08:00 – 12:20	DeLuca et al.	AIR-Spec 2.0 Plans for the July 2 2019 South Pacific Eclipse
SH11C-2890	Monday 08:00 – 12:20	Menzel et al.	Upgrading Stability of an Airborne Infrared Spectrometer (AIR-Spec) for Coronal Observations
SH11B-07	Monday 09:30 - 09:45	Madsen et al.	Characterization of Coronal Plasma with Coordinated IR and EUV Observations of the 2017 Eclipse
SH23A-04	Tuesday 14:25 - 14:40	Samra et al.	Results from the 2017 Eclipse Observation of the Airborne Infrared Spectrometer

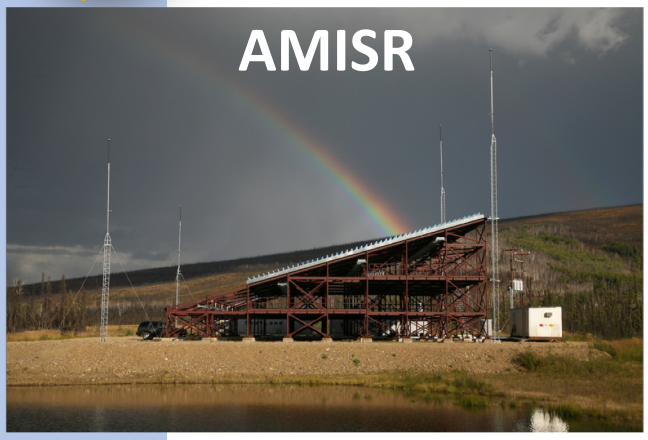
Quick Facts about FY18

- Overall spending in section was $50.3M up 4% from FY17
  - Support for CubeSat program from AGS Division Director
  - Funds from division to pay down mortgage rates

AER	MAG	STR	SWR	FAC
12.6M	7.9M	8.3M	3.5M	17.9M

  - These reflect “loans” from SWR to AER (1.5M) and FAC (2.7M)
- Additional facts about AER, MAG, STR, SWR grants in 2018
  - 124 Actions resulting 56 new awards with a 45% success rate
  - ~70% of new awards made as standard grants
  - ~25% average mortgage rate for the section

Facility Update



- NSF remains committed to the continued operation of this important facility
  - Beginning discussions with awardee resulting from recent solicitation
- A new generator was purchased for RISR low power continuous operations

- UCF – UMET – YEI consortium to operating AO for 5 years
  - Participated in recent World Day campaign
  - HF heater tests successful
- OMB allowing 5 years to spend disaster relief funds
  - Line feed workshop made design recommendations

- After 35 years of exemplary science accomplishments ISR operations ended on 3/31/18
- Future of the site will be based upon PR recommendations, environmental and engineering assessment, and interactions with the GoG

NSF and AGS Budgets

- Funding and operations where impacted by the prolonged government shutdown
  - Prior to that we operated through a series of CRs
    - Received a fraction of FY18 appropriation levels
  - Final budget appropriation has a 4% increase over FY18 to $8.1B
- Detailed breakdown to the directorate level has not yet been determined
  - Expecting a significant fraction of the increase to be targeted towards the Big Ideas
    - Avoids budget 5.6% reduction in AGS budgets in the FY19 budget request
  - Currently we have received about 90% of the FY18 level

NSF 10 Big Ideas

- FY19 Request includes $282M to support the 10 Big Ideas
  - Still waiting for final FY19 allocation
- 6 Research Ideas each get $30M for a total $180M

Harnessing the Data Revolution	Navigating the New Arctic	Future of Work at Human Tech Frontier
The Quantum Leap	Understanding the Rules of Life	Windows on the Universe

- Process Ideas get $102M total
  - Midscale Research Infrastructure $60M
  - INCLUDES $20M
  - Growing Convergence Research $16M
  - NSF 2026 Fund $6M
- Google NSF 10 Big Ideas for more information

Mid-scale Solicitation

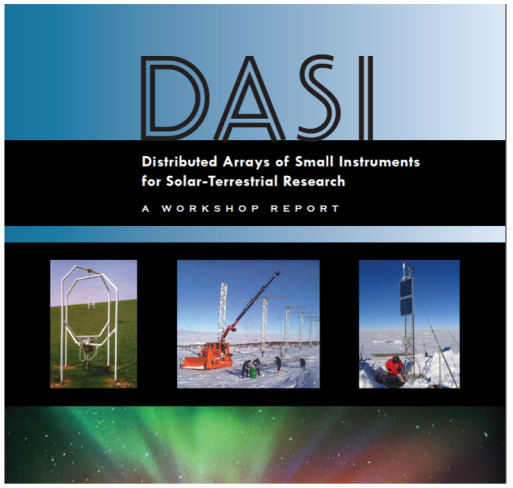
- Mid-scale 1 – NSF-19-537
  - Begins to address the need for research infrastructure
  - Implementation projects - $6-20M
  - Design projects - $600K-20M
  - Two step process with preliminary proposals due 2/19
  - Google NSF Mid-scale 1 for full solicitation
- Mid-scale 2 – NSF-19-542
  - Supports major shared community infrastructure and resources as may be required to enable community-scale research.
  - Implementation projects between $20-70M
  - Two step process with preliminary proposals due 3/11
  - Google NSF Mid-scale 2 for full solicitation

Distributed Arrays of Small Instrumentation

- New solicitation designed to address the increasing need for high spatial and temporal resolution measurements to determine the local, regional, and global scale processes
- Track 1 – Instrument Development
  - Limited term projects focused on proof concept operations of instruments for DASI networks
- Track 2 – Deployment and Operations
  - Support an array of instruments
- Solicitation Basics
  - Due date of April 19, 2019
  - Max award $2M over 4 years - Expect to make 3-4 awards
  - Mix of project sizes expected
  - Google NSF DASI for details

Pathway to New Facilities

- Distributed Arrays of Small Instruments
  - Focused on distributed observations of the Geospace system
  - NSF 19-545 has a due date of April 19
  - Two tracks
    - Track 1 – Instrument development
    - Track 2 – Deployment and operations



- Innovation and Vitality Program
  - Support renovation and upgrade of existing facilities
  - Facilitate the development of new instrumentation
    - Considering initial call in FY20

- Midscale Projects
  - NSF Big Idea supporting $4-70M projects

New CubeSats Recommended

- CubeSat: Climatology of Anthropogenic and Natural VLF wave Activity in Space (CANVAS)
  - PI Robert Marshall, University of Colorado at Boulder
  - *Climatology of Anthropogenic and Natural VLF wave Activity in Space (CANVAS) CubeSat which will measure Very Low Frequency (VLF) wave energy that originates from lightning and ground-based transmitters and propagates to the magnetosphere.*
- Collaborative Research: CubeSat: High-Cadence Measurement of Solar Flare Hard X-rays
  - PI Glesener, Lindsay, University of Minnesota-Twin Cities
  - Sample, John, Montana State University
  - Caspi, Amir, Southwest Research Institute
  - *IMPRESS will perform hard X-ray spectroscopy of solar flares in the rising phase of Solar Cycle 25. The target launch date is late 2021 into a Low Earth Orbit (LEO) with an inclination angle less than 60° and altitudes greater than 450 km.*

CubeSat Ideas Lab

- AGS has developed a partnership with the ENG and CISE directorates to support a new CubeSat Initiative
  - Designed to support both engineering and tech development for Geospace research using CubeSat constellations
  - Supports 1-2 $4M missions
  - Application deadline 2/8
  - Google NSF CubeSat Innovations for full solicitation

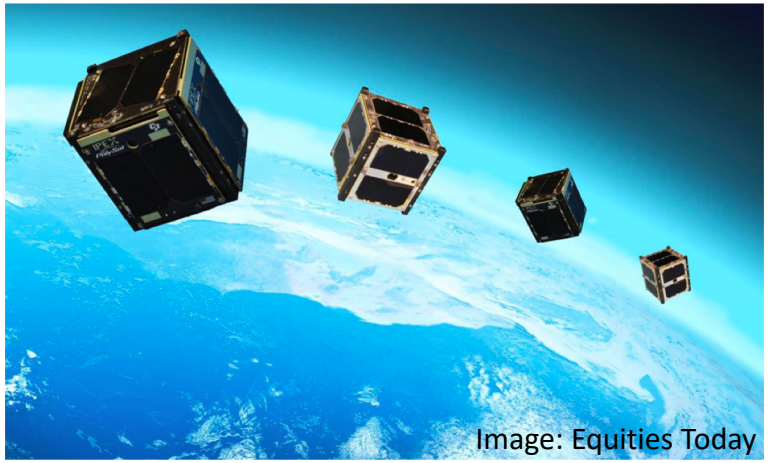


Image: Equities Today

Ideas Lab: Cross-cutting Initiative in CubeSat Innovations

PROGRAM SOLICITATION
NSF 19-530

National Science Foundation

Directorate for Geosciences
Division of Atmospheric and Geospace Sciences

Directorate for Engineering
Division of Electrical, Communications and Cyber Systems
Engineering Education and Centers

Directorate for Computer & Information Science & Engineering
Division of Computer and Network Systems

Preliminary Proposal Due Date(s) ***(required)*** (due by 5 p.m. submitter's local time):

February 08, 2019

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

May 30, 2019

Ideas Lab: What is it?

- An Ideas Lab is an intensive, interactive workshop designed to produce radically innovative research project proposals.
- Participants, from a diverse range of disciplines, come together in a creative, free-thinking environment and immerse themselves in a collaborative process around an important problem or challenge.
- **The goal is to provoke out of the ordinary science that would not otherwise be funded.**
- **NSF encourages the community to participate as PIs or get involved as mentors**

HDR and GEO-CI

- Harnessing the Data Revolution
  - Data Science Corps – (19-518)
    - Supports capacity building through integration of real-world data science projects into classroom instruction
    - $1 – 1.2M over 3 years
      Submission window 1/28 – 2/4
    - Google NSF Data Science Corps for full solicitation
  - Other HDR related solicitations are expected in FY19

- GEO-CI – Support Development and implementation of Cyberinfrastructure for the Geosciences
  - Training-based Workforce Development for Advanced Cyberinfrastructure (19-524)
    - Ensure adoption of CI tools, methods and resources
    - Integrate core literacy into educational activities
    - Supports Pilot, Implementation, and Large-scale Projects
    - $300-500K over two years – Proposals due 2/6
    - Google NSF Cybertraining for full solicitation

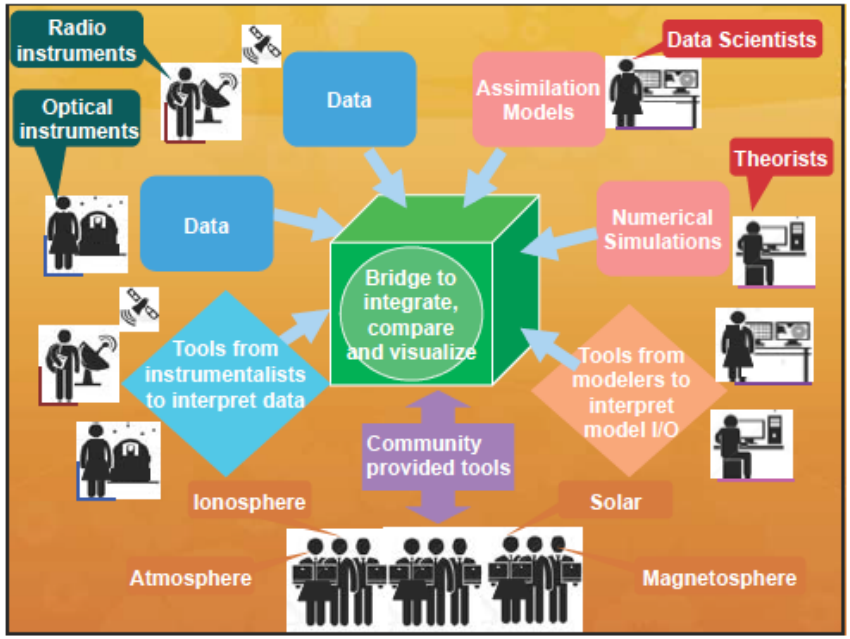
HDR and GEO-CI (Cont.)

- GEO-CI – Support Development and implementation of Cyberinfrastructure for the Geosciences
  - EarthCube Science Enabling Data Capabilities (16-514)
    - Improve geoscience data use and reuse for research
    - Up to 3 years budget commiserate with work –
    - Due March 5, 2019
    - Google EarthCube developing commity driven data
  - EarthCube Research Coordination Networks (16-514)
    - Supports formation of RCNs closely tied to the science and data needs of geoscience programs
    - Up to 3 years and maximum of $300,000
    - Due March 14, 2019
    - Google EarthCube developing commity driven data

Geospace-related CSSI award

- **Cyberinfrastructure for Sustained Scientific Innovation (CSSI) - Data and Software: Elements and Frameworks**
- Elements: Software: The Integrated Geoscience Observatory (InGeO) – PI A. Bhatt

InGeO is a data-linking and software-sharing system to facilitate community-centered and data-driven systems science research with an initial focus on Geospace.



Faculty Development in Space Sciences

- FY19 sees the return of the FDSS program to support the creation of new faculty positions in space sciences

- Solicitation Information
  - Proposal shall support a new space physics hire with the university or college
  - Typical awards will be 200k/year with a maximum of $1.5M
  - Limit 1 per university
  - Due date of May 24, 2019
  - Google NSF FDSS for more information

Support for SWORM

- SWORM is producing a new strategy
  - Update was called for original plan
  - Now that Kelvin Droegemeier is in place as OSTP Director progress is moving forward
- Goal 1 – Space Weather Benchmarks
  - NSF and NASA are leading a Next Step Benchmarking activity
    - NSF has funded STPI to take a leading roll in this activity
- Goal 5 – Advance Understanding and Forecasting
  - Lead an interagency team develop space weather research priorities
    - Submitted to SWORM for approval
- Goal 6 – International Cooperation
  - Participated in “Space Weather as Global Challenge” meeting at the Japanese Embassy

Next Step Benchmarks for Space Weather

- Objectives
  - Improve on existing space weather benchmarks
  - Inform Federal research and development priorities
- Process
  - Engagement with the space weather community
    - White papers will be solicited
    - Community Working groups will be formed
    - Workshops and townhalls will be used to gather input and disseminate results
- Roles
  - Geoff Reeves (LANL) will chair the community steering group
  - IDA Science and Technology Policy Institute will oversee process with support from NSF and NASA

Steps against Harassment

- The National Science Foundation (NSF) will not tolerate sexual harassment, other forms of harassment, or sexual assault, within the agency, at awardee organizations, field sites or anywhere science or education is conducted.


Research and learning are done in all environments, all over the world. All of these places must be harassment-free.

- New terms and conditions going into effect on Oct 21 require awardee organizations to report findings of sexual harassment
  - Currently applies to PIs and CoPIs
  - New CGI increments will trigger the reporting requirements
- See NSF Harassment Page for more details

Questions?

Happy to answer, if I can!