NSF Perspectives on Space Weather R2O

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NSF Mandate

- NSF's mission is to fund basic science research.
- **Specifically,** The NSF Act of 1950 (Public Law 81-507) sets forth the mission:

"to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes."

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Emerging Space Weather Research

- Basic research in solar, space, and atmospheric physics is critical for progress on Space Weather understanding and forecasting capabilities.
- Space Weather is a relatively nascent discipline concerned with the study of processes occurring between the sun, space, the magnetosphere and the ionosphere and full atmosphere, which can represent significant risk to human life, property, and security.
- These factors make it a national priority.

NATIONAL SPACE WEATHER ACTION PLAN

PRODUCT OF THE

National Science and Technology Council

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NSF Support of Space Weather Research

- <u>NSF funds research to enhance fundamental understanding of Space Weather processes</u>
  Targeted Research Programs
  - SHINE, GEM, CEDAR, CubeSat
  - Integrative Space Weather Modeling
- Distributed Networks/Satellite Constellations
  - AMPERE
  - GNSS receivers, magnetometers, radars
  - COSMIC Mission
  - GONG, SOLIS

R2O for Space Weather

- Space Weather Enterprise is in its nascent phase.
  - R2O has been a significant focus of the community.
- The NSF/NASA-funded CCMC is the repository for community models.
  - The CCMC-SWPC relationship provides a pathway to transition research models to operations.
- R2O2R is critical for the Space Weather Enterprise.

Opportunities for NSF to Support R2O

- Can fund research projects that have outcomes that can be transitioned to operations
- Can potentially co-fund projects with NOAA, DOD, and NASA that have components such as:
  - New instrumentation and/or observations that significant new information (which could have real-time accessibility)
  - Data assimilation and data fusion techniques
  - New physical understanding that can lead to operational model improvements
  - Code optimization, efficiencies, and robustness
  - We may co-fund complementary components

Broader Impacts

"I have a very strong feeling that science exists to serve human welfare. It's wonderful to have the opportunity given to us by society to do basic research, but in return, we have a very important moral responsibility to apply that research benefiting humanity." – Walter Orr Roberts

Broader Impacts

- Fundamental research that leads to operational improvements is a broader impact. The O2R2O loop is important here.
- Grassroots engagement to train students, forecasters, the public, etc. on scientifically appropriate use of tools.
- Establishing new collaborations with operations staff.
- Encourage open source community models.
- Tech. Transfer/private sector partnerships.
- ANYthing that may extend the impact of your scientific efforts.

Conclusions

- NSF primarily supports research into the fundamental processes behind space weather
- Our support for R20 is mainly through funding or co-funding fundamental research leading to outcomes/products that can be transitioned to operations.
- Connection of research to prediction and mitigation is an important broader impact

Questions?