

NATIONAL SCIENCE FOUNDATION
Proposal Abstract

Proposal:1937152

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Proposal Title: Convergence Accelerator Phase I (RAISE): Convergence Hub for the Exploration of Space Science (CHES)
Institution: Atmospheric & Space Tech Research Associates
Abstract Date: 08/02/19

The NSF Convergence Accelerator supports team-based, multidisciplinary efforts that address challenges of national importance and show potential for deliverables in the near future.

The broader impacts and potential societal benefit of this Convergence Accelerator Phase I project will be to forge the new convergent relationships necessary to respond to the grand challenges of space weather and fuse new capabilities that connect space weather and societal impacts. "Space weather" is the colloquial term used to describe the conditions and variability of the near-Earth space environment and its tangible impacts on technology, including critical infrastructure like the power grid, satellite services, navigation and communication systems.

In Phase I, this project will focus on one of the most important and immediate impacts of space weather disturbances: disruptive and potentially catastrophic induced currents in the electric power grid known as geomagnetically induced currents (GICs); however, the outcomes will be more broad, providing a foundation for the growth of a space weather Open Knowledge Network in which new data providers can join and become a node in the network. The project intends to embrace a diverse community: diverse in discipline, in sector of society (i.e., across academia, industry, and the public sector), and in representation, and propose to adopt an ethos of 'open by default' by facilitating broad participation in this work through open source efforts and community engagement. The outcome will be extended capabilities of existing data resources, robust and efficient approaches to answering important research questions, and a practical framework to capture and access knowledge - each of which will be freely available. The experience gained through the project activities will provide lessons learned that will be used to help create a newly capable data literate workforce.

The intellectual merit of this work will be to respond to three barriers that stand in the way of an understanding of space weather impact on the power grid commensurate with society's needs: (1) the lack of a cohesive community, due to the wide variety of subject matter experts working on topics related in various ways to space weather, (2) the lack of effective data sharing, coordination, and analysis (e.g., data science) to leverage existing resources and knowledge efficiently; and (3) the diversity of physically dominant processes in each section of the space weather environment, making it difficult to relate various models and observations. The Convergence Hub for the Exploration of Space Science (CHES) plans to create new modes of data-driven discovery. The power grid will serve as a valuable first use case to cultivate a convergent community of space scientists, geophysicists, data scientists, and the industries most affected by space weather. By embracing a data science-driven perspective, that addresses the full data lifecycle from collection to management to processing/analysis and visualization, CHES has the potential to have lasting impacts across each community. A specific

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goal of this effort is to respond to the central goal of the Heliophysics decadal survey to "determine the dynamics and coupling of Earth's magnetosphere, ionosphere, and atmosphere and their response to solar and terrestrial inputs" and the most pressing need identified in the 2019 Space Weather Strategy and Action Plan to "enhanc[e] the protection of critical infrastructure and national security assets."

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.