SPACE WEATHER

Modern Society Depends on Satellite Services

Record numbers of satellites are launched each year. Satellite services are foundational to weather observation and communications networks, navigation systems, airline and space operations, and national security systems, among others. According to the State of Satellite Industry Report, global revenues from satellites, including ground equipment, navigation, and launch industry revenues, were estimated at $269B USD in 2017 and are rapidly growing year-over-year. With this continued investment in space-based assets, the impacts of space weather have growing economic significance to governments, civil space, and commercial operations.

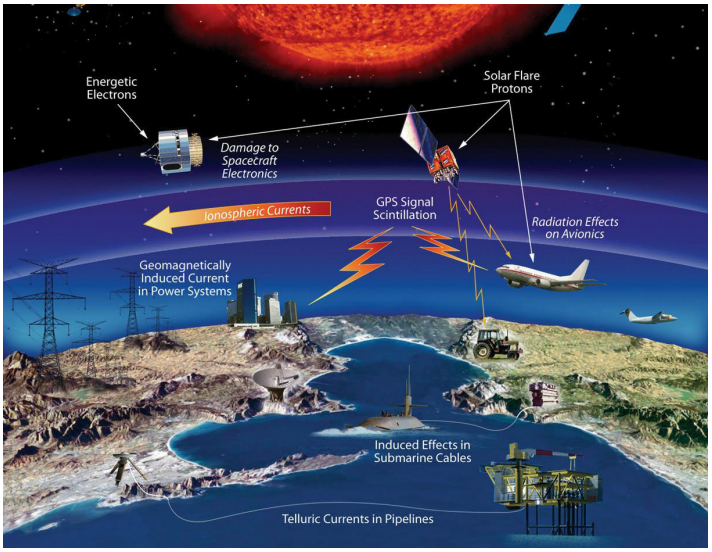
Space weather, including storms on the Sun and in the magnetosphere (the region around a planet dominated by its magnetic field), affects our technology both in space and on Earth. In addition to threatening the health of space-based assets, space weather can impact ground-based and communications infrastructures including electric power grids, making space weather a concern for terrestrial national security and economic vitality.

Space Weather Affects

- National Security
- Airline and Satellite Operations
- Communication Networks
- Navigation Systems
- Electrical Grids

The Importance of Applied Space Weather

Without robust applied space weather research, assessing potential impacts of extreme space weather events is difficult if not impossible. Applications of the research are essential for both measuring the potential economic risks of space weather as well as facilitating technology development to mitigate the impacts. To improve our fundamental understanding, both absolute worst-case scenarios and likely worst-case scenarios for the lifespan of our infrastructure must be modeled and studied. By first defining these scenarios and assessing the potential impacts, governments can craft realistic response plans to ensure a response focused on resiliency of assets.



Technological infrastructure affected by space weather events. *Image courtesy NASA*

Space Weather Strategy and Action Plan

In order to fill gaps in our capacity to fully understand, model, and predict space-weather events, it is important that we continue to improve our fundamental understanding of the Sun-Earth system. To guide the research community's efforts towards improving this understanding, a group of U.S. government stakeholders have developed the Space Weather Action Plan (SWAP). While the SWAP doesn't account for specific economic impacts of space weather, it does provide guidance for developing benchmarks to catalog specific events, a crucial step toward standardizing and prioritizing space weather research for practical applications.

Application Usability Levels Framework

Effective communication tools are a priority need for bridging the gap between research and industry product development. Different specialties within the space weather community often use different jargon when referring to the same thing. To add to the disconnect, members of the space weather community often operate in geographically-siloed research facilities. Improved communication tools are key to closing this gap.

The Application Usability Level (AUL) framework is a methodology for translating pure research into a product or solution for a scientific or practical real-world problem or application. The AUL framework can aid in communication between researcher and user, track progress of a project towards completion, and advertise user needs and research capabilities. The framework highlights where clear communication is necessary to define the requirements and metrics of an application and provides flexibility for the researcher and user alike to adapt their needs. The developers anticipate the AUL framework evolving into a standard tool for most scientific collaborations by ensuring consistency across projects.

The Center for Assessing Space-Weather Impacts and Innovations

The Aerospace Corporation has an extensive history in space weather research, including developing tools and providing space weather services, leveraging targeted space physics research to meet future needs. By standing up the Center for Assessing Space-Weather Impacts and Innovations (CASII), Aerospace is supporting the advancement of a transdisciplinary approach to space weather research. This next-generation science center will be supported by a public-private-academic partnership, with the goal of addressing the science and impacts identified in the SWAP. By bringing together international scientific experts, economists, policy experts, and the user community, CASII will create an environment that enables more effective collaborations to facilitate research ambitions. Employing the AUL framework will help ensure that these targeted research goals will provide useful, actionable information to end users and product developers.

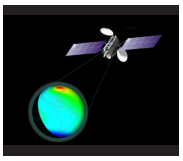
Learn more about Aerospace space weather research, the AUL framework, and CASII at:
aerospace.org/spacewx

Agencies Using Applied Space Weather

Current Space Weather Projects

GOES-R

GOLD



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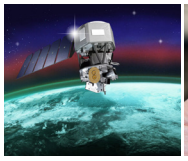

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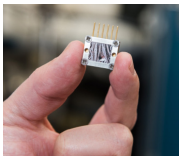

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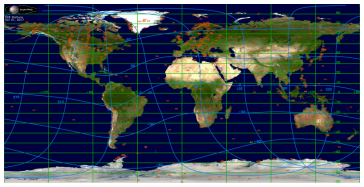

The Aerospace Corporation

The Aerospace Corporation is a national nonprofit corporation that operates a federally funded research and development center (FFRDC) and has approximately 4,000 employees. The Aerospace FFRDC is aligned to support the most critical programs of the Department of Defense and the nation and to serve as its customers' innovation partner across the space enterprise. Consistent with the competencies outlined in our sponsoring agreement, Aerospace provides strategic value through independent, intellectually rigorous, relevant, and timely products and services. With three major locations in El Segundo, CA, Colorado Springs, CO, and Washington, DC, Aerospace addresses complex problems across the space enterprise including the DOD, Intelligence Community, civil, commercial, and other areas of national significance.

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