# National Space Weather Strategy and Action Plan - Optimizing Space Weather Observations


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# Uses of Space Weather Observations and Forecasts

## Space Operations
- Postpone launch of satellite
- Turn off/safe instruments and/or spacecraft in orbit

## Electric Power Grid
- Adjust/reduce system load
- Disconnect components
- Postpone maintenance

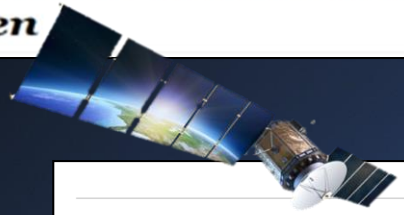
## Airlines
- Divert polar flights
- Change altitude

## GPS/Navigation
- Postpone activities
- Redo survey
- Use backup systems

SECTIONS HOME SEARCH The New York Times

Nov 2015

**Solar Storm Knocks Out Flight Control Systems in Sweden**

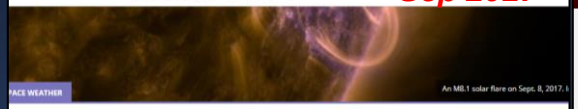


Mar 2012

**Solar Flares Knock Out LightSquared Satellite As Run of Bad Fortune Continues**

by Karl Bode Friday 16-Mar-2012 tags: satellite · business · wireless · alternatives wireless

MOTHERBOARD Sep 2017



**Solar Flares Interfered With Radio Network's Ability to Warn People About Hurricane Irma**

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**Huge Solar Flare Delays Private Rocket Launch to Space Station until Thursday**

by Tariq Malik, Managing Editor | January 08, 2014 08:10am ET

Jan 2014

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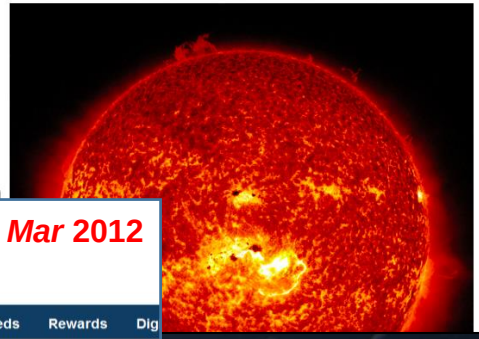

STARS AND STRIPES Mar 2012

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General: Recent solar storm interfered with Air Force satellite

Nov 2015

# National Space Weather Strategy and Action Plan - Actions for Observational Systems

Action 2.1 and 2.2: Identify and ensure baseline ground-based, sea-based, air-based, and space-based operational observation capabilities

- Sustain baseline observation capabilities and identify opportunities to increase their reliability
  - Utilize new technologies
  - Reduce cost through partnerships with the private sector academia, and international partners

# Utilize new technologies, and reduce their cost through partnerships with the private sector

- Enable and sustain the acquisition and delivery of satellite-based Global Navigation Satellite System **radio occultation data** with sufficient geographical coverage, data-rate, and latency to satisfy operational ionospheric-forecasting requirements

- DOC will also ensure that such data are assimilated into operational models of Earth's ionosphere

# National Space Weather Strategy and Action Plan - Actions for Observational Systems

Action 2.4: Identify, develop, and test innovative approaches to enable enhanced, more informative, robust, and cost-effective measurements

"This action should include the utilization of new or additional measurements provided by the private sector and the development of novel observational approaches in partnership with the private sector and international partners, where appropriate"

# National Space Weather Strategy and Action Plan - Actions for Observational Systems

Action 2.6: Identify and release, as appropriate, new or previously underutilized data sets

- NSC, OSTP, DOD, DOE, and DOC currently coordinating efforts to release historical particle data from the LANL GEO satellites
- Exploring option for release of TEC data from LANL instruments on GPS satellites
- Correlation recently established between **phasor measurement units** (PMUs) power reserve consumption records with GICs on transformers and GMD storm rate of change as measured by USGS magnetometers
- 22 responses from recent data call to identify underutilized and historical data sets for the development, validation, and testing of space weather models

# Space Weather Benchmarks

- Called for in 2015 and 2019 Space Weather Strategies to quantify extreme space weather
- Environmental parameters are defined for:
  - Induced geo-electric fields
  - Ionizing radiation
  - Ionospheric disturbances
  - Solar radio bursts
  - Upper atmosphere expansion
- Informs other activities identified within the current Strategy

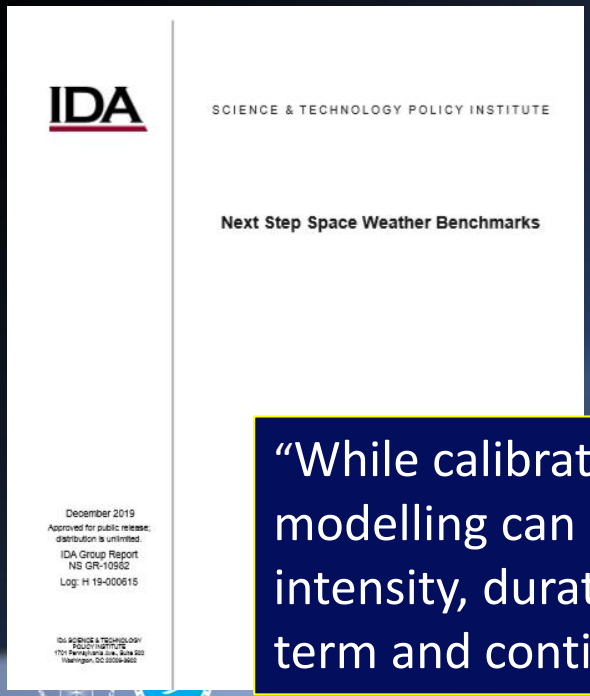
The benchmarks are intended to serve as technical inputs for developing vulnerability assessments, understanding risk, developing more effective mitigation procedures and practices, and enhancing response and recovery planning

# Space Weather Benchmarks

**Recommendations**:

- Ensure new space-based observations at Lagrange point 1 that measure energetic particles (SEP), and instruments in Earth orbit to measure SEPs and GCRs

- Implement a program using mobile variometer stations to demonstrate new solar geomagnetic observation posts (needed for electric field hazard calculations)




- Develop a robust EUV observation system

- Fund solar observational platforms necessary for basic research into extreme solar radio burst causes and characteristics

"While calibrating datasets and supplementing observations with modelling can improve benchmarks, accurately characterizing the intensity, duration, and frequency of extreme events will require long-term and continuing observations"

# 23 July 2012 – Near miss!

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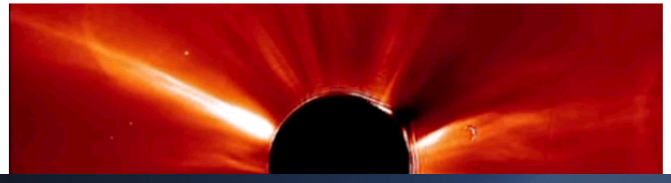
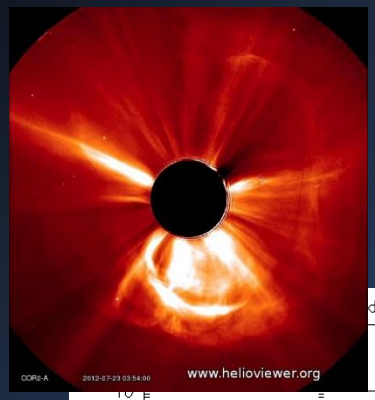
## Huge Solar Storm of 2012 Would Have Sparked Calamity on Earth

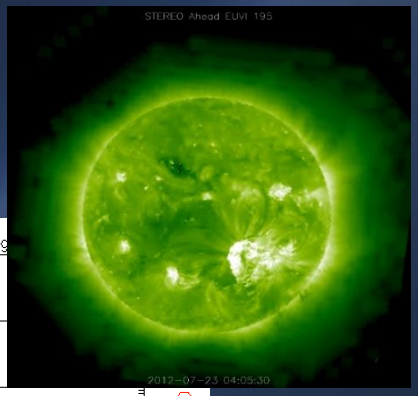
By Elizabeth Howell July 29, 2014 Science & Astronomy

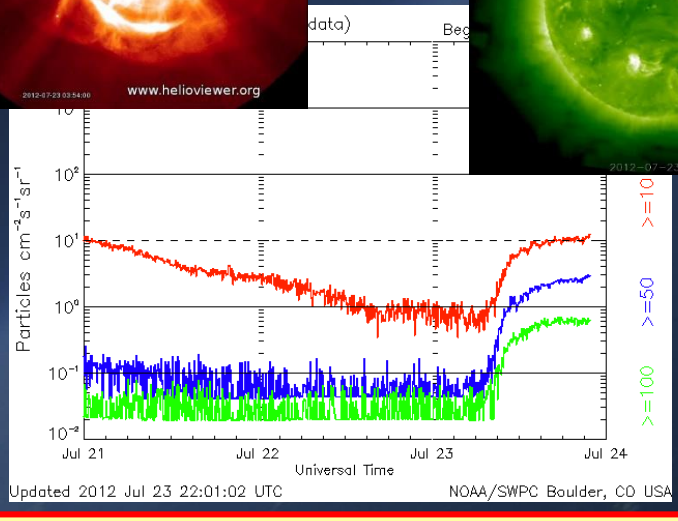
## How a solar storm two years ago nearly caused a catastrophe on Earth

BY JASON SAMENOW July 23 at 3:48 pm






**"Using a well-proven geomagnetic storm forecast model, we find the 23-24 July event would have produced a geomagnetic storm that was comparable to the largest events of the 20th Century."** *Baker et al. 2012*

# Congressional action - new space weather bills introduced

– *To help implement the priorities established in the National Space Weather Strategy and Action Plan*


**Senate bill 881** – ***"Space Weather Research and Forecasting Act"***

- Bipartisan legislation passed the Senate Commerce Committee in Apr 2019

**House companion bill: H.R. 5260** – ***"Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow Act"*** (PROSWIFT Act)

- House companion to S. 881 – bipartisan support
- Introduced in Nov 2019 - approved by the House Committee on Science, Space and Technology on 9 Jan 2020

House and Senate now working together on compromise and expect this legislation to be signed during this Congress

# PROSWIFT recognizes that space-based and ground-based observations “provide crucial data necessary to understand, forecast, and prepare for space weather events”

Agencies shall develop a strategy for coordinated observation of space weather and shall identify—

(1) observations and measurements that must be sustained beyond the lifetime of current ground-based and space-based assets

(2) new observations and measurements that may significantly improve space weather forecasting and prediction

(3) plans for follow-on space-based observations

# Conclusion

Observations are the backbone of forecast and warning capabilities, and key to promoting resilience to the effects of space weather

Without appropriate resilience measures in place, America's risk from space weather will only increase as the Nation increases its reliance on technology and its activities in space