Space Weather and the Next Solar and Space Physics Decadal Survey

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Decadal Survey Purpose & OSTP* Recommended Approach

"Decadal Survey benefits:

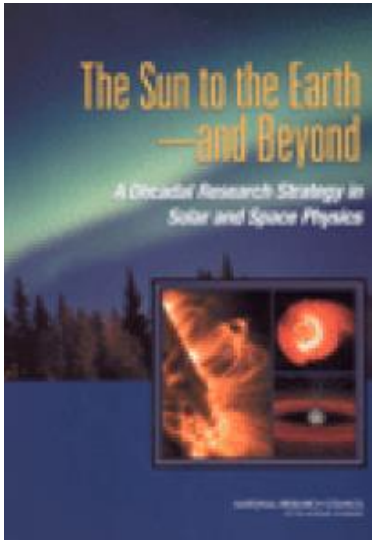
- **Community-based documents offering consensus of science opportunities to retain US scientific leadership**
- **Provides well-respected source for priorities & scientific motivations to agencies, OMB, OSTP, & Congress"**

"Most useful approach:

- **Frame discussion identifying key science questions**
  - **Focus on what to do, not what to build**
  - **Discuss science breadth & depth (e.g., impact on understanding fundamentals, related fields & interdisciplinary research)**
- **Explain measurements & capabilities to answer questions**
- **Discuss complementarity of initiatives, relative phasing, domestic & international context"**

*From "The Role of NRC Decadal Surveys in Prioritizing Federal Funding for Science & Technology," Jon Morse, Office of Science & Technology Policy (OSTP), NRC Workshop on Decadal Surveys, November 14-16, 2006

Context



- *The Sun to the Earth—and Beyond: A Decadal Research Strategy in Solar and Space Physics*
  - Summary Report (2002)
  - Compendium of 5 Study Panel Reports (2003)

- First NRC Decadal Survey in Solar and Space Physics
  - Community-led
  - Integrated plan for the field
  - Prioritized recommendations
  - Sponsors: NASA, NSF, NOAA, DoD (AFOSR and ONR)

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Survey's Task Summary

- **Provide an overview of the science and a broad survey of the current state of knowledge in the field**, including a discussion of the relationship between space- and ground-based science research and its connection to other scientific areas;
- **Identify the most compelling science challenges** that have arisen from recent advances and accomplishments;
- **Identify the highest priority scientific targets** for the interval 2013-2022 (having considered scientific value, urgency, cost category and risk, and technical readiness).
- **Develop an integrated research strategy** that will present means to address these targets

Note:

1. NASA missions not yet in formulation or development to be reprioritized;
2. Reference missions could be proposed by White Paper. No grandfathered missions.

Survey Organization

- **Steering Committee** – Appointed by the NRC and responsible for the final report and its recommendations
  - Nineteen members representing the broad solar and space physics community; includes representatives from the 3 study panels

- **Disciplinary Study Panels** – Appointed by the NRC; provided written input to the steering committee and informed steering committee's deliberations:
  - **Atmosphere-Ionosphere-Magnetosphere Interactions**
  - **Solar Wind-Magnetosphere Interactions**
  - **Solar and Heliospheric Physics**

- **"National Capabilities" Working Groups** – Informal groups drawn from drawn from survey members and from the community
  - Addressed important cross-disciplinary issues and opportunities

Survey Committee

***Chair*: Daniel Baker**, NAE
University of Colorado-Boulder

Brian H. Anderson
Johns Hopkins University APL

Steven J. Battel
Battel Engineering

James F. Drake, Jr.
University of Maryland-College Park

Lennard A. Fisk, NAS
University of Michigan

Marvin Geller
State University of New York at Stony Brook

Sarah Gibson
National Center for Atmospheric Research

Michael A. Hesse
NASA Goddard Space Flight Center

J. Todd Hoeksema
Stanford University

David L. Hysell
Cornell University

Vice Chair: Thomas H. Zurbuchen
University of Michigan

Mary K. Hudson
Dartmouth College

Thomas Immel
University of California-Berkeley

Justin Kasper
Harvard-Smithsonian Center for Astrophysics

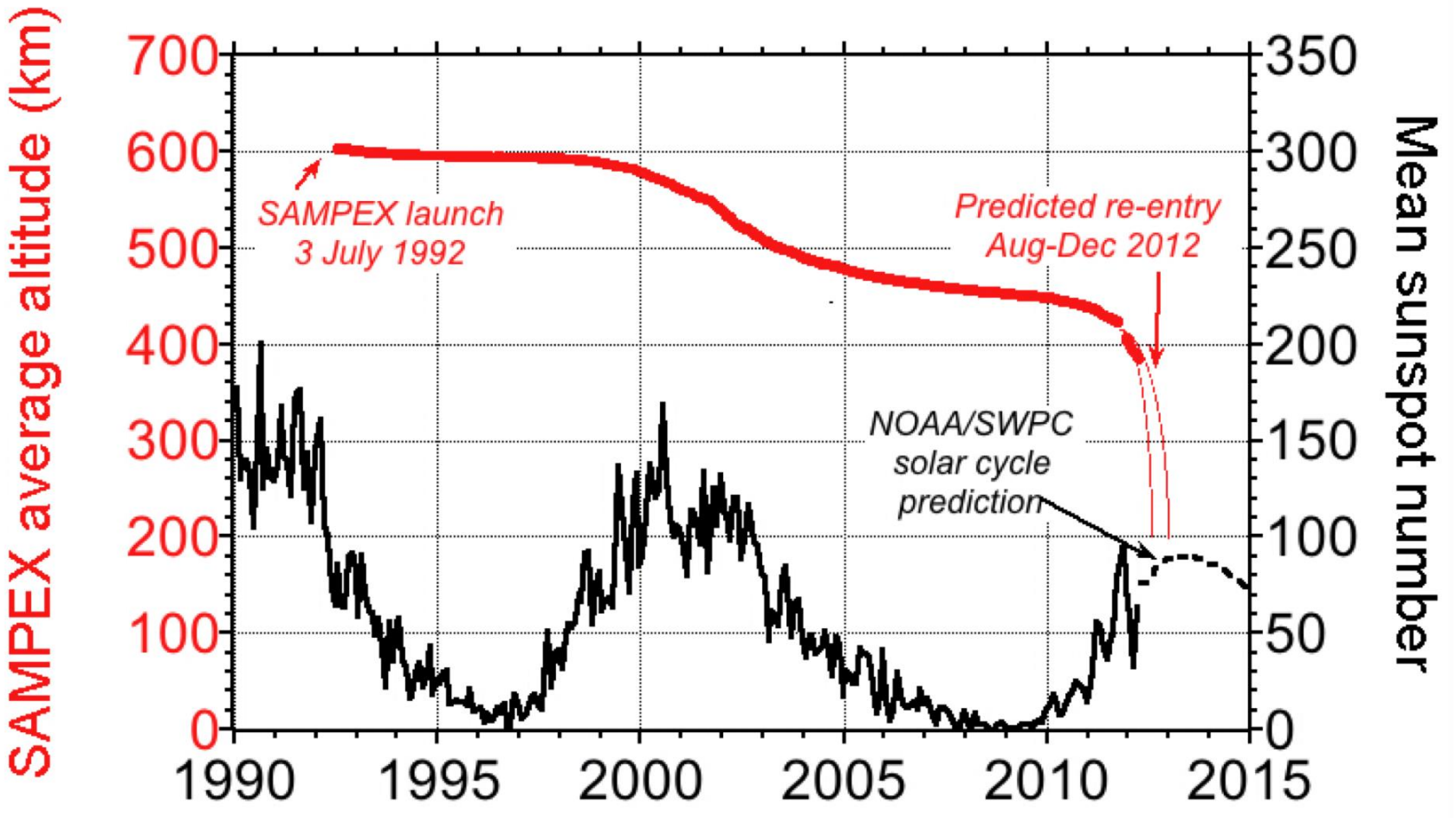
Judith L. Lean, NAS
Naval Research Laboratory

Ramon E. Lopez
University of Texas-Arlington

Howard J. Singer
NOAA Space Weather Prediction Center

Harlan E. Spence
University of New Hampshire

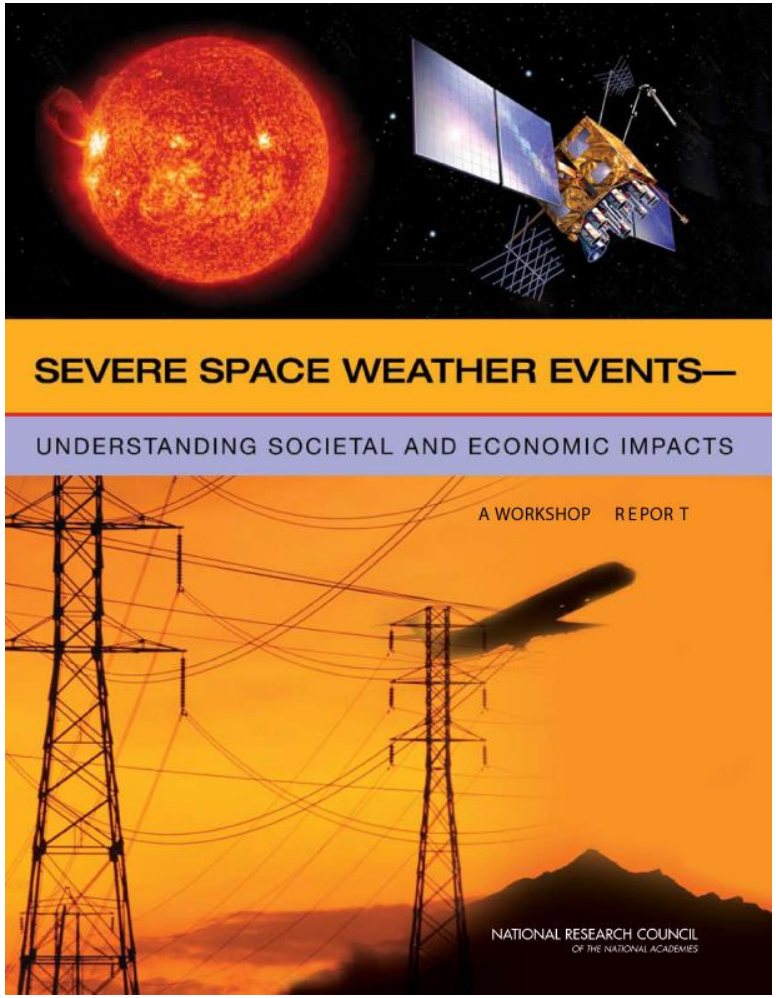
Edward C. Stone, NAS
California Institute of Technology



Baker, Mazur, & Mason [*Space Weather*, in press, 2012]

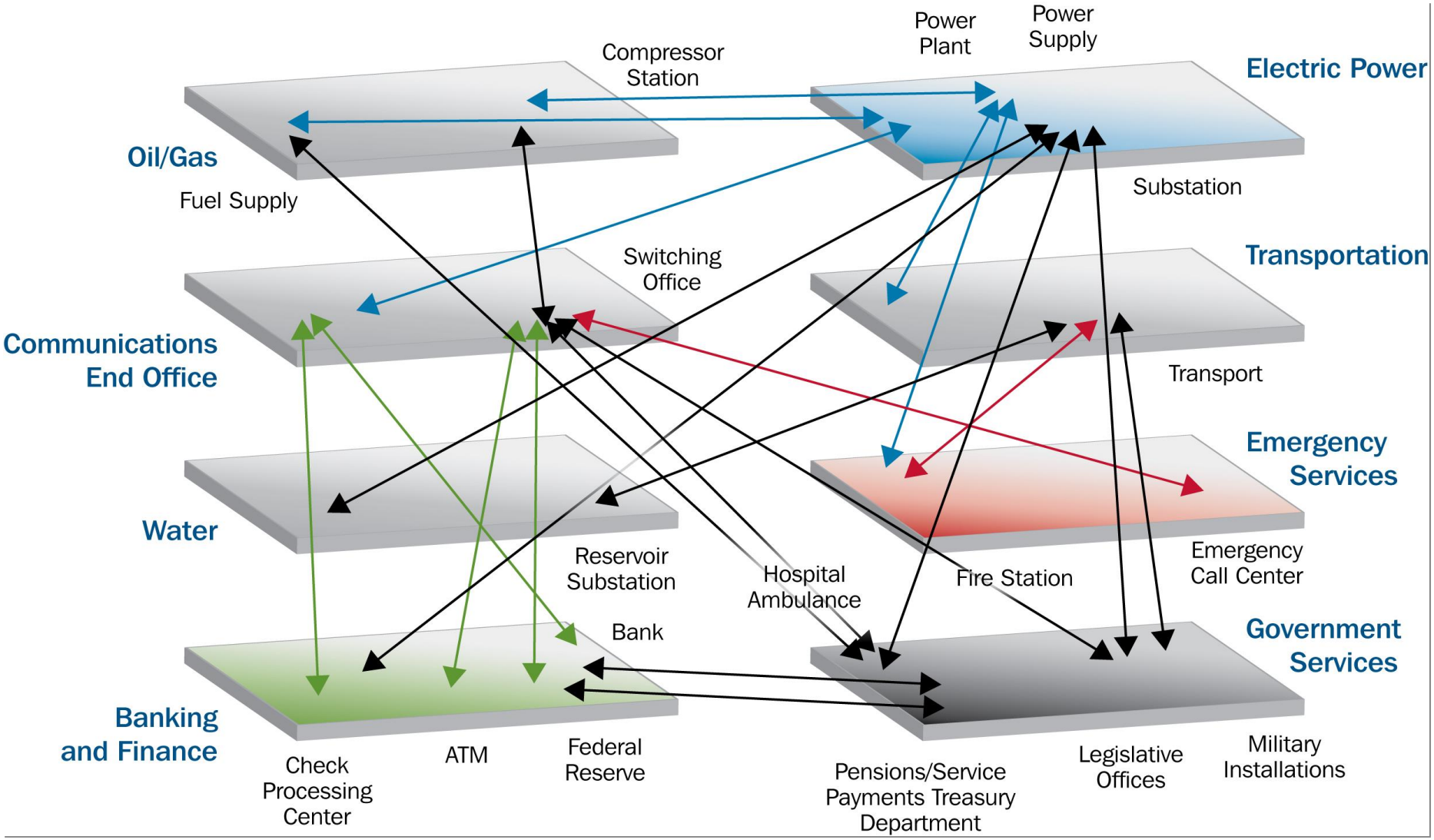
The Societal and Economic Impacts of Severe Space Weather Events

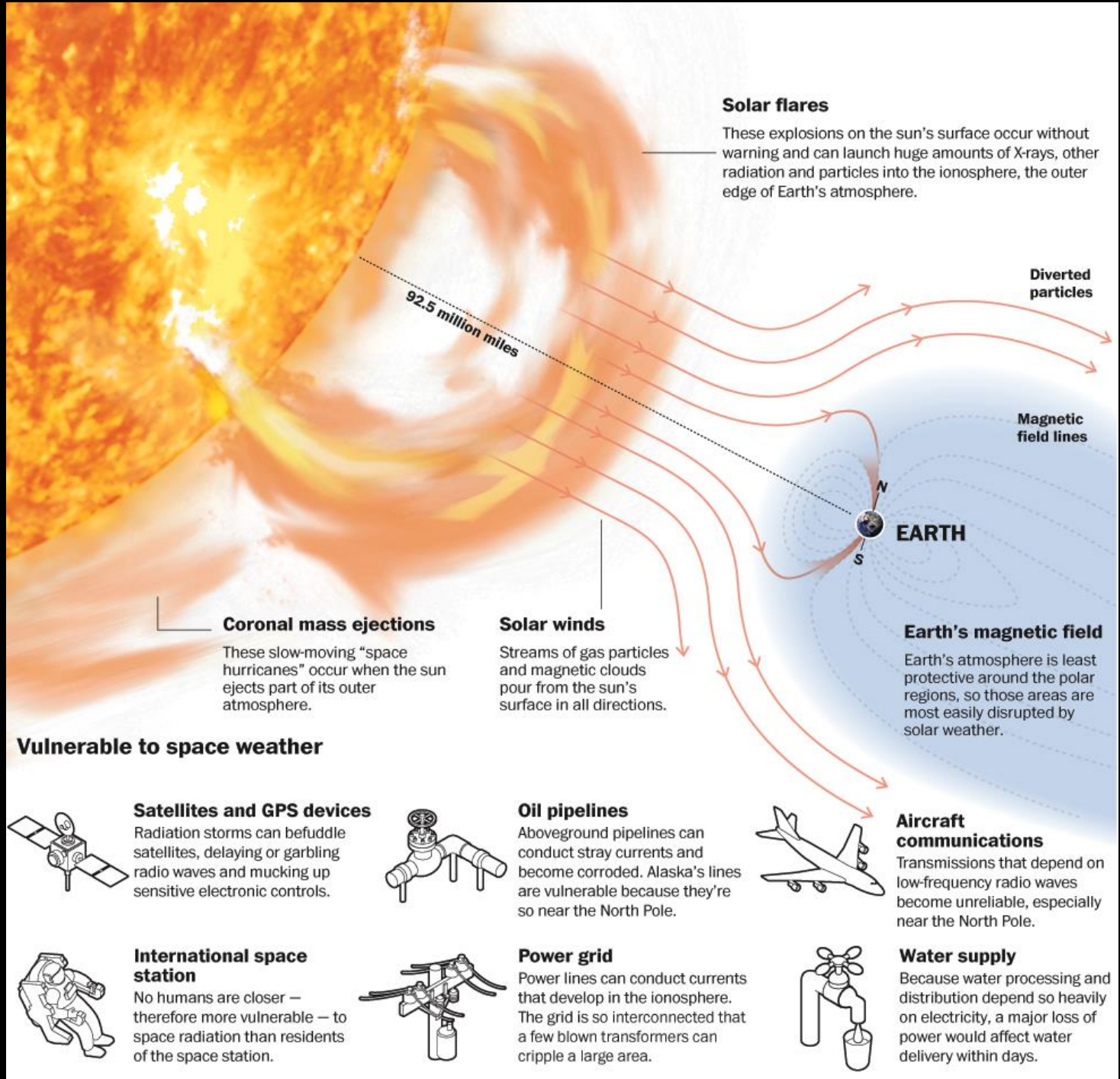
- *May 22-23, 2008 in DC*
- *Approximately 80 attendees from academia, industry, government, and industry associations*
  - **Association reps aggregated data and helped avoid concerns about proprietary or competition-sensitive data**
- *Analyses in specific areas; e.g., GPS, power industry, aviation, military systems, human and robotic exploration beyond low-Earth orbit*
- *Econometric analysis of value of improved SpaceWx forecasts*



[http://www.nap.edu/catalog.php?record_id=12507]

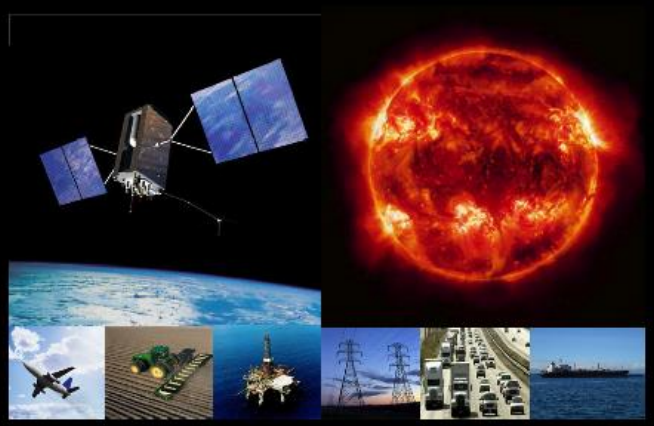
The Interdependencies of Society





Washington Post Graphic

Satellite Navigation & Space Weather:
Understanding the Vulnerability &
Building Resilience



Survey and Space Weather

- Strong focus on, and examination of, supporting research and implementation approaches
- Recommendations to key agencies, programs, and players
- Explicit examination of national/international themes and interagency issues

Survey and Space Weather (Cont'd)

- NSWP:
  - "The overarching goal of the NSWP is to achieve an active, synergistic, interagency system to provide timely, accurate, and reliable space weather warnings, observations, specifications, and forecasts."
- U.S. National Space Policy-June 28, 2010: SpaceWx One of Six Goals:
  - "Improve space-based Earth and solar observation capabilities needed to conduct science, forecast terrestrial and near-Earth space weather, monitor climate and global change, manage natural resources, and support disaster response and recovery."

Overarching question considered by the Survey: Given the austere fiscal environment that is likely for the foreseeable future, are there steps apart from budget augmentations that might help achieve the objectives of the NSWP and the goals of the U.S. National Space Policy.

Survey Status

- Report went out to review by NRC-selected reviewers on 7 March
- Now have all 19 (Yes, **nineteen**!) reviews in hand
- Space weather is highly regarded as a key, integrating theme
- All reports offer thoughtful, constructive reviews and suggestions for improving communication
- To quote Dr. Arthur Charo (Senior Program Officer): “None of the reviewers say you are crazy”

I regard this last point as a major achievement!

Summary

- The Decadal Survey recognizes that space weather affects all of society and both civilian and military systems
- Work on space weather observations, specification, modeling, and forecasting has great societal benefit: It is basic research with a high public purpose
- Virtually all modern human endeavors will require major advances in physical understanding and improved transition of space research to operations

Pre-publication copy to agencies within next several weeks

I sincerely hope that NOAA will use all its influence to assure a MAJOR solar storm on the day of our rollout!

Questions?