

Growing the Space Weather Enterprise

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Roles and Contributions

Space Weather Workshop
Boulder, CO
April 9, 2014

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Agenda

- Policy
 - Space Policies and Laws
- The Space Weather Enterprise
 - Structure
 - Roles
 - Mutual Support
 - Issues
- Opportunities
 - Commercial Space Growth
 - Joint Planning
- Summary

Policy

- Formal
 - National Space Policy (Space Weather?)
 - Agency Policies
 - Congressional Direction
 - Space Act
- Informal
 - Budget Realities
 - Availability of money and accompanying instructions de facto policy
 - Cultural
 - Procedures in Practice
- US Government Weather Data Policies
 - Free to all government agencies
 - Free to all researchers
 - Free to Public
 - Free to weather industry (minimal telecommunications charge)
 - Free to governments worldwide thru World Meteorological Organization (WMO)
 - Government funded satellite systems cannot be sold to private entities
 - Government develops, owns and operates weather satellites (cultural)

U.S. Government Space Policy*

To promote a robust domestic commercial space industry, agencies shall:

- Purchase commercial space services to the maximum extent
- Modify commercial space services when cost effective & timely
- Explore nontraditional arrangements for acquiring commercial space services
- Develop USG space systems only when no US commercial service available
- Refrain from activities that compete with US commercial space activities
- Pursue opportunities for transferring routine space functions to the commercial space sector
- Cultivate entrepreneurship in the commercial space sector through incentives
- Ensure USG space technology available for commercial use

*http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf

U.S. Government Space Policy* (2)

- Minimize the regulatory burden for commercial space activities
- Foster fair and open global trade through suitable standards and regulations
- Encourage purchase of commercial space goods and services in international cooperative arrangements
- Actively promote the export of commercial space goods and services

What about: U.S. Government Laws ???

- Space Business Incentives Act (HR1953)
- Space Transportation Services Purchase Act of 1993 (HR2731)
- The Omnibus Space Commercialization Act of 1996

*http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf

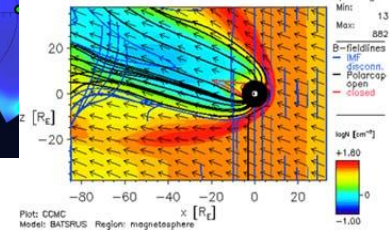
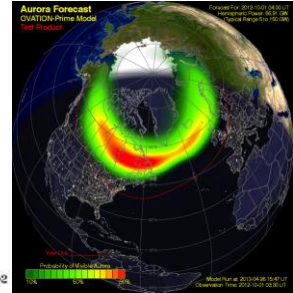
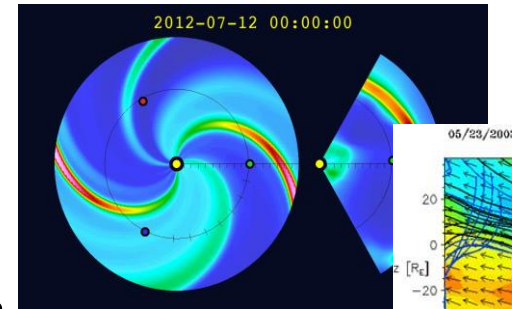
A Weather Ready Nation*

Building our Nation's resilience in the face of increasing vulnerability to **space weather**

Critical observations



Improved Forecast



Partnerships



Better information for better decisions

*Dr. Louis W. Uccellini Meeting the Nation's Evolving Needs for Space Weather Services 94th AMS Annual Meeting Feb 3, 2014

Partnerships with Space Weather Research Community*

Solar /Solar Wind

Magnetosphere/
Ionosphere

Modeling at NOAA

A Sun to Earth Continuum



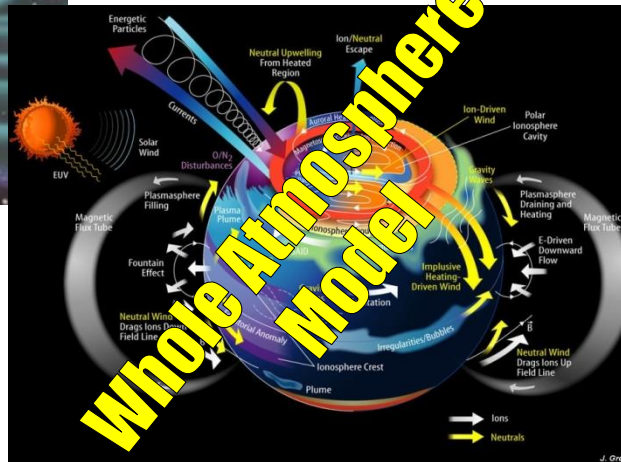
Currently in operations

2015

Ionosphere/
Atmosphere

Earth's surface

Location of 1D Earth Resistivity Models
with respect to Physiographic Regions of the USA



2017



Electric Field Model

Model combination allows for more regional focus

*Dr. Louis W. Uccellini Meeting the Nation's Evolving Needs for Space Weather Services 94th AMS Annual Meeting Feb 3, 2014

2014

Partnerships

Critical Elements for Meeting National and Global Needs*

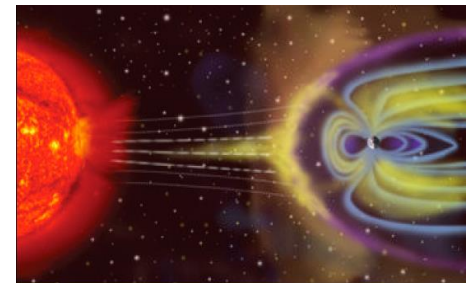


The success of today's space weather industry can NOT be attributed to any one agency, business, corporation, or educational facility. The US Space Weather Enterprise is diverse in its membership – This is a strength that we must recognize.

* Courtesy of William Murtagh

RESPONDING TO THE THREAT*

- Federal Energy Regulatory Commission
 - Standards for Geomagnetic storms
- White House Interagency Working Group
 - Geomagnetically Induced Currents
- Federal Emergency Management Agency
 - Federal Interagency Operations Plan
- North American Electric Reliability Corp.
 - Joint Industry-Government Task Force
- National and International Exercises
 - Secure Grid
 - FEMA/MSB/NOAA
 - National Exercise Program



A Workshop on Managing Critical
Disasters in the Transatlantic Domain—
The Case of a Geomagnetic Storm

February 23-24, 2010



FEMA



* Courtesy of William Murtaugh

American Commercial Space Weather Association

- Formed in 2010;

- Members:

**AER, ASTRA, CPI, CRC,
FF, GO, PiQ, PRA, PSI, Q-up,
SAC, SEC, SET, SSI, SSH, SWFTT, WA**

- Executive Committee:

**G. Crowley (ASTRA),
D. Intriligator (CRC),
R. Schunk (SEC),
K. Tobiska (SET)**



www.acswa.us



American Commercial Space Weather Association

Capabilities*

- Algorithm development
 - Automatic event detections (flares, solar energetic particles, geoeffective CMEs)
- Calibration/validation
- Data assimilation
- GPS modeling and services
- HF propagation
- Numerical modeling and simulation
 - Sun, interplanetary medium
 - magnetosphere, ionosphere
 - thermosphere, lower atmosphere
- Operational implementations / Research to Operations (R2O)
- Risk and threat analyses for infrastructure and space resources
- Satellite data analysis & data product development
- Sensor hardware & modeling
- Software tools
 - Application development (web-based and smart phone)
 - Data hosting / data product delivery
 - Data / model visualization
- Space Situational Awareness (SSA)
- Spacecraft anomaly prediction and assessment
- Space weather data product and service distribution
- Space weather now-casting/forecasting

*<http://www.acswa.us/capabilities.html>

The Global Space Economy

Steady Growth!

Sector	\$B	%
Commercial Products & Services	116	6
Commercial Infrastructure & Support	110	11
U.S. Government Space Budgets	48	0
<u>Non U.S. Government Space Budgets</u>	<u>31</u>	<u>1</u>
*Total	\$304B	7

Stagnant!

U.S. Government

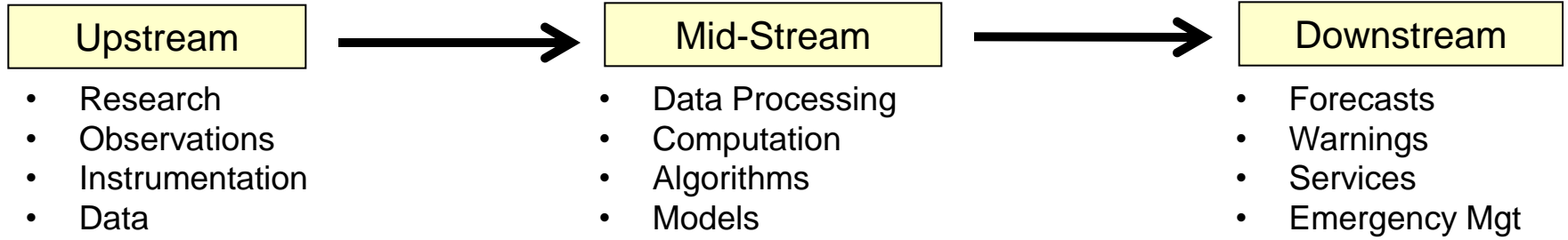
NASA	\$18B
(NOAA	\$5B)
NESDIS	\$2B
USAF	--**

*<http://www.spacefoundation.org/programs/research-and-analysis/space-report/20-space-economy>

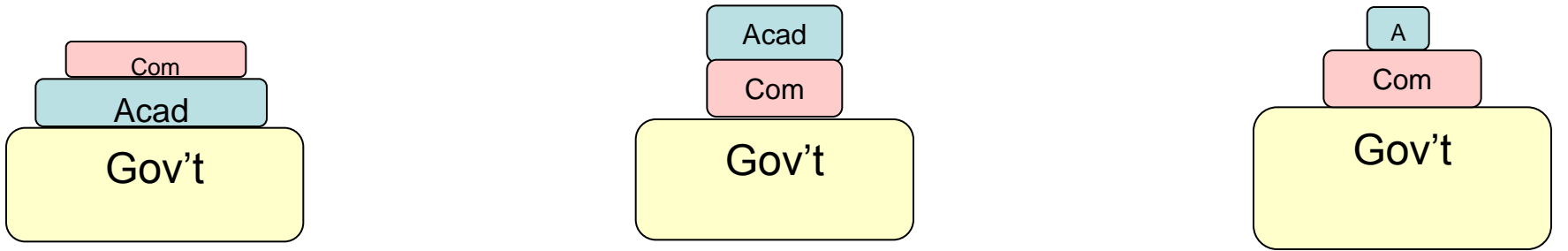
**Money in budget for weather satellite replacement studies only

Space Weather Enterprise

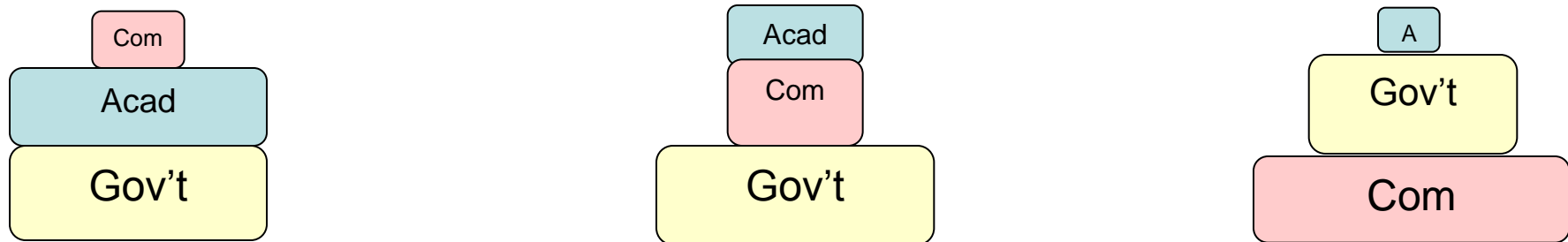
Products and Services



Markets



Compared to Terrestrial Weather



Fair Weather Report*

- Recognizes the Three Sectors
 - NWS (Government) -- protecting life and property and enhancing the national economy
 - Academia -- advancing science and educating future generations
 - Private Sector – production of products and services tailored to client needs
- System is productive but with built-in frictions
 - All contribute to same activities – Differentiating roles difficult
 - Different philosophies of sharing data and models
 - New technologies and user communities emerge affecting role definition
- Eleven Recommendations
 1. NWS defines processes for making decisions not products
 2. NWS Establish independent advisory body
 3. All three parties seek neutral host to discuss issues periodically
 4. NWS maintain activities essential to mission
 5. NWS Make data and products available in internet accessible formats
 6. NWS Improve process for developing new products that meet new needs
 7. NWS develop process to balance local new product creation with public-private partnership
 8. NWS Adopt/improve processes for communicating information in probabilistic formats
 9. NWS retain role as official source of instrumentation, data, and data collection standards
 10. Private sector work with other sectors to develop processes to minimize friction
 11. Academia use transparent processes to transfer technologies and avoid conflicts of interest

*Fair Weather: Effective Partnerships in Weather and Climate Services (2003) NRC Report

Summary

- National Space Policy and Current Laws
 - Strongly support Commercial Space Development
 - Provide incentive and guidelines for increased Public – Private Partnerships
- NWS future includes important Space Weather Initiatives
 - Supports public – private partnerships.
- Budget pressures continue to limit Government growth
- ACSWA growth aligns with Commercial Space growth
- Government interest in Space Weather increasing
- Fair Weather Report sets example of “how to” partner
- Partnering brings added support for all participants

**It is time for serious and detailed discussion of
ROLES AND CONTRIBUTIONS for the future!**



The Environmental Data Services Company

The End