

Growing the Space Weather Enterprise

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Building a Committed Partnership

Space Weather Workshop
Boulder, CO
April 15, 2015

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Agenda

- Committed Partnership
- Policy Foundation
 - National
 - Agencies
- Obstacles to Committed Partnership
 - Data Policy
 - Public Good & Government Control
 - Long Term Viability
 - Quality Control
 - Public Knowledge & Support
- What Success Looks Like!

Committed Partnership

- Partners are defined, organized and connected
 - Government, Industry, Academic
 - Fair-weather Report
- Partners recognize and adopt win-win psychology
- Actively seek and engage in supporting actions
- Level Playing Field
 - AMS
- Frequent consultation
 - AMS Commission on Weather, Climate and Water
- Harmonized Policies & Priorities

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

NOAA Policy*

NRC study (Fair Weather: Effective Partnerships in Weather and Climate Services, National Research Council, 2003)

<http://www.noaa.gov/partnershippolicy/>

Formalized as NOAA Administrative Order 216-112 (July 2007)

Extracts

The three-sector Environmental Information Enterprise has led to an extensive and flourishing set of services that are of great benefit to the public and the economy.

NOAA has a responsibility to foster the growth of this complex and diverse enterprise as a whole to serve the public interest and the Nation's economy.

Nation benefits from government information disseminated both by federal agencies and by diverse nonfederal parties, including commercial and not-for-profit entities.

NOAA will not haphazardly institute significant changes in existing information dissemination activities, or introduce new services,.....

*NOAA's Policy on Partnership; Edward Johnson, Dir Strategic Planning & Policy NWS 1/22/ 2015

NOAA Policy*

NWS Implementation (Directive 1-10)

partnership policy clause 4:

(Language adopted in clarification highlighted)

The nation benefits from government information disseminated both by Federal agencies and by diverse nonfederal parties, including commercial and not-for-profit entities. NOAA recognizes cooperation, not competition, with private sector and academic and research entities best serves the public interest and best meets the varied needs of specific individuals, organizations, and economic entities. NOAA will take advantage of existing capabilities and services of commercial and academic sectors to support efficient performance of NOAA's mission and avoid duplication and competition in areas not related to the NOAA mission. NOAA will give due consideration to these abilities and consider the effects of its decisions on the activities of these entities, in accordance with its responsibilities as an agency of the U.S. Government, to serve the public interest and advance the nation's environmental information enterprise as a whole.

*NOAA's Policy on Partnership; Edward Johnson, Dir Strategic Planning & Policy NWS 1/22/ 2015

Obstacles to Partnership?

US Government Weather Data Policies

- Free to:
 - government agencies
 - researchers
 - public
 - weather industry (minimal telecommunications charge)
 - governments thru World Meteorological Organization (WMO)
- Counters:
 - Data licensing flexibility (contracting policy)
 - Recognize distinct Public and Commercial Needs
 - Actively seek different “Swim Lanes”
 - weather industry (greater incentive to meet commercial needs)
 - Sharing License Costs internationally

Obstacles to Partnership?

Public Good & Government Control

- Government Control over entire value chain is essential?
 - Regulatory Mechanisms
 - Contracting Policies
 - Commercial Competition (market mechanism)
 - Quality Control
 - Partial Value Chain Control may suffice
 - International Obligations
 - WMO members already work on mixed models

Obstacles to Partnership

Long Term Viability?

- Commercial Services are not reliable for long term
 - Here today gone tomorrow?
 - Longer contracts (government in the driver's seat)
 - Commercial Competition (market mechanism)
 - Support more than one provider
 - Quality Control
 - Contracting and testing provisions
 - Many counter examples
 - Space communications
 - Defense procurement

Obstacles to Partnership

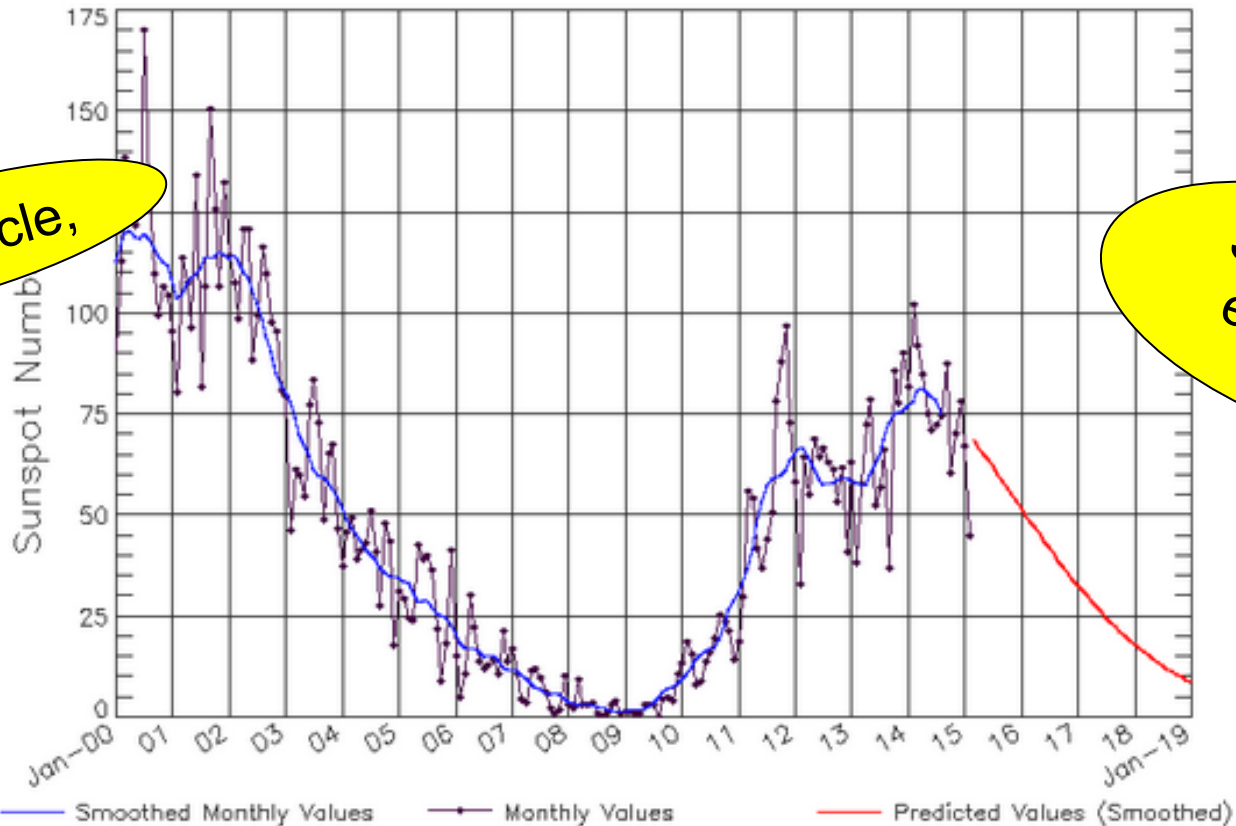
Quality Control

- Commercial Services cannot achieve consistent quality
- Contracting requirements
 - Government in the driver's seat
 - Contracting and testing provisions
- Commercial Competition (market mechanism)
 - Support more than one provider
 - Quality Control critical competitive factor
- Many counter examples
 - Space communications
 - Defense procurement

Obstacles to Partnership

Sunspot Number Progression

ISES Solar Cycle Sunspot Number Progression
Observed data through Feb 2015



Unfortunately,

The sun is not helping us!!

Ideal cycle,

Strong peak every 2 - 4 years!

Updated 2015 Mar 9

NOAA/SWPC Boulder, CO USA

St. Patrick's Day 2015 Geomagnetic Storm*

- **G4 level (severe) geomagnetic storm**
- Commencement: ~14:00 UT (10:00 EDT)
- **Duration: ~18 hours** (G3/G4 conditions sustained for 12 hours)
- Maximum magnetic field (Bz): -30 nT (-20 nT sustained)
- **Strongest G4 storm of Solar Cycle 24 (out of only 5)**
- No proton or electron radiation enhancement with this storm (unusual)
- Cause: Coronal mass ejection(s) at ~0200—0230 UT on 15-March
- Impacts:
 - 200 mV/km induced electric field calculated for NE powerplant locations (about 1/10 of the March 13, 1989 values). **No power failures reported to date.**
 - Severe ionospheric density depletion above 45° latitudes; strong scintillation at equatorial latitudes reported (e.g. Brazil).
 - Spectacular auroral sightings from Michigan to Alaska and as far south as southern Colorado (Montrose county) on early morning of 17-March.
- **Forecast accuracy:**
 - **CME was 15 hours ahead of forecast**
 - **Maximum geomagnetic storm predicted = G1 on 18-March-2015**

*Courtesy of Dr. Tom Berger, SWPC, NWS, NOAA

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



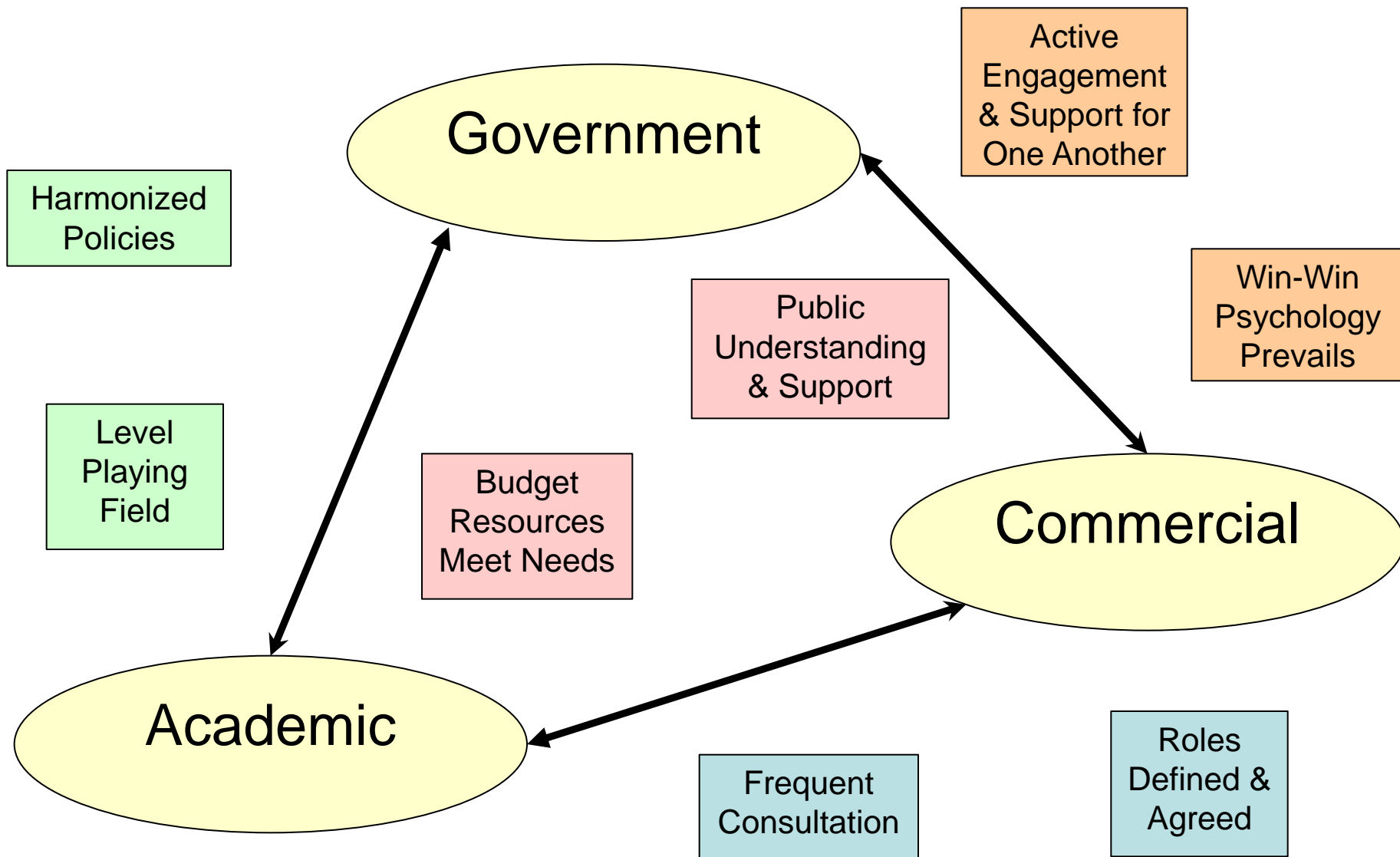
American Commercial Space Weather Association

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>

Success!





The Environmental Data Services Company

The End

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

U.S. Government

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

Stagnant!

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

**Money in budget for weather satellite replacement studies only

Commercial Satellite Imaging

<u>Market Size</u>	<u>\$B</u>
Total Space	304
Satellite Imaging	1.4*

→ **\$3.8B
In 2018****

Imaging – 9 Companies

(Optical and Radar)

- TerraSAR
- RapidEye
- InfoTerra
- Digital Globe / GeoEye
- Antrix
- Radarsat
- SkyBox
- Spot Image
- Skymed

*Euroconsult 2012 and company sources

** <http://www.transparencymarketresearch.com/commercial-satellite-imaging-market.html>

Commercial Satellite Imaging & Non-imaging

<u>Market Size \$B</u>	
Total Space	304
Satellite Imaging & Non-Imaging	11.4*

Global Meteorological and Environmental Data Market

Non-imaging

- Weather **\$10.0B**
- Climate
- Space Weather

Imaging – 9 Companies

(Optical and Radar)

- TerraSAR
- RapidEye
- InfoTerra
- Digital Globe / GeoEye
- Antrix
- Radarsat
- SkyBox
- Spot Image
- Skymed

\$1.4B

*Euroconsult 2012 and company sources

Commercial Satellite Communications

<u>Continent</u>	<u>No. Companies</u>
Asia/Oceania	31
Europe	27
North America	23
South America	5
International	2
Total*	88

<u>Market Size</u>	<u>\$B</u>
Total Space	304
Satellite Communications	149***

- GSA Listings****
- Interactive Voice, Video, or Data Networks for applications such as Distance Learning and Telemedicine
 - Broadcast Satellite Services with network operations and management support
 - Network Diversity/COOP networks such as VSAT backup networks
 - Long duration, baseline communications services and infrastructure to support enduring user requirements
 - Short duration communications services to support temporary user requirements

- **Satellite Communications**
 - Majority commercial****
 - 54% of all satellites in orbit (1000+ Dec 2012) are communications
 - 70% of those are Commercial
 - Bought as a service
 - Governments
 - National Defense Agencies
 - Services not satellites
 - Cost efficient
 - Reliable
 - Technically complex

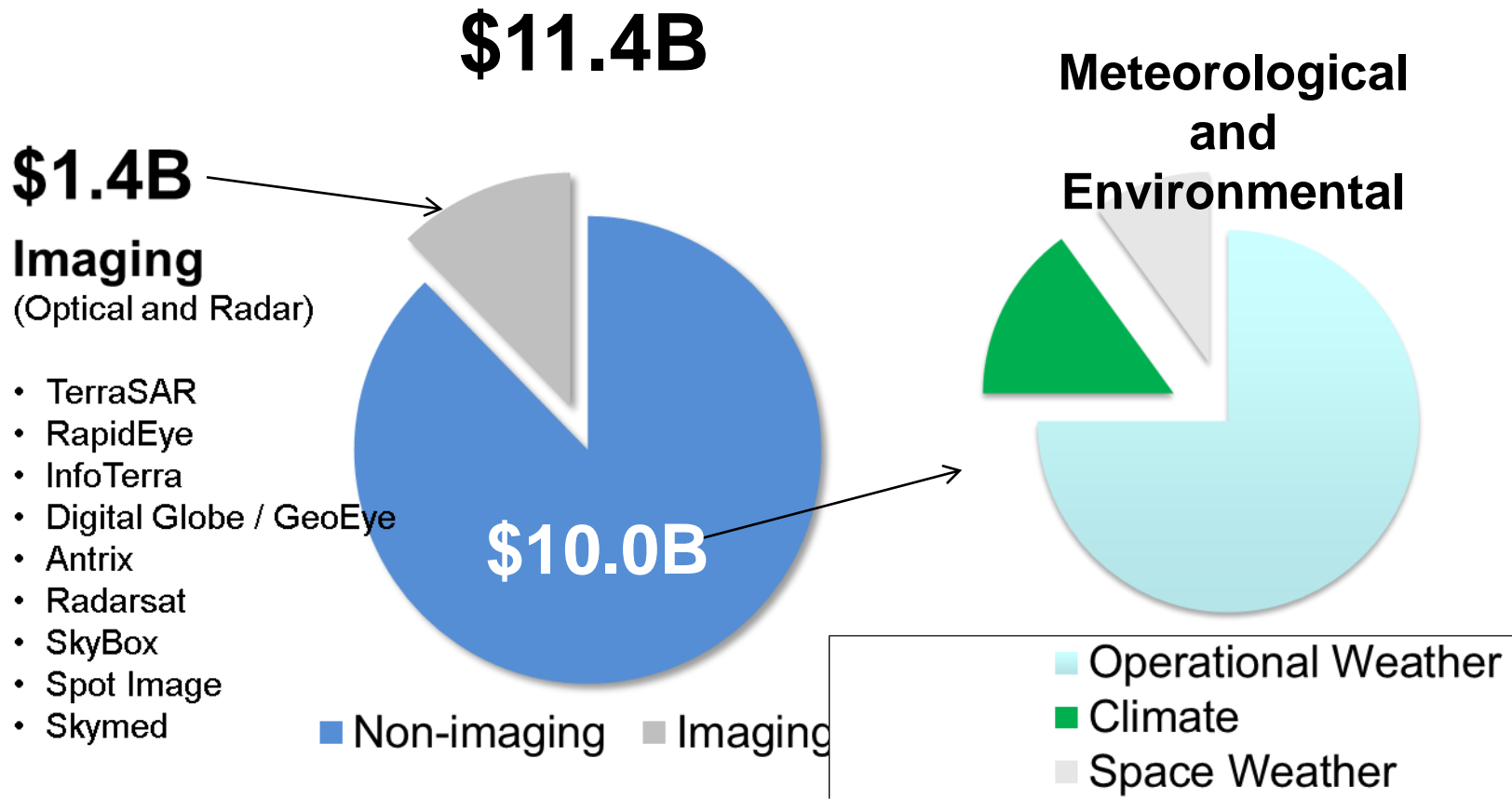
*http://en.wikipedia.org/wiki/List_of_communication_satellite_companies

*** SWAG from Space Foundation & Satellite Industry Assoc. data

**<http://www.gsa.gov/portal/> (U.S. government purchasing agency)

**** http://www.sia.org/wp-content/uploads/2013/06/2013_SSIR_Final.pdf

Global Market



Source: Euroconsult 2012 and company sources

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!**

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* (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