SWEF 2017

Commercial Sector and Building the National Space Weather Partnership

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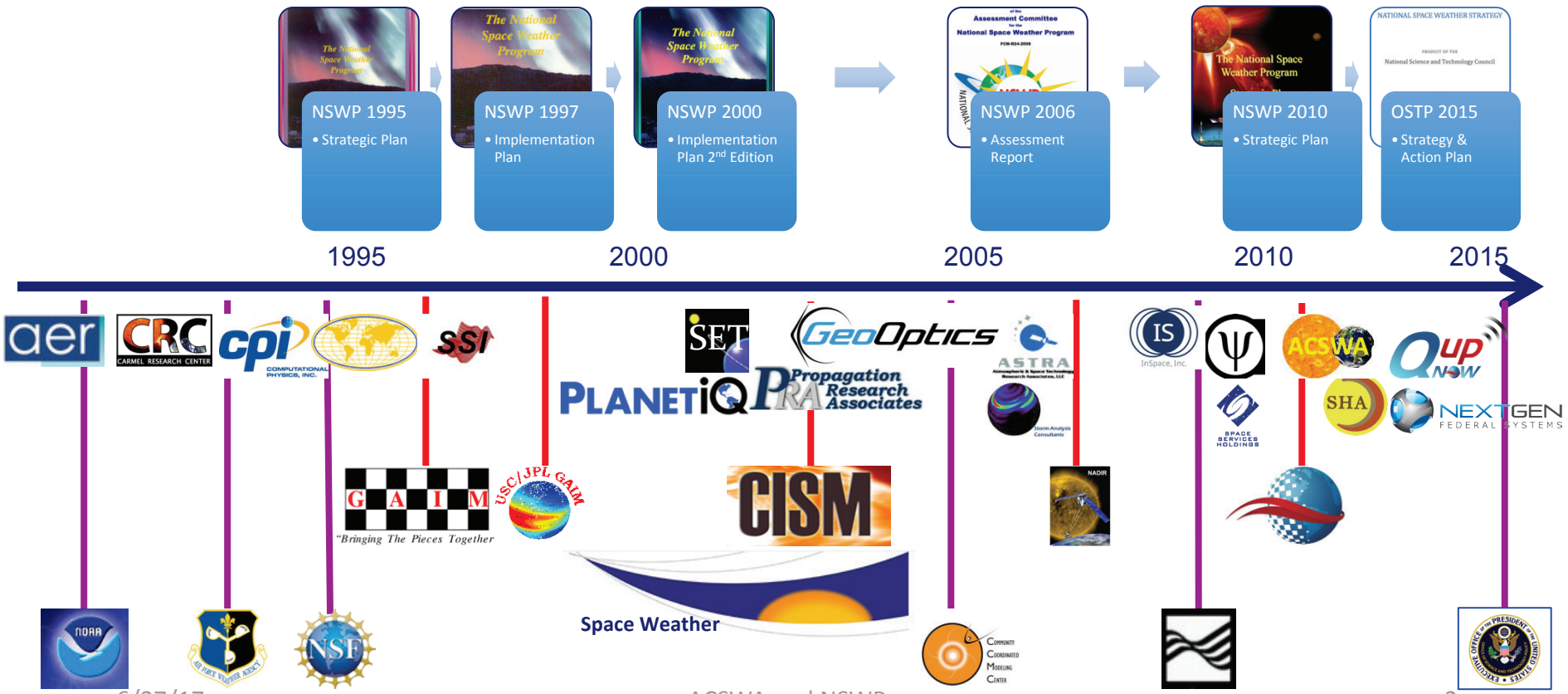
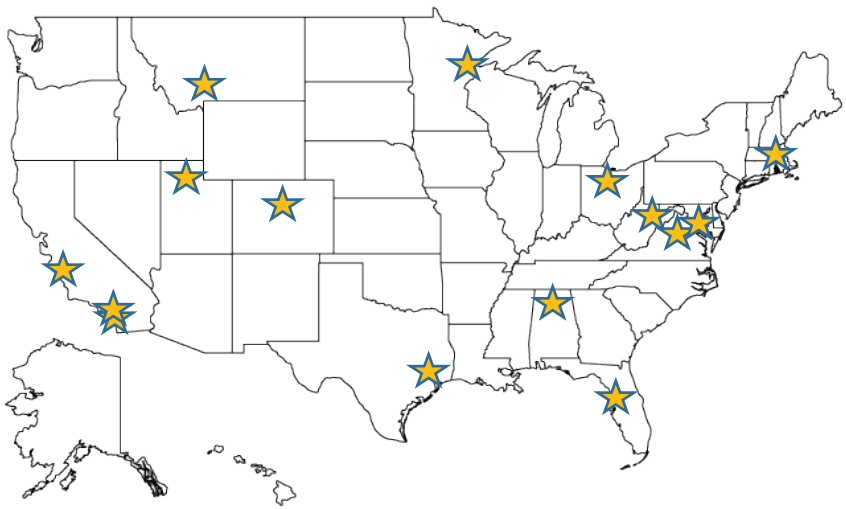
NextGen Federal Systems

National Space Weather Enterprise

- **National Space Weather Program** (1995,1997,2000,2006,2010,2016)
- **Agencies** (OSTP, NOAA SWPC, USAF 557th, NSF, NASA CCMC, USGS)
- **Academia** (GAIM MURI, CISM, NADIR MURI, USU SWC)



ACSWA Geographical Diversity



Effective Policy Communications

Senate Subcommittee on Space, Science, and Competiveness (38%)

Ted Cruz – Texas *	Gary Peters – Michigan
Mike Lee – Utah *	Edward Markey – Massachusetts *
Cory Gardner – Colorado *	Tammy Baldwin – Wisconsin
Jerry Moran - Kansas	Tom Udall – New Mexico
Dan Sullivan - Alaska	Brian Schatz - Hawaii
Ron Johnson – Wisconsin	Maggie Hassan – New Hampshire
Shelley Moore Capito – West Virginia *	

Congress Subcommittee on Space (64%)

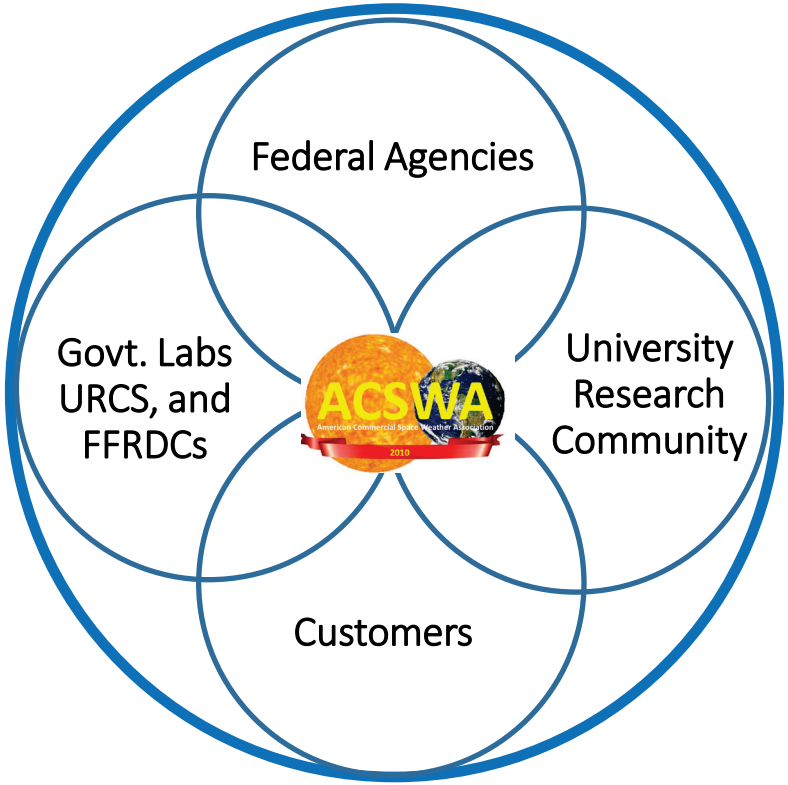
Brian Babin – Texas *	Ami Bera – California *
Mo Brooks – Alabama *	Zoe Lofgren – California *
Dana Rohrabacher – California*	Donald Beyer – Virginia *
Frank Lucas - Oklahoma	Marc Veasey – Texas *
Bill Posey – Florida *	Daniel Lipinski – Illionois
Jim Bridenstine – Oklahoma	Ed Perlmutter – Colorado *
Stephen Knight - California *	Charlie Crist – Florida *
Barbara Comstock – Virginia *	Bill Foster - Illinois
Ralph Abraham - Louisiana	
Daniel Webster – Florida *	
Jim Banks - Indiana	
Andy Biggs - Arizona	
Neal Dunn – Florida *	
Clay Higgins – Louisiana	

Responding to National Space Weather Needs and Goals

- American Space Commerce Free Enterprise Act of 2017
- National Space Weather Research and Forecasting Act
- SWAP
  - R2O-O2R
- NOAA Commercial Space Data Policy

ACSWA Integrates Activities and 'All-of-Community' for NSWP

Activities (ie., SWAP)



Communities

ACSWA Advantages

- corporate memory
- expertise in specific technical areas
- regional expertise
- customer-oriented priority setting
- cost-effective
- agile partnering

ACSWA's Mixed-Model Solutions; Achieving the 99 Goals of SWAP

- Algorithm development
- Automatic event forecasts (flares, solar energetic particles, CMEs, HSS)
- Calibration/validation
- Data assimilation
- Enterprise IT
- GPS modeling and services (signal analysis, scintillation, signal disruption/degradation)
- HF propagation
- Numerical modeling and simulation; Sun, interplanetary medium, magnetosphere, ionosphere, thermosphere, and lower atmosphere
- TRL 9 operational implementations / Research to Operations
- Risk and threat analyses for infrastructure and space resources
- Satellite data analysis & data product development
- Sensor hardware design, development, deployment and 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 nowcasting/forecasting

When ACSWA is Charged with SWAP Goals

- ACSWA companies will **mobilize their collective 'mixed model'** capabilities to undertake a concerted effort carefully and strategically coordinated with all space weather stakeholders
- **Convene a high level Board of Directors** charged with identifying the sources of public and private support for SWAP activities
- Once the mechanisms for realizing this support are identified, the **program will be self-propelling**. The coalescence of benefits to all communities is the fuel that will propel the SWAP

When ACSWA is Charged with SWAP Goals

- This **mobilization could begin as a testbed**, confined to one segment/goal of the SWAP.
  - For example, the recommendations specifically pertaining to ensuring protection against the impacts of **geomagnetically induced current represent an extremely important area requiring an end-to-end solution involving all space weather communities**.
- When proven successful, the activities of the Board could **expand to other space weather impact areas**.

5-Point Proposal to Grow-the-Enterprise Initiative

1. Enact a tax incentive for expanding space weather capabilities
2. Expand agency opportunities programs
   - NASA Flight/Modeling/Data Analyses Opportunities – matching funds
   - DoD and other agency Flight//Modeling/Data Analyses opportunities
   - Create FAA, NOAA, and other application opportunities with investment matching funds
3. Exploit SBIRs/STTRs
   - Phase I and Phase II solicitations to cross the TRL and ARL gap ("valley of death")
   - SBIR/STTR Phase IIE enhancement funding to all successful Phase II projects meeting a societal benefit threshold
   - Encourage agency use of SBIR/STTR Phase III sole source contracts across all agencies to implement new low hanging fruit capabilities
4. Incentivize
   - open sourcing while upholding intellectual property rights
   - B2B cooperation for space weather expansion to new industries
5. Formalize new R2O2R paradigm

Space Physics Applied Research Center (SPARC) Space Weather's R2O-O2R Facility

Must be:

- **flexible**
- **agile**
- **innovative**
- **'all-of-community'**

Board

e.g., DHS DOC DOD DOE DOI/USGS NASA NSF

R2O Facility (physical/virtual)

Director, 9 rotating R2O workstations, and 3 Test beds

Director

Commercial	Nat'l Labs	Academic
DOD	Industry	NASA
Academic	Commercial	NOAA

TRL 2-5

Test bed 1

Test bed 2

Test bed 3

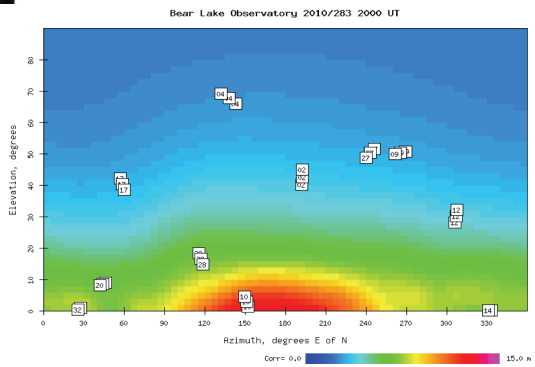
DOD/AFRL
NASA/CCMC
NOAA/SWPC
Commercial
Industry

TRL 6-8

ACSWA Low-hanging Fruit Examples

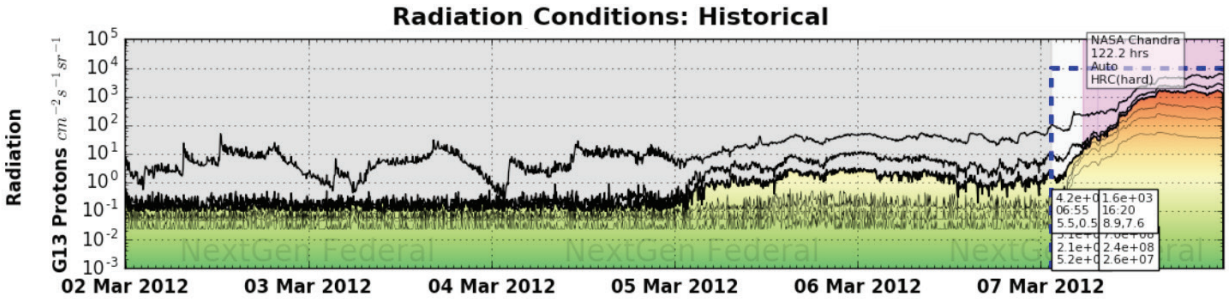
GPS & scintillation

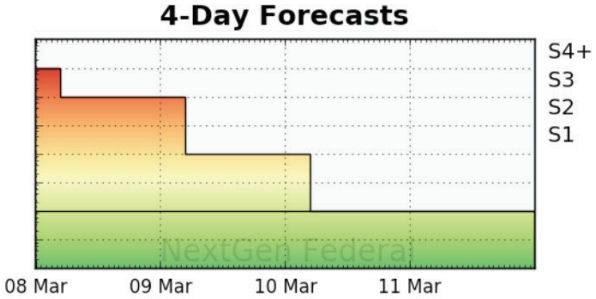
- ✓ ASTRA CASES scintillation
- ✓ USU GAIM and SPOT-ON single frequency accuracy improvement



SEP & flare probabilistic forecasts

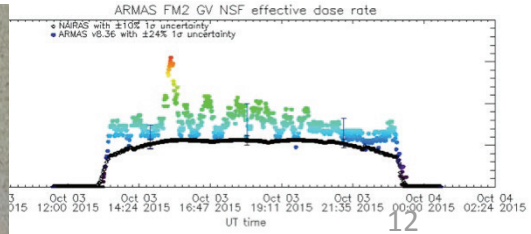
- ✓ NextGen SPRINTS proton forecasts





Aviation radiation monitoring

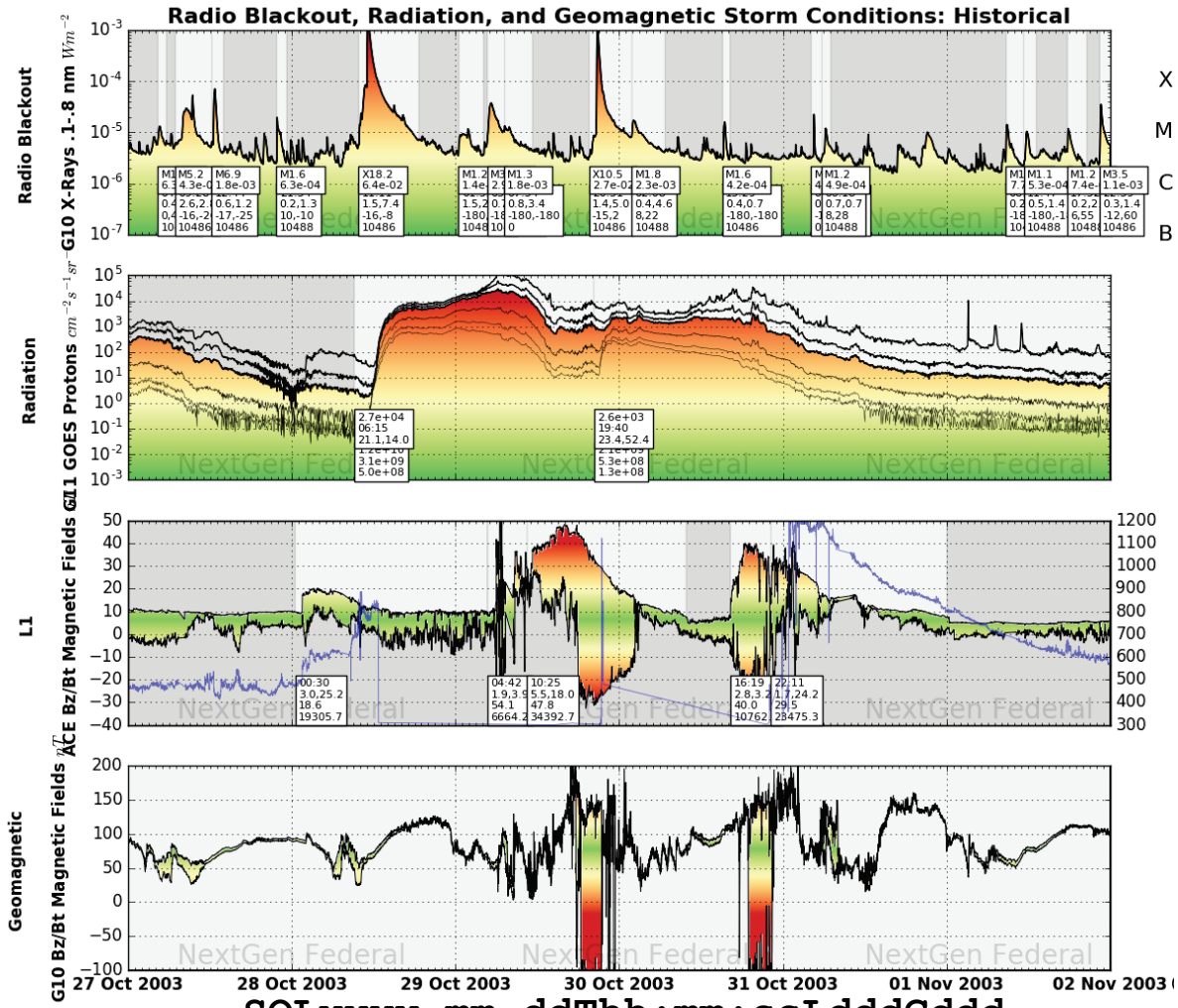
- ✓ SET ARMAS radiation monitoring



Engineering "All-of-Community" Solutions; NextGen Perspective

- Interdisciplinary fields
  - many interacting systems = one complex system
  - Physics, observation, theory, computation, etc
  - Data science is the new statistics
    - statistics: "playing in everybody else's backyard" – John Tukey
- Need for open data repository and crowd-sourcing of space weather events
- Open data repository and process for a 'Clearing House' approach to physics-based models validation

Community Event Database; Crowd-sourcing!



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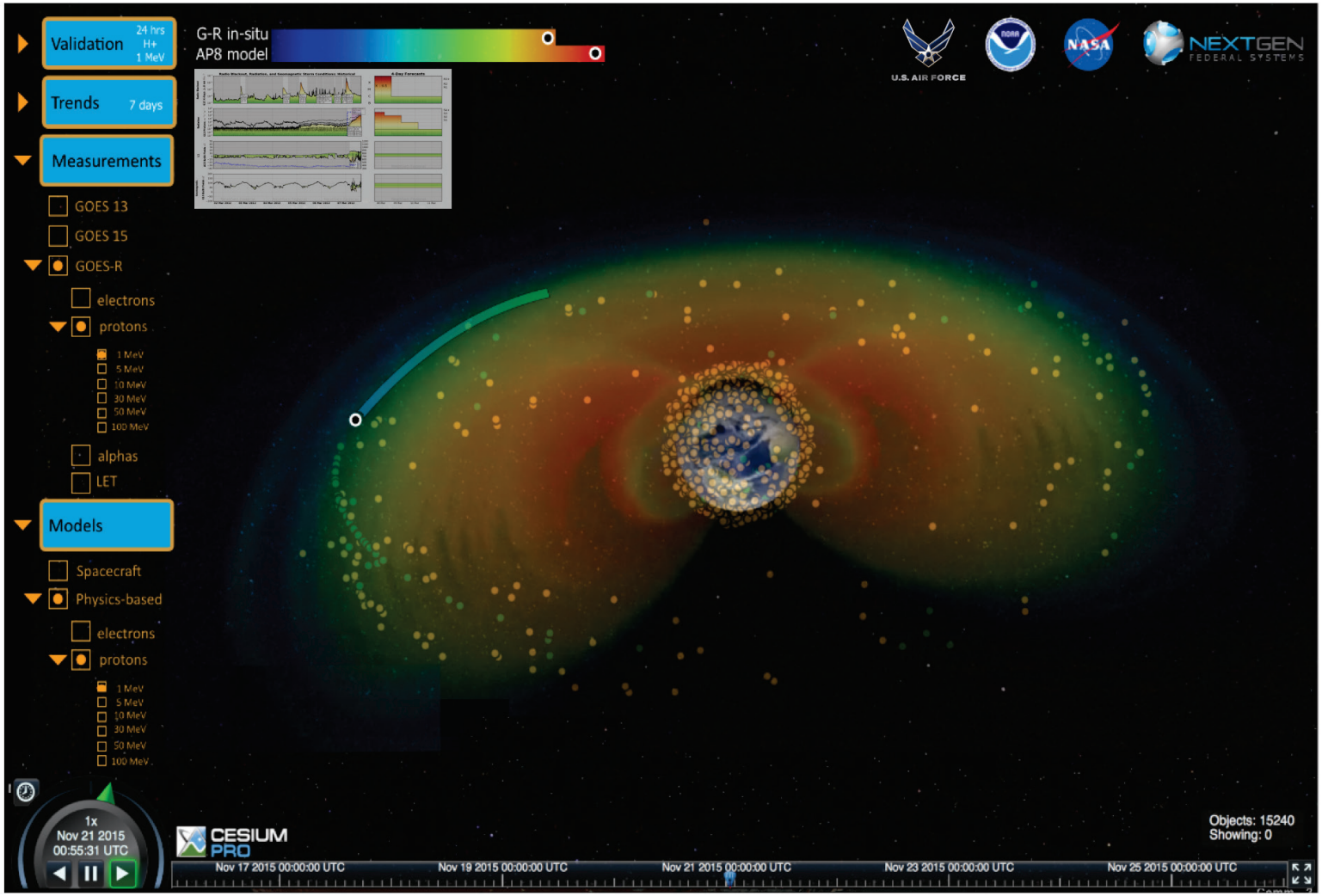
Leibacher et al., 2010

1. Space Wx Events
   - flares
   - SEPs
   - CMEs
   - high-speed streams
   - substorms
2. Benchmarking
3. Forecasting
4. Understanding

Community Process for Physics-based Models and Environment Characterization



Conclusions

- ACSWA lives and breathes NSWP's 'all-of-community'
- Mixed-model approach delivers cost-effective solutions
- Customer oriented
- Agile partnering
  - Academic
  - Agency
  - B2B
  - Industry
- Revenue generating
  - Not soleley dependent on budgets
- Cutting edge technologies that enage across NSWP