Enabling O2R – A Commercial Perspective on the Path Forward

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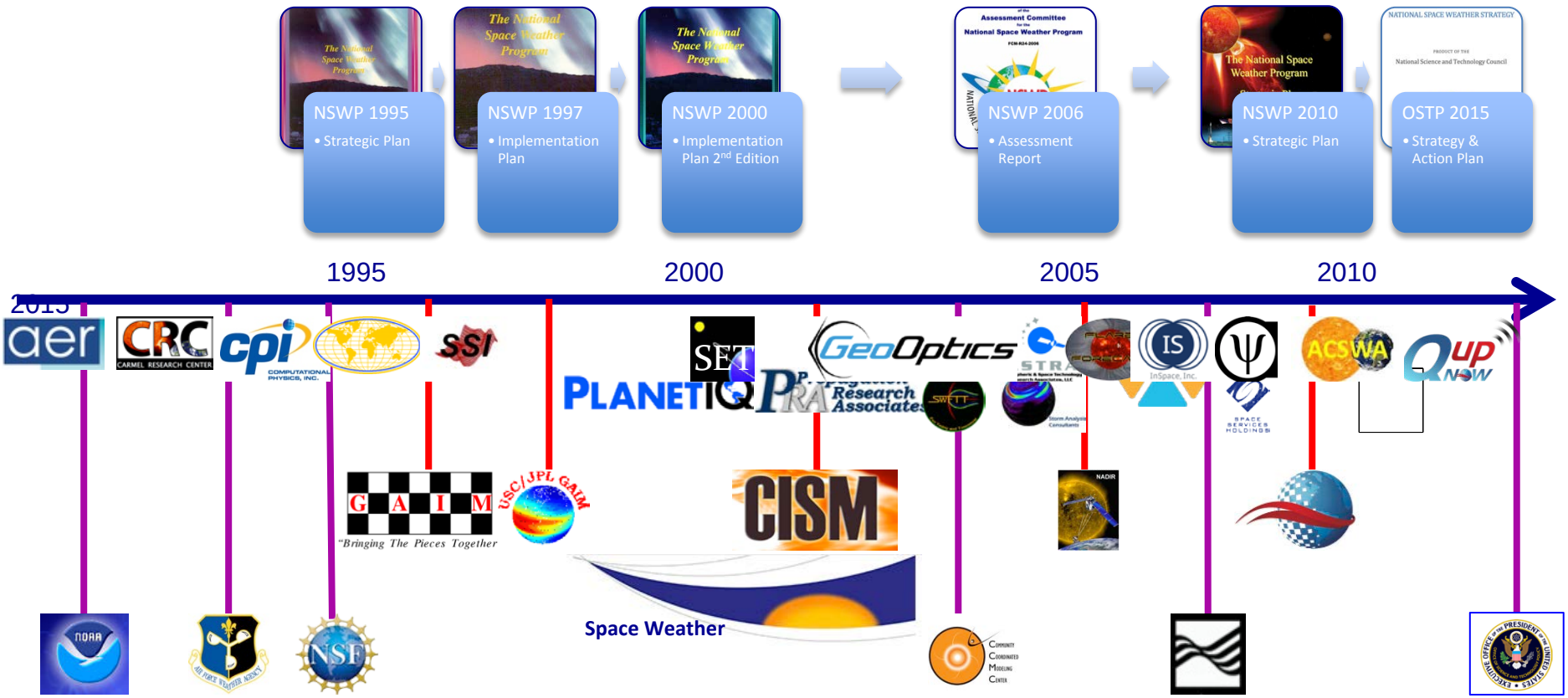
U.S. space weather enterprise

- **National Space Weather Program** (1995,1997,2000,2006,2010)
- **Agencies** (OSTP, NOAA SWPC, AFWA, NSF, NASA CCMC, USGS)
- **Academia** (GAIM MURI, CISM, NADIR MURI, USU SWC)
- **Industry** (19 U.S. companies in ACSWA as of January 1, 2016)



Commercial perspective on O2R

- **"IP Problem" created by a strategic focus on a competitive soft money funding climate – OPEN SOURCE CODE OK FOR SCIENCE BUT INAPPROPRIATE FOR OPERATIONS IN A SECURITY-CHALLENGED WORLD**
  - **academic and industrial sectors use a mix of internal funds, grants, contracts to build products – common goal of expanding the U.S. SpWx Enterprise**
  - **However, organizations will NOT jeopardize the existing economic livelihood of their teams by opening their IP to potential competitors**
  - **if teams are invested in a project, then flexibility for use of products may exist**
  - **If MAJOR funding for open source models is provided, paradigm may change**
- **Use SWAP benchmark areas as foundation for development under Goal 5 (Improve Space-Weather Services through Advancing Understanding and Forecasting) – NEED TO FILL GAPS IN THESE AREAS**

1. **Induced Geo-Electric Fields**
2. **Ionizing Radiation**
3. **Ionospheric Disturbances**
4. **Solar Radio Bursts (SRBs)**
5. **Upper Atmospheric Expansion**

SWAP GAP Implementation Examples

- **Low hanging (existing) fruit:**
  - **Upper Atmospheric Expansion[5]** – USAF JSpOC HASDM
    - 2001 to 2016 "gold standard" database of accurate LEO densities 200–1500 km could be released for use by physics-based modelers and for a baseline leading to data assimilation
  - **Ionospheric Disturbances[3]** – USAF AFWA GAIM FP
    - Results from scintillation, solar flare, and geomagnetic storm conditions could be shared with developers and modeling community to improve the physics
  - **Ionospheric Disturbances[3]** – NOAA USTEC
    - Alaska CASES scintillation data could be utilized to help developers and modeling community to improve the physics
  - **Ionizing Radiation[2]** – USAF GPS
    - GPS particle data release outside of January 2014

SWAP GAP Capacity Building Examples

- **Transformational (near-term) possibilities:**
  - **Ionizing Radiation[2]** – NASA NAIRAS and ARMAS
    - Modeling with data assimilation can be run to build a redundant operational radiation management systems; validation by NASA CCMC; participation of NOAA, NSF, FAA
  - **Supporting of GICs[1], Ionospheric Disturbances[3], Upper Atmospheric Expansion[5]**
    - IPS arrays – improve the timing and magnitude of CME and magnetic cloud material arriving at Earth
    - LIDAR chain – improve upper atmosphere winds and densities
    - Neutron monitor chain – improve radiation environment modeling
  - **There needs to be a mechanism for the community to REGULARLY (AND OFTEN) suggest ideas to Executive Board, Management Board, or Science Advisory Board (SWW and quarterly ACSWA–SWPC telecons not sufficient)**