Space Situational Awareness (SSA) Users Perspective

29 April 2009

Col Shawn Barnes
AFSPC/A5C

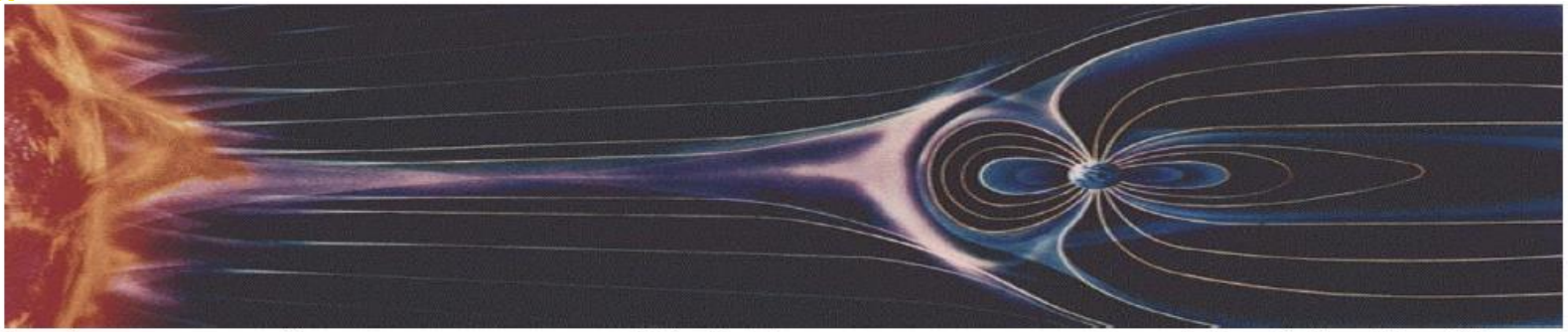
Purpose

- **Communicate the importance of a robust space environmental sensing, data sharing and information processing infrastructure to support US SSA needs**

Overview

- **Space Systems/Services Impacts**
- **Space Situational Awareness (SSA) & the Environment**
- **Environmental SSA Components**
- **Need for Partnerships**

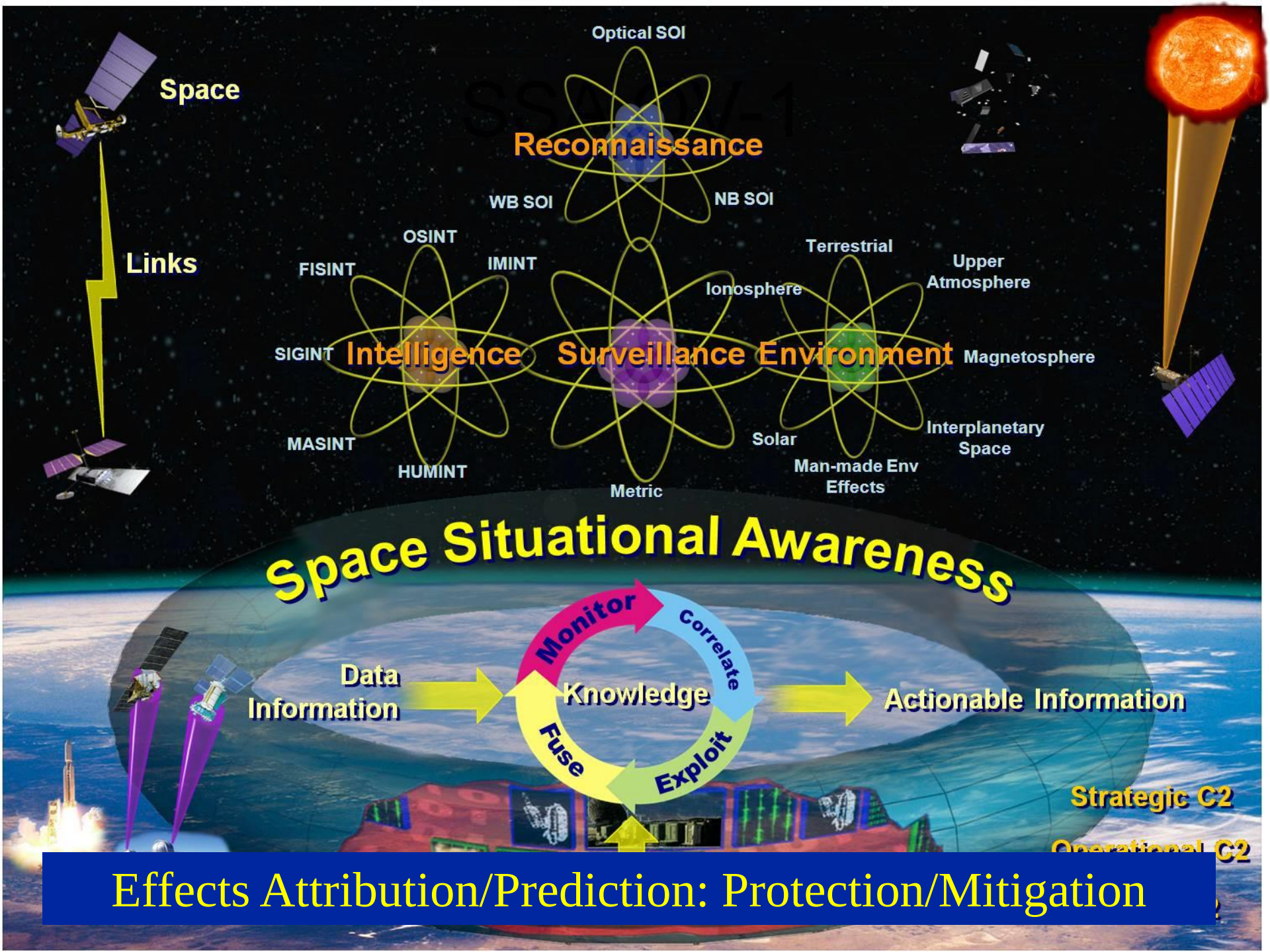
Space Weather—System/Service Impacts



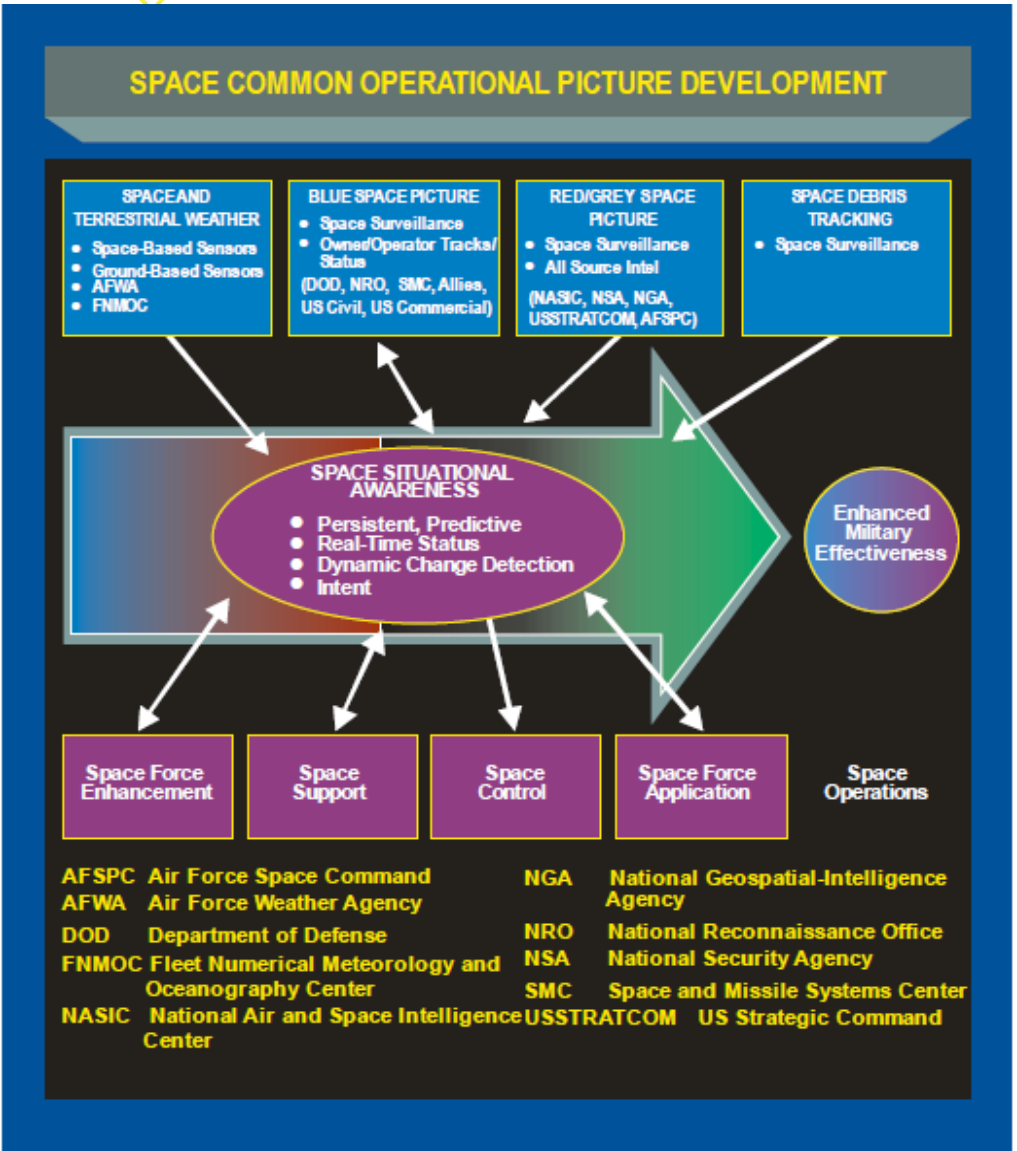
Electromagnetic Radiation	High Energy Charged Particles	Electrically Charged Particle Clouds
EFFECTS	**EFFECTS**	**EFFECTS**
• HF RADIO BLACKOUT	• SATELLITE DISORIENTATION	• GEOLOCATION ERRORS
• SATCOM INTERFERENCE	• SPACECRAFT DAMAGE	• SATCOM DISRUPTIONS
• RADAR INTERFERENCE	• FALSE SENSOR READINGS	• SPACECRAFT ANOMALIES
• SATELLITE ORBIT DECAY	• LAUNCH PAYLOAD FAILURE	• SATELLITE ORBIT DECAY
• GEOLOCATION ERRORS	• HF RADIO BLACKOUT	• RADAR FALSE TARGETS

Sample Impacts

- SATCOM interruptions
- Worldwide HF comm blackouts
- Lost contacts with Air Force One
- Premature satellite orbit decay
- Hundreds of satellite ops disruptions
- Dozens of failed satellite subsystems
- 1300 orbiting objects lost
- Six million people lost electrical power


Space
Links
Optical SOI
Reconnaissance
WB SOI
NB SOI
OSINT
FISINT
IMINT
SIGINT
Intelligence
Surveillance
Environment
Terrestrial
Upper Atmosphere
Ionosphere
Magnetosphere
Interplanetary Space
Solar
Man-made Env Effects
MASINT
HUMINT
Metric
Space Situational Awareness
Monitor
Correlate
Fuse
Exploit
Knowledge
Data Information
Actionable Information
Strategic C2
Operational C2
Effects Attribution/Prediction: Protection/Mitigation

SSA Definition



SSA: "…SSA involves characterizing, as completely as necessary, the space capabilities operating within the terrestrial environment and the space domain. It includes components of ISR; environmental monitoring, analysis, and reporting; and warning functions…."

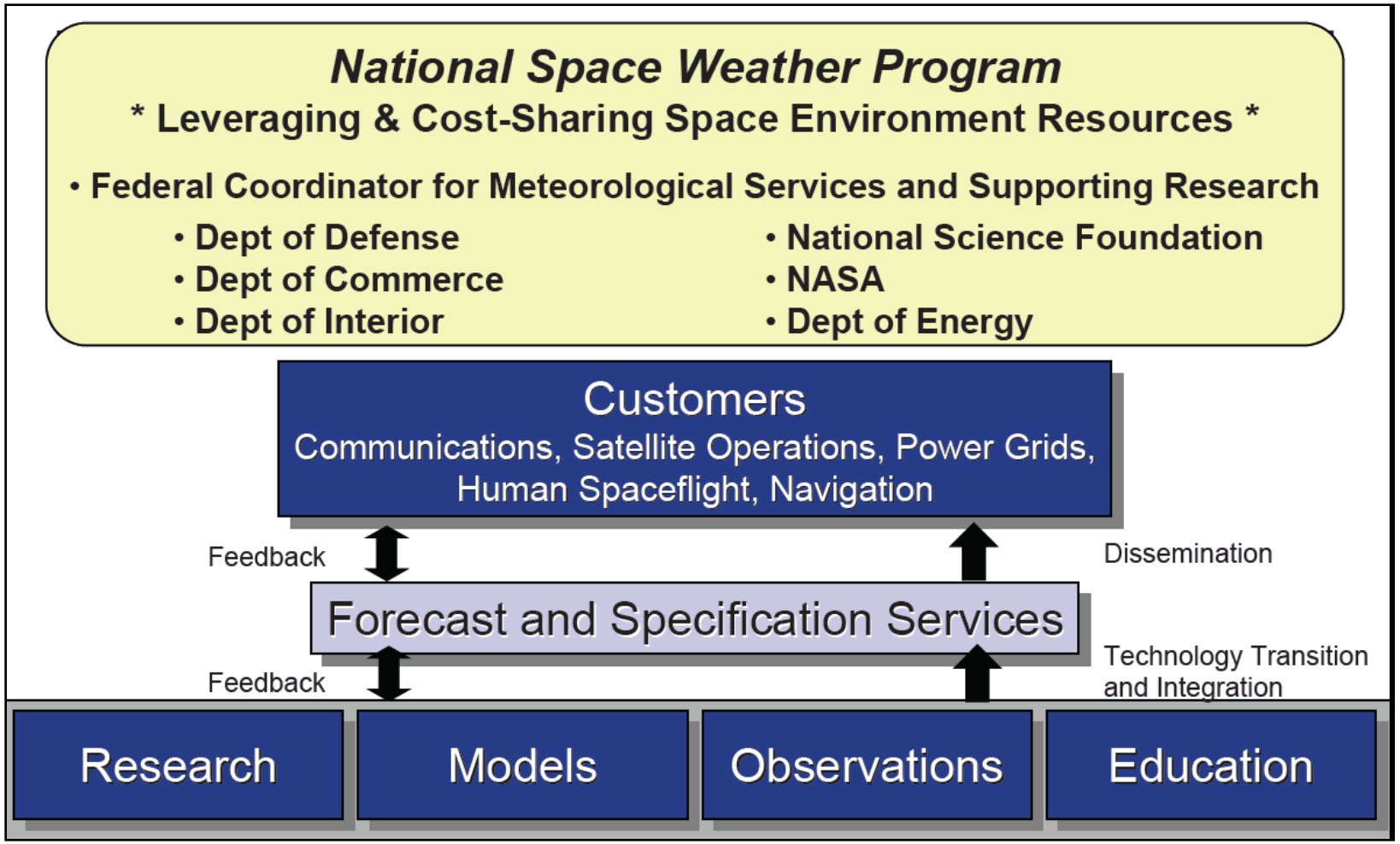
Environmental Monitoring: "… includes the characterization, analysis, and prediction of space weather (e.g., solar conditions), terrestrial weather near important ground nodes, and natural phenomena .... Operators must be able to differentiate between natural phenomena interference and an intentional attack on a space system in order to formulate an appropriate response."

Joint Publication 3-14, Space Operations; Jan 2009

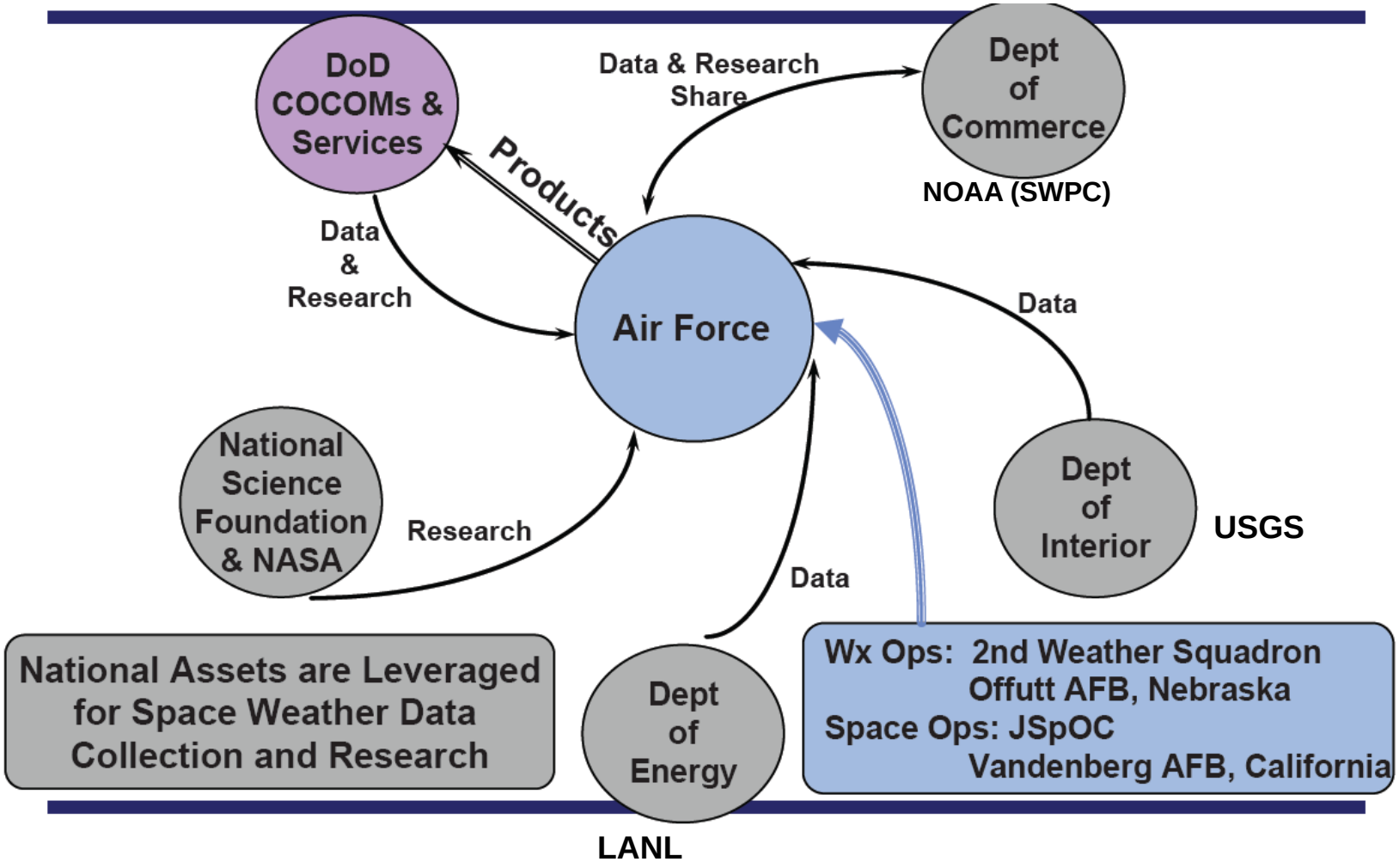
Environmental SSA--Components

- **OBSERVE environmental conditions**
  - **Sensors—Provides eyes on the space environment**
- **PROCESS sensor data**
  - **Environmental Models—Actual & forecast picture of the space relevant environment**
- **DETERMINE EFFECTS**
  - **Data Fusion—Environmental impacts on system/mission operations**
- **INTEGRATE EFFECTS**
  - **Via C2 System**

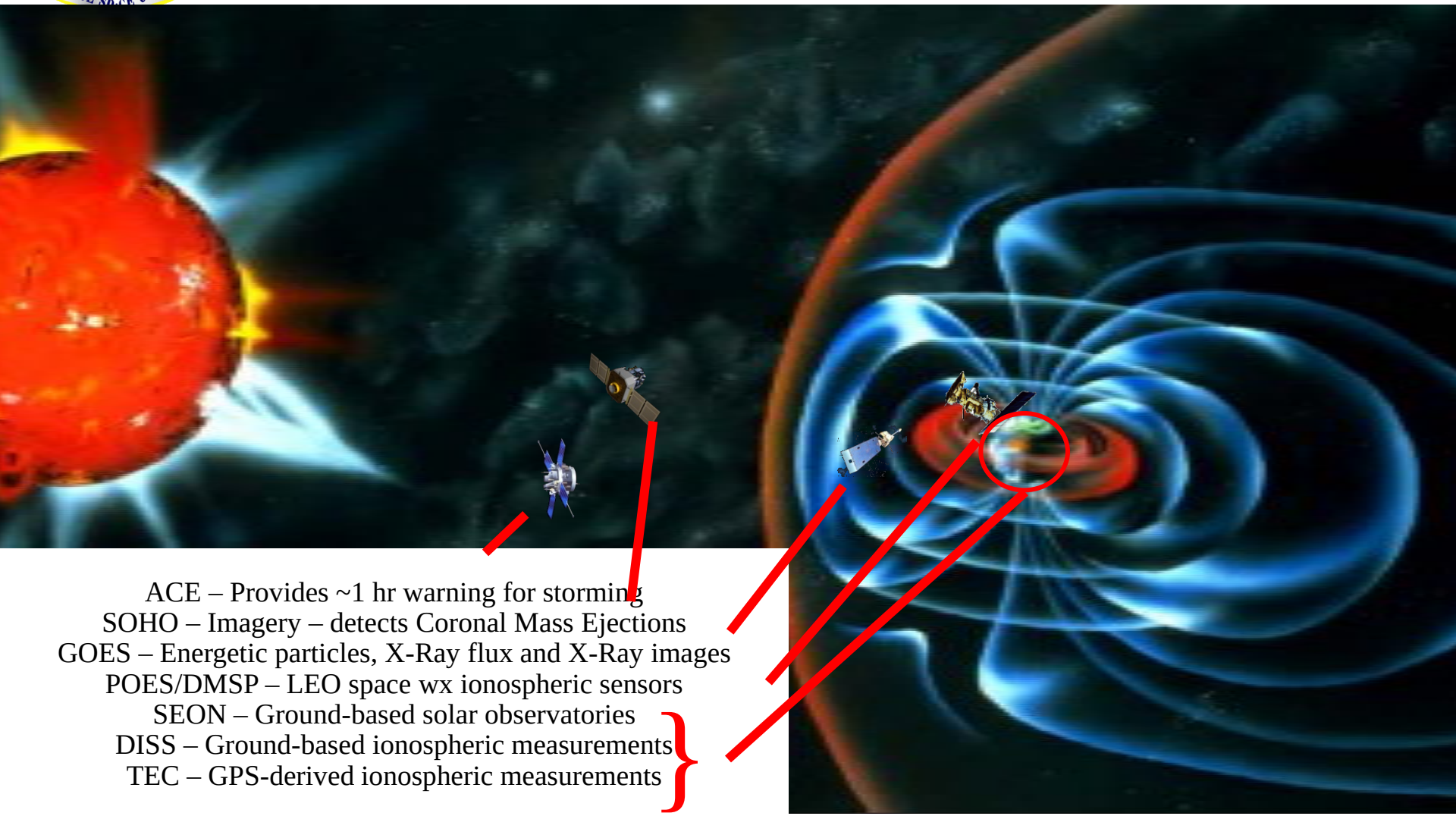
National Cooperative Efforts



DoD Space Operations



Current Capabilities



ACE – Provides ~1 hr warning for storming
SOHO – Imagery – detects Coronal Mass Ejections
GOES – Energetic particles, X-Ray flux and X-Ray images
POES/DMSP – LEO space wx ionospheric sensors
SEON – Ground-based solar observatories
DISS – Ground-based ionospheric measurements
TEC – GPS-derived ionospheric measurements

Summary

- **SSA is critical to protecting space systems and providing assured space services—military, civil, and commercial**
- **Need for robust SSA infrastructure**
  - **Continue planning and budgeting for space environment capabilities**
    - **Bigger challenge than any one on us can tackle**
- **Opportunities: Effective Partnerships—Cross Agency, Academia, and International**