

Headquarters U.S. Air Force

Integrity - Service - Excellence

U.S. Department of Defense Space Weather Services



**Mr. Ralph Stoffler
HQ USAF/A3W
June 2017**

U.S. AIR FORCE



U.S. AIR FORCE

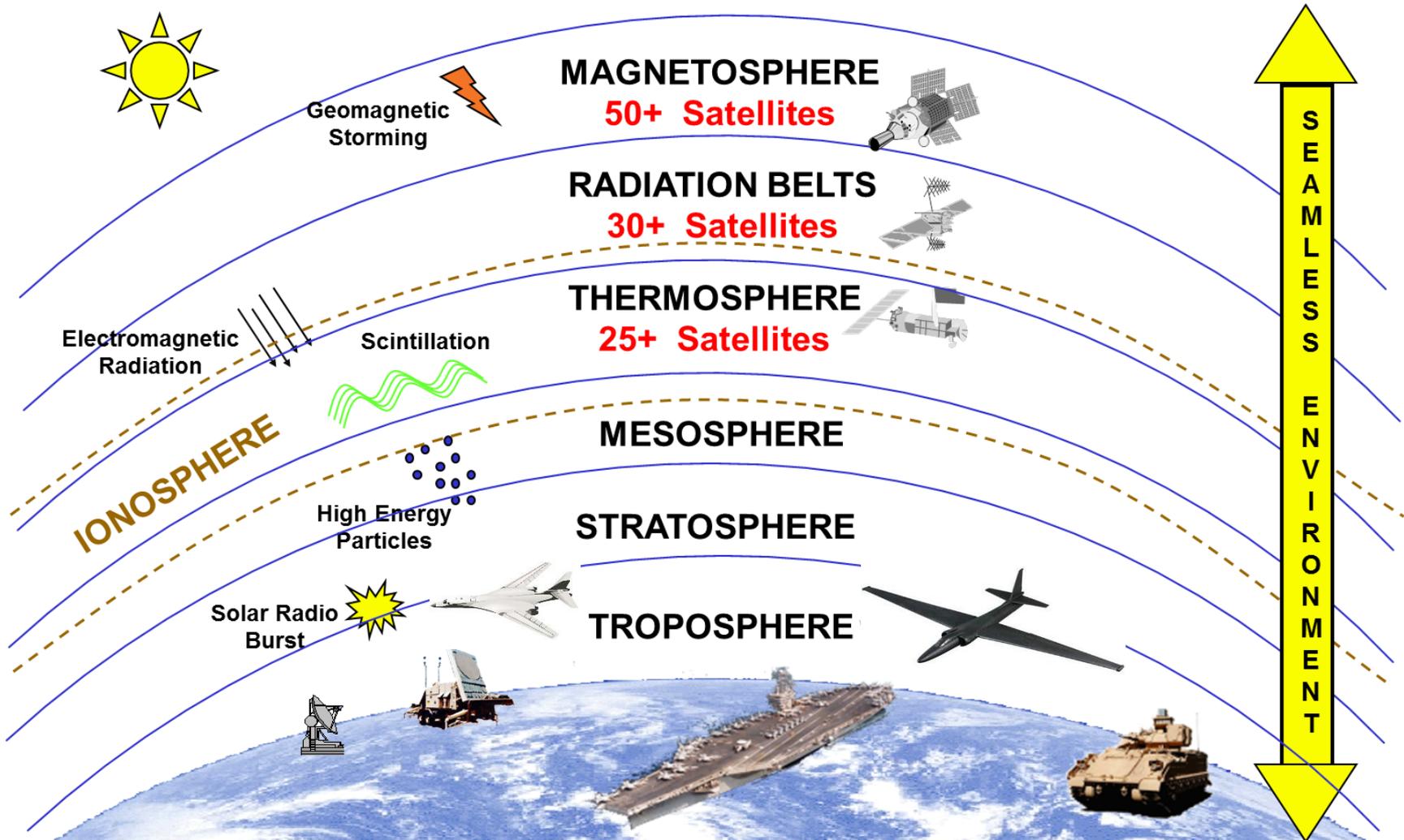
Overview

- **Why Space Weather Important to DoD**
- **Sensor-to-Operator Chain**
- **Space Weather Application**
- **Space Environment**
- **Space Weather Community**
- **National Space Weather Action Plan Engagement**
- **Summary**



Space Environment

U.S. AIR FORCE



Integrity - Service - Excellence



Why Space Wx Important to DoD?

U.S. AIR FORCE

Global Power/Reach



- Need to characterize the HF communications at high latitudes for airlift and global strike operations
- Potential weapon GPS errors

Air Ops



- Ionospheric modeling needed for successful Command and Control (C2) HF communications
- Potential weapon GPS errors

Global Vigilance



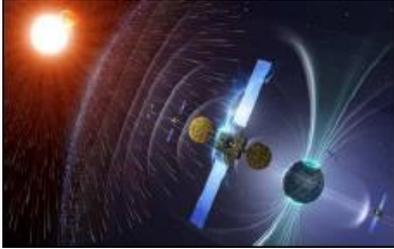
- Characterizing the cosmic ray flux are critical to estimated the radiation dose for high altitude pilots
- Determination of SATCOM communications interference



U.S. AIR FORCE

Why Space Wx Important to DoD?

Space Ops



Characterization of space weather environment for:

- **Space track radar interference**
- **Geolocation**
- **Missile early warning**
- **Satellite anomaly assessments**
- **Satellite orbital decay**

Special Ops



- **Ionospheric specification for Joint Terminal Attack Controller (JTAC) directing Close Air Support via HF Comm**
- **HF Radio Blackout**

Army Ops



- **Ionospheric models provides HF communication radio blackout impacts for Army convoy operations**
- **Need GPS error determination for infantry navigation via hand-held GPS**



U.S. AIR FORCE

Space Weather Observing for Military Operations

- What is the DoD perspective on space weather observing?
 - Operational requirement vs Research need
 - Sensor design, sustainability, lifespan
 - Assured availability
 - Sustained operational data sources
 - Dedicated communications
 - Access across all phases of military operations
 - Accredited systems
 - Usable on DoD/AF IT networks
 - Releasable to partners



Relevant, Reliable, Responsive Obs Feeding Sensor-to-Operator Chain



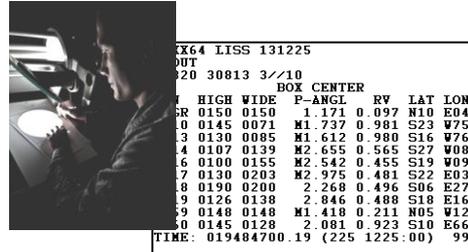
Sensor-to-Operator Examples

U.S. AIR FORCE

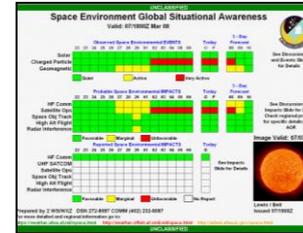
SOON – H α



Forecaster analysis & sunspot classification



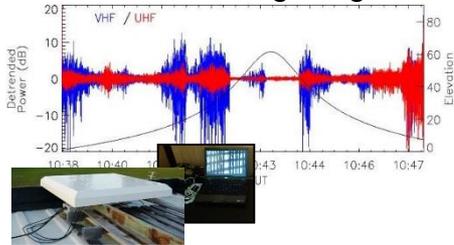
AF Space forecast space wx & impacts



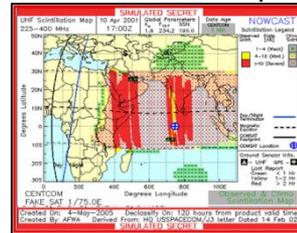
20th Space Control Sq alerted to space object tracking impacts



ISTO – Radio Frequency Beacon over flight signals



UHF Satellite Communications Scintillation Map



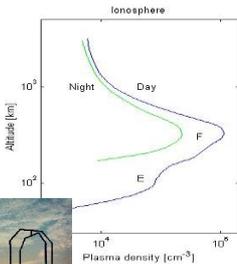
Combined Air Operations Center (CAOC) Theater Intelligence, Surveillance Reconnaissance collection



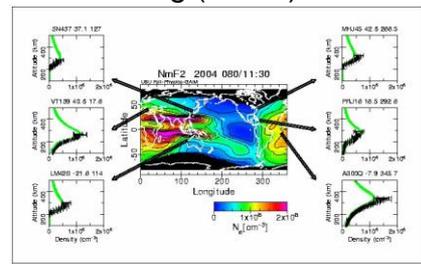
Uninterrupted RQ-1 SATCOM data link to CAOC



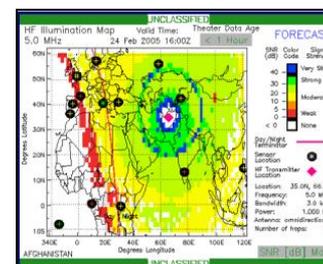
NEXION – derived profiles



Models – Global analysis, Integration, and Modeling (GAIM) assimilates obs



Impact products – HF illumination



Naval Special Warfare Rigid Hull Inflatable Boat C2 via HF Comm



SENSOR

SPACE WEATHER DATA & PRODUCTS

OPERATOR



Space Weather Application

U.S. AIR FORCE

- **557th Weather Wing Space Weather Operations Center (SpaceWOC)**
 - Mission-tailored unclassified and classified analysis, forecasts, warnings
 - Disseminate system-impacting space weather
 - DoD operators and decision makers
 - National agencies
 - Anomaly assessment support
- **Joint Space Operations Center (JSpOC)**
 - C2 system executing USSTRATCOM space control mission
 - Focal point for space force integration & employment in military ops
 - Detect, track, and identify all artificial objects in Earth orbit



Mission Focused DoD & USG Operational Support



Space Weather Community

U.S. AIR FORCE

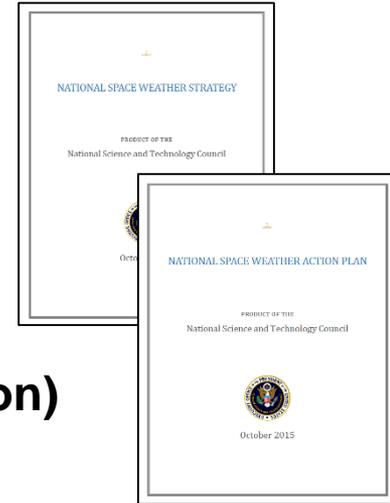
- **DoD actively engaged in global community**
- **Training**
 - **Space weather course (2 weeks) at 557 Weather Wing**
 - **Students from France, Italy, Netherlands, Germany – working to bring in Japan and South Korea**
- **Cooperating in operations**
 - **NOAA SWPC – analysis and forecasting**
 - **Engaging with UK, South Korea on Ops Centers stand-up**
 - **Data sharing via web services – national & int'l partners**
- **Energizing research and development relationships**
 - **Government Labs**
 - **Academia**
 - **Commercial Sector**



DoD NSWAP Engagement

U.S. AIR FORCE

- **Co-lead or Supporting Agency for 34 NSWAP tasks**
 - Drawing expertise from range of DoD organizations – AFRL, NRL, AFOSR, SMC, AFSPC, JSpOC, 557 WW
 - Task 5.3.5 lead sustaining ground-based solar radio obs
- **Developing Annex covering items not contained in NSWAP that impact military operations (e.g., geolocation)**
- **White House Situation Room**
 - Classified support to POTUS & National Security Council during events impacting national & international critical infrastructure or security
- **Executive Order (13744)**
 - Developing preparedness CONOPS and checklist in collaboration with FEMA to coordinate Federal assets/activities in response to and to protect against impending space weather events





Summary

U.S. AIR FORCE

- Air Force committed to space weather observing...now & future
- Team with national & international community for DoD Support
- Sensor-to-Operator – accurate, timely, relevant impacts delivered

Global Power



Global Reach



Air Ops



Agile Combat Support



“Air Force weather enables Joint Warfighters to anticipate and exploit the weather...for air, ground, space, cyberspace and intel operations.”

– AFW Mission



Army Ops



Global Vigilance



Special Ops



Space Weather

Integrity - Service - Excellence