

# ***Headquarters U.S. Air Force***

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*Integrity - Service - Excellence*

## **U.S. Department of Defense Space Weather Services**



**Col Mike Gremillion  
HQ USAF/A3WX  
April 2016**

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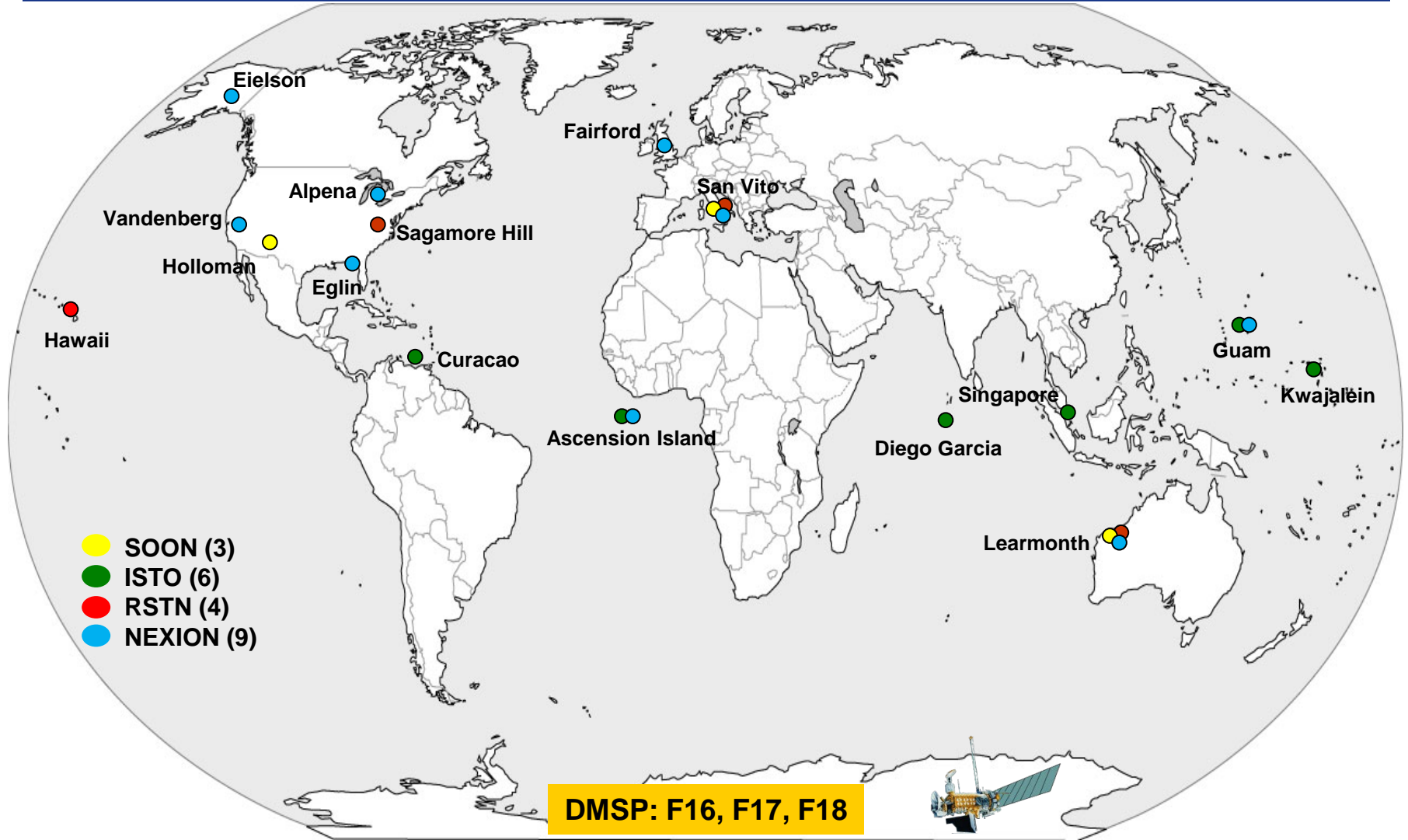
# *Overview*

- **AF space weather observing systems – Current & Future**
- **Space weather application**
- **Space weather community**
- **DoD perspective**
- **Sensor-to-Operator chain**
- **Summary**



# AF Space Weather Observing Current

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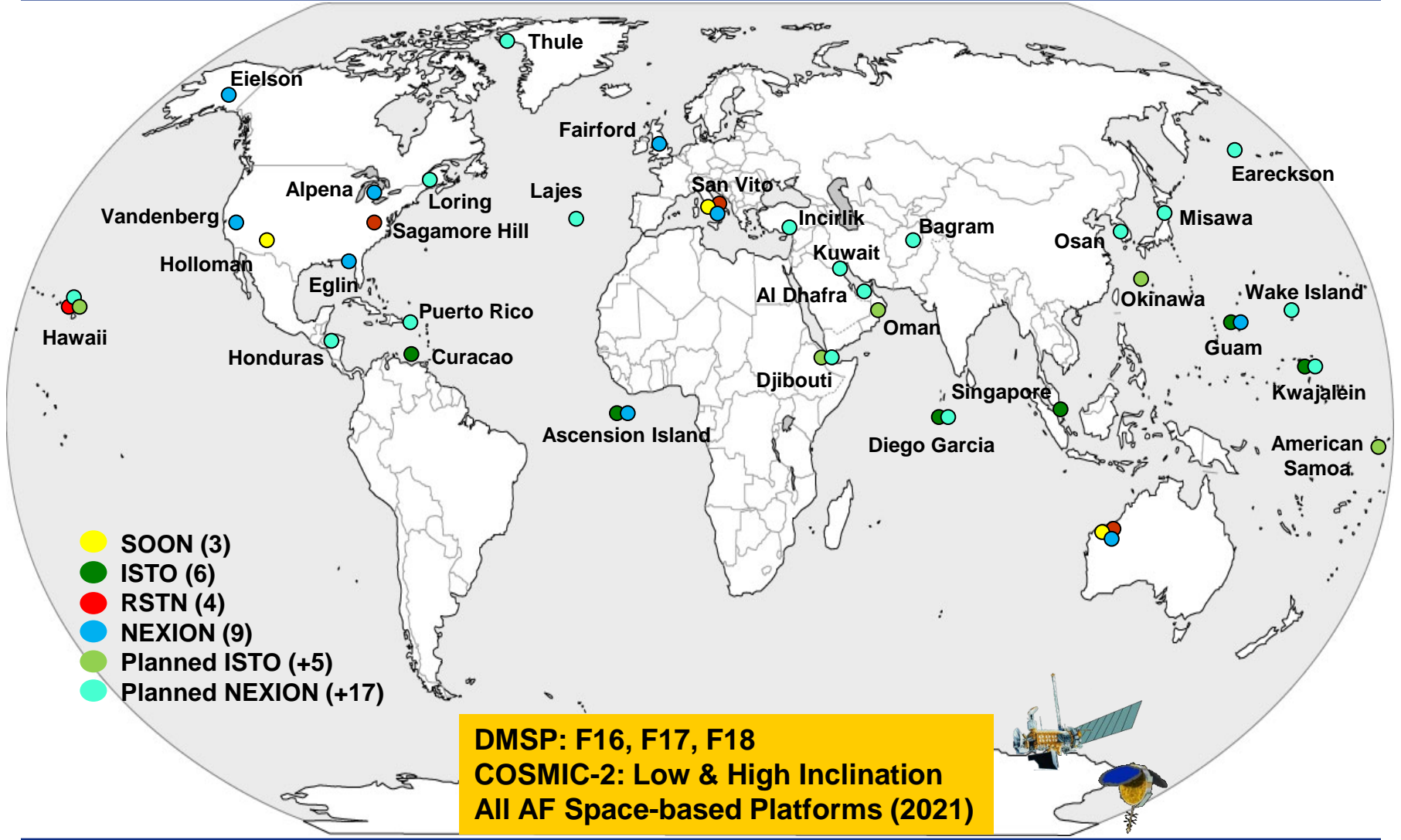


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# AF Space Weather Observing Future

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# Space Weather Application

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- **557<sup>th</sup> 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

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- **Space weather is a team sport!**
- **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**
- **Engaging with UK, South Korea on Ops Centers stand-up**
- **Data sharing via web services – national & international partners**
- **Cooperative efforts**
  - **NOAA SWPC – analysis and forecasting**
  - **AFRL, NRL, JHU/APL – modeling and data**
  - **Academic community**

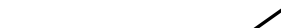
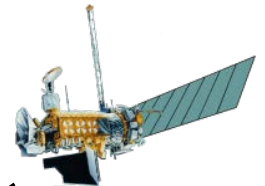




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# Space Weather Observing for Military Operations

- 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



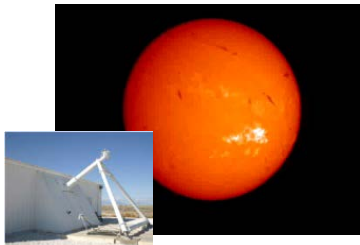
Relevant, Reliable, Responsive Obs Feeding Sensor-to-Operator Chain



# Sensor-to-Operator Examples

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SOON – H $\alpha$

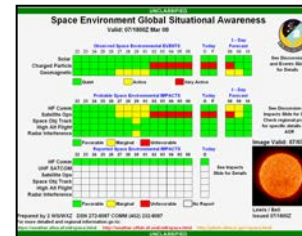


Forecaster analysis & sunspot classification



XX64 LISS 131225
OUT
320 30813 3//10
BOX CENTER
W HIGH WIDE P-ANGL RV LAT LON
GR 0150 0150 1.171 0.097 N10 E04
0 0145 0071 M1.737 0.981 S23 W75
3 0130 0085 M1.612 0.980 S16 W76
4 0107 0139 M2.655 0.565 S27 W08
6 0100 0155 M2.542 0.455 S19 W09
7 0130 0203 M2.975 0.481 S22 E03
8 0190 0200 2.268 0.496 S06 E27
9 0126 0138 2.946 0.489 S18 E16
9 0148 0148 M1.418 0.211 N05 W12
0 0145 0128 2.081 0.923 S10 E66
TIME: 019484700.19 (225 1225:00) 999

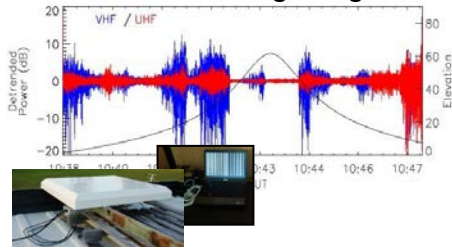
SpaceWOC forecast space wx & impacts



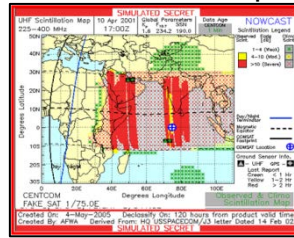
20<sup>th</sup> Space Control Sq alerted to space object tracking impacts



ISTO – Radio Frequency Beacon over flight signals



UHF SATCOM Scintillation Map



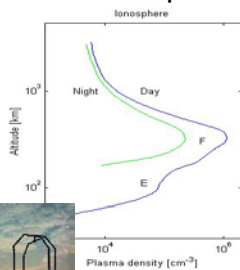
Combined Air Operations Center Theater ISR collection



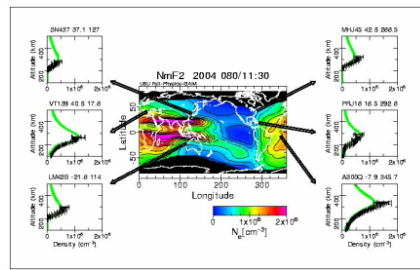
Uninterrupted RQ-1 SATCOM data link to CAOC



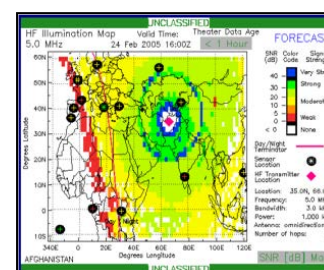
NEXION – derived profiles



Models – GAIM assimilates obs



Impact products – HF illumination



Naval Special Warfare RHIB C2 via HF Comm



SENSOR

SPACE WEATHER DATA & PRODUCTS

OPERATOR





# Summary

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- 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

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