## **Operational GNSS Interference Monitoring**

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### **Example LEO Spacecraft Impacted by GPS Disruption in 2016**



Data from Publicly Available Information (PAI): https://data.cosmic.ucar.edu/gnss-ro/

#### NASA Space System Protection Standard (NASA-STD-1006, Para 4.3):

- "Missions need to detect and report instances of unexplained interference...
- ...GPS degradation/disruption incidents can potentially impact the safe operation of civil space missions"

### **Operational GNSS Interference Monitoring TODAY...**

**Space-based Layer:** 

Global & Persistent Combined Commercial Constellations (DEEP-PNT)

#### Joint Commercial Operations (JCO)

#### **Other Multi-Domain Layers**

- Crowd-sourced
- Informed
- Exquisite



### **Data Exploitation and Enhanced Processing (DEEP) PNT**



Global & Persistent Combined Commercial Constellations

US Space Command Joint Commercial Operations (JCO)



Longitude

**GNSS Disruption / Coverage Heat Maps** 

### Spectrum EMI, Awareness, and Response (SPEAR) Team

#### • Provides uniquely skilled engineers and scientists to:

- Use and evaluate available tools -What Can / Can't the Tools Do?
- Curate data sources
- Interpret tool output and other processed data
- Provide actionable response options (e.g., notification, alerting, enforcement by spectrum authorities, etc.)
- Advance automated IDM processes / system and concept of operations in support of national and international directives / goals

#### • PNT Situational Awareness / DEEP Mission Assurance Toolkit

- Data curation
- Provide contingency back-up capability
- Enable advancement and enhancement of PNT Situational Awareness capabilities

### **Training for International Operators:** JCO DEEP Spectrum EMI, Awareness, and Response (DEEP-SPEAR) Teams



Aerospace-trained operator training international JCO operators.

One of Kind Program for Operational Interference Monitoring Developed by The Aerospace Corporation. Developed and Fielded for Analysts and Operators by Expert Analysts, Engineers, Scientists, and Operators.

#### **Future Work**

Extend DEEP "massless payload" capabilities across the spectrum.

Expand and collaborate with partners to Ensure Shared Spectrum is PROTECTED and PRESERVED.

"We are uniquely establishing the foundation for the space systems architecture and technologies that are enabling new massless payloads across the space enterprise. As the massless payload pioneers, we continue to work with our government partners to enable the strategic vision, craft the technical roadmap, and develop new capabilities that fully exploit the space systems we have to rapidly solve the problems of today while being poised to pivot to the evolving challenges of the future." —DEEP Chief Engineer

# **Thank You!**