NASA Space Weather Event Response & Vulnerability

NASA SWERV Training

February 24, 2026


Stephanie Getty
Sciences and Exploration Directorate, Acting Chief
Welcome to Goddard
NASA
Goddard
SPACE FLIGHT CENTER

Training Team Introductions

Michael Kirk
Laura Ashley Alegbeleye
Carina Alden
Elana Resnick
Heather Fischer
Victoria Sellers

NASA Space Weather Program

Jamie Favors
NASA Space Weather Program, Director

Space Weather Awareness Objectives

01 Develop Foundational Awareness of Space Weather, its Origin and Impacts

02 Differentiate Between Storm-Time and Quiet-Time Space Weather Conditions

03 Recognize Operationally Significant Space Weather Phenomena and Impacts

04 Understand the Capabilities and Limitations of Real-Time Space Weather Models

Space Weather Awareness Objectives

05 Increase Familiarity with the Expertise and Resources at NASA

06 Promote Awareness of Best Practices for Integrating Space Weather Intelligence

07 Facilitate High/Low Side Knowledge Transfer and Application

Space Weather Awareness Agenda Day 1

08:30 **Welcome**
Introductions

09:15 **What is SWx**
Melissa Kane

10:30 **Chain of Events**
Mattie Anastopulos

11:15 **Lunch**

12:30 **Operational Impacts**
Yihua Zheng

14:15 **Ground Impacts**
Carina Alden

15:00 **NASA Resources**
Carina Alden
Elana Resnick

15:30 **SWx Review**
Team

16:30 **Debrief**
High and Low Side

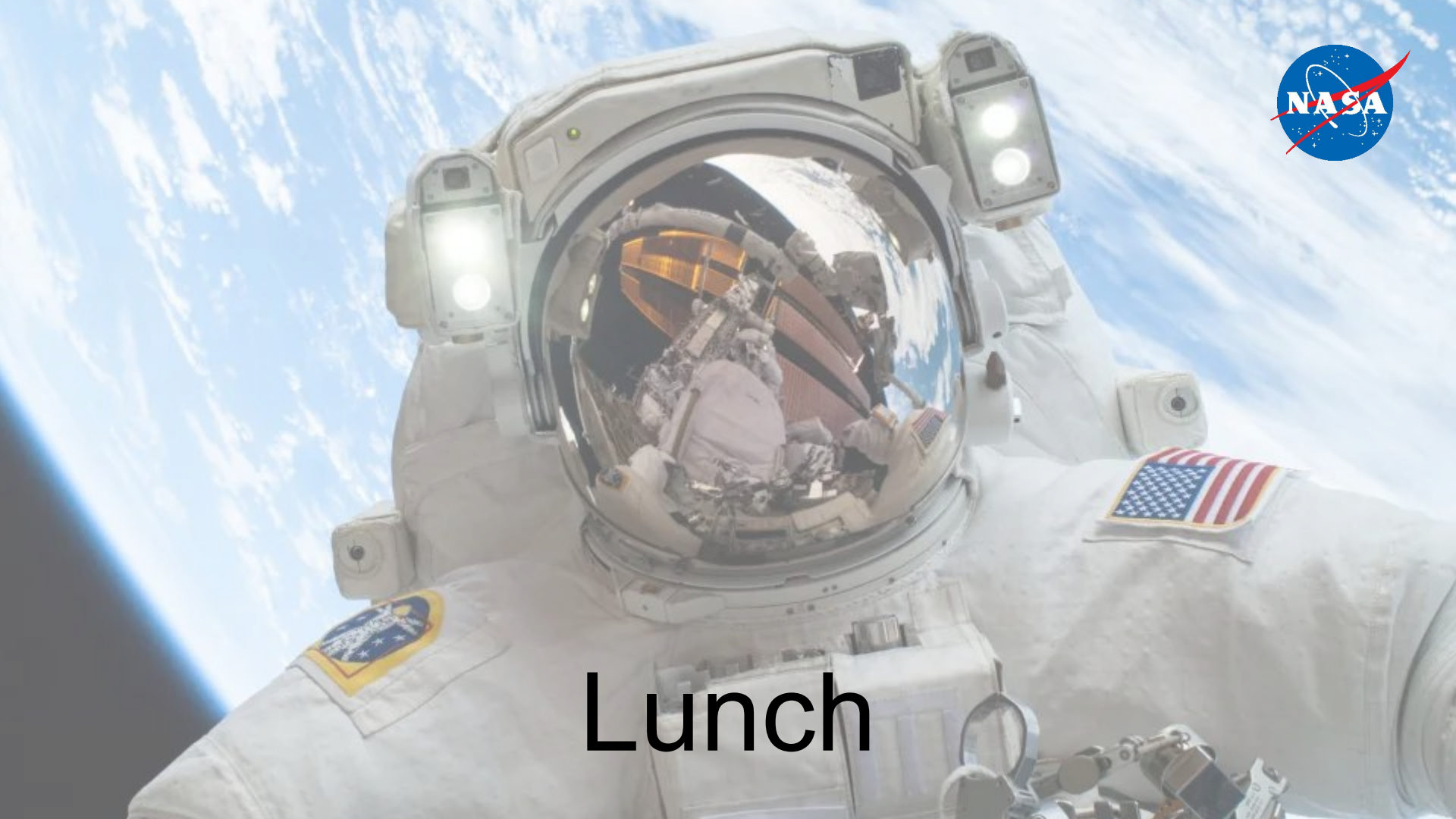
What is Space Weather? Origins and Impacts

Melissa Kane

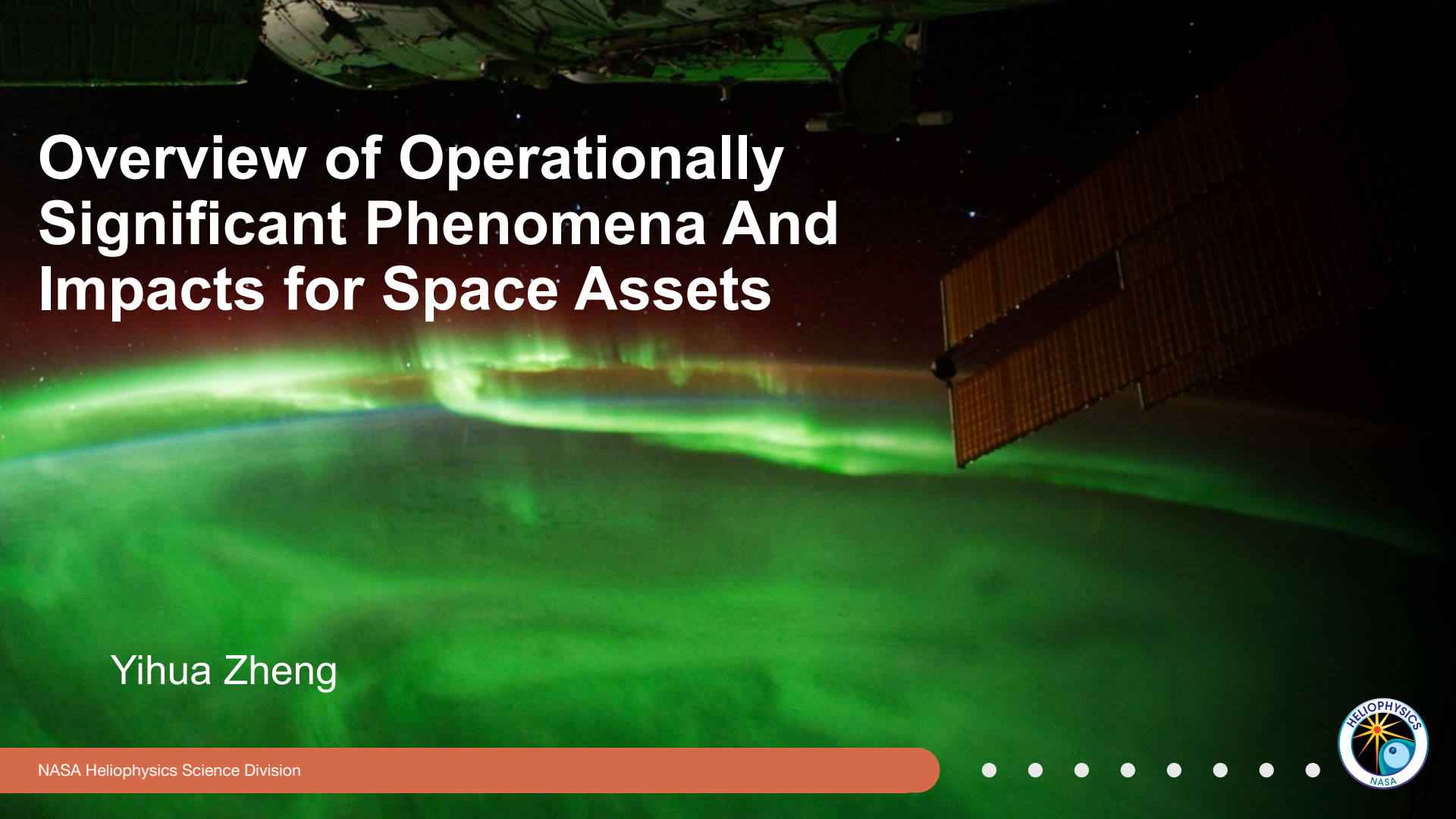

15 Min Break

The Journey from Sun to Earth and Beyond: Chain of Events

Mattie Anastopulos



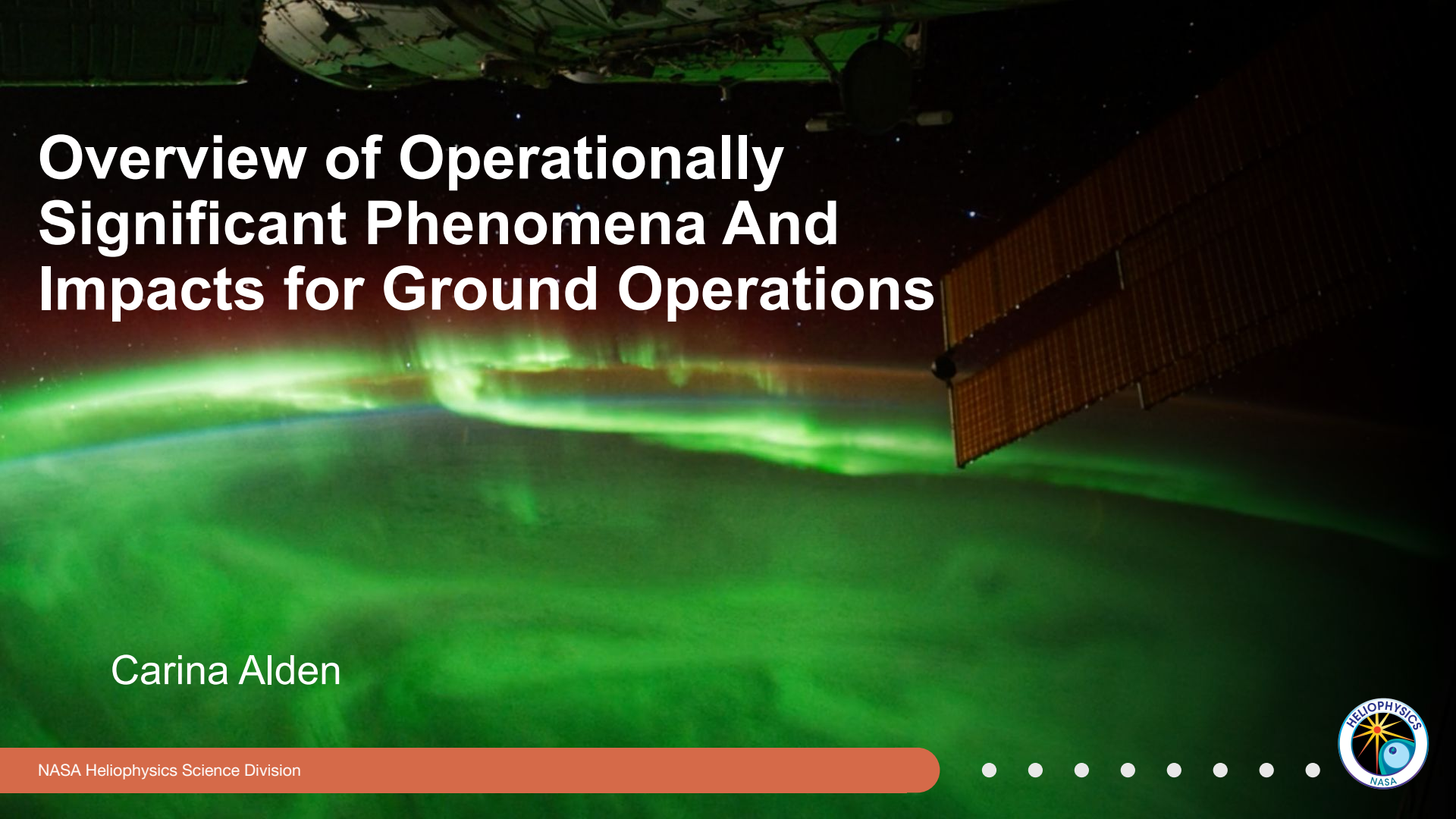
Lunch



Overview of Operationally Significant Phenomena And Impacts for Space Assets

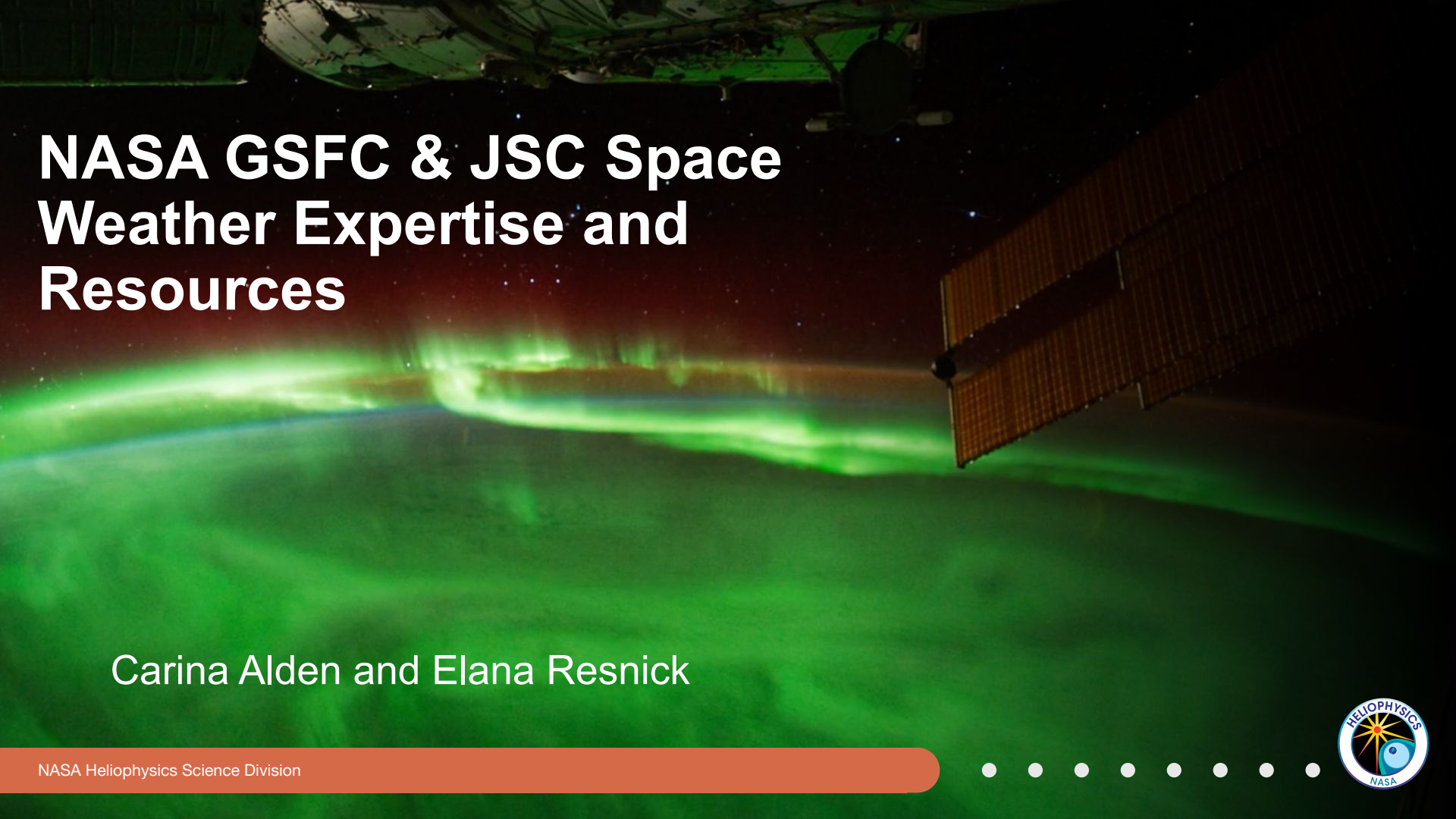
Yihua Zheng


15 Min Break



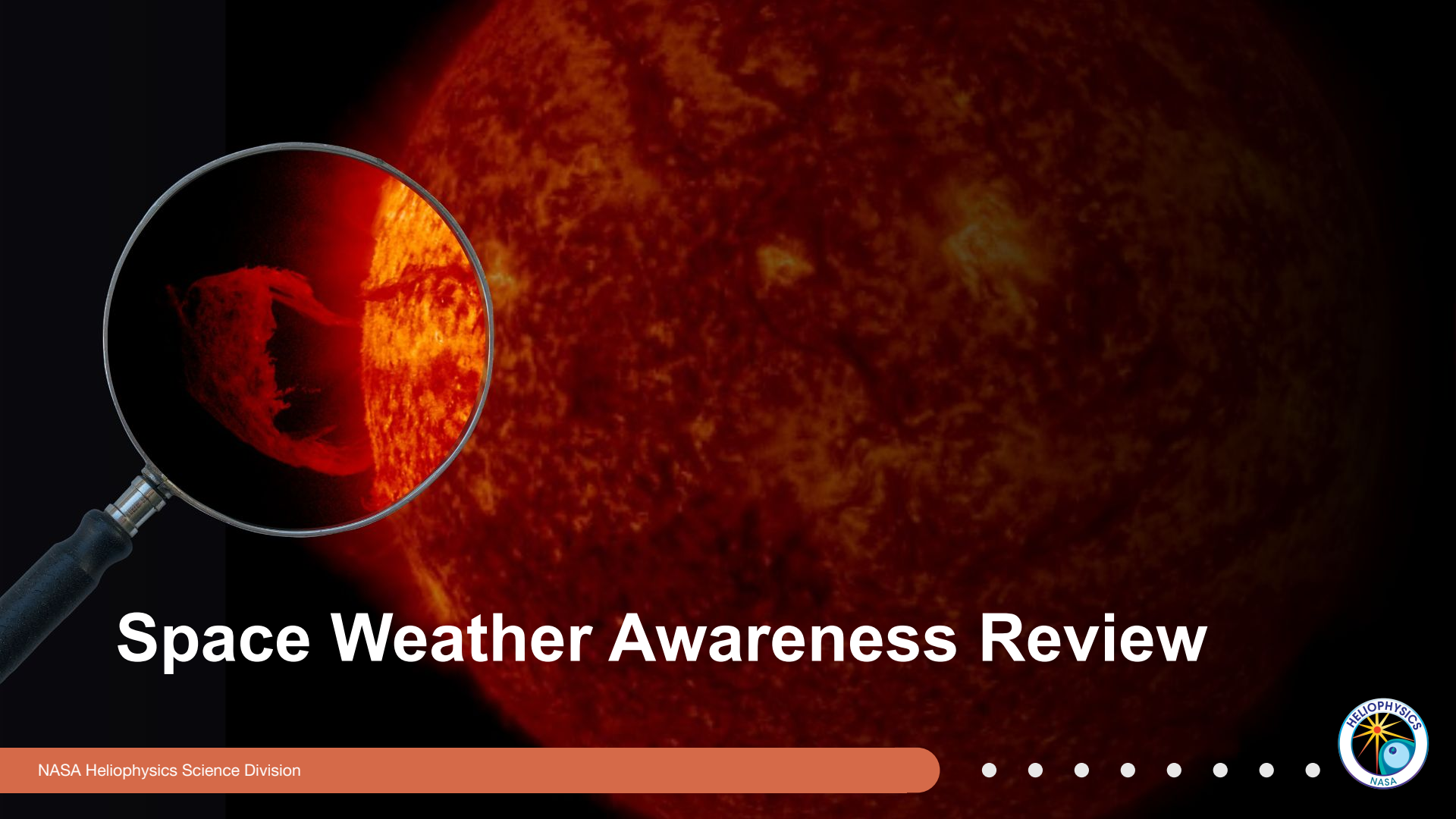
Overview of Operationally Significant Phenomena And Impacts for Ground Operations

Carina Alden



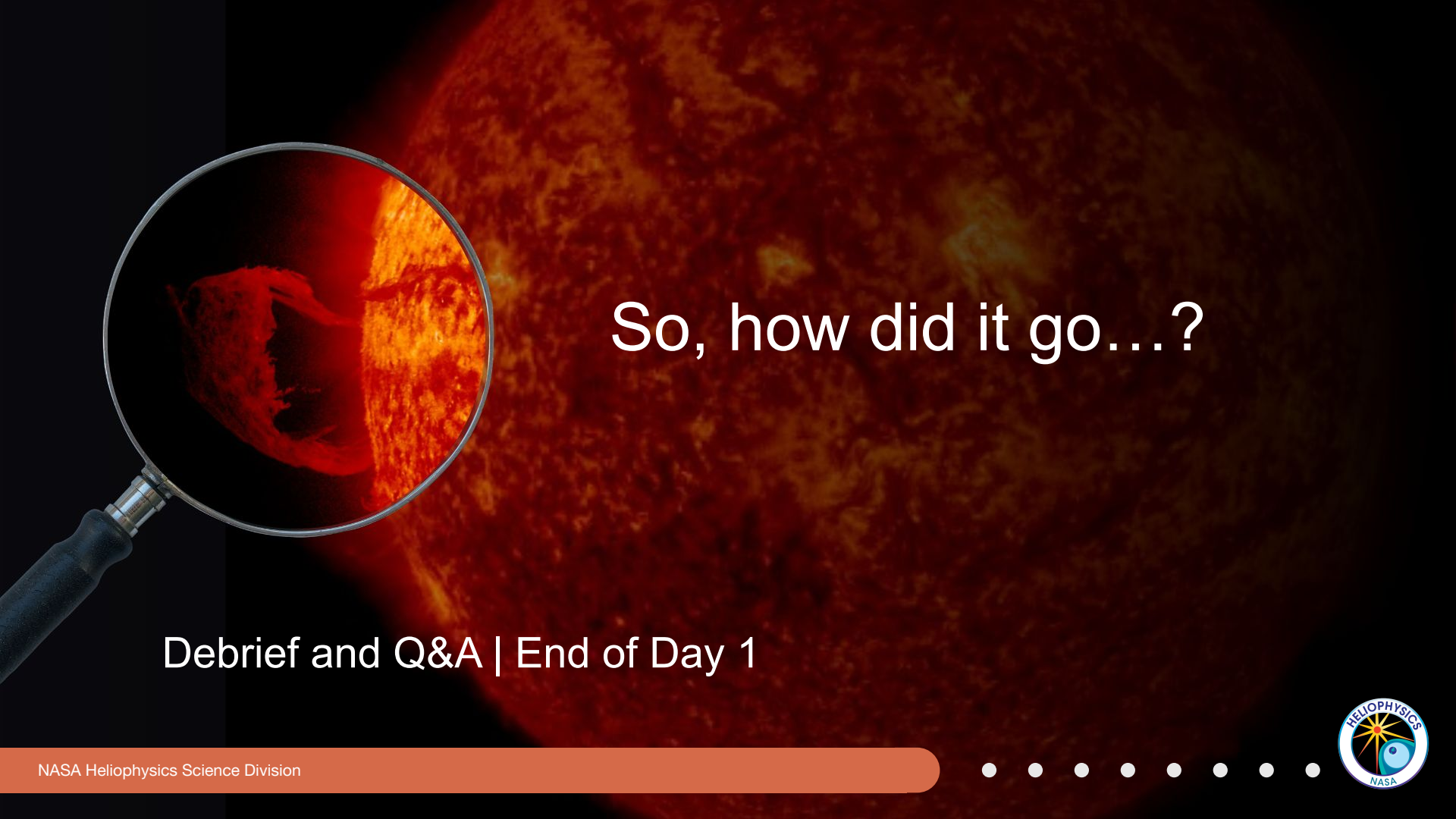
NASA GSFC & JSC Space Weather Expertise and Resources

Carina Alden and Elana Resnick



Space Weather Awareness Review

Transition to Debrief



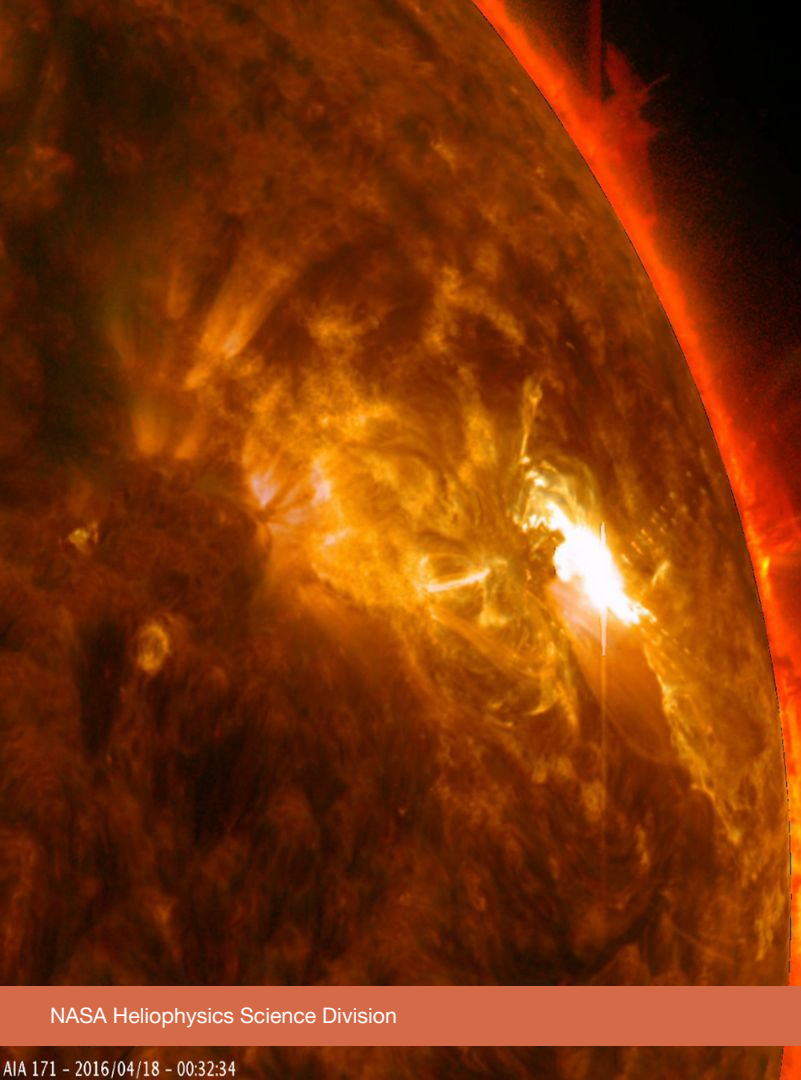
So, how did it go…?

Debrief and Q&A | End of Day 1

NASA Space Weather Event Response & Vulnerability

NASA SWERV Training

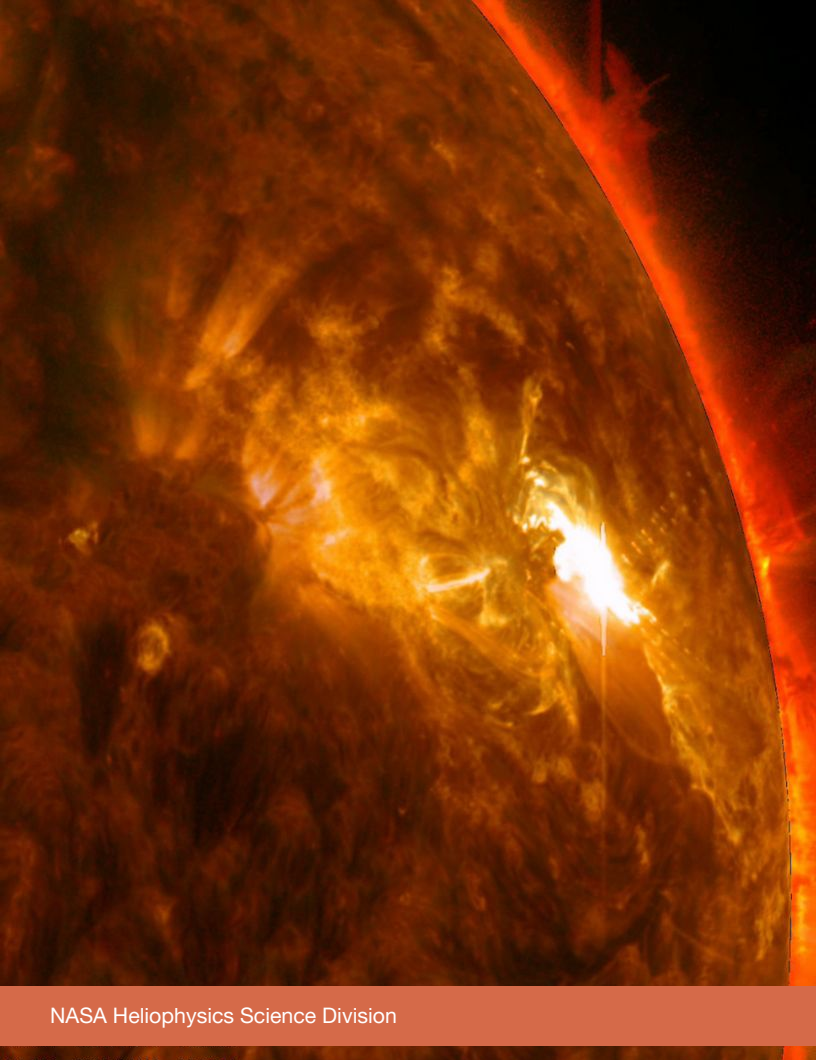
February 25, 2026



Day 1 Recap

Building Foundational Awareness & Operational Context

- **Defined Space Weather & Its Origins**
  - Solar active regions, flares, CMEs, solar cycle drivers
  - Timeline: Sun → Heliosphere → Geospace → Operational Impacts
- **Storm-Time vs. Quiet-Time Conditions**
  - What changes during geomagnetic storms
  - Baseline variability and background space environment
  - Operational expectations across event phases
- **Operationally Significant Phenomena**
  - Geomagnetically Induced Currents (GICs)
  - Ionospheric irregularities (EPBs, Spread-F, Sporadic-E)
  - HF communications degradation
  - GNSS/GPS scintillation
  - Thermospheric drag & satellite orbital impacts
  - Radiation environment (SEPs, protons/electrons, GCRs)



Day 1 Recap

Building Foundational Awareness & Operational Context

- **Historical Case Studies**
  - Space Weather-induced anomalies
  - Lessons learned for resilience and mission assurance
- **Real-Time Models & Data Streams**
  - Capabilities and limitations of tools (e.g., NAIRAS, SAMI3)
  - Distinction between real-time, forecast, and reconstruction
  - Implications for operational environments
- **NASA Expertise & Resources**
  - Subject matter experts across heliophysics sub-disciplines
  - Pathways for consultation and mission support

Space Weather Awareness Agenda Day 2

08:30 **Welcome**
Day 2 Overview

09:00 **Ionospheric Disruptions**
Joe Huba

10:30 **Geomagnetic Storms**
Katherine Garcia-Sage

12:00 **Lunch**

13:30 **Case Study**
Carina Alden

15:15 **Reflection on SWx**
Michael Kirk

15:30 **Feedback and Evaluation**
Heather Fischer
Victoria Sellers

15:45 **Q&A and Closeout**
Team

16:30 **Debrief**
High and Low Side

SWx Judgement Checkup

During quiet time, which effect is noticeably different than during maximum?

A Zero ionospheric variability

B Negligeable satellite drag in LEO

C Increased background GCR flux

D No HF variability for communications

SWx Judgement Checkup

You observe degraded HF comms at mid-latitudes. What is the most likely driver?

A Thermospheric cooling

B Ionospheric turbulence

C SEP event

D Galactic cosmic rays

SWx Judgement Checkup

A model provides real-time radiation dose estimates. What is its main limitation?

A	Computational complexity returns results too slow to be useful.
B	There is limited forecasting capabilities.
C	It can not incorporate uncertainty in input data.
D	Requires embargoed or classified data

SWx Judgement Checkup

What is the first operational effect of a CME arrival?

A	An immediate non-conservative force that opposes satellite motion
B	GNSS failure
C	Shock and IMF orientation effects
D	Power grid collapse with severe transformer damage

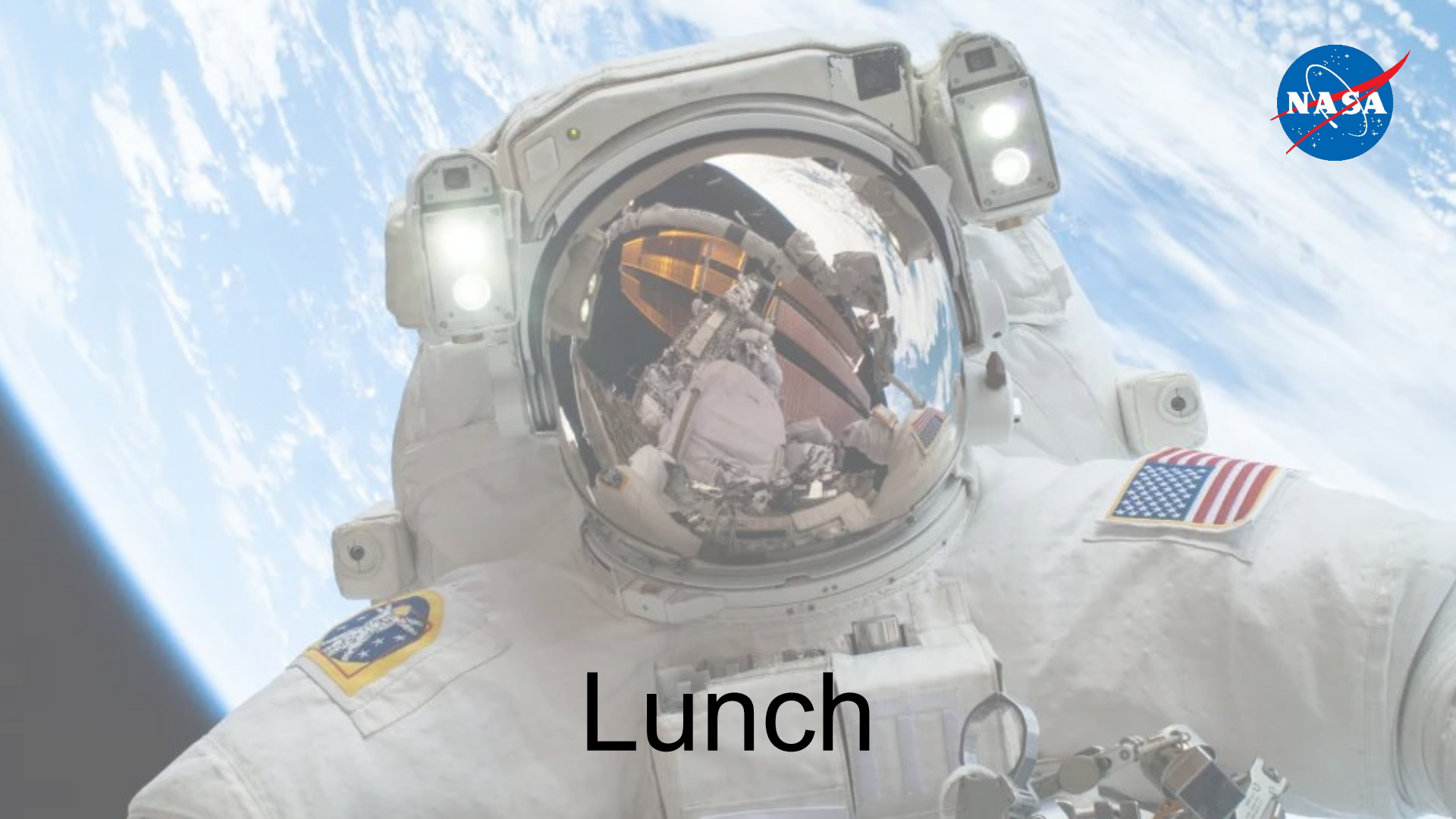
Real-time capabilities and ionospheric disruptions of communications and PNT

Joe Huba


15 Min Break

Geomagnetic Storms and Forecasting Space Weather Disturbances

Katherine Garcia-Sage



Lunch

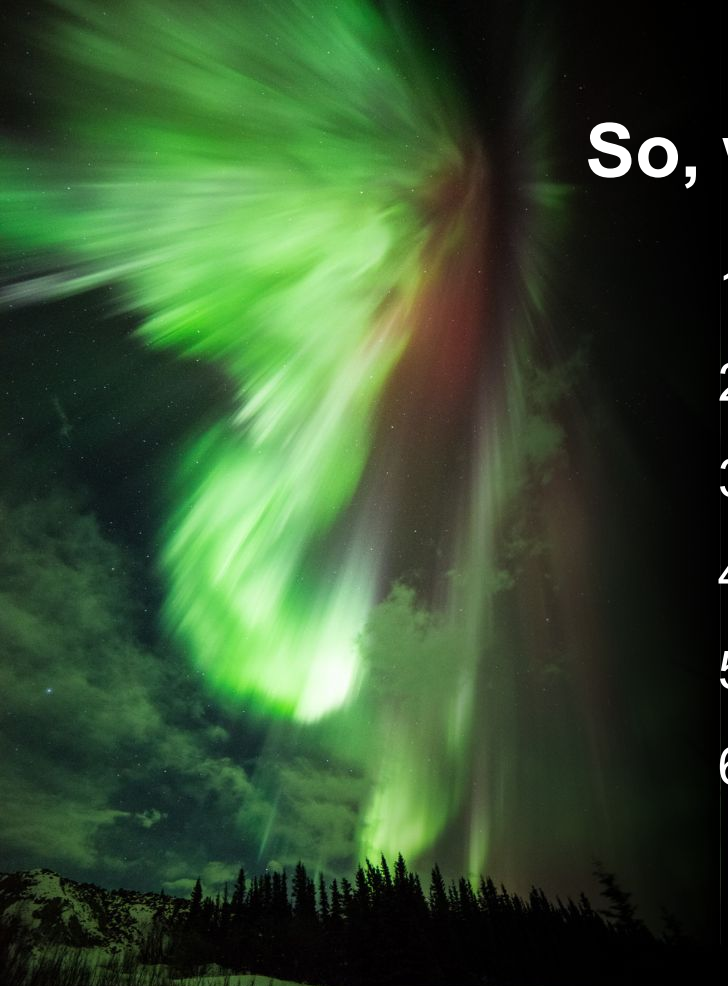
High-Impact Historical Case Study

Carina Alden


15 Min Break

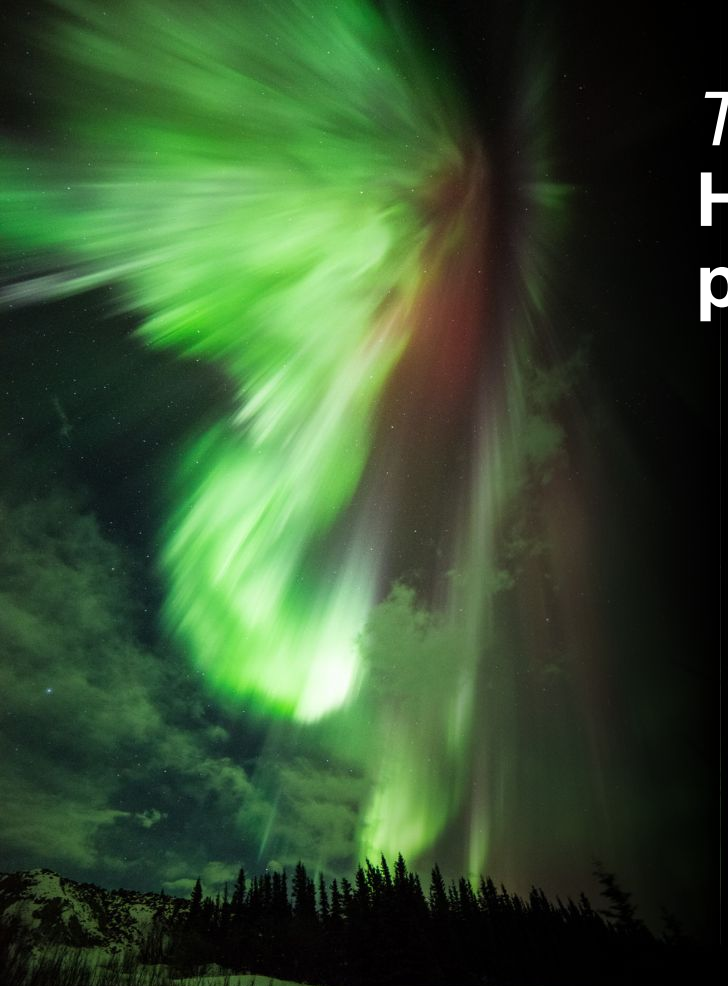
Reflections on the Applicability of SWx Training

Michael Kirk



So, what do you want to do now…?

1. Operational Relevance
2. Depth vs. Breadth
3. Application and Scenario-based Training
4. Data and Tooling
5. Integration and Communications
6. Format and Cadence



Thought Exercise: **How does SWx affect your own projects?**

If we could build one follow-on module specifically for your mission or team, what would it cover?

Feedback and Evaluation

Heather Fischer & Victoria Sellers

Congratulations!

Transition to Debrief

So, how did it go…?

Debrief and Q&A | End of Day 2