

Post-Launch Calibration and Testing of Space Weather Instruments on GOES-R Satellite

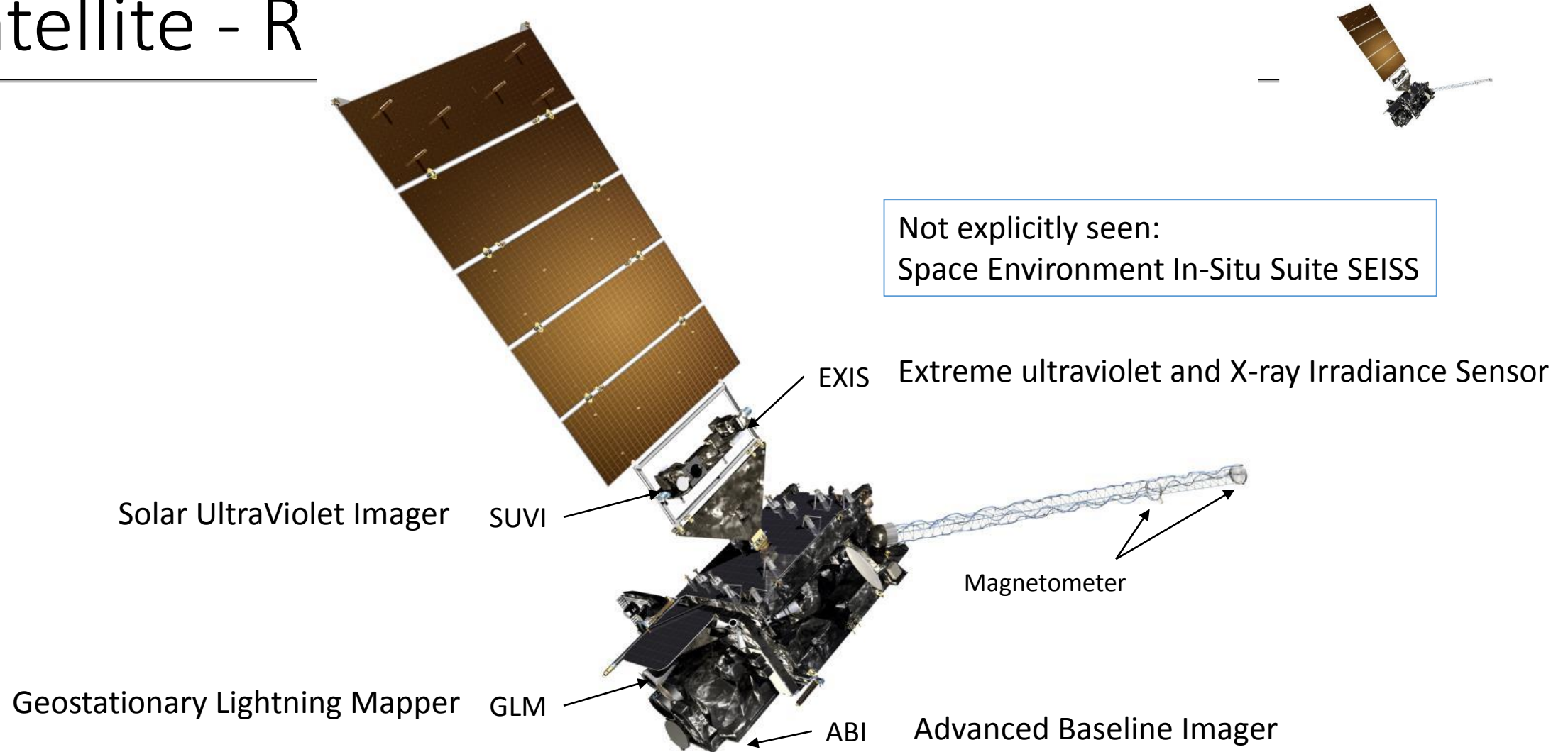
A detailed view of the GOES-R satellite, showing its large solar panel array and the main satellite bus with various instruments and antennas.

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Earth Observing Missions and Sensors:
Development, Implementation, and Characterization IV
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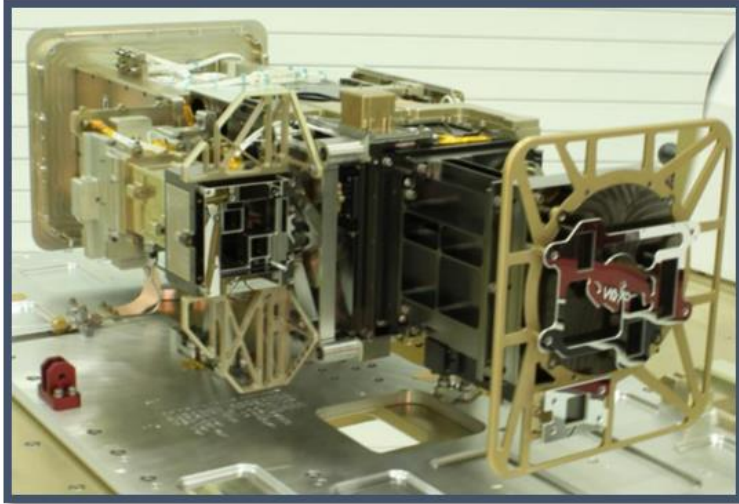
Geostationary Operational Environmental Satellite - R



Space Weather Instruments: EXIS & SUVI

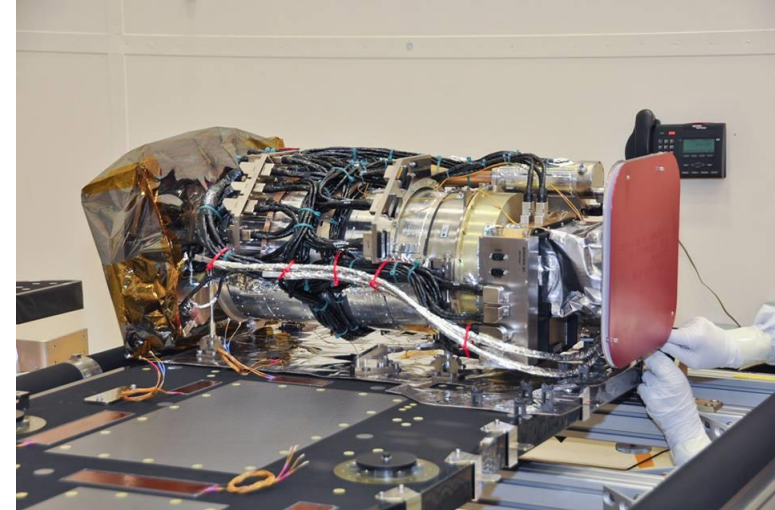


EXIS



- X-Ray Sensor
- Extreme UltraViolet Sensor

SUVI



- Normal Incidence Imaging Telescope
- Guide Telescope Provides Accurate Sun Position

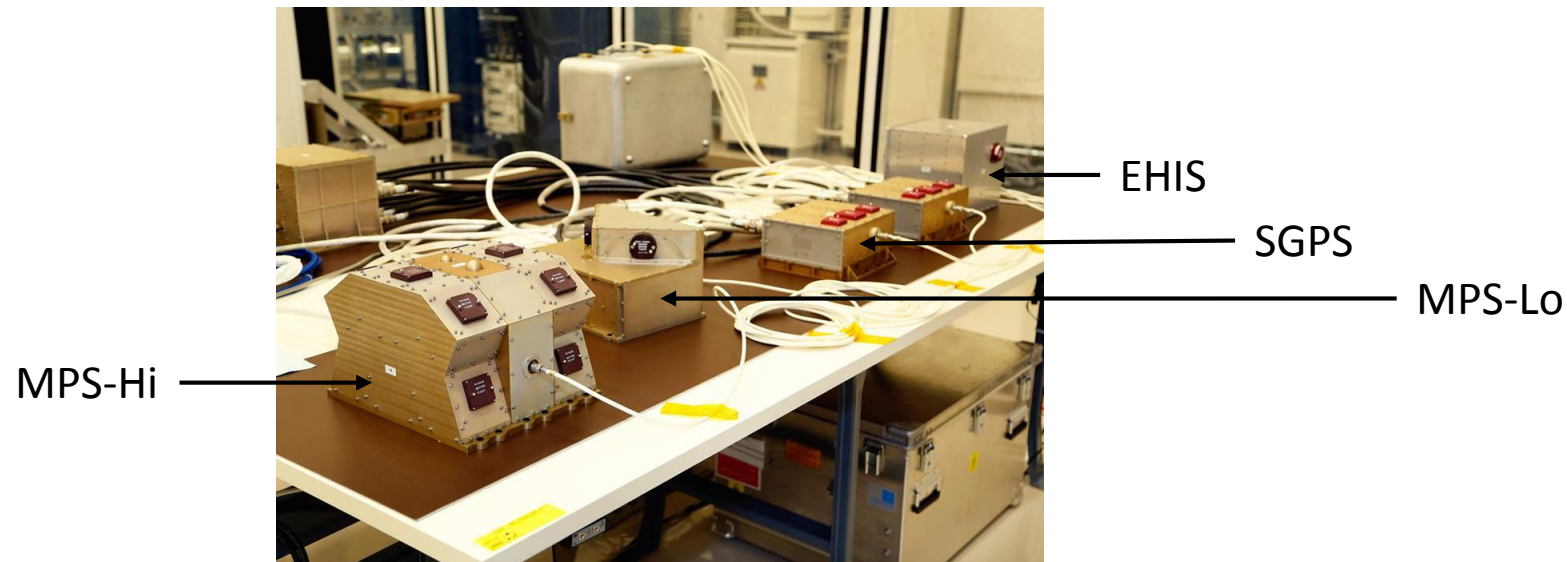
Both Located on Sun-Pointing Platform; Spacecraft Points them to the Sun

Space Weather Instruments: SEISS



5 Particle Count Measuring Sensors

- MPS-Lo, MPS-Hi, SGPS-1, EHIS mounted on the SEISS cabinet
- SGPS-2 Mounted to the Spacecraft +X face
- Digital Processing Unit mounted inside the Spacecraft bus



GOES-R Characteristics



- Operational Mission
 - 5 year ground storage, 5 year on-orbit storage, 10 year operational lifetime
 - Products delivered on a set schedule
 - Minimal outages
 - ✓ Spacecraft interfaces comply through Station keeping and momentum dumps
 - ✓ Eclipses do not effect SEISS Products
- Requirements on Cadence, Latency, and Product Performance
 - Maintaining accuracy requires pre-flight calibration, in-flight calibration tracking, and careful tracking of uncertainties
- Ground Processing Algorithms
- **Dynamic Range:**
 - Varies on all sensors by many orders of magnitude as a function of wavelength and on all timescales

Science Performance Verification



- Requirements Verification
 - Plans
 - Technical Interchange Meetings
 - Approved Documents
- End-to-End Calibrations
 - Interpolation & Extrapolation as needed
- Component Calibration + Modeling
 - Accuracy, Alignments, Cal Coefficients

Performed Prior to Launch

End-to-End Ground Calibration



- EXIS

- Synchrotron Ultraviolet Radiation Facility @ National Institute of Standards Technology, Gaithersburg, MD
 - Pre- and Post-Environmental Testing
- ...

- SEISS

- Air Force Research Laboratory @ Kirtland Air Force Base
- Van de Graaff & Cockroft-Walton Accelerators @ NASA Goddard Space Flight Center
- Northeast Proton Therapy Center Cyclotron Facility at Massachusetts General Hospital
- Brookhaven National Laboratory
- National Superconducting Cyclotron Laboratory @ Michigan State University
- ...

Extensive Ground Calibrations

Component Calibration - SUVI



- Primary and Secondary Mirrors
 - Surface Roughness Measurement
 - Reflectance Measurements for Coated Multi-layered Mirror at Lawrence Berkeley National Laboratory
- Entrance and Analysis Filters
 - In-band performance and Out-of-band rejection
- CCD
 - Gain, Quantum Efficiency

Performance Prediction with Synthesized Model

On-orbit Calibrations / Characterizations: EXIS



- XRS, SPS, and EUVS A/B Darks
- EUVS Filter Characterization
- XRS and EUVS Signal-to-Noise
- Field-of-View Mapping
- XRS and EUVS Signal-to-Noise
- Cruciform Scan Slew
- ...

On-Orbit Calibration Tests Finalized ...

On-orbit Calibrations / Characterizations: SUVI



- CCD Dark Current Characterization
- Shutter Light Leakage
- Off-Band Signal Characterization (filter light leaks)
- Flat-Field Calibration (Kuhn-Raster, Boustrophedon)
- Focus Check
- Guide Telescope Calibration
- Cross calibration with EXIS

... with Inputs from Scientists and Engineers, and ...

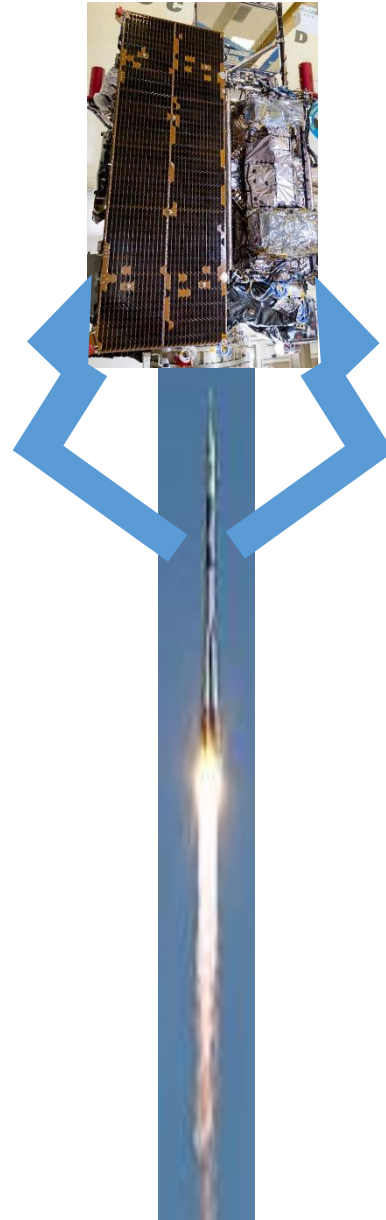
On-orbit Calibrations / Characterizations: SEISS



- In-Flight Calibration
 - To determine detector threshold characteristics
- EHIS On-Orbit Calibration, Pulse Height Analysis
- MPS-Lo Voltage Bias Optimization
- Cross Calibration of the +X SGPS and the -X SGPS
- SGPS D3-D1 Logic Circuit Test
 - To determine effectiveness of rear entry particle suppression

Calibration Sequence of Events Developed

**Next
Generation
Waiting in
the Wings!**



**Can't wait
for the
launch!**