

# An Overview of the GOES-R Program



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GOES-R System Program Director

AMS 91<sup>st</sup> Annual Meeting

7<sup>th</sup> Annual Symposium on Future National Operational  
Environmental Satellite Systems

January 25, 2011







# GOES-R Mission Overview



GOES-R is the next generation of GOES satellites that will provide a major improvement in quality, quantity, and timeliness of data collected.

## Earth Pointing



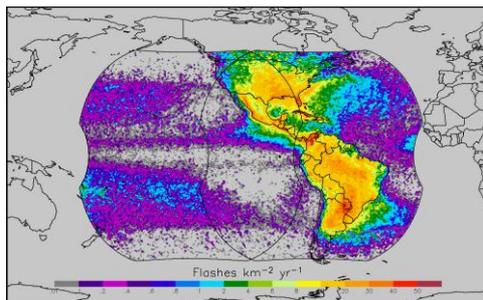
Visual & IR Imagery



- Advanced Baseline Imager (ABI)



Lightning Mapping

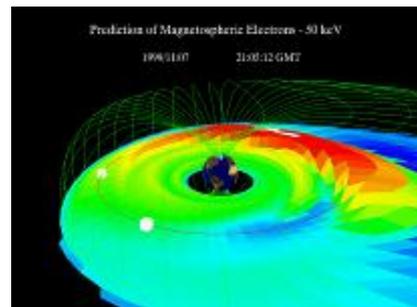


- Geostationary Lightning Mapper (GLM)

## In-Situ



Space Weather Monitoring



- Space Environment in-Situ Sensor Suite (SEISS)
- Magnetometer

## Sun Pointing



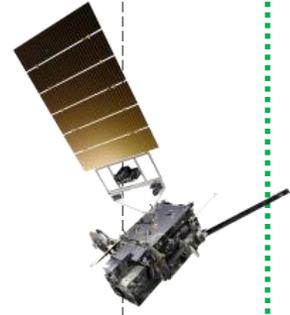
Solar Imaging

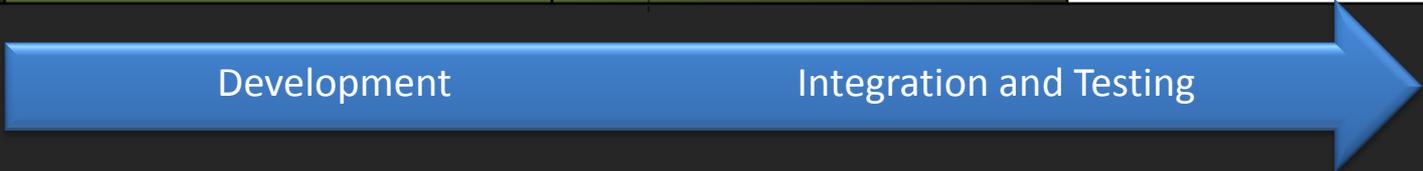


- Solar Ultra-Violet Imager (SUVI)
- Extreme UV/X-Ray Irradiance Sensors (EXIS)

## New and improved capabilities for:

- increased lead times for severe weather warnings
- better storm tracking capabilities
- solar, space weather, and climate analyses
- advanced products for aviation, transportation, commerce

	2007	2008	2009	2010	2011	2012	2013	2014	2015
<b>Program /System</b>		System Design Review complete ✓				Working towards System PDR in June 2011			<div data-bbox="1439 235 1709 449" style="border: 1px solid black; border-radius: 15px; background-color: #f4a460; padding: 5px; text-align: center;"> <b>Launch Readiness Oct. 2015</b> </div> 
<b>Flight Segment</b>	Spacecraft	Spacecraft SDR complete ✓			PDR held January 18-20 2011 ✓				
	Instruments	5 Instrument contracts underway ✓  EXIS, SUVI, SEISS, and GLM have all passed CDR ✓			ABI PTM completed TVAC testing ✓				
<b>Ground Segment</b>	Core contract awarded to Harris Corp. ✓ Core SRR complete ✓ 80% delivery of baseline product algorithms ✓ RBU lease awarded ✓			Antenna SDR complete ✓ GS Project and Antenna System PDR April 2011					





# GOES-R Spacecraft



## Specifications

**Size** ~5.5 meters (from launch vehicle interface to top of ABI)

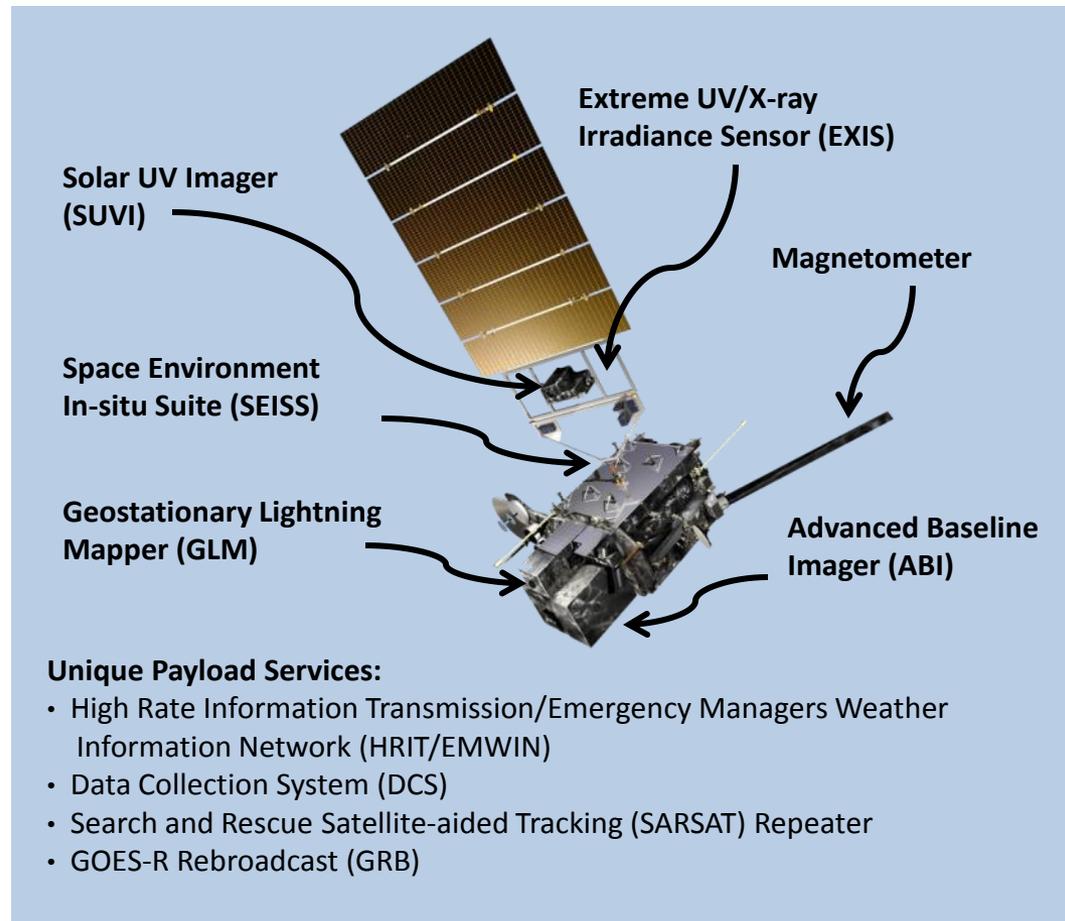
**Mass** Satellite (spacecraft and payloads) dry mass <2800kg

**Power Capacity** >4000W at end-of-life (includes accounting for limited array degradation)

Lockheed-Martin Space Systems Co (LMSSC) of Newtown, PA is primary contractor

## Current Status

- Design activities progressing well
- Spacecraft System Definition Review (SDR) completed March 9-10, 2010
- Spacecraft baseline established in April 2010
- Preliminary Design Review (PDR) held January 18-20, 2011





# Advanced Baseline Imager (ABI)

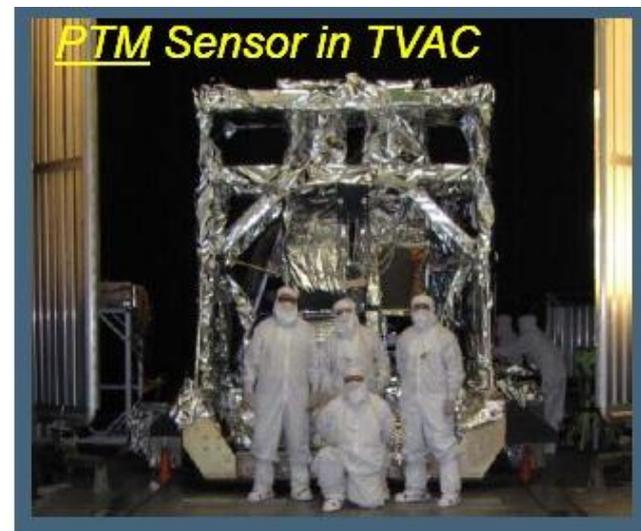


## Specifications

- 16 channel imager
- Improves upon current capabilities in spectral information (3X), spatial coverage (4X), and temporal resolution (5X)
- Continues current products and will enable new products for severe weather forecasting, fire and smoke monitoring, volcanic ash advisories, and more

## Current Status

- ITT Corporation (Ft. Wayne, IN) is primary contractor
- ABI PTM instrument successfully completed all environmental testing this year culminating with thermal-vacuum (TVAC) testing in November 2010
- ABI delta Critical Design Review (CDR) is scheduled for February 22-24, 2011



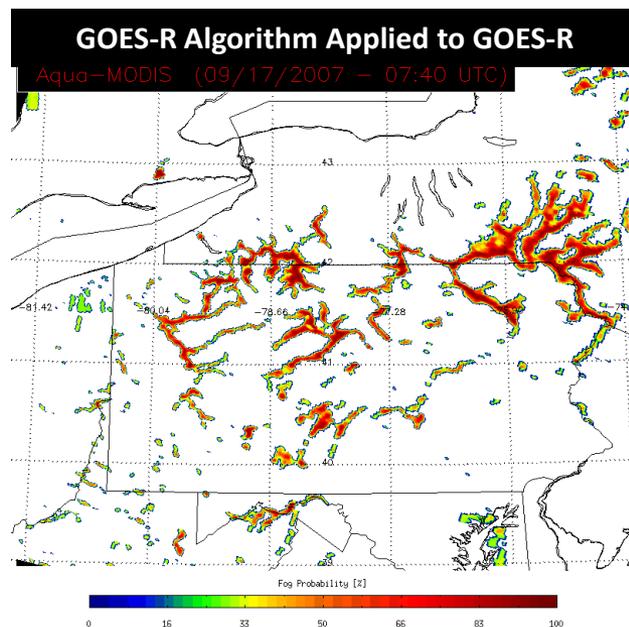
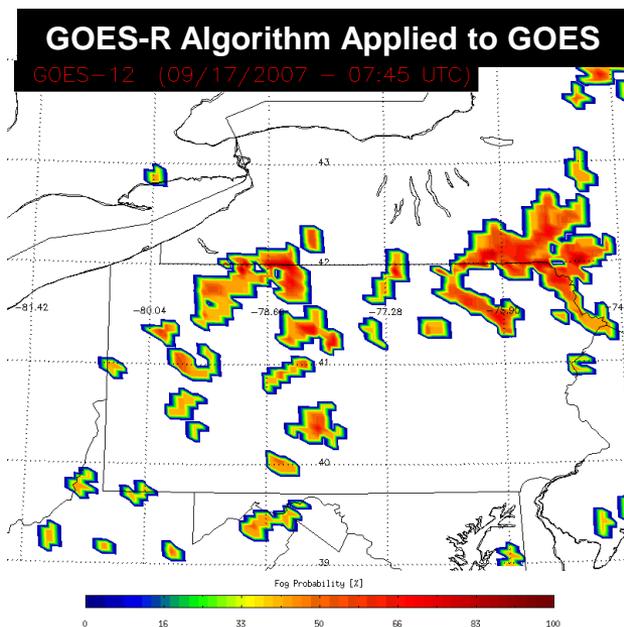
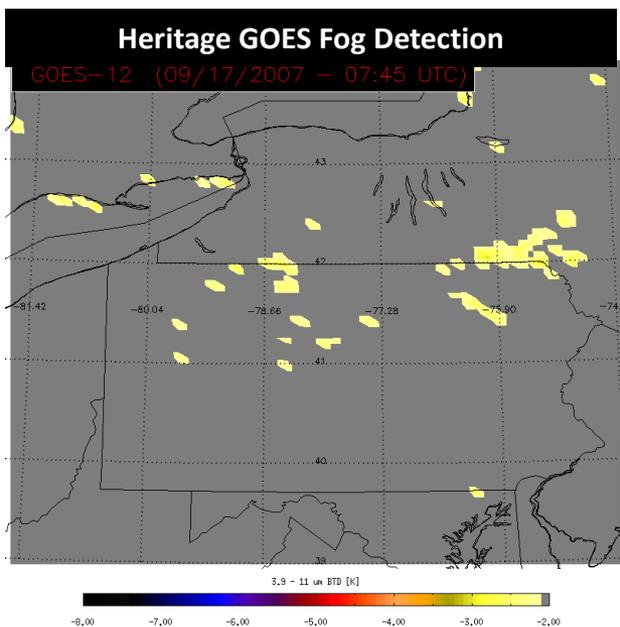
**ABI Proto-Type Model (PTM)**



# GOES-R Fog Probability Product Improvements

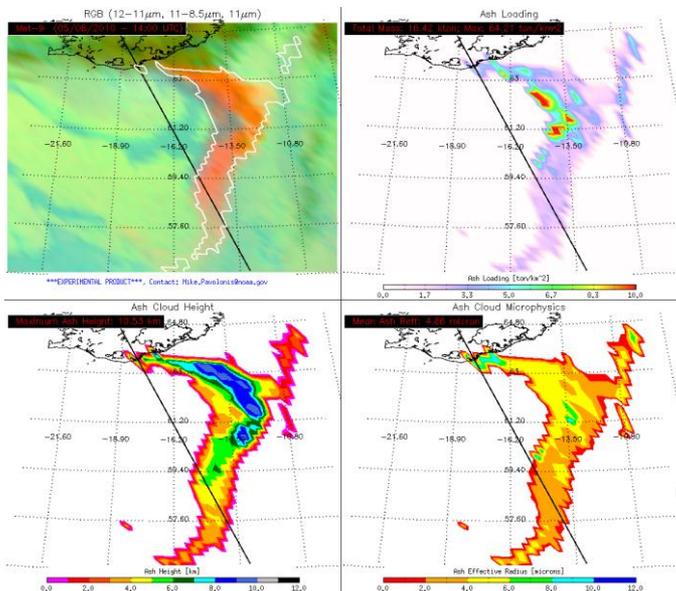


- **Improved algorithm technology** - the GOES-R algorithm provides quantitative information on fog probability, while heritage GOES fog detection products are more qualitative in nature
- **Improved sensor technology** - the ABI has greatly improved spectral information, spatial resolution, and temporal resolution

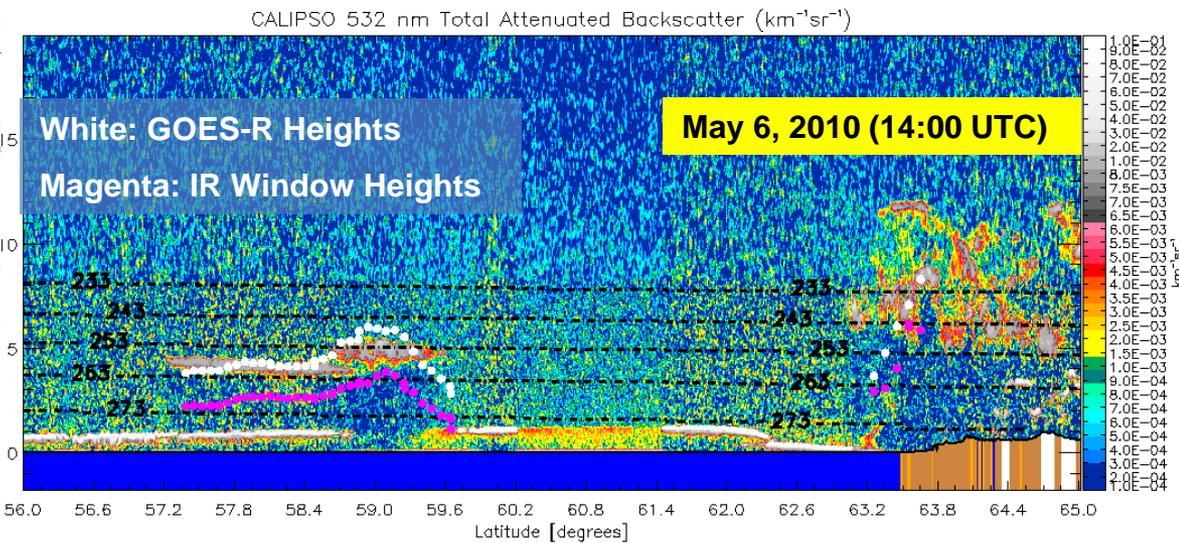




# Volcanic Ash Product Suite (Extent, Height, Mass Loading, Size) - Eyjafjallajökull Volcanic Ash Cloud -



*The GOES-R ash cloud heights closely match the CALIPSO cloud top boundary. The traditional methodology underestimates the cloud height.*



*The ash cloud top height is critically important for determining if ash is at jetliner cruising altitudes (nowcasting component). In addition, the ash cloud height is a key parameter for initializing dispersion models (forecasting component).*



# Geostationary Lightning Mapper (GLM)



## Specifications

- **Detects total lightning:** in cloud, cloud to cloud, and cloud to ground
  - Aids in forecasting severe storms and tornado activity, and convective weather impacts on aviation safety and efficiency
  - Currently no ocean coverage, and limited land coverage in dead zones

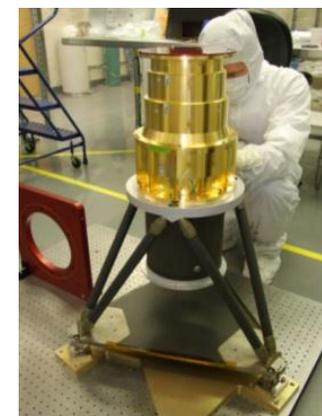
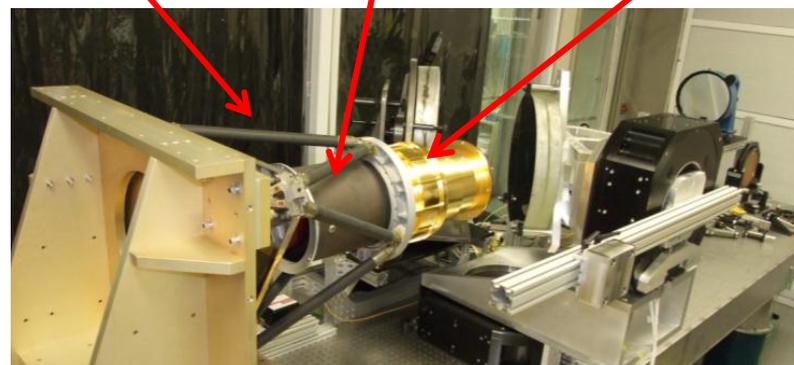
## Current Status

- Lockheed Martin Applied Technology Corp (Palo Alto, CA) is primary contractor
- Critical Design Review (CDR) completed in December 2010
- Engineering Design Unit (EDU) continuing to go thru fabrication and Flight Model 1 is in development

Sensor Unit  
Mechanical Support  
Structure

Metering tube

Optical Assembly



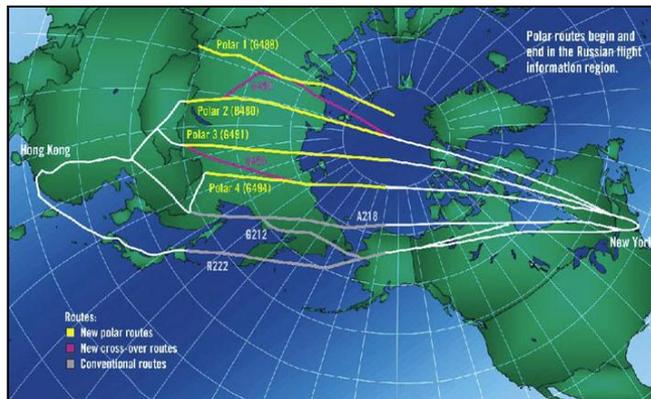
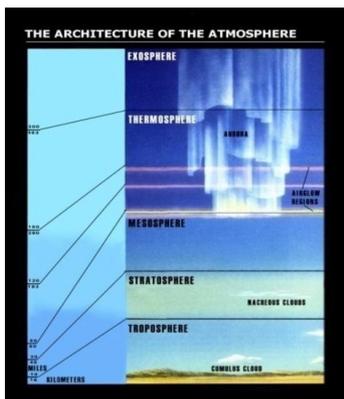
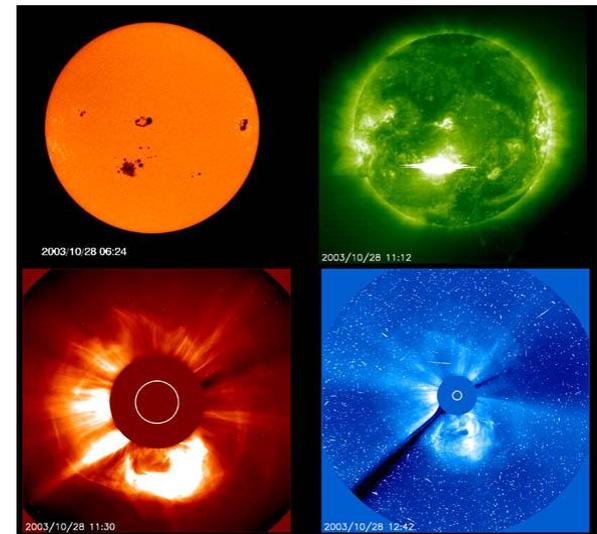


# Space Weather Instruments



## Space Environment Impacts Earth!

- Instruments provide early warning
- Communications satellites / power grids
- Voice and data blackouts over poles
  - Communications blackouts
  - Aviation routing
- Astronaut safety
  - Solar storms can expose astronauts to equivalent of 8 chest X-rays



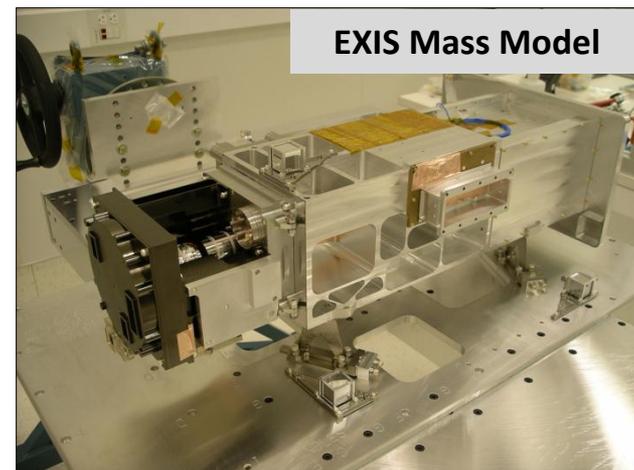


# Space Weather Instruments

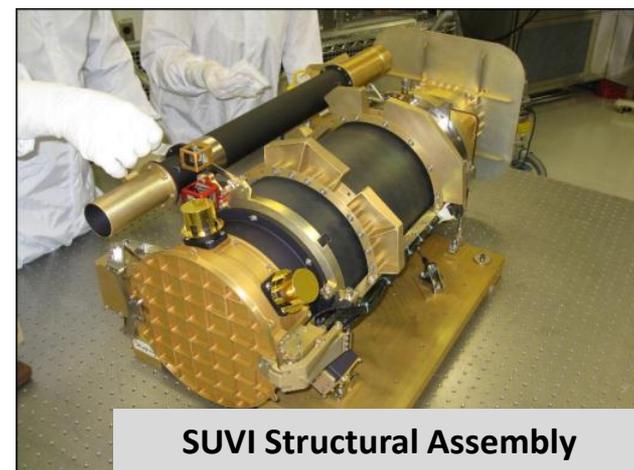


## Current Status:

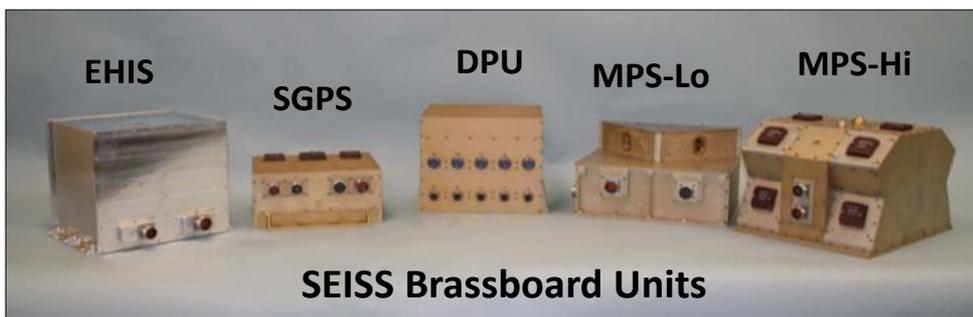
- **Extreme UV/X-ray Irradiance Sensor (EXIS)**
  - Test Unit verification in progress
  - Procurement & fabrication of flight parts are underway
- **Space Environment In-Situ Suite (SEISS)**
  - Completed CDR in June 2010
  - Program focus has been on transitioning to flight model manufacturing
- **Solar UV Imager (SUVI)**
  - Completed CDR in December 2009
  - EDU integration ongoing & flight fabrication underway



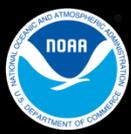
EXIS Mass Model



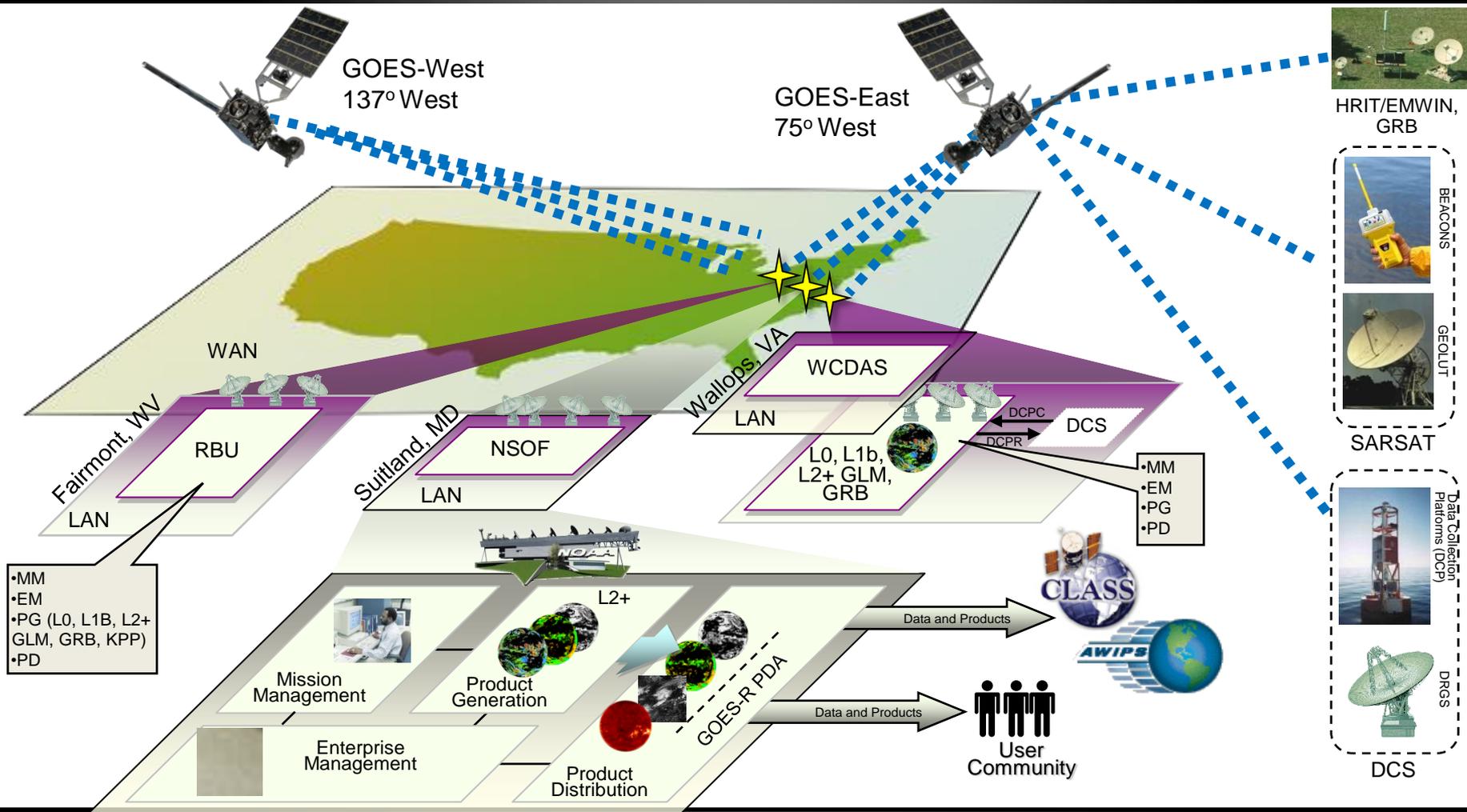
SUVI Structural Assembly



SEISS Brassboard Units



# Ground Segment System Architecture

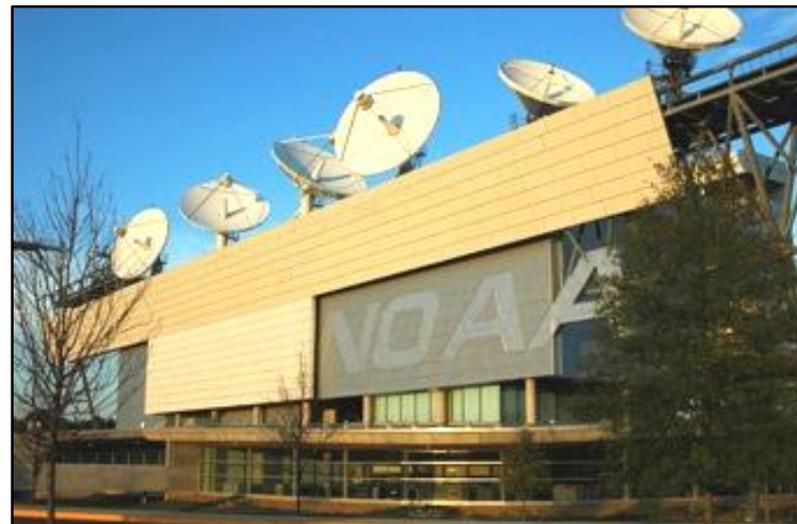




# Ground Segment Status



- Core GS System Definition Review (SDR)/Systems Requirements Review (SRR) successfully held in April 2010
- Completed all 18 Core GS element Software Requirements Reviews (SWRR)
- All Element PDRs were completed this month
- Core GS Preliminary Design Review (PDR) scheduled for March 1-4, 2011
- GS Project PDR scheduled for April 26-27, 2011



**NOAA Satellite Operation Facility (NSOF)  
Suitland, Maryland**

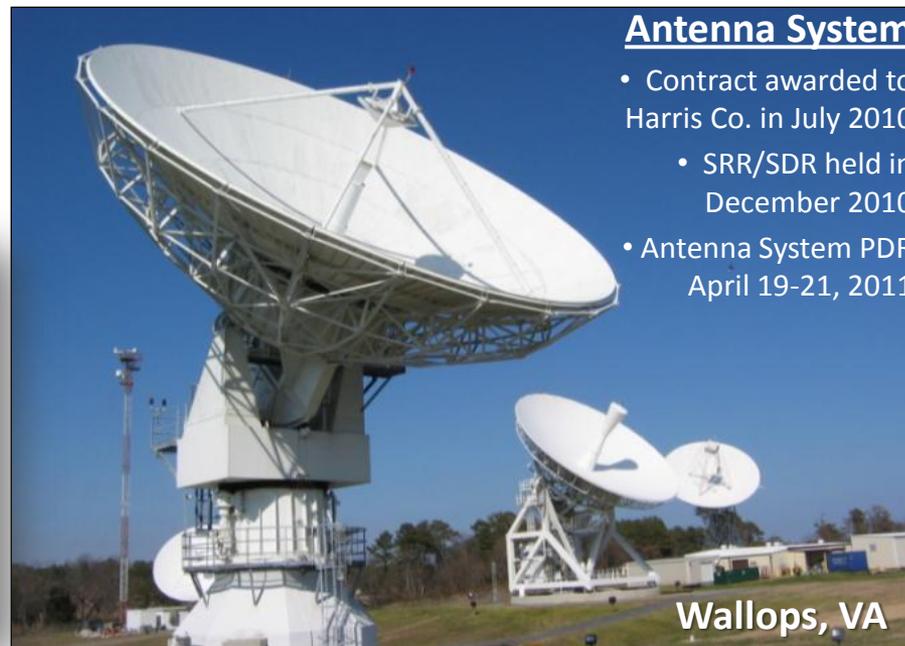


# Ground Segment Status (con't)



## Remote Backup Unit (Fairmont, WV)

- Lease signed in Dec 2009
- Site preparations are underway
- Antenna foundation construction to begin this spring



## Antenna System

- Contract awarded to Harris Co. in July 2010
  - SRR/SDR held in December 2010
- Antenna System PDR April 19-21, 2011

## ESPDS/GOES-R Product Distribution & Access (PDA) System

- Evolution of legacy ESPC systems including data ingest, product processing, and distribution for future JPSS & GOES-R era
- Contract awarded to Solers, Inc. in August 2010



# Algorithm Working Group



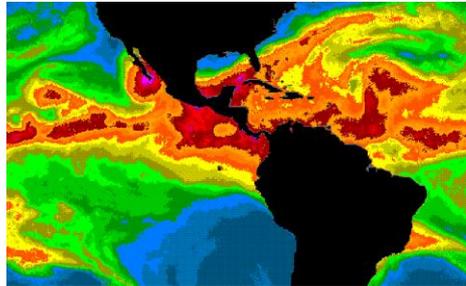
Algorithm Development



Calibration, Validation,  
and Verification

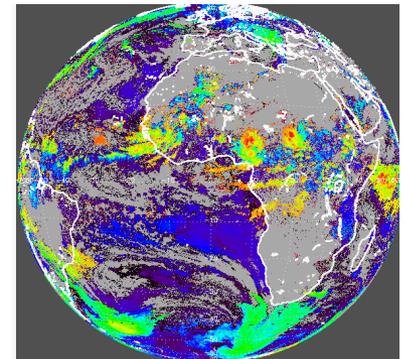
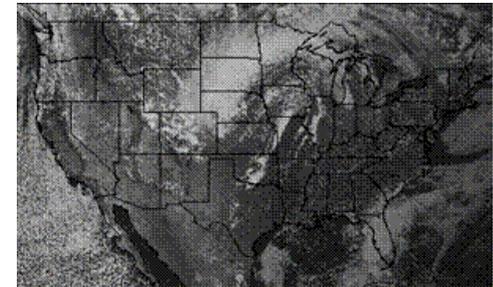


Algorithm Sustainment and  
Product Tailoring



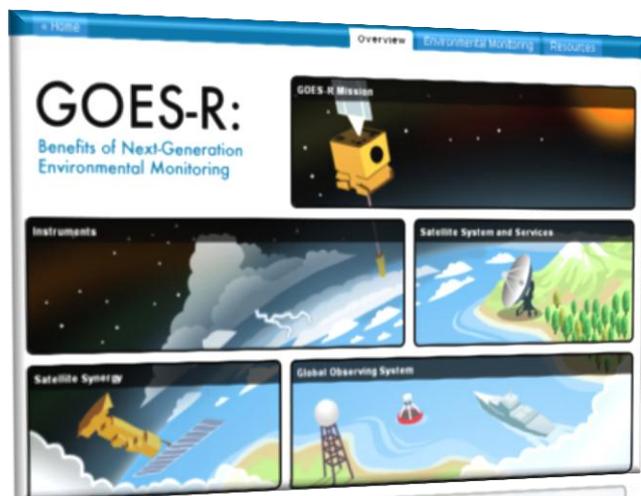
## AWG Achievements:

- 100% Algorithm Packages for Baseline Products completed November 2010
- 80% Algorithm Packages for Option Products completed November 2010
- Algorithm Review Executive Board (ADEB) delivered the final report on Level 2+ algorithms and the Algorithm Theoretical Basis Documents (ATBD) have been released





# Training and Education



## GOES-R 101

Bernie Connell<sup>1</sup>, Timothy J. Schmit<sup>2,3</sup>, Jim Gurka<sup>5</sup>,  
Steve Goodman<sup>5</sup>, Don Hillger<sup>2,4</sup>, Steven Hill<sup>6</sup>,  
And many other contributors

GOES-R Program in cooperation with  
Satellite Hydrology and Meteorology (SHyMet) Forecasters Course

<sup>1</sup> Cooperative Institute for Research in the Atmosphere, Colorado State University  
<sup>2</sup> NOAA/NESDIS Satellite Applications Research  
<sup>3</sup> Advanced Satellite Products Branch  
<sup>4</sup> Regional and Mesoscale Meteorology Branch  
<sup>5</sup> NOAA/NESDIS/OSD GOES-R Program Office  
<sup>6</sup> NOAA/NWS Space Weather Prediction Center  
<sup>7</sup> Cooperative Institute for Meteorological Satellite Studies, University of Wisconsin-Madison



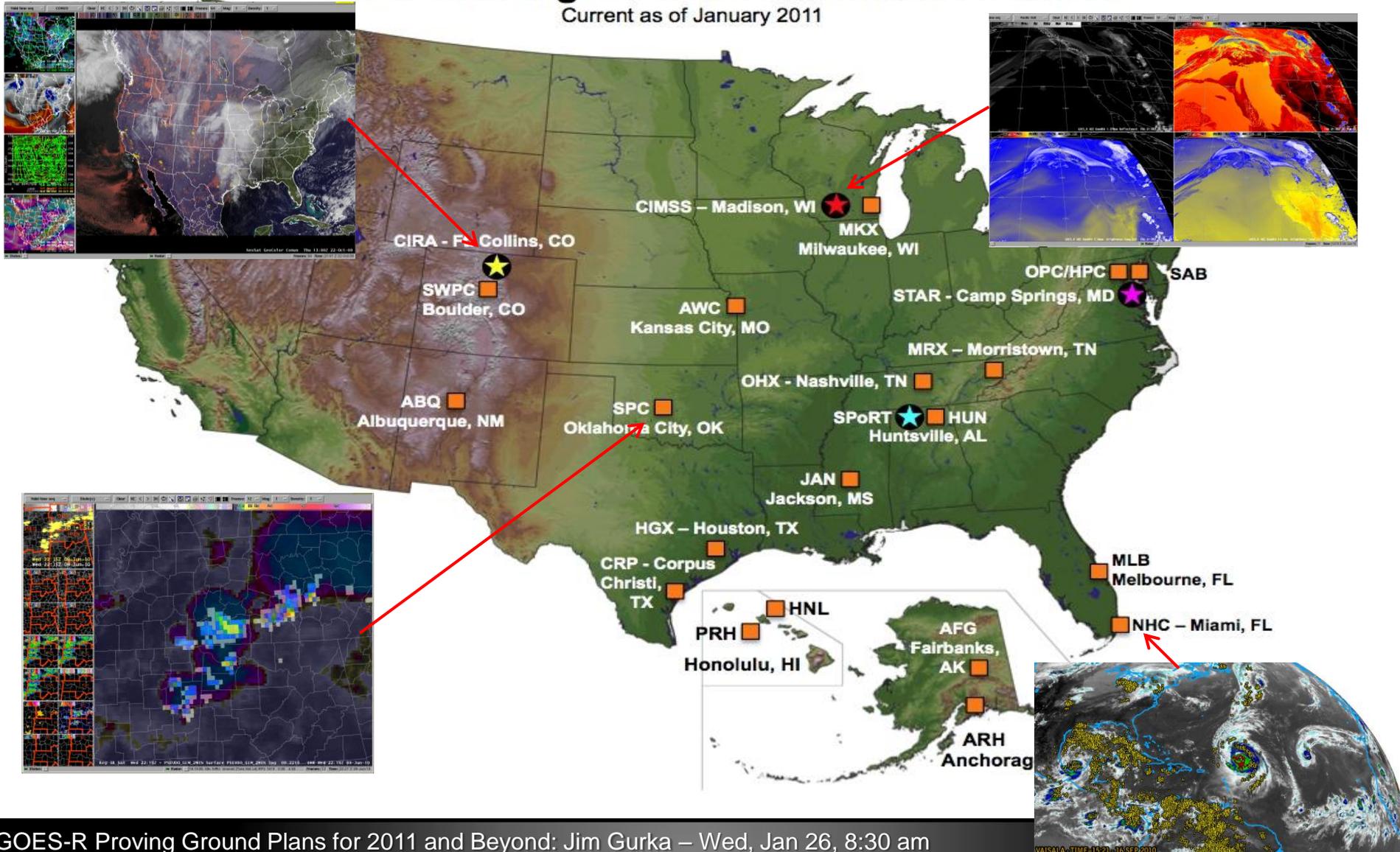
## Online training modules

- [http://meted.ucar.edu/goes\\_r/envmon/](http://meted.ucar.edu/goes_r/envmon/)
- <http://cimss.ssec.wisc.edu/satmet/>
- <http://rammb.cira.colostate.edu/visit/video/goesr101/player.html>
- [http://rammb.cira.colostate.edu/training/shymet/forecaster\\_intro.asp](http://rammb.cira.colostate.edu/training/shymet/forecaster_intro.asp)

# GOES-R Proving Ground

## GOES-R Proving Ground Evaluation Partners

Current as of January 2011



GOES-R Proving Ground Plans for 2011 and Beyond: Jim Gurka – Wed, Jan 26, 8:30 am  
 GOES-R Proving Ground 2010 Spring Experiment: Chris Siewert – Wed, Jan 26, 9:30 am



# Direct Readout Comparisons

	GOES I-P	GOES-R
Full Disk Image	30 minutes	5 minutes
Imager bands	5	16
Visible	1 kilometer	0.5 kilometer
Near Infrared	N/A	1 kilometer
Infrared	4 kilometer	2 kilometer
Bit Depth	10 bits	12 bits – Visible, 14 bits Infrared
Raw Instrument Data	2.62 Mbps	~ 100 Mbps (ABI: ~60Mbps)
Space Weather	~100 kbps	3.5 - 4Mbps
Geostationary Lightning Mapper	N/A	7.5 Mbps
Telemetry	4 kbps	1, 4 & 32 kbps
Planned Data Outage	>300 hrs/yr	<2 hrs/year
GRB/GVAR	2 Mbps	31 Mbps
HRIT/EMWIN	LRIT: 128 kbps EMWIN: 19.2 kbps	400 kbps
DCS	233 simultaneous downlinks	466 simultaneous downlinks
SARSAT	36 dBm uplink power	32 dBm uplink power ( <i>will be able to detect emergency beacons with weaker signals</i> )



# 7<sup>th</sup> GOES Users Conference



Joint with 36<sup>th</sup> Annual NWA Meeting in Birmingham, AL  
Oct. 15-21, 2011 at the Wynfrey Hotel

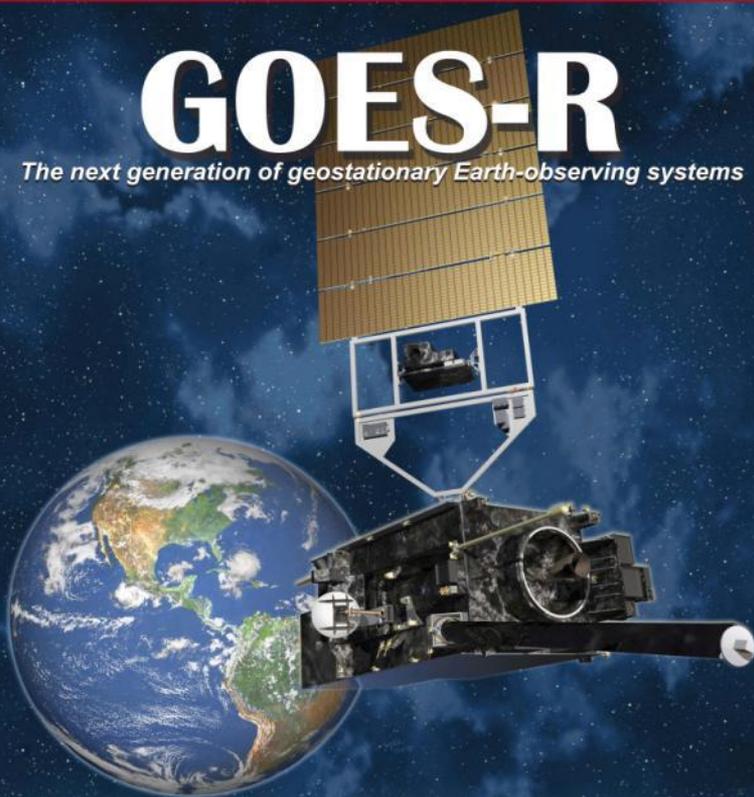


Visit: <http://www.goes-r.gov> or <http://www.nwas.org/meetings> for more info!

**NOAA Satellite and Information Service**

# GOES-R

*The next generation of geostationary Earth-observing systems*



**Advanced imaging  
for accurate forecasts**



**Real-time mapping  
of lightning activity**



**Improved monitoring  
of solar activity**

**Thank you!**

*Any ????*