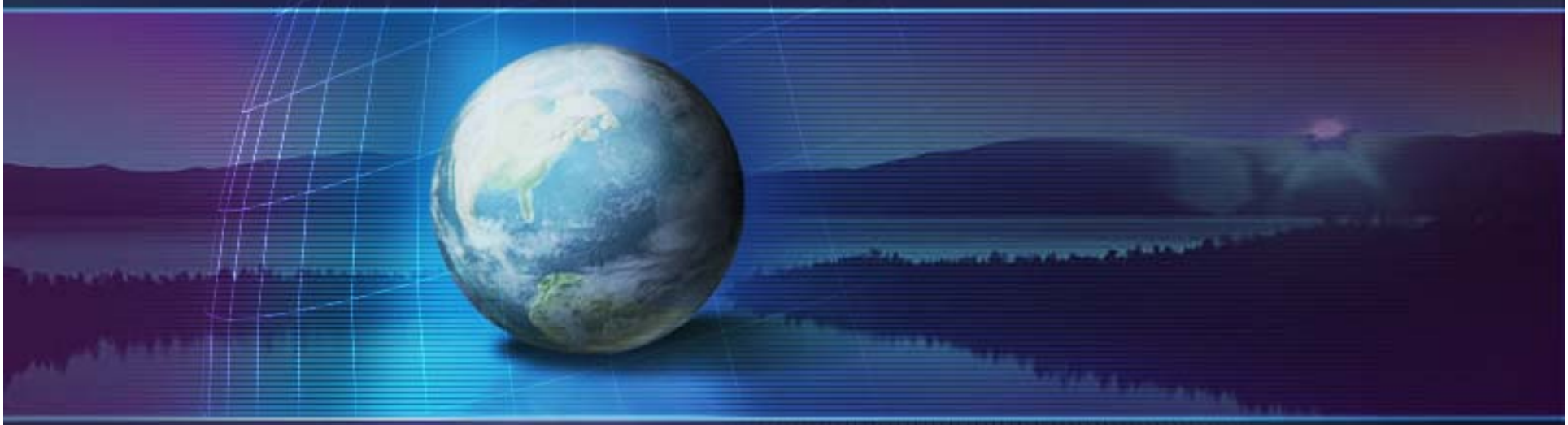
GOES-R Instrument Status and Accommodations



Barbara Pfarr
GOES-R Program Systems Engineering
January 2010
AMS Conference

Agenda

- Instrument Developmental Status
- Significant Changes in the Last Year
- Introducing the GOES-R Spacecraft…

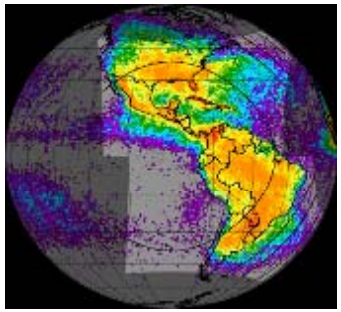
GOES-R Mission

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

Visible & IR Imagery

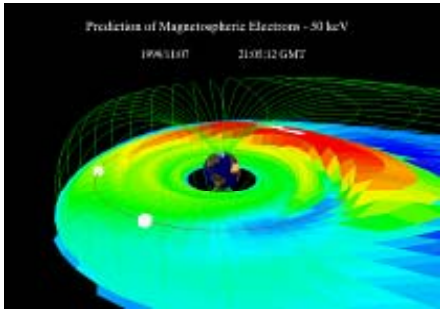
- *Advanced Baseline Imager (ABI)*

Lighting Mapping



- *Geostationary Lightning Mapper (GLM)*

Space Weather Monitoring



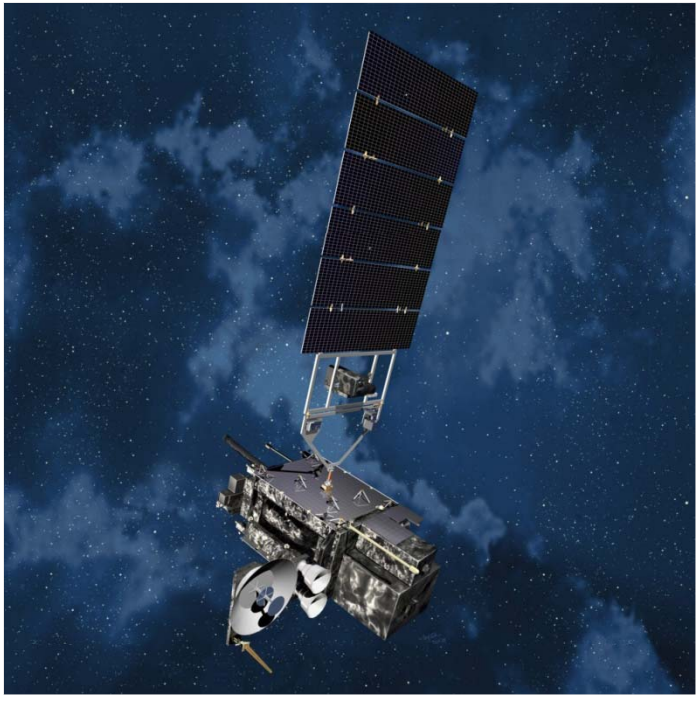
- *Space Environment In-Situ Sensor Suite (SEISS)*
- *Magnetometer*

Solar Imaging

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

GOES-R Overview

Extending the continuity of NOAA's 40-year geostationary mission, GOES-R will be the next weather sentinel for monitoring threatening weather, and providing data for forecasting and environmental analyses



A collaborative development and acquisition

- Flight Project - led by NASA
- Ground Segment Project - led by NOAA

Scheduled for launch in 2015

Six advanced instrument payloads

New and improved capabilities for

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

GOES-R Instruments

Advanced Baseline Imager (ABI)

- Implementation phase (3 years post-CDR; PTM testing in progress)
- Contractor: ITT Corporation, Ft Wayne, IN

Geostationary Lightning Mapper (GLM)

- Implementation phase (Subsystem CDRs in progress; CDR in Summer 2010)
- Contractor: Lockheed Martin Advanced Technology Corp, Palo Alto, CA

Solar Ultra Violet Imager (SUVI)

- Implementation phase (CDR in December 2009)
- Contractor: Lockheed Martin Advanced Technology Corp, Palo Alto, CA

Extreme Ultra Violet /X-Ray Irradiance Sensor (EXIS)

- Implementation phase (CDR in November 2009)
- Contractor: Laboratory for Atmospheric and Space Physics, Boulder, CO

Space Environmental In-Situ Suite (SEISS)

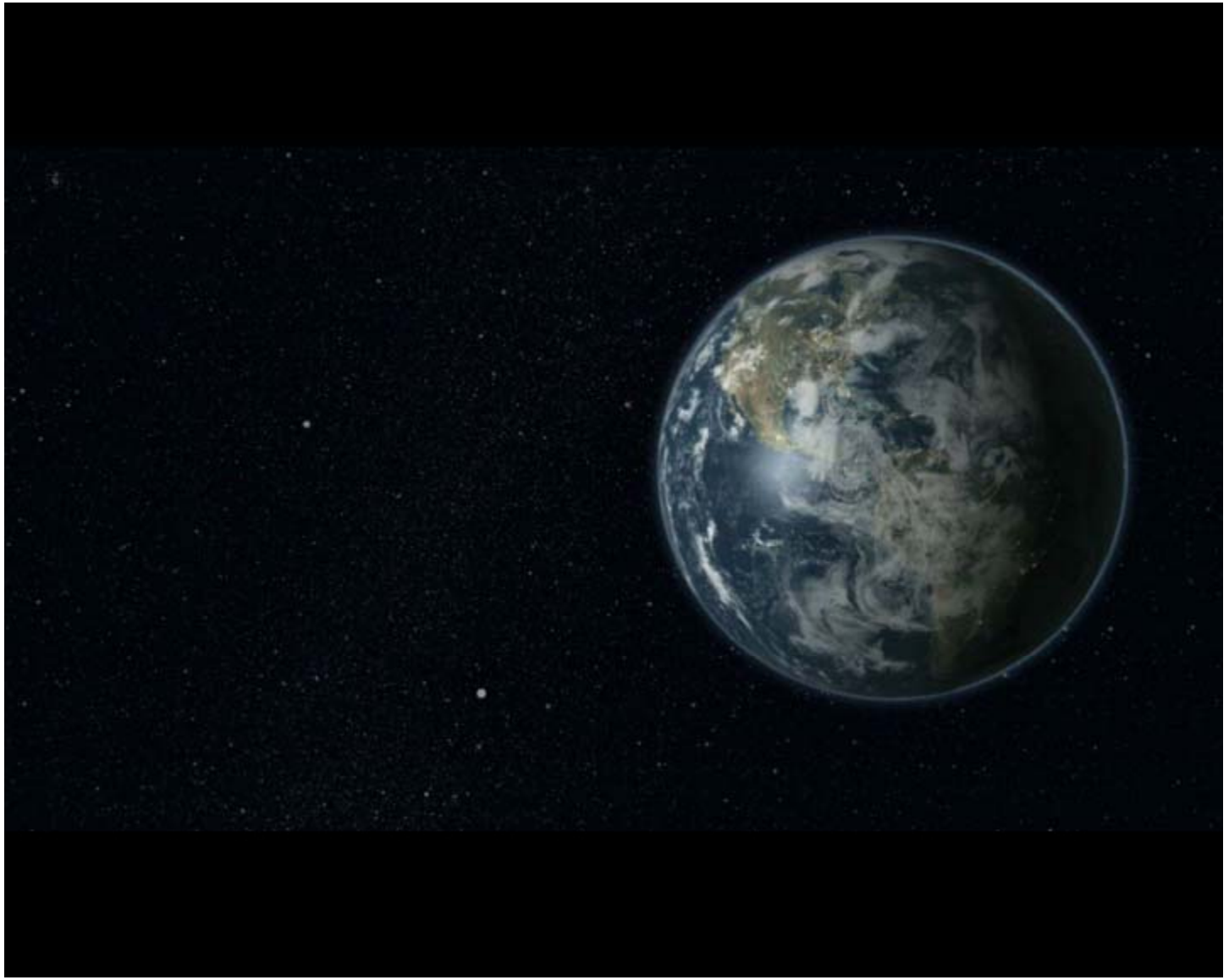
- Implementation phase (Subsystem CDRs in progress; CDR in May 2010)
- Contractor: Assurance Technology Corporation, Carlisle, MA

Magnetometer (MAG)

- Procured as part of spacecraft contract
- Implementation phase (SDR in March 2010)
- Contractor: Lockheed Martin, Newtown, PA

Changes in the Last Year

- **A spacecraft platform has been selected!**
  - A derivative of the Lockheed Martin A2100 bus will be used for the GOES-R series
    - Shares some developmental commonality with GPS III
  - The first major spacecraft milestone, the Systems Definition Review, is planned for March 2010
  - Magnetometer development included as part of the Spacecraft contract
- **Five instruments are in implementation**
  - ABI, SUVI and EXIS have completed CDR
  - SEISS and GLM CDRs scheduled for Spring/Summer 2010
- **ABI Prototype Model Bench Testing nearing completion**
  - Environmental testing planned for Spring 2010
- **Instrument interfaces evolving with spacecraft**
  - Instruments and spacecraft have been utilizing common, stable interface requirement documents
  - ICD development activities with the Spacecraft team have been started



GoesRintro-HD.wmv

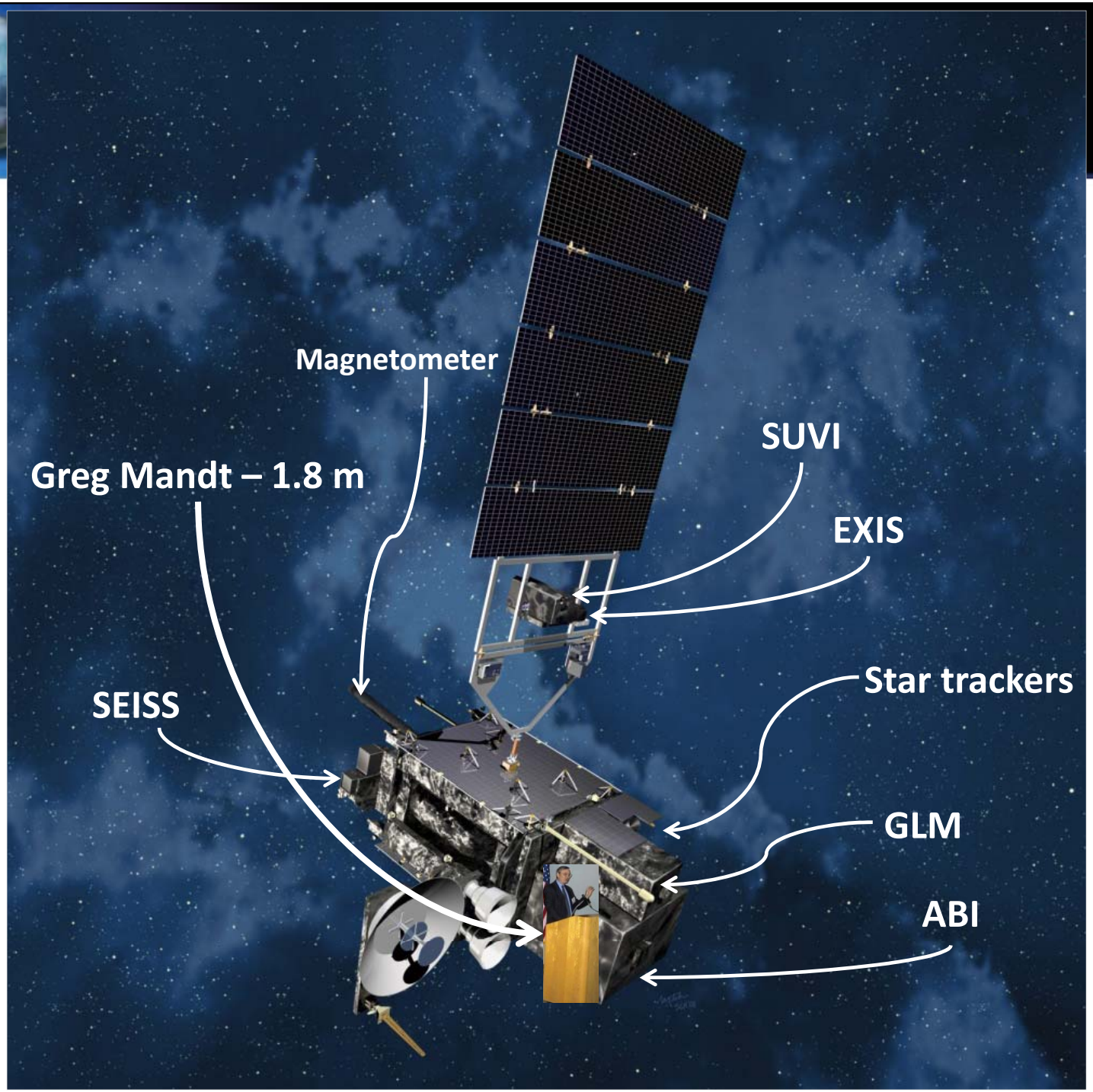
GoesRintro-HD.mov

Satellite Driving Requirements

- Provide **precision, stable space platforms** at two operational geostationary orbital locations (75W and 137W) carrying the baseline instrument set
- Operational Mission - First Launch 2015: Provide continuity and improvements over the current system with **spacecraft bus reliability of greater than 0.8** after 10 years of on-orbit operation preceded by up to 5 years on-orbit storage
- Spacecraft **On-Orbit Life of 15 years** with orbit East-West and North-South position maintained to within +/-0.5 degree.
- Collect and transmit up to **100Mbps Instrument Payload data** from each location continuously.
- **Continuous Rebroadcast function** at L-Band up to 31 Mbps utilizing dual polarization
- Provide improved **continuing services** (Search & Rescue, Data Collection, Emergency Manager's Weather Information Network (EMWIN))

Instrument Accommodation

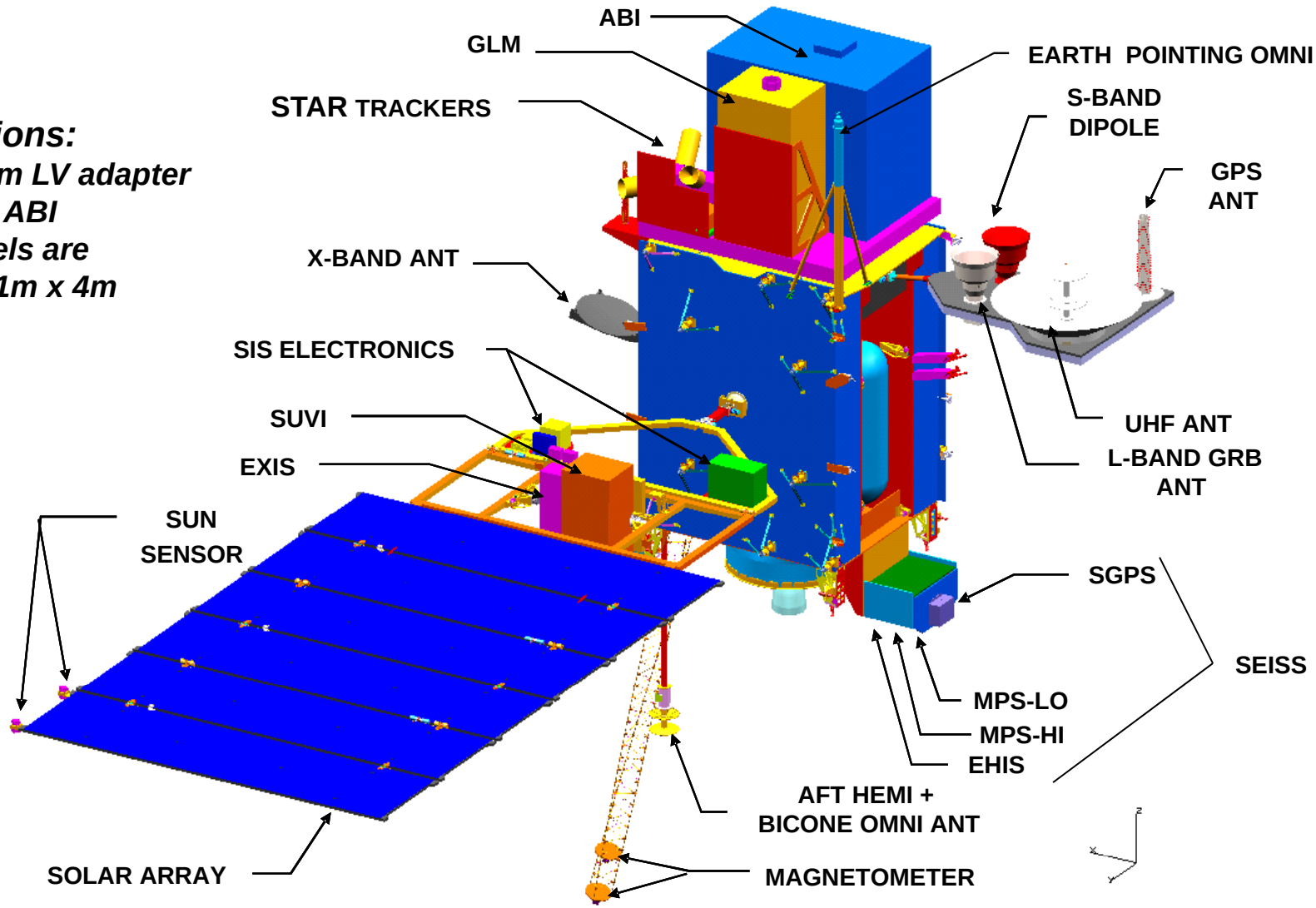
- On the GOES-R "family tree" of instruments, there are **three general classifications** for the instrument payloads
- **Nadir-pointing**
  - Earth-pointed "business end" of GOES
  - Highly stable, precision pointed platform
  - Dynamically isolated from the rest of the spacecraft
  - Supports operation of the ABI and GLM
- **Solar-pointing**
  - Utilizes a Sun Pointing Platform (SPP) housed on the solar array yoke
  - The SPP provides a stable platform that tracks the seasonal and daily movement of the sun relative to the spacecraft
  - Supports operation of the SUVI and EXIS
- **In-Situ**
  - SEISS and the Magnetometer provide localized measurements of particles and fields in geosynchronous orbit
  - Accommodation challenges include:
    - a wide variance in Field-of-View (FOV) requirements for the SEISS sensors, and,
    - a boom to provide relative magnetic isolation for the Magnetometer


Magnetometer
Greg Mandt – 1.8 m
SUVI
EXIS
SEISS
Star trackers
GLM
ABI

GOES-R Spacecraft Configuration

Dimensions:

- ***5.4m from LV adapter to top of ABI***
- ***S/A Panels are approx. 1m x 4m each***



GOES-R Satellite Production and Support Locations

LOCKHEED MARTIN

Sunnyvale

- Solar array

Newtown

- Program office
- System Engineering
- Structure
- Power
- Communications
- Thermal
- System module I&T

Palo Alto,CA
Stockton, CA
Sunnyvale, CA
Denver, CO
Columbia, MD
Newtown, PA
Greenbelt, MD
Woodland Hills, CA
Glendale, AZ
Stennis, MS
Cape Canaveral, FL

Lockheed Martin GOES-R Locations
LM GOES-R Subcontractor Locations

AASC
ARES CORPORATION
Honeywell
NORTHROP GRUMMAN
SAIC

Denver

- System engineering
- C&DH
- Flight software
- GN&C
- Mechanisms
- MGSE/EGSE
- Satellite AI&T

Stennis

- Propulsion subsystem
- Core module integration

Cape Canaveral

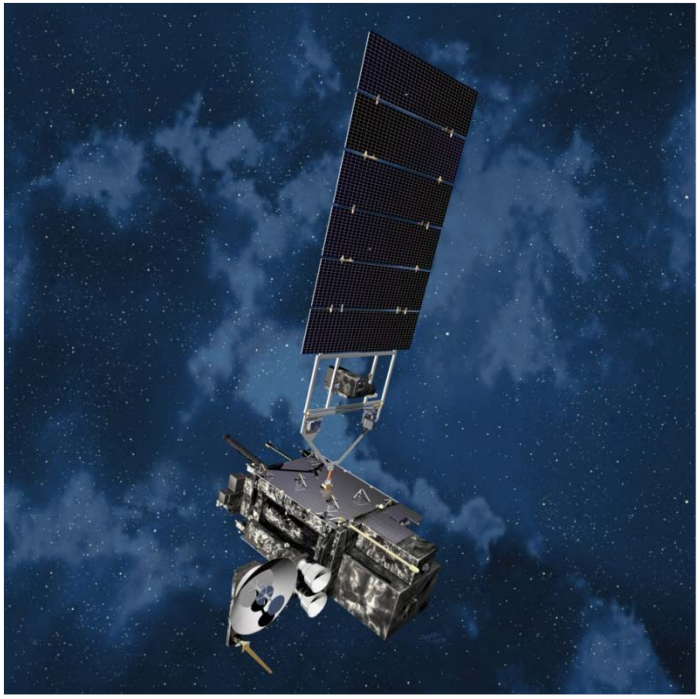
- Launch processing

Greenbelt

- Customer liaison
- Instrument accom
- System engineering
- Mission ops supt

DP063-MSN-588

Notable Performance Elements



Operates through periodic station-keeping and momentum adjust maneuvers

- Low risk station-keeping operations
- Increased instrument availability
- Decreased propellant required due to high efficiency thruster

Vibration Isolation for optical bench

Total time of noncompliance for instrument interface requirements <120 min per year

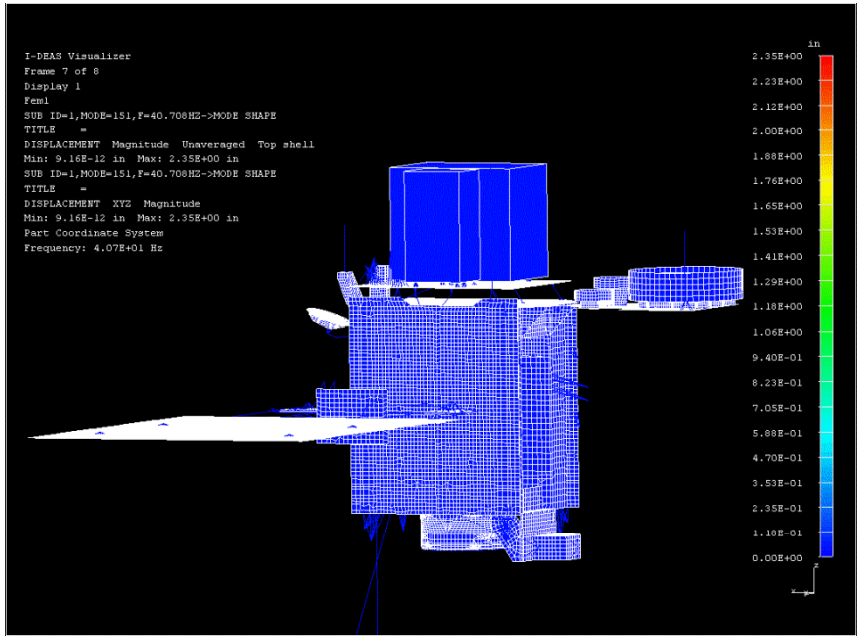
Design Elements Support Precision Pointing

ABI and GLM are mounted on stiff optical bench

- Dynamics are tunable to optimize system performance
- Couple instrument motion to IMU and star trackers with low thermal distortion

High-accuracy attitude determination system on the instrument optical bench

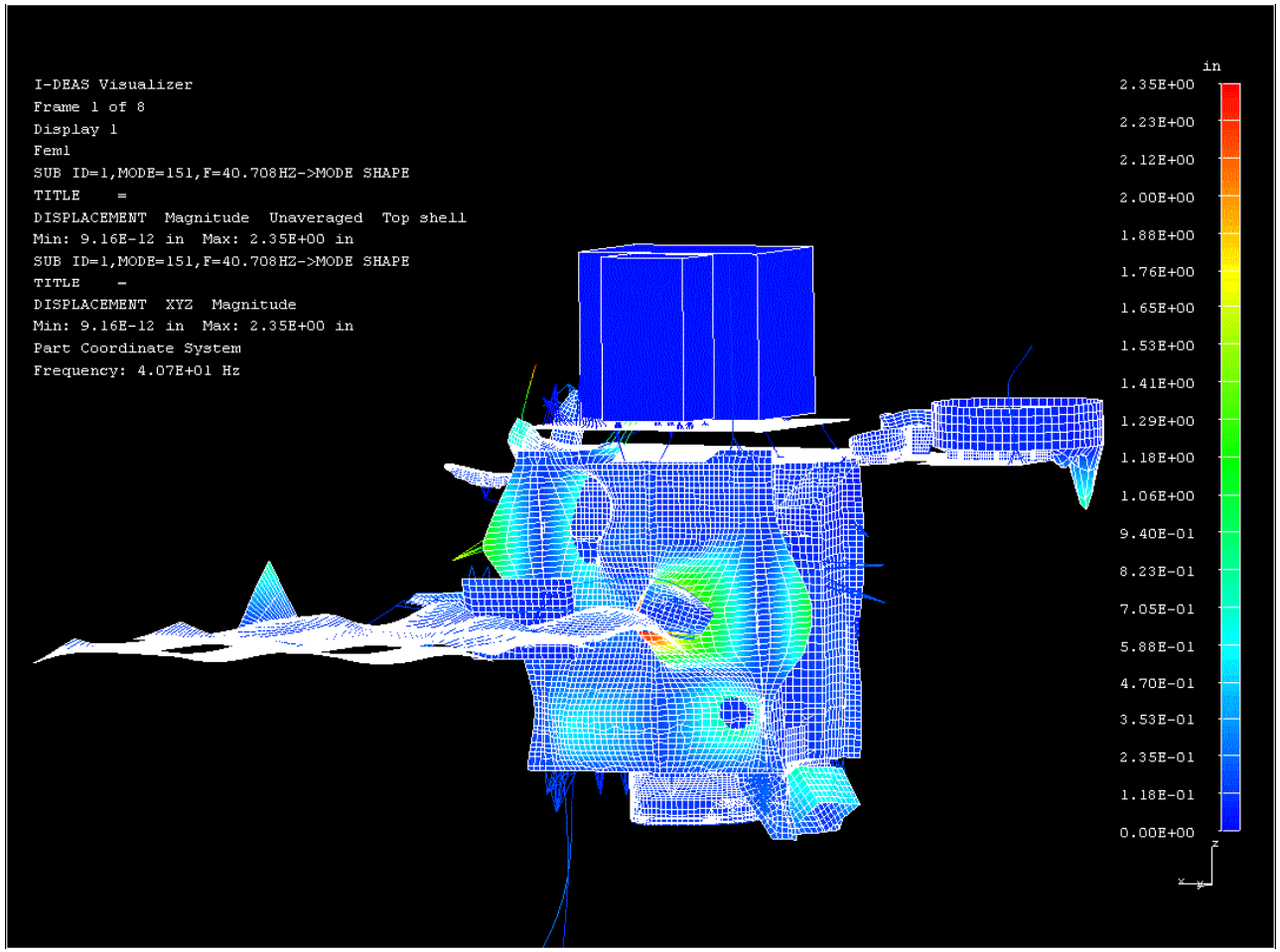
- High accuracy star trackers
- High-bandwidth, low-latency and low-noise IMU for effective motion compensation



Animation shows the vibration-isolation impact

Augmented attitude control array damping demonstrated with risk-reduction tests

Optical Bench Vibration Isolation Impact



Summary

- The Spacecraft has started implementation
  - GOES-R spacecraft-to-instrument interfaces designed to minimize science data outages
    - A tremendous improvement over the current operational series (GOES-I/M and GOES-NOP)

- ABI, SUVI, EXIS, SEISS and GLM are at or beyond the CDR phase
  - Starting to “bend metal” (i.e. building flight hardware)!
  - Operational concepts for all instruments remain under review
  - Spacecraft-to-instrument critical interface definitions are being baselined

Acknowledgments

Thanks to Jamie Hawkins and the LM Spacecraft Team for their contributions to this presentation