Ensuring the Preparedness of Users: NOAA Satellites GOES-R, JPSS

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GOES-R?

GOES-R will provide improved detection and observations of meteorological phenomena that directly impact public safety, protection of property, and economic health and development.

- Improve hurricane track & intensity forecasts
- Increase thunderstorm & tornado warning lead time
- Improve aviation flight route planning
- Data for long-term climate variability studies

- Improve solar flare warnings for communications and navigation disruptions
- More accurate monitoring of energetic particles responsible for radiation hazards to humans and spacecraft
- Better monitoring of Coronal Mass Ejections to improve geomagnetic storm forecasting
Transition from GOES NOP to GOES-R

**Full Resolution (GVAR to GOES Rebroadcast):**
- Improved data products for hemispheric retransmission
  - Faster full disk images
    - 5 minutes (Mode 4) and 15 minutes (Mode 3)
  - Full set of Level 1b data
    - Data from six GOES-R instruments including 16 ABI channels

**EQUIPMENT:** Transition to GOES Rebroadcast (GBR) requires new antenna, receiver hardware, and processing system to handle the new data volumes

**Low Resolution & Text Products (LRIT and EMWIN combine to HRIT/EMWIN):**
- Improved data products for hemispheric retransmission
  - Faster full disk images: between 15 and 30 minutes
  - Warnings, Watches, Tropical Storm Information
  - Copy of GOES Data Collection System (GOES DCS)

**EQUIPMENT:** Transition to HRIT/EMWIN Requires new antenna and receiver hardware

www.noaasis.noaa.gov/NOAASIS/ml/manulst.html
Upgrade or Replace GVAR?

GRB Ground Antenna Sizes

NOTES:
1. Calculations based on available data as of May 2011
2. Each antenna size is usable within the indicated contour
3. Rain attenuations included are: 1.3/1.6/2.0/2.2/2.5 dB (3.8 to 6 m)
4. An operating margin of 2.5 dB is included as the dual polarization isolation is likely to vary within each antenna size area

Antenna Diameters

- 6.0 m
- 5.0 m
- 4.5 m
- 4.2 m
- 3.8 m

Courtesy Satya Kalluri
GOES-R / JPSS Proving Ground

• GOES-R/ JPSS Proving Ground provides mechanism to:
  – Involve Cooperative Institutes, Algorithm Working Group, National Centers, NOAA Testbeds and WFOs in user readiness
  – Get prototype GOES-R/JPSS products in hands of forecasters
  – Keep lines of communication open between developers and forecasters
  – Allow end user to have say in final product, how it is displayed and integrated into operations

• With adjustments based on user feedback...Proving Ground continues to grow and plans are in place for 2013 and beyond.

• For GOES-R and JPSS to be a success, forecasters must be able to use GOES-R products on Day 1!
The GOES-R Proving Ground

- **AWC – Kansas City, MO** IR Imagery of Oceanic Storms
- **CIRA/STAR – Ft. Collins, CO** ABI Synthetic Low Cloud Enhancement Imagery
- **CIMSS/STAR – Madison, WI** Fog/Low Stratus Product
- **STAR/UMBC – College Park, MD** Aerosol Optical Depth
- **SPoRT/NASA – Huntsville, AL** GLM Lightning Density
- **SPC – Norman, OK** Severe Storms 1-Min Visible Imagery of Overshooting Tops
- **NHC – Miami, FL** RGB Air Mass for Hurricane Sandy
GOES-R Training and User Education

Online Training Modules
- GOES-R ABI: Next Generation Satellite Imaging (COMET)
- GOES-R: Benefits of Next-Generation Environmental Monitoring (COMET)
- GOES-R 101
- Satellite Hydrology and Meteorology for Forecasters (SHyMet)
- SPoRT product training modules
- Commerce Learning Center

Printed Materials
- GOES-R Fact Sheets (18)
- GOES-R Tri-fold
- User Readiness Plan
- GRB Downlink Specifications and Product Users Guide

Outreach Projects (with NWSFOs)
- COMET will reach out to the GOES-R Proving Ground Partners and connect them with university faculty to use current and prototype data products for the purpose of building a bridge from products that are currently available to those that will become available when GOES-R is launched.
JPSS Overview

JPSS consists of five satellites (Suomi NPP, JPSS-1, JPSS-2, FF-1, FF-2), ground system and operations through 2028

- JPSS mission is to provide global imagery and atmospheric measurements using polar-orbiting satellites
- To provide operational global observations in the early afternoon orbit which are critical inputs for numerical weather prediction models
- To provide uninterrupted continuity of observations from current NOAA POES, NASA EOS and SUOMI NPP satellites
Community Satellite Processing Package (CSPP)

- CSPP supports the Direct Broadcast (DB) meteorological and environmental satellite community with packaging and distribution of open source science software.
- CSPP supports DB users of both polar orbiting and geostationary satellite data processing and regional real-time applications through distribution of free software, and through training in local product applications.
April, 8-12, 2013
College Park, MD
Summary

• GOES-R is coming - Launch planned late 2015
• Suomi-NPP instruments performing well; key opportunity to prepare for JPSS
• New sensors, products, and services will help improve forecasts and increase lead times for warnings and decision makes
• User preparation is essential to take advantage of the advanced capabilities
• Thank You!
Back up Slides
GOES Mission

• For the protection and enhancement of the Nation’s economy, security, environment, and quality of life...
• Continuity of GOES Operations since 1974 at orbits of ~35,000 km
• Warnings to U.S. Public -- Detect, track and characterize
  – Hurricanes, Severe storms (including flash floods) and winter cyclones
• Imagery for weather forecasting

• Derived products for analysis and forecasting
  – Surface temperatures (sea and land), Winds for aviation and NWS numerical models,
  – Soundings and radiances for NWS models (Atmospheric Stability, Lifted indices, Precipitable water)
  – Air Quality, Rainfall Estimates
• Environmental data collection – platforms including buoys, rain gauges, river levels, ecosystem monitoring
• Space weather monitoring and forecasting, Search and Rescue
Continuity of GOES Operational Satellite Program

Fiscal Year
09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

January 2012

GOES-12 South America Coverage
GOES-13 GOES East
GOES-15 GOES West
GOES-14 On-orbit Storage
GOES-R
GOES-S
GOES-T
GOES-U

Approved: [Signature]
Assistant Administrator for Satellite and Information Services

Satellite is operational beyond design life
Post Launch Test / On-orbit storage
Operational

Signed on: 1/25/12

NATIONAL WEATHER SERVICE
## GOES-R Capabilities

<table>
<thead>
<tr>
<th>Capability</th>
<th>Current GOES</th>
<th>GOES-R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Disk Image</td>
<td>30 minutes</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Imager bands</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>Visible</td>
<td>~1 kilometer</td>
<td>0.5 - 1 kilometer</td>
</tr>
<tr>
<td>Near Infrared</td>
<td>N/A</td>
<td>1 - 2 kilometer</td>
</tr>
<tr>
<td>Infrared</td>
<td>4-8 kilometer</td>
<td>2 kilometer</td>
</tr>
<tr>
<td>BitDepth</td>
<td>10 bits</td>
<td>12 bits – Visible, 14 bits IR</td>
</tr>
<tr>
<td>Raw Instrument Data</td>
<td>2.62 Mbps</td>
<td>~ 100 Mbps (ABI: ~60Mbps)</td>
</tr>
<tr>
<td>Data Compression</td>
<td>None</td>
<td>Lossless</td>
</tr>
<tr>
<td>Sounder</td>
<td>19 bands</td>
<td>N/A</td>
</tr>
<tr>
<td>Space Weather</td>
<td>~100 kbps</td>
<td>3.5 - 4 Mbps</td>
</tr>
<tr>
<td>Geostationary Lightning Mapper</td>
<td>N/A</td>
<td>7.5 Mbps</td>
</tr>
<tr>
<td>Telemetry</td>
<td>4 kbps</td>
<td>1, 4 &amp; 32 kbps</td>
</tr>
<tr>
<td>Planned Data Outage</td>
<td>&gt;300 hrs/yr</td>
<td>&lt;2 hrs/year</td>
</tr>
<tr>
<td>Command and Control</td>
<td>Individual commands/events/day (limited 1 day autonomy for GOES N/P)</td>
<td>Autonomous for 7 days/satellite</td>
</tr>
<tr>
<td>Ground System Backup</td>
<td>Limited</td>
<td>Yes</td>
</tr>
<tr>
<td>Archive and Access</td>
<td>Limited</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of Products</td>
<td>37</td>
<td>35</td>
</tr>
<tr>
<td>Level 1b Product Data Rate (Rebroadcast)</td>
<td>2.11 Mbps (GVAR)/satellite</td>
<td>31 Mbps (GRB)/satellite</td>
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<tr>
<td>Level 2+ Product Data Rate</td>
<td>~ 50 GB/satellite/year</td>
<td>~ 1.14 TB/satellite/year</td>
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GOES- R Sensors

✓ Instruments
✓ Advanced Baseline Imager (ABI)
✓ Geostationary Lightning Mapper (GLM)
✓ Magnetometer
✓ Space Environment in-Situ Sensor Suite (SEISS)
✓ Solar Ultra-Violet Imager (SUVI)
✓ Extreme UV/X-Ray Irradiance Sensors (EXIS)
GOES-R Data Distribution

Sectorized Cloud and Moisture Imagery

L1B and L2+ Derived Products

Direct Broadcast Community

NOAAPort Community

Operational User Community (NOAA Centers, DOD, NCEP, Int’l Partners)

Climate Research & Academia
Joint Polar Satellite System (JPSS)

• JPSS provides operational continuity of polar afternoon orbit satellite-based observations and products

• S-NPP operating well, spacecraft and instruments healthy, cal/val progressing well and on schedule, ATMS data being assimilated into operational weather models

• JPSS-1 instruments on schedule instrument flight builds ranging from 65 to 100% complete; spacecraft development well under way; launch vehicle under contract

• RFO for free flyer spacecraft (FF1) released; supports SARSAT, data collection (ARGOS) and Total Solar Irradiance

• TSIS Calibration Transfer Experiment (TCTE) delivered and integrated into STP-3

*Launch Readiness Date based on FY 2013 President’s Budget Request

<table>
<thead>
<tr>
<th>Launch Readiness Date</th>
<th>FY 2017 (JPSS-1)*; FY 2021 (JPSS-2)</th>
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<tbody>
<tr>
<td>Program Architecture</td>
<td>2 Satellites (JPSS-1 and JPSS-2) &amp; 2 free-flyer satellites</td>
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<tr>
<td>Program Operational Life</td>
<td>FY 2016 – FY 2028</td>
</tr>
<tr>
<td>Program Life-cycle FY 2013 President’s Budget</td>
<td>$12.9 billion</td>
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Continuity of NOAA’s Polar (Primary) Operational Satellite Programs

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<tr>
<th>Fiscal Year</th>
<th>DoD</th>
<th>NOAA</th>
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<tr>
<td>09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30</td>
<td>DMSP 17</td>
<td>DMSP 18</td>
</tr>
<tr>
<td></td>
<td>DMSP 19</td>
<td>MetOp - A</td>
</tr>
<tr>
<td></td>
<td>DMSP 20</td>
<td>MetOp - B</td>
</tr>
<tr>
<td></td>
<td>MetOp - C</td>
<td>MetOp-SG.A1</td>
</tr>
<tr>
<td></td>
<td>MetOp-SG.B1</td>
<td>SG A2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SG B2</td>
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<tr>
<td></td>
<td>NOAA - 19</td>
<td>Suomi NPP</td>
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<tr>
<td></td>
<td>TCTE</td>
<td>JPSS - 1</td>
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<tr>
<td></td>
<td>Free Flyer-1</td>
<td>JPSS - 2</td>
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<tr>
<td></td>
<td>Free Flyer-2</td>
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<tr>
<td></td>
<td>GCOM W-1</td>
<td>GCOM W-2/3</td>
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Approved: [Signature]

Signed on: [Date]

Launch Dates based on PB13