GOES-R Ground Segment
Product Readiness & Operations
(Science Algorithms & Products)
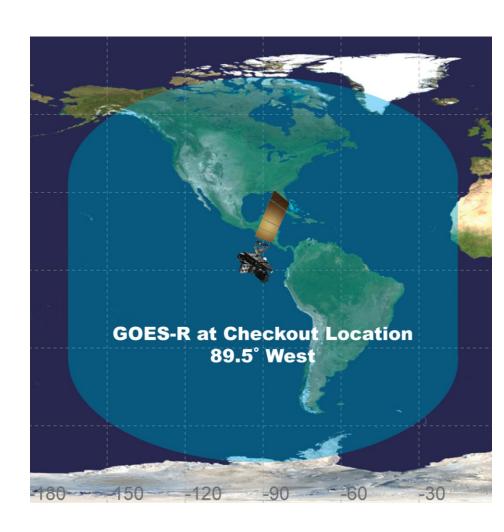
Heather Kilcoyne

Outline

- GOES-R Launch

- Algorithm Development and Cal/Val Organization

- Cal/Val Program

- Data Distribution and Access
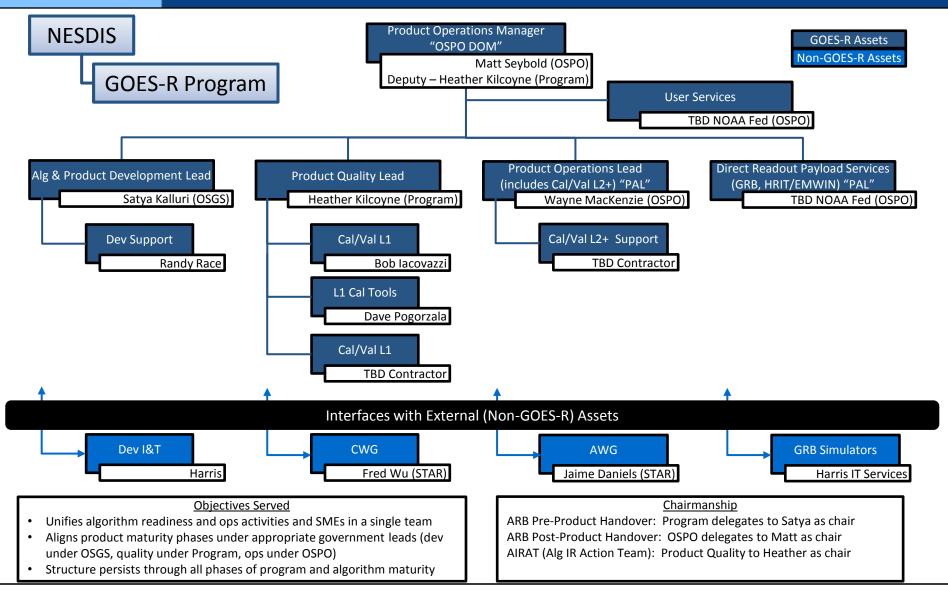
- Readiness Activities

GOES-R Launch

- GOES-R launches in March 2016

- Launch and orbit raising: 12 days

- Level 1b products will be validated during Post Launch Test (six months) and will be available through GOES-R Rebroadcast (GRB) service as products are certified

- Level 2+ product certification begins after L1b products and will be distributed on a product-by-product basis as they mature

- GOES-16 extended validation: Sept 2016 – March 2017

- GOES-16 operational: March 2017 at TBD orbit location

GOES-R at Checkout Location 89.5° West

Product Readiness & Operations Team

GOES-R Assets
Non-GOES-R Assets

Product Operations Manager
"OSPO DOM"
Matt Seybold (OSPO)
Deputy – Heather Kilcoyne (Program)

NESDIS

GOES-R Program

User Services
TBD NOAA Fed (OSPO)

Alg & Product Development Lead
Satya Kalluri (OSGS)

Dev Support
Randy Race

Product Quality Lead
Heather Kilcoyne (Program)

Cal/Val L1
Bob Iacovazzi

L1 Cal Tools
Dave Pogorzala

Cal/Val L1
TBD Contractor

Product Operations Lead
(includes Cal/Val L2+) "PAL"
Wayne MacKenzie (OSPO)

Cal/Val L2+ Support
TBD Contractor

Direct Readout Payload Services
(GRB, HRIT/EMWIN) "PAL"
TBD NOAA Fed (OSPO)

Interfaces with External (Non-GOES-R) Assets

Dev I&T
Harris

CWG
Fred Wu (STAR)

AWG
Jaime Daniels (STAR)

GRB Simulators
Harris IT Services

Objectives Served
- Unifies algorithm readiness and ops activities and SMEs in a single team
- Aligns product maturity phases under appropriate government leads (dev under OSGS, quality under Program, ops under OSPO)
- Structure persists through all phases of program and algorithm maturity

Chairmanship
ARB Pre-Product Handover: Program delegates to Satya as chair
ARB Post-Product Handover: OSPO delegates to Matt as chair
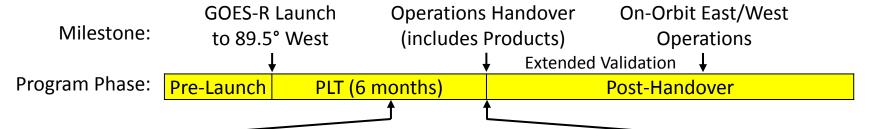AIRAT (Alg IR Action Team): Product Quality to Heather as chair

GOES-R Calibration/Validation Program

- Goal of the Cal/Val Program is to have Provisional L1b (and CMI) and Beta L2 data products at the Operations Handover to be held about 6 months post-launch
  - Provisional = Ready for users to assess in their applications for operational use
  - Beta = Product is minimally validated and may contain significant errors

- Calibration Working Group (CWG) will conduct Post-Launch Performance Tests to calibrate and validate the L1B data products
  - CWG will identify, report and collaborate with instrument vendors to resolve issues with ground segment algorithms
  - CWG will modify calibration tables as needed

- Algorithm Working Group (AWG) will also perform post-launch analyses to calibrate and validated the L2 data products
  - AWG will identify, report, and resolve issues with ground segment algorithms.
  - AWG will modify configuration tables as needed.

Validation and Availability for GOES-R Baseline Products

Milestone:	GOES-R Launch to 89.5° West	Operations Handover (includes Products)	On-Orbit East/West Operations

Extended Validation

Program Phase:	Pre-Launch	PLT (6 months)	Post-Handover

L1b Product Activities
- L1b Validation - Products recertified against pre-launch instrument performance
- 'First Light' Data captures shared from Instruments
- Insertion of L1b products into GRB service is controlled by ground system and will occur as products are certified

L2+ Product Activities
- L2+ Validation – Same certification process as L1b products
- However, L2+ certification begins after L1b products and the portfolio will mature at an overall slower rate with some products certified post-Operations Handover

Distribution Testing
- Testing of Distribution Requirements for GRB, AWIPS, and PDA will occur with Integration & Test Customers, utilizing a terrestrial test-purpose data flow from Wallops to NSOF

Mission Notifications
- Mission notifications will inform users of new product operations and caveats (e.g. GOES maneuver data caveats) leading up to, during, and after Operations Handover

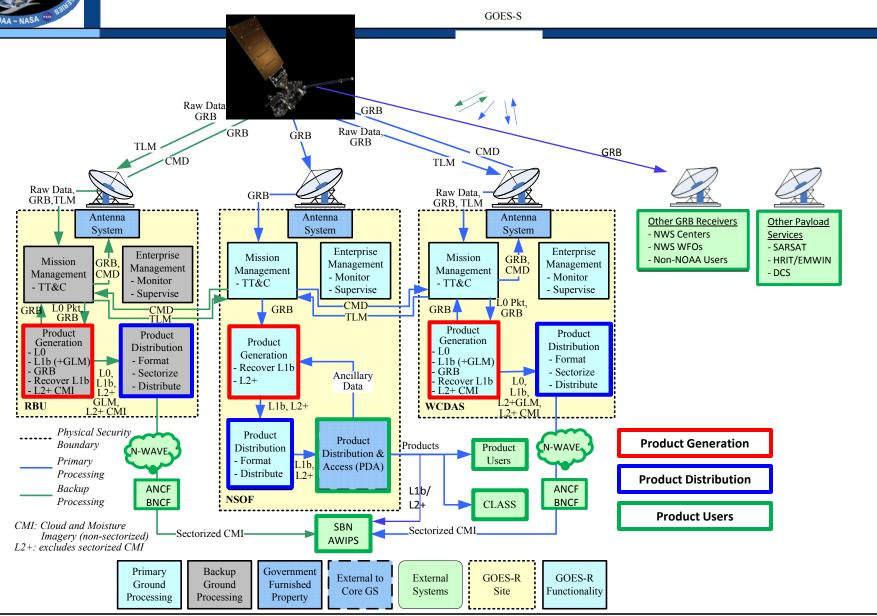# Data Distribution and Access

- Operational Software
  - Operational software for the L2 data products has been made available to STAR through access to the Ground Configuration Management system, and STAR will provide Delivered Algorithm Packages with any necessary algorithm changes to be implemented on the operational system via the Ground Contractor.
  - Operational software for the L1b data products is available to the CWG, though funding has not been provided for facilities to run the software offline.
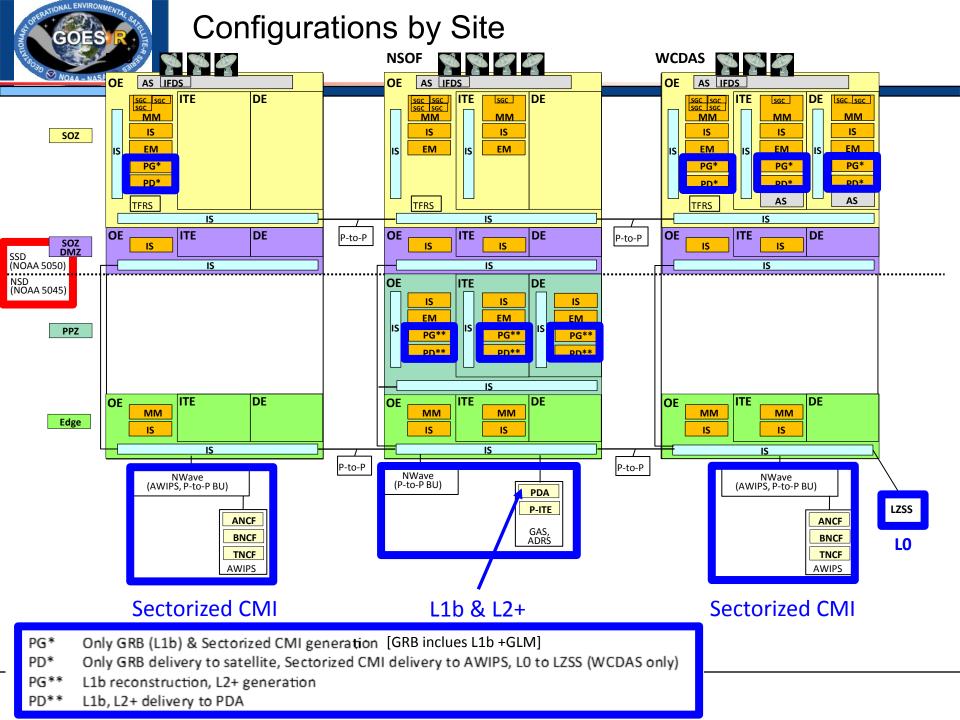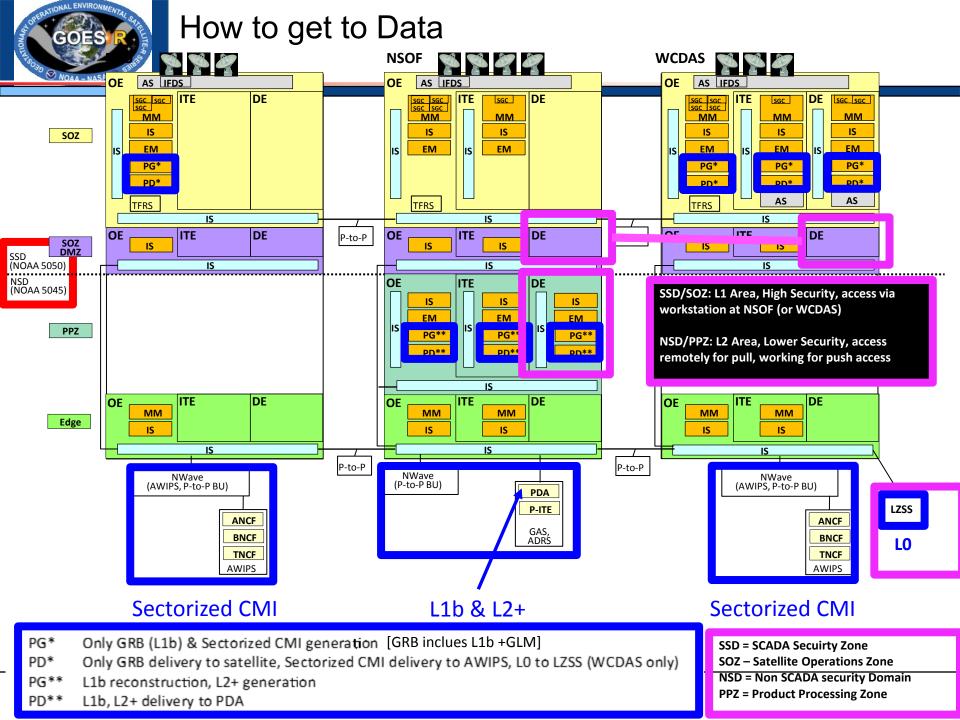- Data Access
  - CWG may access L0 through the Level Zero Storage System (LZSS) at WCDAS remotely
  - CWG may access L1b data from the NSOF/WCDAS Development Environments (DEs) from the NSOF (secured area)
  - AWG may access L2 data from the DE at the NSOF (not as secure area)
  - STAR will also access the L1b and L2 from PDA
    - DE will be for anomaly resolution and diagnostic data not distributed over PDA

GOES-R Distribution to Users

Configurations by Site

SOZ

SOZ DMZ

SSD (NOAA 5050)

NSD (NOAA 5045)

PPZ

Edge

NSOF

WCDAS

Sectorized CMI

L1b & L2+

Sectorized CMI

L0

PG*	Only GRB (L1b) & Sectorized CMI generation	[GRB inclues L1b +GLM]
PD*	Only GRB delivery to satellite, Sectorized CMI delivery to AWIPS, L0 to LZSS (WCDAS only)	
PG**	L1b reconstruction, L2+ generation	
PD**	L1b, L2+ delivery to PDA	

How to get to Data

NSOF

WCDAS

SOZ

SOZ DMZ

SSD (NOAA 5050)

NSD (NOAA 5045)

PPZ

Edge

SSD/SOZ: L1 Area, High Security, access via workstation at NSOF (or WCDAS)

NSD/PPZ: L2 Area, Lower Security, access remotely for pull, working for push access

Sectorized CMI

L1b & L2+

Sectorized CMI

PG*	Only GRB (L1b) & Sectorized CMI generation [GRB inclues L1b +GLM]
PD*	Only GRB delivery to satellite, Sectorized CMI delivery to AWIPS, L0 to LZSS (WCDAS only)
PG**	L1b reconstruction, L2+ generation
PD**	L1b, L2+ delivery to PDA

SSD = SCADA Secuirty Zone

SOZ – Satellite Operations Zone

NSD = Non SCADA security Domain

PPZ = Product Processing Zone

Readiness Activities

- Pre-Launch "rehearsals" will prepare the CWG and AWG for the post-launch activities

- DOEs are mission rehearsals executed by the Data Operations team

  - DOEs provide incremental readiness to prepare systems, operators, processes, and teams to support mission operations

  - Conducted in a "rehearse like we fly" manner

  - Both nominal and anomalous conditions are exercised
    - Problems encountered are recorded and opened for investigation
    - Unscripted events are injected including failover scenarios
    - Some long duration DOEs are planned to satisfy consumers' needs

  - Goal is to ultimately exercise the entire ground system by processing various data sets from end-to-end, from L0 through L2+, including PDA in DOE-3 and DOE-4 (STAR and CIMSS may not have PDA Access for DOE-3,4)

  - DOE-4 will include participation by the NWS TOWR-S (Total Operational Weather Readiness - Satellites) project which is incorporating distribution to elements of the AWIPS community
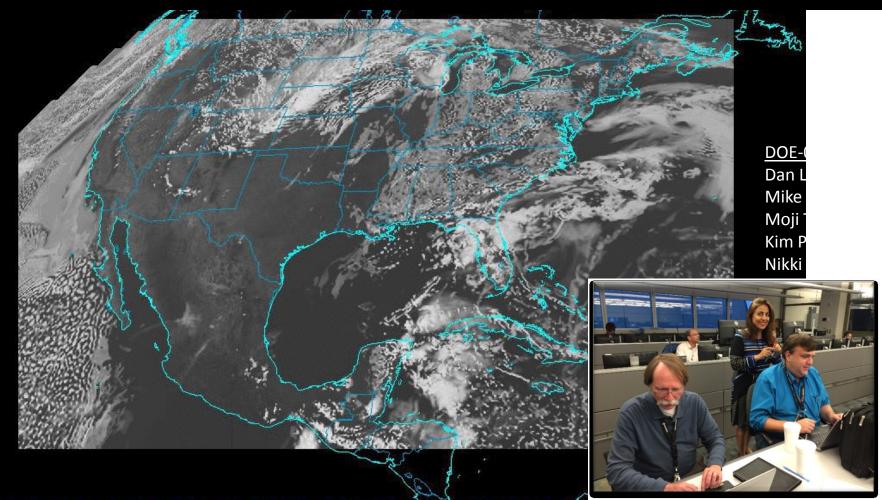

CBU: Consolidated Back-Up in Fairmont, WV

Readiness Activities

- AWG and CWG participating in Ground Segment's Data Operations Exercises (DOEs)
  - DOE-0: NOV 2014: Analysis of DOE 0 data is almost complete
  - DOE-1-2: 15-30 JUN 2015
    - Algorithm change
    - Manually transfer data off of OE to DE (NSOF PPZ DE)
  - DOE-3: AUG 2015
    - Analyze Space Wx Prototypes and Final Product Set updates (WCDAS DE)
  - DOE-4: OCT 2015
    - Cal INR update (Fast track LUT process)

Simulated Cloud & Moisture Imagery (CMI) from the First GOES-R Data Operations Exercise (DOE-0)

DOE-0
Dan L
Mike
Moji T
Kim P
Nikki

Simulated ABI Band_01(0.47um) 05-11-2014 05:56:51UTC

Additional PRO Activities

- Product Definition & Users Guide (PUG), metadata, and support POCs
- Calibration and Validation Planning and Rehearsals via Data Operations Exercises
- Science Products and Tools Verification & Validation
- Finalizing Anomaly Tracking, Configuration Management, Integration, Test, and Check-Out Processes
- Formalizing Mission Notice Language and SOPs
- Reviewing Transition & Handover Steps and Timelines
- Setting 'First Light' Imagery & Data Release Strategies
- Working on SOPs for GOES-R mode changes and mesoscale domain defaults and changes
  - Assisting NWS in updating their existing GOES-13/14/15 RSO request SOPs to also handle GOES-R
  - Writing SOPs for OSPO/SAB to request GOES-R mode and domain changes
  - Writing SOPs for ESPC Help Desk to receive and transmit requests to GOES-R Satellite Operations
- Initiating Processes for Baseline Product Enhancements and New Products

NSC: GOES-R Product Portfolio Status

Baseline Products

Advanced Baseline Imager (ABI)

1. Aerosol Detection (Including Smoke and Dust)
2. Aerosol Optical Depth (AOD)
3. Clear Sky Masks
4. Cloud and Moisture Imagery (KPP)
5. Cloud Optical Depth
6. Cloud Particle Size Distribution
7. Cloud Top Height
8. Cloud Top Phase
9. Cloud Top Pressure
10. Cloud Top Temperature
11. Derived Motion Winds
12. Derived Stability Indices
13. Downward Shortwave Radiation: Surface
14. Fire/Hot Spot Characterization
15. Hurricane Intensity Estimation
16. Land Surface Temperature (Skin)
17. Legacy Vertical Moisture Profile
18. Legacy Vertical Temperature Profile
19. Radiances
20. Rainfall Rate/QPE
21. Reflected Shortwave Radiation: TOA
22. Sea Surface Temperature (Skin)
23. Snow Cover
24. Total Precipitable Water
25. Volcanic Ash: Detection and Height

Geostationary Lightning Mapper (GLM)

1. Lightning Detection: Events, Groups & Flashes

Space Environment In-Situ Suite (SEISS)

2. Energetic Heavy Ions
3. Magnetospheric Electrons & Protons: Low Energy
4. Magnetospheric Electrons: Med & High Energy
5. Magnetospheric Protons: Med & High Energy
6. Solar and Galactic Protons

Magnetometer (MAG)

7. Geomagnetic Field

Extreme Ultraviolet and X-ray Irradiance Suite (EXIS)

8. Solar Flux: EUV
9. Solar Flux: X-ray Irradiance

Solar Ultraviolet Imager (SUVI)

10. Solar Imagery (X-ray): coronal holes, solar flares, coronal mass ejection source regions

Future Capabilities

Advanced Baseline Imager (ABI)

Absorbed Shortwave Radiation: Surface
Aerosol Particle Size
Aircraft Icing Threat
Cloud Ice Water Path
Cloud Layers/Heights
Cloud Liquid Water
Cloud Type
Convective Initiation
Currents
Currents: Offshore
Downward Longwave Radiation: Surface
Enhanced "V"/Overshooting Top Detection
Flood/Standing Water
Ice Cover
Low Cloud and Fog
Ozone Total
Probability of Rainfall
Rainfall Potential
Sea and Lake Ice: Age
Sea and Lake Ice: Concentration
Sea and Lake Ice: Motion
Snow Depth (Over Plains)
SO_2 Detection
Surface Albedo
Surface Emissivity
Tropopause Folding Turbulence Prediction
Upward Longwave Radiation: Surface
Upward Longwave Radiation: TOA
Vegetation Fraction: Green
Vegetation Index
Visibility

Legend:
- GOES-R Key Performance Parameters
- Added to Baseline, required for Snow Cover
- Prospective Post-Handover Implementation
- Prospective Prototype Wrapped Algorithms