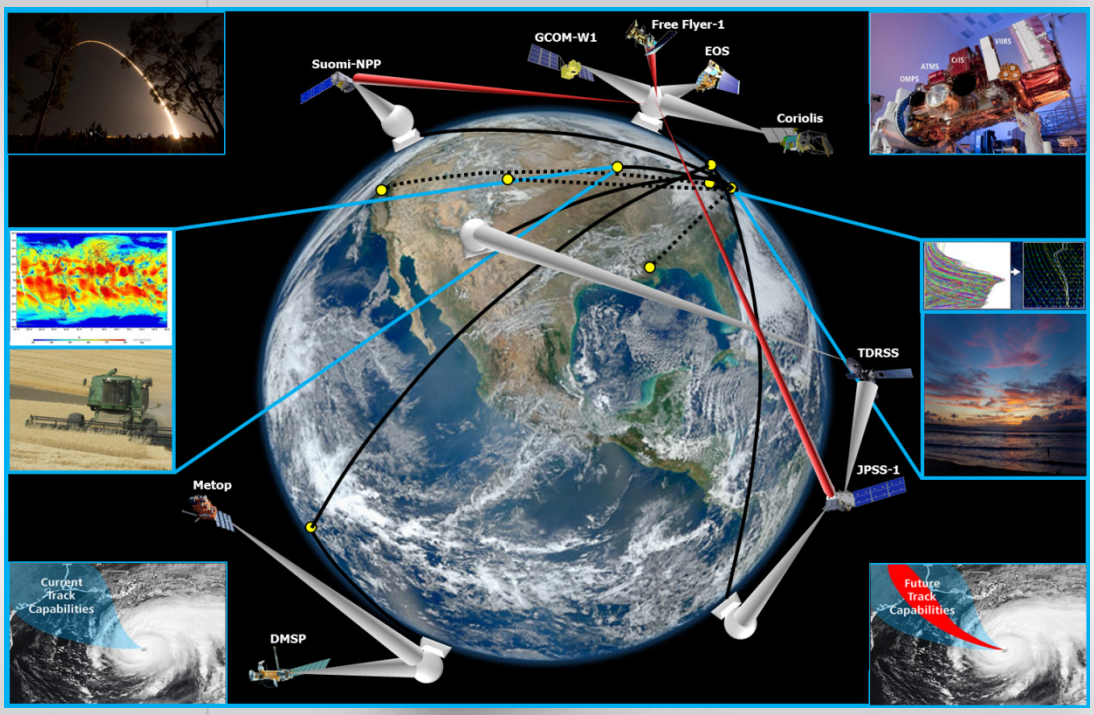

Modeling Additional Missions in the Joint Polar Satellite System (JPSS) Common Ground System (CGS)

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Support to Multiple Missions in the JPSS CGS

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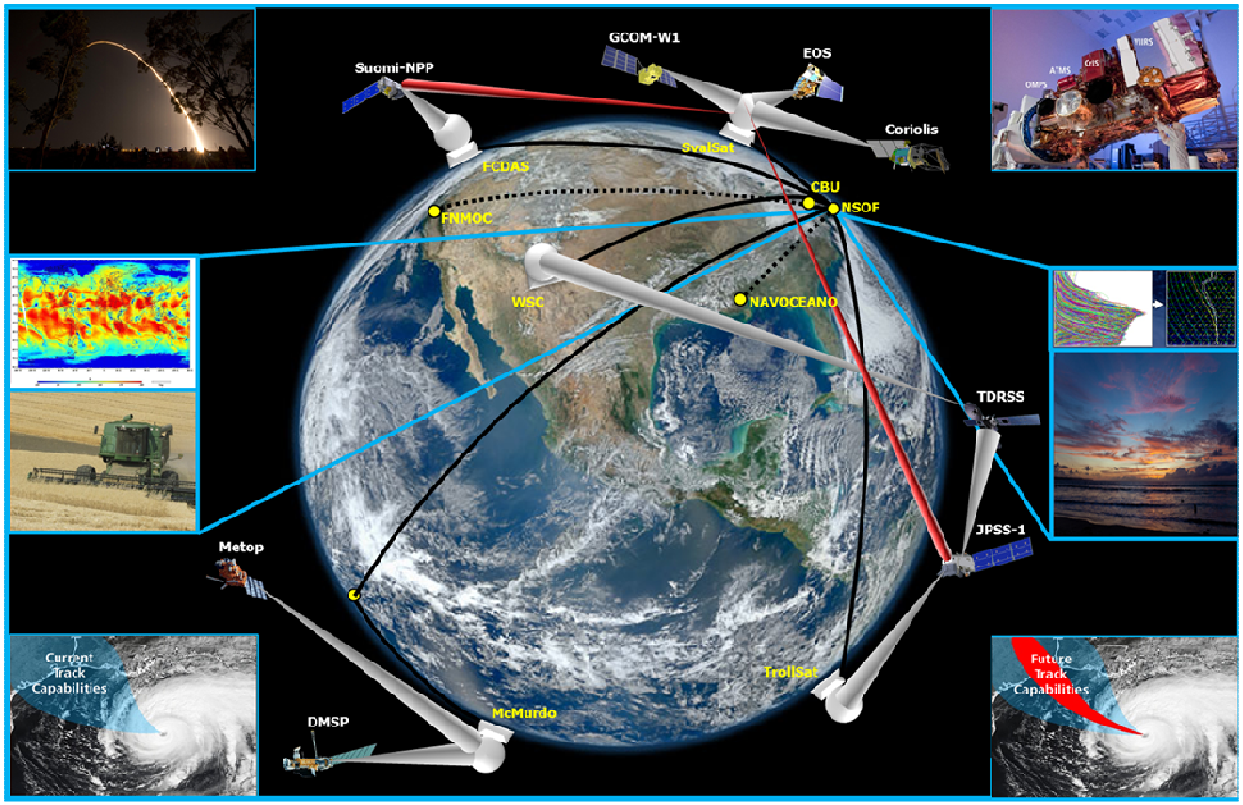
- The Joint Polar Satellite System (JPSS) will contribute the afternoon orbit component and ground processing system replacing NOAA's current Polar-orbiting Operational Environmental Satellites (POES)
  - The JPSS Common Ground System (CGS) provides command, control, data acquisition, routing and processing, and product delivery for the Suomi National Polar-orbiting Partnership (S-NPP) and future JPSS satellites
  - The CGS also provides support to a number of additional missions beyond S-NPP and JPSS



Support to Multiple Missions in the JPSS CGS

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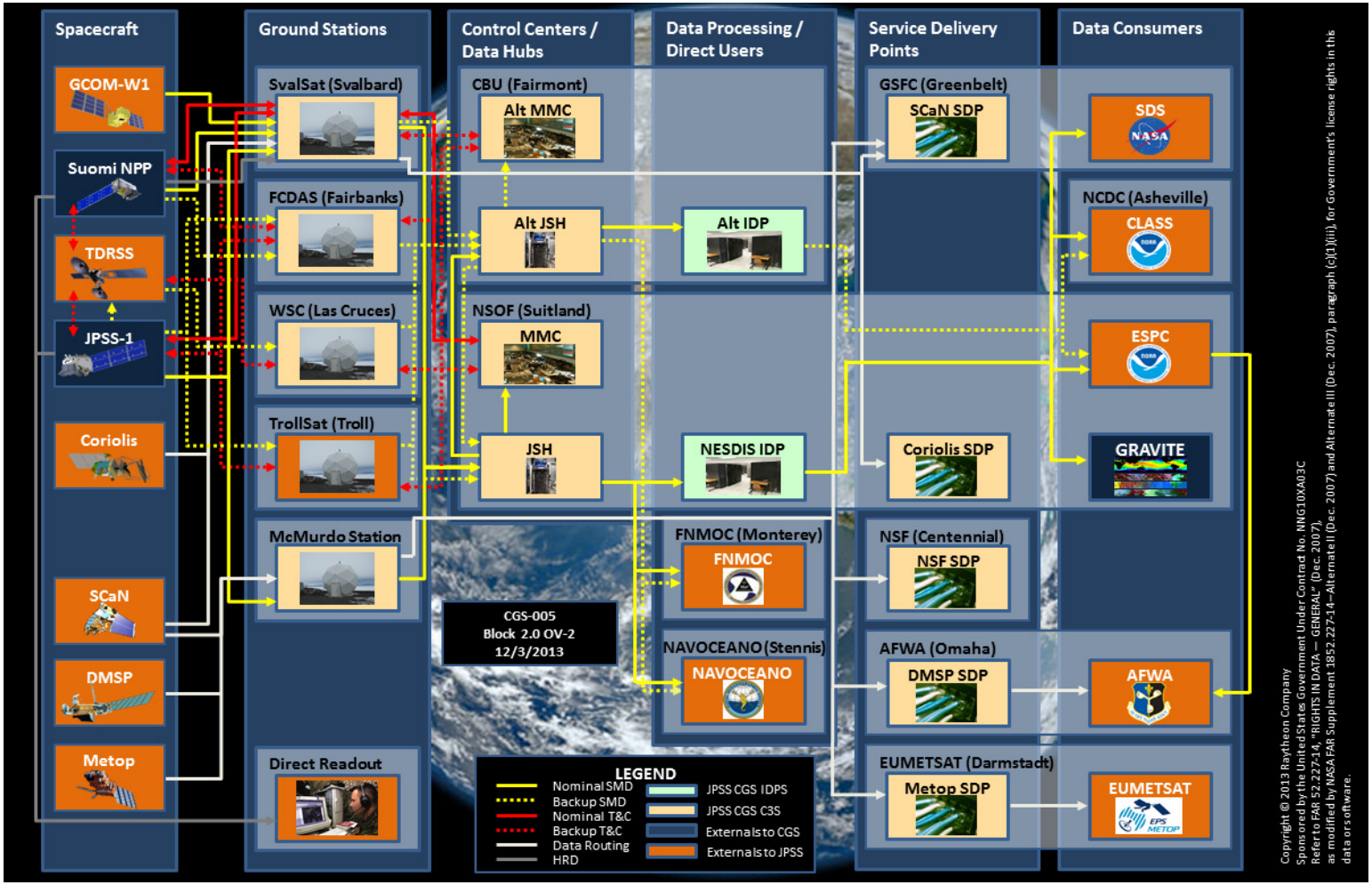

CGS Block 2.0 (2016)

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- In part to continue accommodating such a wide variety of missions, the CGS is being upgraded to Block 2.0, which will be in operations by early 2016
- This upgrade leverages lessons learned from S-NPP operations to date, and provides added robustness to support the more operational stature that S-NPP has assumed since launch
- The upgrade also bolsters the scalability of the CGS for all the missions it supports

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Different Types of Support in the CGS

- CGS support services fall into 3 main categories:

1) Managed Mission Services: CGS flies the satellite, manages mission resources, acquires and/or routes the raw data, and generates and distributes data products

Example: S-NPP for NOAA/NASA

2) Data Processing Mission Services: CGS acquires and/or routes the raw data, generates and distributes data products

Example: GCOM-W1 for JAXA

3) Data Acquisition and Routing Mission Services: CGS acquires and/or routes the raw data

Example: Metop for EUMETSAT

CGS Scalability

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- Scalability is a key tenet of the CGS. The table below summarizes the CGS scalability requirements and associated architectural enablers
- The graphic on the following chart shows a level-deeper picture of the architecture, annotated with a mapping to the Joint Architecture Reference Model (JARM) and locations of CGS extension points for scalability

Mission Services	Baseline Support	Scalability Requirement	Architectural Enablers
Managed Missions	• S-NPP • JPSS-1 • JPSS-2	• 2 Solar Irradiance Missions • DoD Weather Mission • JPSS-equivalent Mission	• Scalable hardware • Virtualization • Mission-specific slots • Global scalable WAN
Data Processing	• GCOM-W1	• GCOM-W2 • GCOM-W3 • GCOM-C1 • GCOM-C-equivalent	• Scalable hardware • Virtualization • Global scalable WAN
Data Acquisition & Routing	• NSF • DMSP • Metop • ScAN • Coriolis	• Metop-equivalent • POES-equivalent	• Scalable hardware • Global scalable WAN

CGS Architecture and Extension Points

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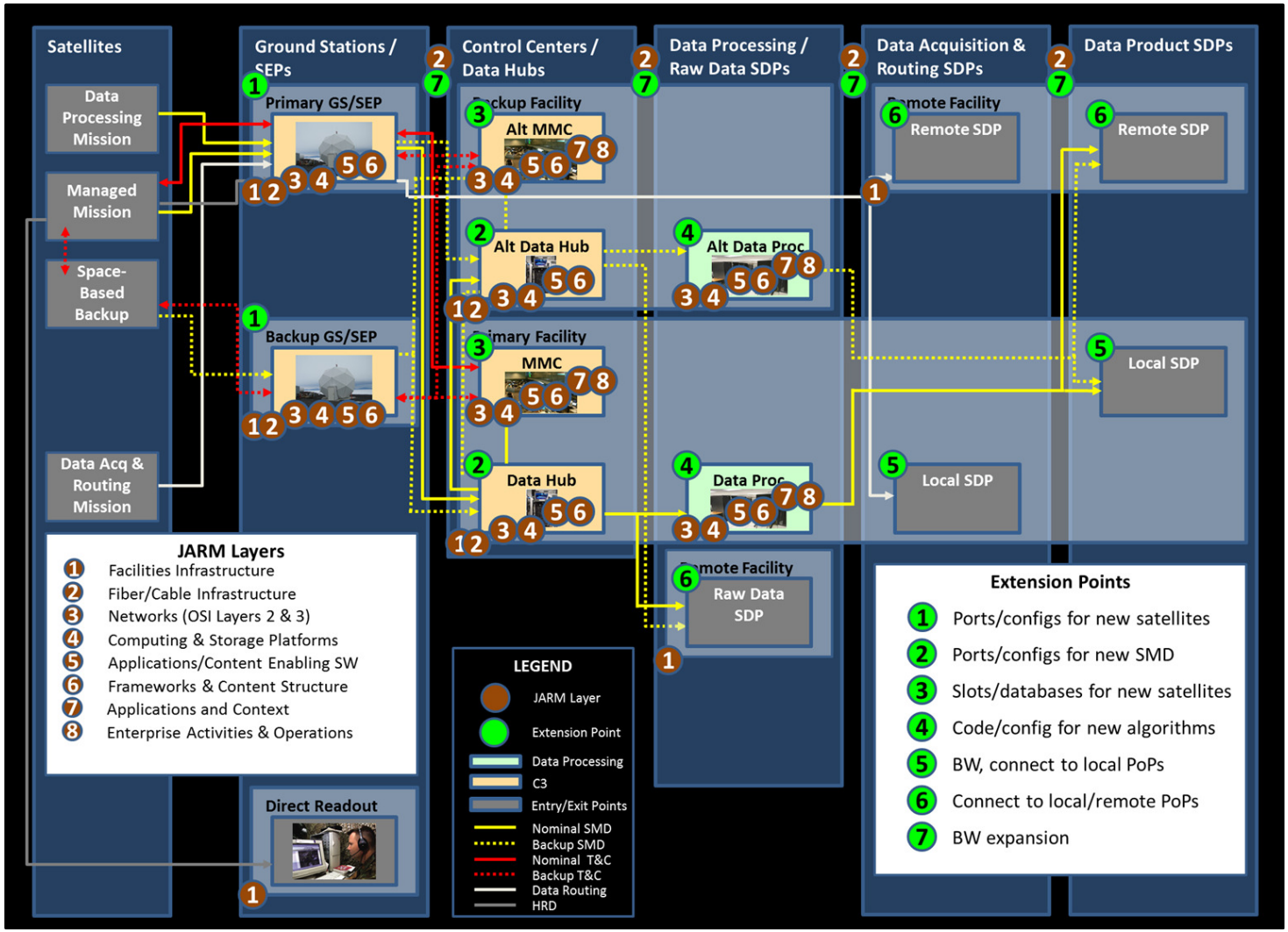

Adding a Mission to the CGS: Examples from Block 1.x

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- Referencing the previous chart:
  - The addition of Data Acquisition and Routing support for DMSP required the use of extension points 1 (configuration of CGS receptors at McMurdo) and 6 (connection to the service delivery point for the 557th Weather Wing)
  - The addition of Data Acquisition and Routing support for Metop required the use of extension point 6 (connection to the service delivery point for EUMETSAT)
  - The addition of Data Processing support for GCOM-W1 required the use of extension points 1 (shared antenna usage at SvalSat), 2 (routing to the NSOF for data processing), 4 (code to package the raw data into HDF) and 5 (delivery of the raw data to a local delivery point at the NSOF). For GCOM-W1, operational capability was achieved in a matter of months from the time the agreement and associated engineering effort were approved

Modeling Additional Missions in the JPSS CGS: Tools

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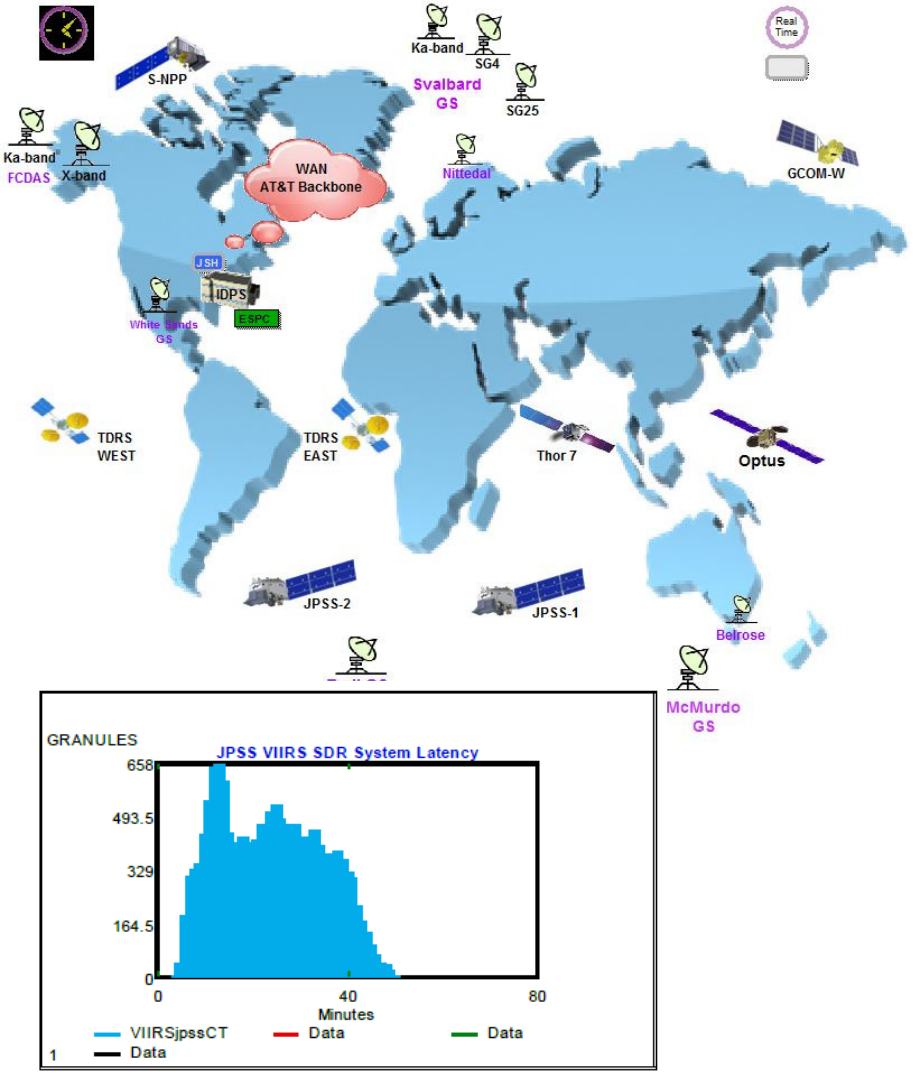
- To support systems engineering and hardware sizing activities, Raytheon developed a system simulation tool: the CGS Architecture and Mission Performance Unified Simulation (CAMPUS)
- CAMPUS is a discrete-event, queue-based model of the JPSS CGS, built in ExtendSim
- CAMPUS models the latency, throughput, and data volume from sensor collection to data delivery, and was validated against the Block 1.2 CGS currently in operations



Modeling Additional Missions in the JPSS CGS: Approach

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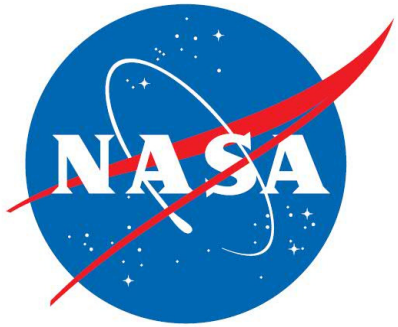
- New missions can be easily added to CAMPUS
- They can be fully integrated to use the same pathways (Ground Stations/WAN/JSH/IDPS) or they can be routed such that they only use some of these resources
- Assumptions are made when modeling a new mission, including:
  - Timing/Latency of desired Algorithms
  - Orbital Parameters of Spacecraft
  - Ground Stations used to downlink data
  - Data Volumes of sensors and products
- As the CGS continues in operations through Block 2.0 and beyond, we can use these capabilities to better assess and predict performance when adding new missions



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