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Joint Polar Satellite System Common Ground System (JPSS CGS) Performance for the Suomi National Polar-orbiting Partnership (S-NPP) Mission

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Ground System Performance Defined

- JPSS CGS is a comprehensive, multi-mission ground system that supports 7 satellite remote sensing missions, including JPSS
- Comprehensive ground systems perform the following :
  - Command and control of space and ground assets
  - Satellite data acquisition and routing
  - Processing data into higher-order products
  - Delivering products to users

- Fundamental operating requirements:
  - Ensure safety of the spacecraft, instruments, and ground assets
  - Maximize the amount of data and products delivered to end users
  - Minimize the time from detection of phenomena to delivery of products
  - Meet data product quality requirements
- Ground System performance can be distilled to two measures:
  - Availability: the number of data items delivered against the maximum possible
  - Latency: the time from photon detection to delivery of final products

JPSS CGS Deployment/CONOPS for S-NPP

JPSS CGS Performance Test

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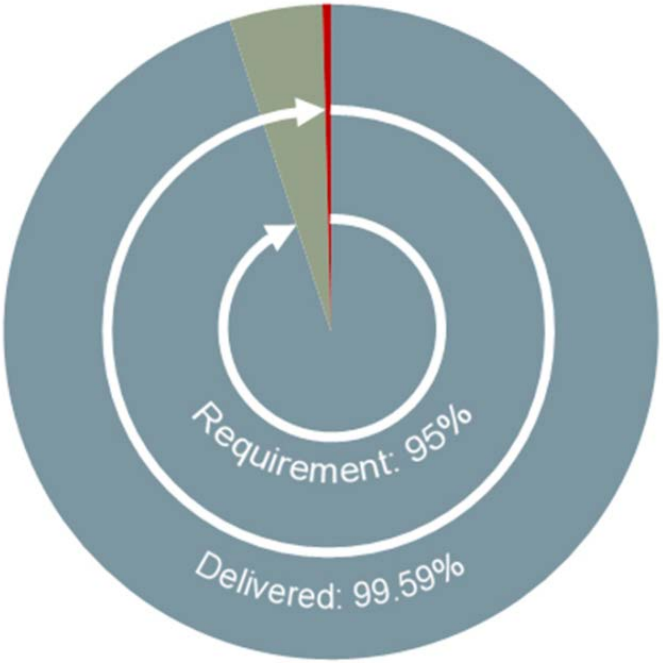
CGS EDR* Availability to Archive
11/5/12 – 12/19/12



- Requirement
- Delivered above Requirement
- Undelivered

CGS EDR* Latency to AFWA
11/5/12 – 12/19/12

- Requirement
- Delivered above Requirement
- Did not meet Latency

*EDR: Environmental Data Record

Definition & Methodology - Availability

- Availability - the ratio of actual items delivered to the theoretical maximum number of data items that could be delivered over a particular period
- Data items, or granules, are counted at key points within the system. As value-added processing occurs, a particular raw granule will generate additional product granules in a deterministic manner
- The number of expected granules is adjusted to remove counts of missing data if those granules are missing due to factors external to the CGS
  - This adjudication is automated in some well characterized cases, but requires a review board decision in others
- The actual number of granules delivered to customer nodes is measured (designated as "Data Made Available [DMA]")
- For the Archive node:

Product	Adj. Expected Gran	DMA	Results	Requirement
EDR Availability	1,964,168	1,956,075	99.59%	95.0%

Definition & Methodology - Latency

- Latency - the time from the detection of a photon by an instrument to the time a product is made available to the data consumer's interface
- The number of expected granules is the DMA number from the availability calculation, adjusted to remove counts of late data if those granules are missing due to factors external to the CGS (called "DMA – Exceptions")
- Actual number of granules delivered within the latency requirement (designated as "Data Made Latency [DML)]")
- For the AFWA node:

Product	DMA - Exceptions	DML	Results
EDR Latency (AFWA)	2,265,485	2,261,819	99.84%

CGS Performance and Evaluation Reporting Tool (C-PERT)

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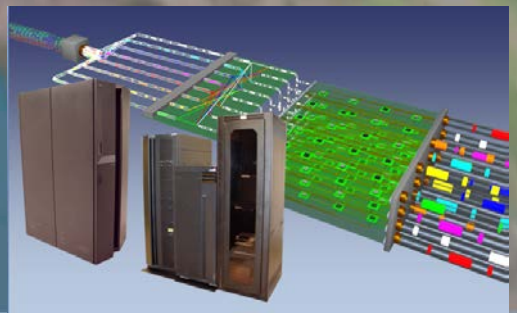
- Minimally invasive to the operational system while collecting pertinent data about operations
- Mines existing logs and receives appropriate metrics for relevant data in real time. Data are placed in tool database and file storage areas, as appropriate
- Generates and reports metrics based on automatic analysis. Measures successful and timely deliveries. Classifies availability and latency issues with respect to receipt and production of data and delivery of products
  - Examples of exclusion conditions: sensor did not record data; sensor mode did not produce science data, missing input data (previously excluded); product not requested, etc.
  - Examples of availability failures: data acquired, but lost internally; missing input data due to internal error; product generated but not delivered; etc.
- Considers cross-granule and cross-sensor complexities as well as ancillary and auxiliary data impacts
- Handles ambiguous cases through Indeterminate Anomaly metric, allowing for manual adjudication (counts as failure unless overridden)

Conclusion

- The performance test executed from 5 November 2012 through 19 December 2012 was the first opportunity to formally quantify operational JPSS CGS capabilities
  - Suomi NPP is the first of several JPSS satellites, and the first CGS end-to-end mission
  - As a multi-mission system, an important basis for CGS analysis is provided by the detailed S-NPP performance measurements
- Exceeding the S-NPP performance requirements by significant margins validates the basic design and implementation of CGS
- Detailed analysis of failure categories provides a roadmap to improvements planned for CGS Block 2.0 (for support of JPSS-1 launch in 2017)



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