Algorithm Change Management Process

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Our current problems are prior solutions

- IDPS heritage processing code architecture was driven by
  - Latency
  - Sole source holistic approach
- We continue to peel the NPOESS onion
- Acknowledged: Performing development in operations is dumb
  - No time to re-architect before S-NPP launch
  - Making the best of a bad situation

Interface Data Processing System (IDPS) String Configuration

String	Land Gridding Configuration	Snow/Ice Gridding Configuration	Snow/Ice Seed Data Version	VIIRS RSB AutoCal Mode	Data Stream	IDPS Build #
Raytheon Factory I&T	Active	Active	April 2014	Automatic	Live - operational	Mx8.4
NESDIS IDPS I&T	Active	Inactive	April 2014	Static*	Live - operational	Mx8.4
NESDIS IDPS Ops	Active	Inactive	April 2014	Static*	Live - operational	Mx8.3

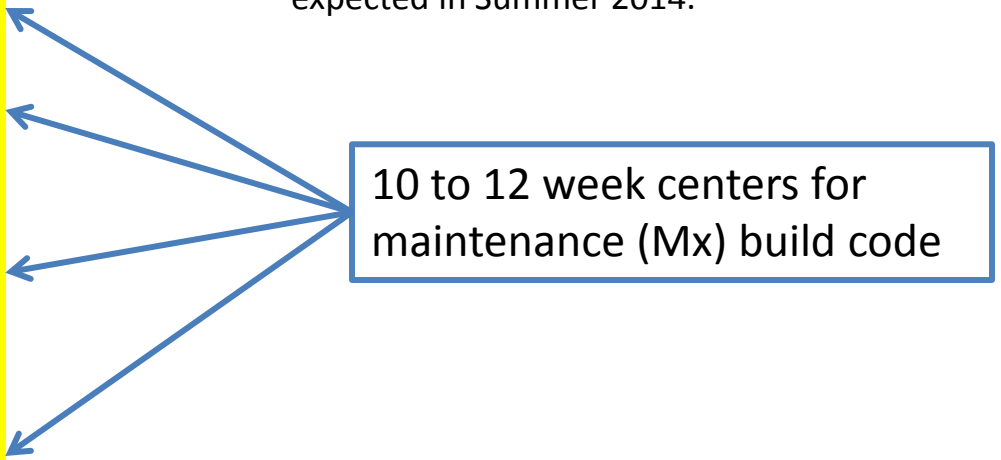
*Transition to RSB AutoCal Automatic Mode expected in Summer 2014.

Mx8.3: Operational as of 03/18/2014.

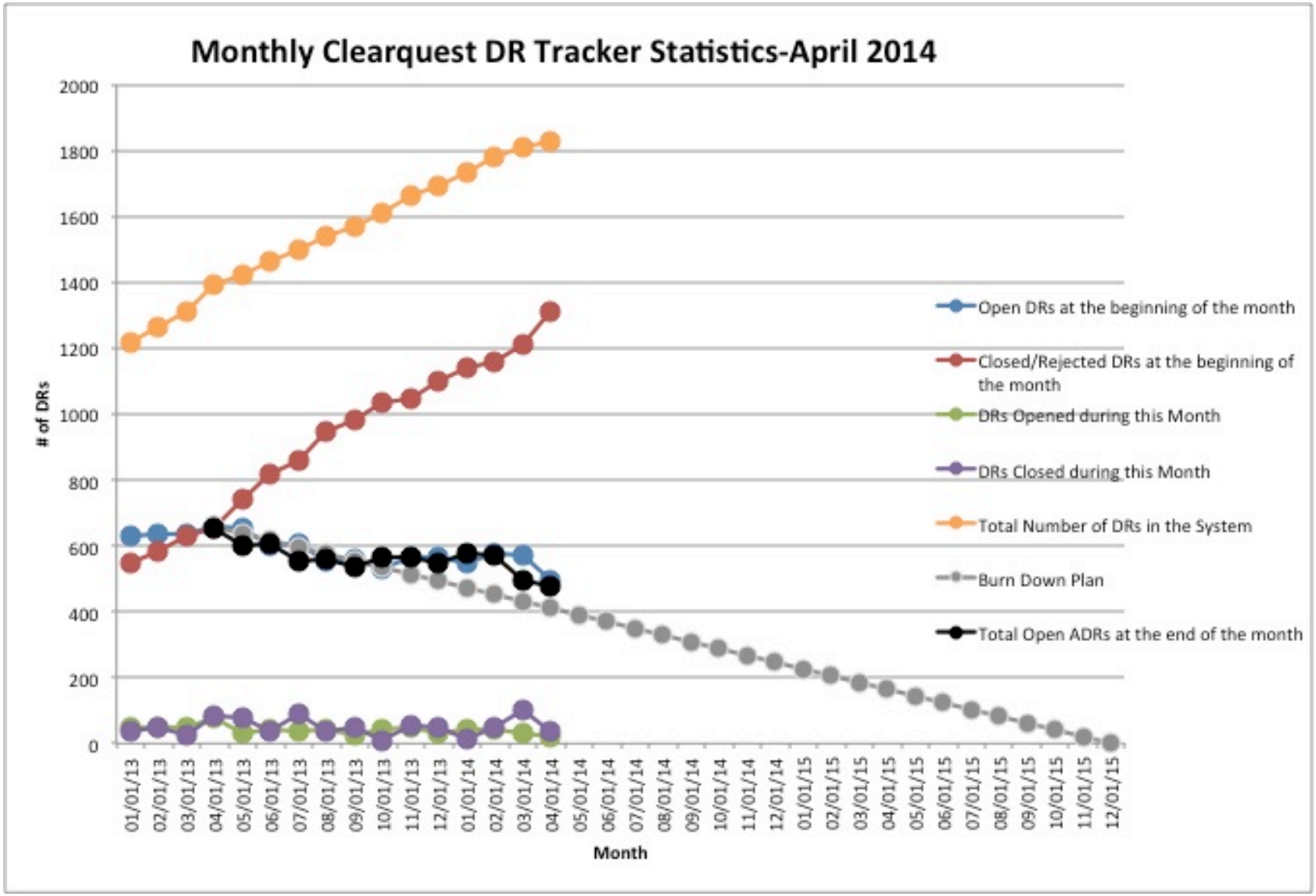
Mx8.4: TTO scheduled for 06/02/2014. Release will include incorporation of VIIRS Terrain-Corrected DNB Geolocation.

Mx8.5: TTO scheduled for 08/15/2014. Content in work. Targeting incorporation of daily GMASI ancillary for VCM and downstream EDR/IP quality improvements.

Mx8.6: TTO scheduled for 10/31/2014. Targeting incorporation of necessary ground system changes to support CrIS instrument transition to full spectrum mode.



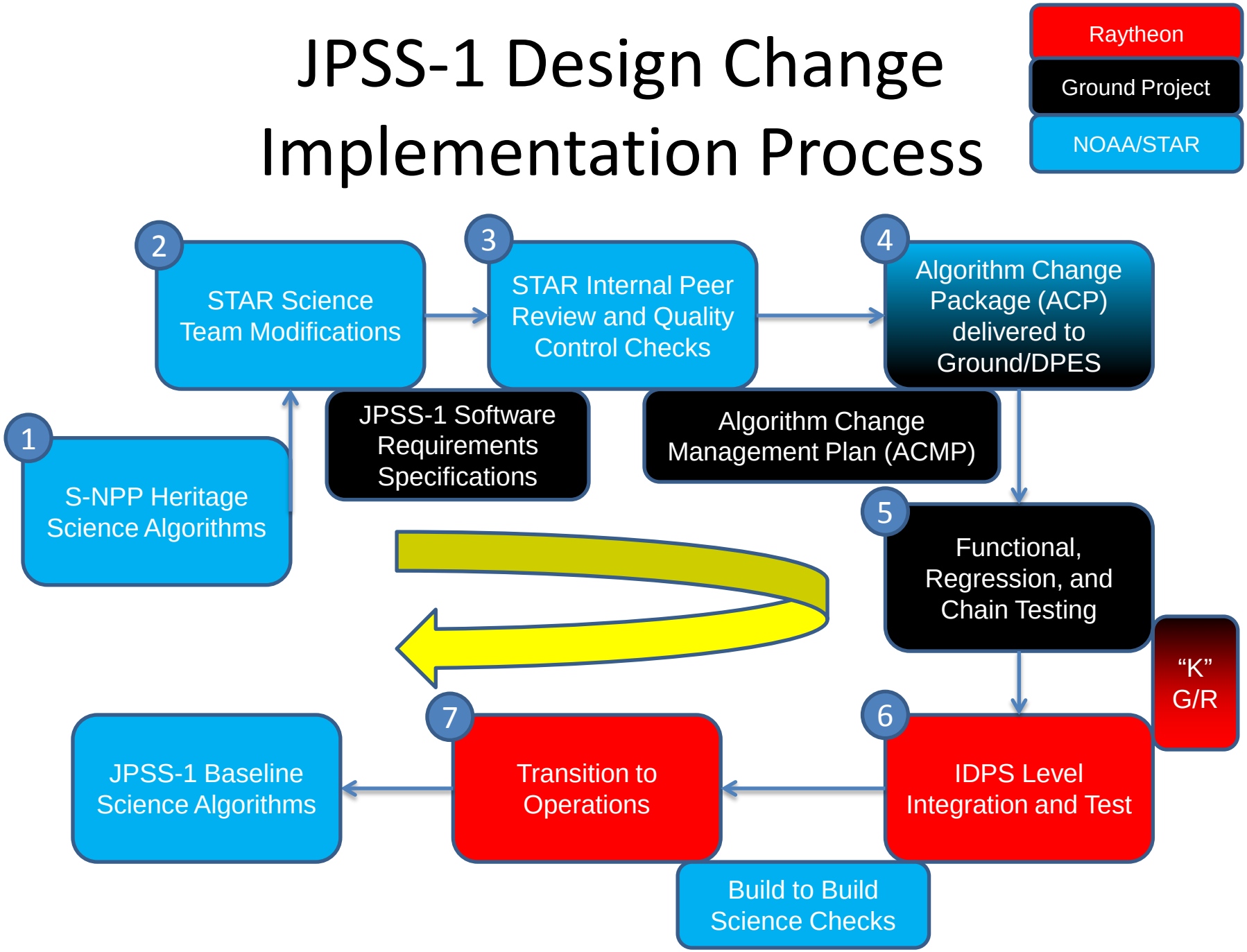
S-NPP CAL-VAL Discrepancy Report Burn-Down



Configuration Management and Contracts

- Configuration Management of the Operational System and Contract protocols are process drivers
  - Raytheon must track the state of the system they are going to deliver to the government at JPSS-1 Launch plus one year
  - Science code in IDPS Processing is GFE residing in a contractor owned system
    - Changes to that GFE by STAR represents a delivery from the Government to the Contractor

JPSS-1 Design Change Implementation Process



JPSS NESDIS Unique Products (NUPs)

Tom Schott
OSD Satellite Product Manager

May 15, 2014

Outline

- Overview of JPSS NESDIS Unique Products (NUPs)
- Approval Process for NUP Development
- Lifecycle of a NUP
- S-NPP and JPSS-1 NUP Schedule and Plans
- Summary

NESDIS Unique Products Overview

- NESDIS Unique Products (NUPs) are observable parameters derived from Suomi NPP Sensor and Temperature Data Records in accordance with the science product requirements in the JPSS Level 1 Requirements Document (L1RD) and its Supplement
- Algorithm development follows the Satellite Product and Services Review Board Process
- Algorithms and corresponding Delivered Algorithm Packages (DAPs) are developed by STAR with OSPO Product Area Leads (PALs) participation
- Software runs within NPP Data Exploitation (NDE), a subsystem of the Environmental Satellite Processing Center (ESPC)
- Consumer requirements are defined in coordination with OSPO PALs, STAR, NDE and end users
  - Format, geographic coverage, map projection, time aggregation, grid spacing, compression approach, and preferred method of distribution
- Products are made available by subscription to real-time operational end users
- NUPs are/will be provided to NOAA Comprehensive Large Array-data Stewardship System (CLASS) for long-term archiving

NESDIS Unique Products
Prioritized Listing

Critical

VIIRS
Green Vegetation Fraction
Polar Winds
Sea Surface Temperature (ACSPO)

ATMS
Land Surface Emissivity (MIRS)

Supplemental High

CrIS
Outgoing Longwave Radiation (NUCAPS)
Infrared Ozone Profile (NUCAPS)

CrIS/ATMS
Atm Moisture Profile (NUCAPS)
Atm Temperature Profile (NUCAPS)

ATMS
Cloud Liquid Water (MIRS)
Rainfall Rate (MIRS)
Sea Ice Concentration (MIRS)
Snow Cover (MIRS)
Snow Water Equivalent (MIRS)
Total Precipitable Water (MIRS)

Supplemental Low

ATMS
Land Surface Temperature (MIRS)
Moisture Profile (MIRS)
Temperature Profile (MIRS)

CrIS
Trace Gases (CO, CO2, CH4) (NUCAPS)

VIIRS
Vegetation Health Product Suite

Critical: Products with critical impact to NOAA Line Office operations and/or outcomes
Supplemental High: Products with high impact to NOAA Line Office operations and/or outcomes
Supplemental Low: Products with lower impact to NOAA Line Office operations and/or outcomes

ACSPO: Advanced Clear Sky Processor for Oceans; **MIRS**: Microwave Integrated Retrieval System; **NUCAPS**: NOAA Unique CrIS/ATMS Processing System

NESDIS Unique Products
Blended Products

- The JPSS L1RD Supplement includes a requirement to, “support modifications to ESPC blended products” (L1RDS-2260)

Critical

- Blended Sea Surface Temperature (with VIIRS)
- Blended Sea Surface Temperature (with AMSR2)

Supplemental High

- Blended Snow Cover (with VIIRS)
- Blended Snow Cover (with AMSR2)
- Blended Rainfall Rate (with ATMS)
- Blended Rainfall Rate (with AMSR2)
- Blended Total Precipitable Water (with ATMS)
- Blended Total Precipitable Water (with AMSR2)
- Blended Ozone (with OMPS NP)
- Blended Ozone (with OMPS CrIS)
- Blended Soil Moisture (with AMSR2)

Supplemental Low

- Blended Land Surface Temperature (with VIIRS)

Blended Product: A data product that is dependent on direct measurements from sensors on more than one satellite

Approval Process for a NUP Project

1. Identify JPSS Level-1 and/or Level-2 Requirements
2. STAR and OSPO develop Project Plans that describe NUP requirements, capabilities, system architecture, plan of operations, project milestones, and funding needs
3. The SPSRB reviews and approves the Project Plans
4. STAR and OSPO brief new or updated Project Plans at FY Annual Review for Satellite Product Development (ARSPD)
5. An Executive Board (EB) and NOAA Low-earth Orbiting Requirements Working Group (LORWG) representatives prioritize the Project Plans and suggest recommendations and/or adjustments
6. The EB provides funding allocation recommendations to OSD
7. OSD updates the JPSS Product System Development and Implementation (PSDI) Technical Task Agreement (TTA) for JPSS funding consideration
8. STAR and OSPO submit purchase requests for approved projects and begin NUP development adhering to the Review Standards for SPSRB Satellite Product Development (http://projects.osd.noaa.gov/SPSRB/doc/SPSRB_Review_Stds.pdf)

Lifecycle of a NUP

1. Define Requirements (JPSS Level 1)

2. Develop Algorithm
   - Preliminary Design Review
   - Critical Design Review
   - Unit Test Readiness Review
   - System (Algorithm) Readiness Review

   Develop/Test in NDE Sandbox
   - NDE environment
   - NDE operating system
   - NDE compilers
   - Science libraries

3. Prepare and Deliver Delivered Algorithm Package (DAP)
   - Algorithm Delivery Standards, Integration, and Test V1.4 (DAP document)
   - Configuration Management of DAP

4. Office of Satellite and Product Operations (OSPO) performs software review

5. Integrate DAP into NDE
   - Configuration management
   - Production rules
   - Unit testing

   Develop Algorithm Enhancements and Updates
   - Redeliver DAP

6. Test Algorithm within Test Environment
   - System Test
   - Performance Test

7. Satellite Products and Services Review Board approves product for operations

8. Generate Operational Product within Production Environment
   - Operations
   - 24/7 Monitoring

Calibration/ Validation

KEY
STAR
NDE

S-NPP and JPSS-1 NUPs Schedule and Plans

- **S-NPP JPSS L1RD NUPs will be operational for S-NPP by summer 2015**

Observable Parameter	Ops
Atm Moisture Profile (NUCAPS)	Oct-13
Atm Temperature Profile (NUCAPS)	Oct-13
Land Surface Emissivity (MIRS)	Dec-13
Cloud Liquid Water (MIRS)	Dec-13
Rainfall Rate (MIRS)	Dec-13
Sea Ice Concentration (MIRS)	Dec-13
Snow Cover (MIRS)	Dec-13

Observable Parameter	Ops
Snow Water Equivalent (MIRS)	Dec-13
Total Precipitable Water (MIRS)	Dec-13
Land Surface Temperature (MIRS)	Dec-13
Moisture Profile (MIRS)	Dec-13
Temperature Profile (MIRS)	Dec-13
Sea Surface Temperature (ACSPO)	Mar-14
VIIRS Polar Winds	May-14

Observable Parameter	Ops
Green Vegetation Fraction	Jun-14
CrIS Outgoing Longwave Radiation (NUCAPS)	Nov-14
Trace Gasses (NUCAPS)	Nov-14
Infrared Ozone Profile (NUCAPS)	Nov-14
Vegetation Health Suite	Jan-15

- **JPSS-1 NUP development will occur from FY16 through FY18**
  - Project Plans for FY16 JPSS-1 NUPs will be reviewed and approved by summer 2015
  - Algorithms to support the generation of Key Performance Parameters will be available before launch
  - Algorithms will be updated to handle two satellites
  - Algorithms will be updated after launch to capture JPSS-1 sensor performance characteristics

Summary

- NUPs are environmental observable parameters designed to meet the requirements in the JPSS Level-1 Requirements Document and its Supplement
- STAR, OSPO, and NDE participate in algorithm development, testing, activation, and identification of consumer requirements
- NUP algorithm development follows the SPSRB software development process
- S-NPP JPSS L1RD NUPs will be operational for S-NPP by Summer 2015
- JPSS-1 NUP Project development planning underway

Questions?

Comparing the Change Process of JPSS & SPSRB

Presented by
Walter Wolf
NOAA/NESDIS/STAR

Thanks to Luanne Spiller, Tom Schott, and Gary Mineart

Overview

- To compare the change processes between JPSS and Satellite Product and Services Review Board (SPSRB) for NDE projects, you have to take a step back and look at the Lifecycle Process for both

General Lifecycle Phases

- Basic Research
- Exploration Phase
- Planning Phase
- Design Phase
- Build Phase
- Test and Implementation Phase
- Operations and Maintenance Phase

Questions

- Are the two process lifecycles the same?
  - » Pretty much
- Are there differences between the two?
  - » Sure
- How so, you ask?
  - » Requirements
  - » Projects are in different phases
  - » Process Lifecycle Tailoring

Phases of Projects: S-NPP

- Over the past couple of years, the majority of the S-NPP algorithms have been in a maintenance/update phase

- Most of these algorithms are being improved, but the major design reviews have been completed

Phase of Projects: NDE

- NDE algorithms has been in multiple phases over the past couple of years

- During these phases, algorithms have been:
  - » Developed by STAR
  - » Delivered to NDE
  - » Integrated and tested within the NDE system
  - » Transitioned to operations

Process Comparison

- Lets compare the overall process lifecycle to show how similar the process for algorithm development are between the two projects

Process Comparison

- Both Projects have already been though the *Research and Exploration Phases*

- For each project, the *Planning Phase* is worked as new requirements are addressed
  - » New products
    - – CrIS OLR products
  - » New product capability
    - – CrIS SDR full resolution updates for J1
    - – NUCAPS full resolution capability updates

Process Comparison

- The *Design Phase* is currently ongoing for both NDE and JPSS algorithms

- During this phase, the reviews that may be seen are:
  - » Requirements Review
  - » Preliminary Design Review
  - » Critical Design Review

- Critical Design Reviews are being conducted for both NDE algorithms and the J1 algorithms with significant changes
  - » NDE: OMPS Limb Profiles CDR was conducted last February
  - » JPSS: Top of Canopy NDVI next week

Process Comparison

- The *Build Phase* is currently ongoing for both NDE and JPSS algorithms

- During this phase, the reviews that may be seen are:
  - » Code Unit Test Reviews
  - » Software Reviews
  - » Algorithm Readiness Review

- These Reviews are currently being conducted for NDE algorithms and will be conducted starting later this year the J1 algorithms with significant changes
  - » NDE: JPSS Risk Reduction Cloud Mask Code Unit Test Readiness Review was conducted two weeks ago

Process Comparison

- The *Test and Implementation Phase* is currently ongoing for both NDE and JPSS algorithms
- The scope of testing and implementation by Solers (NDE) and Raytheon (JPSS) is dependent upon the requirements within the associated contracts
- The purpose of the testing and implementation is the same for both projects: to ensure that the algorithm has been implemented correctly and is functioning according to the system requirements

Process Comparison

- The *Operational and Maintenance Phase* is currently ongoing for both NDE and JPSS algorithms
- Algorithms are running operationally
- The algorithm maintenance updates follow the associated Change Process
- The steps within each Change Process are slightly different, but the purpose is the same – to get algorithm updates and improvements into operations

General Algorithm Change Steps

JPSS Algorithm Change Steps

- Team develops algorithm offline
- Algorithm integrated and test in ADL
- ADL algorithm tested on GRAVITE
- Algorithm integrated into G-ADA and unit tested
- Raytheon tests algorithm on development machine, chain testing
- Raytheon tests algorithm on Test machine
- Algorithm runs in operations

NDE Algorithm Change Steps

- Team develops algorithm offline
- Algorithm integrated and test into associated program
- STAR tests algorithm on NDE development machine
- NDE tests algorithm on Test machine
- Algorithm runs in operations

Summary

- The algorithm lifecycle processes between JPSS and SPSRB (for NDE projects) are pretty much the same – STAR follows the same algorithm development process for both projects (which line up with the STAR Enterprise Process Lifecycle processes)

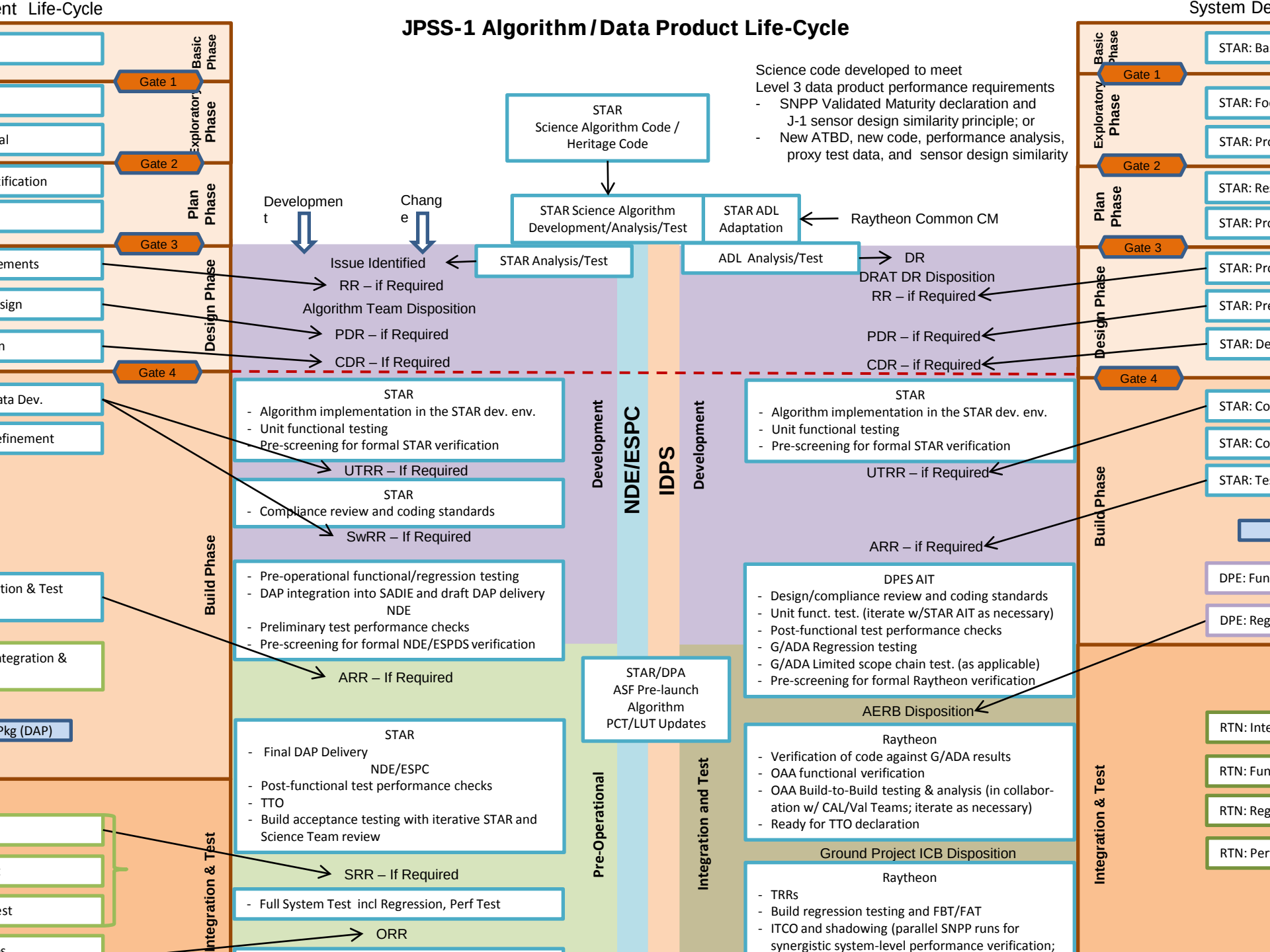
- Individual process steps may be tailored, dependent upon the requirements

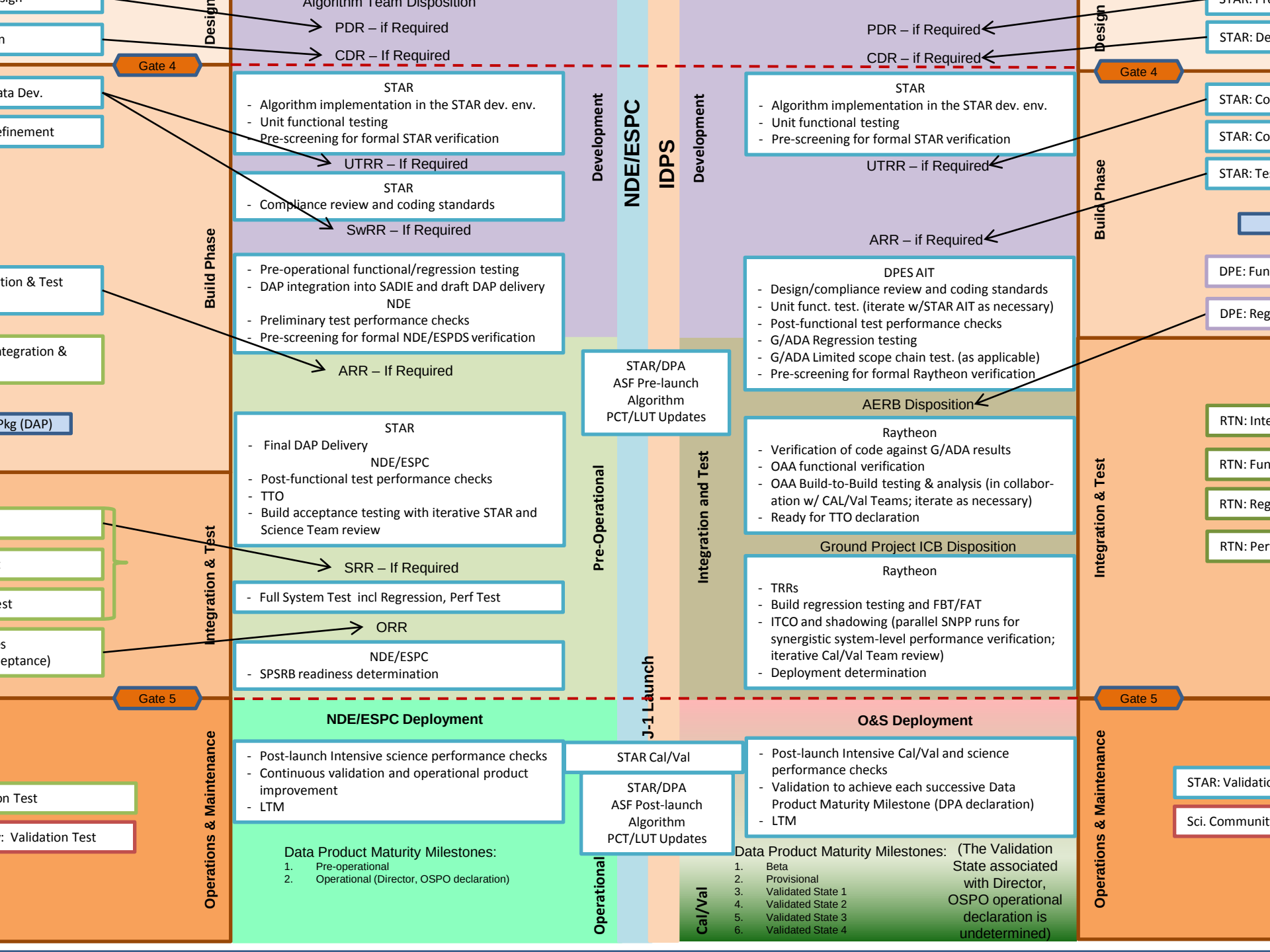
- Documentation and some change process steps may be slightly different, again according to the requirements

Reference Material:

Note that this material is in draft form and has not been formally approved

JPSS-1 Algorithm / Data Product Life-Cycle




Algorithm Team Disposition
PDR – if Required
CDR – If Required
PDR – if Required
CDR – if Required
Design
Gate 4
STAR
- Algorithm implementation in the STAR dev. env.
- Unit functional testing
- Pre-screening for formal STAR verification
UTRR – If Required
STAR
- Compliance review and coding standards
SwRR – If Required
- Pre-operational functional/regression testing
- DAP integration into SADIE and draft DAP delivery
NDE
- Preliminary test performance checks
- Pre-screening for formal NDE/ESPDS verification
ARR – If Required
STAR
- Final DAP Delivery
NDE/ESPC
- Post-functional test performance checks
- TTO
- Build acceptance testing with iterative STAR and Science Team review
SRR – If Required
- Full System Test incl Regression, Perf Test
ORR
NDE/ESPC
- SPSRB readiness determination
Gate 5
NDE/ESPC Deployment
- Post-launch Intensive science performance checks
- Continuous validation and operational product improvement
- LTM
Data Product Maturity Milestones:
1. Pre-operational
2. Operational (Director, OSPO declaration)
Development
NDE/ESPC
IDPS
Pre-Operational
Operational
J-1 Launch
STAR/DPA
ASF Pre-launch
Algorithm
PCT/LUT Updates
STAR Cal/Val
STAR/DPA
ASF Post-launch
Algorithm
PCT/LUT Updates
Development
STAR
- Algorithm implementation in the STAR dev. env.
- Unit functional testing
- Pre-screening for formal STAR verification
UTRR – if Required
ARR – if Required
DPES AIT
- Design/compliance review and coding standards
- Unit funct. test. (iterate w/STAR AIT as necessary)
- Post-functional test performance checks
- G/ADA Regression testing
- G/ADA Limited scope chain test. (as applicable)
- Pre-screening for formal Raytheon verification
AERB Disposition
Raytheon
- Verification of code against G/ADA results
- OAA functional verification
- OAA Build-to-Build testing & analysis (in collaboration w/ CAL/Val Teams; iterate as necessary)
- Ready for TTO declaration
Ground Project ICB Disposition
Raytheon
- TRRs
- Build regression testing and FBT/FAT
- ITCO and shadowing (parallel SNPP runs for synergistic system-level performance verification; iterative Cal/Val Team review)
- Deployment determination
O&S Deployment
- Post-launch Intensive Cal/Val and science performance checks
- Validation to achieve each successive Data Product Maturity Milestone (DPA declaration)
- LTM
Data Product Maturity Milestones:
1. Beta
2. Provisional
3. Validated State 1
4. Validated State 2
5. Validated State 3
6. Validated State 4
(The Validation State associated with Director, OSPO operational declaration is undetermined)
Cal/Val
Build Phase
Integration and Test
Integration & Test
Operations & Maintenance
Design
Gate 4
Gate 5
Build Phase
Integration & Test
Operations & Maintenance

STAR Algorithm Integration Team (AIT) Capabilities: Using Algorithm Development Library (ADL) for Troubleshooting, Testing and Generating Product Data

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STAR JPSS 2014 Annual Science Team Meeting
NCWCP, College Park, MD, USA
May 12-16, 2014

Overview

1. Role of STAR AIT
2. ADL Framework
3. Testing and Troubleshooting
4. Communication with DPES
5. Quality Check

Overview

1. Role of STAR AIT
2. ADL Framework
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Role of STAR AIT

- Code Testing in ADL
- Communication with Science Teams and DPES
- Troubleshooting
- Algorithm Package Preparation and Delivery
- Attending Science Team Meetings
- Reviewing ATBD and OAD documents
- Consultancy to Science Teams
- Emulation of Various Operational Scenarios
- Code Research and Analysis and Result Analysis
- Lead Algorithm Lifecycle Reviews

Overview

1. Role of STAR AIT
2. ADL Framework
3. Testing and Troubleshooting
4. Communication with DPES
5. Quality Check

ADL Framework

- ADL is the Test System - Developed by Raytheon
- ADL mimics IDPS system
- ADL provides a Diagnostic Framework
- ADL is recommended by Data Products Engineering and Services (DPES)
- I-P-O Model (Input-Processing-Output)
- ADL Versions evolve with IDPS Versions (Example: IDPS MX8.3~ADL4.2_MX8.3)

Overview

1. Role of STAR AIT
2. ADL Framework
3. Testing and Troubleshooting
4. Communication with DPES
5. Quality Check

Testing & Troubleshooting in ADL

- **Step 1:** Get ADL Version from Raytheon CM system
- **Step 2:** Put these versions in STAR AIT Common CM system giving this a distinct name to differentiate from other baselines
- **Step3:** Create a Test Stream out of the above Main Integration Streams
- **Step 4:** Work with the Test Stream creating Future Emulation Scenarios
- **Step 5:** Commit these changes so that others can use their changes over your changes and create a new emulation scenario
- **Step 6:** Find out the Golden Day (special days for specific events) of interest from the science team member
- **Step 7:** Organize all the needed input files for this test date
- **Step 8:** Build ADL and Run the Executables to generate Product Data

Testing & Troubleshooting in ADL

- **Step 1:** Get ADL Version from Raytheon CM system at

https://199.46.132.15/cqweb/

ADL Source Tar Packages:

Reference the "ClearQuest Reports" section below to view fixed and release notes per planned release.

- ADL4.1 + Mx7.1 Code and Data Packages
- ADL4.1 + Mx7.2 Code and Data Patch Packages
- ADL4.2 + Mx7.2 Code and Data Patch Packages
- ADL4.2 + Mx8.0 Code and Data Packages
- ADL4.2 + Mx8.0 OMPS Data Update Packages
- ADL4.2.2 + Mx8.1 Code and Data Packages
- ADL4.2.2 + Mx8.3 Code and Data Packages

Note: We have installed COTS from University of Wisconsin site at at https://jpss-adl-wiki.ssec.wisc.edu/mediawiki/index.php/ADL_Installation. We obtained previous versions of ADL from this site

Testing & Troubleshooting in ADL

- **Step 2:** Put these versions in STAR AIT Common CM system giving this a distinct name to differentiate from other baselines

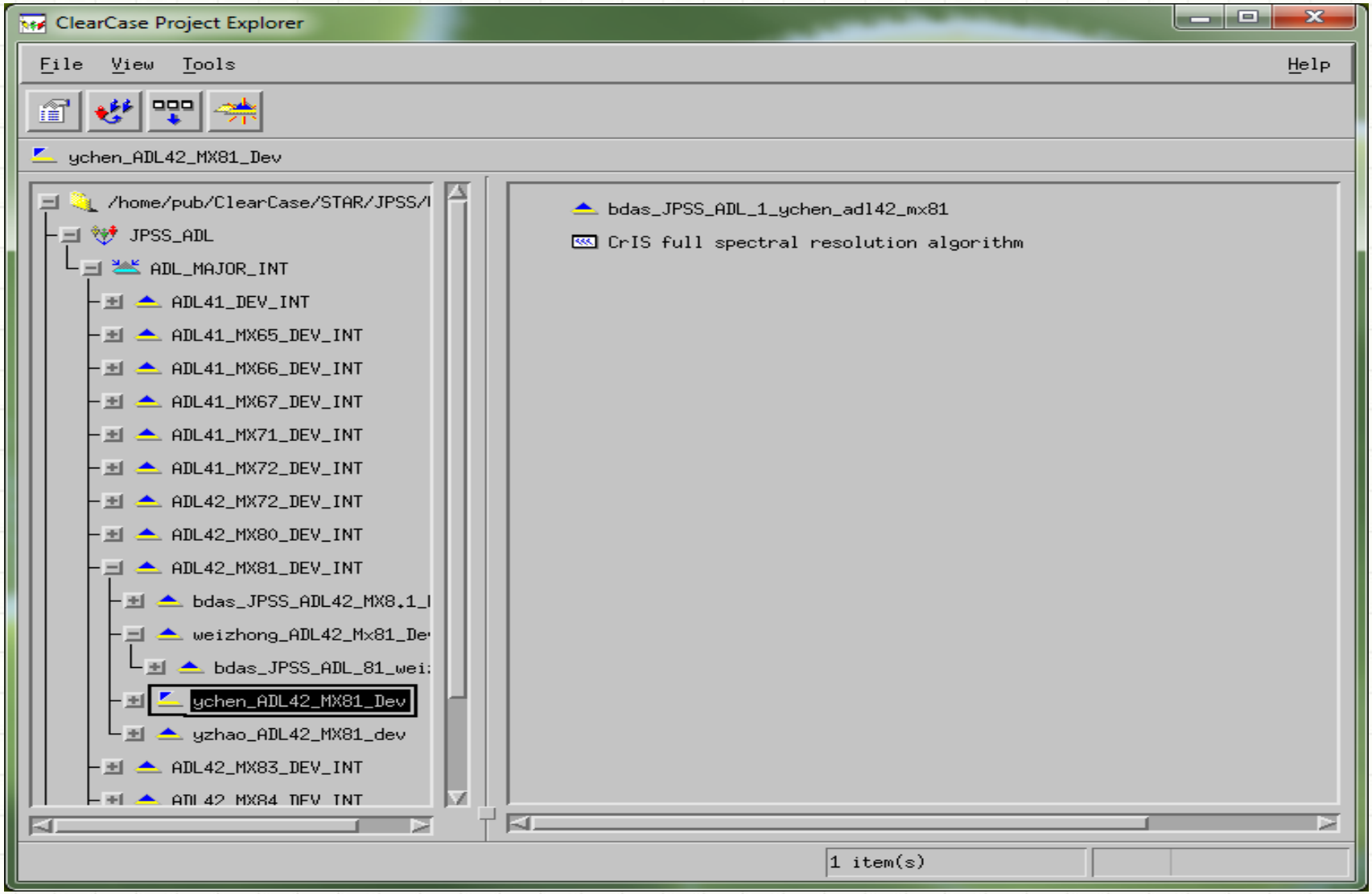
Examples:

- ADL41_MX65_DEV_INT
- ADL41_MX72_DEV_INT
- ADL42_MX72_DEV_INT
- ADL42_MX80_DEV_INT
- ADL42_MX81_DEV_INT
- ADL42_MX83_DEV_INT

- **Step3:** Create a Test Stream out of the above Main Integration Streams

Examples: bdas_JPSS_ADL_ADL4.2
weizhong_Adl_42_Mx80_Dev

Testing & Troubleshooting in ADL



Testing & Troubleshooting in ADL

- **Step 4:** Work with the Test Stream creating Future Emulation Scenarios

Examples:

- Use changes for DR 7259 (OMPS TC SDR) to MX8.0 Baseline Version
- Use changes for DR 7310 (OMPS TC EDR) to MX8.0 Baseline Version
- Use both changes for DR 7259 and DR 7310
- Use changes in DR 7259 for TC SDR and DR 4823 for NP SDR and find the effect on NP EDR IMOPO

- **Step 5:** Commit these changes so that others can use their changes over your changes and create a new emulation scenario

Examples:

Weizhong commits cloud mask algorithm related changes

Bigyani commits aerosol related changes

Bigyani can test the effect of VIIRS SDR related changes & Cloud Mask related changes on Aerosol before all of them are available in a future IDPS version

Testing & Troubleshooting in ADL

- **Step 6:** Find out the Golden Day (special days for specific events) of interest from the science team member

- **Step 7:** Organize all the needed input files for this test date

Example:

- AIT has version 8.3 of ADL
- Somebody wants to test for Golden Day on April 23, 2013 for Aerosol EDR Team
- Version 8.3 of ADL packs the data with VIIRS first track files that are updated in February 2014
- We cannot use these files for April 23, 2013. So, get the compatible files
- Get the hdf5 files for this date from CLASS and search the metadata to check what LUTs, ancillary files were used
- Updated LUTs, compatible first track files and compatible ancillary files such as Polar Wander, NCEP, NAAPS files etc. to generate the result

Testing & Troubleshooting in ADL

❑**Step 7:** Organize all the needed input files for this test date (continued)

Example:

1) AIT has to test Aerosol Algorithm with MX8.3 baseline for spatial filter
2) Get this version of the algorithm from Raytheon Common CM or AIT CM manager gets it and puts it in our AIT Common CM system
3) Install ADL, build and create the executables
4) Check the data that come with ADL 8.3
5) Some files for VIIRS SDR are first track: VIIRS-SDR-GEO-DNB-PARAM-LUT, VIIRS-SDR-DNB-C-COEFFS-LUT, VIIRS-SDR-DG-ANOMALY-DN-LIMITS-LUT etc. The data that come with ADL 8.3 has all of these recent files. I get these files from Raytheon Common CM or Gravite Information Portal site.

Testing & Troubleshooting in ADL

❑**Step 7:** Organize all the needed input files for this test date (continued)

6) Some files are actual non-first-track LUT changes, such as VIIRS-SDR-RSR file which is replaced by 3 more files in MX 8.3 such as RSBAUTOCAL and VIIRS-SDR-DNB-LGS-GAINS-LUT and VIIRS-SDR-DNB-GAIN-RATIOS-LUT etc. I use these actual LUT changes that are not first track, but improvements in coefficients
7) Generate SDRs that are reflective of MX 8.3 changes.

Testing & Troubleshooting in ADL

❑**Step 7:** Organize all the needed input files for this test date (continued)

Example:

a) After generating SDRs, focus on cloud mask

b) Check for any LUT changes. The PCT file VIIRS-CM-IP-AC_npp_20130815000000Z_20130924000000Z was updated in August 2013 and use this file for Cloud Mask run instead of whatever was used on April 23, 2013.

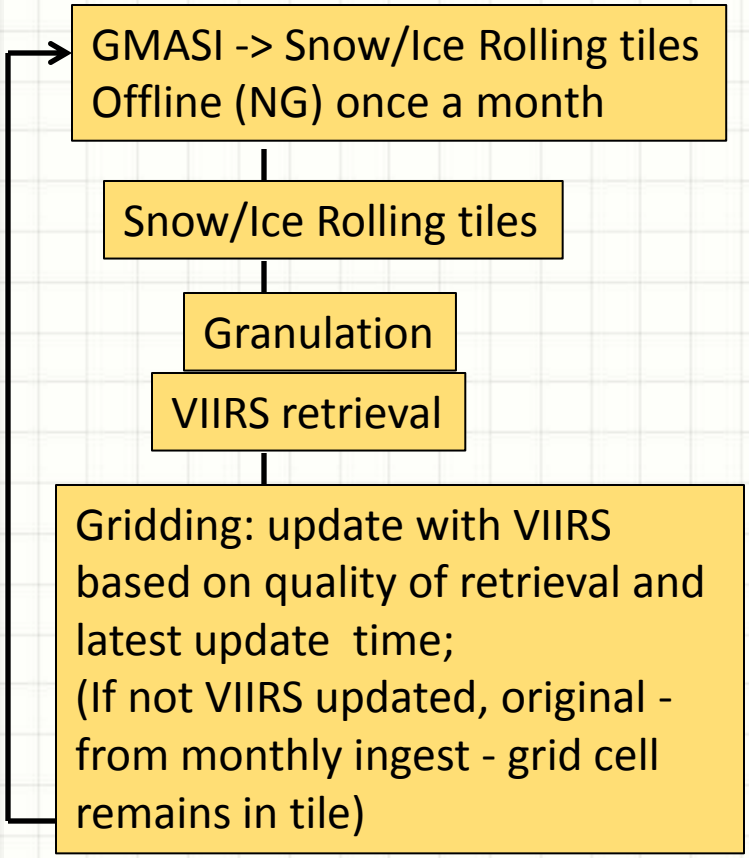
c) Then check for any Aerosol LUT updates in ADL MX8.3

d) VIIRS-AOT-LUT is changed from MX8.1 version and use this new LUT for the Golden Day instead of the actual version of VIIRS-AOT-LUT that was used for April 23, 2013 IDPS run.

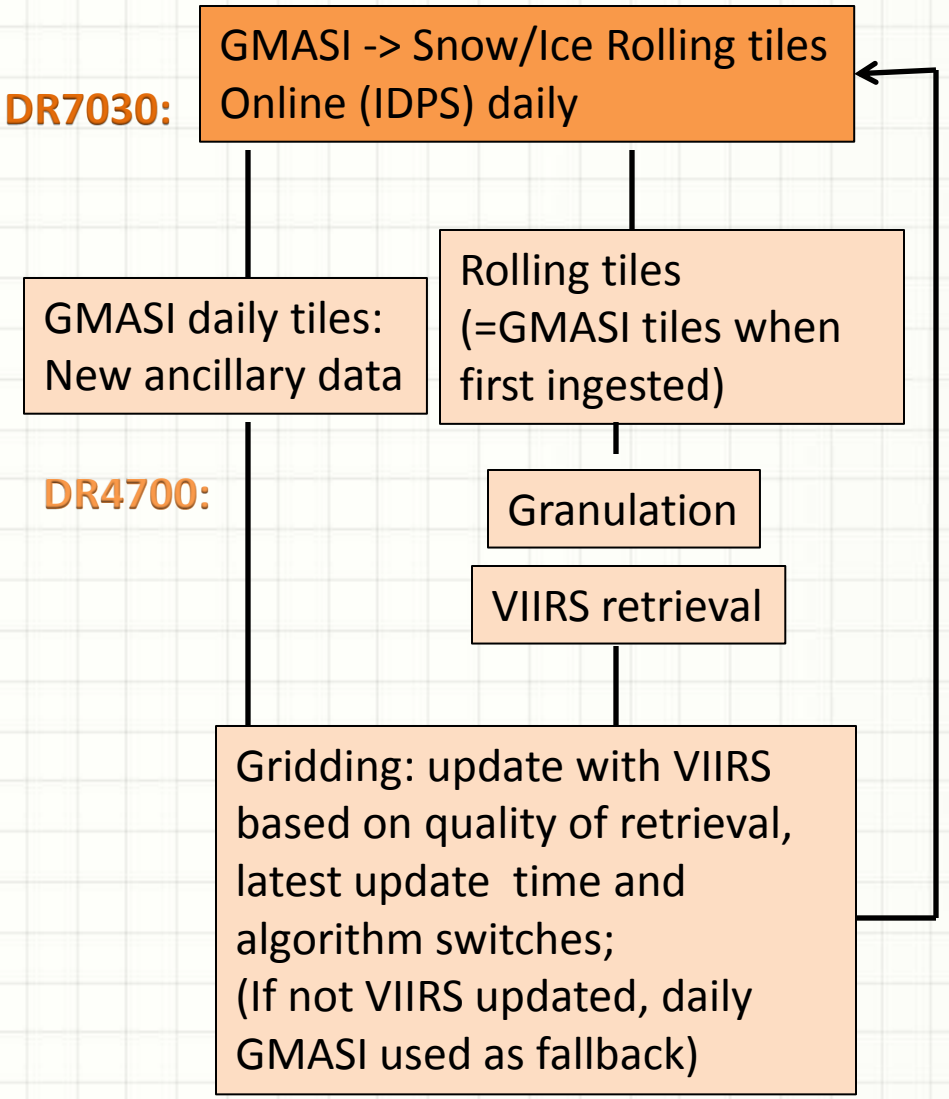
❑**Step 8:** Build ADL and Run the Executables to generate Product Data

Testing & Troubleshooting Examples

Snow/Ice Rolling tiles in current and proposed systems



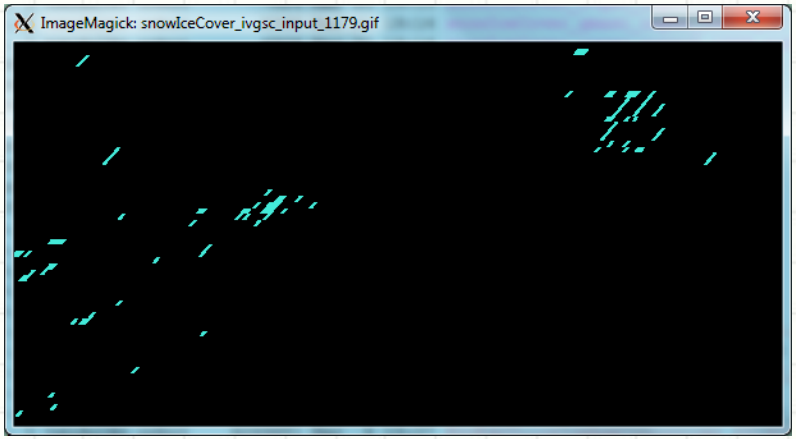
DR4700 implementation depends on DR7030



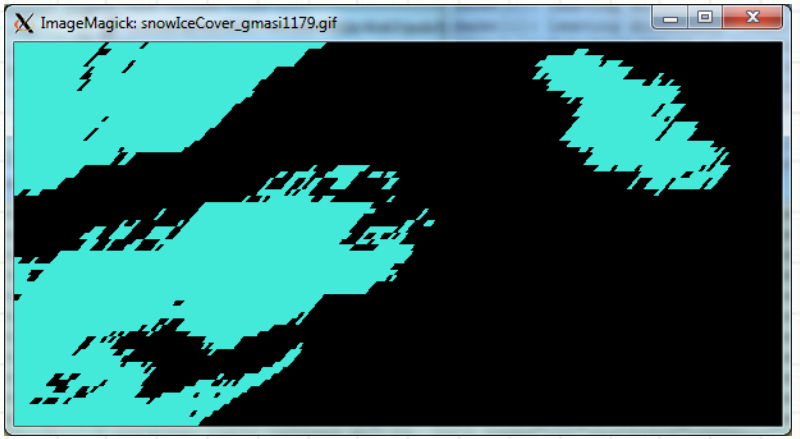
Testing and Troubleshooting Examples

Example for updated run: VIIRS snow cover gridding ON and VIIRS sea ice gridding ON

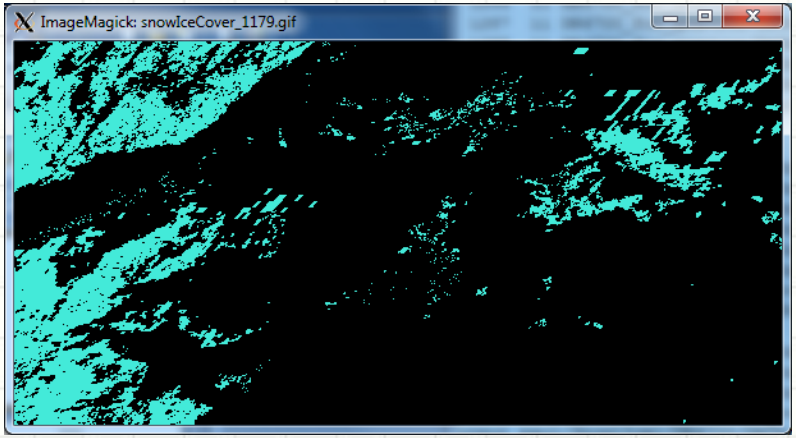
Input Snow/Ice Rolling tile (Nov 15, 2012)



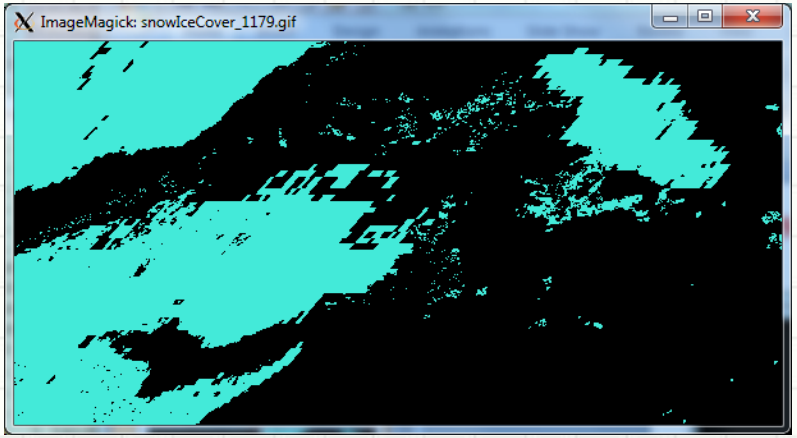
Input GMASI tile (Dec 16, 2012)



Baseline: Output Snow/Ice Rolling tile



Updated: Output Snow/Ice Rolling tile

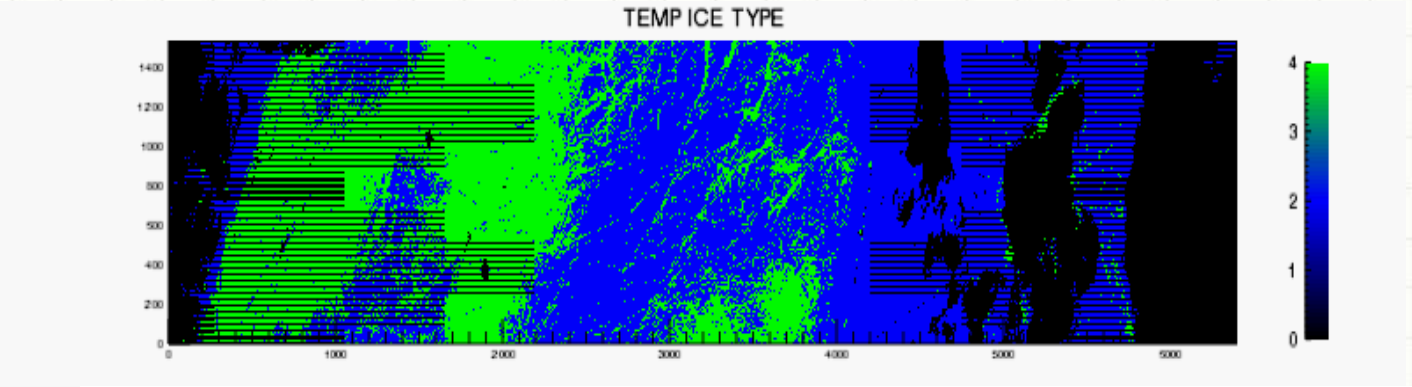


Tile 1179: Canada (South East of Hudson Bay)

Sensitivity Tests

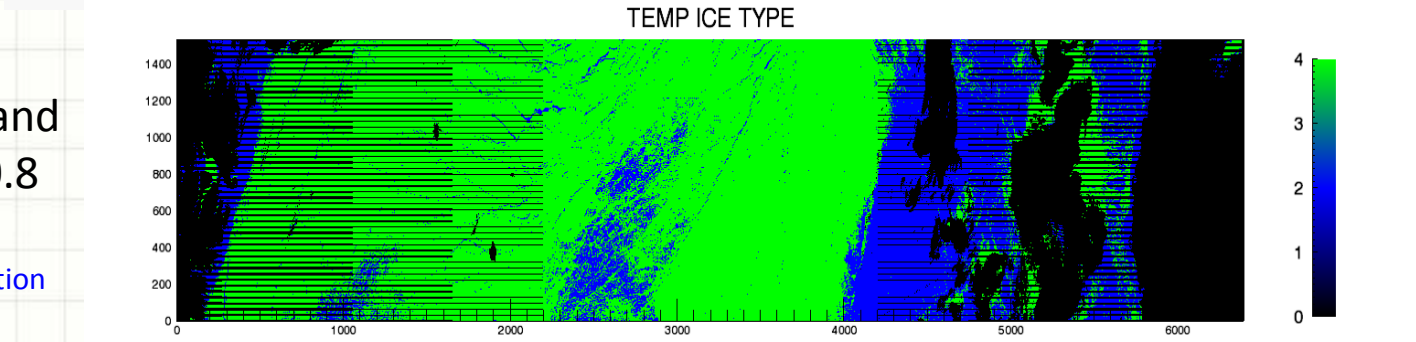
Green – old ice
Blue – new ice

Baseline: no changes

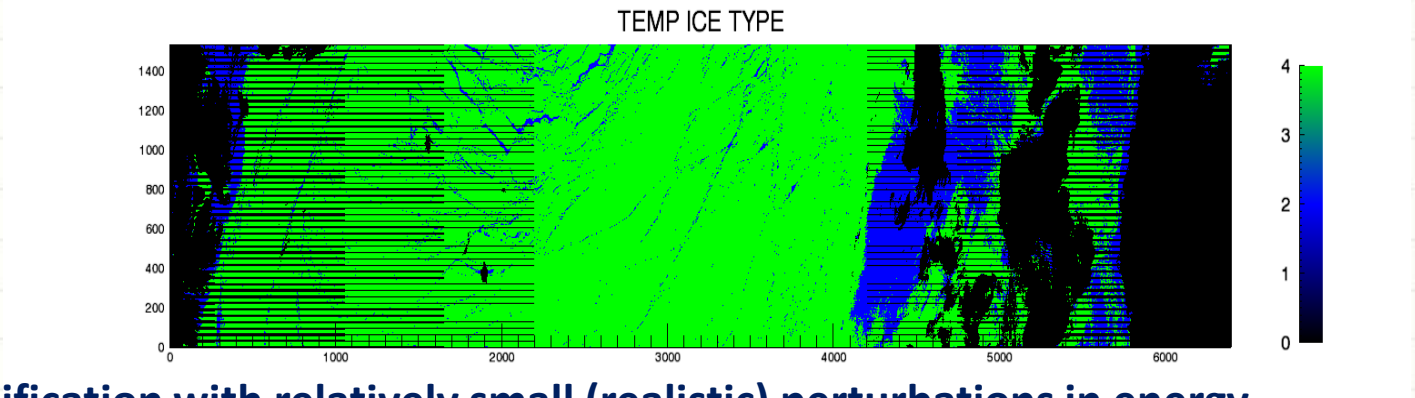


SWR=SWR*0.7 and Albedo=const=0.8

SWR = Shortwave Radiation



Albedo=0.8
Temp=Temp-2
Sh=Sh-0.0002
Sh – Specific Humidity



Change in classification with relatively small (realistic) perturbations in energy balance terms and ancillary data (granules near terminator zone)

Testing & Troubleshooting Summary

- **Step 1:** Get ADL Version from Raytheon CM system
- **Step 2:** Put these versions in STAR AIT Common CM system giving this a distinct name to differentiate from other baselines
- **Step3:** Create a Test Stream out of the above Main Integration Streams
- **Step 4:** Work with the Test Stream creating Future Emulation Scenarios
- **Step 5:** Commit these changes so that others can use their changes over your changes and create a new emulation scenario
- **Step 6:** Find out the Golden Day (special days for specific events) of interest from the science team member
- **Step 7:** Organize all the needed input files for this test date
- **Step 8:** Build ADL and Run the Executables to generate Product Data

Overview

1. Role of STAR AIT
2. ADL Framework
3. Testing and Troubleshooting
4. Communication with DPES
5. Quality Check

Communication with DPES

- We communicate with DPES if we find any discrepancy in ADL version matching the description of the update in release notes etc.
- We verify with them if some LUTs have a description that slightly differs somewhere in the name.
  Example: CrIMSS case where 4 of the LUT files had a different end date description in the file
- We communicate with them constantly during change request package submission process for them to check the package, then we verify the functional test results, regression test results, help in AERB review process if any reviewer has any doubts etc.

Overview

1. Role of STAR AIT
2. ADL Framework
3. Testing and Troubleshooting
4. Communication with DPES
5. Quality Check

Quality Check

ADL Version Check

When we get a new ADL version, we build and use the executables to run a few sample SDR and EDR cases and compare the results with IDPS results.

For Example, MX8.1/8.2 became effective on February 20, 2014 and MX 8.3 became effective in operations on March 18, 2014.

- We take a day, say February 25 and retrieve IDPS data.
- Use the metadata to get information about input files.
- Use compatible input files to run them in compatible ADL 4.1/4.2 framework in our system.
- Then run for ATMS SDR, VIIRS SDR, VIIRS CM, OMPS TC SDR etc. and compare with IDPS results.

Quality Check

Science Check

Constant Communication with the Science Team for Verification of the Results and DPES for Integration

Examples:

For CrIMSS EDR, I worked with Mike Wilson and Chris Barnet continuously throughout the submission of the change request, AERB Review and final integration.

For OMPS EDR, I worked with Larry, Trevor and Maria throughout the preparation and submission of the change request, functional test and regression test verification and final integration.

Quality Check (Continued)

Document Check

We also review documents from time to time to track failures, strange behavior of results etc. to support the science teams.

- ATBD documents
- OAD documents
- Other presentations made by science team members
- Publications by the corresponding science team members.
- Requirement documents
- CDR and Other related documents.

Quality Check (Continued)

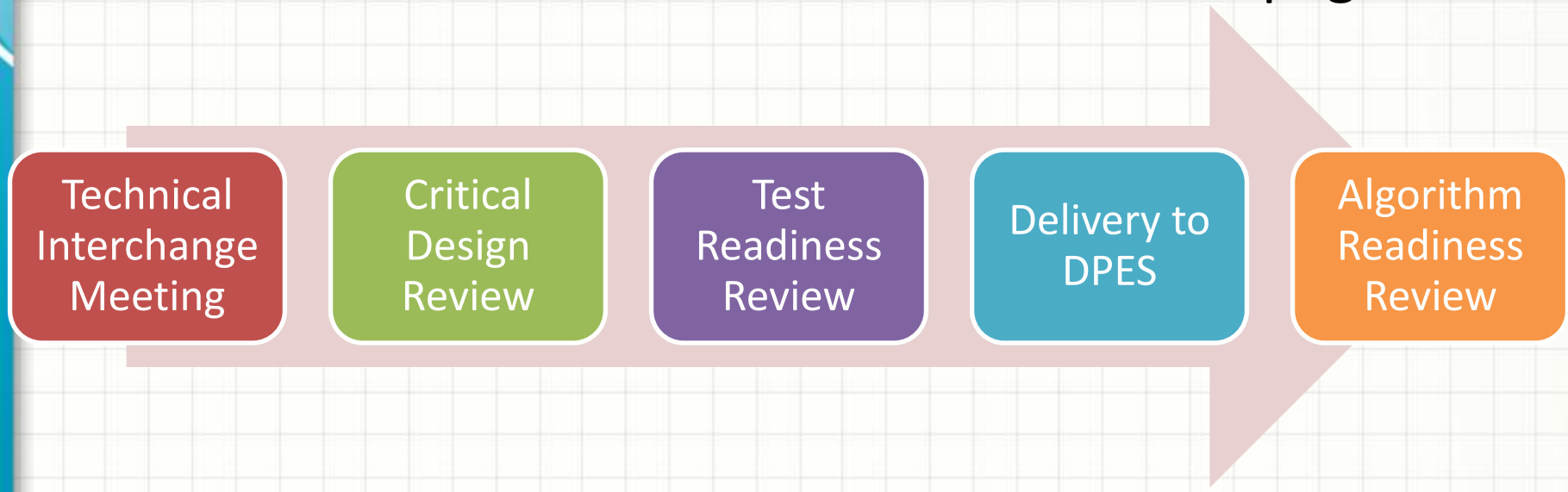
Algorithm Package Check

- ATBD Documents
- OAD Documents
- Test Data Sets
- Updated Software
- Baseline and Updated Results
- DPE Processing Request Form
- Algorithm LUT PCT or Algorithm Delivery Checklist
- Update Delivery Report
- Any Other Supporting Documents

Life Cycle Reviews for J1 Algorithms

STAR AIT Review Process for J1 is based on the Capability Maturity Model Integration Process.

- Shows that we understand requirements
- Shows we can develop algorithms to meet requirements.
- Ensures all stakeholders are on the same page



Life Cycle Reviews for J1 Algorithms

TIM
- Candidate algorithm design is discussed to ensure it meets all scientific and operational requirements

CDR
- STAR AIT and science team describe the chosen algorithm, showing that it will meet requirements
- Implementation Concept and Software Architecture are discussed, so that all changes to input/output structure are known

TRR
- Show that the algorithm, within the operational framework, meets coding standards and science expectations
- Establish datasets that will be used to show that the algorithm will meet requirements

DTD
- The algorithm is delivered to DPES for implementation into G-ADA.

ARR
- Describe tests that show the algorithm will be ready for delivery to CGS Contractor.

AIT Capabilities: How Much Data We Can Process?

- We have provided OMPS EDR data for TC. TC EDR needed CrIMSS EDR and VIIRS EDR as inputs. It took almost a week for one day of TC EDR generation.
- It took only 4 days for one day of OMPS NP EDR generation.
- For Aerosol EDR for one day with two scenarios, took one week to process.

AIT Capabilities: How Much Data We Can Process?

- STAR AIT will be implementing a HTCondor cluster to be used across projects
- AIT is in the process of buying a few JPSS machines to add to a cluster.
- AIT personnel will manage the cluster.
- JPSS storage capabilities will be added in the future.
- Currently, AIT can only generate one day worth of data in five to seven days if we have an average system load and no other system mishaps. This is expected to be improved with the implementation of the HTCondor cluster.

AIT Work Examples

- Land surface albedo LUT updating
- Adjust Quality Flag for Thin Cirrus in Land Surface Temperature (LST) and Update LUT
- Add Quality Check for ActiveFire
- Equation Modification for Sea Surface Temperature and Evaluating Downstream Impact
- Roll Back LST LUT from Provisional to Beta Version
- New Rain Algorithm for CrIMSS
- Wavelength Shift for OMPS, submit CRP
- New Ozone Mixing Fraction for OMPS, submit CRP
- Implementing NOAA Global Multisensor Automated Snow/Ice Map (GMASI) Tile

AIT Work Examples

- PCT file update for CrIS SDR
- Troubleshooting, testing and change request package submission for ATMS SDR
- Provide one day of test data to OMPS team with 4 DR updates, 2 for TC and 2 for NP
- Helping in OMPS Darks production transfer to GRAVITE
- Conducting sensitivity tests for Ice Age algorithm
- Submit change request package for OMPS BIAS table replacement for TC and NP

Summary

Accuracy of Algorithms -> Product Accuracy

STAR AIT ROLES:

- **Testing and Troubleshooting**
  - Facilitates Structured Tests
  - Performs Emulation Experiments with Chain Run Tests
  - Performs Code Updates, Tests and Delivery
  - Facilitates Review Process
  - Produces Product Test Data
- **Communication Facilitation**
- **Quality Check: Algorithm Check, Science Check & Documentation Check**

QUESTIONS?

The STAR Algorithm Integration Team (AIT) Research to Operations Process

Presented by

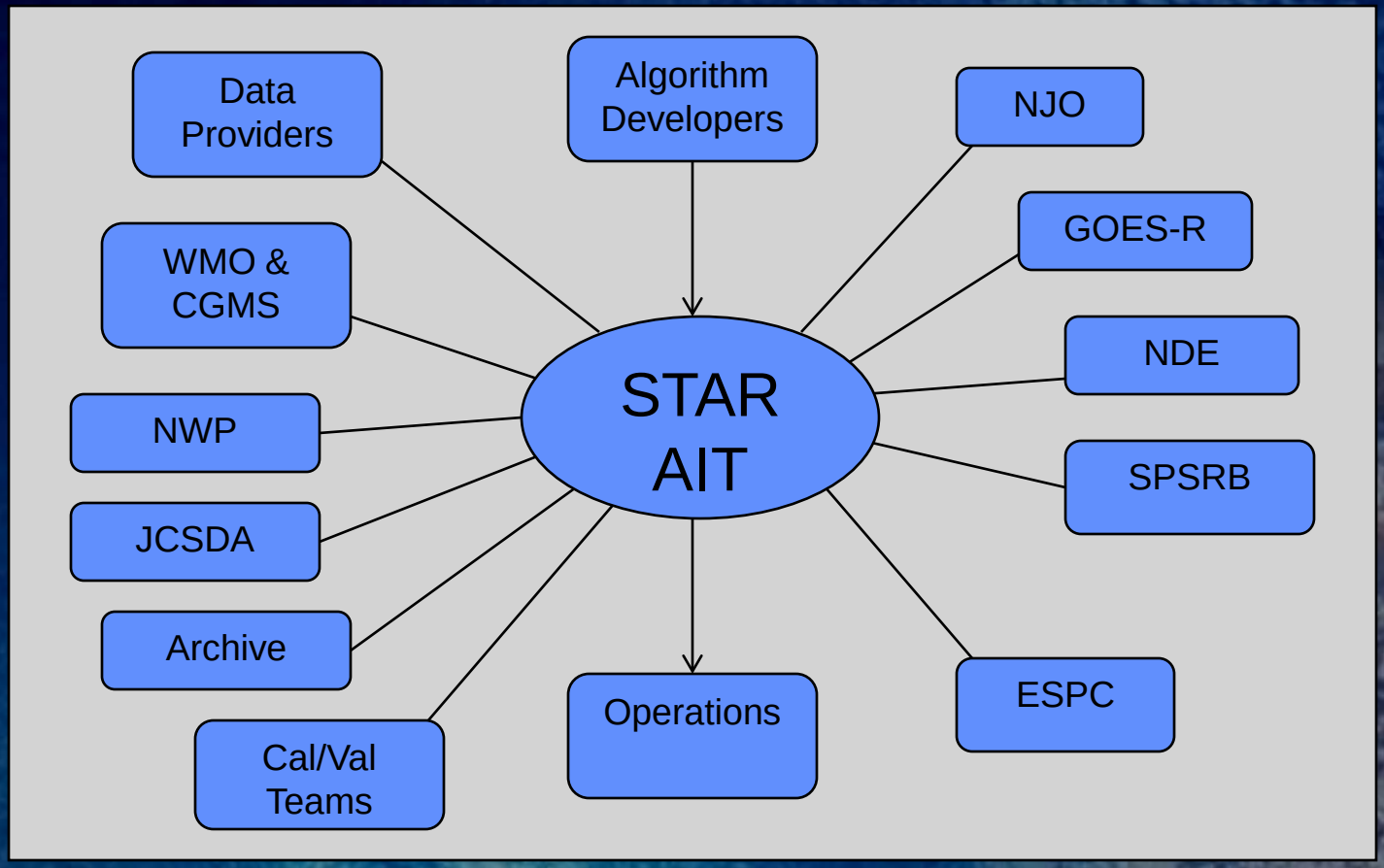
Tom King

The Problem

- Scientists write code that needs to go to operations, but:
  - » Many scientists often prefer interpreted languages like IDL and Matlab or even older languages like Fortran 77. Fortran 90/95 or C/C++ expertise does not always exist.
  - » Code written in isolation without considering how it would run within a larger system
  - » Code works with only certain compilers
  - » Code uses non-standard functions
  - » Code doesn't account for operational concerns such as run time, memory usage, disk I/O, error checking
  - » Haven't considered what input and ancillary data are actually available in the operational environment and what the latency of those data have
  - » Code is often not well documented
  - » Code is often written by a mixture of programmers with varying styles and abilities
  - » Paths are hardcoded and algorithms assume the data they need will be in arranged in a particular data tree
  - » Executable code makes system calls (assuming a certain OS)
- Operations is tasked only to receive, run, and monitor the code

The Problem

- R2O isn't as simple as cleaning up science code and delivering to operations. This work also involves coordinating with many stakeholders.



STAR R2O Solution

- The solution is to have the STAR Algorithm Integration Team (AIT) act as a “middle man” to:
  - » Assist the science teams in providing Quality Assurance (QA) for the entire R2O process and do so in a way that isn’t a burden for them
  - » Work with stakeholders to refine requirements and enhance user readiness

- Product QA is concerned with assuring that the work products (software & documentation) created during the project’s lifecycle meet their requirements.

- Process QA is concerned with assuring that the process standards (reviews & stakeholder interaction) are met throughout the project lifecycle.

The STAR AIT Team

- The STAR AIT team is lead by Walter Wolf and consists of 30+ contractors

- The STAR AIT R2O process has been successfully applied to a number of past and current projects:
  - IASI
  - NUCAPS
  - GCOM
  - BUFR/GRIB2 Toolkit
  - Blended Cloud Products
  - JPSS Risk Reduction
  - GOES-R AIT
  - JPSS AIT
  - OSPO Product Monitoring
  - VIIRS Polar Winds
  - GOES Winds
  - Advanced Composition Explorer

R2O Process Methodology

- The STAR AIT R2O process evolved from a CMMI level 3 process that was tailored and blended with the existing SPSRB process.

- The process consists of working with science teams and the stakeholders to do the following:
  - » Conduct a standard set of project reviews
  - » Generate a standard set of documentation
  - » Stakeholder interaction
    - – Requirements development/refinement
  - » Risk tracking and mitigation
  - » Code cleanup for:
    - – Coding/Security
    - – Configuration Management
    - – Software Testing & Product Validation
    - – Common data formats and metadata (CF & ISO)
    - – Standard languages, tools, and libraries
  - » Delivered Algorithm Package (DAP) delivery

Reviews

- The review process is described on the SPSRB website at (http://projects.osd.noaa.gov/SPSRB/design_review_guidance.htm)

  - Preliminary Design Review (PDR)
    - Present preliminary requirements
    - Identify the problem, provide background, and discuss competing solutions
    - Identify an initial design
    - Presents risks

  - Critical Design Review (CDR)
    - Finalize requirements
    - Verify that the chosen design is able to meet those requirements
    - Present algorithm theoretical basis
    - Software architecture & Concept of operations
    - Product QA (Validation plans)
    - Presents risks

Reviews

- Unit Test Readiness Review (UTTR)
  - Present test plan, procedures, and results
  - Test must demonstrate that software is meeting its functional requirements
  - Presents risks
- Software Review (SR)
  - Check that code meets all SPSRB coding and ESPC security standards
- Algorithm Readiness Review (ARR)
  - Demonstrate that all data products are meeting requirements
  - Identify Delivered Algorithm Package (DAP) components and demonstrate that they meet requirements
  - Presents risks

Documentation

- STAR project documentation:
  - » Requirements Allocation Document (RAD)
    - Identify basic and derived requirements
    - Tie these requirements to user requests
    - Allocate requirements to components of the system design
  - » Review Item Disposition (RID) – Risk Tracking
    - Track, rate, mitigate, and assign individuals to address risks for the lifecycle of the project
  - » Presentation slide packages
    - Preliminary Design Review
    - Critical Design Review
    - Unit Test Readiness Review
    - Algorithm Readiness Review

Documentation

- SPSRB required documentation (Templates are available here http://projects.osd.noaa.gov/SPSRB/standards_data_mtg.htm)
  - System Maintenance Manual (SMM)
    - Describes the system design, interfaces, files (input, intermediate, and output)
    - Identifies the hardware, system requirements
    - Identifies the installation and operational procedures (shutdown/restart) required to run the system
    - Describes monitoring (error message, quality monitoring), maintenance, and troubleshooting
  - External Users Manual (EUM)
    - Describes the detailed format of the output data files for end users
  - Algorithm Theoretical Basis Document (ATBD)
    - Provides the theoretical background and description of the algorithm
    - Performance estimates, practical considerations
    - Validation procedures
    - Assumptions and limitations

Code Updating

- Getting code to meet SPSRB coding standards
  - » Removing hardcoded paths
  - » Adding comments and standard headers
  - » Using meaningful variable names
  - » Standard indentation of blocks
  - » Avoiding non-standard functions
- Porting code to target operating systems, compilers, and platforms
- Adding error checking and logging
- Profiling and debugging
- Rewriting code into ESPC approved languages
- Testing to verify offline research and operational codes produces the same results
- Providing updates or tools for handling operational interfaces
- Integration into a test system (e.g. ADL or the GOES-R Framework)

Development Standards

- Coding of software:
  - SPSRB Coding standards available on the SPSRB website (http://projects.osd.noaa.gov/SPSRB/standards_software_coding.htm)
  - OSPO Technical Reference Model (TRM) is the source of IT standards and specifications
  - Software review conducted with OSPO PAL and ESPC IT security
- Using the STAR CM Tool (IBM Rational ClearCase, Version 7.0) to track and baseline development
- Implementing use of standard data formats such as netCDF, HDF, BUFR, and GRIB
  - netCDF and HDF are preferred formats for many users and the archives
  - BUFR and GRIB are standard NWP formats
  - Metadata follows Climate and Forecast (CF) and ISO 19115 standards

Development Standards

- Use of standard tools
  - » Common use of home-grown functions for time calculations, error checking, wrappers to netCDF and HDF API functions
  - » Code generators for I/O handling (read, write, allocate, and deallocation) for Fortran 90 and C/C++
  - » Use of Valgrind for profiling (resource usage and memory leaks)
  - » Common set of home-grown coding checking/cleaning
- Implementation of standard test procedures
  - » Code unit and system testing
  - » Presentation of the results to stakeholders at the UTRR and ARR
  - » Development of test plans
    - – Identify test environment
    - – Identify test data sets (input, intermediate, output)
    - – Identify test code
    - – Show test steps
    - – Show test results and compare to requirements

Stakeholder Interaction

- Requirements development/refinement
  - » Working with end users to identify and agree upon on data formats and content
  - » Defining archive and metadata requirements
  - » Identifying or defining interfaces between algorithms and system into which they run
  - » Identifying documentation needs
  - » Identifying production rules for downstream integrators
  - » Identifying file name conventions
- Coordinating additional paperwork and documentation
  - » Data Access Request (DAR) forms
  - » Coordination with DMWG
  - » CLASS Submission Agreements (SA)
- Providing sample data products and software to end users prior to operational implementation for
  - » Product validation
  - » End-user readiness
- Reprocessing data for science teams to assist Cal/Val activities
- Attending Integration Product Team (IPT) meetings
  - » Keep track of upstream changes to algorithms and input formats
  - » Coordinate development with updates to the system in which the science algorithms will run
  - » Coordinate common standards for output and algorithm interfaces

Risk Tracking

- Identify risks and impacts
- Developing and managing schedules
- Assigning risks a rating as a function of likelihood and impact
- Developing mitigation plans
- Assigning actions to individuals for mitigation efforts
- Opening and closing risks as needed
- Risks and actions are presented and discussed at each review step

Delivered Algorithm Package (DAP)

- DAP contents
  - Test plans and test data
  - SPSRB documentation (ATBD, SMM, EUM)
  - Source Code
  - All scripts, static data files, and configuration files
  - Production rules
  - Description of interfaces
  - Delivery memo and README

R2O Example: NUCAPS

- NOAA Unique CrIS/ATMS Product System (NUCAPS)
  - » Project Lead: Walter Wolf
  - » STAR algorithm science lead: Mark Liu (previously was Chris Barnet)
  - » OSPO PAL: Awdhesh Sharma
- It is an SPSRB-funded project whose goal is to produce a software package that runs in NDE to provide
  - » Produce CrIS thinned radiances in BUFR for NWP
  - » Produce retrieved profiles of temperature, water and trace gasses
  - » Produce validation products for STAR Cal/Val and OSPO monitoring
  - » VIIRS cloud products collocated to CrIS
  - » CrIS OLR
- NUCAPS was designed to be delivered in several phases so the process was tailored to the project schedule, scale and funding
- Leveraged the algorithms of AIRS and IASI
- Users consist of NWP, archive users, science teams

R2O Example: NUCAPS Stakeholder Interaction

- Stake holder interaction and requirement derivation efforts
  - » Acquire documents defining the project requirements (JPSS L1RD Supplement, SPSRB Project Plan, OSPO TRM, SPSRB coding standards and document templates, NDE DAP delivery standards). From this develop the RAD.
  - » Define and negotiate interfaces to the NDE system
  - » Identify required data formats, naming conventions, DAP delivery standards, documentation, system requirements (target platform, OS, compilers)
  - » Articulate algorithm needs to NDE (input and ancillary data, production rules, resource requirements)
  - » Worked with JCSDA, EMC, EUMETSAT, and WMO to define contents of and approval for the CrIS BUFR table descriptors
  - » Worked with NGDC and NCDC/CLASS to define metadata and archive requirements and methods
  - » Worked with OSPO PAL, NUCAPS science lead, and the Product Quality Monitoring team lead to define a monitoring methodology
  - » Worked with the STAR NDE, OSPO, and DMWG to acquire output data to support Cal/Val efforts at STAR

R2O Example: NUCAPS Project Reviews and Documentation

- Assembled and led the following reviews
  - Preliminary Design Review
  - Critical Design Review for Day 1 and 2 Products
  - Unit Test Readiness Review for Day 1 and 2 Products
  - Algorithm Readiness Review for Day 1 Products
  - Algorithm Readiness Review for Day 2 Products
  - Software Review
  - Critical Design Review for Day 3 Products

- Developed and delivered project documentation for each phase
  - SMM
  - EUM
  - ATBD
  - RAD
  - RID
  - Review Slide Packages

R2O Example: NUCAPS Software Development

- Software development and update efforts
  - » Acquired CrIS and ATMS sample data provided by IPO
  - » Developed code following SPSRB coding standards
  - » Developed a near realtime simulation data generating system outputting IDPS-like HDF5 CrIS and ATMS (using GFS as input and a forward model)
  - » Developed a near real time processing system to ingest the simulated data, mimic the NDE interfaces, ran the algorithm code, and distributed data to a STAR ftp server (all on a 24/7 basis)
  - » Developed readers for input data and writers for output
  - » Developed the pre and post-processing software for the NUCAPS retrieval algorithm
  - » Developed the software to spatially and spectrally thin the CrIS radiances
  - » Developed the netCDF4 to BUFR conversion software
  - » Developed the software to generate the validation products (daily gridded, binary, and matchup data sets)
  - » Developed software for product monitoring of SDRs and EDRs
  - » Cleaned up retrieval code and developed scripts to create and "operationalized" version of the code (remove diagnostic print statements)
  - » Ported retrieval code to the target platform (IBM AIX)
  - » Tracked updates in ClearCase revision control

R2O Example: NUCAPS Validation Efforts

- Validation efforts
  - » Delivered preliminary DAPs to prepare NDE for integration
  - » Delivered test data products to NCEP, EUMETSAT, AWIPS, JCSDA
  - » Reprocessed NUCAPS focus days for product validation
  - » Reprocessed of the retrievals at the locations of AEROSE dedicated radiosondes for product validation
  - » Providing data to NPROVS for product monitoring
  - » Delivered monitoring product software to OSPO
  - » Made CrIS BUFR and NUCAPS retrieval products available to end users
  - » Coordinated with NDE, ESPC, and the STAR DMWG to gain access to the optional product output files here at STAR in support of validation and monitoring efforts
  - » Validated the DAP contents

R2O Example: NUCAPS Additional Efforts

- Additional efforts
  - » Tracked and mitigated risks throughout the lifecycle of the project
  - » Delivered Day 1 and Day 2 NDE-compliant DAPs to NDE
  - » Assisted with NDE integration, troubleshooting, and validation after delivery
  - » Handled project logistics and provided guidance to the NUCAPS science team to
    - Get links to documentation templates
    - Update schedules
    - Review process (advising on content, reviewing ATBD slides)
    - Assisting with access to tools and data sets, paperwork to access development hardware

Summary

- The STAR AIT role consists of working with science teams and the stakeholders to do the following:
  - » Conducting a standard set of project reviews
  - » Generating a standard set of documentation
  - » Stakeholder interaction
  - » Risk tracking and mitigation
  - » Code cleanup
- The STAR AIT R2O process is to each project depending on the scale, scope, and schedule
- The intended outcome of all this effort is meant to improve the lives of algorithm developers, operations, and end users so
  - » They can do their jobs
  - » Projects can enhance user readiness
  - » Reduce transition costs
  - » Improve maintainability of code in the long term

S-NPP/JPSS ESPC Operations Today and Tomorrow

Chris Sisko

Data Operations Manager

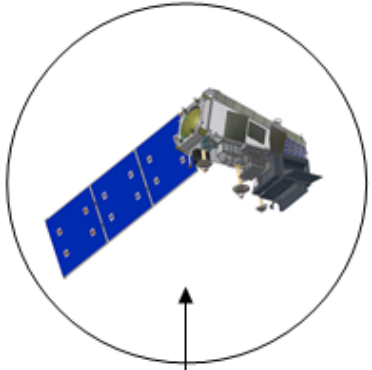
NESDIS/OPSO

May 15th, 2014

STAR JPSS 2014 Annual Science Team Meeting
May 12-16, 2014

Outline:

- SNPP real-time data operations – Today
- Key Performance Parameters (KPPs)
- Operational products currently available from the NDE system
- Short term activities
  - NDE Test System (System Acceptance / Handover)
- Future direction:
  - Data Quality Assurance
  - High level depiction of PG/PD systems
  - Readiness for ground system upgrades
  - Schedules
- Summary



Svalbard - McMurdo
Fairbanks - Troll - TDRSS

*KPP – Key Performance Parameters

User Community

- NWS (AWIPS)*
- NWS / NCEP* (Super Computers)
- Authorized NOAA and NASA users
- International Partners
- DoD
- DoD/USAF AFWA
- EUMETSAT

DoD/USAF AFWA
DoD/USN FNMOC
DoD/USN NAVO

NCEP POP
NCEP POP
NOAA MAN
NOAA MAN
NOAA MAN
DAPE
COPC
EUMETcast
RMDCN GTS

NOAA-5045 (ESPC)

NDE 1.0 (PE-1)
Operational System

NDE 1.0 (PE-2)
Test System

IDPS Ops / I&T Dataflow
IDPS Ops Dataflow
NCEP POP / COPC

EUMETcast
- UKMET
- ECMWF
- ~150+ subscribers

NOAA-5042 (JPSS CGS)

CS3
Communication,
MMC / AMMC
Command & Control

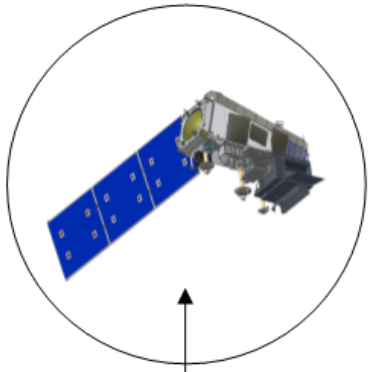
IDPS
Interactive Data Processing Segment
Data Processing & Distribution

GRAVITE (NOAA/NASA)
Calibration/Algorithms

Science Data Segment (NASA)
Science/Climate Studies

Comprehensive Large Array-data Stewardship System (NOAA)
Long-term Archive/Access

NWP Community
- JMA
- CMC
- AFWA
- India NCMRWF
- other GTS users



Svalbard - McMurdo
Fairbanks - Troll - TDRSS

NOAA-5045 (ESPC)

NDE 1.0 (PE-1)
Operational System

NDE 1.0 (PE-2)
Test System

IDPS Ops / I&T Dataflow

IDPS Ops Dataflow

NOAA-5042 (JPSS CGS)

CS3
Communication,
MMC / AMMC
Command & Control

IDPS
Interactive Data Processing Segment
Data Processing & Distribution

*KPP – Key Performance Parameters

User Community

NWS (AWIPS)*

NWS / NCEP*
(Super Computers)

Authorized NOAA and NASA users

International Partners

DoD

DoD/USAF AFWA

EUMETSAT

DAPE

COPC

NCEP POP

NCEP POP

NOAA MAN

NOAA MAN

NOAA MAN

NCEP POP / COPC

DoD/USAF AFWA

DoD/USN FNMOC

DoD/USN NAVO

EUMETcast

EUMETcast

UKMET

ECMWF

~150+ subscribers

RMDCN GTS

GRAVITE
(NOAA/NASA)
Calibration/Algorithms

Science Data Segment
(NASA)
Science/Climate Studies

Comprehensive Large Array-data Stewardship System (NOAA)
Long-term Archive/Access

NWP Community

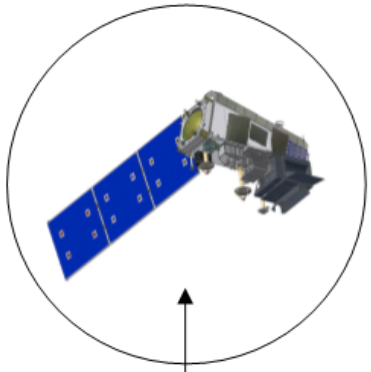
JMA

CMC

AFWA

India NCMRWF

other GTS users



Svalbard - McMurdo
Fairbanks - Troll - TDRSS

NOAA-5045 (ESPC)

NDE 1.0 (PE-1)
Operational System

NDE 1.0 (PE-2)
Test System

IDPS Ops / I&T Dataflow

IDPS Ops Dataflow

NOAA-5042 (JPSS CGS)

CS3
Communication,
MMC / AMMC
Command & Control

IDPS
Interactive Data Processing Segment
Data Processing & Distribution

*KPP – Key Performance Parameters

User Community

NWS (AWIPS)*

NWS / NCEP*
(Super Computers)

Authorized NOAA and NASA users

International Partners

DoD

DoD/USAF AFWA

DAPE

COPC

DoD/USAF AFWA

DoD/USN FNMOC

DoD/USN NAVO

EUMETSAT

NCEP POP

NCEP POP

NOAA MAN

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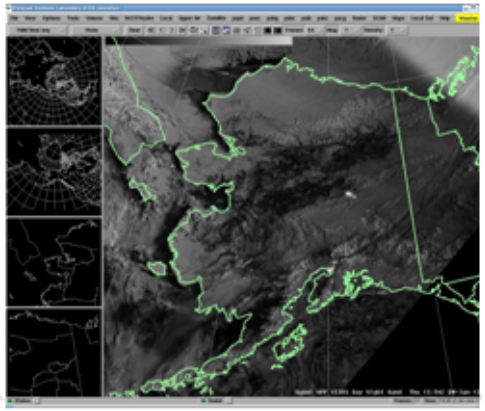
other GTS users

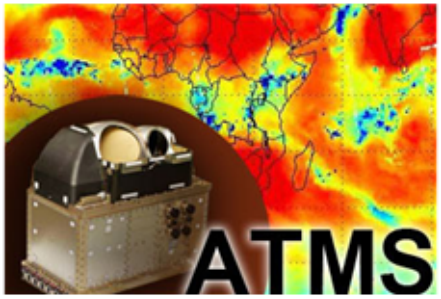
VIIRS Imagery EDR - 0.64µm (I01), 3.74µm (I04), 11.45µm (I05), 8.55 µm (M14), 10.763 µm (M15), and 12.03 µm (M16) for latitudes greater than 60ºN in the Alaskan region

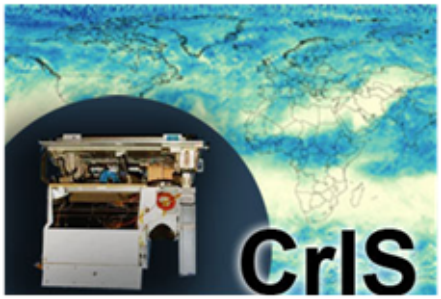
NWS Alaska Region

Anchorage WFO
Fairbanks WFO

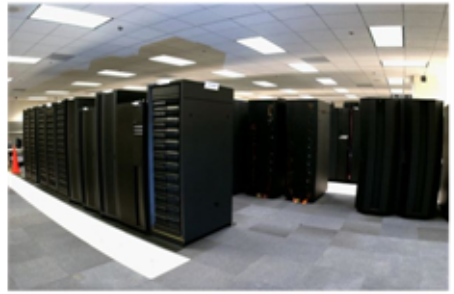


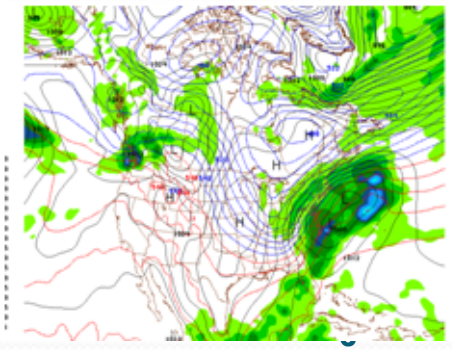
CrIS & ATMS SDRs – for data assimilation into numerical weather prediction (NWP) models





National Centers for Environmental Prediction (NCEP)





NWS/NCEP GDAS – NWP Data Assimilation (covering the time period for: March 2014)

Daily Average (RECEIVED)

	00Z	06Z	12Z	18Z	Total
ATMS	661,550	658,445	659,555	660,323	2,639,873
CrIS	33,244,481	33,209,169	33,330,465	33,191,693	132,975,808
HIRS4	10,613,244	10,556,369	10,441,145	10,549,585	42,160,343
AMSU-A	15,722,630	16,003,873	16,339,462	15,487,544	63,553,509
MHS	14,240,432	13,824,664	13,724,892	13,825,513	55,615,501
GOME	107,798	107,789	105,627	107,941	429,155
IASI	363,066,786	355,270,608	350,559,872	364,489,233	1,433,386,499
	Total Number of Observations				

Daily Average (SELECTED)

	00Z	06Z	12Z	18Z	Total
ATMS	253,424	252,711	252,509	253,110	1,011,754
CrIS	4,941,416	4,937,000	4,952,361	4,930,124	19,760,901
HIRS4	733,822	734,141	724,042	733,046	2,925,051
AMSU-A	998,096	994,271	983,831	989,992	3,966,190
MHS	246,630	240,423	238,482	241,149	966,684
GOME	8,334	8,386	8,251	8,268	33,239
IASI	13,760,992	13,442,259	13,361,808	13,744,473	54,309,532
	Total Number of Observations				

Information provided by NCEP Central Operations

NDE Operational Products (Sep 27th, 2013)

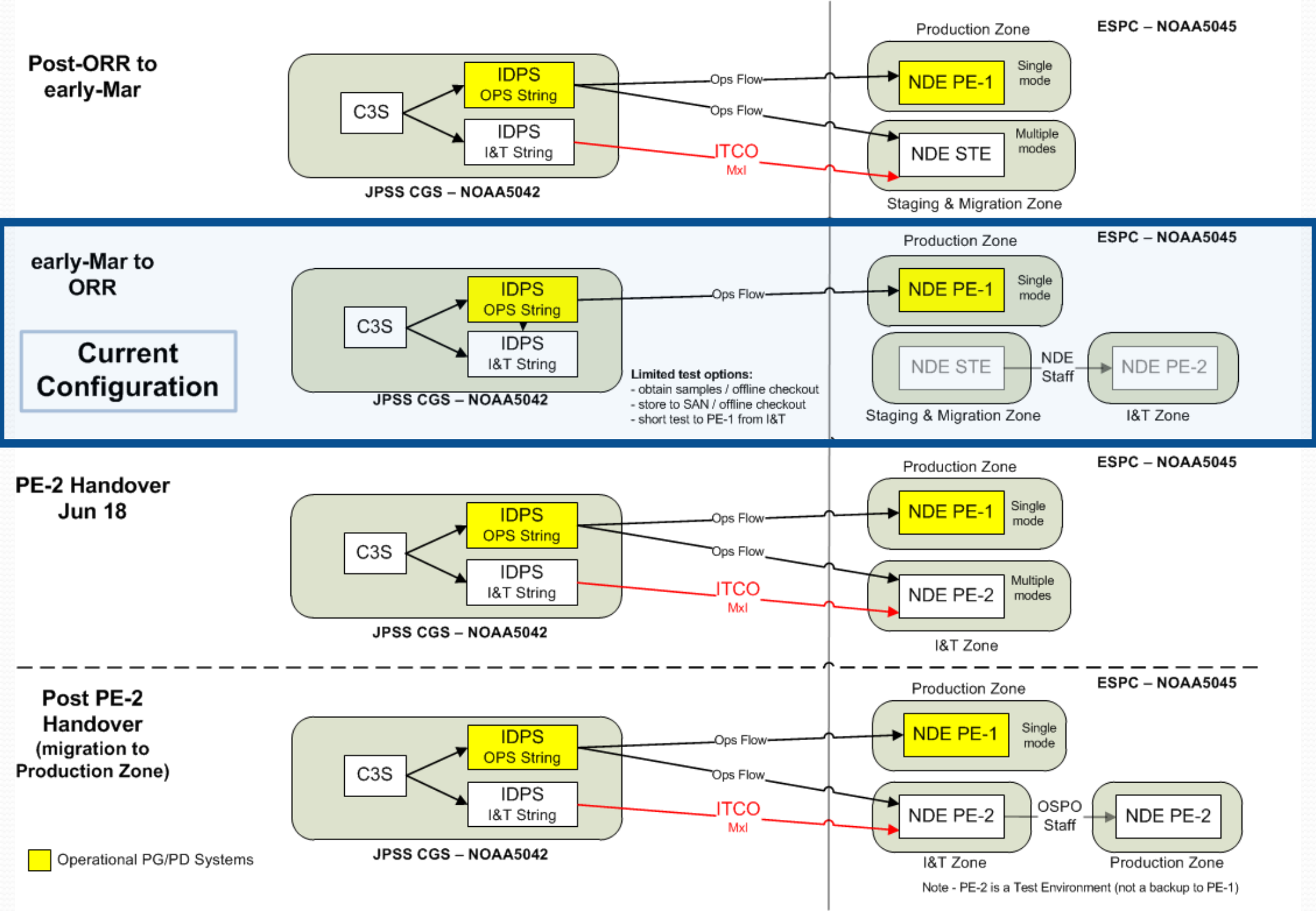
Application Short Name	Application Name	Product Name	Format	Satellite
ATMS-SDR	ATMS SDR radiances	ATMS SDR radiances 22 channels (NDE)	BUFR	SNPP
CRIS-SDR-399	CrIS SDR radiances 399	CrIS IR sounder SDR radiances 399 channels for NWP data assimilation (NDE)	BUFR	SNPP
CRIS-SDR-1305	CrIS SDR radiances 1305	CrIS IR sounder SDR radiances 1305 channels for NWP data assimilation (NDE)	BUFR	SNPP
VIIRS-EDR-I01	VIIRS EDR-I01	VIIRS EDR Band I01 0.64 µm (NDE)	netCDF	SNPP
VIIRS-EDR-I04	VIIRS EDR I04	VIIRS EDT Band I04 3.74 µm (NDE)	netCDF	SNPP
VIIRS-EDR-I05	VIIRS EDR I05	VIIRS EDT Band I05 11.45 µm (NDE)	netCDF	SNPP

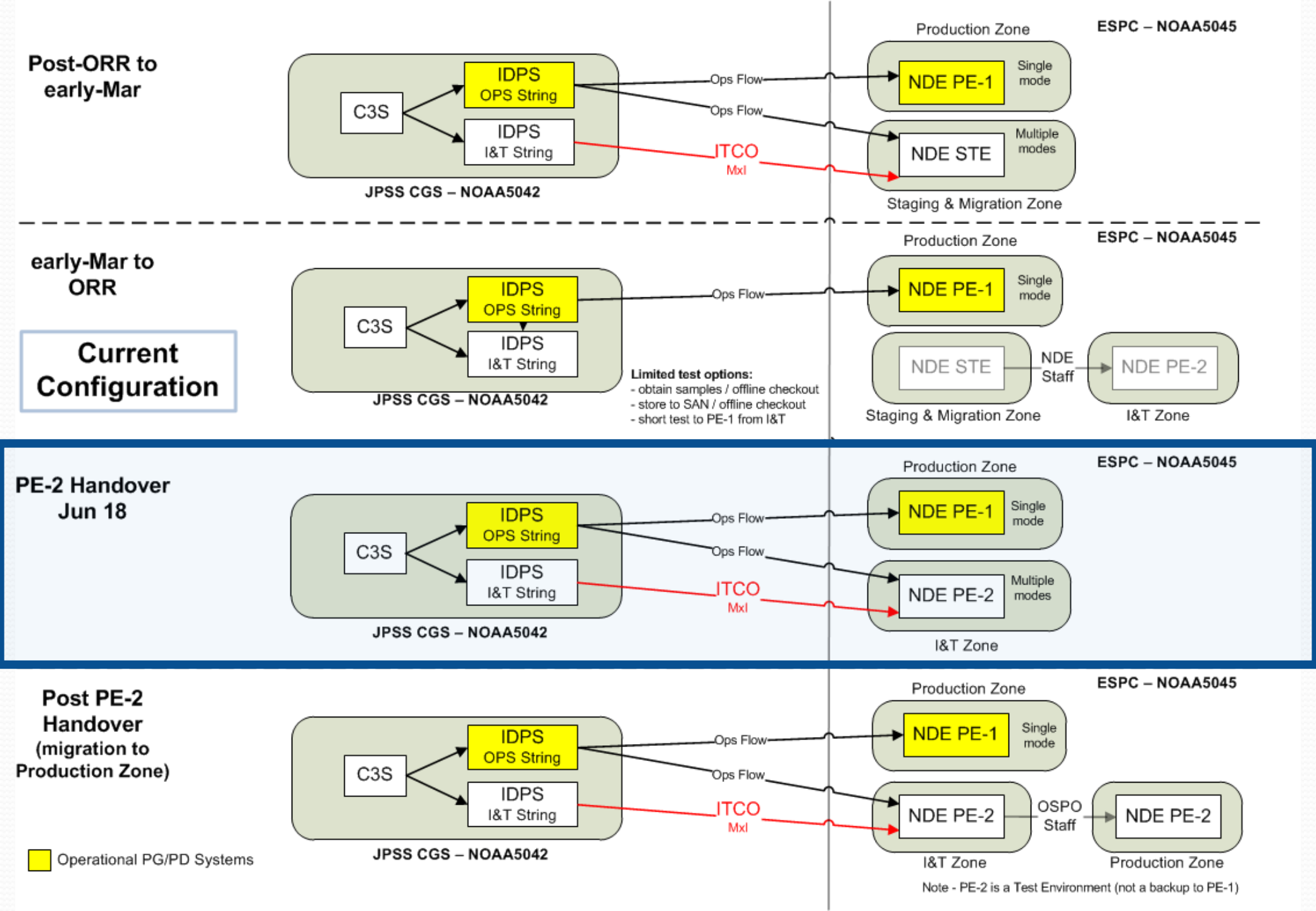
- NDE PE1 (Production Environment) ORR completed on Sep 17th, 2013.
- Operational on Sep 27th, 2013
- Customers: NCEP, NWS-AWIPS (NCF) and EUMETSAT

NDE Operational Products (Today)

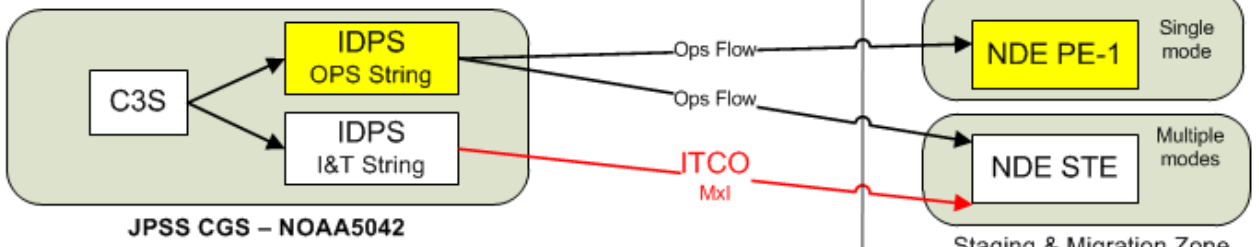
Application Short Name	Application Name	Product Name	Format	Satellite
ACSPO SST	Advanced Clear Sky Processor for Oceans (NDE) - SST	SST, Clear Sky Mask	netCDF	SNPP
AOT	Aerosol Optical Thickness	VIIRS Aerosol Optical Thickness (NDE)	BUFR	SNPP
ATMS-SDR	ATMS SDR radiances	ATMS SDR radiances 22 channels (NDE)	BUFR	SNPP
CRIS-SDR-399	CrIS SDR radiances 399	CrIS IR sounder SDR radiances 399 channels for NWP data assimilation (NDE)	BUFR	SNPP
CRIS-SDR-1305	CrIS SDR radiances 1305	CrIS IR sounder SDR radiances 1305 channels for NWP data assimilation (NDE)	BUFR	SNPP
NUCAPS Level 1	NOAA Unique CrIS ATMS product System Level 2	CrIS/ATMS Atmos Temp Profile CrIS/ATMS Atmos Moisture Profile	netCDF	SNPP
MIRS ATMS	Microwave Integrated Retrieval System (NDE) - ATMS	MIRS ATMS granule image products MIRS ATMS granule SND products MIRS ATMS tailoring image products MIRS ATMS tailoring SND products	netCDF	SNPP
OMPS-NP	OMPS nadir profile	Ozone nadir profile (NDE)	BUFR	SNPP
OMPS-TC	OMPS total column	Ozone total column (NDE)	BUFR	SNPP
VIIRS-EDR-I01	VIIRS EDR-I01	VIIRS EDR Band I01 0.64 µm (NDE)	netCDF	SNPP
VIIRS-EDR-I04	VIIRS EDR I04	VIIRS EDT Band I04 3.74 µm (NDE)	netCDF	SNPP
VIIRS-EDR-I05	VIIRS EDR I05	VIIRS EDT Band I05 11.45 µm (NDE)	netCDF	SNPP
VPW	VIIRS Polar Winds	VIIRS Polar Winds (NDE)	BUFR, netCDF	SNPP

- Green Vegetation Fraction
- Microwave Tropical Cyclone Products


Post-ORR to early-Mar
C3S
IDPS OPS String
IDPS I&T String
JPSS CGS – NOAA5042
Ops Flow
Ops Flow
ITCO
Mxl
Production Zone
ESPC – NOAA5045
NDE PE-1
Single mode
NDE STE
Multiple modes
Staging & Migration Zone
early-Mar to ORR
Current Configuration
C3S
IDPS OPS String
IDPS I&T String
JPSS CGS – NOAA5042
Ops Flow
Limited test options:
- obtain samples / offline checkout
- store to SAN / offline checkout
- short test to PE-1 from I&T
Production Zone
ESPC – NOAA5045
NDE PE-1
Single mode
NDE STE
NDE Staff
NDE PE-2
Staging & Migration Zone
I&T Zone
PE-2 Handover Jun 18
C3S
IDPS OPS String
IDPS I&T String
JPSS CGS – NOAA5042
Ops Flow
Ops Flow
ITCO
Mxl
Production Zone
ESPC – NOAA5045
NDE PE-1
Single mode
NDE PE-2
Multiple modes
I&T Zone
Post PE-2 Handover (migration to Production Zone)
C3S
IDPS OPS String
IDPS I&T String
JPSS CGS – NOAA5042
Ops Flow
Ops Flow
ITCO
Mxl
Production Zone
ESPC – NOAA5045
NDE PE-1
Single mode
NDE PE-2
OSPO Staff
NDE PE-2
I&T Zone
Production Zone
Note - PE-2 is a Test Environment (not a backup to PE-1)
Operational PG/PD Systems

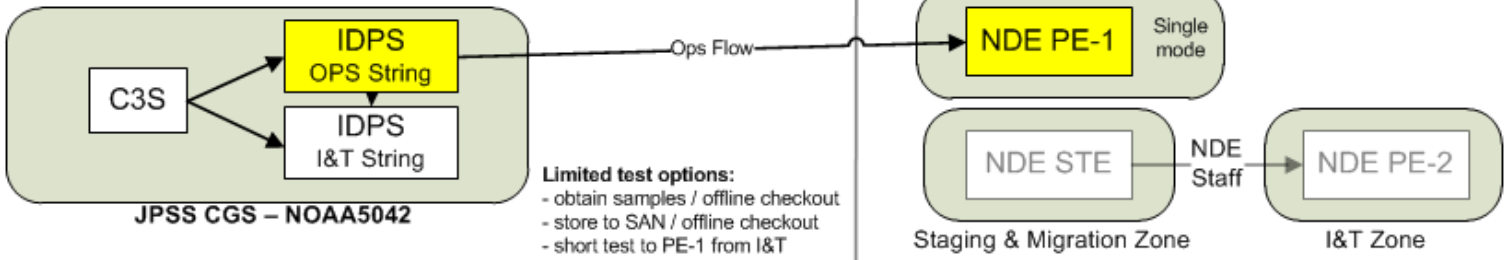

Post-ORR to early-Mar
C3S
IDPS OPS String
IDPS I&T String
JPSS CGS – NOAA5042
Ops Flow
Ops Flow
ITCO
Mxl
Production Zone
ESPC – NOAA5045
NDE PE-1
Single mode
NDE STE
Multiple modes
Staging & Migration Zone
early-Mar to ORR
Current Configuration
Limited test options:
- obtain samples / offline checkout
- store to SAN / offline checkout
- short test to PE-1 from I&T
NDE Staff
NDE PE-2
I&T Zone
PE-2 Handover Jun 18
Post PE-2 Handover (migration to Production Zone)
OSPO Staff
Operational PG/PD Systems
Note - PE-2 is a Test Environment (not a backup to PE-1)

Post-ORR to early-Mar

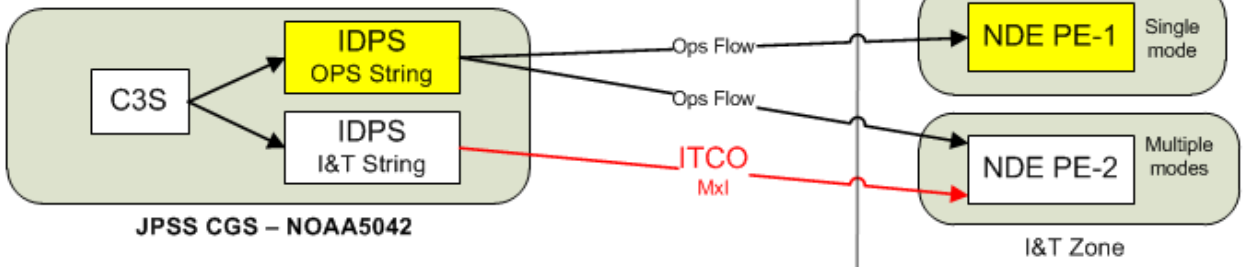


early-Mar to ORR

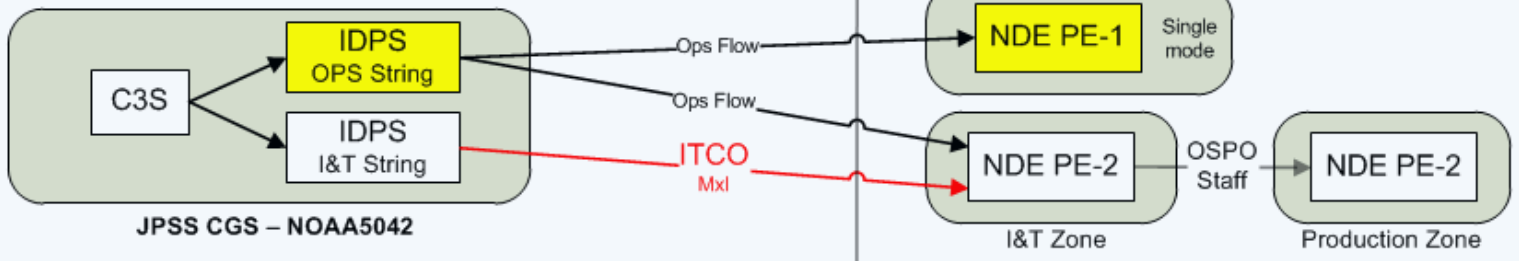
Current Configuration



PE-2 Handover Jun 18



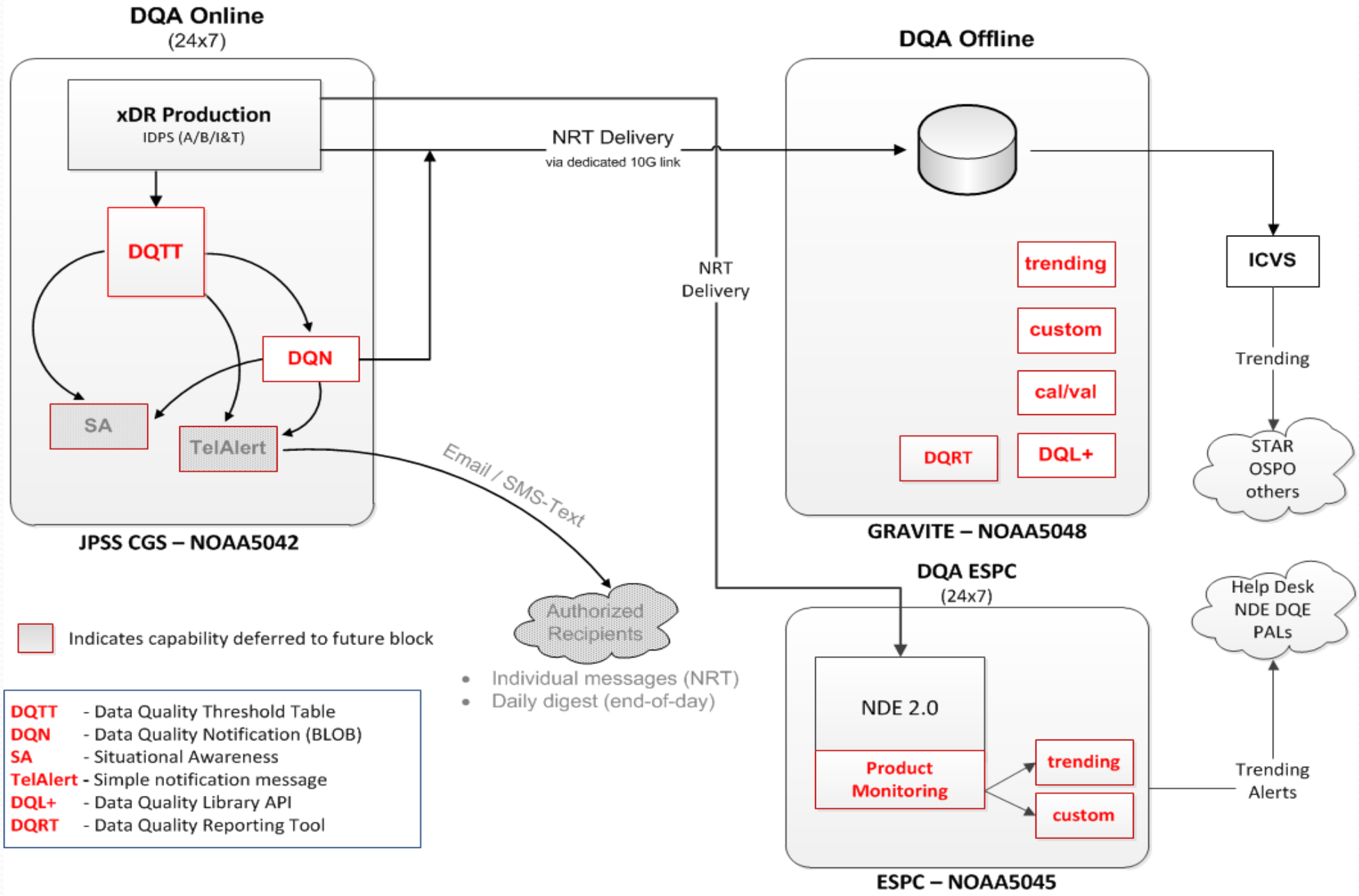
Post PE-2 Handover (migration to Production Zone)

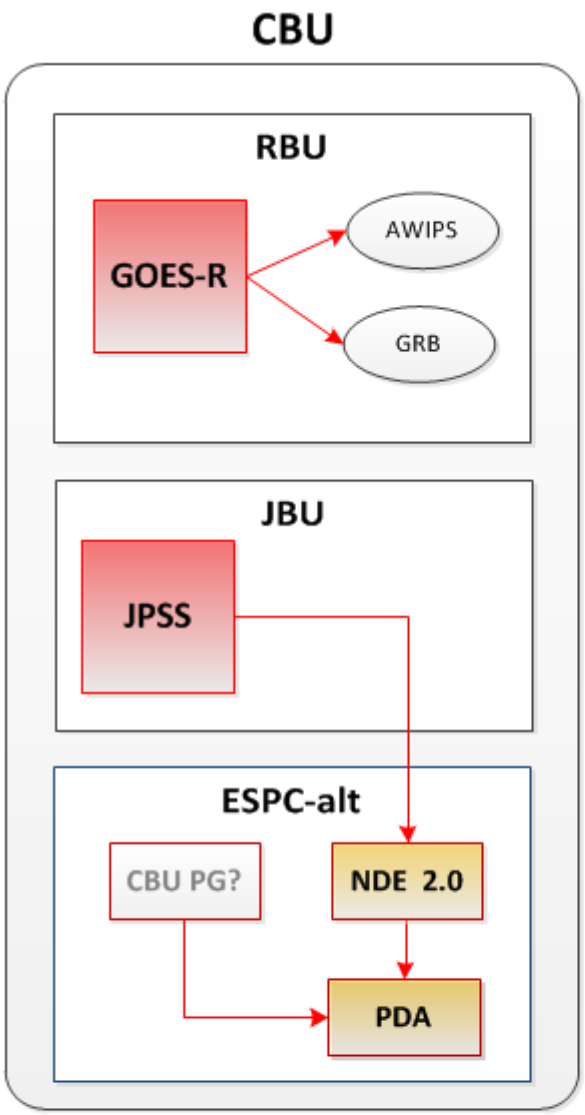


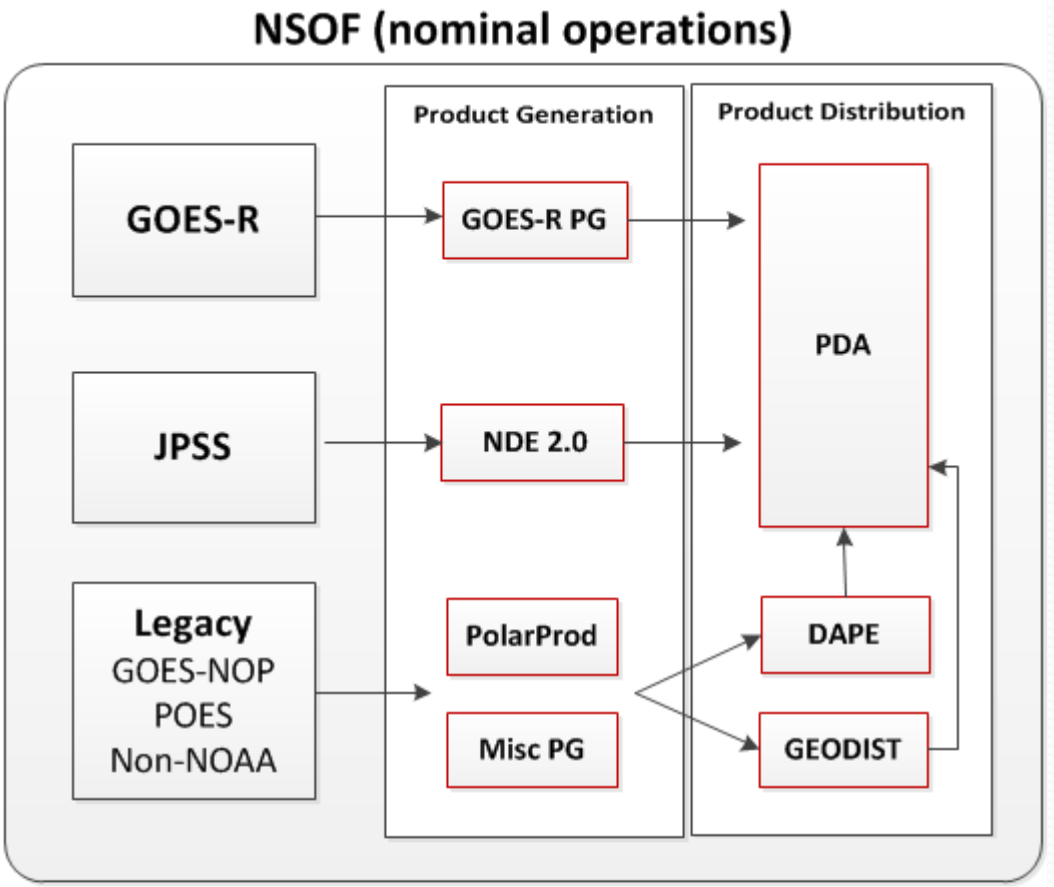
Operational PG/PD Systems

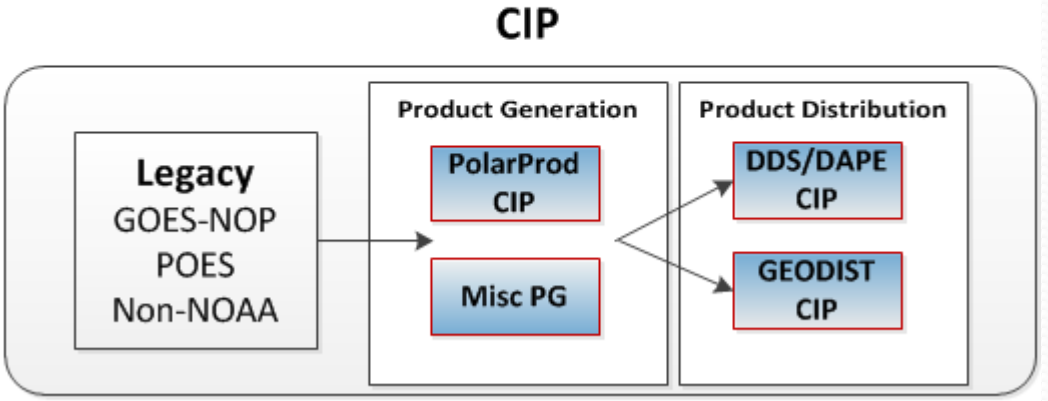
Future Direction

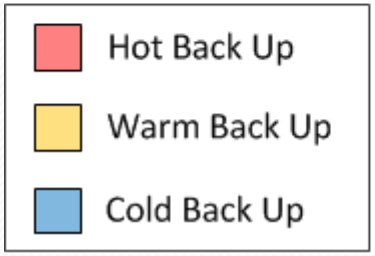
- Data Quality Assurance (DQA)
- PDA – Enterprise Distribution
- Backup Facility (Fairmont, WV)
  - Consolidated Backup (CBU)
- Readiness Activity approach for ground segment upgrade
  - JPSS Block 2.0
  - NDE 2.0 and PDA
- Schedules


DQA Online
(24x7)
xDR Production
IDPS (A/B/I&T)
DQTT
DQN
SA
TelAlert
JPSS CGS – NOAA5042
NRT Delivery
via dedicated 10G link
NRT
Delivery
DQA Offline
trending
custom
cal/val
DQRT
DQL+
GRAVITE – NOAA5048
ICVS
Trending
STAR
OSPO
others
Email / SMS-Text
Authorized
Recipients
Individual messages (NRT)
Daily digest (end-of-day)
DQA ESPC
(24x7)
NDE 2.0
Product
Monitoring
trending
custom
ESPC – NOAA5045
Help Desk
NDE DQE
PALs
Trending
Alerts
Indicates capability deferred to future block
DQTT - Data Quality Threshold Table
DQN - Data Quality Notification (BLOB)
SA - Situational Awareness
TelAlert - Simple notification message
DQL+ - Data Quality Library API
DQRT - Data Quality Reporting Tool

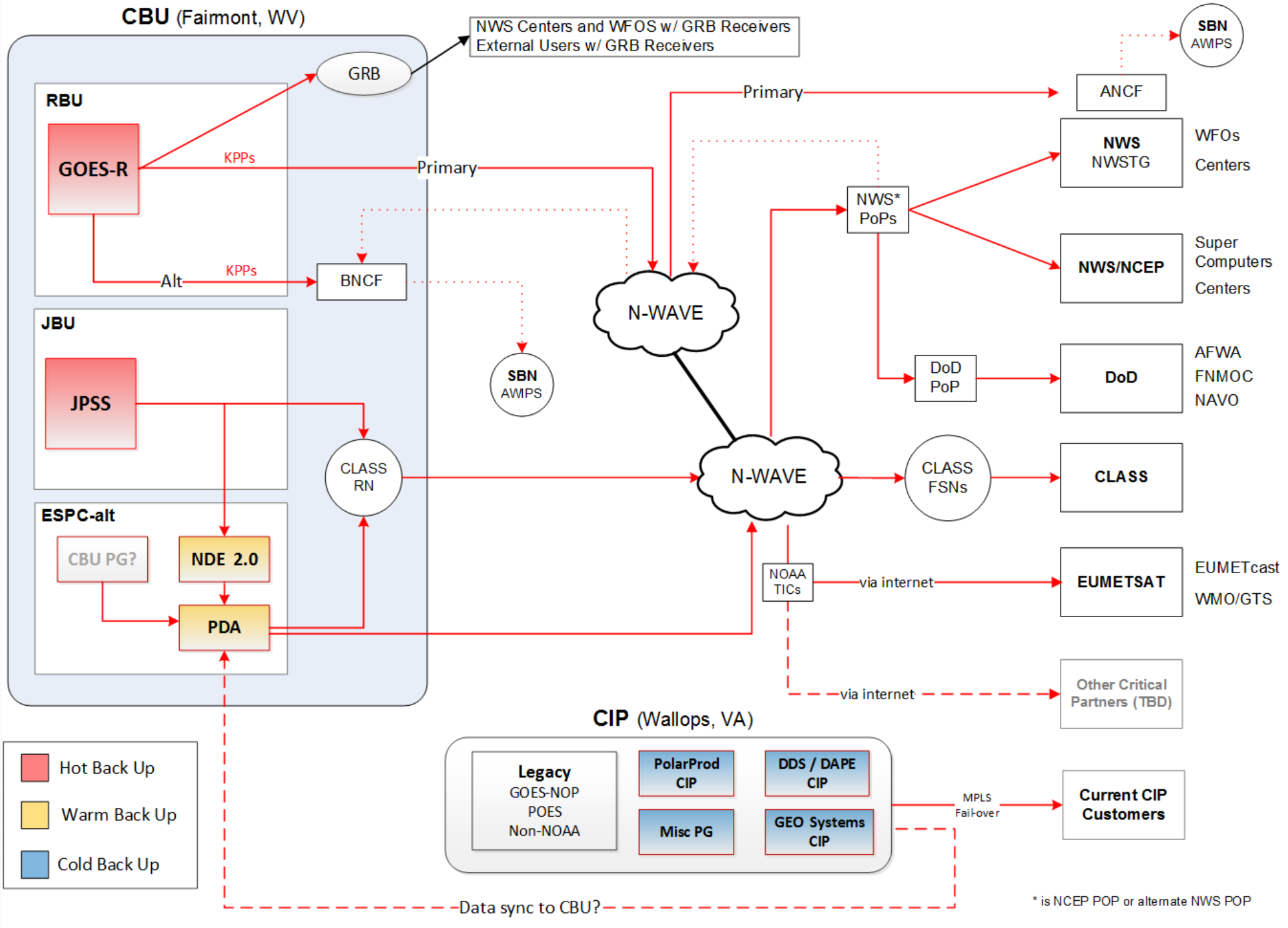


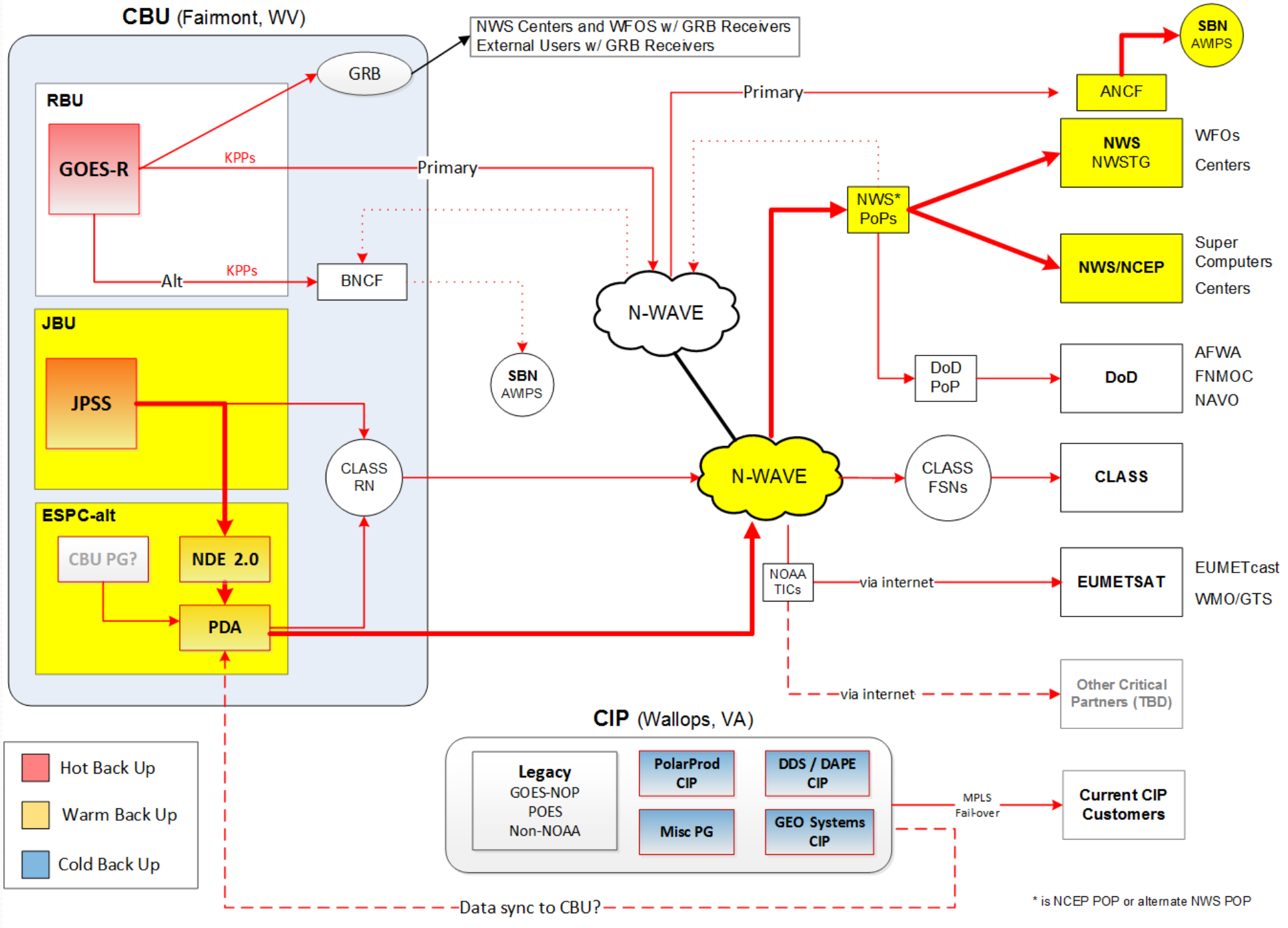






CBU – Consolidated Back Up
RBU – GOES-R Back Up
JBU – JPSS Back Up
CIP – Critical Infrastructure Protection


CBU (Fairmont, WV)
NWS Centers and WFOS w/ GRB Receivers
External Users w/ GRB Receivers
GRB
RBU
GOES-R
KPPs
Alt
KPPs
BNCF
Primary
JBU
JPSS
CLASS RN
ESPC-alt
CBU PG?
NDE 2.0
PDA
SBN AWIPS
N-WAVE
N-WAVE
Primary
ANCF
SBN AWIPS
NWS* PoPs
NWS NWSTG
WFOs
Centers
NWS/NCEP
Super Computers
Centers
DoD PoP
DoD
AFWA
FNMOC
NAVO
CLASS FSNs
CLASS
NOAA TICs
via internet
EUMETSAT
EUMETcast
WMO/GTS
via internet
Other Critical Partners (TBD)
CIP (Wallops, VA)
Legacy
GOES-NOP
POES
Non-NOAA
PolarProd CIP
DDS / DAPE CIP
Misc PG
GEO Systems CIP
MPLS Fail-over
Current CIP Customers
Hot Back Up
Warm Back Up
Cold Back Up
Data sync to CBU?
* is NCEP POP or alternate NWS POP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CBU PG?
NDE 2.0
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SBN AWIPS
N-WAVE
Primary
ANCF
SBN AWIPS
NWS* PoPs
NWS NWSTG
WFOs
Centers
NWS/NCEP
Super Computers
Centers
DoD PoP
DoD
AFWA
FNMOC
NAVO
N-WAVE
CLASS FSNs
CLASS
NOAA TICs
via internet
EUMETSAT
EUMETcast
WMO/GTS
via internet
Other Critical Partners (TBD)
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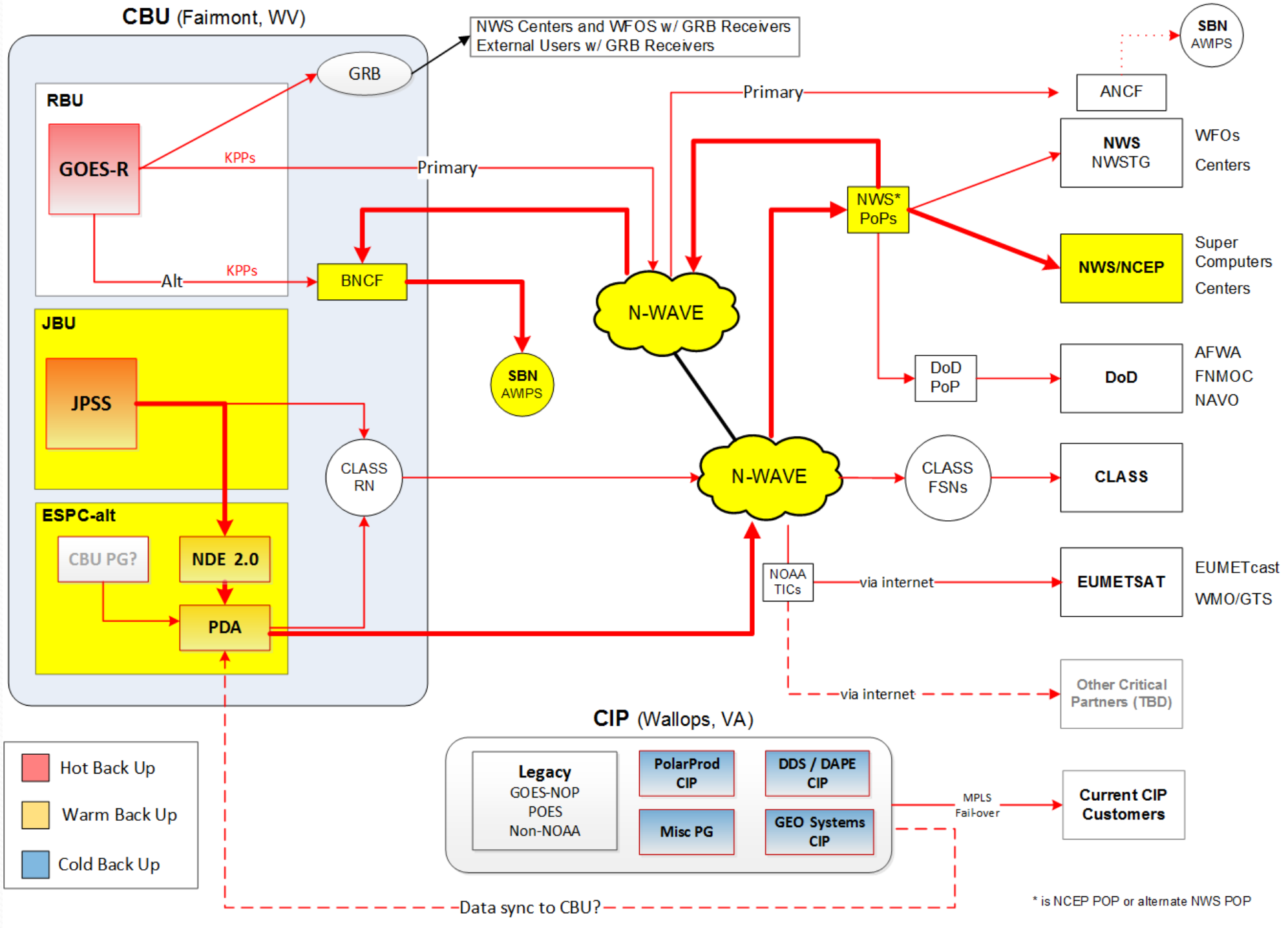
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External Users w/ GRB Receivers
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BNCF
JBU
JPSS
SBN
AWIPS
CLASS
RN
ESPC-alt
CBU PG?
NDE 2.0
PDA
N-WAVE
N-WAVE
Primary
ANCF
SBN
AWIPS
NWS*
PoPs
NWS
NWSTG
WFOs
Centers
NWS/NCEP
Super
Computers
Centers
DoD
PoP
DoD
AFWA
FNMOC
NAVO
CLASS
FSNs
CLASS
NOAA
TICs
via internet
EUMETSAT
EUMETcast
WMO/GTS
via internet
Other Critical
Partners (TBD)
CIP (Wallops, VA)
Legacy
GOES-NOP
POES
Non-NOAA
PolarProd
CIP
DDS / DAPE
CIP
Misc PG
GEO Systems
CIP
MPLS
Fail-over
Current CIP
Customers
Hot Back Up
Warm Back Up
Cold Back Up
Data sync to CBU?
* is NCEP POP or alternate NWS POP

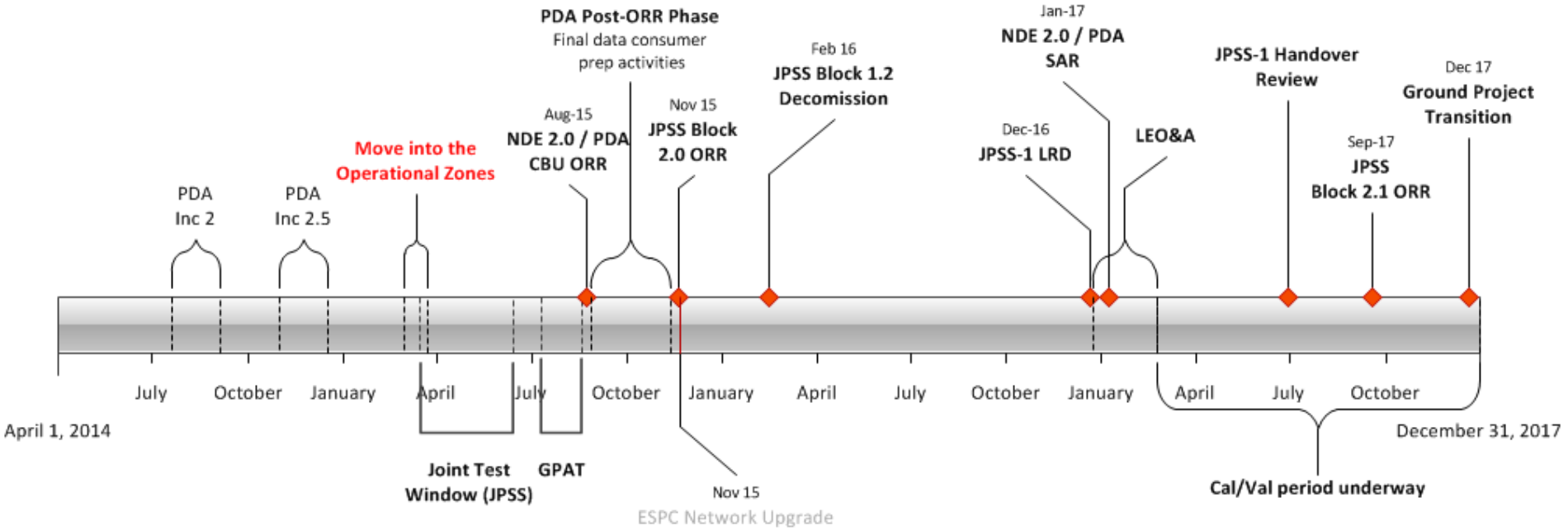
Readiness Activities – Approach

- Primary objective: provide frequent opportunities for external users to test with the systems, when possible.
- Continue outreach and establish training opportunities for all users (via webinars, and/or recorded sessions) on how to use the core and full capabilities of the system.
- Ensure key customers are kept informed of external user interface activation and interface test schedules early on for their planning process (i.e. resource management).
- Potential constraints:
  - resource availability
  - other test commitments (GOES-R, internal testing, etc.)
  - infrastructure (i.e. network bandwidth capacity, etc.)
  - operational priorities (critical weather events and/or other factors)
  - user availability (competing priorities)

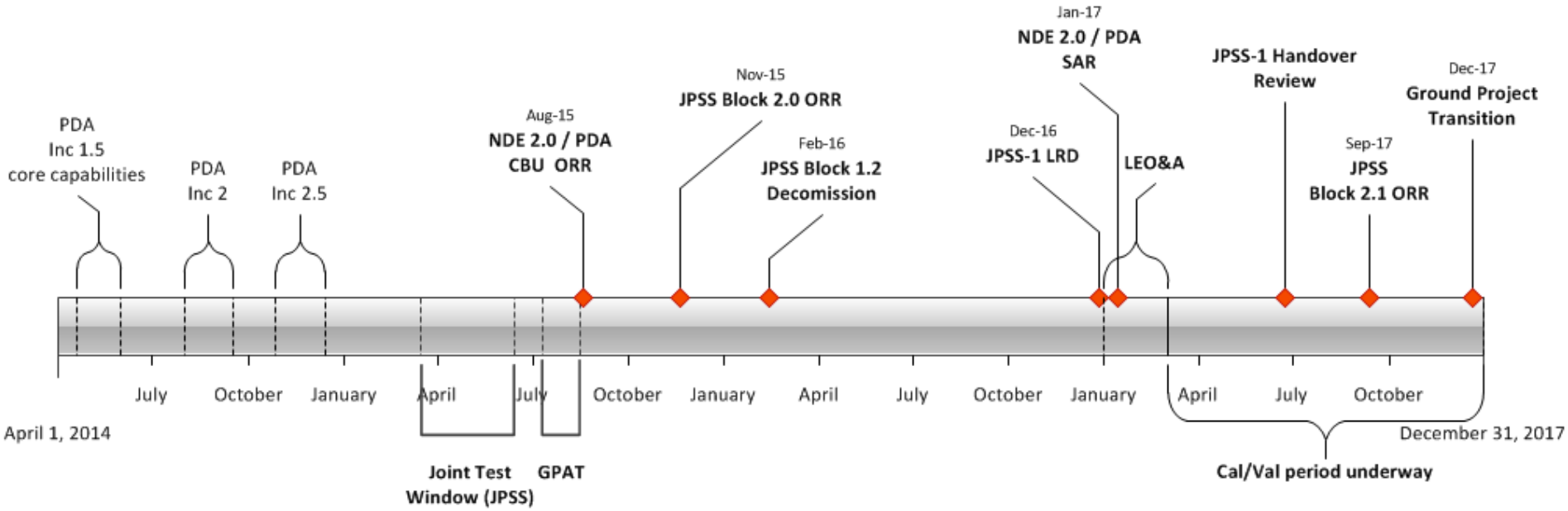
User Change Impact Table

Data Consumer	Ground Segment Upgrade	JPSS-1 Time Period	NSOF → CBU	CBU → NSOF
NWS (AWIPS) - NWSTG - NCF	• interface (PDA) • Data mgmt method • IP/network (user's primary POP)	• xDR changes • cal/val status	• IP/network (alt POP) • Coordinated switching	• IP/network (user's primary POP) • coordinated switching
NWS (NCEP) - WCOSS - Nat'l Centers	• Interface (PDA) • Data mgmt method • IP/network (user's primary POP)	• xDR changes • cal/val status • BUFR changes	• IP/network (alt POP) • Coordinated switching	• IP/network (user's primary POP) • coordinated switching
DoD - AFWA - FNMOC - NAVO	• Interface (PDA) • Data mgmt method • IP/network (user's primary POP)	• xDR changes • cal/val status • PDA DAPE service functionality	• IP/network (alt POP) • Coordinated switching	• IP/network (user's primary POP) • coordinated switching
EUMETSAT	• Interface (PDA) • Data mgmt method • IP/network (TAT)	• xDR changes • cal/val status • BUFR changes	• IP/network (internet) • Coordinated switching	• IP/network (TAT) • coordinated switching
Other vital operational NOAA partners	• Interface (PDA) • Data mgmt method • IP/network (internet)	• xDR changes • cal/val status	• IP/network (internet) • Coordinated switching	• IP/network (internet) • Coordinated switching
All others	• Interface (PDA) • Data mgmt method • IP/network (internet)	• xDR changes • cal/val status • BUFR changes	• Service not available • Directed to 3rd party data rely services	• Service not available Directed to 3rd party data rely services

NSOF PDA I&T (String 2) – becomes the OSPO operational system in 2015



CBU PDA I&T – becomes the CBU operational system in 2015



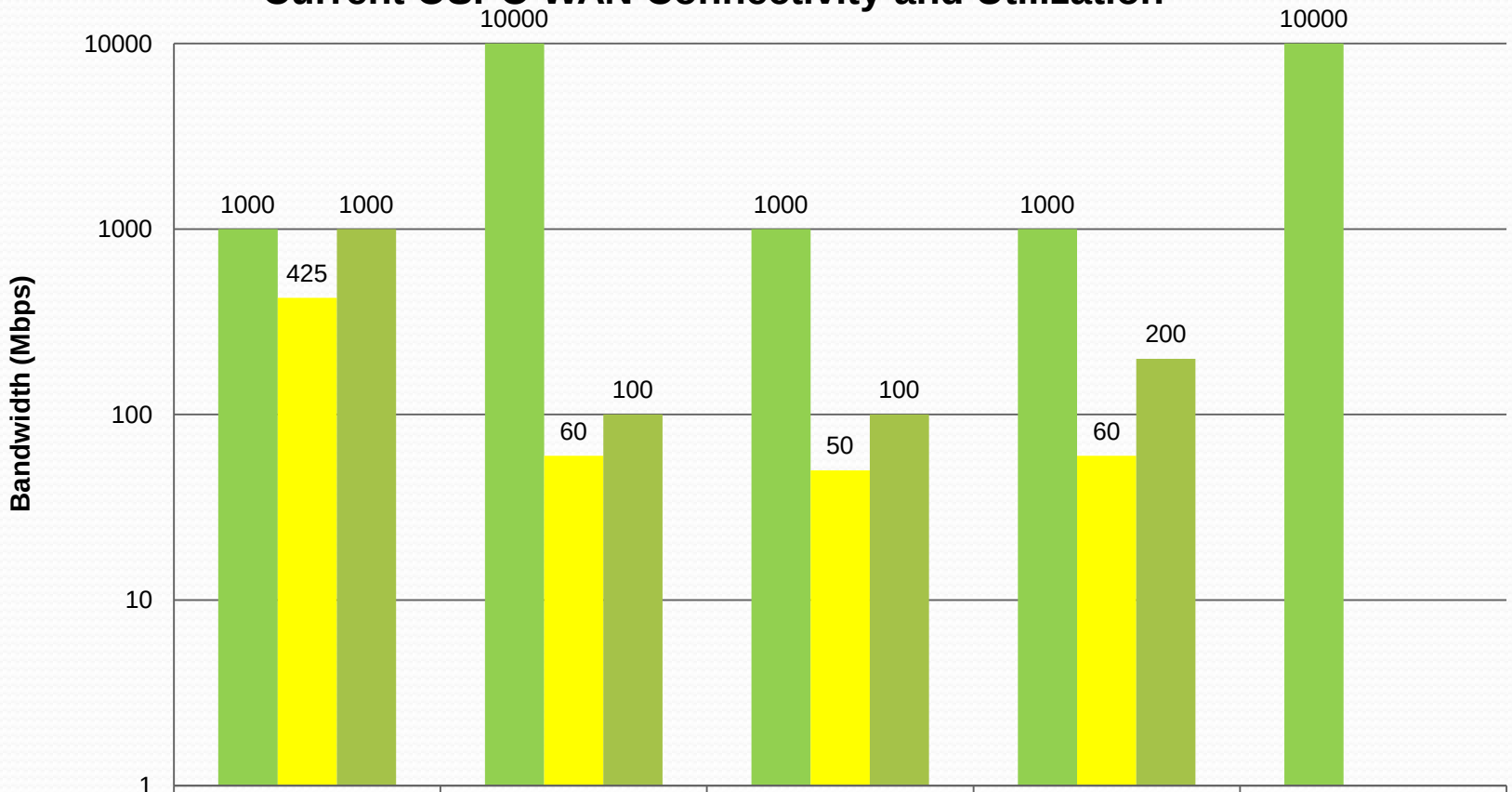
Summary

- The S-NPP NDE 1.0 real-time product generation/distribution system has been operational since Sep 27, 2013 and serving key customers with vital mission needs.
- Future activities:
  - In 2015, there are significant transition / upgrade activities occurring: JPSS Block 2.0, NDE 2.0, PDA and CBU (backup facilty).
- Challenges:
  - Infrastructure constraints (network capacity)
  - Supporting significant transition activities – ESPC, JPSS and GOES-R.

Questions or Comments

Background Slides

Current OSPO WAN Connectivity and Utilization



	NOAA MAN	NCEP PoP	PON (to NCWCP)	NIC	N-WAVE
Full Capacity	1000	10000	1000	1000	10000
Average Utilization	425	60	50	60	0
Spikes	1000	100	100	200	0

External internet traffic to STAR and other authorized partners.

NCEP, NWS & DOD

Does not include IDPS AFWA connection

OSPO/SPSD

10G example

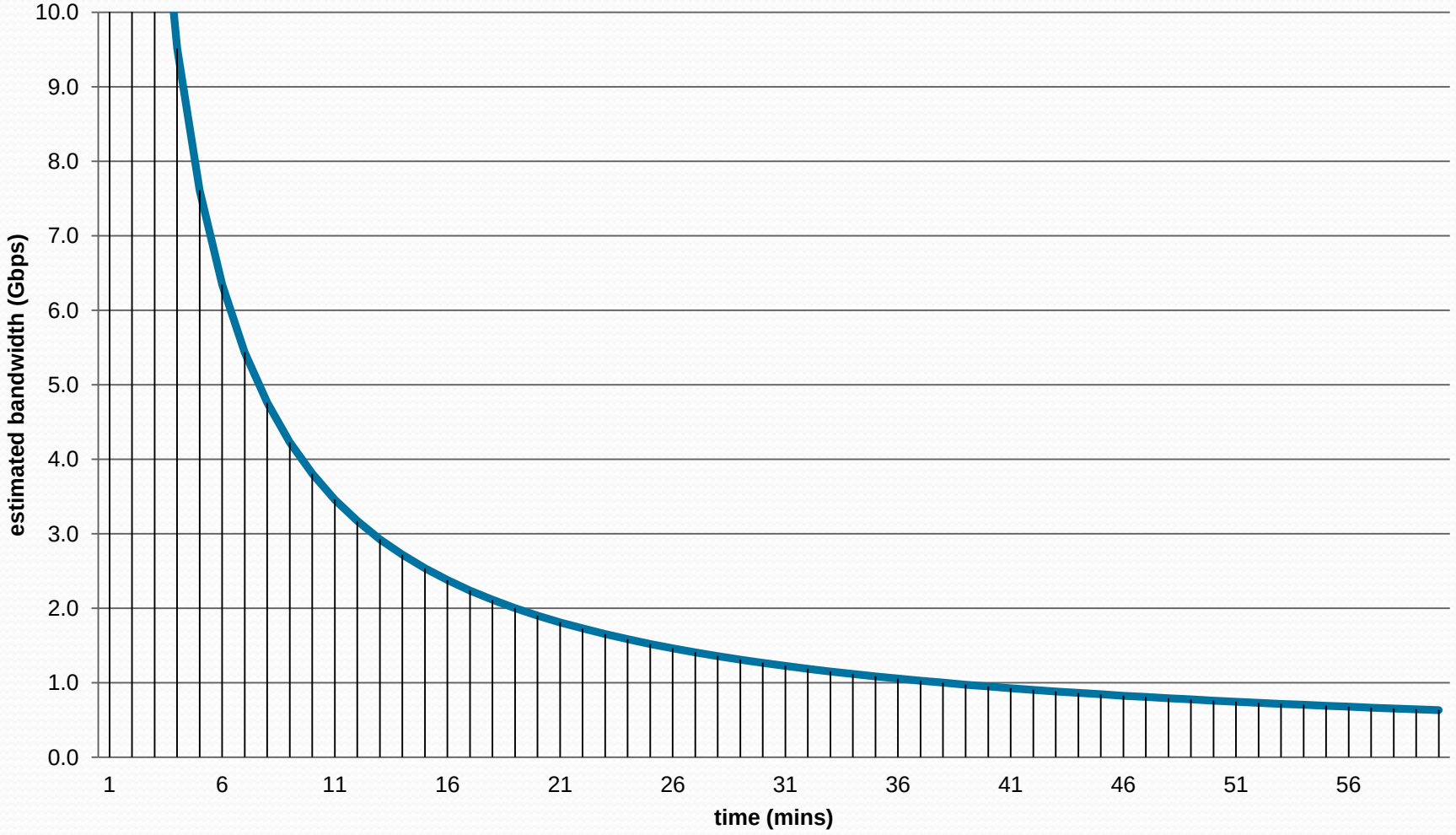


Figure 1. Estimated bandwidth necessary to transfer one full orbit of SNPP data as a function of time. SNPP generates a data volume of approximately 4 TB/day (uncompressed) - equates to approximately 290 GB/orbit . The depicted bandwidth curve is rough estimate (does not include network overhead or contention).

Definition of Hot, Warm and Cold Backup

- Hot Backup - system is fully functional and producing data; data is ready for distribution to end points, but delivery is a suspended activity until it is needed.
- Warm Backup - system is fully functional and standing by in a ready state; minimal routine activity such as synchronizing configurations and other activity may be ongoing within the system to maintain its readiness state.
- Cold Backup - system is functional, requires manual intervention to place it into a mode capable of becoming operational. Full functionality may take several hours or several days before reaching nominal operational capacity.

Example of COOP activation notice to External Users

Subject: Administrative Notification of ESPC CIP Activation:

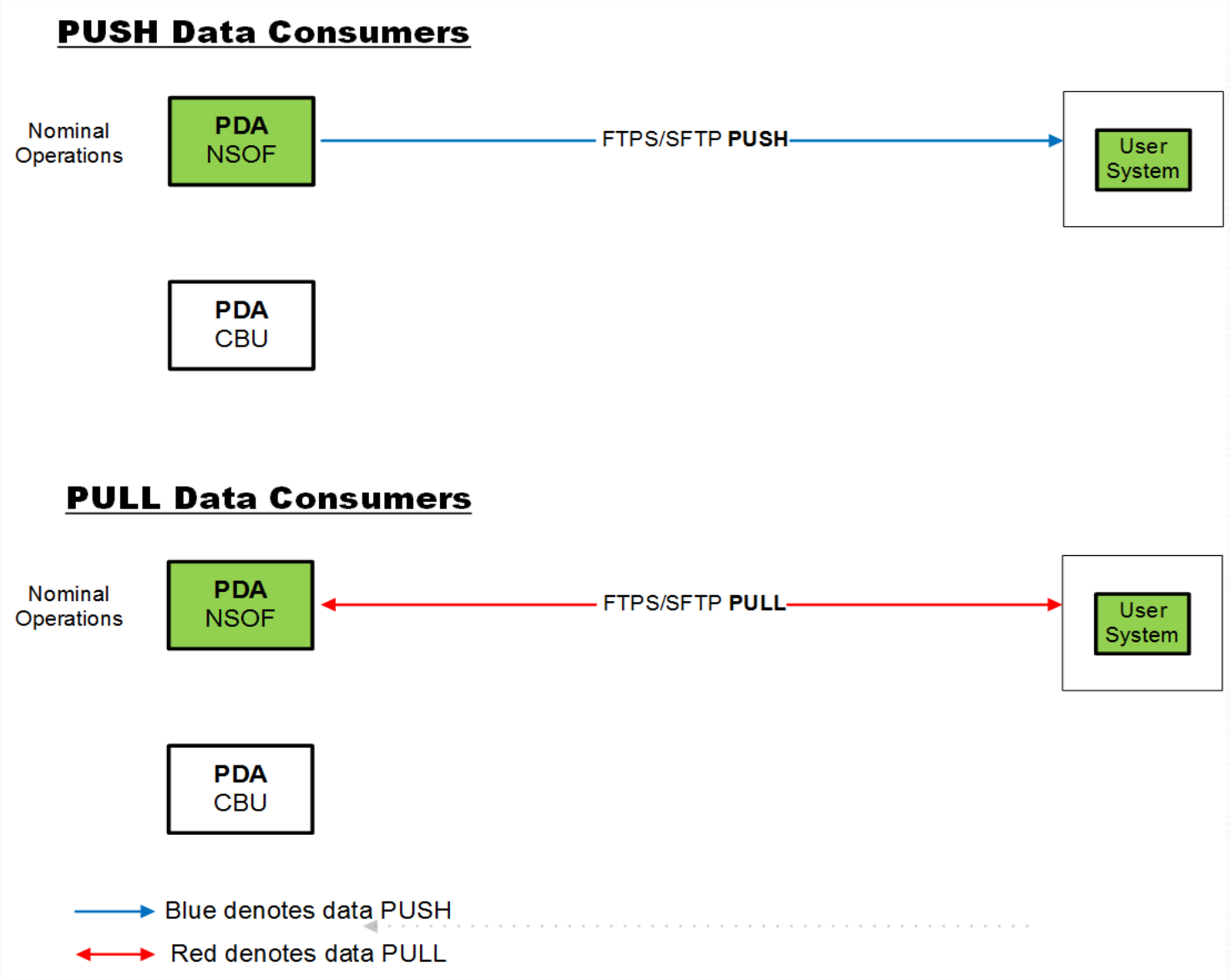
***Topic: *Notification of ESPC CIP Activation**
***Date/Time**: * September 30, 2010 2055 UTC * ***
Product(s) or Data Impacted: *CIP Phase 1-3 Products.*
***Date/Time of Initial Impact: * September 3, 2010 2030 UTC* ***
***Date/Time of Expected End:* Unknown* ***
Length of Outage: *This exercise will not effect normal ESPC data distribution.*
***Details/Specifics of Change: * The ESPC Critical Infrastructure Protection (CIP) site will begin Activating the CIP in support of the Production Zone Network Outage. Products will meet their optimum capability 24 hours after activation.** The CIP site, in Wallops Island, will remain activated until Further Notice.* ***
*** ***

Contact Information for Further Information:
ESPC Operations at ESPCOperations@noaa.gov at 301-817-3880

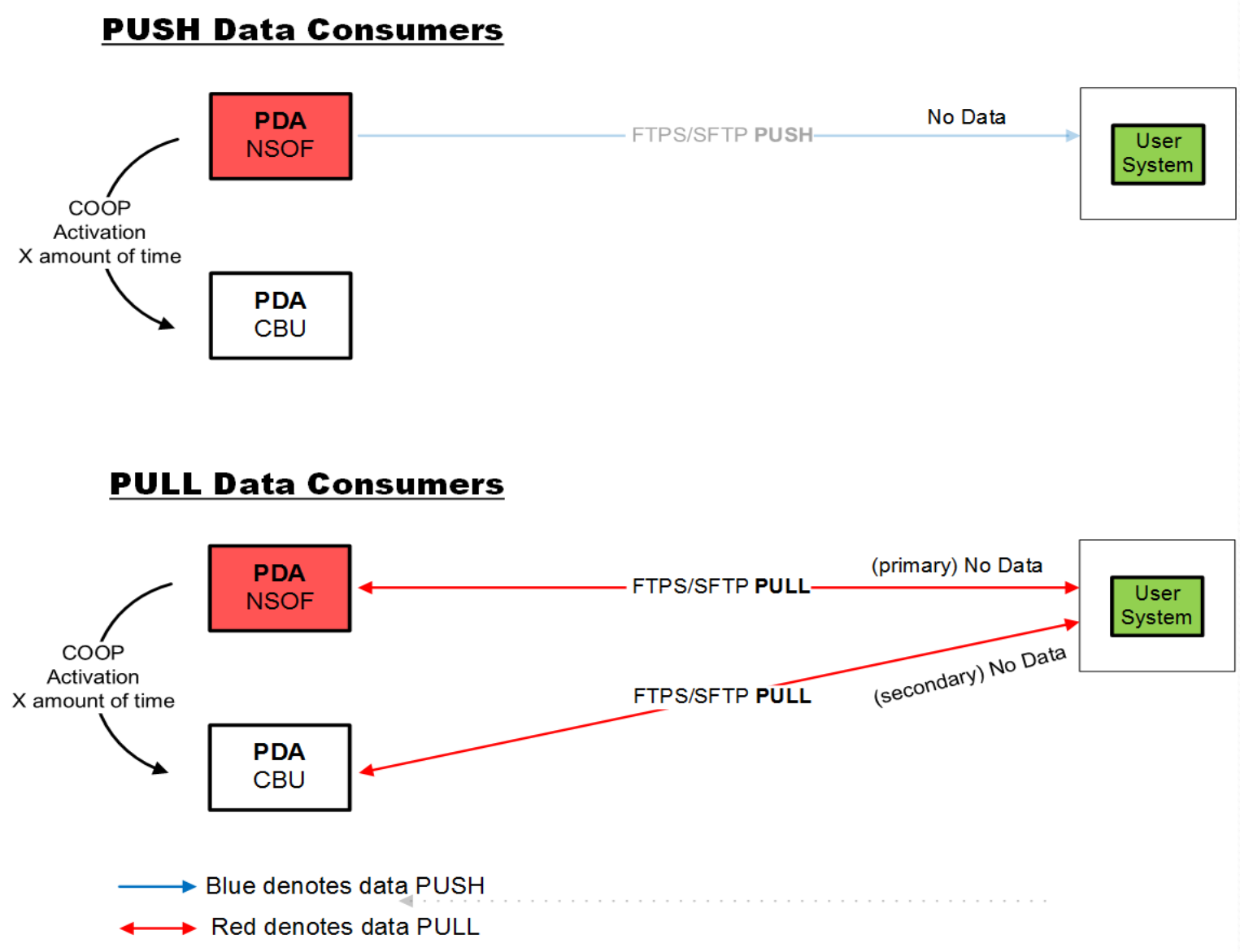
ESPC Notifications (WMO Bulletins):

- **NOUS71 KNES** (AWIPS ID ADANES) for urgent notices (e.g., outages or anomalies).
- **NOUS72 KNES** (AWIPS ID ADMNES) for routine notices.

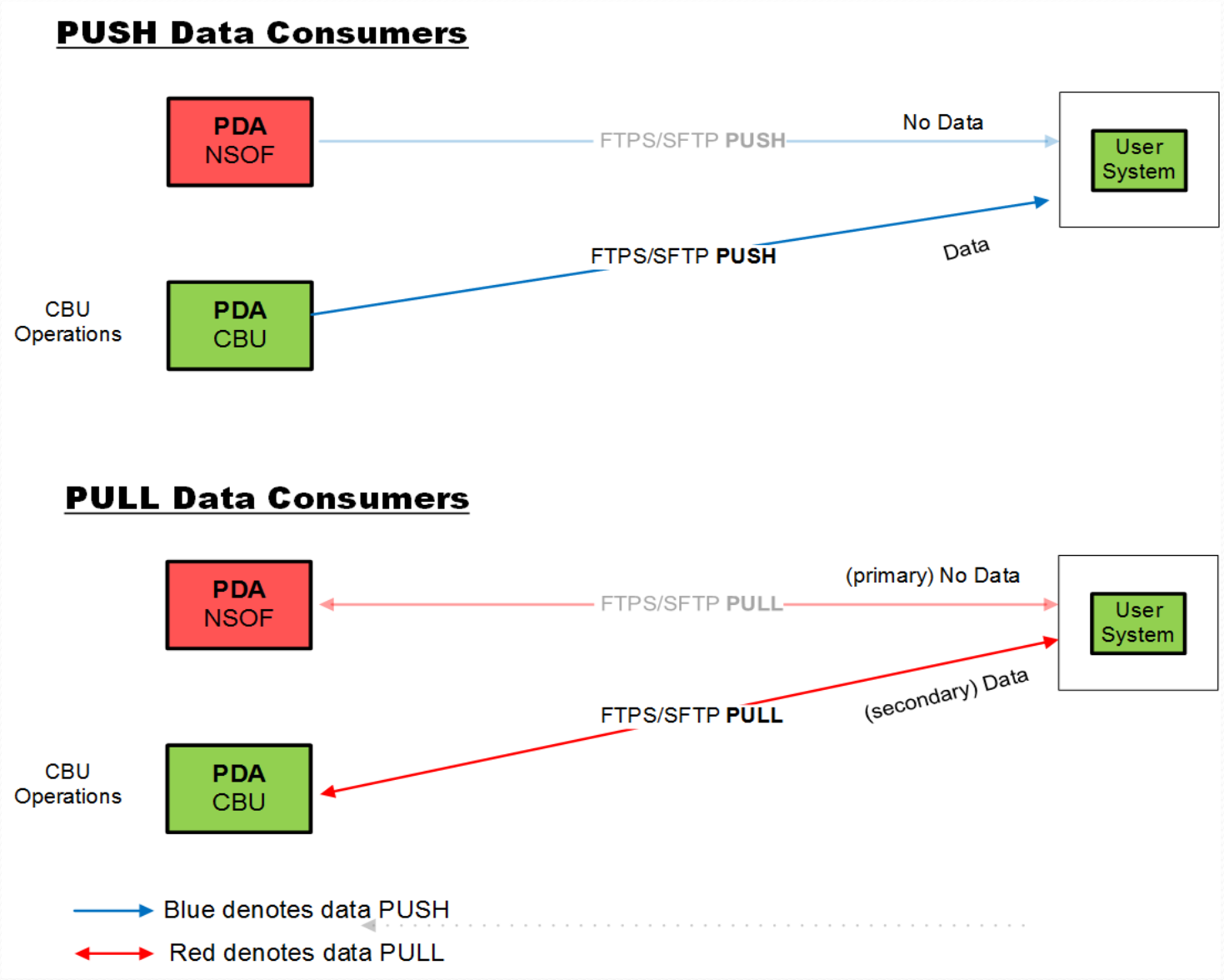
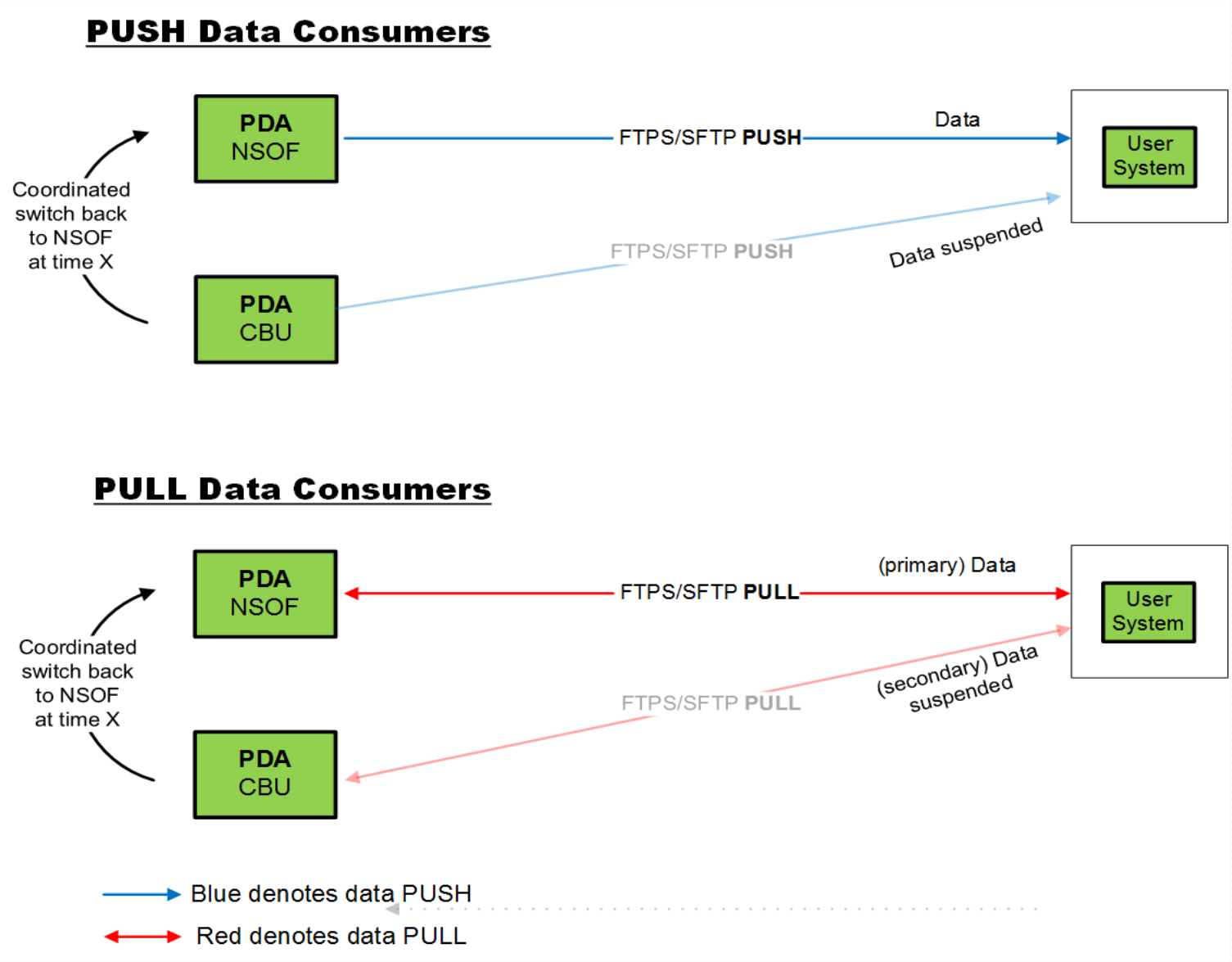
Nominal Operations (NSOF)



Transition of Operations (NSOF → CBU)



CBU Operations



Transition of Operations (CBU → NSOF)