Office of Satellite and Product Operations

Joint Polar Satellite System 2 (NOAA-21)
Product Operations Plan (POP)

Version 1.0
February 2022

Prepared by:

JPSS Data Operations Manager, Office of Satellite Products and Operations (OSPO)

JPSS Product Portfolio Manager, JPSS Ground Segment DPMS

Environmental Satellite Processing Center (ESPC) System Owner, OSPO

OSPO Data Operations Support Team

U.S. Department of Commerce

National Oceanic and Atmospheric Administration

National Environmental Satellite, Data, and Information Service

Office of Satellite and Product Operations

Approval Page

Office of Satellite and Product Operations

Joint Polar Satellite System 2 (NOAA-21) Product Operations Plan (POP)

GROUP: Office of Satellite and Product Operations	GROUP: Joint Polar Satellite System Ground Segment
MCNITT.JAMES.ALLERTON.1041639640 Digitally signed by MCNITT.JAMES.ALLERTON.1041639640 Date: 2022.02.24 13:43:48 -05'00'	Lihang Zhou (affiliate) Digitally signed by Lihang Zhou (affiliate) Date: 2022.02.24 16:26:25 -05'00'
Jim McNitt JPSS Data Operations Manager	Lihang Zhou Data Product Management and Services Deputy and JPSS Product Portfolio Manager

Changes/Revisions Record

This standard operating procedure is changed as required to reflect system, operational, or organizational changes. Modifications made to this document are recorded in the Changes/Revisions Record below. This record will be maintained throughout the life of the document.

Version Number	Date	Description of Change/Revision	Section/Pages Affected	Changes Made by Name/Title/ Organization
1.0	February 2022	First formal issue	All	JPSS Data Operations Manager and Data Operations Support Team

Table of Contents

1. Introduction

1.1. Background

Within NOAA's National Environmental Satellite, Data, and Information Service (NESDIS), the Joint Polar Satellite System (JPSS) Program and Office of Satellite and Product Operations (OSPO) work together to transition new JPSS series satellites to operations.

OSPO's Environmental Satellite Processing Center (ESPC) serves as the near real-time data center that ingests, processes and distributes environmental satellite data products and information from NOAA and non-NOAA managed satellites. OSPO's ESPC serves as the civilian interface for data access for both government agencies and international partners. Additionally, ESPC distributes near real-time data to authorized academic institutions and commercial enterprises. The ESPC systems for product generation and product distribution are the NOAA Data Exploitation (NDE) and Product Distribution and Access (PDA).

The JPSS series of satellites consists of Suomi National Polar-orbiting Partnership (S-NPP), NOAA-20, JPSS-2, JPSS-3, and JPSS-4.[1] The JPSS satellites provide critical environmental data collection required by the nation to monitor real-time weather events and for inclusion into numerical weather prediction to improve accuracy and reduce uncertainty in medium range forecasts. The fly-out charts are available at: https://www.nesdis.noaa.gov/current-satellite-missions/currently-flying

JPSS-2 will be renamed NOAA-21 after the satellite reaches its orbit. Preparations for NOAA-21 data product operations include the test activities described in the JPSS-2 Product Test Plan (PTP) and NOAA Center for Satellite Applications and Research (STAR) preparation of the NOAA-21 calibration and validation (Cal/Val) plans and delivery of updated JPSS-2 product algorithms to JPSS Ground Segment's Data Product Management and Services (DPMS) for implementation in the Interface Data Processing Segment (IDPS). IDPS generates the Mission Unique Products and distributes the products to the ESPC, Cal/Val teams, and NOAA's archive. OSPO is planning to generate and distribute NOAA-21 products to operational users through the ESPC.

1.2. Purpose

The purpose of this document is to describe the work required to process and distribute NOAA-21 data products during Launch, Early Orbit & Activation (LEO&A) and after handover to OSPO for nominal operations. The plan provides the timeline and roles and responsibilities for transitioning NOAA-21 products to the ESPC operations environment, including Cal/Val.

1.3. Scope

The scope of the JPSS-2 POP includes the JPSS data product workflow and the systems that support the workflow. The JPSS workflow described in this plan is the sequence of processes that generate and distribute JPSS products. This document describes the management of the JPSS product distribution

1 https://www.jpss.noaa.gov/mission_and_instruments.html

by OSPO ESPC during LEO&A and after handover until NOAA-21 is designated the primary JPSS satellite, and all NOAA-21 products reach at least the Provisional maturity level.[2] The product maturity stages are listed in Appendix A.

The primary goal during this period will be to process and distribute the following:

- NOAA-21 Key Performance Parameter (KPP)[3] products to the National Weather Service National Centers for Environmental Prediction (NCEP).
- Available NOAA-21 data products to the NOAA STAR Cal/Val teams.
- Beta-level NOAA-21 products to authorized users.
- Provisional-level NOAA-21 products to operational users.

The following users are authorized for early access to Beta-level NOAA-21 products: Fleet Numerical Meteorology and Oceanography Center (FNMOC), US Air Force 557th Weather Wing (WW), National Weather Service (NWS) Advanced Weather Interactive Processing System (AWIPS), and NWS AWIPS-Data Delivery (DD). FNMOC and 557th will need to access the NDE/PDA I&T environment in order to receive NOAA-21 products prior to NOAA declaring NOAA-21 operational.

The secondary goal will be to distribute the following:

- S-NPP KPP products to NCEP and other Numerical Weather Prediction (NWP) centers to support the evaluation of NOAA-21 KPP products, calculate bias errors, and tune the data assimilation and forecast modeling systems.
- S-NPP products to STAR to support the NOAA-21 Cal/Val activities as described in the Cal/Val plans. The Cal/Val plans are located at: https://www.star.nesdis.noaa.gov/jpss/Docs.php

Minimum system success of the JPSS requires all four performance attributes identified as KPPs listed below to be met for one set of products. KPPs are those polar system capabilities that if they cannot be met, would compromise NOAA's weather mission to provide essential warnings and forecasts to protect lives and property, and would be cause for program reevaluation or cancellation. Per the JPSS Level 1 Requirements Document (L1RDS)[4], the JPSS KPPs are:

- Advanced Technology Microwave Sounder (ATMS) Temperature Data Records (TDRs)
- Cross-track Infrared Sounder (CrIS) SDRs
- For latitudes greater than 60ºN in the Alaskan region, Visible Infrared Imaging Radiometer Suite (VIIRS) Imagery Environmental Data Record (EDR) at 0.64µm (I1), 1.61µm (I3), 3.74µm (I4), 11.45µm (I5), 8.55 µm (M14), 10.763 µm (M15), 12.03 µm (M16), and 0.7 µm Near Constant Contrast (NCC) EDR.
- 87-minute data latency for the ATMS TDRs, CrIS SDRs and the VIIRS Imagery EDR channels specified above.

2 Primary Satellite: For polar-orbiting operational satellites, the primary satellite designation indicates that the satellite and KPP sensors have been capitalized by NOAA, the KPP products have been validated to a level of maturity which allows their operational use, users are ready to use KPP products operationally, and all IT systems required to acquire, process and distribute KPP products have an Authorization to Operate.
3 KPPs are defined in the JPSS Level 1 Requirements (L1RDS) - J2 Follow-On Final
4 https://www.jpss.noaa.gov/assets/pdfs/technical_documents/L1RD.pdf

During the LEO&A period the emphasis will be on getting the NOAA-21 KPP products to the Provisional maturity level and promoted to ESPC Ops. During the post-handover period, the emphasis will be to process and distribute in near-real time, products in ESPC Ops that have reached provisional maturity and have been declared operational. NDE and PDA are scoped to generate Level 2 products and distribute products from two JPSS satellites only. If three JPSS satellites are on-orbit and providing observational data after the LEO&A of JPSS-2 (NOAA-21), operational generation of Level 2 products and distribution of all products from S-NPP will be suspended after OSPO declares NOAA-21 operational and the NOAA-21 KPP products reach Provisional and are approved for operations. The IDPS will process and distribute products from three JPSS satellites to CLASS, GRAVITE, and NDE/PDA. This plan does not describe how S-NPP data products will be generated and distributed to support the NOAA-21 transition. NESDIS's Office of Systems Architecture and Advanced Planning (OSAAP) is investigating the use of the GOES-15 and S-NPP Spacecraft (after the launch and checkout of GOES-T and JPSS-2) and is leading the Legacy Satellites Integrated Product Team (IPT).

1.4. Assumptions

1.4.1. JPSS-2 Product Test Plan (PTP) objectives met prior to launch

The JPSS-2 Product Test Plan (PTP) lists the following objectives:

- KPP products operational by L+90 days (same as NOAA-20).
- All NDE/PDA EDRs transition to operations faster than NOAA-20. To facilitate this, all "JPSS-2-ready" EDR algorithms should be integrated into the NDE I&T string in time for the various test events outlined in this test plan
- All IDPS sensor and temperature data records from OMPS and VIIRS (not covered in Objective 1) transition to operations faster than NOAA-20

The PTP also lists the Cal/Val group objectives deemed necessary to verify the functionality of all science data products pre-launch and describes how to best meet those objectives pre-launch test objectives. The Cal/Val objectives are:

- Deliver all JPSS-2 (NOAA-21) specific SDR, TDR, and EDR algorithms, including any changes needed to meet geolocation requirements, nine months prior to JCT 3 for incorporation into their respective ground processing systems
- Participate in a minimum two end-to-end (E2E) JPSS-2 test data flows (including JCTs) from the satellite down to all Cal/Val Group members to verify functionality of the system and algorithms prior to launch
- Support STAR Science Team requests for specific specialized data sets via the JPSS-2 Test Data and Tools Working Group (TD&TWG) test data request process

For planning purposes, we assume those CAl/VAl objectives will be met prior to the NOAA-21 launch.

1.4.2. JPSS Constellation Orbit

The current plan is to place NOAA-21 a quarter orbit ahead of S-NPP. The three observatories will stay in this configuration with NOAA-20 leading until NOAA-21 is declared primary for the 1330 LTAN. After NOAA-21 is designated primary, the operations team will move NOAA-20 forward to

give NOAA-21 and NOAA-20 the required half orbit separation.

Figure 1. Planned JPSS Constellation

At launch plus 3 months (L+3) satellites assignments are expected to be:

- Primary: NOAA-20
- Secondary: S-NPP
- Tertiary: NOAA-21

At L+x (month determined in advance, when NWS NCEP Central Operations (NCO) is ready to assimilate the J-2 data in the modeling system) satellites assignments are expected to be:

- Primary: NOAA-20
- Secondary: NOAA-21
- Tertiary: S-NPP

At about launch plus 9 to 12 months (L+9-12) satellites assignments are expected to be:

- Primary: NOAA-21
- Secondary: NOAA-20
- Tertiary: S-NPP

1.4.3. JPSS Level 2 product generation migrating to the Cloud

Currently, NESDIS is planning to transition OSPO's JPSS and Global Change Observation Mission 1st - Water (GCOM-W) product generation capabilities to the NESDIS Common Cloud Framework (NCCF), in coordination with the ongoing Legacy Migration. The NCCF will implement an interface with IDPS in the Cloud to receive JPSS satellite data. The NESDIS Cloud Program Management Office is working with the NESDIS Product Portfolio Management Team and STAR to prepare a schedule based on the delivery schedule for the Cloud containerized Enterprise algorithms. The current schedule is to deliver a Minimally Viable Product (MVP) to ingest and generate S-NPP, NOAA-20, and GCOM-W Level 2 products in the NCCF by Q4 FY2022. The NCCF is described in Appendix F.

1.4.4. JPSS product distribution migrating to the Cloud after FY2025

OSPO's JPSS product distribution capability will start migrating to the Cloud in FY2023 and the migration is expected to be completed in FY2025. For the purpose of the plan, the on-premise PDA

will remain the primary access node for operational users who require near-real-time JPSS data products until after NOAA-21 is designated the primary satellite.

1.4.5. OSPO plans to remove S-NPP products from ESPC Ops

When OSPO declares the NOAA-21 satellite operational and the NOAA-21 KPP products reach Provisional and are approved for operations, then the following activities are planned to occur:

- S-NPP products will be moved off the ESPC (NDE and PDA) Ops environment and onto the Integration & Test (I&T) environment. At that point S-NPP VIIRS data products will no longer flow to Okeanos which is the legacy ocean color product generation system at OSPO.
- ESPC will then transition the NOAA-21 products from I&T to Ops. At that point, only the NOAA-20 and NOAA-21 products will be distributed through PDA Ops.

1.4.6. S-NPP becomes tertiary when NOAA-21 is declared operational and NWS is assimilating NOAA-21 data

OSPO will continue to operate the S-NPP satellite after the NOAA-21 satellite is declared operational and NWS NCEP is assimilating NOAA-21 KPPs at its NCO. OSPO plans to operate the S-NPP satellite at least until NOAA-21 is designated the primary satellite, as no formal guidance to decommission S-NPP has been provided. Note that S-NPP was designed to support controlled reentry at the end of its mission life. OSPO can command propulsive maneuvers to lower the orbit perigee to approximately 50 km and target any surviving debris for open ocean entry. Due to resource constraints at OSPO the S-NPP spacecraft will be operated at a lower priority than the primary and secondary satellites. The S-NPP VIIRS Lunar Roll for VIIRS calibration activities will need to be scheduled in such a way that it does not interfere with the primary and secondary satellite operations.

1.4.7. IDPS will continue to process S-NPP Level 1b products

IDPS will continue to process S-NPP Level 1b products and distribute the products to Government Resource for Algorithm Verification, Independent Test, and Evaluation (GRAVITE) for distribution to the STAR Central Data Repository (SCDR), and to Comprehensive Large Array-Data Stewardship System (CLASS), for archive.

- After NOAA-21 is declared operational, IDPS Ops will not distribute the S-NPP products to NDE/PDA Ops, therefore the S-NPP Level 1b products generated on IDPS will not be distributed to operational users through PDA. S-NPP VIIRS L1b will come into STAR via SCDR, the STAR Central Data Repository. IDPS Ops will distribute S-NPP products to CLASS.
- IDPS I&T will temporarily (for about one month) distribute S-NPP products to NDE I&T.

1.5. Constraints

1.5.1. NDE, PDA, and CLASS capacity designed, sized, and built for two JPSS satellites

OSPO's ESPC capacity was designed and built for two JPSS satellites. The ESPC systems (NDE and PDA) inherited the two-JPSS satellite requirement from the JPSS Program and are only sized for a capacity of two JPSS satellites. The ESPC System Owner stated that there is no margin available to

support three JPSS series satellites in the ESPC Ops environment. CLASS capacity was also designed and built for two JPSS satellites.

Hosting S-NPP products at a desired operational level for an extended period on I&T could negatively impact other mandated ESPC activities: security patching, algorithm testing/fixes, and sustainment activities. This could negatively impact all products generated and distributed in the ESPC.

OSAAP is investigating the use of the GOES-15 and S-NPP Spacecraft (after the launch and checkout of GOES-T and JPSS-2) for a Guest Investigator research program using the data. It is likely that this plan will need to be updated when OSAAP completes the study.

2. Referenced Documents

a. JPSS Level 1 Requirements - J2 Follow-On Final L1RDS
https://www.jpss.noaa.gov/assets/pdfs/technical_documents/L1RD.pdf
b. JPSS Ground System Concept of Operations, Rev F
c. Joint Polar Satellite System – 2 (JPSS-2) Product Test Plan (PTP), 474-01598, Revision - Joint Polar Satellite System (JPSS) Code 474
d. Joint Polar Satellite System (JPSS) Environmental Satellite Processing Center (ESPC) Requirements Document (JERD), Volume 1
https://www.jpss.noaa.gov/assets/pdfs/technical_documents/JERDV2_Version_3_Updated_11292019-mcl-FinalDRAFT-mcl.pdf
e. Environmental Satellite Processing and Distribution System (ESPDS) Development Enterprise System Requirements Document (ESRD), Version 2.3
f. JPSS Ground Segment Data Product Specification, JPSS-REQ-1009, Effective: 17 March 2016, Version: 1.0
https://www.jpss.noaa.gov/assets/pdfs/technical_documents/JPSS-REQ-1009_GSegDPS_Version_1.3_Sept-7-2018-update.pdf
g. JPSS Common Data Format Control Book – External, Volume I - Overview
https://www.jpss.noaa.gov/sciencedocuments/sciencedocs/2015-06/474-00001-01_JPSS-CDFCB-X-Vol-I_0124D.pdf
h. NESDIS Memo: Transition to NESDIS Common Cloud Framework (NCCF), April 2021
i. The Suomi National Polar Orbiting Partnership (S-NPP) Data Exploitation (NDE) Algorithm Change Management Process (ACMP) Handbook, Version 1.0, September 2020
j. JPSS Algorithm Change Management Plan
k. JPSS-2 Flight Transition Plan (Draft)
l. Cloud Computing Lexicon and Related Terms
m. NESDIS Level Requirements, NESDIS-REQ-1001.1 (2020)

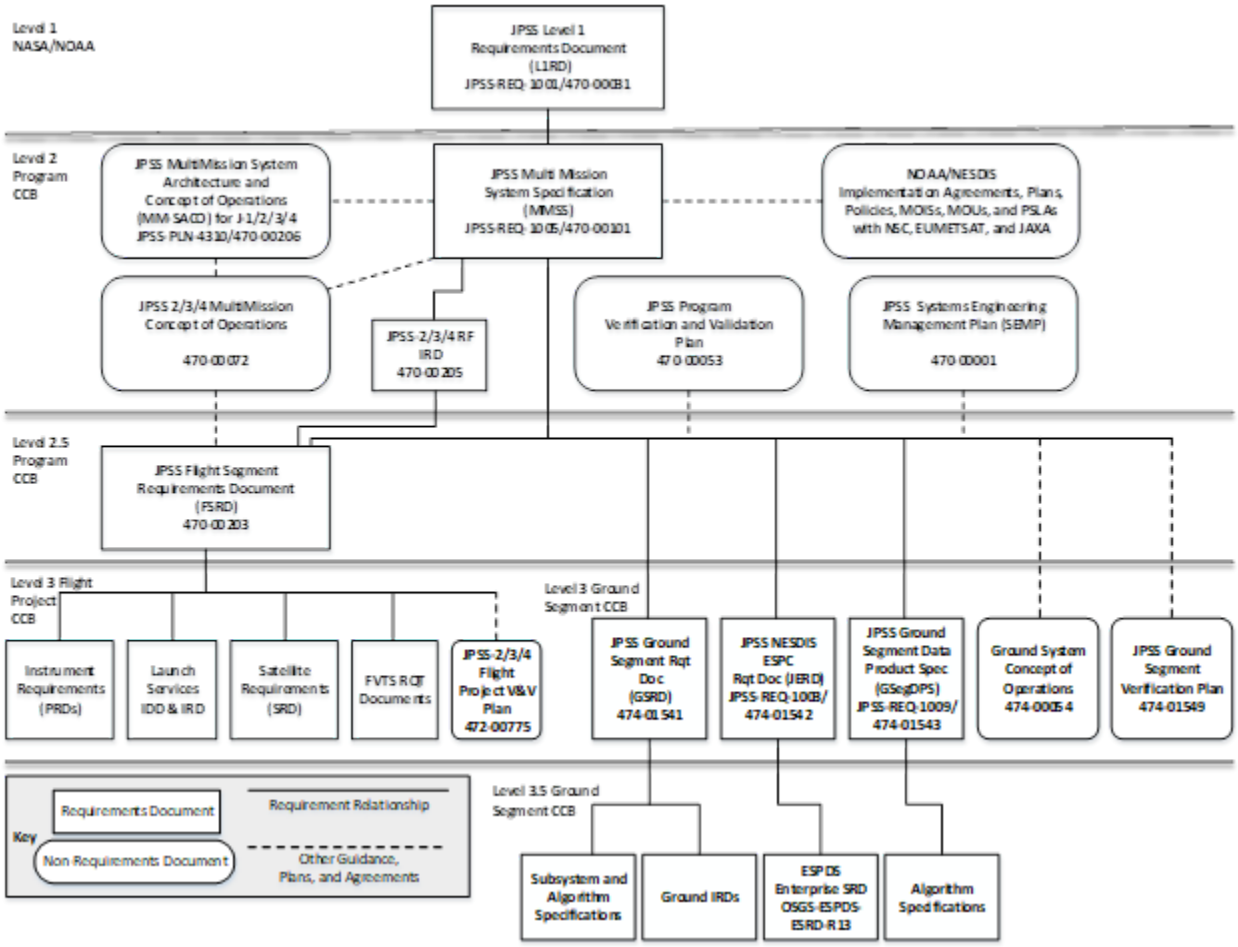


Figure 2. JPSS Requirements Document Hierarchy

3. Overview of JPSS Product Management

The Satellite Products and Services Review Board (SPSRB) is responsible for the oversight and guidance necessary to effectively manage the product life cycle process from product development, transition into operations, enhancements and retirement.

The SPSRB process relies upon appointed individuals to execute the functions of SPSRB positions, working groups, or advisory boards. SPSRB Executive Board: Co-chaired by the NESDIS STAR and OSPO Directors. The NESDIS STAR, OSPO, and Office of Satellite Ground Services (OSGS) Office representatives comprise the voting members. Interested observers include National Centers for Environmental Information (NCEI), NWS, National Ocean Service (NOS), National Marine Fisheries Service (NMFS), Oceanic and Atmospheric Research (OAR), OSAAP, JPSS, GOES-R, and program scientists. The SPSRB Executive Board meets as needed to review and approve new processes and policies. The board also provides guidance on how to address outstanding SPSRB issues. SPSRB: Co-chaired by the OSPO SPSD Chief and STAR management. The SPSRB provides a forum for NESDIS offices and stakeholders to monitor the progress of product development, approve new

products going into operations, and approve retirements and divestitures of operational requirements. The SPSRB membership is composed of representatives from NESDIS offices and user organizations. The SPSRB also provides satellite product development guidance and policy.

NESDIS is currently going through a number of changes related to Product Portfolio Management. Per the FY19 IT Summit guidance, NESDIS is planning and funding science product Transition to Operations (T2O) projects with an emphasis on continuity and sustainment of products and algorithms. In May 2020, the NESDIS Executive Council approved the establishment of the Product Portfolio Management (PPM) team to lead the FY21 Data Agnostic Common Services (DACS) Management Demonstration. The PPM team will oversee management of the algorithm portfolios from formulation through retirement. The PPM team manages the NOAA L2+ products (e.g. EDRs), but not the RDRs and SDRs. The PPM Team also manages the non-NOAA products. The PPM is responsible for oversight of development and implementation of science algorithm projects in order to maintain product quality and performance while leveraging continuous science improvement. The PPM Team will ensure effective integration of data from applicable data sources and retirement of old sources. The JPSS PPM is a member of the PPM Team. The SPSRB processes are evolving to keep pace with these ongoing changes within NESDIS.

4. NOAA Satellite Product Processing and Distribution Capabilities

4.1. Current Capabilities

4.1.1. Satellite Downlink and Stored Mission Data Handling

Once per orbit, the S-NPP Stored Mission Data (SMD) is downlinked through a 300 Mbps X-band link and acquired by a JPSS X-band antenna at Svalbard. The SMD is preprocessed into annotated Virtual Channel Data Units (aVCDU) and routed to the JPSS SMD Hub (JSH) in CONUS. The JSH relays the aVCDUs to the NASA Science Data Segment (SDS) in near real-time. It also extracts S-NPP Application Packets (APs) and forwards them to the JPSS Data Processing Nodes, where it is fully processed into S-NPP data products (xDRs) for delivery and archival. The S-NPP APs are also made available to Fleet Numerical Meteorology and Oceanography Center (FNMOC).[5] In addition to the primary SMD receiving site at Svalbard, S-NPP also uses OSPO's Fairbanks Command and Data Acquisition Station (FCDAS) as an additional site for the SMD operations.

Unlike S-NPP, NOAA-20 uses the JPSS Ka-band receptors at Svalbard, Fairbanks, McMurdo Station, and Troll for its mission data acquisition. The Troll Satellite Station (TrollSat) operated by Kongsberg Satellite Services (KSAT) is located at Jutulsessen, Antarctica. These four locations for receptors provide opportunities for two SMD contacts during each orbit, significantly reducing data latency to less than 80 minutes compared to less than 140 minutes for S-NPP. During each contact, the SMD is down-linked via a 300 Mbps Ka-band link and acquired by a JPSS Ka-band receptor.

5 The JSH provided data to Naval Oceanographic Office (NAVOCEANO) until 2020. NAVOCEANO discontinued its use of JSH in Spring 2020.

The SMD is preprocessed into aVCDUs and routed to JSH in CONUS. The JSH relays the aVCDUs to the NASA SDS in near real-time. It also distributes aVCDUs to FNMOC. FNMOC uses the Community Satellite Processing Package (CSPP) software to generate xDRs. JSH extracts the APs and forwards them to the IDPS in the Cloud, where the data are fully processed into JPSS data products (xDRs) for delivery to the ESPC, GRAVITE, and CLASS.

In addition to using the SMD receiving sites at Svalbard, Fairbanks, Troll, and McMurdo, NOAA-20 also utilizes the TDRS as a contingency for transmitting SMD to the JPSS Ground System. Utilizing TDRS during anomalies for data acquisition maintains data product latency performance in case of polar ground station or satellite nadir Ka antenna failure.

4.1.2. Interface Data Processing Segment (IDPS)

IDPS ingests the Stored Mission Data (SMD) from the Command, Control and. Communications Segment (C3S) and then generates Level 1b products. The artifacts from satellite on-board storage and ground communication routing are removed prior to arrival at the IDPS, with initial ingest processing providing RDRs (per sensor/channel raw bits). The RDRs are processed with the appropriate Mission Support Data (MSD) in the IDPS to produce SDRs (geolocated and calibrated samples), TDRs, IPs, and the VIIRS Imagery EDR. The JPSS RDRs, SDRs, IPs, TDRs, VIIRS Imagery EDRs, and associated metadata are then distributed to configured recipients such as ESPC, GRAVITE, CLASS, and NASA SDS. The recipients have the option of receiving products compressed or uncompressed (RDRs are never compressed). IDPS can generate and distribute Mission Unique Products (MUP) for three JPSS satellites.

IDPS transitioned to the Cloud in 2021.The initial migration of the IDPS on-premises operational baseline to the Cloud was completed with minimal baseline changes in order to avoid hardware obsolescence issues. The only changes made to the baseline were the changes designated as explicitly necessary to operate in the Cloud.

4.1.3. Environmental Satellite Processing Center (ESPC) Systems

The ESPC is NOAA's primary data-processing system for the Nation's environmental satellite data and it is located at the NOAA Satellite Operations Facility (NSOF) in Suitland, MD. Through a large variety of hardware, software, networks, telecommunication lines, and software tools; ESPC ingests, processes, and distributes environmental data and information received from all of NOAA's satellites, several foreign countries' satellites and the Department of Defense's (DoD) satellites. ESPC includes the operational satellite data distribution network which provides NESDIS' customers access to real-time or near real-time environmental data and information on a continuous (24 hours per day/7 days per week) basis. The primary product applications are near real-time imagery, interactive products, and automated products, used by NWS and DoD as inputs to analyses and forecast models.

The ESPC systems used for JPSS data processing were developed by the Office of Satellite Ground Services (OSGS) as the Environmental Satellite Processing and Distribution Services (ESPDS). The major ESPDS segments are ingest, product generation, product distribution, and infrastructure. The Product Generation (PG) Segment is NDE. The Product Distribution (PD) Segment is PDA. The ESPC infrastructure consists of storage devices, enterprise services, security devices, and networks. A high reliability infrastructure is critical to maintain NOAA satellite ingest, data processing and distribution on an uninterrupted 24x7 basis.

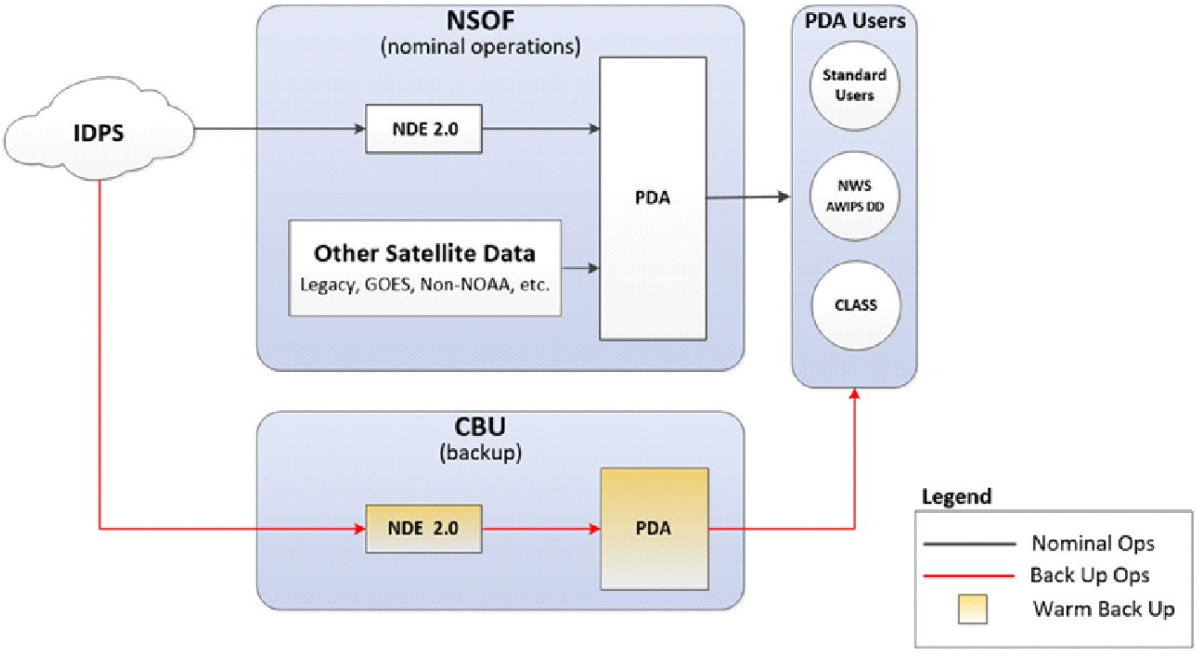


Figure 3. JPSS Product Generation and Distribution Diagram

4.1.3.1. NOAA Data Exploitation (NDE)

The NDE system has three environments; Operational (OPS), System Test (TEST), and Development (DEV), and the Consolidated Backup (CBU). Each environment provides the following JPSS capabilities:

- Receives Level 1b products (RDRs, SDRs, and TDRs) from IDPS.
- Generates Level 2 products (EDRs).

The NDE provides the following JPSS product generation and distribution capabilities:

- Receives and processes Level 1b products (RDRs, SDRs, and TDRs (ATMS) from S-NPP, GCOM-W1, NOAA-20, and JPSS-2/3/4 that are generated on IDPS
- Generates tailored and Binary Universal Form for the Representation of meteorological data (BUFR) formatted files.
- Forwards products to the PDA for distribution to customers.

NOAA STAR developed a tailoring software system that converts satellite operational products into BUFR formatted files. The Reformatting Toolkit converts the products from the JPSS CrIS and ATMS and GCOM-W1 Advanced Microwave Scanning Radiometer 2 (AMSR2). The toolkit is running in the NDE.

The ESPDS Product Generation Integrated Product Team (PG IPT) and the Product Readiness TIM (PRT) together are the change control process that ensures the NDE system continues to maintain its

standard of data. New or updated NESDIS NOAA Unique Products (NUPs) are delivered to NDE in the form of Delivered Algorithm Packages (DAPs). DAPs contain all the necessary information, including Look-up Tables (LUTs) and source code required for implementing updates to Science Algorithms (SAs) in the NDE Data Handling System (DHS).

The DAP delivery process and Science Algorithm (SA) integration into NDE are facilitated by the product Integrated Product Team (pIPT), which is composed of Product Area Leads (PALs) from OSPO and NDE Algorithm Integrators (NALI), as well as algorithm developers and testers from STAR.

4.1.3.2. Product Distribution and Access (PDA)

The PDA is responsible for implementing the processes and providing the services needed to access and distribute NESDIS data from multiple sources to the near real-time user community in support of the NESDIS mission to provide timely access to global environmental data from satellites and other sources to promote, protect, and enhance the Nation's economy, security, environment and quality of life. Primary users of this system include the NWS NCEP NCO, NWS AWIPS Network Control Facility (NCF), NMFS, NOS, NESDIS, the National Ice Center (NIC) and various elements of the DoD. Additionally, the system will support long-term data archival by providing select data to the CLASS. The system consists of a data receive point, a user access point and temporary data store. The user access point is a user interface, consisting of both a Graphical User Interface (GUI) and an Application Programming Interface (API), whereby users are able to search for data, establish data subscriptions and make ad-hoc data requests. PDA gets the data from the Data Providers either through data "Push" or data "Pull." The PD Segment provides a unique directory structure for each data file that is inventoried within the PD Segment through these interfaces. The directory structure design supports unique identification of each Data File that is critical to fulfill the ESPDS business functions, such as data search, and data request. Metadata describes a data file in inventory. The PD Segment uses metadata to inventory the data and make it available to Data Consumers for access to the data through search leading to an ad hoc request of the data file. PDA currently distributes S-NPP and NOAA-20 data records and information received from the JPSS Common Ground System (CGS) to the NOAA user community.

4.2. Planned Capabilities

In accordance with NESDIS Cloud guidance, OSGS is planning to transition current PG capabilities from the ESPC NDE to the NCCF PG Service. OSGS plans to exploit NCCF services and leverage NCCF's inherent scalability.

The migration of JPSS and GCOM-W PG capabilities will be accomplished incrementally using SAFe and DevOps methodologies. The approach is to deliver a Minimally Viable Product (MVP) to ingest and generate JPSS and GCOM-W products in the NCCF by Q4 FY2022. This will ingest JPSS & GCOM-W data from IDPS, integrate Enterprise Cloud Containerized Algorithm Packages (CCAP), generate associated products, and distribute to BDP and on-premise PDA. CLASS can provide a Cloud-based interface with data providers in addition to on-prem. Archive will be on-prem CLASS until NCCF archive capabilities have been implemented. The MVP capability is a proof of concept capability that will provide products in a minimally useful form. The value will be to demonstrate

JPSS and GCOM-W Product Generation in NCCF.

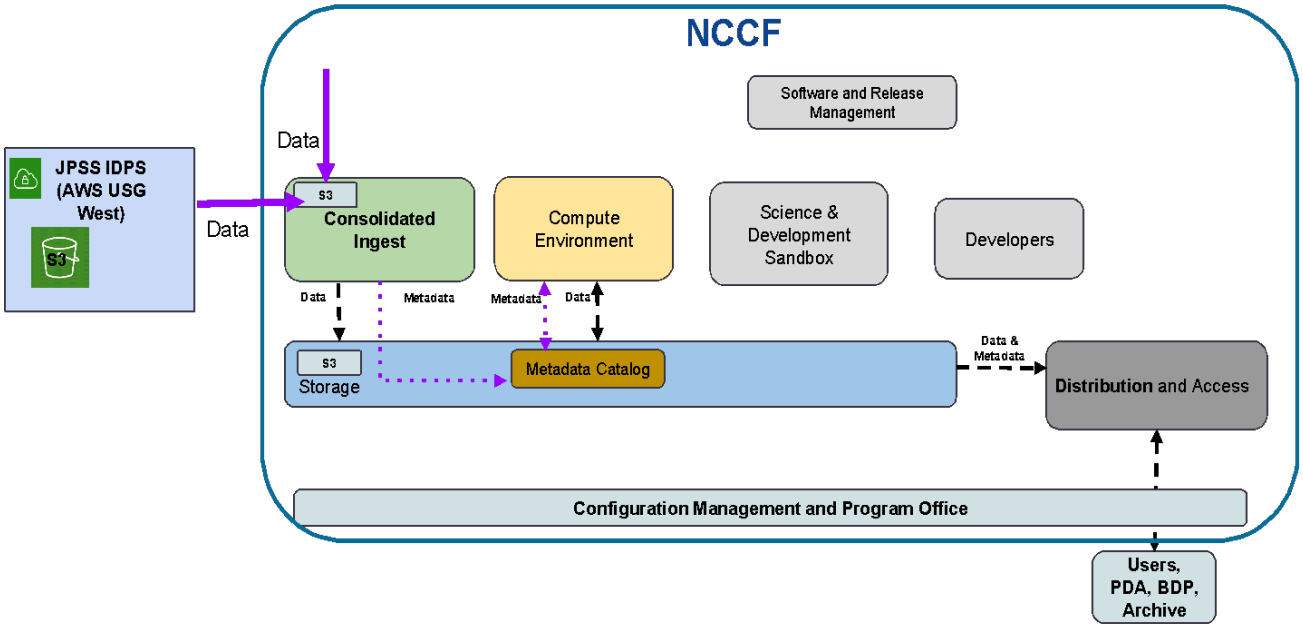


Figure 4. JPSS and GCOM-W Product Generation in the Cloud

Following the MVP proof of concept demonstration, OSGS will incrementally expand NCCF capability to include the full complement of needed NDE algorithms and products. NESDIS' goal is to migrate NDE capabilities to NCCF so that the on-premise NDE instance at NSOF and CBU can be decommissioned.

Although NESDIS also plans to migrate the PD capabilities to the Cloud, the on-premise PDA is expected to serve as ESPC's primary PD node at least through FY2025.

There is the possibility that STAR could retrieve products from the Cloud early.

5. Roles and Responsibilities

5.1. LEO&A R&R

5.1.1. OSPO JPSS Data Operations Manager

The JPSS Data Operations Manager (DOM) works in OSPO's SPSD. The JPSS DOM will:

- Provide oversight for this plan.
- Monitor progress.
- Recommend controls to improve schedule performance.
- Coordinate with the JPSS PPM, JPSS PAL, ESPC System Owner, JPSS Product Engineer, NDE System Lead, and PDA Manager.

- Cohair the Polar Product Operations and Readiness Team (Polar PORT)

5.1.2. OSPO Mission Operations Division (MOD) Systems Branch

The MOD System Branch is responsible for NDE and PDA operations and maintenance.

- The Branch's NDE System Lead will:
  - Ensure that DAPs and production rules for NOAA-21 are in place.
  - Control the subscriptions. Determine what data flows to PDA I&T and OPS.
- The Branch's PDA Manager will:
  - Ensure catalog entries are created on PDA for NOAA-21 products.
  - Make pre-operational data available to approved users. Assist users with subscriptions on PDA as needed.

5.1.3. OSPO SPSD Satellite Products Branch (SPB)

The Branch's JPSS PAL will work with the other PALs in the Branch to:

- Ensure KPP data products meet the requirements as stated in the JPSS Ground Segment Data Product Specification.
- Prepare SPSRB operations briefings.
- Transition products to operations once approved by SPSRB.
- Verify with the NWS NCEP that the BUFR products can be decoded properly.

5.1.4. JPSS Program Scientist

- Chairs the JPSS Products Validation Maturity Review Board.
- Science community users may contact the JPSS Program Scientist to request early access to NOAA-21 data.
- The JPSS Program Scientist, after consulting with the JPSS Product Portfolio Manager can then approve or disapprove the user's request and will forward the decision memo to the JPSS Data Operations Manager (DOM).

5.1.5. JPSS Ground Segment's Data Product Management and Services

The JPSS Ground Segment's Data Product Management and Services (DPMS) will:

- Maintain a Technical Task Agreement (TTA)[6] with STAR for JPSS service to be provided by STAR. Oversee the execution of the TTA and ensure JSTAR activities are on schedule, within the budget, and meet the performance requirements.
- The JPSS Product Portfolio Manager cohairs the Polar PORT.

6 The TTA is negotiated each year between the JPSS Program and STAR. The TTA captures the JPSS-related work (individual task descriptions) that will be done during that year and the resources (cost by task, FTEs and support service contracts) required from the JPSS budget line to undertake it, with obligation and costing details.

- Provide OSPO and OSGS a timeline for JPSS-2 science data flow from IDPS.
- Confirm to OSPO's JPSS Product Engineer and OSGS that science data has started flowing (pre-beta) and notifies the Data Ops team to enable subscriptions to CalVal users from PDA I&T string.
- Notify affected stakeholders by email when data products have reached beta maturity and requests that Beta user subscriptions be activated on PDA I&T.
- Notifies affected stakeholders when data products have reached provisional maturity.

DPMS will distribute notifications to users prior to handover to OSPO. After handover notifications will be issued by OSPO as ESPC Notifications

5.1.6. NOAA Center for Satellite Applications and Research (STAR)

The STAR JPSS Team will:

- Primarily focus on the ATMS SDR and TDR, CrIS SDR, and VIIRS SDR product Cal/Val and product maturity validation, promoting products through the various maturity levels.
- As a secondary focus, ensure successful Cal/Val and product maturity validation for the non-KPP JPSS products (listed in Appendix B).
- Deliver any needed table or code updates to DPMS and affected stakeholders.
- Other STAR Science Team Responsibilities also include Algorithm Enhancements, product quality monitoring, supporting product life cycle management, user engagement, scientific accuracy, verification, and ensuring scientific accuracy, verification, and validation for the product outputs.

The STAR Algorithm Scientific Software Integration and System Transition Team (ASSISTT) members actively support the STAR JPSS science and Cal/Val teams with algorithm integration activities. ASSISTT communicates directly with science algorithm teams, Data Product Engineering & Services (DPES), J-STAR, and JPSS Algorithm Management Project (AMP) to facilitate algorithm integration. ASSISTT has designated points of contact (POCs) for each team, as well as scripting and configuration management specialists for integration activities. ASSISTT is responsible for:

- Assisting teams with code updates, testing, and deliveries • Providing technical support and expertise to teams.
- Serving as experts in the Algorithm Development Library (ADL) Framework, which emulates the IDPS system.
- Serving as experts in the NDE framework.
- Providing a venue for effective configuration management.
- Facilitating a structured test and review process for new algorithms.

5.2. Post-handover Roles and Responsibilities

5.2.1. OSPO JPSS Data Operations Manager

The JPSS DOM will:

- Provide oversight for this plan.
- Monitor progress.
- Recommend controls to improve schedule performance.
- Coordinate with the JPSS PPM, JPSS PAL, ESPC System Owner, JPSS Product Engineer, NDE System Lead, and PDA Manager.
- Cohair the Polar Product Operations and Readiness Team (Polar PORT).
- Contribute to management decisions associated with JPSS data operations (both in JPSS and OSPO).

5.2.2. OSPO Mission Operations Division Systems Branch

The MOD Systems Branch is responsible for NDE and PDA operations and maintenance. Responsibilities after the NOAA-21 handover include:

- Determine which products or algorithms will be incorporated into a release and perform configuration management (CM) functions in accordance with OSPO policy.
- Perform functional checkouts of the algorithms on the test environment.
- Perform the promotion of products from I&T to CBU and Ops once a product is authorized for operations.
- Make operational data available to approved users. Assist users with subscriptions on PDA as needed).

5.2.3. OSPO SPSD Product Area Leads

The individual PALs will:

- Coordinate with DPMS.
- Prepare SPSRB operations briefing.
- Transition products to operations once approved by SPSRB. For NOAA-20, the KPP products were briefed to SPSRB prior to operations, the rest of the EDRs were briefed to the SPSD Chief.
- The PAL will prepare (ESPC Notifications and unofficial notifications (email list) to announce upcoming changes with sufficient lead time.
- Coordinate with users. Serve as primary Government Point of Contact (POC) and primary advocate and customer interface for the product
- Coordinate with STAR to integrate new science algorithms & enhancements, products, and services into operations and to ensure scientific accuracy, verification, and validation for the product outputs

The JPSS PAL will:

- Validate the data products are meeting requirements.

5.2.4. Data Product Management and Services (DPMS)

DPMS manages the MUP Algorithm Change Management Process. For the MUPs, after handover, any algorithm discrepancies should be documented in an Algorithm Discrepancy Report (ADR).

In accordance with the JPSS Algorithm Change Management Plan, the JPSS Algorithm Manager (JAM) will:

- Submit an Algorithm Discrepancy Report (ADR) on behalf of the STAR team, user, or stakeholder who identified the discrepancy or issue.
- Assist the Discrepancy Review Action Team (DRAT) as it performs an initial assessment and assigns a priority to the ADR.
- Be notified when STAR ASSISTT has verified the code at the unit test level and has assembled the Algorithm Change Package (ACP) and delivers the full ACP to DPMS.
- Open a Configuration Change Request (CCR) while the DPMS Algorithm Integration Team (AIT) is testing the ACP and submit the CCR for AERB stakeholder review.
- Actively monitor the change as it is delivered to and implemented by the CGS Contractor.
- Close the ADR in JDRS when all required actions concerning an ADR are complete.

The DPMS Algorithm Integration Team (AIT) will:

- Be provided with an Algorithm Development Area (ADA) by the CGS contractor on the Data Processing – Algorithm Environment (DP-AE) that has the current operational IDPS build installed (as well as the previous 5 builds available).
- Perform functional and regression testing of code provided in the ACP received from STAR on the ADA residing in DP-AE, using the test cases provided by the science teams and STAR ASSISTT in the ACP.
- Create an ASP and deliver it to the CGS contractor once adequate testing is completed and the ACP has been verified by DPMS and the corresponding CCR has been approved by the AERB.
- Review new builds verify they operate as expected after deployment to DP-AE.

The JPSS Product Portfolio Manager chairs the AERB, and co-chairs the Polar PORT. The JPSS PPM is also a member of the PPM Team and works with JPSS DOM and PALs and JSTAR to provide oversight of the JPSS EDR (level 2+) products transition to operation, and ensure the life cycle developments are consistent with the NESDIS PPM enterprise processes.

5.2.5. JPSS Product Engineer

The JPSS Product Engineer s responsible for IDPS operations, including:

- Ensure IDPS system integrity is maintained.
- Ensure SDR integrity and availability.
- Work with OSPO O&M contractors (OMS) and DPMS to understand and analyze any product quality flags, required changes, on-going product quality anomalies and anything related to actual data quality.
- Interact with MOD Data Quality Engineers Bi-weekly JPSS Data Quality Working Group to coordinate and exchange operational and data quality analysis between OPS/EMOSS and OMS.
- Analyze future IDPS maintenance releases (Cloud) for operational use.

- Collaborate with JPSS Flight and Ground personnel to ensure proper notifications for data outages, maintenance, and or any other issues to the user/science community.

The JPSS Product Engineer or contractor support is on call/available 24/7/365.

5.2.6. OSPO's Data Quality Engineers (DQE)

The DQEs support sustainable and reliable JPSS IDPS data processing with optimized system configurations. Specific SDR processing and SDR quality responsibilities include:

- Monitor for problems or issues related to SDRs.
- Identify or assist in identifying root causes associated with ground systems and/or onboard instruments impacting SDRs.
- Provide support to address concerns/inquiries from internal/external users or in-house JPSS engineers.
- Participate in processes leading to IDPS software modifications, software upgrades or software migration to Cloud.
- When there is an official IDPS software release or upgrade, examine the release notes and make sure the delivery meets the requirements. Independently conduct pre-release tests.

A DQE is on call/available 24/7/365.

5.2.7. NOAA Center for Satellite Applications and Research

STAR Science Team Responsibilities include providing Cal/Val functions during the lifecycle of the algorithm or product, algorithm enhancements, and subject matter expertise to support the algorithm, especially when troubleshooting is required. STAR also supports product quality monitoring, product life cycle management, and user engagement. STAR responsibilities include:

- Deliver DAPs to the algorithm integrator.
- Deliver algorithm maintenance updates when necessary (i.e. table or code updates).
- Verify that products can be decoded properly, such as BUFR.
- Participate in product maturity reviews and product validation.

Note that other organizations participate in Cal/Val. NRL Monterey will continue to serve on the Cal/Val teams.

5.2.8. Product Portfolio Management Team

The PPM Team is responsible for the oversight and guidance necessary to effectively manage the JPSS Level 2 (non-MUP) product life cycle process from product development, transition into operations, enhancements, and retirement.

6. User Engagement

The STAR JPSS Science Team Leads, JAMs, PALS, JPSS PPM, and JPSS DOM all engage with JPSS product users. User engagement can be either informal or formal. Informal user engagement occurs through science teams and surveys. Formal user engagement occurs at Scientific conferences,

through interagency and international agreements, working groups, and user notifications. Formal user engagement opportunities are listed below:

6.1. NOAA's National Weather Service

OSPO, STAR, and JPSS Program Science staff members participate in the NWS/NESDIS Satellite Data User Readiness Team (SURT) Biweekly Technical Interchange Meetings (TIM). The TIMs help the Office of Planning & Programming for Service Delivery (OPPSD) Systems Engineering, Integration, and Test (SEIT) team to successfully plan and execute satellite product Operational Test and Evaluation (OT&E) at the NWS Weather Forecast Office (WFO) and National Centers.

The NWS Office of Observations participates in the SUNWG, SPSRB, and JPSS Stakeholders Forum. The SUNWG Charter includes the following: Provide NOAA-wide input into satellite operational requirements for low-earth orbit (LEO), geostationary-earth orbit (GEO), and Space Weather, including the use of partner observations.

6.2. Segment Integration Working Group (SIWG)

The JPSS Ground Segment coordinates the weekly SIWG meeting. OSPO also participates. The following segments/organizations participate in the SIWG:

- NOAA CLASS
- NOAA NESDIS OSPO ESPC/ESPDS
- USAF 557th Weather Wing (WW)
- US Navy FNMOC
- NAVOCEANO
- NASA Science Data Segment (SDS)
- JPSS Ground Segment DPMS for Government Resource for Algorithm Verification, Independent Test, and Evaluation (GRAVITE)
- KSAT

6.3. NOAA – EUMETSAT Operations Working Group

The NOAA – EUMETSAT Operations Working Group facilitates operational interactions between NOAA NESDIS OSPO and EUMETSAT, defines POCs, and extends the existing coordination mechanisms to a working level venue for resolving issues. Some missions require detailed coordination for day-to-day operations while other programs require data exchange or coordination of shared resources.

6.4. International Ocean-Colour Coordinating Group (IOCCG)

The International Ocean-Colour Coordinating Group (IOCCG) is an international Committee of experts with representatives from national space agencies as well as the ocean color and inland water user communities (research scientists). It was established in 1996 under the auspices of the

Intergovernmental Oceanographic Commission of UNESCO, following a resolution endorsed by the Committee on Earth Observation Satellites (CEOS). IOCCG promotes the application of remotely-sensed ocean-colour/inland water radiometry data across all aquatic environments, through coordination, training, liaison between providers (space agencies) and users (scientists), advocacy and provision of expert advice. Objectives include developing consensus and synthesis at the world scale in the subject area of satellite ocean color radiometry (OCR), establishing specialized scientific working groups to investigate various aspects of ocean-color technology and its applications, and addressing continuity and consistency of ocean color radiance datasets through the CEOS OCR-Virtual Constellation.

6.5. NOAA Ocean Color Coordinating Group (NOCCG)

NOAA ocean color product users include NMFS, NWS, NOS) OAR, NOAA CoastWatch/OceanWatch, and NOAA CoralReefWatch.

The NOAA ocean color webpage is located at: https://www.star.nesdis.noaa.gov/jpss/oceancolor.php

6.6. NOAA CoastWatch/OceanWatch/PolarWatch Program ("CoastWatch")

The NOAA CoastWatch program is a primary conduit for user engagement for ocean, coastal and aquatic-related satellite data and data products. The program itself is housed in NESDIS/STAR/SOCD and the program organization includes regional Nodes across the country hosted by other NOAA line offices. CoastWatch executes multiple user engagement and communications activities. https://coastwatch.noaa.gov

6.7. International TOVS Working Group (ITWG)

The International TIROS Operational Vertical Sounder (TOVS) Working Group (ITWG) is convened as a sub-group of the Radiation Commission of the International Association of Meteorology and Atmospheric Sciences (IAMAS) and of the Coordination Group for Meteorological Satellites (CGMS). ITWG continues to organize International TOVS Study Conferences (ITSCs) which have met every 18-24 months since 1983. Through this forum, operational and research users of Television Infrared Observation Satellite (TIROS) Operational Vertical Sounder (TOVS) data from the NOAA series of polar orbiting satellites and other atmospheric sounding data have exchanged information on methods for extracting information from these data on atmospheric temperature and moisture fields and on the impact of these data in numerical weather prediction and in climate studies. They have also prepared recommendations to guide the directions of future research and to influence relevant programs of WMO and other agencies (NASA, NESDIS, EUMETSAT).

An important part of the Group's work has been to foster and participate in the generation of software to be shared throughout the community to enable use to be made of these data for operations and research. The Group also has an important education and training role.

6.8. Coordination Group for Meteorological Satellites

The Coordination Group for Meteorological Satellites (CGMS) is the group that globally coordinates meteorological satellite systems. This includes protection of in orbit assets, contingency planning, improvement of quality of data, support to users, facilitation of shared data access and development of the use of satellite products in key application areas. The coordination is pursued from an end-to-end perspective, through development of multilateral coordination and cooperation across all meteorological satellite operators in close coordination with the user community such as WMO, IOC-UNESCO, and other user entities.

The main goals of the coordination activities of the Coordination Group for Meteorological Satellites are to support operational weather monitoring and forecasting as well as climate monitoring, in response to requirements formulated by WMO, its programs and other programs jointly supported by WMO and other international agencies.

It is the policy of CGMS to coordinate satellite systems of its members in an end-to-end perspective, including protection of in-orbit assets and support to users - e.g. through appropriate training - as required to facilitate and develop shared access to and use of satellite data and products in various applications. This policy is reflected in the structure of the CGMS High Level Priority Plan (HLPP) initially endorsed by CGMS-40 plenary session in 2012, covering: Coordination of observing systems and protection of assets:

- Coordination of observing systems and protection of assets
- Data dissemination, direct read out services and contribution to the WIS product development
- Enhance the quality of satellite-derived data and products
- Outreach and training activities
- Cross-cutting issues and new challenges

7. Product Processing and Distribution during NOAA-21 LEO&A

7.1. Timeline

The Launch, Early Orbit and Activation (LEO&A) period is designed for initial spacecraft and instrument commissioning over a 90-day period for NOAA-21. The JPSS-2 Flight Transition Plan describes the activities planned for LEO&A. JPSS-2 (NOAA-21) launch is planned to occur no earlier than September 30, 2022. During this period the following satellite designations are expected:

- Primary: NOAA-20
- Secondary: S-NPP
- Tertiary: NOAA-21

7.2. Planned Activities

The intent of the LEO&A period is to perform the following major activities:

- Orbit raising during the first few days to its final operational orbit position
- Specific spacecraft related checkouts
- Instrument activations and outgassing
- Perform extended instrument commissioning activities vital for Cal/Val

During the LEO&A period, the NASA Mission Operations Support Team (MOST) will be solely responsible for spacecraft and instrument activities. NOAA-21 will not be operationally handed to OSPO until Launch +90 days as part of formal Handover.

- As described in the timeline on Appendix C, the Cal/Val and science teams receive the KPP products during this period. Algorithm Maturity Reviews will be held for:
    - ATMS SDR/TDR Beta and Provisional
    - CrIS SDR Beta and Provisional
    - VIIRS SDR Beta and Provisional

VIIRS Imagery EDR Beta and Provisional NOAA-21 data will be available through the JSH, High Rate Data (HRD) direct broadcast, GRAVITE, and CLASS during this period. Until official notification is provided, this data will be considered pre-operational and should not be publicly-released, distributed, or used for operational applications.

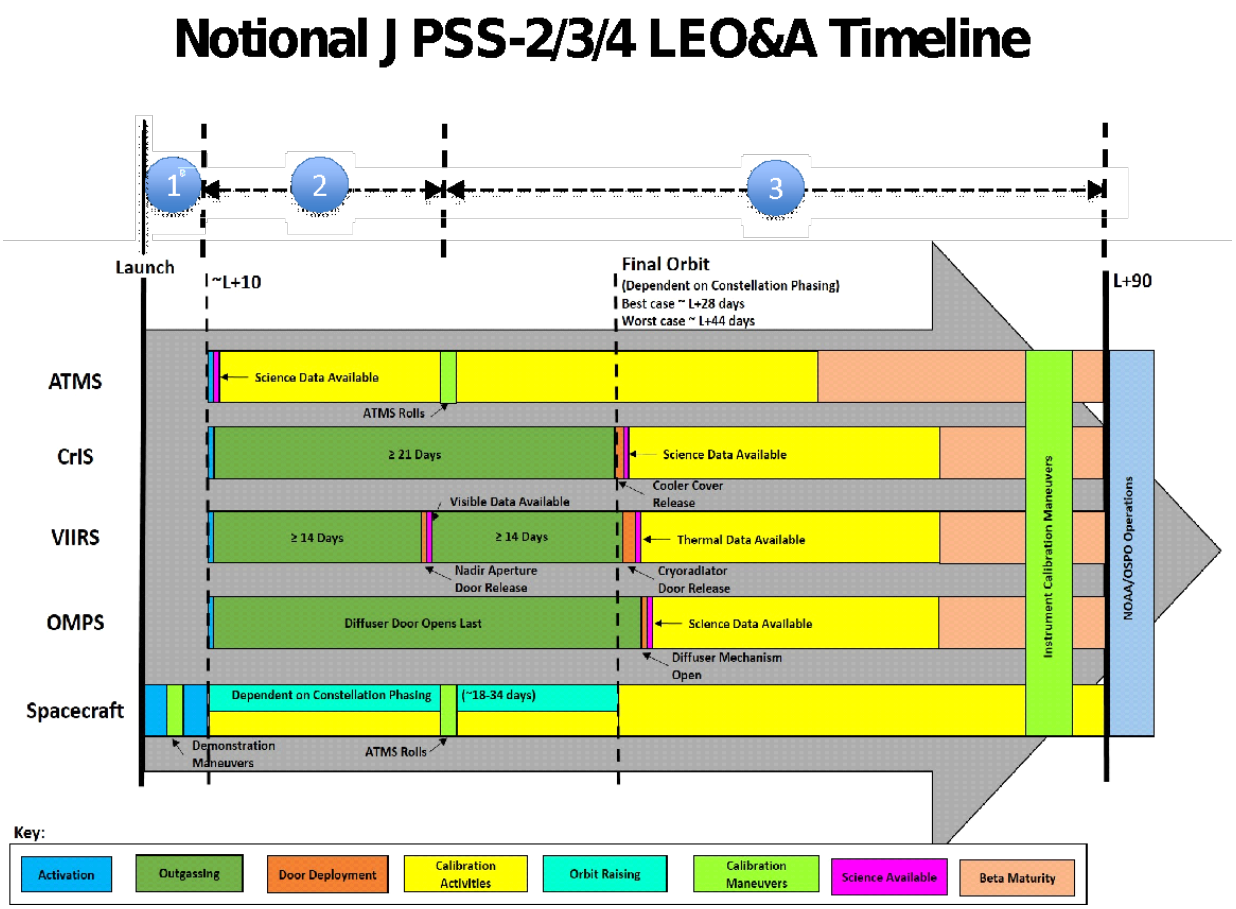


Figure 5. Notional JPSS-2/3/4 LEO&A Timeline

7.3. Early Access Users

Since the spacecraft and instrument payload will be undergoing checkouts and testing, any science instrument data produced is considered to be "early release" and will only be made available to select data consumers since the science products are not yet operational. Users receiving "early release" data are advised not to use it for operational purposes.

There are two categories of "early access" users who typically need JPSS data early:

- JPSS Cal/Val Consumers who are participating in the Cal/Val activities.
- JPSS Beta Consumers who require products at the Beta maturity level so that they can prepare their systems for the products when it reaches Provisional.

Authorized JPSS Cal/Val Consumers include: NOAA STAR; NWS NCEP Environmental Modeling Center (EMC); NWS NCEP NCO; OSPO PALs; NCF-SBN; NCEI; NOAA CLASS, and the National Ice Center. The following requested to be added to the list: Naval Research Laboratory Ocean and Atmospheric Science and Technology (OAST) Directorate in Monterey, CA (NRL Monterey) and Stennis Space Center, MS.

JPSS Beta Consumers include: FNMOC; US Air Force 557th Weather Wing (WW); NWS AWIPS; NWS AWIPS-Data Delivery (DD); NOAA STAR; NCEP Storm Prediction Center (SPC); NCEP Space Weather Prediction Center (SWPC); NCEP National Hurricane Center (NHC); NCEP Aviation Weather Center (AWC); EUMETSAT; CANADA MC; Big Data Project (BDP); Japan Meteorological Agency (JMA); and NAVOCEANO.

Note that ESPC access to the NOAA-21 products prior to NOAA declaring NOAA-21 operational will be through the NDE/PDA I&T environment.

7.4. Product Activation Process

This section describes the activation process for product delivery to a particular user. During the LEO&A period, science data will not be not distributed to all end users since the data has only reached either beta or provisional maturity as described in Appendix A. However, data can be distributed to select users during the LEO&A period for early checkout, testing or readiness preparation. These select users may include the National Weather Service, FNMOC, USAF 557th WW, and approved International partners where a mutual agreement to share data has been established. The process to approve early data activations to end users is:

- Science community users may contact the JPSS Program Scientist to request early access to NOAA-21 data. The JPSS Program Scientist, after consulting with the JPSS Product Portfolio Manager can then approve or disapprove the user's request and will forward the decision memo to the JPSS Data Operations Manager (DOM).
- Operational users can contact the JPSS DOM to request early data access.
- If the request is approved, then the JPSS DOM will inform the user regarding the terms of use of the data and explains any limitations inherent in the data if known
- Once the new data flow is established, the data team will monitor the stability over a period of time - if the data flow activation is problematic, the team reserves the right to temporarily shut off the new data flow in order to prevent disruptions to other users
- The user will make all efforts to safeguard use of the new data such that it is not used operationally for any decision support services or any other activity that can pose harm to a recipient

7.5. Pre-Operational Product Generation

Data flows from IDPS are expected to be automatic once the instrument is turned-on and enough science data is flowing. For NOAA-21 KPPs, products are planned to be made operational (and approved by the Satellite Products and Services Review Board (SPSRB)) within L+90 days. All KPP-related algorithms and production rules are in place. Once data starts flowing from IDPS, NDE should be configured automatically to produce the KPPs.

Products generated on NDE Ops during the LEO&A period are:

- ATMS SDR/TDR (BUFR)[7]
- CrIS SDR (BUFR)
- VIIRS Imagery and NCC EDRs (See Section 3.2)
- VIIRS SDR
- OMPS SDR

7.6. Pre-Operational Product Distribution

7.6.1. HRD Direct Broadcast

The HRD downlink will start a few days after launch and instrument data will flow once each instrument is turned-on. Use of data may be restricted until NOAA releases "First Light" images. Cautionary use until products are declared provisional/operational. HRD users will be advised by the JPSS Program not to use the data for operations. OSPO SPSD Direct Service Branch will inform the members of the HRD User Group by email.

7.6.2. GRAVITE

GRAVITE access is controlled by accounts. The CalVal user's primary access will start from instrument turn-on.

7.6.3. CLASS

CLASS access will be restricted until data products reach provisional maturity. Users can request early access through the CLASS help desk.

7.6.4. IDPS Ops

NOAA-21 products will be distributed on IDPS I&T and IDPS OPS during this period. S-NPP and NOAA-20 products will be IDPS Ops. In order for CLASS OPS to receive NOAA-21 pre-operational products, the data needs to flow from IDPS OPS (restricted) to CLASS.

7.6.5. ESPC (PDA) Ops

Once each NOAA-21 product is approved for operations, NOAA-21 products will be eligible for promotion to PDA Ops (starting with KPPs). However, due to the two-satellite requirement NOAA-21 products will not be distributed on PDA Ops during the LEO&A period. Authorized PDA subscribers who need access to NOAA-21 products during this period, will need to access the PDA I&T environment.

If ESPC can do it safely (without impacting product operations from the JPSS primary and secondary satellites and other missions) then ESPC could try to provide Beta-level KPP products on PDA Ops on a best effort basis. The data loading will be tested on NDE/PDA I&T first (during the JCT3 TVAC) and then evaluated on NDE/PDA Ops. Decisions will have to be made monthly based on NDE/PDA

7 BUFR data format standards, provided at http://www.wmo.int/pages/prog/www/WMOCodes.html

Ops data volume and capacity analysis

7.6.6. IDPS I&T

NOAA-21 products will be distributed on IDPS I&T during the LEO&A period.

7.6.7. ESPC (PDA) I&T

NOAA-21 data will flow on I&T from instrument turn-on. Approved CalVal Users will have priority access to the data. Approved Beta Users will have access to data upon completion of the beta validation period. All data from the I&T environment is only approved for user readiness and CalVal purposes. It is not to be used operationally. NWP Centers that need access to NOAA-21 products during this period, will need to request access to the NDE/PDA I&T environment.

7.6.8. JPSS SMD Hub

FNMOC and NASA SDS will receive S-NPP, NOAA-20, and NOAA-21 data from the JSH. Since the spacecraft and instrument payload is undergoing checkouts and testing, any science instrument data produced is considered to be "early release" and will only be made available to select data consumers since the science products are not yet operational. Users receiving "early release" data are advised not to use it for operational purposes.

8. NOAA-21 Post-Handover Product Operations

8.1. Timeline

The NOAA-21 post-handover period will start after the LEO&A period and upon NESDIS assuming operations responsibility for NOAA-21. At some point after handover, NOAA-21 will be declared operational. The key rules that apply to the operational declaration are:

- A mission is declared operational when the spacecraft bus and instrument functionality is understood and is as expected.
- Exception have been understood and accepted and do not adversely affect operations.
- Following a successful check out by NASA as well as a successful handover readiness review.
- Key performance parameters are met.
- KPP products have reached at least provisional maturity and have been declared operational (data are accepted by key stakeholders).

During this period the following satellite designations are expected:

- At L+x (month to be determined when NWS NCEP NCO is ready to assimilate the J-2 data in the modeling system) satellites assignments are expected to be:
    - Primary: NOAA-20
    - Secondary: NOAA-21
    - Tertiary: S-NPP

- At about launch plus 9 to 12 months (L+9-12) satellites assignments are expected to be:
  - Primary: NOAA-21
  - Secondary: NOAA-20
  - Tertiary: S-NPP

For the purpose of the plan, the post-handover period ends when NOAA declares NOAA-21 the primary satellite (for planning purposes, at about L+9-12).

The key rules that apply to the primary mission designation are:

- Latency requirements always apply to the primary mission.
- Allocation of resource for data transfers is prioritized for the primary mission.
- Allocation of resources at the receptor sites is prioritized for the primary mission.
- Primary is defined by its ranking against other missions and in the NOAA policy. It is the most important mission. This is done when:
  - Key performance parameters are met.
  - Prime instruments have reached at least provisional maturity and have been declared operational (data are accepted by key stakeholders).
  - Users have agreed that they are ready to transition.

8.2. Planned Activities

During the post-handover period OSPO will operate the satellite as part of the normal polar constellation. All aspects of flight and ground will be managed within established operational processes, including reporting.

As described in the timeline on Appendix C, the Cal/Val and science teams continue the products Cal/Val and maturity validation process during this period.

8.3. Product Activation Process

This section describes the activation process for new product promotion or a significant product upgrade.

- Product is approved for operations by the SPSRB or the SPSD Chief, by which point it has reached at least provisional maturity.
- The OSPO Data Operations team may activate a product early within the operational system if that product has successfully navigated through the Algorithm Readiness Review, however, data distribution from the operational environment can only be enabled after the product has been declared operational by the SPSRB.
- The Data Operations team will coordinate with major users regarding the activation of a new data subscription.
- To comply with the NDE/PDA capacity constraint of two-JPSS satellites – If three JPSS satellites are on-orbit and providing observational data after the Handover of NOAA-21,

production and distribution of products from the tertiary satellite (S-NPP) would be moved off the ESPC Ops environment and temporarily onto the I&T environment. S-NPP production rules and DAPs may be necessary in a contingency situation, therefore they would be suspended on the system, but not removed unless there is an operational need to do so.

- However, OSPO plans to conduct a test during the JPSS Compatibility Tests (in March 2022). If ESPC can do it safely (without impacting product operations from the JPSS primary and secondary satellites and other missions) then ESPC could try to provide on a best effort three tiers of support (Tier 1 is highest priority within the best effort and tier 3 is the lowest priority). The data loading would have to be tested on NDE/PDA I&T first (during the JCTs) and then evaluated on NDE/PDA Ops. Decisions will have to be made monthly based on NDE/PDA Ops data volume and capacity analysis.
  - Tier 1. Assuming that the NDE/PDA Ops capacity supports this, S-NPP KPPs could remain on NDE/PDA Ops as a best effort to support NWS request for 6 months of S-NPP KPP products while NCEP evaluates NOAA-21 KPP products. (Note that other NWP centers requested 3 months of overlap). KPPs include ATMS TDRs and CrIS SDRs in BUFR format.
  - Tier 2. Assuming that the NDE/PDA Ops capacity supports this, N-SPP OMPS LP products could remain on NDE/PDA Ops as a best effort at least until the NOAA-21 OMPS LP product reaches Provisional.
  - Tier 3. Assuming that the NDE/PDA Ops capacity supports this, then categories of S-NPP products could remain on NDE/PDA Ops until the equivalent category of NOAA-21 products reach Provisional. Continue sending SNPP VIIRS M-band SDRs to Okeanos from PDA until Ocean Color migrated to Cloud in FY23, if capacity permits, on a best effort.
- At 30 days prior to the suspension of a tertiary satellite (S-NPP) data product, an ESPC Notification will be sent to users alerting them to the change.
- Only products that have reached Provisional and have been approved can be used for operations. Per Appendix A, at Provisional, "the product is recommended for potential operational use (user decision) and in scientific publications after consulting product status documents."

8.4. Post-Operational Product Generation

Product Algorithm Readiness Reviews (ARRs) will coincide with a product reaching provisional maturity and with SPSRB approval.

The Proof of Concept JPSS Product Generation in the Cloud is described in Section 4.2. The Proof of Concept MVP will include S-NPP ATMS and CrIS BUFR.

8.5. Post-Operational Product Distribution

8.5.1. HRD Direct Broadcast

The HRD direct broadcast capability is an operational service from the spacecraft. Announcements of changes to the HRD service will be provided by the OSPO Direct Services PM and will be provided by the Direct Readout software providers.

8.5.2. GRAVITE

Access is controlled by accounts. Cal/Val and GRAVITE users will continue to have access to the data.

8.5.3. CLASS

Restricted access until data reaches provisional maturity. Users can request early access through the CLASS help desk. DPMS Lead is approver of early-access requests.

8.5.4. IDPS Ops

IDPS has a 3-JPSS satellite requirements. IDPS Ops will generate and distribute all S-NPP SDRs and TDRs. IDPS Ops will generate and distribute all NOAA-20 operational products and all NOAA-21 products that are Provisional or Validated and approved for operations.

8.5.5. ESPC (PDA) Ops

When NOAA-21 is declared operational and the NOAA-21 KPP products are approved for operations, then NOAA-21 data product distribution through PDA Ops will commence following the established product promotion process. Users can subscribe anytime the ESPC puts the products in the catalog, but delivery will be prevented to those users not eligible for beta or pre-beta (per a list jointly agreed to by the JPSS DOM and GOES-R DOM).

NWS will receive NOAA-21 products for use in OT&E. Beta and Provisional-level NOAA-21 products, specifically CrIS and ATMS Level 1b (Sensor Data Record [SDR]) products will be routed to FNMOC.

8.5.6. IDPS I&T

IDPS has requirements for product generation for three JPSS satellites. IDPS I&T will generate and distribute all S-NPP SDRs and TDRs. IDPS Ops will generate and distribute all NOAA-20 operational SDRs and TDRs and all NOAA-21 SDRs and TDRs that are Provisional or Validated and approved for operations.

8.5.7. ESPC (PDA) I&T

Only approved users will have access to the NDE/PDA I&T environment. Data produced on the I&T system is not intended for operational use; moreover, data on I&T is not guaranteed and is provided on a best effort basis. During the Cal/Val phase, beta level maturity data shall be provided to approved users via the I&T environment.

8.5.8. JPSS SMD Hub

FNMOC and NASA SDS will receive S-NPP, NOAA-20, and NOAA-21 data from the JSH.

9. S-NPP Product Availability after NOAA-21 is Declared Operational

9.1. Timeline

When NOAA-21 is declared operational (after LEO&A and a successful handover), then the following will occur:

- S-NPP products will be moved off the ESPC Ops environment and onto the I&T environment.
- ESPC will then transition the NOAA-21 products from I&T to Ops. At that point, only the NOAA-20 and NOAA-21 products will be distributed in ESPC Ops.
- S-NPP products will temporarily (one to two months) be available to a small number of subscribers in ESPC I&T (including STAR and NOAA National Weather Service (NWS) NCEP EMC). PDA I&T is not supported 24x7, and should not be considered operational.
- IDPS will continue to process S-NPP data and will distribute the products to GRAVITE and CLASS. GRAVITE will distribute the S-NPP products to the SCDR.

The S-NPP satellite will remain operational after NOAA-21 is declared operational and at least until NOAA-21 is designated the primary satellite, as no formal guidance to decommission the satellite has been provided.

9.2. S-NPP Product Generation and Distribution

9.2.1. Level 1 Processing and Distribution

The IDPS will generate S-NPP Level 1 products (SDRs and TDRs). IDPS will distribute the products to GRAVITE and CLASS.

9.2.2. Level 2 Processing and Distribution

STAR's JPSS Cal/Val teams will be able to access the S-NPP SDRs and TDRs on GRAVITE. STAR can then generate EDRs. Direct Broadcast (DB) users can use the CSPP LEO software to generate Level 2 S-NPP products.

9.2.3. Use of S-NPP Products for NOAA-21 Cal/Val

STAR's JPSS Cal/Val teams will be able to access the S-NPP SDRs and TDRs on GRAVITE. STAR can then generate EDRs.

9.2.4. High Rate Data Direct Broadcast

The S-NPP HRD will continue until OSPO ceases S-NPP satellite operations.

10. User Considerations

10.1. Overlap Periods

10.1.1. Overlap Period for NWP Centers

OSPO presented the above timeline during the NOAA-21 Mission Operations Review (MOR) in May 2020. The NWS submitted Advisory #4 during the MOR. NWS requested to receive S-NPP KPP products for at least six months while NWS NCEP evaluates the NOAA-21 KPP products. In July 2021, the NWS confirmed that NWS needed a six-month long overlap.

Other NWP users also requested an overlap period. Japan Meteorological Agency (JMA) requested a 3 month overlap period (parallel distribution) with S-NPP and NOAA-21 data available in near-real-time. Australia Bureau of Meteorology (BOM) requested as long a parallel dissemination as possible (ideally three months).

NWP Centers that need NOAA-21 products prior to NOAA declaring NOAA-21 operational, will access those products through the NDE/PDA I&T environment.

10.1.2. Overlap Period for Ocean Products

NAVOCEANO requested that the S-NPP VIIRS SDRs be distributed as they are now for 12 months after NOAA-21 is declared operational. NAVOCEANO operationally processes VIIRS data to generate ocean color, sea surface temperature, and sea ice concentration for Navy fleet support and model assimilation. NAVOCEANO operationally processes Visible Infrared Imaging Radiometer Suite (VIIRS) data to generate ocean color, sea surface temperature, and sea ice concentrations for Navy fleet support and model assimilation. NAVOCEANO processes VIIRS SDRs from S-NPP and NOAA-20 that are acquired through an ESPC PDA push to the 557th Weather Wing who then forwards the data to NAVOCEANO. The overlap period is intended to give NAVOCEANO adequate time to get most of NAVOCEANO's NOAA-21 VIIRS processing up and running, while continuing to provide operational support from S-NPP.

S-NPP, NOAA-20, and NOAA-21 VIIRS all have different sensor response functions. For the NOAA-21 Cal/Val effort, the S-NPP VIIRS SDR and ocean color data will be required to evaluate the performance of the NOAA-21 ocean color products. NOAA STAR will need long-term S-NPP stability to understand and get information of the NOAA-21 VIIRS data (e.g., sensor calibration stability, OC data performance). NOAA STAR needs at least three years of S-NPP data overlap with NOAA-21 to evaluate NOAA-21. NOAA STAR will also evaluate, and make corrections for, NOAA-21 ocean color product data.

NOAA Line Office users of S-NPP VIIRS data will also require overlap and time to transition their operational products from S-NPP to NOAA-21. Ideally from many Line Office user perspectives, they prefer merged datasets to minimize coverage gaps. Therefore, as long as the VIIRS sensor on S-NPP is producing valid, reliable data at the satellite, users would like to see the data continually supported. Also see section 10.3 below.

This version of the POP does not provide for the requested overlap period.

10.1.3. Overlap Period for Climate

NWS CPC stated that an overlap of at least one year between the S-NPP and the NOAA-21 OMPS LP products would be ideal so that a full seasonal cycle can be captured in the overlap. There is a WMO

Integrated Global Observing System (WIGOS) requirement for a one-year overlap for climate data.[8] Satellite systems for climate monitoring should adhere to the specific principles listed in the Manual on WIGOS, such as ensuring a period of overlap for new and old satellite systems that is long enough to determine inter-satellite biases and maintain the homogeneity and consistency of time series observations.

Because NOAA-20 does not have OMPS LP, NOAA-21 will be only the second OMPS LP used for climate operations. Due to improvements in the NOAA-21 OMPS LP detector filters, there could be significant changes in the SNRs and stray light. The overlap period is needed to ensure a consistent long-term climate record.

Also, S-NPP VIIRS provides long-term measurements. Continuing the S-NPP VIIRS data record (from one sensor) would benefit climate-related studies.

10.2. Product Gaps

When NESDIS declares NOAA-21 operational, the KPP products will be approved for operations, but the non-KPP products, including OMPS LP, will not be in the NDE/PDA operations environment. This will result in a gap. There are other non-MUP products than OMPS-LP and Ocean Color; e.g. most of Land products, Snow, Ice, and NUCAPS sounding products, based on the NOAA-21 (JPSS-2) Cal Val Timeline, those will not be Provisional by the time NOAA-21 is declared operational.

10.2.1. OMPS LP

NOAA STAR's Ozone team recommends NESDIS, at a minimum, keep producing S-NPP OMPS LP products until NOAA-21 OMPS LP products reach the Validated maturity level. The maturity validation process is estimated to take between 12 and 18 months after the NOAA-21 launch. Even for a series of instruments STAR has found that one year is the minimum duration required to identify and characterize the inter-instrument biases, as there are always some differences.

In this version of the POP, there will be no OMPS LP product distributed through PDA operations when S-NPP products are removed until the NOAA-21 OMPS LP product reaches Provisional and is approved for operations.

10.2.2. Ocean Color

NOAA-21 ocean color won't reach Provisional until L+15. There will be a gap of about 1 year (with only NOAA-20 ocean color product available) if S-NPP ocean color is not generated.

With three JPSS satellites (i.e., three VIIRS sensors), daily merged three-sensor ocean color products can essentially eliminate data gaps due to sun glint and high sensor-zenith angles, as well as mitigate the impacts of data gaps from cloud coverage. This is a significant improvement for the coverage of ocean color products.

8 Manual on the WMO Integrated Global Observing System, Annex VIII to the WMO Technical Regulations, 2019 Edition

10.3. Determining User Readiness

Within the JPSS Program, the JPSS Chief Scientist tracks product use and user readiness activities, leveraging the SUNWG for verification of user readiness. The JPSS Chief Scientist manages the JPSS proving ground and risk reduction program to improve the utilization of JPSS data in NOAA's product and services. The science communication and outreach efforts undertaken by the JPSS Chief Scientist focuses on education and training needed by users, collecting feedback from users to accomplish product assessments, developing education materials to enhance classroom experience, and encouraging public participation in outreach education. The JPSS DOM will tracks user readiness for NOAA-21 product in regards to receipt of NOAA-21 products from OSPO.

10.3.1. The JPSS Proving Ground and Risk Reduction (PGRR)

The PGRR program was established in 2012 and its primary objective is to develop and enhance user applications of Suomi NPP/JPSS data, algorithms and products. The PGRR supports user demonstration by stimulating interactions between technical experts from the JPSS Program, university partners and key user stakeholders. The PGRR has strategically invested in multiple projects to maximize the benefits of the use of current JPSS capabilities and identify new ways of using JPSS data operationally. JPSS Program Science and Naval Research Laboratory, Ocean and Atmospheric Science and Technology Directorate's Marine Meteorology Division have an agreement that facilitates NRL's earl Cal/Val of ATMS data from NOAA-21.

10.3.2. Segment Integration Working Group (SIWG)

The SIWG serves as the primary method of communication and coordination between the JPSS Program and the Mission Partners during JPSS Common Ground System development, test, deployment, and sustainment. Although focused primarily on the JPSS CGS, the SIWG promotes technical integration, improve MP interfaces, and optimize the use of resources that affect the members of the SIWG across the JPSS Program. The SIWG provides its members with visibility into NOAA-21 milestones and activities, including JPSS-2 JCT events, that are of particular importance to their planning and programming processes. The SIWG will provide its members an opportunity to communicate to the JPSS Program their internal milestones, risks and issues that are tightly coupled with, and dependent upon, JPSS milestones.

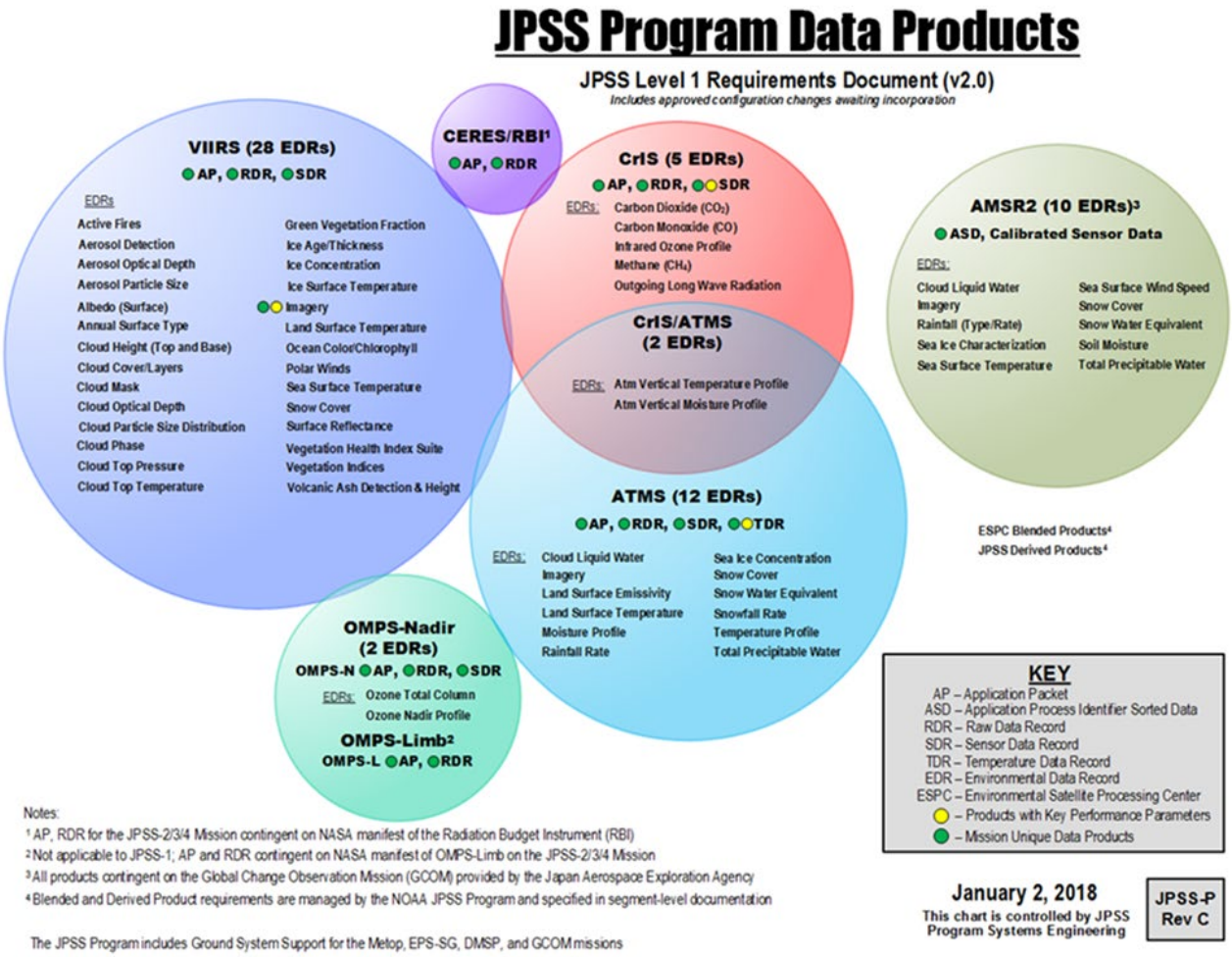
10.3.3. Polar PORT

The Polar PORT is jointly chaired by OSPO SPSD and the JPSS Ground Segment. The Polar PORT meets monthly in order to facilitate effective communications across the organizations responsible for JPSS science algorithm and product calibration and validation, integration, and operations (including product generation and distribution). Functions include monitoring the transition of JPSS products to operations, monitoring JPSS product maturity timelines, ensuring product quality, ensuring effective product user engagement, and tracking user readiness.

Appendix A. JPSS Data Product Maturity Stages

JPSS Data Product Maturity Stages
Beta • Product is minimally validated, and may still contain significant identified and unidentified errors. • Information/data from validation efforts can be used to make initial qualitative or very limited quantitative assessments regarding product fitness-for-purpose. • Documentation of product performance and identified product performance anomalies, including recommended remediation strategies, exists.
Provisional • Product performance has been demonstrated through analysis of a large, but still limited (i.e., not necessarily globally or seasonally representative) number of independent measurements obtained from selected locations, time periods, or field campaign efforts. • Product analyses are sufficient for qualitative, and limited quantitative, determination of product fitness-for-purpose. • Documentation of product performance, testing involving product fixes, identified product performance anomalies, including recommended remediation strategies, exists. • Product is recommended for potential operational use (user decision) and in scientific publications after consulting product status documents.
Validated • Product performance has been demonstrated over a large and wide range of representative conditions (i.e., global, seasonal). • Comprehensive documentation of product performance exists that includes all known product anomalies and their recommended remediation strategies for a full range of retrieval conditions and severity level. • Product analyses are sufficient for full qualitative and quantitative determination of product fitness-for-purpose. • Product is ready for operational use based on documented validation findings and user feedback. • Product validation, quality assurance, and algorithm stewardship continue through the lifetime of the instrument.

Appendix B. List of NOAA-21 Products



Description of JPSS Product Types

Product Types include the Raw Data Records (RDR), Sensor Data Record (SDR), Temperature Data Record (TDR), Intermediate Product (IP), and Environmental Data Record (EDR):

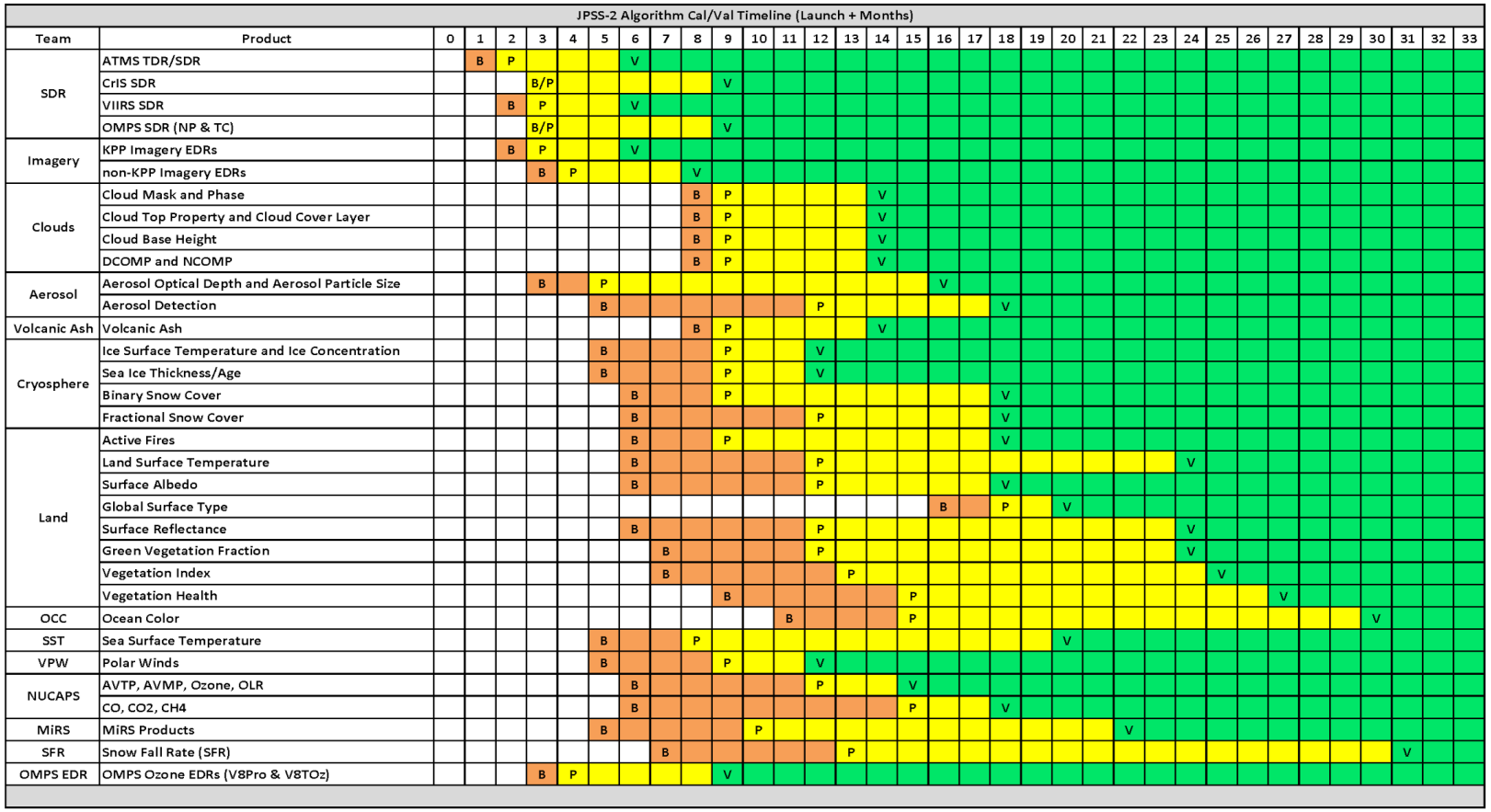
- RDRs (Level 0) are full-resolution, digital sensor data, time-referenced and locatable in earth coordinates with absolute radiometric and geometric calibration coefficients appended, but not applied, to the data.
- SDRs (Level 1b) are produced when an algorithm is used to convert RDRs to geolocated, calibrated brightness temperatures, radiances, or reflectances with associated ephemeris data.
- TDRs are geolocated antenna temperatures (T_a) with all relevant calibration data counts and ephemeris data to revert from T_a into counts.
- IPs are defined as a data subset or retrieval by-product that is required within another primary data product's generation sequence or is used as an input to secondary processing or analysis.

The IPs defined here are packaged and delivered to the end user. Other IPs are generated during the creation of EDRs but are not delivered.

- EDRs (Level 2+) are produced when an algorithm is used to convert SDRs to geophysical parameters and imagery.

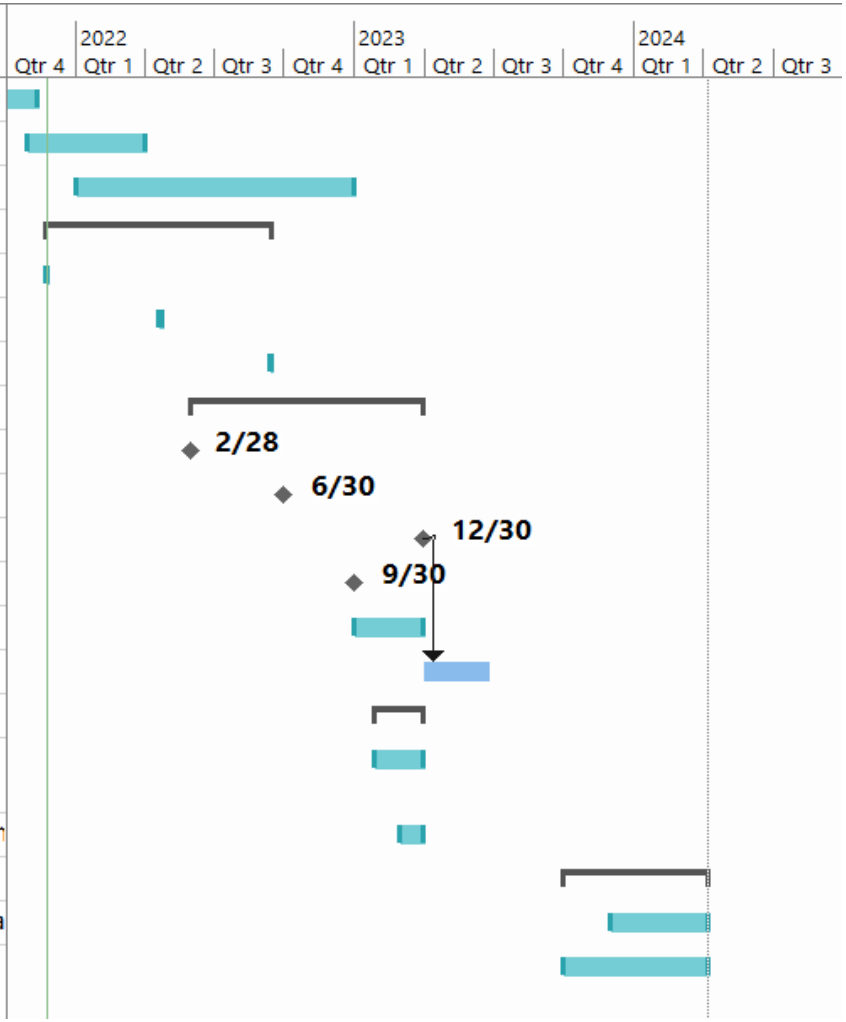
NOAA-21 Product List	
ATMS TDR/SDR	CrIS SDR
OMPS SDR	VIIRS Imagery
Cloud Phase/Type	Cloud Height (CTH, CTP, CTT)
Cloud Cover Layer (CCL)	DCOMP
Aerosol Optical Depth and Aerosol Particle Size (AOD)	Aerosol Detection (ADP)
Ice Surface Temperature and Ice Concentration	Sea Ice Thickness/Age
Fractional Snow Cover	VIIRS Polar Winds
Enterprise Active Fires	Land Surface Reflectance
Land Surface Temperature	Land Surface Albedo
Vegetation Index (VI)	Vegetation Health (VH)
Sea Surface Temperature	NUCAPS Products
Snow Fall Rate (SFR)	OMPS Ozone EDR: V8TOz
GCOM (AMSR-3 Cal/Val Plan, AMSR3 launch target is Apr-2023)	Reformatting Toolkit to NDE
VIIRS SDR	Active Fires (I-Band)
VIIRS Cloud Mask (ECM)	AST (Annual Surface Type)
Cloud Base Height (CBH)	Green Vegetation Fraction
NCOMP	Ocean Color
Volcanic Ash	MiRS Products
Binary Snow Cover	OMPS Ozone EDR: V8Pro

Appendix C. NOAA-21 Product Maturity Timeline



Appendix D. Integrated Master Schedule

ID	Task Mode	Task Name
1		Advise Users of Plan for S-NPP and Collect Inputs
2		OSAAP Conduct Study
3		JPSS PG in the Cloud MVP
4		**JPSS-2 JPSS Compatibiilty Test DSEs**
5		JCT2a DSE
6		JCT3 TVAC
7		JCT4 DSE
8		**Reviews**
9		FOR
10		ORR
11		PLAR/HRR
12		Launch
13		LEO&A
14		Handover
15		**KPP Product Maturity Reviews**
16		Transition ATMS and CrIS SDR from Beta to Provisional
17		Transition VIIRS Imagery from Beta to Provisior
18		**Non-KPP Product Maturity Reviews**
19		Transition Ocean Color from Beta to Provisiona
20		Transiton Vegetation Health from Beta to Provisional



Appendix E. Assignments

Title	Organization	Name	Email Address
ESPC System Owner	OSPO MOD	Chris Sisko	chris.a.sisko@noaa.gov
JPSS MOM	OSPO MOD	Justin Gronert	justin.gronert@noaa.gov
JPSS DOM and Cochair of the Polar PORT	OSPO SPSD	Jim McNitt	james.mcnitt@noaa.gov
PDA Manager	OSPO MOD SB	Donna McNamara	donna.mcnamara@noaa.gov
NDE System Lead	OSPO MOD SB	Jing Han	jing.han@noaa.gov
JPSS Spacecraft Lead and Polar Engineering Supervisor	OSPO MOD EB	Carl Gliniak	carl.gliniak@noaa.gov
JPSS Lead Instrument Engineer	OSPO MOD EB	Bruce Thomas	bruce.p.thomas@noaa.gov
OSPO JPSS Product Engineer	OSPO MOD EB	Henok Amenu	henok.amenu@noaa.gov
Lead Data Quality Engineer	OSPO MOD EB	Dejiang Han	dejiang.han@noaa.gov
Data Operations Support Team	OSPO SPSD	Cherie Mumford	cherie.mumford@noaa.gov
Data Operations Support Team	OSPO SPSD	Katie McCormick	katie.mccormick@noaa.gov
Chief SPB	OSPO SPSD	Zhaohui Cheng	zhaohui.cheng@noaa.gov
JPSS PAL	OSPO SPSD SPB	Shuang Qiu	shuang.qiu@noaa.gov
PAL	OSPO SPSD SPB	AK Sharma	awdhesh.sharma@noaa.gov
PAL	OSPO SPSD SPB	Sheekela Baker-Yeboah	sheekela.baker-yeboah@noaa.gov
PAL	OSPO SPSD SPB	Liqun Ma	liqun.ma@noaa.gov
PAL	OSPO SPSD SPB	Hanjun Ding	hanjun.ding@noaa.gov
PAL	OSPO SPSD SPB	Vaishali Kapoor	vaishali.kapoor@noaa.gov

PAL	OSPO SPSD SPB	Hongming Qi	hongming.qi@noaa.gov
PAL	OSPO SPSD SPB	David Donahue	david.donahue@noaa.gov
User Services	OSPO SPSD	Jason Taylor	SPSD.UserServices@noaa.gov
User Services	OSPO SPSD	Josh Jankot	SPSD.UserServices@noaa.gov
DPMS Manager	JPSS Ground Segment	Marge Ripley	marge.ripley@noaa.gov
JPSS Portfolio Product Manager (PPM), DPMS Deputy, and Cochair of the Polar PORT	JPSS Ground Segment and PPM Team	Lihang Zhou	lihang.zhou@noaa.gov
DPMS Algorithm Sustainment Lead"	JPSS Ground Segment	Bonnie Reed	bonnie.reed@noaa.gov
DPMS Cal/Val Lead	JPSS Ground Segment DPMS	Laura Dunlap	laura.dunlap@noaa.gov
JAM	DPMS	Deirdre Bolen	deirdre.bolen@noaa.gov
CoChair	SPSRB	Eileen Maturi Oceanographer	eileen.maturi@noaa.gov
CoChair	SPSRB	Tom Renkevens Chief SPSD	thomas.renkevens@noaa.gov
JPSS Program Lead Scientist at STAR	STAR	Alisa H. Young, Ph.D.	alisa.young@noaa.gov
Chief, Satellite Calibration & Data Assimilation (SCDA) Branch	STAR	Changyong Cao, Ph.D.	changyong.cao@noaa.gov
CrIS SDR Team Leader	STAR	Flavio Iturbide-Sanchez, Ph. D.	flavio.iturbide@noaa.gov
Snowfall Rate	STAR	Huan Meng	huan.meng@noaa.gov

Ozone	STAR	Larry Flynn	lawrence.e.flynn@noaa.gov
OMPS SDR	STAR	Banghua Yan, Ph. D.	banghua.yan@noaa.gov
SST Lead	STAR	Sasha Ignatov	alex.ignatov@noaa.gov
Ocean Color	STAR	Menghua Wang	menghua.wang@noaa.gov
Imagery Team Lead, Regional and Mesoscale Meteorology Branch (RAMMB)	STAR	Bill Line	bill.line@noaa.gov
Chief, Portfolio Management Branch	Chief, Portfolio Management Branch	Chief, Portfolio Management Branch	Chief, Portfolio Management Branch
PPM Team Lead	OSGS	Walter Wolf	walter.wolf@noaa.gov

Appendix F. NCCF Overview

The NESDIS Memo, Transition to NESDIS Common Cloud Framework (NCCF), signed in April 2021, codifies the decision to develop and migrate mission capability to the NCCF. The overall architecture of the ground segment will be developed by the Office of Systems Architecture and Advanced Planning (OSAAP), with specific attributes of the NCCF developed by the Assistant Chief Information Officer-Satellites (ACIO-S) and the Office of Satellite Ground Services (OSGS). OSGS is responsible for implementation of the NCCF. The specific mission capability to which this decision applies is:

- Ingest of all non-NOAA data. This applies to satellite and non-satellite data from public and private sources used for operational purposes. (Note: some residual on-premise hardware may be required to ingest data from legacy missions)
- Generation of level-2 and higher satellite products implemented on NESDIS systems.
- Product Dissemination to operational users (Note: product dissemination will use the Product Distribution and Access (PDA) sub-system for dissemination to operational users until the cloud-based capability is ready)
- Archive of all data using an enterprise metadata catalog approach. Archive of data will be consistent with NAO 212-15 – Management of Environmental Data and Information (Note: archive of data will continue to be managed by on-premise systems in the near-term until cloud archive services are available in NCCF)

This direction does not preclude on-ramping additional capability to the NCCF as specific business cases support (e.g., level-1 processing, ingest of data from NOAA assets). This direction applies to legacy systems in operation, and new systems or data flows becoming operational after Q3 FY2021.

The NCCF will include the following:

- Consolidated Ingest Service:
    - Single point of entry for all NESDIS data types and protocols
    - Customized security screening based on source and business agreements
    - Highly available, fault tolerant, and scalable gateway to the NCCF
- Enterprise Storage Service
    - Scalable and centralized data repository capable of storing all types of NESDIS data
    - Supports the full data lifecycle - from ingest through archive
    - Leverages all types of cloud vendor provided storage and underpins the entire NCCF
- Metadata Catalog Service
    - Selected NOAA OneStop as core of catalog service based on an AoA
    - Scales easily and cheaply to manage billions of records, demonstrated over 111 million records per day
    - Agnostic to data type - satellite/in situ
    - Supports both real-time and retrospective cataloging requirements
    - Search queries are fast and scalable

- Compute Environment Service
  - Scalable, fault tolerant, and data agnostic high performance computer service
  - Supports all NESDIS compute needs
  - Supports scientific data processing and development. Scalable infrastructure to support current and future product generation needs
  - Even limited optimizations can significantly reduce time/cost in cloud
- Distribution & Access Service
  - Could provide all required NESDIS data delivery pathways:
    - Low-latency push/pulls
  - Cloud-to-cloud transfers using Big Data Program (BDP)
  - Public access capabilities
  - Demonstrated ability to leverage the PDA system until the NCCF distribution service is complete and users are ready for the Cloud

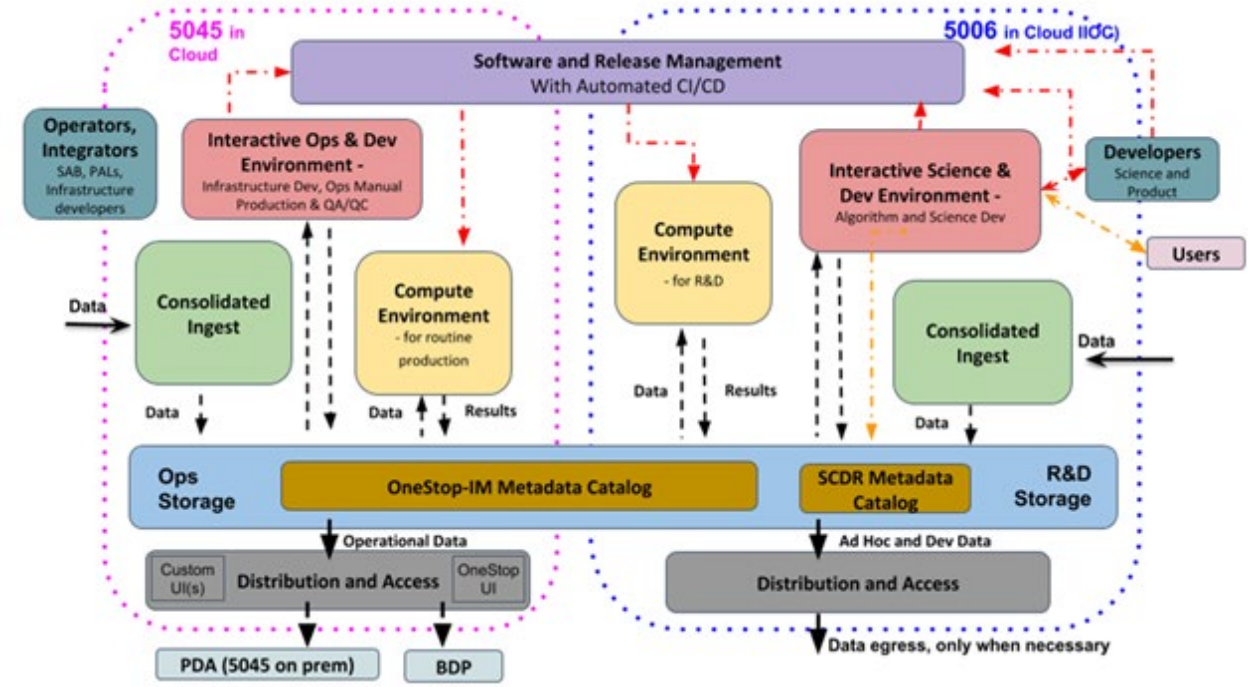


Figure F- 1. NCCF and FISMA Boundaries

The NCCF Roadmap is described in the figure below:

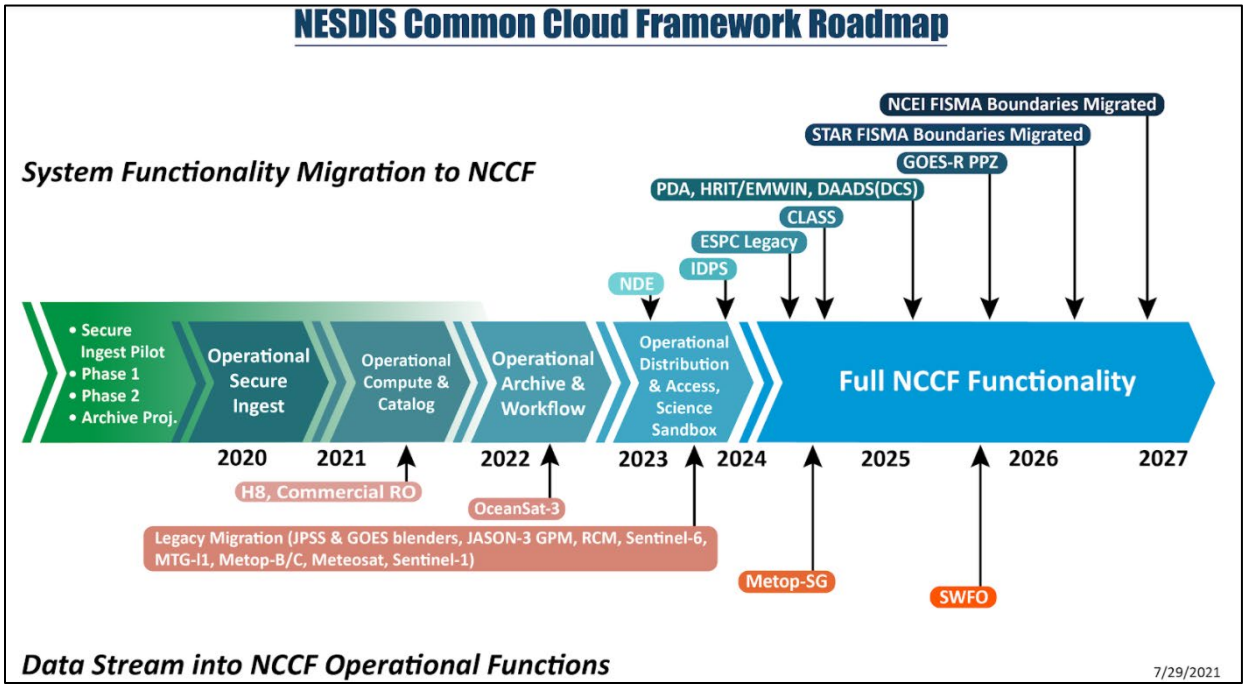


Figure F- 2. NCCF Roadmap

Appendix G. Acronym List

Acronym	Definition
ACMP	Algorithm Change Management Plan
ACP	Algorithm Change Package
ADA	Algorithm Development Area
ADL	Algorithm Development Library
ADR	Algorithm Discrepancy Report
AIT	Algorithm Integration Team
AMP	Algorithm Management Project
AMSR2	Advanced Microwave Scanning Radiometer 2
AOD	Aerosol Optical Depth
AP	Application Packet
API	Application Programming Interface
ARR	Algorithm Readiness Reviews
ASSISTT	Algorithm Scientific Software Integration and System Transition Team
ATMS	Advanced Technology Microwave Sounder
aVCDU	Annotated Virtual Channel Data Units
AWC	Aviation Weather Center
AWIPS	Advanced Weather Interactive Processing System
BUFR	Binary Universal Form
Cal/Val	Calibration and Validation
C3S	Command, Control, and Communications Segment
CBH	Cloud Base Height
CBU	Consolidated Backup
CCAP	Cloud Containerized Algorithm Packages
CCL	Cloud Cover Layer
CCR	Configuration Change Request
CDA	Command and Data Acquisition
CDAS	Command and Data Acquisition Station
CDFCB	Common Data Format Control Book
CDR	Climate Data Record
CEOS	Committee on Earth Observation Satellites
CERES	Clouds and the Earth's Radiant Energy System
CGMS	Coordination Group for Meteorological Satellites
CGS	Common Ground System
CIMSS	Cooperative Institute for Meteorological Satellite Studies
CLASS	Comprehensive Large Array-data Stewardship System
CLAVR-x	Clouds from AVHRR Extended
CM	Configuration Management
CrIS	Cross-track Infrared Sounder

CSPP	Community Satellite Processing Package
DACS	Data Agnostic Common Services
DAP	Delivered Algorithm Package
DB	Direct Broadcast
DHS	Data Handling System
DoD	Department of Defense
DOM	Data Operations Manager
DP-AE	Data Processing - Algorithm Environment
DPES	Data Product Engineering & Services
DPMS	Data Product Management and Services
DRAT	Discrepancy Review Action Team
DQE	Data Quality Engineer
EDR	Environmental Data Record
EMC	Environmental Modeling Center
ERB	Engineering Review Board
ESPC	Environmental Satellite data Processing Center
ESPDS	Environmental Satellite Processing and Distribution Services
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
FISMA	Federal Information Security Management Act
FNMOC	Fleet Numerical Meteorology and Oceanography Center
GCOM-W	Global Change Observation Mission 1st - Water
GEO	Geostationary Earth Orbiting
GRAVITE	Government Resource for Algorithm Verification, Independent Test, and Evaluation
GUI	Graphical User Interface
HLPP	High Level Priority Plan
HRD	High Rate Data
IAMAS	International Association of Meteorology and Atmospheric Sciences
IDMZ	Internet Demilitarized Zone
IDPS	Interface Data Processing Segment
IOCCG	International Ocean-Colour Coordination Group
IP	Intermediate Product
IPT	Integrated Product Team
ISSO	Information Systems Security Officer
I&T	Integration and Test
IT	Information Technology
ITSC	International TOVS Study Conferences
ITWG	International TOVS Working Group
JAM	JPSS Algorithm Manager
JMA	Japan Meteorological Agency

JPSS	Joint Polar Satellite System
JSH	JPSS SMD Hub
KPP	Key Performance Parameter
KSAT	Kongsberg Satellite Services
L1RDS	Level 1 Requirements Document
LEO	Low Earth Orbiting
LEO&A	Launch, Early Orbit & Activation
LTAN	Local Time of the Ascending Node
LUT	Look Up Table
Mbps	Megabytes per second
MIRS	Microwave Integrated Retrieval System
MOD	Mission Operations Division
MOR	Mission Operations Review
MOU	Memorandum of Understanding
MOST	Mission Operations Support Team
MSD	Mission Support Data
MUP	Mission Unique Product
MVP	Minimally Viable Product
NALI	NDE Algorithm Integrators
NASA	National Aeronautics and Space Administration
NAVOCEANO	Naval Oceanographic Office
NCC	Near Constant Contrast
NCCF	NESDIS Common Cloud Framework
NCEI	National Centers for Environmental Information
NCEP	National Centers for Environmental Prediction
NCF	Network Control Facility
NCO	NCEP Central Operations
NDE	NOAA Data Exploitation
NESDIS	National Environmental Satellite, Data, and Information Service
netCDF	Network Common Data Form
NHC	National Hurricane Center
NIC	National Ice Center
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOCCG	NOAA Ocean Color Coordinating Group
NOS	National Ocean Service
NSOF	NOAA Satellite Operations Facility
NUP	NOAA Unique Product
NWP	Numerical Weather Prediction
NWS	National Weather Service

OAR	Oceanic and Atmospheric Research
OCR	Ocean Color Radiometry
OMPS	Ozone Mapping and Profiler Suite
OPPSD	NWS Office of Planning & Programming for Satellite Delivery
OpsCon	Operational Concept
OSGS	Office of Satellite Ground Services
OSPO	Office of Satellite and Product Operations
OT&E	Operational Test and Evaluation
PAL	Product Area Lead
PD	Product Distribution
PDA	Product Distribution and Access
PDF	Portable Document Format
PG	Product Generation
PG IPT	Product Generation Integrated Product Team
pIPT	Product Integrated Product Team
POC	Point-of-Contact
Polar PORT	Polar Product Operations and Readiness Team
POP	Product Operations Plan
PPM	Product Portfolio Manager
PTP	Product Test Plan
RD	Reference Documents
RDR	Raw Data Record
SA	Science Algorithm
SCDR	STAR Central Data Repository
SDR	Sensor Data Record
SDS	Science Data Segment
SFR	Snowfall Rate
SMD	Stored Mission Data
S-NPP	Suomi National Polar-orbiting Partnership
SPB	Satellite Products Branch
SPSRB	Satellite Products and Services Review Board
SPC	Storm Prediction Center
STAR	Center for Satellite Applications and Research
SURT	Satellite Data User Readiness Team
SWPC	Space Weather Prediction Center
TDR	Temperature Data Record
TIM	Technical Interchange Meetings
TIROS	Television Infrared Observation Satellite
TOVS	TIROS Operational Vertical Sounder
TrollSat	Troll Satellite Station

TTA	Technical Task Agreement
VAL	Validation
VC	Virtual Channel
VH	Vegetation Health
VI	Vegetation Index
VIIRS	Visible Infrared Imaging Radiometer Suite
WIGOS	WMO Integrated Global Observing System
WFO	Weather Forecast Office
WMO	World Meteorological Organization
xDR	All Data Records