Geostationary Operational Environmental Satellite (GOES) – R Series

Solar Ultraviolet Imager (SUVI) Beta, Provisional and Full Validation Readiness, Implementation and Management Plan (RIMP)

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U.S. Department of Commerce (DOC)  National Oceanic and Atmospheric Administration (NOAA)  NOAA Satellite and Information Service (NESDIS)
National Aeronautics and Space Administration (NASA)

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SUVI Beta, Provisional and Full Validation
Readiness, Implementation and Management Plan (RIMP)

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### Document Change Record

**SUVI Beta, Provisional and Full Validation Readiness, Implementation and Management Plan (RIMP)**

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PREFACE

The Readiness, Implementation, and Management Plans (RIMPs) have been created to document the analysis techniques, methodology, duration, tools, data, resources, staffing, and schedule of the Post-Launch Product Tests (PLPTs) to be used by the calibration and validation (cal/val) science teams to demonstrate the different levels of product maturity. The primary purpose of the RIMPs is to act as a planning resource for the cal/val teams as they prepare for Launch. Additionally, the RIMPs can be used by other members of the GOES-R Program to prepare for cal/val activities, to assess the suitability of the cal/val test plans, and to understand the science teams’ data and resource requirements. Cal/val testing is likely to reveal necessary algorithm and look-up table (LUT) changes to evolve the product quality through the maturity levels. The Algorithm Change Management Plan (ACMP) will be used to track and implement these software changes.

The evolving cal/val maturity of GOES-R products is described by three levels: Beta, Provisional, and Full Validation. The Flight Project is responsible for producing the Level 1b (L1b) products according to the GOES-R Level III requirement documents. Once Beta maturity of the L1b products is achieved, validation activities for Level 2+ (L2+) products can begin. Further levels of maturity (Provisional and Full Validation) require additional and often long-term activities. A detailed description of the three product maturity levels is given in Figure 1, but a brief description of the three maturity levels are:

**Beta:** the product is minimally validated based on product quick looks using the initial calibration parameters and may still contain significant errors. Product is made available to users to gain familiarity with data formats and parameters.

**Provisional:** product performance has been demonstrated through a select number of independent measurements and periods. The analysis is sufficient to communicate known product performance and issues to end users, and the product is ready for operational use.

**Full:** product performance has been demonstrated over a large and wide range of representative conditions, with comprehensive documentation of product performance, including known anomalies and their remediation strategies. The product is operational.

Product quality assessment and declaration of maturity levels is performed during Peer Stakeholder–Product Validation Reviews (PS-PVRs). At each PS-PVR, the status of products will be presented by members of the cal/val science teams. For GOES-16 and GOES-17 L1b products, Beta maturity PS-PVRs are held once each instrument’s Post-Lauch Tests (PLTs) have been successfully completed by the GOES-R Flight Project and the instrument vendors. For GOES-18 and GOES-19, Beta maturity will leverage early PLT results and the performance and characterization needed for the first public image/data release. After an L1b product has achieved Beta maturity, the product is added to the GOES Rebroadcast (GRB) stream, so that operational users can begin familiarizing themselves with the product format and parameters. Beta PS-PVRs for ABI L2+ products were only held for GOES-16; for subsequent satellites,
ABI L2+ Beta maturity is assumed when the L1b product is Beta due to the maturity of the Ground Processing Algorithms (GPAs). After an L1b or L2+ product has achieved Provisional maturity, the product is approved for distribution from Product Distribution and Access (PDA) and Comprehensive Large Array-data Stewardship System (CLASS). The review panel at the PS-PVRs will include the GOES-R Operational Readiness Working Group (GORWG), GOES-R Program System Engineering (PSE), NOAA Office of Satellite and Product Operations (OSPO), National Weather Service (NWS), Calibration Working Group (CWG; L1b products) and/or Algorithm Working Group (AWG; L2+ products), NESDIS Office of Satellite Ground Services (OSGS), NESDIS Scientist, GOES-R Scientist, and GOES-R Product Readiness and Operations (PRO). The outcome of the PS-PVR is determined by the panel Chair. PS-PVR artifacts will be publicly available at https://www.noaasis.noaa.gov/GOES/product_quality.html.

The introspection necessary to create these RIMPs has led to extensive consultations between the cal/val teams and other groups within the GOES-R Program, including Program System Engineering, the Flight Project and the Ground Segment. Figure 2 below describes the responsibilities and accountability of each of the main parties involved in the creation of the RIMPs. This delineation is required because GOES-R operations are to be handed over from the GOES-R Program to NOAA OSPO at the end of the PLT period, yet the process of validating product maturity will continue. This changing nature of accountability during the process must be acknowledged. Accountability of the RIMPs changes at Operations Handover from NASA to NOAA and is aligned with the level of each RIMP’s validation maturity objective.

Accountability describes which organization owns documentation, process, and procedures. Responsibility describes which organization creates, executes, and maintains specific activities.

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## GOES-R Product (L1b and L2+) Maturity Levels

### Beta Validation

**Preparation Activities**
- Initial calibration applied (L1b).
- Rapid changes in product input tables, and possibly product algorithms, can be expected.
- Product quick looks and initial comparisons with ground truth data (if any) are not adequate to determine product quality.
- Anomalies may be found in the product and the resolution strategy may not exist.

**End State**
- Products are made available to users to gain familiarity with data formats and parameters.
- Product has been minimally validated and may still contain significant errors.
- Product is not optimized for operational use.

### Provisional Validation

**Preparation Activities**
- Validation and quality assurance (QA) activities are ongoing, and the general research community is now encouraged to participate.
- Severe algorithm anomalies are identified and under analysis. Solutions to anomalies are in development and testing.
- Incremental product improvements may still be occurring.
- Users are engaged in the Customer Forums (L2+ products only), and user feedback is assessed.

**End State**
- Product performance (L1b or L2+) has been demonstrated through analysis of a small number of independent measurements obtained from selected locations, periods, and associated ground-truth/field program efforts.
- Product analysis is sufficient to communicate product performance to users relative to expectations.
- Documentation of product performance exists that includes recommended remediation strategies for all anomalies and weaknesses. Any algorithm changes associated with severe anomalies have been documented, implemented, tested, and shared with the user community.
- Testing has been fully documented.
- Product ready for operational use and for use in comprehensive calibration/validation activities and product optimization.

### Full Validation

**Preparation Activities**
- Validation, QA, and anomaly resolution activities are ongoing.
- Incremental product improvements may still be occurring.
- Users are engaged and user feedback is assessed.

**End State**
- Product performance for all products is defined and documented over a wide range of representative conditions via ongoing ground-truth and validation efforts.
- Products are operationally optimized, as necessary, considering mission parameters of cost, schedule, and technical competence as compared to user expectations.
- All known product anomalies are documented and shared with the user community.
- Product is operational.

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**Figure 1. GOES-R product maturity levels.**

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Figure 2. Delineation of RIMP execution accountability between GOES-R and CWG/AWG.
1. SUVI VALIDATION OVERVIEW

The Solar Ultraviolet Imager (SUVI) is a normal incidence telescope in the Ritchey-Chrétien configuration with a charge-coupled device (CCD) detector at the Cassegrain focus. A schematic of the SUVI optical path is illustrated in Figure 3. Six narrowband extreme ultraviolet (EUV) channels are utilized to image the full-disk solar corona and chromosphere in different temperature bands. The mirror pairs are segmented into six different regions each with unique coatings designed to provide peak reflectance in that respective band; an image of the mirrors are shown in Figure 4. Fixed entrance and selected focal-plane filters are used with the intention of blocking the undesired out-of-band light from reaching the CCD, and tailoring SUVI transmission. Baffles block stray and scattered light and energetic particles from reaching the CCD. The SUVI performance characteristics are listed in Table 1. As the ability to predict space weather events gains importance, new tools with greater capabilities are needed. SUVI is a break from the tradition of using the X-ray spectrum to merely image the Sun and is helping to evolve the science of solar forecasting. SUVI utilizes the EUV portion of the spectrum, and so has more in common with the Solar and Heliospheric Observatory / Extreme ultraviolet Imaging Telescope (SOHO/EIT) and Solar Dynamic Observatory / Atmospheric Imaging Assembly (SDO/AIA) scientific instruments than it does with the Solar X-ray Imager (SXI) of GOES 12-15.

Figure 3. SUVI Optical Path
This document describes the management and implementation of the GOES-R Series SUVI Post-Launch Product Testing (PLPT). This document is focused on the PLPTs and all information pertinent to PLPT is documented here. Post-Launch Tests (PLTs) are also discussed as needed, but are being run by the SUVI vendor Lockheed Martin Advanced Technology Center (LMATC) in Palo Alto, CA and the GOES-R Flight Project, so the detailed information is documented and configuration managed in various Flight documents. There is some additional information on the PLTs in Appendix C (final approved list available in Operations Configuration Management System).

Post-Launch Testing (PLT) validates SUVI calibration and characterization. The PLTs ensure that the images obtained by SUVI are well understood, not only with regards to a basic task such as focus, but also that the characteristics that can affect the images, such as light leakage, dark counts, and off-band signals are well understood.

Only PLTs support SUVI Beta maturity, and those tests are listed in Table 2 with details in Appendix C. The PLPTs required for Provisional and Full Validation are listed in Table 3 and Table 4, respectively, with each test’s details provided in Appendix A. Within each entry in Appendix A, the entry “Reference MRD” gives the reference numbers from the Mission Requirements Document (MRD). The objective of the testing described in this RIMP is to, where feasible, validate the MRD SUVI-related performance requirements and to determine

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through instrument and product characterization if the deliverable products satisfy their intended use in the intended environment, which also permits certification of the on-orbit performance against the pre-launch performance baseline. The inclusion of each PLPT in the cal/val effort is justified based on input from the instrument scientists and the instrument vendor. The listing of MRD items does not fully enumerate the possible results from each PLPT, including those that may address other performance baseline results, but are the priority items according to the science team. Due to the limitations of PLT, validating the MRD requirements is limited to SUVI stability and pointing performance.

SUVI’s CCD detector measures photon flux, not irradiance, and cannot distinguish between photons of different energies. SUVI passbands often encompass multiple spectral lines at different energies. Thus the conversion from instrumental units to irradiance requires multiple assumptions that introduce significant uncertainty into the radiometric values reported in the SUVI L1b product. Any attempt to validate MRD requirements related to radiance will also suffer from those uncertainties.

Furthermore, validating a solar EUV imager’s radiometric performance on-orbit presents additional challenges since the only source of EUV illumination that can be detected by these instruments is the Sun itself. In the absence of an external measurement of spectral irradiance from the Sun, the accuracy of SUVI measurements cannot be validated. In fact, there is no guarantee the Sun will even produce the range of radiance necessary to explore the full range described in MRD requirement 2047.

Instead, SUVI PLPTs will provide a long term comparison between expected performance based on preflight calibration and the on-orbit performance against other similar on-orbit imagers and other instruments. Although this does not allow assessment of the radiometric performance of the imager against requirements in MRD 2047, 2048, and 2051, it will allow verification that the instrumental light gathering power is in line with preflight expectations, quantify any difference, assess sources of error, and track on-orbit degradation in the SUVI response. If a satellite goes into storage after Handover, SUVI trends will have to be reset. However, it is expected that there will be minimal degradation if the SUVI door is closed during storage.

Moreover, SUVI PLPTs will validate other important elements of calibration measured during PLT, including the instrumental dark current, flat field, focus, light leakage and many other factors that could affect image quality. Since the most critical need of data users is to have a focused, well-oriented image of the Sun to assess global solar conditions, a SUVI product that satisfies MRD requirements 2043, 2044, 2045, 2046, and 2052 and has a well characterized spectral response function that can be validated by intercalibration implicitly addresses all of the baseline user science needs.

**Beta Maturity Activities**

The PLTs that support Beta maturity are listed in Table 2. The PLT identification codes in the Test ID include a single letter in the second field. The letter “C” means the test is part of the radiometric calibration, an “E” is an engineering test, and a “P” denotes a performance test.

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Transitional PLTs, meaning they are not only conducted during PLT but also extended into PLPT and beyond, have corresponding vendor tools that are deliverable to National Centers for Environmental Information - Colorado (NCEI-CO). All of the SUVI PLTs are transitional except for shutter light leakage (G*-E-SUV-005) and effective area (G*-E-SUV-014).

For GOES-16 and GOES-17, all PLTs were run before a Beta PS-PVR was held to determine that the product had reached Beta maturity. For GOES-18 and GOES-19, the minimum criteria for SUVI Beta product maturity – as agreed upon by a working group of Subject Matter Experts (SMEs) from CWG, Flight, LMATC, and MIT LL – is that PLTs G*-C-SUV-001 through G*-E-SUV-011 are run. G*-P-SUV-007 would not need the LUT updated and G*-E-SUV-009 only needs the first two iterations run to meet this Beta maturity criteria.

Table 2. SUVI PLTs that support Beta maturity for each satellite in the GOES-R Series (16, 17, 18, and 19). Table also indicates which PLTs are transitional. The star (*) in each Test ID represents the satellite number (i.e., 16, 17, 18, or 19). Blue color denotes test was / will be done. Gray shading indicates test was not / will not be done or is a reserve test.

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<td>G*-C-SUV-001</td>
<td>Guide Telescope Calibration</td>
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<td>G*-E-SUV-002</td>
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<td>G*-E-SUV-005</td>
<td>Shutter Light Leakage</td>
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<td>G*-C-SUV-006</td>
<td>Off-Band Signal Characterization</td>
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<td>G*-P-SUV-007</td>
<td>Flat-Field Calibration</td>
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<tr>
<td>G*-E-SUV-009</td>
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<td>G*-E-SUV-011</td>
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<td>Extended Sequencer</td>
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<td>Effective Area</td>
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<td>G*-E-SUV-015</td>
<td>Extended Corona Imaging Operations</td>
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<td>G*-E-SUV-016</td>
<td>Filter Throughput</td>
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Provisional Maturity Activities

The PLPTs that are utilized to validate the instrument calibration are listed in Table 3 and are used to support Provisional maturity. They also need to be performed at certain intervals over the instrument lifetime in order to maintain the fidelity of the SUVI data.

Table 3. SUVI PLPTs that support Provisional maturity for each satellite in the GOES-R Series (16, 17, 18, and 19). Purple color denotes test was / will be done. Gray shading indicates test was not / will not be done or is a reserve test.

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<td>PLPT-SUV-003</td>
<td>SUVI/AIA Intercalibration</td>
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<td>PLPT-SUV-006</td>
<td>SUVI/EXIS Intercalibration</td>
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<td>PLPT-SUV-007</td>
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Full Maturity Activities

The PLPTs that support Full maturity are listed in Table 4. The Full PLPTs have additional time allotted for data collection and analysis, and include a supplementary target of opportunity SUVI/EVE Rocket Underflight Intercalibration reserve test (PLPT-SUV-008).

Table 4. SUVI PLPTs that support Full maturity for each satellite in the GOES-R Series (16, 17, 18, and 19). Green color denotes test was / will be done. Gray shading indicates test was not / will not be done or is a reserve test.

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<td>PLPT-SUV-002</td>
<td>SUVI Trending - Detector performance</td>
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<td>PLPT-SUV-003</td>
<td>SUVI/AIA Intercalibration</td>
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<td>PLPT-SUV-006</td>
<td>SUVI/EXIS Intercalibration</td>
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<td>PLPT-SUV-007</td>
<td>GOES SUVI/GOES SUVI Intercalibration</td>
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<tr>
<td>PLPT-SUV-008</td>
<td>SUVI/EVE Rocket Underflight Intercalibration</td>
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The validation processes and procedures, monitoring and analysis methods, tools, and expected output artifacts are described in the following sections. The details of the PLPTs are in Appendix A, while the details of the reference data sets are in Appendix B. The details of each

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PLT are in Appendix C, and information on the tools used in the validation process is in Appendix D.

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2. SCHEDULE OF EVENTS

The nominal post-launch validation schedule for all GOES-R Series products is shown in Figure 5\(^1\). The schedule for PLT is owned by the GOES-R Flight Project and under configuration management. The details should be expected to change up to Launch and possibly even during PLT if major anomalies are found.

Once PLPT begins, SUVI PLPTs will be conducted simultaneously within the criteria for the next maturity level. The details of the SUVI schedule are noted in Table 5.

**GOES-R Series Post-Launch Science Product Validation Schedule**

![Figure 5. Post-launch science product validation schedule from Launch through Operations.](image)

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<tr>
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<th>Nominal (months)</th>
<th>Nominal (days)</th>
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<th>GOES-17</th>
<th>GOES-18</th>
<th>GOES-19</th>
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<td>L+0</td>
<td>11/19/16(L+0)</td>
<td>3/1/18(L+0)</td>
<td>12/7/21</td>
<td>4/1/24</td>
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<tr>
<td><strong>Outgas</strong></td>
<td>L+2</td>
<td>L+60</td>
<td>1/21/17(L+63)</td>
<td>5/14/18(L+74)</td>
<td>2/7/22</td>
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<td><strong>Beta</strong></td>
<td>L+4</td>
<td>L+120</td>
<td>4/19/17(L+151)</td>
<td>8/21/18(L+154)</td>
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<td>8/1/24</td>
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<td>L+180</td>
<td>5/4/18(L+531)</td>
<td>5/14/19(L+439)</td>
<td>6/7/22</td>
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<td>L+545</td>
<td>11/5/20(L+1447)</td>
<td>7/29/21</td>
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<td>10/1/25</td>
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\(^1\) See also the GOES-R Series Calibration and Product Validation Strategy (410-R-CALVAL-0192) section on the GOES-R Calibration and Product Validation Schedules.

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The following subsections describe the nominal SUVI product schedule on the assumption that a satellite is going to Operations. The goal is for Beta and Provisional Validation to be completed before Handover at L+6 months, at which point the satellite will either go into Operations or storage mode.

2.1 BETA MATURITY TESTING

For GOES-16 and GOES-17 a Beta PS-PVR was held to show the results of the PLT activities and determine if the product demonstrates on-orbit performance adequate to begin detailed product testing. In lieu of a Beta PS-PVR, for GOES-18 and GOES-19 the results from a subset of PLTs will be used for a Beta Certification. A cross-collaborative working group, including the cal/val team, GOES-R Program, and the Flight vendor, have defined those PLTs as G*-C-SUV-001 through G*-E-SUV-011; G*-P-SUV-007 does not need the LUT updated and G*-E-SUV-009 only needs the first two iterations run.

2.1.1 Beta Entrance Criteria:

Completion of launch, orbit raising, and outgassing, expected by L+60 days.

2.1.2 Duration of Beta Testing:

The Flight- and vendor-led PLT activities begin during the Beta phase and for GOES-16 and GOES-17 Beta maturity has been achieved around L+150 days. However, for GOES-18 and GOES-19, the prerequisites and activities leading up to the Beta maturity declaration will be streamlined and are expected to be achieved by L+120 days. Although Beta Certification will be given before all PLTs have been completed, the PLT activities will continue beyond this point into the PLPT period.

2.1.3 Beta Testing Artifacts:

The PLT reports will be generated by the Flight and vendor teams. These will be discussed at the Post Test Data Review (PTDR) meetings and stored on the GOES-R portal. There will be a summary report in the form of a README that will describe the instrument and L1b data status.

2.1.4 Exit Criteria and Readiness for Beta Certification:

The general criterion for Beta product maturity is that the product has demonstrated on-orbit performance adequate to begin detailed product testing. Specific criteria for completing the PLTs necessary for establishing Beta maturity are described in the PLT forms.

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
2.2 PROVISIONAL MATURITY TESTING

2.2.1 Provisional Entrance Criteria:

PLPT activities begin during Flight-led PLT activities - after the first public image release.

2.2.2 Duration of Provisional Testing:

Once PLPT begins, SUVI tests will be conducted simultaneously. PLPT-SUV-001 looks at the trending of the CCD temperature. This trending also should occur throughout the test period. The remaining PLPTs are intercalibrations that should occur throughout the PLPT schedule. A number of these are needed to make a valid statistical comparison. All intercalibration activities are planned to be continued throughout the mission.

Provisional evaluation needs to be based on L1b products from the GOES-R Ground System (GS). Reprocessed data can help supplement the evaluation if the reprocessing code reliably re-creates GS products to validate the product performance.

Provisional testing is scheduled for completion and the Provisional PS-PVR presented by L+180 days. In the event that less than the nominal amount of time for data collection is available beyond Beta Certification, the Provisional PS-PVR will still be held prior to L+180 days and the risks and caveats from those PLPTs that did not meet their success criteria must be described, as well as the remaining actions or tests that would need to be accomplished after storage or drift that would lead to a successful Provisional result.

2.2.3 Provisional Testing Artifacts:

A slide deck that documents the results of the Provisional PLPTs with tables and figures to substantiate the conclusions will be created. The success criteria for each individual Provisional PLPT are listed in the PLPT descriptions within Appendix A. There will also be a summary report in the form of a README that will describe the instrument and L1b data status.

2.2.4 Exit Criteria and Readiness for Provisional PS-PVR:

All PLPTs supporting Provisional Validation need to be summarized in a slide deck and presented at a PS-PVR prior to Handover.

2.3 FULL MATURITY TESTING

2.3.1 Full Entrance Criteria:

Data are Provisionally mature. If the satellite has gone into storage immediately after Provisional Validation, Full maturity PLPTs will start after the satellite is moved out of storage location.

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
2.3.2 Duration of Full Testing:

One year of testing with Provisional data is the scheduled duration for Full maturity validation. Full evaluation needs to be based on L1b products from the GOES-R GS. Reprocessed data can help supplement the evaluation if the reprocessing code reliably re-creates GS products to validate the product performance.

2.3.3 Full Testing Artifacts:

A slide deck that documents the results of the Full PLPTs with tables and figures to substantiate the conclusions will be created. The success criteria for each individual Full PLPT are listed in the PLPT descriptions within Appendix A. There will also be a summary report in the form of a README that will describe the instrument and L1b data status.

2.3.4 Exit Criteria and Readiness for Full PS-PVR:

Product performance is defined, product is operationally optimized, and all known product anomalies are documented and shared with the user community. Full Validation is expected by L+545 days if the satellite is not placed into storage. However, space weather phenomena of significant impact (as detailed in the PLPT descriptions) are needed for Full Validation, and lack of such phenomena prior to L+545 days may delay Full Validation.
3. ROLES AND RESPONSIBILITIES

The GOES-R Calibration/Validation Plan Volume 1: L1b Data (cal/val plan) is the governing document defining organizational responsibilities for GOES-R product testing, including the analysis, review, approval, and anomaly resolution processes required for product validation. The cal/val plan takes precedence over the following summary of specific PLT responsibilities.

PLT assessments of SUVI instrument functionality, non-nominal operations, and initial data quality are conducted by the Mission Operations Support Team (MOST) with vendor support by Lockheed Martin. SUVI will achieve Beta Validation during these early PLT assessments. Subsequent PLPT activities to advance product maturity to Provisional Validation involves detailed data analysis conducted under guidance of the CWG and GOES-R Program management by members of the cal/val team at NOAA, NASA, and industry. The roles and responsibilities of specific individuals and organizations during each satellite's PLT period are listed in Table 6 (names and affiliations subject to change).

Table 6. SUVI roles and responsibilities.

<table>
<thead>
<tr>
<th>Role</th>
<th>GOES-16</th>
<th>GOES-17</th>
<th>GOES-18/19</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUVI PLPT Team</td>
<td>Instrument Lead: Dan Seaton (CIRES, NCEI); PLPT Lead: Jonathan Darnel (CIRES, NCEI)</td>
<td>Instrument Lead: Dan Seaton (CIRES, NCEI); PLPT Lead: Jonathan Darnel (CIRES, NCEI)</td>
<td>Instrument Lead: Dan Seaton (CIRES, NCEI); Deputy Instrument Lead: Chris Bethge (CIRES, NCEI); PLPT Lead: Jonathan Darnel (CIRES, NCEI)</td>
</tr>
<tr>
<td>GOES-R Product Quality Lead</td>
<td>Jon Fulbright (PRO)</td>
<td>Elizabeth Kline (PRO)</td>
<td>Elizabeth Kline (PRO)</td>
</tr>
<tr>
<td>Ground Segment Product Readiness and Operations Cal/Val Coordination</td>
<td>Jon Fulbright (PRO); Alternate: Elizabeth Kline (PRO)</td>
<td>Jon Fulbright (PRO); Alternate: Elizabeth Kline (PRO)</td>
<td>Jon Fulbright (PRO); Alternate: Elizabeth Kline (PRO)</td>
</tr>
<tr>
<td>PLT Test Engineer(s)</td>
<td>Matt Garhart (MOST)</td>
<td>Calvin Nwachuku (MOST)</td>
<td>Matt Garhart (MOST)</td>
</tr>
<tr>
<td>SUVI Product Quality Feedback</td>
<td>Dan Seaton (CIRES, NCEI); Backup: William Rowland (CIRES, NCEI), Jonathan Darnel (CIRES, NCEI)</td>
<td>Dan Seaton (CIRES, NCEI); Backup: William Rowland (CIRES, NCEI), Jonathan Darnel (CIRES, NCEI)</td>
<td>Dan Seaton (CIRES, NCEI); Backup: William Rowland (CIRES, NCEI), Jonathan Darnel (CIRES, NCEI), Chris Bethge (CIRES, NCEI), Laurel Rachmeler (NCEI)</td>
</tr>
<tr>
<td>ERB Rep</td>
<td>Elizabeth Kline (PRO)</td>
<td>Elizabeth Kline (PRO)</td>
<td>Elizabeth Kline (PRO)</td>
</tr>
<tr>
<td>Remote Access</td>
<td>Ryan Williams (PRO); Jon Fulbright (PRO)</td>
<td>Janet Larson (PRO)</td>
<td>Janet Larson (PRO)</td>
</tr>
</tbody>
</table>

Check the GOES-R Portal at [https://goesportal.ndc.nasa.gov](https://goesportal.ndc.nasa.gov) to verify correct version prior to use.
Check the GOES-R Portal at [https://goesportal.ndc.nasa.gov](https://goesportal.ndc.nasa.gov) to verify correct version prior to use.
4. TOOLS

In order to carry out the many tasks for PLPT activities, NCEI has been required to develop capabilities, often in the form of software, to perform the necessary comparison and analysis to support and complete the PLPT activities. The following is a descriptive list of these capabilities. A more complete description can be found in Appendix D.

4.1 DATA RETRIEVAL

- SUVI L0 products encoded in Consultative Committee for Space Data Systems (CCSDS) packets from GOES-R CLASS
- GOES-R instrument L1b products from the GOES-R PDA
- Scientific products from NASA Satellites. These can be retrieved from NASA data portals or through pre-packaged utilities built into SunPy, SolarSoft, and other data portals.
- Reprocessed instrument L1b and L2 products from NCEI’s Satellite Product Analysis and Distribution Enterprise System (SPADES)

4.2 INTERCOMPARISON WITH SIMILAR SOLAR INSTRUMENTS

- SUVI instruments will be compared against other NOAA solar instruments
  - GOES-R Series SUVI instruments
  - GOES-R Series EXIS-EUVSA instruments
- SUVI instruments will be compared against similar NASA scientific solar instruments
  - Solar Dynamics Observatory Atmospheric Imaging Assembly (SDO-AIA)
  - Solar Dynamics Observatory Calibration Rocket Underflight

4.3 MAKING TRENDS OF SUVI PERFORMANCE

- Trend quantifiable SUVI performance characteristics
- Trend intercomparisons with SUVI against other solar instruments

4.4 CREATE PLOTS, IMAGES, AND OTHER DATA VISUALIZATIONS THAT DISPLAY TRENDING AND OTHER SUVI DATA IN A MEANINGFUL MANNER.

Table 7. Tool capabilities created and used by NCEI-CO to carry out PLPTs and for tracking over mission life.

<table>
<thead>
<tr>
<th>PLPT Name</th>
<th>Required Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLPT-SUV-001</td>
<td>Data Retrieval, Data Visualization</td>
</tr>
<tr>
<td>PLPT-SUV-002</td>
<td>Data Retrieval, Trending, Data Visualization</td>
</tr>
<tr>
<td>PLPT-SUV-003</td>
<td>Data Retrieval, Intercomparison, Trending, Data Visualization</td>
</tr>
<tr>
<td>PLPT-SUV-006</td>
<td>Data Retrieval, Intercomparison, Trending, Data Visualization</td>
</tr>
<tr>
<td>PLPT-SUV-007</td>
<td>Data Retrieval, Intercomparison, Trending, Data Visualization</td>
</tr>
<tr>
<td>PLPT-SUV-008</td>
<td>Data Retrieval, Intercomparison, Data Visualization</td>
</tr>
</tbody>
</table>

Check the GOES-R Portal at [https://goesportal.ndc.nasa.gov](https://goesportal.ndc.nasa.gov) to verify correct version prior to use.
These tools use existing community-based software from the solar physics IDL and Python libraries, SolarSoft and SunPy, to pull data from other sources. In general, these tools obtain data using the Virtual Solar Observatory to search and access individual science-level data archives over HTTP.

In addition, the SUVI vendor, LMATC, has developed a set of software tools designed to support their PLT activities. These tools have been handed over to NCEI in order to facilitate calibration tracking for the lifetime of the GOES-R Series mission, and NCEI is in the process of transitioning those tools to run on the NCEI servers. More details on these tools can be found in Appendix D.

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
5. PRE-LAUNCH

For SUVI, the Data Operations Exercises (DOEs) will validate the data flows rather than exercise the functionality of the L1b algorithms across a wide range of environmental conditions. The DOEs will run live data from either GOES-EAST or GOES-WEST through a GOES-18 or GOES-19 configured GS. DOE-2 for GOES-18 pre-launch testing has the option of running old GOES-R Series data (e.g., an energetic solar event). To mitigate risks, inconsistencies in the format and content of each L1b test product will be noted and tracked within the Algorithm Action Review Team (AART). Any discrepancies found during the rehearsals will be entered into the Work Request (WR)/Algorithm Design Review (ADR) process. The SUVI rehearsals are finished when all discrepancies are documented.
6. REFERENCES

The following government documents have information relevant to this RIMP document. Unless otherwise noted, all documents with a “410-R” or “417-R” prefix are located in the GOES-R Library (in the Windchill repository). All other documents can be found in the GOES-R Portal at https://goesportal.ndc.nasa.gov/.

Unless otherwise noted, the current versions of the following documents apply.

- 410-R-CALVAL-0192, GOES-R Series Calibration and Product Validation Strategy
- 410-R-CONOPS-0008, GOES-R Series Concept of Operations (CONOPS)
- 410-R-MRD-0070, GOES-R Series Mission Requirements Document (MRD)
- 410-R-PLN-0101, GOES-R Series Calibration/Validation Plan Volume 1: Level 1b Data
- 417-R-PLN-0246, GOES-R Series Post-Launch Testing (PLT) Plan
- SUVP-RP-09-1677, Operations Handbook, SUVI CDRL 120
- SUVP-RV-09-1385, GOES-R SUVI Critical Design Review, CDRL 025
- GOES-R PLT and Active PLPT Forms on the GOES-R Program Portal:
  Repository > 01 GOES R > 02 GOES R - Flight Project > 04 Mission Operations > 900 CM Docs > 935 PLT - GOES-R
  Repository > 01 GOES R > 02 GOES R - Flight Project > 04 Mission Operations > 900 CM Docs > 936 PLT - GOES-S
  Repository > 01 GOES R > 02 GOES R - Flight Project > 04 Mission Operations > 900 CM Docs > 937 PLT - GOES-T
- GOES-R Passive L1b PLPT Forms on the GOES-R Program Portal:
  Repository > 01 GOES R > 02 GOES R - Flight Project > 04 Mission Operations > PLT > GOES-18 Passive PLPT forms

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
A. **APPENDIX A: POST-LAUNCH PRODUCT TESTS**

Unless otherwise noted in the individual test description, each PLPT is performed for each satellite of the GOES-R Series, and the point of contact (POC) is the SUVI PLPT Team.

A.1 **PLPTs that support the BETA maturity**

None – Only PLTs are required for Beta maturity.

A.2 **PLPTs that support PROVISIONAL maturity**

A.2.1 **SUVI Trending - CCD Temperature** [PLPT-SUV-001]

**Objective:** Initiate trending of the temperature of the CCD heater block.

**Reference MRD:** 2045, 2046, 2052

**Start Time:** As soon as telemetry is available

**Duration:** Ongoing/duration of PLPT period

**Mode:** This test is performed while the instruments are collecting data under normal operations. SUVI telemetry data is collected over a contiguous 24-hour period, and the telemetry points pertinent to the SUVI heater block thermistors are extracted. Conversions from the thermistor readings to Centigrade scale are performed if necessary. Trends are created for both primary and redundant thermistors.

**GOES-R Data Type(s):** SUVI L1b data

**Success Criteria:** The ability to extract CCD temperature readings from data.

**Dependencies:** See Mode

**Procedural References:** None

**Comparison/Reference Data:** None - Data trends are examined

**Monitoring & Analysis Method:** The analysis will be done by NOAA/NCEI/SGB. The analysis will establish and report on the trending of the CCD heater block thermistor readings. The trending is used during mission operations to monitor the thermal conditions of the SUVI detector.

**Tools Needed:** Data Retrieval, Data Visualization

A.2.2 **SUVI/AIA Intercalibration** [PLPT-SUV-003]

**Objective:** Characterize the SUVI performance with respect to a known and well-calibrated source (SDO/AIA).

**Reference MRD:** 2052

**Start Time:** PLT Day 93

**Duration:** Ongoing/duration of PLPT period

**Mode:** This test is performed while the instrument is collecting data under normal operations. A set of images taken over a contiguous 24-hour period is compared to a data from the SDO/AIA instruments taken during the same time period. The SUVI and AIA instruments have 5 comparable channels that can be used for cross-calibration purposes.

**GOES-R Data Type(s):** SUVI L1b data

Check the GOES-R Portal at [https://goesportal.ndc.nasa.gov](https://goesportal.ndc.nasa.gov) to verify correct version prior to use.
Success Criteria: If SDO/AIA is available, the trends are established by computing the daily averages for the channels that are shared between the respective instruments (94, 131, 171, 195/193, 304). Success is determined after demonstrating the start of intercomparison and trending of the SUVI and SDO/AIA instruments, and that the trends are as expected and not anomalous or out-of-family with prior and current SUVI instruments. If at least 6 months of SUVI and SDO/AIA are able to be obtained, the analysis of the trends must demonstrate a clear, stable, and predictable relationship between the respective instruments and thus the calibration of the SDO/AIA can be transferred to the SUVI instrument.

Dependencies: See success criteria

Procedural References: None

Comparison/Reference Data: SUVI data have been obtained using sequences representing nominal operations. SDO/AIA data have been obtained using sequences representing nominal operations. Data for thermal conditions, exposure times, and amplifier settings are used for trending analysis, validation of the test data set, and validation that the commanded conditions are being achieved.

Monitoring & Analysis Method: The analysis will be done by NOAA/NCEI/SGB with collaboration from LMSAL as necessary. The analysis will investigate and report on the cross-calibration. The data from the different temperature settings will be used to determine the performance and stability of the SUVI Level-1b product with respect to a well-maintained solar EUV telescope.

Tools Needed: Data Retrieval, Intercomparison, Trending, Data Visualization

A.2.3 SUVI/EXIS Intercalibration [PLPT-SUV-006]

Objective: Characterize SUVI performance with respect to available GOES-R Series EXIS/EUVS-A instruments having well-calibrated response functions.

Reference MRD: 2052

Start Time: PLT Day 93

Duration: Ongoing/duration of PLPT period

Mode: This test is performed while the instruments are collecting data under normal operations. SUVI data will be taken over a contiguous period, ideally of at least 3 months. These data are compared to data taken by any well-calibrated operational GOES-R Series EXIS/EUVS-A instrument during the same time period. The SUVI and EUVS-A instruments have comparable channels that can be used for cross-calibration purposes.

GOES-R Data Type(s): SUVI L1b data, EXIS/EUVS-A L1b data

Success Criteria: The trends are established by computing the daily averages for the channels that are shared between the respective instruments. Success is determined after demonstrating the start of intercomparison and trending of the SUVI and EXIS/EUVS-A instruments, and that the trends are as expected and not anomalous or out-of-family with prior and current SUVI instruments. If at least 3 months of contiguous data are able to be obtained, the analysis of the trends must demonstrate a clear, stable, and predictable relationship between the respective instruments and thus the calibration of the GOES-R Series EXIS EUVS can be transferred to the SUVI instrument.

Dependencies: See success criteria

Procedural References: None

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
Comparison/Reference Data: Contiguous SUVI data taken by using sequences representing nominal operations. Contiguous EXIS/EUVS-A L1b data taken in a mode representing nominal operations. Data for thermal conditions, exposure times, and amplifier settings are used for trending analysis, validation of the test data set, and validation that the commanded conditions are being achieved.

Monitoring & Analysis Method: The analysis will be done by NOAA/NCEI/SGB with collaboration from Lockheed Martin Solar and Astrophysics Laboratory (LMSAL) as needed. The analysis will investigate and report on the cross-calibration between SUVI and the GOES-R Series EUVS-A instruments. The cross-calibration performed using normal operations data taken during the PLT/PLPT phase of the GOES-R program will be used to characterize the beginning-of-life instrument response functions. This will serve as the start of instrument degradation trend for the purpose of monitoring the instrument response over the mission lifetime.

Tools Needed: Data Retrieval, Intercomparison, Trending, Data Visualization

A.2.4 GOES SUVI/GOES SUVI Intercalibration [PLPT-SUV-007]

Required for GOES-R satellites: 17, 18, 19

Objective: Characterize SUVI performance with respect to available operational GOES-R Series SUVI instruments.

Reference MRD: 2052

Start Time: PLT Day 93

Duration: Ongoing/duration of PLPT period

Mode: This test is performed while the instruments are collecting data under normal operations. SUVI data will be taken over a contiguous period of at least 2 months. These data are compared to data taken by any operational GOES-R Series SUVI instrument during the same time period. The GOES-R Series SUVI instruments have the same channels that can be used for cross-calibration purposes.

GOES-R Data Type(s): SUVI L1b data

Success Criteria: The trends are established by computing the daily averages each channel. Success is determined after analyzing at least 2 months of trending. The analysis of the trends must demonstrate a clear, stable, and predictable relationship between the respective instruments.

Dependencies: See success criteria

Procedural References: None

Comparison/Reference Data: At least 2 months of contiguous SUVI data taken by using sequences representing nominal operations. At least 2 months of operational GOES-R Series SUVI L1b data taken in a mode representing nominal operations. Data for thermal conditions, exposure times, and amplifier settings are used for trending analysis, validation of the test data set, and validation that the commanded conditions are being achieved.

Monitoring & Analysis Method: The analysis will be done by NOAA/NCEI/SGB with collaboration from Lockheed Martin Solar and Astrophysics Laboratory (LMSAL) as needed. The analysis will investigate and report on the cross-calibration between SUVI and other operations GOES-R Series SUVI instruments. The cross-calibration performed using normal operations data taken during the PLT/PLPT phase of the GOES-R program will be used to characterize the beginning-of-life instrument response functions. This will serve as the start of instrument degradation trend for the purpose of monitoring the instrument response over the mission lifetime.

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
serve as the start of instrument degradation trend for the purpose of monitoring the instrument response over the mission lifetime.

**Tools Needed:** Data Retrieval, Intercomparison, Trending, Data Visualization

### A.3 PLPTs that support FULL maturity

#### A.3.1 SUVI Trending - CCD Temperature [PLPT-SUV-001]

Unless otherwise noted, see the Provisional test description for PLPT-SUV-001.

**Objective:** Continue trending of the temperature of the CCD heater block.

#### A.3.2 SUVI Trending - Detector Performance [PLPT-SUV-002]

**Objective:** Initiate trending of the parameters derived from Photon Transfer Curves (also called Light Transfer Curves). The derived parameters to be trended are detector gain, read noise, charge transfer efficiency, and linearity.

**Reference MRD:** 2052

**Start Time:** L+52, after completion of PLT G*-E-SUV-002

**Duration:** Ongoing/duration of PLPT period

**Mode:** SUVI detector parameters derived from Photon Transfer Curves (PTCs), such as detector gain, read noise, and linearity are to be monitored throughout the mission lifetime. The SUVI instrument is in normal operations mode after all calibration-related PLTs have been completed. The test procedure is to follow that of the G*-E-SUV-002 - CCD Characterization PLT Test. These images are used to construct the PTCs from which the detector parameters are derived.

**GOES-R Data Type(s):** SUVI L1b data

**Success Criteria:** Sets of LED images are read by the SUVI instrument and successfully downlinked to the GOES-R Ground System.

**Dependencies:** If the Out-Of-Band PLT (G*-C-SUV-006) demonstrates significant light leakage through the entrance filters, then this test might need to have commands for off-pointing the instrument included. A possible alternative to off-pointing is to close the front door during this test.

**Procedural References:** None

**Comparison/Reference Data:** None - Data trends are examined

**Monitoring & Analysis Method:** The analysis will be done by NOAA/NCEI in collaboration with LMSAL. The analysis will establish and report on the trending of the CCD parameters derived from the PTC. The trending is used during mission operations to monitor the performance characteristics of the SUVI detector.

**Tools Needed:** Data Retrieval, Trending, Data Visualization

#### A.3.3 SUVI/AIA Intercalibration [PLPT-SUV-003]

Unless otherwise noted, see the Provisional test description for PLPT-SUV-003.

**Success Criteria:** If SDO/AIA is available, trends are made by computing the daily averages for the channels that are shared between the respective instruments (94, 131, 171, 195/193, 304). Success is determined after analyzing the respective trends after at least 6 months of trending. The analysis of the trends must demonstrate a clear, stable, and
predictable relationship between the respective instruments and thus the calibration of the SDO/AIA can be transferred to the SUVI instrument.

A.3.4 **SUVI/EVE Intercalibration** [PLPT-SUV-004]

*PLPT-SUV-004 removed.*

A.3.5 **SUVI/EUVS Intercalibration** [PLPT-SUV-005]

*PLPT-SUV-005 removed.*

A.3.6 **SUVI/EXIS Intercalibration** [PLPT-SUV-006]

Unless otherwise noted, see the Provisional test description for PLPT-SUV-006.

**Success Criteria:** The trends are continued by computing the daily averages for the channels that are shared between the respective instruments. Success is determined after analyzing at least 6 months of trending. The analysis of the trends must demonstrate a clear, stable, and predictable relationship between the respective instruments and thus the calibration of the GOES-R Series EXIS EUVS can be transferred to the SUVI instrument.

**Monitoring & Analysis Method:** The analysis will be done by NOAA/NCEI/SGB with collaboration from Lockheed Martin Solar and Astrophysics Laboratory (LMSAL) as needed. The analysis will investigate and report on the cross-calibration between SUVI and the GOES-R Series EUVS-A instruments. The cross-calibration performed using normal operations data taken during the PLT/PLPT phase of the GOES-R program will be used to characterize the beginning-of-life instrument response functions. This Full maturity test will serve as the continuation of instrument degradation trending for the purpose of monitoring the instrument response over the mission lifetime.

A.3.7 **GOES SUVI/GOES SUVI Intercalibration** [PLPT-SUV-007]

Unless otherwise noted, see the Provisional test description for PLPT-SUV-007.

**Success Criteria:** The trends are continued by computing the daily averages for the channels that are shared between the respective instruments. Success is determined after analyzing at least 6 months of trending. The analysis of the trends must demonstrate a clear, stable, and predictable relationship between the respective instruments.

**Monitoring & Analysis Method:** The analysis will be done by NOAA/NCEI/SGB with collaboration from Lockheed Martin Solar and Astrophysics Laboratory (LMSAL) as needed. The analysis will investigate and report on the cross-calibration between SUVI and other operations GOES-R Series SUVI instruments. The cross-calibration performed using normal operations data taken during the PLT/PLPT phase of the GOES-R program will be used to characterize the beginning-of-life instrument response functions. This Full maturity test will serve as the continuation of instrument degradation trending for the purpose of monitoring the instrument response over the mission lifetime.

Check the GOES-R Portal at [https://goesportal.ndc.nasa.gov](https://goesportal.ndc.nasa.gov) to verify correct version prior to use.
A.3.8 **SUVI/EVE Rocket Underflight Intercalibration** [PLPT-SUV-008]

**Required for GOES-R satellites:** N/A – Reserve test / target of opportunity

**Objective:** Characterize the SUVI performance with respect to a known and well-calibrated source (EVE Rocket / EUV Spectrometer).

**Reference MRD:** 2052

**Start Time:** N/A – target of opportunity

**Duration:** N/A – target of opportunity

**Mode:** This test is performed while the SUVI instrument is collecting data under normal operations. The EVE Rocket / EUV Spectrometer covers the entire SUVI spectral range so can be used for cross-calibration purposes.

**GOES-R Data Type(s):** SUVI L1b data

**Success Criteria:** Success is determined after analyzing comparison between SUVI and EVE Rocket / EUV Spectrometer underflight data. The analysis of the comparison must demonstrate a clear, stable, and predictable relationship between the respective instruments and that thus the calibration of the EVE Rocket / EUV Spectrometer can be transferred to the SUVI instrument.

**Dependencies:** See success criteria

**Procedural References:** None

**Comparison/Reference Data:** EVE Rocket / EUV Spectrometer underflight data

**Monitoring & Analysis Method:** The analysis will be done by NOAA/NCEI/SGB with collaboration from LMSAL as necessary. The analysis will investigate and report on the cross-calibration between the SUVI and the EVE Rocket instrument. Convolve GOES-16 and GOES-17 SUVI Spectral Response Functions with EVE Rocket data for proxy SUVI irradiance, then compare with SUVI irradiance measurements. The cross-calibration performed using normal operations data taken during the PLT phase of the GOES-R program will be used to characterize the beginning-of-life instrument response functions. This will serve as the start of instrument degradation trend for the purpose of monitoring the instrument response over the mission lifetime.

**Tools Needed:** Data Retrieval, Intercomparison, Data Visualization

Check the GOES-R Portal at [https://goesportal.ndc.nasa.gov](https://goesportal.ndc.nasa.gov) to verify correct version prior to use.
B. APPENDIX B: GOES-R SERIES AND VALIDATION REFERENCE DATA

B.1 Data set 1: Name: GOES-R SUVI L0  
Storage Location: LZSS  
Access Process: SPADES  
Spatial Coverage: Solar disk  
Temporal Coverage: 10 seconds  
Contingency: NCEI FTP (ftp://ftp.avl.class.noaa.gov/ddt/NCEI-NC/); GOES-R Level 0 Archive Service (GL0AS)

B.2 Data set 2: Name: GOES-R SUVI L1b  
Storage Location: SPADES  
Access Process: PDA  
Spatial Coverage: Solar disk  
Temporal Coverage: 10 seconds  
Contingency: CLASS

B.3 Data set 3: Name: SDO/AIA  
Storage Location: jsoc.stanford.edu  
Access Process: Internet  
Spatial Coverage: Solar Disk  
Temporal Coverage: 12 seconds  
Contingency: None

B.4 Data set 4: Name: EXIS-L1b-SFEU (PDA)  
Storage Location: SPADES  
Access Process: PDA  
Spatial Coverage: Solar Disk  
Temporal Coverage: 10 second  
Contingency: CLASS

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
C. APPENDIX C: PLT DETAILS

Approved final list and details can be found in the individual PLT forms. The list is repeated here for convenience and is not necessarily the final approved list. Stars (*) in the Test IDs represent the satellite number (i.e., 16, 17, 18, 19). Unless otherwise stated in the individual test, each PLT is performed for each satellite in the GOES-R Series, and the POC is the PLT Test Engineer.

C.1 Test ID: G*-C-SUV-001

Test Name: Guide Telescope Calibration
Test Duration: 2 hr. This needs to be run 2 times; the first run will be used to determine offset and gain, and the second run will use the offset and gain determined in the first run to validate the settings. Calibration will be repeated quarterly for the first year after launch of the satellite, then annually over the life of the mission.
Objective: Perform a calibration of the SUVI Guide Telescope (GT) to determine calibration coefficients.
Success Criteria: The GT coefficients are determined and uploaded to SUVI. GT coefficients are validated via inspection of solar imagery.
Prerequisites/Dependencies:
• G*_PLT_SUVI_Initial_Power_On
• FSS to GT calibration has been performed (G*-C-GNC-005)
• CCD Dark Current and LTC Characterization has been performed (G*-SUV-E-002)
• Instrument outgassing complete and instrument door open
• Sun pointing platform (SPP) is active and using the GT for pointing control
• CCD is at operational temperature
• First execution occurs after focus check with focus checks occurring between each GT calibration
• Validation run will be executed after all calibrations have been completed
• Flight Software (FSW) state is in FSA_READY or FSA_OPS
• SUV_SQ_STATUS equals 0
• Photodiode calibration has been performed (during GT initialization)
• No sunspots on the limb (edge of the Sun) during image-taking period.
Data Requirements:
• Readings from photodiodes in a pair are subtracted to give a GT Error Signal in the Y and Z.
• SUVI ET can take images of the Sun where the solar limb can easily be determined using the 171 Å channel with the filter wheels in the Thin Aluminum and Open positions.
• Fine Sun Sensor (FSS) and SADA and SEGA angles in order to determine pointing. Lockheed Martin Palo Alto is responsible for data analysis using LMSAL developed software accessing level 0 data in LZSS.
C.2 **Test ID:** G*-E-SUV-002  
**Test Name:** CCD Dark Current Characterization and LTC Characterization  
**Test Duration:** 5.5 hr. (+12 hr. for thermal stability at −65 C)  
**Objective:**  
Dark Current Characterization: Obtain a set of dark current images for a range of exposure times and detector temperatures to characterize the instrument thermal noise (dark current). This characterization will be used by ground system processing to correct solar images for the CCD thermal noise.  
Light Transfer Curve: Characterize the CCD performance parameters over a range of operating temperatures. The parameters include: CCD system gain, linearity, full well, and read noise.  
**Success Criteria:** The collection of dark images has been reviewed and analyzed to characterize the variation of the dark current with exposure time and amplifier settings. The variations of the system gain, linearity, full well, and the read noise with CCD temperature has been characterized and the values are within family of ground test measurements. GPA tables will be updated if necessary.  
**Prerequisites/Dependencies:**  
- G*_PLT_SUVI_Initial_Power_On  
- G*_PLT_SUVI_GT_Initial_Setup  
- G*_PLT_SUVI_Door_Unlatch  
- G*_PLT_SUVI_Door_Open  
- G*_PLT_SUVI_Decontam_Off  
- Outgassing complete and instrument door open  
- Sun pointing platform (SPP) is active  
- FSW state is FSA_OPS or FSA_READY with SUV_SQ_STATUS = 0  
- Instrument powered on in operational configuration; i.e., CEB has been powered, CCD waveforms have been uploaded, and instrument has been acquiring images at temperature for an hour. Latent dark current is measureable soon after waveforms are uploaded to the CEB; this dark current dissipates after reading out images for an hour and initialization of the CEB is avoided  
- Test is started with CCD at −65 C or the coldest possible temperature after twelve hours.  
**Data Requirements:** Dark images collected at various operating temperatures through each readout amplifier, temperature telemetry. Normal, Dark, and Light Transfer Curve Image (LTC) frames with various camera settings are obtained. Lockheed Martin Palo Alto is responsible for data analysis using LMSAL developed software accessing level 0 data in LZSS.

C.3 **Test ID:** G*-E-SUV-003  
**Test Name:** Mechanism Spin Time Characterization  
**Test Duration:** 1 hr. x 2 runs  
**Objective:** Characterize the spin time performance of the instrument rotary mechanisms (filter wheels, aperture selector, and shutter).
Success Criteria: Filter wheel, aperture selector, and shutter spin times and current draw are acceptable. Shutter exposure durations are confirmed.

Prerequisites/Dependencies:
- G*_PLT_SUVI_Initial_Power_On (Mission Hot)
- G*_PLT_SUVI_GT_Initial_Setup
- G*_PLT_SUVI_Door_Unlatch
- G*_PLT_SUVI_Door_Open
- G*_PLT_SUVI_Decontam_Off (Mission Nominal)
- Test should be conducted at mission high following outgas and normal operational temperatures.
- FSW state is FSA_OPS or FSA_READY with SUV_SQ_STATUS = 0.

Data Requirements:
Record the following values for analysis
- SUV_AS_SPIN_TIME – Aperture selector spin time
- SUV_AS_POS – Aperture selector current software position
- SUV_FW1_SPIN_TIME – Filter Wheel 1 spin time
- SUV_FW1_POS – Filter Wheel 1 current software position
- SUV_FW2_SPIN_TIME – Filter Wheel 2 spin time
- SUV_FW2_POS – Filter Wheel 2 current software position
- SUV_CNV_P15V_MTR_I_P – Mechanism motor current (for all spin tests); read from Image Summary Packet or APID 800 (start byte/bit = 516/4; data length = 12 bits).

Lockheed Martin Palo Alto is responsible for data analysis using LMATC developed software accessing level 0 data in LZSS.

C.4 Test ID: G*-E-SUV-005
Test Name: Shutter Light Leakage
Test Duration: 1 hr.
Objective: Quantify light leakage through the shutter.
Success Criteria: Shutter light leakage (if any) has been characterized and is within the allocated margin.

Prerequisites/Dependencies:
- G*_PLT_SUVI_Initial_Power_On
- G*_PLT_SUVI_GT_Initial_Setup
- G*_PLT_SUVI_Door_Unlatch
- G*_PLT_SUVI_Door_Open
- G*_PLT_SUVI_Decontam_Off
- CCD Dark Current and LTC Characterization has been performed (G*-SUV-E-002)
- Instrument outgassing completed, powered on in operational configuration
- Maneuver coordinated with EXIS
- CCD is at operational temperature
- FSW state is FSA_OPS or FSA_READY with SUV_SQ_STATUS = 0
- Low solar activity several days prior to test (i.e., no CME)
- Should occur when Earth and Moon will not be in the field of view by at least ±2 degrees after 2 degree off-point.

**Data Requirements:** Images collected off-pointed and Sun-pointed. Lockheed Martin Palo Alto is responsible for data analysis using LMATC developed software accessing level 0 data in LZSS. Dark current data from G16-E-SUV-002 (Dark Current Characterization) is required to complete the analysis.

### C.5 Test ID: G*-P-SUV-006
**Test Name:** Off-Band Signal Characterization
**Test Duration:** 0.5 hr.
**Objective:** Characterize the signals through the entrance filter and the analysis filters in both filter wheels for both in-band and out-of-band radiation.

**Success Criteria:** The analyses of the images obtained verify that the out-of-band response from extraneous radiation and in-band stray radiation is sufficiently characterized. This characterization will allow the images to be correctable to meet the minimum detectable flux and noise requirements for the duration of the mission.

**Prerequisites/Dependencies:**
- G*_PLT_SUVI_Initial_Power_On
- FSS to GT calibration has been performed (G*-C-GNC-005)
- CCD Dark Current and LTC Characterization has been performed (G*-SUV-E-002)
- CCD is at operational temperature
- Instrument outgassing completed, powered in operational configuration
- FSW state is FSA_OPS or FSA_READY with SUV_SQ_STATUS = 0.

**Data Requirements:** Images collected during direct solar imaging. Lockheed Martin Palo Alto is responsible for data analysis using LMATC developed software accessing level 0 data in LZSS.

### C.6 Test ID: G*-C-SUV-007
**Test Name:** Flat-Field Calibration
**Test Duration:** 6 hr. x 2 runs. Flat field calibration will be repeated quarterly during the first year, and annual thereafter.
**Objective:** Obtain flat-field data by performing sweeps across the solar disk in the E/W and N/S directions while imaging.

**Success Criteria:** A complete set of well-exposed images suitable for flat-field analysis is obtained. Flat-field analysis produces a method for removing pixel-to-pixel variations in response, which can be removed during ground processing. GPA tables updates as needed.

**Prerequisites/Dependencies:**
- G*_PLT_SUVI_Initial_Power_On
- G*_PLT_SUVI_GT_Initial_Setup
- G*_PLT_SUVI_Door_Unlatch
- G*_PLT_SUVI_Door_Open
- G*_PLT_SUVI_Decontam_Off
- CCD Dark Current and LTC Characterization has been performed (G*-SUV-E-002)
- Instrument outgassing completed and powered in operational configuration

Check the GOES-R Portal at [https://goesportal.ndc.nasa.gov](https://goesportal.ndc.nasa.gov) to verify correct version prior to use.
• CCD is at operational temperature
• Minimal solar activity (Quiet Sun as defined in PORD)
• FSW state is in FSA_OPS or FSA_READY
• SUV_SQ_STATUS equals 0
• Earth Pointing Platform (EPP) should be unlocked.

Data Requirements: The Boustrophedon images are downlinked in APID 808 (or 0x0328). 3 full frame scan images for each filter wheel setting, 1 full frame dark scan image per channel, 6 full frame Sun centered images with Thin/Open, and 6 full frame darks with the same filter settings are taken for each of the channels. Lockheed Martin Palo Alto is responsible for data analysis using LMATC developed software accessing level 0 data in LZSS.

C.7  Test ID: G*-E-SUV-009
Test Name: Focus Check
Test Duration: 1 hr. x 3 runs. Focus check will be repeated quarterly for the first year of nominal operations, and annually thereafter.
Objective: Determine and set the optimal focus setting and the plate scale.
Success Criteria: The optimal position has been determined. The plate scale has been determined.
Prerequisites/Dependencies:
• G*_PLT_SUVA_Initial_Power_On
• G*_PLT_SUVA_GT_Initial_Setup
• G*_PLT_SUVA_Door_Unlatch
• G*_PLT_SUVA_Door_Open
• G*_PLT_SUVA_Decontam_Off
• FSS to GT calibration has been performed (G*-C-GNC-005)
• CCD Dark Current and LTC Characterization has been performed (G*-SUV-E-002)
• Test should be conducted at normal operational temperatures
• Sun pointing platform (SPP) is active and using the GT for pointing control
• FSW state is FSA_OPS or FSA_READY with SUV_SQ_STATUS = 0.

Data Requirements: Solar images obtained at various focus settings. Lockheed Martin Palo Alto is responsible for data analysis using LMATC developed software accessing level 0 data in LZSS.

C.8  Test ID: G*-E-SUV-010
Test Name: Mechanical Delay Characterization
Test Duration: 3 hr. x 2 runs. Test will be repeated once per quarter over mission life.
Objective: Characterize the delay performance of the instrument rotary mechanisms (filter wheels, aperture selector, and shutter).
Success Criteria: Filter wheel, aperture selector, and shutter delay times are acceptable and within family of pre-launch measurements. All data are analyzed following the test to determine success of the test.
Prerequisites/Dependencies:
• G*_PLT_SUVA_Initial_Power_On (Mission Hot)
• G*_PLT_SUVI_GT_Initial_Setup
• G*_PLT_SUVI_Door_Unlatch
• G*_PLT_SUVI_Door_Open
• G*_PLT_SUVI_Decontam_Off (Mission Nominal)
• Test should be conducted at mission high following outgas and normal operational temperatures
• FSW state is FSA_OPS or FSA_READY with SUV_SQ_STATUS = 0

Data Requirements: Per the list in the PLT form, various filter wheel, aperture selector, and shutter values recorded using CASSIE for analysis. Lockheed Martin Palo Alto is responsible for data analysis using LMATC developed software accessing level 0 data in LZSS.

C.9 Test ID: G*-E-SUV-011
Test Name: Mechanical Encoder Current Transfer Ratio Characterization
Test Duration: 1.5 hr. This test will establish the baseline measurements utilized for quarterly comparisons throughout the lifetime of the instrument.
Objective: Characterize the performance of the Mechanism encoders. The current transfer ratio (CTR) is estimated and trended. The CTR test confirms the encoder settings. The settings are different for each mechanism and are based on measurements when the mechanism was assembled. The CTR of the encoders is expected to remain relatively constant throughout ground testing, and may degrade on-orbit due to radiation. The CTR has to be adequate to pull the encoder voltage down to 1.5 volts (where the drive electronics is guaranteed to see the signal as a "low"). The initial encoder settings are selected to provide 100% margin. Once the mechanisms are integrated to the instrument, CTR cannot be calculated directly because there is no way to read the encoder voltages. Instead, run through a list of encoder settings and note where the status changes from 1 to 0. At beginning of life, only first few infra-red emitting diode (IRED) settings are needed.
Success Criteria: Sufficient margin exists for current transfer ratio for each mechanism encoder. All data are analyzed following the test to determine success of the test.
Prerequisites/Dependencies:
• G*_PLT_SUVI_Initial_Power_On
• G*_PLT_SUVI_GT_Initial_Setup
• G*_PLT_SUVI_Door_Unlatch
• G*_PLT_SUVI_Door_Open
• G*_PLT_SUVI_Decontam_Off
• Test should be conducted within mechanism operational temperatures
• FSW state is FSA_OPS or FSA_READY with SUV_SQ_STATUS = 0
Data Requirements: Per the table in the PLT form, various filter wheel, aperture selector, shutter, focus monitor, commanded settings, and IRED set values are recorded for analysis. The CTR data analysis tool, SUVI_CTR spreadsheet, is used to estimate the current transfer ratio for each of the encoders.

C.10 Test ID: G*-E-SUV-012
*Required for GOES-R Series satellites: 17, 18, 19

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
**Test Name:** Extended Sequencer  
**Test Duration:** 16 hr. (ACTIVE time 9:30 (8.5 hours + 1 hour for upload); PASSIVE time 6:30)  
**Objective:** The objective of this test is to simulate SUVI nominal operations including two eclipse seasons (there are two eclipse seasons per year). The test runs at least 6.5 hours of imaging with the standard “NCEI” imaging sequence, runs through eclipses #1-24 (vernal), resets the eclipse time tracker, and lastly runs through eclipses #1-24 (autumnal). During six of the longest eclipse periods, mechanism calibration tests and a CCD characterization test will be automatically triggered by the SUVI sequencer. At all other times, the SUVI sequencer will be imaging following its normal operating sequence. The test will validate spacecraft automated scripts and the interface between spacecraft commands and the SUVI instrument that are necessary to complete the scheme for automated mechanism testing during eclipse. The portions of the test that consist of standard sequencing complete all of the automated calibration slots that will be used during operations, fully validating the on-board products that will be used in operations.  
**Success Criteria:** This test will be deemed successful if the SUVI scripts complete without unexpected errors. SUVI eclipse operations must conclude by restarting the sequencer.  
**Prerequisites/Dependencies:**  
- G*_PLT_SUVI_Initial_Power_On  
- G*_PLT_SUVI_GT_Initial_Setup  
- G*_PLT_SUVI_Door_Unlatch  
- G*_PLT_SUVI_Door_Open  
- G*_PLT_SUVI_Decontam_Off  
- Test should be conducted within mechanism operational temperatures  
- FSW state is FSA_OPS or FSA_READY with SUV_SQ_STATUS= 0  
- Mechanisms are initialized  
- CEB is turned on and configured to take images  
- Outgassing complete and instrument door open  
**Data Requirements:** Record various eclipse, mechanism data, and mechanism delay values per the tables in the PLT form.

**C.11 Test ID:** G*-E-SUV-014  
*Required for GOES-R Series satellites: 17  
**Test Name:** Effective Area  
**Test Duration:** 1.5 hours  
**Objective:** Compare the effective area of different SUVI flight models.  
**Success Criteria:** Script(s) executed without errors.  
**Prerequisites/Dependencies:** Instrument outgassing completed, powered on in operational configuration. The test should be scheduled as closely as possible to the PLT 007 Flat-Fielding Calibration. It can be run before or after the Flat-Fielding Calibration. FSW state is FSA_OPS or FSA_SEQ with SUV_SQ_STATUS= 0 or 1.  
**Data Requirements:** Images collected via running the standard sequence. Lockheed Martin Palo Alto is responsible for data analysis using LMSAL developed software accessing level 0 data in LZSS.

Check the GOES-R Portal at [https://goesportal.ndc.nasa.gov](https://goesportal.ndc.nasa.gov) to verify correct version prior to use.
C.12 Test ID: G*-E-SUV-015

*Required for GOES-R Series satellites: 17, 18

Test Name: Extended Corona Imaging Operations

Test Duration:
- Phase 1 – 15 min. active commanding + 5 hr. passive data collection
- Phase 2 – 25 min. active commanding + 3 days passive data collection
- Phase 3 – 25 min. active commanding + 4 weeks passive data collection

Objective: Perform Solar coronal imaging.

Success Criteria:
1. Phase 1 is successful if attitude disturbances observed are equivalent to typical LTR firing. Phase 2 cannot be initiated until this success criteria is met.
2. Phase 2 is successful if the SUVI data are collected over the 72 hours period and there has been no increase to the GLM RTEP counts from Phase 1. Phase 3 cannot be initiated until these success criteria are met.
3. Phase 3 is successful if all the scheduled SUVI image data are collected.
4. RTS and TMONs execute successfully.

Prerequisites/Dependencies:
- Instrument powered on in operational configuration, outgassing completed, and at nominal temperatures:
  - G* PLT_SUVI_Initial_Power_On
  - G* PLT_SUVI_GT_Initial_Setup
  - G* PLT_SUVI_Door_Unlatch
  - G* PLT_SUVI_Door_Open
  - G* PLT_SUVI_Decontam_Off
- Per LMSSC recommendation, Active Vibration Dampening (AVD) Compensation should be disabled for SADA slews in all phases.
- This cannot be scheduled concurrently with any other PLTs that require long-term pointing stability for any passive data collects
- No other activities that require SADA/SEGA nor GNC mode changes occur during any phase (maneuvers are allowed to overlap and impact will be characterized). EXIS will be Sun-pointed only during the pointing dwell at location “2” in the figure.
- SUVI must be configured for imaging operations prior to Phase 2
- All SUVI and EXIS PLT’s should be completed prior to Phase 3
- Custom SADA/SEGA slew Cfg files, RTS files, TMON files, SUVI FDB and SCT files, are all delivered, approved, and promoted through CM for each test Phase. The FDB and SCT files are needed for Phases 2 and 3.

Data Requirements:
- High rate GNC telemetry for assessing attitude stability and disturbances directly correlated with SADA/SEGA gimbal movement
  - Assigned to: NASA GNC
- GLM number of false events during all three phases with the goal of 0 false events by Phase 3.
  - Assigned to: LMATC GLM
- Stitched SUVI images.

Check the GOES-R Portal at [https://goesportal.ndc.nasa.gov](https://goesportal.ndc.nasa.gov) to verify correct version prior to use.
C.13 Test ID: G*-E-SUV-016
*Required for GOES-R Series satellites: 17, 18, 19
Test Name: Filter Throughput
Test Duration: Passive.
Objective: Compute filter transmission of SUVI flight model filters.
Success Criteria: Filter transmission values are calculated and validated against the default values.
Prerequisites/Dependencies:
- G*_PLT_SUVI_INITIAL_Power_On
- G*_PLT_SUVI_GT_Initial_Setup
- G*_PLT_SUVI_Door_Unlatch
- G*_PLT_SUVI_Door_Open
- G*_PLT_SUVI_Decontam_Off
- Instrument outgassing completed, powered on in operational configuration
- Mission Nominal temperatures
- SUV_CEB_PWR_ST = 1 and CEB is initialized
- SUV_CEB_VID_OS_L = 512 for imaging at mission nominal temperatures
- FSW state is FSA_READY, FSA_OPS, or FSA_SEQ with SUV_SQ_STATUS= 0 or 1

Data Requirements: Data is collected via PLTs G*-C-SUV-006 Off-Band Characterization and G*-C-SUV-007 Flat Field Calibration. Lockheed Martin Palo Alto is responsible for data analysis using LMSAL developed software accessing level 0 data in LZSS.
D. APPENDIX D: TOOLS

D.1 Tool #1: Data Retrieval
Location: NCEI-CO
Description: Capabilities to ingest data from a variety of sources: GOES-R Series, GOES-NOP Series, NASA satellites, CLASS, GRB, PDA, LZSS, and SPADES.
Developer: NCEI
Data Dependencies: Standalone. Uses as OS/SW: Python 2.7+, Numpy, Scipy, Pyfits/Astropy. Local Environment: SPADES. Data Inputs: SUVI L0 (LZSS) and L1b (PDA).
Testing accomplished or planned: Access to SPADES, NCEI, JSOC (NASA), and GOES-NOP data has been verified.
POC: NCEI-CO

D.2 Tool #2: Instrument Intercomparison
Location: NCEI-CO
Description: Trending data comparing SUVI instruments against other solar instruments
Developer: NCEI
Data Dependencies: Standalone. Uses as OS/SW: Python 2.7+, Numpy, Scipy, Pyfits/Astropy. Local Environment: SPADES. Data Inputs: SUVI L1b (PDA), EXIS-L1b-SFEU (PDA), GOES-NOP EUVS (NCEI), and SDO/AIA.
Testing accomplished or planned: Proof of concept presented at SHINE (2015). Capabilities have been demonstrated at Provisional and Full Validation PS-PVRs.
POC: NCEI-CO

D.3 Tool #3: Trending
Location: NCEI-CO
Description: Creating trends of quantities pertaining to SUVI instrument performance.
Developer: NCEI
Data Dependencies: Standalone. Uses as OS/SW: Python 2.7+, Numpy, Scipy, Pyfits/Astropy. Local Environment: SPADES. Data Inputs: SUVI L1b (PDA) and SDO/AIA.
Testing accomplished or planned: Proof of concept presented at SHINE (2015). Capabilities have been demonstrated at Provisional and Full Validation PS-PVRs.
POC: NCEI-CO

D.4 Tool #4: Data Visualization
Location: NCEI-CO
Description: Holds the various methods to generate plots, images, etc.
Developer: NCEI
Local Environment: SPADES.

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: NCEI-CO

D.5 Tool #5: SUVI_LTC
Location: LMATC
Description: Measure the SUVI Light Transfer Curve.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.6 Tool #6: SUVI_PLATESCALE
Location: LMATC
Description: Measure platescale from Kuhn raster or Flatfield offpoint.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.7 Tool #7: SUVI_FLATFIELD
Location: LMATC
Description: Compute flatfield image from Kuhn raster
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.8 Tool #8: SUVI_MAKE_BADPIX
Location: LMATC
Description: Compute bad pixel map from Kuhn raster.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.9 Tool #9: SUVI_MAKE_DARK
Location: LMATC
Description: Compute dark and pedestal from dark calibration run.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.10 Tool #10: SUVI_GTCAL
Location: LMATC
Description: Compute GT-ETA offset and scale factor from cruciform.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.11 Tool #11: SUVI_THROUGHPUT
Location: LMATC
Description: Compute throughput normalization from SUVI, EXIS, AIA, or EVE data.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.12 Tool #12: SUVI_GET_RESPONSE
Location: LMATC
Description: Return SUVI response function using calibration data and CHIANTI model.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.13 Tool #13: SUVI DEM FIT
Location: LMATC
Description: Compute DEM model using SUVI response function.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.14 Tool #14: SUVI IMAGE BLEND
Location: LMATC
Description: Return a composite image (e.g. 284-subtracted 304 image) from multiple images.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.15 Tool #15: SUVI ANALYZE MECH
Location: LMATC
Description: Analyze the results of a SUVI mechanism test.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.16 Tool #16: SUVI FILTER CHECK
Location: LMATC
Description: Analyze the results of a SUVI filter test.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.17 Tool #17: SUVI_LIMBFIT
Location: LMATC
Description: Find center of solar disk in a SUVI image.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.18 Tool #18: SUVI_SHARPNESS
Location: LMATC
Description: Assess the relative quality of each image.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.19 Tool #19: SUVI_DESPIKE
Location: LMATC
Description: Removing cosmic rays based on appearance of a single image.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.20 Tool #20: SUVI_TIME_DESPIKE
Location: LMATC
Description: Time-domain de-spiking (removing cosmic rays based on image sequence).
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.21 Tool #21: SUVI_ALIGN_IMAGE
Location: LMATC
Description: Generalized image alignment (apply roll, scale, and shift).
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.22 Tool #22: SUVI_PREP
Location: LMATC
Description: Dark subtraction, flat fielding, de-spiking, image alignment.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.23 Tool #23: SUVI_GET_DISP
Location: LMATC
Description: Image cross-correlation (measuring sub-pixel shifts between similar images).
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A
Testing accomplished or planned: Code and Unit Testing, Acceptance Test, Independent Review.
POC: LMATC

D.24 Tool #24: SUVI_MFITS
Location: LMATC
Description: Reform CCSDS science data packet to FITS, and populate FITS header and housekeeping data.
Developer: LMATC
Development schedule & handover plan: Tool has been delivered to NCEI-CO.
Data Dependencies: IDL, SolarSoft
Local Environment: N/A

Check the GOES-R Portal at https://goesportal.ndc.nasa.gov to verify correct version prior to use.
**Testing accomplished or planned:** Code and Unit Testing, Acceptance Test, Independent Review.

**POC:** LMATC

**D.25 Tool #25: SUVI_CHECK_IMAGE**

- **Location:** LMATC
- **Description:** Consistency checking (data format check).
- **Developer:** LMATC
- **Development schedule & handover plan:** Tool has been delivered to NCEI-CO.
- **Data Dependencies:** IDL, SolarSoft
- **Local Environment:** N/A

**Testing accomplished or planned:** Code and Unit Testing, Acceptance Test, Independent Review.

**POC:** LMATC

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Check the GOES-R Portal at [https://goesportal.ndc.nasa.gov](https://goesportal.ndc.nasa.gov) to verify correct version prior to use.
E. APPENDIX E: ACRONYMS

The acronym list below covers a select set of acronyms associated with SUVI and general GOES-R procedures. To see a more comprehensive list of acronyms used within the GOES-R Program, see the GOES-R Series Acronyms webpage at https://www.goes-r.gov/resources/acronyms.html.

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AART</td>
<td>Algorithm Action Review Team</td>
</tr>
<tr>
<td>ACMP</td>
<td>Algorithm Change Management Plan</td>
</tr>
<tr>
<td>ADR</td>
<td>Algorithm Design Review</td>
</tr>
<tr>
<td>AIA</td>
<td>Atmospheric Imaging Assembly</td>
</tr>
<tr>
<td>AWG</td>
<td>Algorithm Working Group</td>
</tr>
<tr>
<td>Cal/Val</td>
<td>Calibration and Validation</td>
</tr>
<tr>
<td>CCD</td>
<td>Charge-Coupled Device</td>
</tr>
<tr>
<td>CCSDS</td>
<td>Consultative Committee for Space Data Systems</td>
</tr>
<tr>
<td>CLASS</td>
<td>Comprehensive Large Array-data Stewardship System</td>
</tr>
<tr>
<td>CONOPS</td>
<td>Concept of Operations</td>
</tr>
<tr>
<td>CR</td>
<td>Change Request</td>
</tr>
<tr>
<td>CTR</td>
<td>Current Transfer Ratio</td>
</tr>
<tr>
<td>CWG</td>
<td>Calibration Working Group</td>
</tr>
<tr>
<td>DN</td>
<td>Digital Number</td>
</tr>
<tr>
<td>DOE</td>
<td>Data Operations Exercise</td>
</tr>
<tr>
<td>eGRES</td>
<td>electronic GOES-R Export Service</td>
</tr>
<tr>
<td>EIT</td>
<td>Extreme Ultraviolet Imaging Telescope</td>
</tr>
<tr>
<td>EPP</td>
<td>Earth Pointing Platform</td>
</tr>
<tr>
<td>ERB</td>
<td>Engineering Review Board</td>
</tr>
<tr>
<td>ESP</td>
<td>Extreme Ultraviolet Spectrophotometer</td>
</tr>
<tr>
<td>EUV</td>
<td>Extreme Ultraviolet</td>
</tr>
<tr>
<td>EVE</td>
<td>EUV Variability Experiment</td>
</tr>
<tr>
<td>EXIS</td>
<td>Extreme ultraviolet and X-ray Irradiance Sensors</td>
</tr>
<tr>
<td>FSS</td>
<td>Fine Sun Sensor</td>
</tr>
<tr>
<td>FSW</td>
<td>Flight Software</td>
</tr>
<tr>
<td>GL0AS</td>
<td>GOES-R Level 0 Archive Service</td>
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<td>GOES</td>
<td>Geostationary Operational Environmental Satellite</td>
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<td>GOES-R</td>
<td>GOES-R Series</td>
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<tr>
<td>GORWG</td>
<td>GOES-R Operational Readiness Working Group</td>
</tr>
<tr>
<td>GRB</td>
<td>GOES Rebroadcast</td>
</tr>
<tr>
<td>GS</td>
<td>Ground Segment</td>
</tr>
<tr>
<td>IRED</td>
<td>Infra-Red Emitting Diode</td>
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<table>
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<td>L0</td>
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<td>L1b</td>
<td>Level 1b</td>
</tr>
<tr>
<td>L2</td>
<td>Level 2</td>
</tr>
<tr>
<td>LM</td>
<td>Lockheed Martin</td>
</tr>
<tr>
<td>LMATC</td>
<td>Lockheed Martin Advanced Technology Center</td>
</tr>
<tr>
<td>LMSAL</td>
<td>Lockheed Martin Solar and Astrophysics Laboratory</td>
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<tr>
<td>LTC</td>
<td>Light Transfer Curve</td>
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<tr>
<td>LUT</td>
<td>look up table</td>
</tr>
<tr>
<td>LZSS</td>
<td>Level Zero Storage System</td>
</tr>
<tr>
<td>MOST</td>
<td>Mission Operations Support Team</td>
</tr>
<tr>
<td>MRD</td>
<td>Mission Requirements Document</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
</tr>
<tr>
<td>NCEI-CO</td>
<td>National Centers for Environmental Information - Colorado</td>
</tr>
<tr>
<td>NESDIS</td>
<td>NOAA Satellite and Information Service</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NWS</td>
<td>National Weather Service</td>
</tr>
<tr>
<td>OSPO</td>
<td>Office of Satellite and Product Operations</td>
</tr>
<tr>
<td>PASS</td>
<td>Product Algorithm Science Support</td>
</tr>
<tr>
<td>PDA</td>
<td>Product Distribution and Access</td>
</tr>
<tr>
<td>PLPTs</td>
<td>Post-Launch Product Tests</td>
</tr>
<tr>
<td>PLTs</td>
<td>Post-Launch Tests</td>
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<tr>
<td>POC</td>
<td>Point of Contact</td>
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<tr>
<td>PORD</td>
<td>Performance and Operational Requirements Document</td>
</tr>
<tr>
<td>PRO</td>
<td>Product Readiness and Operations</td>
</tr>
<tr>
<td>PSE</td>
<td>Program System Engineering</td>
</tr>
<tr>
<td>PS-PVR</td>
<td>Peer Stakeholder-Product Validation Review</td>
</tr>
<tr>
<td>PTC</td>
<td>Photon Transfer Curves</td>
</tr>
<tr>
<td>PTDR</td>
<td>Post Test Data Review</td>
</tr>
<tr>
<td>RIMP</td>
<td>Readiness, Implementation, and Management Plan</td>
</tr>
<tr>
<td>SDO</td>
<td>Solar Dynamic Observatory</td>
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<tr>
<td>SMEs</td>
<td>Subject Matter Experts</td>
</tr>
<tr>
<td>SOE</td>
<td>Sequence of Events</td>
</tr>
<tr>
<td>SOHO</td>
<td>Solar and Heliospheric Observatory</td>
</tr>
<tr>
<td>SPADES</td>
<td>Satellite Product Analysis and Distribution Enterprise System</td>
</tr>
<tr>
<td>SUVI</td>
<td>Solar Ultraviolet Imager</td>
</tr>
<tr>
<td>SXI</td>
<td>Solar X-ray Imager</td>
</tr>
<tr>
<td>WR</td>
<td>Work Request</td>
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