



STScI | SPACE TELESCOPE
SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

S&OC Update

Jeff Valenti
JWST Mission Scientist @ STScI

2021 June 15



Topics

- Commissioning exercises
- COVID mitigation
- System freeze
- Recent and upcoming S&OC enhancements
 - Exposure Time Calculator (ETC 1.6, 1.6.1)
 - Astronomer's Proposal Tool (APT 2020.5, 2021.1, 2021.2)
 - Operations Script Subsystem (OSS 8.3, 8.4)
 - Data Management Subsystem (DMS 7.7, 7.7.1, 7.8)
- Moving to normal operations
- Cycle 1 performance monitoring (JWQL)



Commissioning exercises

- Exercises in the Mission Operations Center (MOC)
 - Feb 22: Integrated Crew Exercise ICE-1
 - Feb 23-28: Ground SEGment GSEG-4
 - Mar 8-13: Launch Readiness Exercise LRE-2, Science Instrument Rehearsal SIR-3
 - May 3: ICE-2
 - May 17-22: LRE-3
 - Jun 14-21: LRE-4 (this week!)
 - Jul 19-23: Normal Operations 11
 - Aug 2-13: LRE-5
- Joint wavefront exercises
- Science instrument commissioning analysis rehearsals



COVID mitigation

- Onsite presence at STScI is still highly restricted
 - Essential staff
 - Small number of additional staff
 - Anticipate moving to restricted presence in the near future
- Evolving protocols
 - Negative PCR test or proof of vaccination
 - Proximity sensors and limits on room capacity
- Hybrid approach for commissioning exercises
 - Low density of staff working on site
 - Large contingent working remotely
 - All activities are being accomplished



S&OC updates during system freeze

- System freeze began 2021-Apr-30
 - Rehearse with the same system that will be used during commissioning
 - S&OC Build 4.8 is the baseline, witness test was 2021-Apr-19
- Submit freeze waivers to Mission Operations Working Group (MOWG)
 - Waiver required for everything from flight software to data analysis tools
 - Requestor presents justification (e.g., needed for commissioning)
 - Changes will require stronger justification the closer we get to launch
- Continue to maintain software and develop new capabilities
 - Implement enhancements as time permits, but defer release until Cycle 1



ETC 1.6 in PPS 14.14

- Released on 2021-Mar-31
- Selected highlights
 - Support F277W filter for NIRISS SOSS
 - Update exposure time for NIRCам Grism Time Series with 1 output
 - Ignore uncertain knowledge of flat field when calculating S/N for time series
 - Split NIRSpec Fixed Slit/BOTS into separate modes
 - Add time series modes for MIRI Imaging and MIRI MRS
 - Include first and last group when calculating S/N for MIRI LRS time series
 - Add spectral templates
 - Sun, Jupiter, Saturn, Uranus, low temperature Phoenix models (200-3000 K)
 - Planetary nebula models from CLOUDY, supernovae, kilonova
 - "Normal" galaxies from SWIRE, Galaxy spectra from Brown+ (2019), composite QSO
 - Simple stellar population models
 - Improve usability, show SOSS spectral orders together



ETC 1.6.1 in PPS 14.15

- Planned release date is this month
- Planned content
 - Add full-frame reset between integrations in MIRI exposures
 - Affects exposure time, but not S/N for fixed NGROUP and NINT
 - Mimic pipeline behavior when calculating S/N for MIRI exposures
 - Drop last frame for NGROUP > 2, Drop first frame for NGROUP > 3
 - Ignore fast full-frame reset time when calculating saturation
 - Pixel-by-pixel reset of subarray occurs after fast full-frame reset
 - Remove warning for NINT > 1 when using MIRI SLOWR1 readout pattern
 - Useful for managing SSR and downlink usage
 - Update the Pandeia Engine News site
 - <https://outerspace.stsci.edu/display/PEN/Pandeia+Engine+News>



APT 2020.5 in PPS 14.13

- Released on 2020-Dec-18 [55 tickets, not all JWST]
- Selected highlights
 - Support guide star acquisition in crowded fields (i.e., Galactic Center)
 - Calculate and display ecliptic and galactic coordinates for fixed targets
 - Reduce MIRI TA overhead for smaller detector region in OSS 8.1
 - LRS/MRS: 172 s → 60 s, Coronagraphy: 214 s → 102 s
 - Double width of MSA frame displayed in MPT shutter view
 - Update NGROUP and NINT limits in WFSC Commissioning template
 - Fix Aladin bugs affecting mosaics, position angles, parallels, and MSA catalogs
 - Fix connection to target confirmation server



APT 2021.1 in PPS 14.14

- Released on 2021-May-11 [50 tickets, not all JWST]
- Selected highlights
 - Limit total number of frames in an exposure to 196608
 - Affects a few long time series observations, mitigation is to split into multiple exposures
 - Ability to support new MIRI readout patterns: FASTR1 and SLOWR1
 - Add reset frame between integrations in an exposure to improve calibration accuracy
 - Limit MIRI integrations to a maximum of 2000 seconds to mitigate cosmic rays
 - Allow pure parallel attachment to IFU, MRS, WFSS, LRS, and fixed slit
 - Previously attachment allowed only to Imaging and MOS
 - Use new FULLP aperture for NIRCam module B when visit includes TA
 - Remove solar system category for fixed targets, provide menu for description
 - Allow override of maximum number of MSATA reference sources
 - Use zero offset dithers in LOS Jitter exposures to obtain multiple exposures



APT 2021.2 in PPS 14.15

- Planned release date is 2021-Jun-17
- Planned content [66 tickets, not all JWST]
 - Support NIRCам Grism Time Series with Module B for commissioning
 - Revamp diagnostics to manage downlink and SSR usage (separate presentation)
 - Add diagnostics to manage impact of non-interruptible linked sets of visits
 - Implement multiple exposures for NIRSpec bright object time series mode
 - Fix exposure indexing bug for some observations of internal targets (e.g., darks)
 - Estimate, report, and limit lamp-on duration in a MIRI observation
 - Support visualization of usable FOV for NIRCам WFSS
 - Calculate additional overhead to configure ISIM data handler for long exposures



OSS configuration

- Launch with OSS 8.2 in EEPROM, loaded on 2021-Jan-25
- Rehearsals and exercises can load later version of OSS in RAM
- Plan to load OSS 8.4 in RAM early in commissioning (day ~35)
- APT 2021.2 (June) will assume OSS 8.4 by default
 - Make OSS features (MIRI FASTR1/SLOWR1, NIRCcam FULLP) visible to observers
 - Operations routinely overrides default for rehearsals and exercises



OSS 8.3

- Certified completed in Oct 2020, test report submitted in Nov 2020
- Selected highlights
 - Support cryo-cooler testing at JPL
 - Add a wait step during cryo-cooler assisted anneal
 - Reduce small-angle maneuver overheads, as anticipated in the APT timing model
 - Wait for small-angle maneuver to settle before starting guide star reacquisition
 - Allow dithers when NIRISS Imaging is prime (but not yet in APT)
 - Support multiple dither points when NIRISS Imaging is parallel



OSS 8.4

- Certified completed in June 2021
- Selected highlights
 - Implement work around for high-gain antenna move taking longer than expected
 - Implement guide star ID for crowded fields with many stars that saturate
 - Support new MIRI readout patterns: FASTR1, FASTR100, and SLOWR1
 - Limit total number of frames in an exposure to 196608
 - Allow more time to configure ISIM data handler for long exposures
 - Include fast full-frame resets in exposure time calculation for NIR subarrays
 - Check magnitude of roll adjustment after first iteration of MSA target acquisition
 - Change MRS lamp current
 - Support new FULLP aperture for NIRCам module B



JWST v0.18.3 in DMS 7.7

- Released on 2021-Jan-25 [96 tickets]
- Selected highlights
 - Add FITS SIP keywords to provide approximate coordinates
 - Produce separate FITS extension for each spectral order
 - Reduce memory usage in jump step
 - Update thresholds used in saturation step
 - Fix bugs and enhance 1D spectral extraction
 - Improve association rules for MIRI LRS, NIRSpec lamp, NIRSpec IFU, and TSO TA
 - Use subset of wavelengths for default TSO light curve product
 - Adopt latest ImPlaneIA algorithm for AMI analysis
 - Use separate package for core data model functionality
 - Fix high-priority bugs reported during testing of previous version



JWST v1.1.0 in DMS 7.7.1

- Released on 2021-Feb-26 [41 tickets]
- Selected highlights
 - Support new MIRI readout patterns: FASTR1, FASTR100, and SLOWR1
 - Add transformation to barycentric frame, remove differential velocity aberration
 - Add missing spectral coordinate frames for TSO grism and WFSS
 - Correct flux units in 2D spectra of extended sources for NIRSpec MOS and IFU
 - Record center of extraction region in header for IFU data
 - Remove background exposures from stage 3 coronagraphic associations
 - Save segmentation map used to generate catalog in stage 3 image pipeline
 - Fix high-priority bugs reported during testing of previous version



JWST v1.2.3 in DMS 7.8

- Planned release date is this month
- Planned content
 - Calculate aperture-corrected total magnitude for point and extended sources
 - Implement a correction for overlapping spectra in WFSS [phase 1]
 - Manage parameter files in CRDS, rather than in software package
 - Remove inapplicable keywords from headers of resampled images
 - Add option to save combined background image in stage 2 pipelines
 - Constrain pupil value in stage 3 WFSS associations
 - Enhance outlier detection in stage 3 TSO pipeline
 - Fix high-priority bugs reported during testing of previous version
 - Fix reference pixel subtraction for 4-amp subarray reported by NIRCcam IDT



Moving to normal operations

- All cycle 1 programs have now been specified
 - Review and refine programs as needed (separate presentation)
 - Telescope Time Review Board (TTRB) evaluates program change requests
- Commissioning will enable the start of normal operations
 - Demonstrate observatory is functional
 - Update reference data needed for operations (e.g., focal plane geometry)
- Begin normal operations
 - Interleave calibration and science observations (ERS in first 5 months)
 - Release data a couple days after observation, using best available calibration
 - Reprocess data as calibration knowledge improves over the course of Cycle 1
 - Monitor scientific performance (next two slides)
- Prepare for Cycle 2 call for proposals (~5 months into Cycle 1)



Cycle 1 science performance monitoring

- Tasks
 - Visually inspect raw images and data products, noting any anomalies
 - Monitor science performance derived from science data
 - Examples: target acquisition precision, detector noise, wavelength repeatability
- JWQL Science performance monitoring software
 - Framework complete
 - Authenticated access to archive catalogs and cached data
 - Web application to view images and plots
 - API to access historical measurements in local database
 - Developing suite of core monitors
 - Incorporate commissioning algorithms and code
 - Adding new capabilities in priority order
 - Add and refine monitors over the life of the mission



Screen grab

WELCOME TO THE JWQL APPLICATION.



The JWST Quicklook Application (JWQL) is a database-driven web application and automation framework for use by the JWST instrument teams to monitor the health and stability of the JWST instruments. Visit our [about page](#) to learn more about our project, goals, and developers.

The JWQL application is currently under heavy development. The 1.0 release is expected in 2019.

FIND A JWST PROPOSAL OR FILE

Submit a proposal number (e.g. 86600, 783) or file root (e.g. jw86600006001_02101_00008_quider1) to view that



QUERY THE ARCHIVE FOR ANOMALIES

NIRCAM

ARCHIVE



Access available images for NIRCam here.

Images

MONITORS



Explore the NIRCcam instrument monitoring suite.

Monitors

- Bias Monitor
- Readnoise Monitor
- Gain Level Monitor (Currently Unavailable)
- Mean Dark Current Rate Monitor
- Bad Pixel Monitor
- Photometric Stability Monitor (Currently Unavailable)

DOCUMENTATION



View NIRCcam JWST Documentation (JDOX) here.

NIRCcam Documentation