Vera C. Rubin Observatory
Systems Engineering

Rubin Observatory Construction Documentation Inventory

(Report from the Rubin Observatory Documentation Working Group)

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SITCOMTN-012

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Abstract

This technical note primarily brings together the sources of critical and historical documentation developed across the Rubin Observatory Construction project, with some sources developed by Rubin Observatory Pre-operations and Operations Teams also included. This inventory is meant as a guide for the Rubin Operations project to determine how and what documentation is transferred as a deliverable from the Construction project. This report is a product of the Documentation Working Group. It responds to charge item 2 in the *Charge to the Documentation Working Group*, LSE-489. The proposed future state for Rubin Observatory Operations documentation will be reported in another technical report, SITCOMTN-014.

Change Record

Version	Date	Description	Owner name
0.1	2021-06-01	Initial draft from Confluence pages.	Chuck Claver
1.0	2021-06-10	First release	Chuck Claver
2.0	2024-09-06	Second release	Matthew Rumore
3.0	2024-09-25	Final release	Matthew Rumore

Document curator: Matthew Rumore

Document source location: `https://github.com/lsst-sitcom/sitcomtn-012`

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Rubin Observatory Construction Documentation Inventory

1 Introduction

As part of the second objective of LSE-489.lsst.io, this document represents the work of the Rubin Observatory Documentation Working Group in their survey of sources for construction and operations critical information and documents. These sources include:

- DocuShare;
- TechNotes from lsst.io;
- Confluence Pages;
- Engineering Models;
- GitHub Repositories;
- System-wide Databases;
- Verification Reports;
- Education and Public Outreach;
- Information Technology; and
- Individual Storage, Slack Chat, and Personal Repository Spaces.

There are additional document categories under development and continuous content updates to documents by Construction, Pre-operations and Operations Teams at the time of releasing SITCOMTN-012.lsst.io. This document may be revised to include updates to sources and documents as they are developed and matured; but this is not required. These include procedures for standard operations, regular maintenance, servicing and repair.

2 DocuShare

Xerox® DocuShare® content management system (Xerox, 2021) is the Construction Project's official document repository. It was selected during the design and development phase to

meet the NSF requirement for a document management system. During Construction, the National Science Foundation (NSF) requires retention of, at minimum, record of any decision affecting the cost, schedule or performance baseline. The NSF Major Facilities Guide specifies retention of a contingency log, change requests and approvals, and system integration, commissioning, testing and acceptance plans and results. During Operations, the NSF requires retention of documents related to facility performance in terms of maintenance, operating time, scheduled and unscheduled down time, and use for research and education. In addition to NSF requirements, the Construction Project Office expects DocuShare to be the repository for official versions of management policies, plans and procedures, design documents, safety documentation, hazard analyses, released requirements and interface control documents generated from the SysML model, and project standards, guidelines and templates. The previous list is not intended to be exhaustive.

Three of DocuShare's advantages are handles, version control and co-location. Each object has a unique identifier called a handle, which follows the object regardless of versioning or location(s) in the directory structure (called collections). Each handle has a version history that lists all previously uploaded files for the object in question. One of those versions is designated as the preferred version, which represents the document's official, approved version and is served by the database when clicking the object's title or from a properly formatted URL shared or hosted outside of DocuShare. The object's handle does not change when/if a new version of the document is created. Lastly, objects can appear simultaneously in as many collections as are necessary and/or relevant to the document. This is facilitated by an object's "locations" property; locations are added as appropriate, and the handle automatically appears in the newly added locations. The combination of handles, versioning and co-location creates a system where each document is represented by a single record, avoiding duplication and/or version confusion.

Currently, DocuShare contains more than 30,000 documents in more than 10,000 collections. A high-level survey of DocuShare shows retention of: (1) requirements, designs, interfaces, policies and plans under change control — whether controlled at the project- or subsystem-level; (2) change control action records; (3) status reports to NSF, Association of Universities for Research in Astronomy (AURA) and other stakeholders; (4) safety standards, accidents reports and investigations documentation; (5) hazard mitigation verification artifacts; (6) risk reports; and (7) project-level review agendas, presentations and reference documents. Creation, retention and version control of those documentation classes generally have been well managed; however, the bulk of DocuShare documents likely represents objects created ad

hoc by general project staff for specific purposes. In addition, there are thousands of pieces of work product that may have archival significance but likely will not be useful for Operations.

As part of the Rubin Observatory Document Working Group effort, a study was conducted to evaluate the future use of DocuShare into Operations. The DocuShare Options Trade Study [Document-36788] is found at `ls.st/Document-36788`, and includes an examination of the following use cases:

- Using the Existing Rubin Observatory Project DocuShare instance with modifications;
- Extending Rubin Observatory Project DocuShare with Archiver Server Enabled; and
- Adopting the National Optical-Infrared Astronomy Research (NOIR) Laboratory DocuShare instance.

3 TechNotes: https://www.lsst.io

LSST the Docs (LTD), also known by its URL "lsst.io," is a documentation hosting platform built and operated by the SQuaRE (Data Management) team. LTD hosts what are called static websites, meaning any website built from HTML, CSS and JavaScript that doesn't need an active server to render content (as opposed to say Confluence, DocuShare, or Drupal websites). Static websites are a natural fit for documentation projects that originate from a GitHub repository, such as software documentation or LaTeX documents. Teams use the same processes to collaborate on documentation as they are with code, and the documentation is tested and built using the same process as the software is tested and built. LTD is unique in that is it built around versioned documentation. The root URL for a documentation project hosts the "default" version (which has a configurable meaning for each project). The user can also browse other versions of the documentation through the "/v/" dashboard pages (for example `https://www.lsst.io/v/`). Versions might correspond to software release versions or to temporary collaborative drafts corresponding to GitHub pull requests.

The homepage for the documentation platform, `https://www.lsst.io`, serves as a portal for documentation. (SQuaRE Team, 2017) Users can search across metadata and full text (this feature is powered by the commercial service Algolia (Algolia, 2021a) in conjunction with a scraper bot built by SQuaRE) or browse through curated collections. As `https://www.lsst.io`

is a site designed and built by the SQuaRE team, there is considerable opportunity to refine the design of the portal to meet the specific needs of Rubin Observatory. It is also possible for the portal to list and provide search functionality for documentation hosted on other platforms (potential examples include Confluence, DocuShare, and the acronyms/terminology database).

From a technical perspective, LTD hosts two types of documentation projects: guides and documents. Guides are multi-page websites. The guideline in the Data Management (DM) subsystem is that every software project or service has a guide hosted on lsst.io. An example of a DM guide for a software project is `https://pipelines.lsst.io` and a guide for a service is `https://nb.lsst.io`. T&S is also hosting software guides: see `https://obs-controls.lsst.io` as an example. Besides documentation tied to specific software projects or services, guides can also collect procedures for teams, see the DM Developer Guide (`https://developer.lsst.io`) or the Observatory Operations Documentation (`https://obs-ops.lsst.io`). Though not required, guides are generally authored using an open-source tool called Sphinx (Sphinx) using a theme that is maintained by the SQuaRE team. The second type of documentation, documents, are "single-page" artifacts that are analogous to documents that might be found in DocuShare. Indeed, DM has taken to developing most of its LDM change-controlled documents on its lsst.io site to take advantage of the sophisticated collaboration features that GitHub offers (for an example, see `https://ldm-151.lsst.io`). (GitHub) Change-controlled documents are submitted to DocuShare for archival once approved using a release process mediated through GitHub, Jira, and the relevant control board. LTD is currently hosting documents from the DMTR, LDM, LPM, LSE, and SCTR document series (note that this includes test and verification reports). Besides change-controlled documents, Rubin Observatory project members can also author informal documents called technical notes (technotes). Technical notes were introduced as a medium that blended the organization of DocuShare documents (documents have unique handles) with the ease of Confluence (staff can author and publish technical notes independently without assistance or overt oversight).

Technical note series are associated with different subsystems and include DMTN, ITTN, PSTN, RTN, SITCOMTN, SMTN, SQR, and TSTN. Counts of the number of available documents of each type are listed in the table below, as of June 2021:

Content Type	Document Count
Guides	59
DMTN	172

DMTR	22
ITTN	34
LDM	38
LPM	2
PSTN	51
RTN	12
SCTR	8
SITCOMTN	12
SMTN	14
SQR	49
TSTN	25

3.1 Terminology

lsst.io: The documentation hosting domain for Rubin Observatory, which is powered by LSST the Docs. All subdomains of lsst.io are independent documentation projects (for example, `developer.lsst.io` for the DM Developer Guide or `https://sqr-006.lsst.io` for the SQR-006 technote).

`www.lsst.io`: The documentation portal. This is a regular documentation project hosted on lsst.io, but it uses the "www" subdomain to serve as a documentation homepage. `www.lsst.io` provides documentation search and faceted browsing capabilities. It is still in development and the current status is documented at `https://www.lsst.io/about/`. The site itself is built with React/Gatsby.js (`https://github.com/lsst-sqre/www_lsst_io`), the search database is SaaS (Algolia, 2021b)), and the bot that indexes content into the search database is called Ook (`https://github.com/lsst-sqre/ook`).

LSST the DOCS (LTD): Commonly written as LTD, LSST the Docs is the technical system for hosting versioned static websites. lsst.io is one such deployment. The technical motivation and design of LTD are documented in SQR-006: The LSST the Docs Platform for Continuous Documentation Delivery (`https://sqr-006.lsst.io`, SQR-006). The key technical features of LTD are:

- High reliability, scaling, and security: documentation is hosted in Amazon S3 and served

through the Fastly content distribution network. We don't operate any servers that receive traffic from users;

- Versioned documentation; and
- Flexibility to host any type of static website.

Technical notes (technotes): These are documents that are not change controlled, but otherwise have features similar to "official" project documents. They were designed by the DM SQuaRE team as a replacement for Confluence in writing organized documents for sharing ideas within, and beyond, the project. See SQR-000: The LSST DM Technical Note Publishing Platform (`https://sqr-000.lsst.io`) for our motivation to create technical notes. [SQR-000]

4 Confluence Pages

Confluence is used by the by the Construction Project for many purposes. Confluence is primarily a collaborative tool where teams/groups can document and share and develop information. (Atlassian, 2021a) The tool is organized in "work spaces" for which the Project currently has 34 defined spaces. Each space contains a varying number of pages and sub-pages. Many of these spaces are very specialized or have been set up for personal use. In this section, we limit ourselves to those spaces that are directly related to the deliverables from the integrated Rubin Construction Project spanning of two independent repositories — one served out of Tucson for the Major Research Equipment and Facility Construction (MREFC) effort and another served out of SLAC National Accelerator Laboratory (SLAC) for the Department of Energy (DOE) Major Item of Equipment (MIE) LSSTCam subsystem effort.

4.1 Tucson-based MREFC Spaces

Most of the pages linked here require Rubin Construction project credential for access.

- Project Management Controls
- Project Science
- Rubin Admin.
- System, Integration, Test & Commissioning

    - SIT–Com Management
    - SIT–Com Planning
    - SIT–Com Activities
    - SIT–Com Science Verification
    - SIT–Com Requirements for Operations
    - SIT–Com DOE Notes
- Systems Engineering
    - Failure Report, Analysis and Corrective Action System
    - Verification & Validation Documentation
    - Hazard Verification Documentation
    - Risk Management
    - Telescope & Site Change Control
    - MagicDraw importing, setup, usage instructions
- Data Management
    - Rubin Science Platform
- Telescope & Site
- Education & Public Outreach
- Rubin Observatory Knowledge Base

4.2 SLAC-based LSSTCam Spaces

These pages require SLAC LSSTCam credentials.

- Primary LSSTCam Space
- LSSTCam Safety & Hazards
    - LSSTCam Subsystem Pages
        * LSSTCam Project Management (3.01)
        * LSSTCam Systems Integration (3.02)
        * LSSTCam Sensors (3.03)
        * LSSTCam Science Rafts (3.04.01)
        * LSSTCam Corner Rafts (3.04.02)
        * LSSTCam Optics (3.05)

        * LSSTCam Body & Shutter (3.06.01)
        * LSSTCam Shutter (3.06.02)
        * LSSTCam Exchange System (3.06.03)
        * LSSTCam Cryostat (3.06.04)
        * LSSTCam Control System (3.07.01)
        * LSSTCam Data Acquisition System (3.07.02)
        * LSSTCam Auxiliary Electronics (3.07.03)
        * LSSTCam Integration and Test (3.08)
    - LSSTCam Group Pages
        * LSSTCam Databases & Management
        * Sensor Characterization & Testing
        * ComCam (DOE)
        * Auxiliary Telescope (DOE)
        * LSSTCam General Computing
        * LSSTCam Refrigeration & TMA
        * LSSTCam Commissioning & Early Operations
    - LSSTCam Policies & Procedures
    - Other LSSTCam pages
        * LSSTCam Libraries
        * LSSTCam Indexes
        * LSSTCam Document Lists
        * LSSTCam Document Status
        * LSSTCam Images & Photos
        * LSSTCam Technical Notes
        * LSSTCam Past Events & Review (2013)
        * LSSTCam Upcoming Events
        * Workshop & Meetings
- LSSTCam Review Space
- E2V Sensor Development Material (restricted, non-disclosure agreement (NDA) required)
- ITL Sensor Development Material (restricted, NDA required)

5 Engineering Models

Solidworks Product Data Management (PDM) Professional (Solidworks, 2021) is the Telescope and Site group's official computer-aided design (CAD) model repository. It was selected during

the design and development phase to meet the NSF requirement for configuration management of the baseline mechanical engineering design. The software uses a check-out / check-in system to allow configuration management of the design. Each check-in produces a new version of the part or assembly. Earlier versions can be accessed if needed to compare designs or revert to an earlier design. A workflow feature allows the designs to go through a review process until the design is approved and locked from further changes. A revision process is also included in the workflow to allow for changes to the designs if needed after final approval. The software allows for vault replication at multiple sites and the project currently has a server operating in Tucson and Chile to support CAD users at multiple sites.

The PDM system currently stores all the Telescope & Site group's CAD models of the original mechanical baseline design. The CAD models are linked to a series of ICD documents (drawings) describing the mechanical interfaces for the different optical and mechanical subsystems of the observatory. In addition to the baseline design models, the PDM system contains CAD models of the as-designed and as-built CAD models from the subsystem vendors. Complete designs and documentation of subsystems completed by the Telescope and Site group are also included. In addition to CAD models a series of design and drafting standards is also stored in the PDM system.

The PDM system currently contains all design work created by the Telescope & Site group from early design and development through construction. No information has been deleted or archived at this time. The PDM system will be needed by the Operations team as the observatory goes through its design lifecycle of revisions and upgrades. A reorganization of the PDM vault to archive obsolete information is envisioned at the end of the construction phase of the project.

Rubin Observatory PDM Vault contents includes:

- **Original Project Baseline Design Documentation**
  - ICD drawings for original requirements documents
  - CAD models of T&S subsystems baseline design
  - Library of CAD models contains commercial off the shelf parts
  - Template files
    * Project drawing sheets, part files and assemblies template files

    * Project dimension standard files for Solidworks
    * Project Tables (BML, Revision, hole tables, etc.)

- **Complete designs (models & drawings) for subsystems completed by the T&S group**
  - M1M3 mirror cell assembly
  - M2 cone baffle
  - Miscellaneous handling fixtures
  - ComCam Assembly
- **CAD models of T&S subsystems from vendor contracts**
  - Telescope Mount Assembly (FDR Model)
  - M2 Cell Assembly
  - M2 Hexapod Assembly
  - Camera Hexapod & Rotator Assembly
  - Dome (FDR model)
  - Coating Plant
  - Auxiliary Telescope & Instrumentation
  - Summit Facility includes Auxiliary Telescope Facility
- **CAD model of SLAC Camera assembly** (last update/synchronized with PDM vault in July 2013)

6 GitHub

The Rubin Observatory uses GitHub for software and documentation collaboration. (GitHub) The Observatory uses a large number of GitHub repositories, primarily to ease access control. As such, each Construction subsystem generally has its own GitHub organization, though in some cases subsystems have additional GitHub organizations for specific teams or projects. The main GitHub organization `https://github.com/lsst` contains all software components officially released by the Data Management Subsystem (i.e., the Science Pipelines), and as such it serves as the public face of the Observatory for astronomers interested in Rubin Observatory and LSST software. Not all operations software is found in the "lsst" organization, though. For

example, the Science Platform software is contained in `https://github.com/lsst-sqre`, Telescope & Site software in `https://github.com/lsst-ts`, Education and Public Outreach (EPO) software in `https://github.com/lsst-epo`, and Camera software in several organizations.

GitHub organizations with operational software and documentation will likely transition smoothly to Operations teams. Particular attention will need to be paid to maintaining organizations that no longer have an active team associated with them.

The following table provides a large overview, but not exhaustive list of GitHub organizations.

Organization	Subsystem(s)	Documents	Notes
lsst	DM, PM, SIT-Com	LPM, LSE, LDM, RTN	LSST Science Pipelines and change-controlled documents. See DMTN-104 (DM product tree)
lsst-camera-ccs	LSSTCam		Camera Control System (semi-private). See also LSST CCS release management
lsst-camera-daq	LSSTCam		Camera DAQ (private)
lsst-camera-dh	LSSTCam		Camera Data Handling, eTraveler, miscellaneous scripts, sequencers
lsst-camera-electronics	LSSTCam		Camera firmware
lsst-camera-visualization	LSSTCam		Camera visualization (image display)
lsst-dm	DM	DMTN, DMTR	DM workspace for technical notes, non-pipeline packages, unofficial and "legacy" pipelines packages
lsst-dmsst	DM		DM System Science Team
lsst-dm-tutorial	DM		DM tutorials (mostly for authenticating workshop attendees and notebooks)
lsst-epo	EPO		Education and Public Outreach
lsst-it	IT	ITTN	IT-related projects
lsst-opsim	SIT–Com		LSST Operations Simulator
lsst-pst	PST	PSTN	Project Science Team
lsst-se	SIT–Com		Systems Engineering
lsst-sims	SIT–Com	SMTN	LSST Simulations Group
lsst-sitcom	SIT–Com	SCTR, SITCOMTN	System Integration, Test, and Commissioning
lsst-sqre	DM	SQR	DM SQuaRE (Science Platform, SQuaRE, and documentation infrastructure)

lsst-ts	TS		Telescope & Site
lsst-tstn	TS	TSTN	Telescope & Site technical notes
rubin-observatory	PMO		Ops and pre-ops management documentation

7 System Databases

There are a number of system databases used in the Construction project.

7.1 MagicDraw

MagicDraw (No Magic, Inc.) is a tool used by the project to maintain a model of the Rubin Observatory system creating a relational database between system elements. Developed through the Rubin Observatory's use of MagicDraw, user guides are collected on the following Project confluence page: MagicDraw Users Guide.

The system elements captured with the MagicDraw database include:

- Hazard Analysis — imported from various vendor and internal spreadsheets and now source of truth. Synced to Jira for verification
- FMEA — imported from various vendor and internal spreadsheets and now source of truth (currently incomplete)
- Requirements — source of truth with exports to DocuShare
- Verification Elements — source of truth for requirements details, synced to/from Jira
- Verification Plans/Cycles/Cases — synced to/from Jira, not source of truth
- SAL Commands, Events, Telemetry — imported from CSC XML
- Operations Concepts — source of truth
- System level state machine — source of truth
- Interlocks — modeled from source material
- Structural decomposition — sync from SolidWorks in the future

7.2 Jira

Jira is used by the by the Construction Project for many purposes. Jira is primarily a issue tracking tool where teams/groups can document, organize, track and report on software or administrative tasks. (Atlassian, 2021b) The tool is organized in "work spaces" called projects, each of which tracks a list of enumerated tickets or issues. Jira provides a wide variety of tools to manipulate or organize projects and tickets. Many of these projects are very specialized or have been set up for personal use. Listed below are projects related to the deliverables from the integrated Construction project spanning of two independent repositories — one served out of Tucson for the MREFC effort and another served out of SLAC for the DOE MIE LSSTCam effort.

Most of the pages linked here require Rubin Construction project credentials or SLAC LSSTCam credentials for access.

The following Tucson-based Jira projects contain technical documentation:

- Verification Elements/Plans/Cycles/Cases/Results — source of truth
- Risks, Opportunities, Mitigations — source of truth
- FRACAS - Failures, corrective actions — source of truth
- Hazard mitigation verifications — source of truth

The following SLAC-based Jira projects include:

- Camera Action Items: Captures action items for all Camera Subsystems, from various sources (reviews, internal discussions, etc.). Utilization is described on this confluence page: Using Jira and Confluence to track Action Items.
- Test Data Framework: Spans many purposes, includes (not exclusive) reporting Data Portal, Data Catalog, CCS initiated analyses, limitations, improvements (web-app or otherwise), eTraveler or database impacts (typically data structure related or new implementations).
- Camera Control System Core

  - CCS Core: Self-explanatory.
  - CCS Driver: Driver development for using specific software/equipment with CCS.
  - CCS Subsystem: Not sure the difference between this and CCS Core.
  - CCS Project: Old project; as stated by LSSTCCSPROJ-80, it is replaced by CCS Core; but unsure if all tickets were migrated (open or closed).
  - CCS Documentation: Old project, few tickets remain open.

- CCS Camera Subsystem and Interfaces Related
  - CCS Power Manager Subsystem: self-explanatory.
  - CCS Rafts: self-explanatory.
  - CCS Refrigerator: self-explanatory.
  - CCS Shutter: self-explanatory.
  - CCS Utility Trunk: self-explanatory.
  - CCS OCS Bridge and MCM: self-explanatory.
  - CCS DAQ: self-explanatory.
  - CCS FCS: self-explanatory (FCS - filter change system?).
- CCS and Specific Applications
  - CCS Test Stands: use of and item-specific items for test stands at various sites.
  - CCS IR2 Infrastructure: self-explanatory (IR2 is the SLAC Cleanroom).
  - CCS ComCam: self-explanatory, but issues not exclusive to this Jira project.
- DREB Firmware: 8 tickets (all resolved) for DREB.
- eTraveler CCB: Changes to instructions, local software changes (Job Harness/Install), and a few decisions about how eTraveler was organized/implemented (software and hardware). See the following confluence page for context on CCB use: eTraveler CCB

7.3 Drupal

Rubin uses the Drupal web content management framework as its websites' back-end. This includes `https://www.lsst.org`, `https://project.lsst.org` and sites created to facilitate project meetings and reviews. To avoid the complication of having to make multiple site updates

when content changes, `https://www.lsst.org` and `https://project.lsst.org` documents are served by hyperlinks that pull files from whatever repositories contain their sources of truth. While it is possible to upload discrete files to a specific site's server location, by policy and standard the project eschews doing so, except in the case of meetings and reviews. Those sites' server directories contain document and presentation files in order to preserve the state of that documentation as it was presented at the time of the meeting or review. However, during or at the conclusion of the event, the files are uploaded to DocuShare in a collection specific to the event. Presentations are uploaded as discrete handles. Other documentation such as policies, requirements, and design documents are uploaded as a ZIP file archive, since they represent a snap-shot of an existing handle. The previous is true for project-level reviews and meetings like the Project and Community Workshops, but it may not be true for Drupal sites used for subsystem-level reviews and workshops.

- Change Control: What resides in Drupal that is not in DocuShare?
- Review materials
- Are the review material fully captured in Docushare? Yes, for Project level reviews. There is an open question regarding lower level reviews.
- Historical WEB pages

7.4 Euporie

Euporie is a server in the Construction project network that contains a directory labeled "TS-Deliverables." The directory contains subfolders of each of the subsystems being managed by the Telescope & Site group. The subdirectories contain vendor-supplied documentation as contract deliverables (design documentation, construction drawings, manuals and misc. information) for storage.

The Euporie repository can be accessed here (requires Rubin Observatory credentials through VPN): `smb://euporie`.

7.5 T&S Commandable SAL Component XML files

The T&S XML package defines the data objects for all Commandable Service Abstraction Layer (SAL) Components (CSC). These data objects are defined in eXtensible Markup Language (XML).

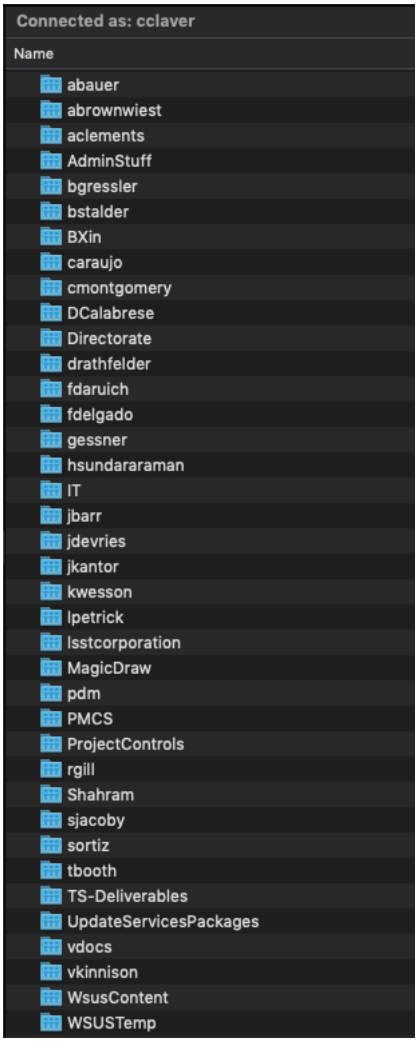

FIGURE 1: The current (June 2021) directory structure of the Euporie remote drive repository

FIGURE 2: The Telescope & Site folders on the Euporie repository used to collect documents from vendors

SAL consumes the XML to produce language specific libraries that enable communication over the Data Distribution System (DDS) network. These XML files are critical for defining the configuration and interaction of the systems within the Summit Facility observing environment.

A link to the T&S TechNote covering the XML files is here: `https://ts-xml.lsst.io`

7.6 LSSTCam construction information

During construction, the Camera used a set of web-based tools used across multiple sites during the testing and construction of the Camera and its subcomponents — eTraveler, Data Portal and Data Catalog. The information and data products from work performed at local facilities was recorded in the Data Catalog and Data Portal, for data archive and recording process information. Most databases and servers managed by SLAC used these tools to capture procedure, testing data, track component/assembly status and information, and to track the acceptance and non-conformance reports. eTraveler, Data Portal and Data Catalog include independent "prod" and "dev" instances, both of which have information on production parts.

There are some locations managed by other institutions, such as *Institut National de Physique Nucléaire et de Physique des Particules* (IN2P3) and Brookhaven National Laboratory (BNL).

Note that this section does not include information captured in other sections of this report, e.g, SLAC manages an instance of Confluence and Jira with LSSTCam information.

7.6.1 eTraveler

eTraveler is a web-based tool used across multiple sites during the testing and construction of the Camera and its subcomponents. It was used to provide procedures, begin testing and data collection locally, upload information and data to servers (primarily to the Data Portal and Data Catalog), track component/assembly information, and track the acceptance and non-conformance reports. The itemization below includes the relevant links and a description of critical construction information.

- eTraveler: includes PROD database and DEV database
- Data Portal: includes PROD database and DEV database

- Data Catalog: includes PROD database and DEV database
  - Data Portal is user interface and report generation using Data Catalog files/pointers.
  - Comprehensive view/search for NCRs
  - Some travelers in eTraveler have special reports generated for sensors and rafts, indexed by Run Number.
  - ASPIC summary table
  - Sensor Acceptance from vendors summary table
- e-log: possible content, mostly BNL activities. Data was not migrated from Fermi National Accelerator Laboratory server/database. A lot of what used to be in e-log is now in Slack.
- Main Content of eTraveler:
  - Historical information about how camera was assembled, including specific operators, date/time, results, etc. Some procedures have been moved to DocuShare; unsure of percentage or locations.
  - Non-conformance reports (NCR) for hardware and operations.
  - Raw Data and analysis results from test stands (including BNL and IN2P3) and data from BOT/CCOB testing. The data itself is stored at SLAC outside of the eTraveler/-DataCatalog database. Much of the data (but not all) has been archived at National Center for Supercomputing Applications (NCSA).
  - CCD vendor data (metrology and electro-optical testing) along with the analysis results.
  - REB testing results from SLAC; and ASPIC testing results before assembly on REB.
  - Records for acceptance of hardware; most notably sensor acceptance from vendors and Camera subsystem hardware from subsystems (e.g., science and corner rafts).
  - Records for summary information, e.g. sensor acceptance, pre-ship review of science rafts from BNL to SLAC.
  - Labels of hardware or travelers capturing specifics or issues.
  - Hardware inventory tracking, including quantity, location, stock and status.

7.6.2 CCS IR2 Database

This contains historical telemetry data from all construction operations (full camera and test stands) in the SLAC IR2 Cleanroom. In addition this contains the "image database" for images taken in the SLAC Cleanroom.

7.6.3 CCS Summit Database

This database contains the following:

- Telemetry from ComCam, Main Camera and Auxiliary Telescope on the summit (in principle also all in EFD)
- Configuration for ComCam, Main Camera and Auxiliary Telescope on the summit (in principle all data is in EFD)
- Camera Image database for ComCam, Main Camera, Auxiliary Telescope

7.6.4 SLAC V–Drive & BNL Raft Share Folder

A network folder at SLAC (V-Drive) was used during construction. It will likely contain historical records.

A network folder at BNL (LSST) includes notes, photographs, documents, reports, etc. A large majority of, if not all, critical items should already be in DocuShare, Confluence or eTraveler. The network folder includes historical records, as well.

7.7 Miscellaneous

There are a few miscellaneous items with additional technical documentation.

- IN2P3 filter changer documentation
- Von Ardenne Catalog

8 Verification Reports

The Rubin Observatory Verification Architecture is composed of our MagicDraw model, Jira with Test Manager application, and Syndeia to synchronize data between MagicDraw and Jira. The verification system ensures traceability from our requirements to the verification artifacts which are verifying them. The verification system is used for all types of verification methods (Inspection, Analysis, Test, Demonstration) and for both vendor verifications and Rubin Observatory verifications.

For vendor verifications, we trace the requirements/verification elements to the test cases in Jira. The test cases represent a verification artifact provided from the vendor with the results attached to the test cases.

For all verification events performed by the SIT-COM and DM teams, a SIT-COM Test Plan/Report (SCTR) or DM Test Plan/Report (DMTR) is created.

Each verification event includes the following elements:

- Traceability to all requirements/verification elements to be verified.
- Document the required test personnel, test equipment, software, entry/exit criteria, etc. to execute the verification event.
- Annotations in the EFD to timestamp the start and stop of a particular test when running from a notebook or script.
- Document timestamps in test case of the start and stop of a particular test when running manually from a Engineering User Interface System (EUI).
- Document all deviations or anomalies in the execution of the test case, such as needing to stop and then restart, execute in a different order, etc.
- Document the actual results of the steps beyond just marking the step as pass or fail.
- Generate Bug, FRACAS tickets for issues or failures that arise during verification.
- Generate Deviation tickets for failed verifications of requirements that will not be fully met.

- Generate plots, analysis results, links to raw data sources.
- All testers should attend verification planning meeting to ensure they are knowledgeable about how to perform the tests.
- Testers should provide feedback on how to improve the procedures.
- Develop a Jupyter notebook template that shows how to structure the notebook and how to create annotations.

The SCTR or DMTR is generated using the Jira REST API pulling the information from the verification objects. Formal detailed records of each verification done by Rubin Observatory is in Jira LSST Verification and Validation project with reports published to lsst.io as a SCTR or DMTR with an archive in DocuShare as well.

9 Education & Public Outreach

Education and Public Outreach (EPO) has several repositories for documentation during Rubin Observatory Construction.

EPO maintains a collection of documents in Docushare, and has been attentive to using this as the repository for documents as they are moved from a “working” to a “final” state. The EPO Docushare collection includes evaluation reports, needs assessment reports, presentations, progress reports, and strategy and design documents.

EPO uses Confluence as a collaborative workspace to create, share and discuss files, ideas, meeting minutes, specifications, mockups, diagrams and projects. The EPO Confluence file structure is updated regularly and pages that are no longer active have been archived. In some cases, Confluence pages contain links to external sources, e.g., Google Suite.

EPO maintains a collection of working documents in Google Suite. This material is of a similar type to that found in Confluence, and also includes content being developed for Rubin Observatory’s public-facing website in Operations, and will eventually be moved to that website’s content management system.

Individual EPO team members use Dropbox for design and visual documents. In cases where

files require persistence and/or access by the EPO team, they are moved to Docushare.

Finally, the EPO technical team uses GitHub to develop software, and contains technological notes regarding the construction of online EPO products and tools.

Links to EPO specific documents can be found here:

- **Docushare:** `https://docushare.lsst.org/docushare/dsweb/View/Collection-21`
- **Confluence:** EPO
- **Google Suite:** `https://drive.google.com/drive/u/0/folders/1psuXwgM5EsnM-2h58Dj14sfTTZD1kpo7`
- **Github:** `https://github.com/lsst-epo`

10 Information Technology

The Information Technology (IT) team in Chile uses four platforms for documentation:

- The IT tech note series, ITTN: `https://www.lsst.io/ittn/`. Note: IT is are actively moving from writing Confluence pages to using ITTN documents more and more.
- README files in GitHub repositories in `https://github.com/lsst-it/`. For example, https://github.com/l it/k8s-cookbook contains procedures for standing up and operating various Kubernetes clusters.
- Confluence; primarily for day-to-day communications exchange with the Commissioning and Camera teams.
- DocuShare, as required by the project.

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B Acronyms

Acronym	Description
API	Application Programming Interface
ASPIC	Analog Signal Processing ASIC
AURA	Association of Universities for Research in Astronomy
BNL	Brookhaven National Laboratory
BOT	Bench for Optical Testing
CAD	Computer-aided Design
CCB	Change Control Board
CCD	Charge-Coupled Device
CCOB	Camera Calibration Optical Bench
CCS	Camera Control System
CSC	Commandable SAL Component
ComCam	The commissioning camera is a single-raft, 9-CCD camera that will be installed in LSST during commissioning, before the final camera is ready.
DAQ	Data Acquisition System

DDS	Data Distribution System
DM	Data Management
DMTN	DM Technical Note
DMTR	DM Test Report
DOE	Department of Energy
DREB	Daughter REB
E2V	Teledyne e2v
EFD	Engineering and Facility Database
EPO	Education and Public Outreach
EUI	Engineering User Interface System
FDR	Final Design Review
FMEA	failure modes and effect analysis
FRACAS	Failure Reporting Analysis and Corrective Action System
HTML	HyperText Markup Language
ICD	Interface Control Document
IN2P3	Institut National de Physique Nucléaire et de Physique des Particules
IT	Information Technology
ITL	University of Arizona Imaging Technology Laboratory
LDM	LSST Data Management (Document Handle)
LPM	LSST Project Management (Document Handle)
LSE	LSST Systems Engineering (Document Handle)
LSP	LSST Science Platform (now Rubin Science Platform)
LSST	Legacy Survey of Space and Time (formerly Large Synoptic Survey Telescope)
LSSTCam	MIE Camera Subsystem Project
LTD	LSST the Docs
LaTeX	(Leslie) Lamport TeX (document markup language and document preparation system)
M1M3	Primary Mirror Tertiary Mirror
M2	Secondary Mirror
MCM	Master Control Module
MIE	Major Item of Equipment
MREFC	Major Research Equipment and Facility Construction
NCR	Non Conformance Report

NCSA	National Center for Supercomputing Applications
NDA	Non-disclosure Agreement
NOIR	NSF's National Optical-Infrared Astronomy Research Laboratory; `https://nationalastro.org`
NSF	National Science Foundation
OCS	Observatory Control System
PDM	Solidworks Product Data Management Professional
PM	Project Manager
PMO	Project Management Office
PS	Project Scientist
PST	Project Science Team
PSTN	Project Science Technical Note
REB	Readout Electronics Board
REST	REpresentational State Transfer
RM	Release Manager
RTN	Rubin Technical Note
S3	(Amazon) Simple Storage Service
SAL	Service Abstraction Layer
SE	System Engineering
SIT	System Integration, Test
SLAC	SLAC National Accelerator Laboratory
SQR	SQuARE document handle
SQuaRE	Science Quality and Reliability Engineering
SaaS	Software as a Service
SysML	System Modeling Language
T&S	Telescope and Site
TMA	Telescope Mount Assembly
TS	Test Specification
URL	Universal Resource Locator
VPN	virtual private network
XML	eXtensible Markup Language